



DiscoverU

DISCOVERING UNIVERSITY SPORT AND DUAL CAREER

4 Healthy Academic Society 2024 Conference Report

(Extended from Seminar with workshops on
Good practice of existing initiatives)



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Hrvatski akademski
sportski savez
Croatian Academic
Sports Federation



Akademicki
Związek
Sportowy



UNIVERSITÀ
DEGLI STUDI
DI SALERNO

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1. Event Summary

Besides sports, the UniSport Finals also organized the international scientific conference "4 Healthy Academic Society" for the second year in a row, focusing on topics of physical and mental health and health-oriented physical exercise. The conference was held for two days, on the 31st of May and 1st of June in Poreč, Croatia, bringing together over 80 participants from 7 countries.

The 4 Healthy Academic Society International Conference focused on various aspects related to sports practice and the promotion of a healthy and active lifestyle, divided into three main sessions: health and healthy lifestyle, anthropometric characteristics related to physical activity, mental health of athletes and technological innovations in sports practice.

The Conference program began on Friday morning 31st, opened by an inspiring presentation from Prof. Alessandro Bortolotti of the University of Bologna, about the role of communication in playing and sporting activities.

Scientific papers and contributions from academics and technical experts were presented within the program, addressing topics such as innovations in sports technology, injuries in sports, dual careers, psychological and sociological aspects of student sports, sustainable sports programs and many other current topics related to students and sports.

On Saturday, June 1, 2024, the second day of the Conference was opened by the intervention of Fernando Parente from the International University Sport Federation (FISU). Mr. Parente provided an extensive overview of FISU's multi-year strategy to enhance its social relevance and growth. He highlighted that significant gaps still exist within the structure of international university sports, particularly between the continental and local levels. The objective of the global strategy is to bridge these gaps, starting with the student and national levels. FISU believes that strong universities are the foundation for robust National University Sports Federations (NUSFs), as well as continental ones.

Within the events, a round table entitled "Sports at public higher education institutions, YES or NO?" was also organized by the Croatian Academic Sports Federation, with the participation of panellists from Croatian state institutions and higher education institutions to discuss the current issues related to academic sports and sports in general in Croatia.

At the occasion of the event, also partners of the DiscoverU project met in person for their project meeting, and had a chance to participate in the conference and watch several interesting sport competitions.

Organizers and competitors spent three unforgettable days, and this year's edition of the Unisport Finals demonstrated once again that sport strongly intertwines issues related to education, recreation, entertainment and socialization. Occasions like these are proof of this and constitute exceptional networking platforms for the development of further similar initiatives.

Details about the conference can be found at the official website of the event <https://conference.unisport.hr> and DiscoverU project website <https://discoveru.eusa.eu>.



As part of the 2nd International Scientific Conference 4 Healthy Academic Society, organized by the Croatian Academic Sports Federation in the city of Poreč from May 30th to June 1st, the second in-person partners' meeting of the project Discovering university sport and supporting dual career (DiscoverU) took place.

Representatives of all project partners met in Poreč on May 30th and attended the opening ceremony of the UniSport Finals, the finals of the Croatian university championships. On the next day, Friday 31st of May, they followed the opening part of the Conference, before gathering for the project meeting at Hotel Parentium.

The project meeting was opened by greetings from the President of the Croatian Academic Sports Federation, Mr Haris Pavletić, and its Secretary General, Mr Nikola Vincetic, who welcomed all project partners and expressed their satisfaction in hosting the DiscoverU meeting in the framework of the three-day event. Representatives of the partners then introduced each others, and briefly presented the organizations taking part in the project.

Mr. Simone De Luca, representing EUSA and its Institute, provided a general overview of the project, recalling its purpose and methodology and the role assigned to each partner, summarizing all the phases and activities undertaken so far and those still to be addressed. Some words were also dedicated to the visual identity of the project, in order to inform partners about the project website and the templates to be used for deliverables and presentations regarding all the official resources to be produced and disseminated.

Following the project overview, the representative of the European Athlete as Student network (EAS), Prof. Mojca Doupona from the University of Ljubljana, took the stage to inform all partners about the communication and dissemination activities related to the project.

Ms Marianna Pikul from the University Sports Association of Poland (AZS) updated the partners regarding the project implementation strategy. She presented and detailed the project Quality Assurance Plan, explaining the role of the Quality Assurance Manager and how the tasks and deadlines should be kept under control accordingly.

Mr Maté Nagyistok, on behalf of the Hungarian University Sports Federation (MEFS), presented and detailed the project Evaluation Plan that will be used to monitor the partners and participants satisfaction and success, according to a set of indicators to be updated during the progress of the project. Subsequently, Mr Nagyistok gave a presentation about the progressing and last steps of the preparation of the European Universities Games 2024 in Debrecen and Miskolc.

Regarding the Action Plan and coming up activities, important information were also shared. Mr Emanuele Milanese gave a short recap of the role and tasks of the University of Salerno in the project, updating the partners on the ongoing activities linked to the research part and the compilation of the National information factsheets. From MEFS side, Maté Nagyistok informed the partners regarding the data collection system to be used to prepare the Internal research reports, which will be based on the research already done and that still to be produced by the partners.

Finally, Mr Ivan Kaselj and Ms Marija Panijan the Croatian Academic Sports Federation, explained how the Collection of good practice will be approached, mentioning several examples of already existing events and projects in which CASF/HASS has taken part.

The partners agreed to meet again in person in Hungary in July during the European University Games 2024, where they will have the opportunity to participate in a wide range of side activities scheduled from 11 to 14 July.

The DiscoverU project is lead by the EUSA Institute, and brings together two NGOs; besides EUSA, also the European Athlete as Student network (EAS), national university sport bodies from Croatia (CASF/HASS), Hungary (HUSF/MEFS) and Poland (AZS), as well as the University of Salerno are also part of the project partnership. Although competitive university sport is not the priority of the project, it is worth noting that the consortium includes hosts of four European Universities Games: 2016 Zagreb-Rijeka (CRO), 2022 Lodz (POL), 2024 Debrecen-Miskolc (HUN) and 2026 Salerno (ITA).

The 3-year project, co-funded by the European Union, aim to improve sport and physical activity opportunities for students in higher education on one hand, addressing larger student population; and at the same time promote and support dual career in higher education in partnering countries. This will be achieved by gathering information, sharing good practice examples and implementing sports and educational activities.



2. Event Promotion

The webinar was promoted by project partners, mainly by CASF, in English and Croatian.

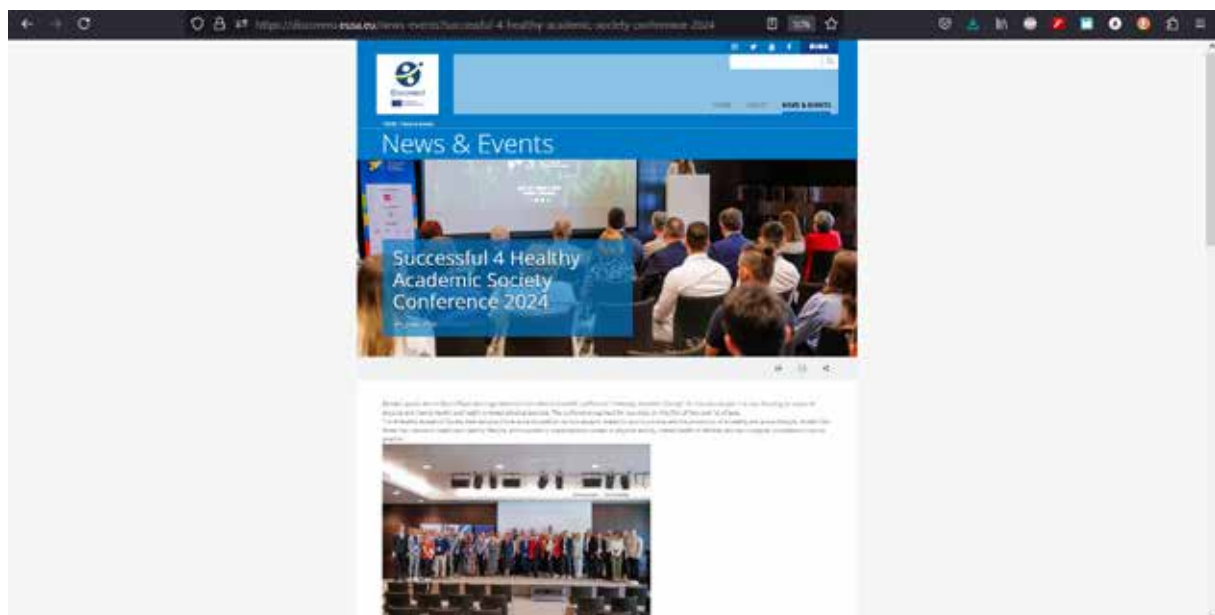
The promotion was done in electronic and online form, mainly using the websites and social media.

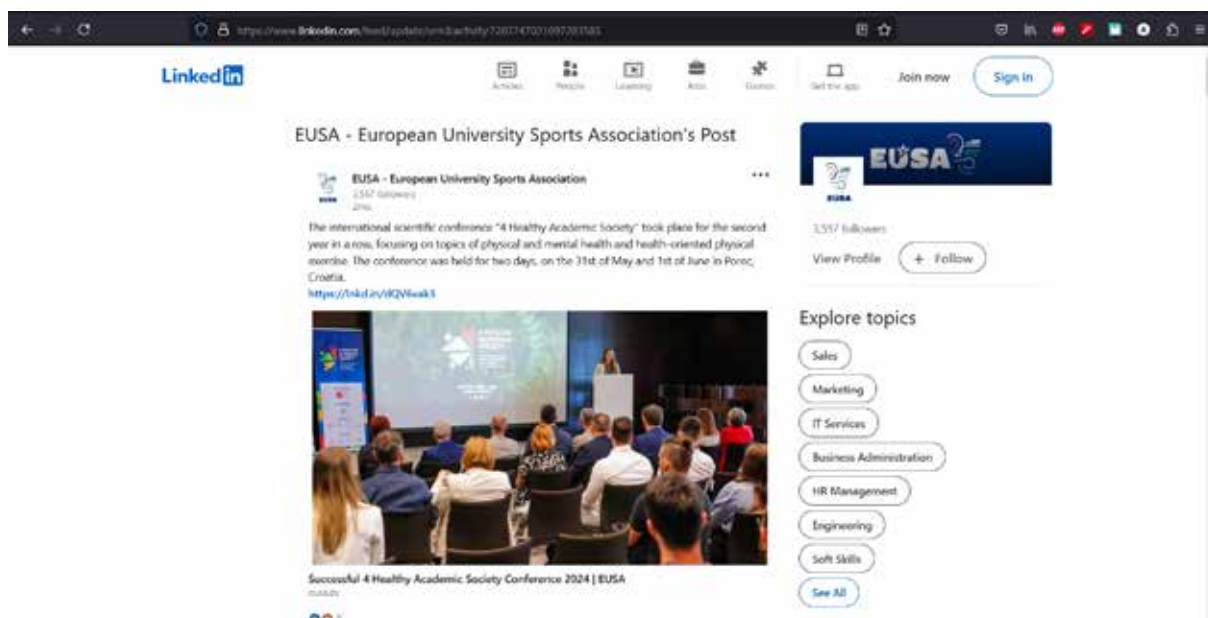


3. Event Reporting and Dissemination

After the event, the news with a short report was posted on the DiscoverU project website, as well as on the websites and social media channels of the partners, with EUSA and CASF taking the lead.

All participants who registered for the event also received the pdf version of the Proceedings, as a book of abstracts.





4. Event Satisfaction Survey

After the event, all participants who took part in the event were sent an email, where we thanked them for the attendance, and asked them to evaluate the event, via an online survey (using MS Office Forms).

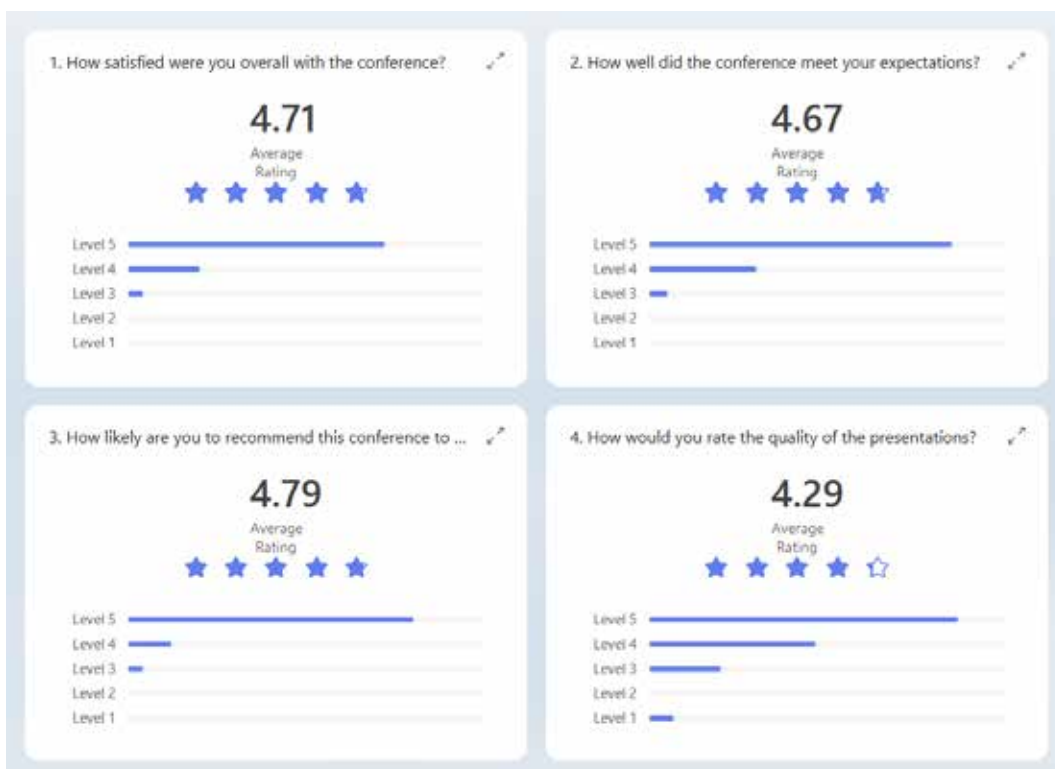
The screenshot shows a Microsoft Office Forms questionnaire titled "2nd '4 Healthy Academic Society' scientific conference - Evaluation questionnaire". The form includes an introduction paragraph, a note about anonymity, and a thank you message. It contains three questions with star ratings:

- 1. How satisfied were you overall with the conference? (Mark only one star.)
- 2. How well did the conference meet your expectations? (Mark only one star.)
- 3. How likely are you to recommend this conference to others? (Mark only one star.)

24 people (28 % of those attending) filled out the survey, with an average overall evaluation of 4,7/5, and generally providing positive feedback on the questions asked.

The feedback will be used when planning future events.

Survey results overview:



5. Were the presentations relevant to your interests? ✓

4.46

Average
Rating



6. Did the speakers deliver the information in a clear and... ✓

4.38

Average
Rating



7. Was the content of the conference appropriate for you... ✓

4.63

Average
Rating



8. Did you learn anything new or valuable from the conf... ✓

4.63

Average
Rating



9. How would you rate the quality of the conference faci... ✓

4.83

Average
Rating



10. Was the conference well-organized? ✓

4.96

Average
Rating



11. Was the staff helpful and courteous? ✓

4.87

Average
Rating



12. Was the food and beverage provided satisfactory? ✓

4.92

Average
Rating



13. Was the length of the conference just right? ✓ ↗

4.83

Average
Rating



14. What did you like most about the conference? ✓ ↗

14 responses submitted



15. What could be improved for future conferences? ✓ ↗

11 responses submitted



16. Is there anything else you would like to share about ... ✓ ↗

6 responses submitted



5. Proceedings



4 HEALTHY ACADEMIC SOCIETY

International Scientific
Congress of student' sport,
physical exercises and health
POREČ, May 30 - June 1, 2024

Proceedings

2nd INTERNATIONAL SCIENTIFIC CONFERENCE
4 HEALTHY ACADEMIC SOCIETY

POREČ, CROATIA, May 30 - June 1, 2024

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4 HEALTHY ACADEMIC SOCIETY**
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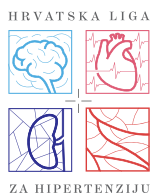
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Conference

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Welcome Note

Dear colleagues,

We are delighted to present the proceedings of the 2nd "4 Healthy Academic Society" conference. This conference emphasizes the importance of health care within the academic community, with a special focus on the student population, recognizing that physical and mental health are key factors for academic success and overall well-being. Through various topics, the conference provided a comprehensive platform for discussing the importance of physical activity and healthy lifestyles. We particularly focused on the themes of students' physical and mental health, anthropological characteristics, health-oriented physical exercise, dual careers, and innovations and ICT applications in student sports. The papers highlight how fitness, body composition, and motor skills significantly impact the overall health of students and how regular physical activity can improve mental health, reduce stress, enhance sleep, and increase motivation. Special emphasis was placed on health-oriented physical exercise. Additionally, we explored how behavioral changes and healthy lifestyles can positively impact the general well-being of students, encouraging them to adopt healthy habits that will accompany them throughout their lives.

The conference also addressed the importance of dual careers in sports, exploring how the educational process can be adapted for athletes and how their engagement in sports can be valued. The papers emphasize the importance of community, social interaction, team spirit, and friendships formed within sports communities, which further contribute to students' overall satisfaction and mental health.

Safety, sustainability, and technological advancements in academic sports were also important topics. Injury prevention, safety policies, and medical support were considered crucial aspects of maintaining athletes' health. Technological advancements, especially the application of artificial intelligence, offer new possibilities for personalized training and increased safety. The implementation of technology for monitoring and encouraging sports activities and the development of environmentally friendly sports programs represent steps toward modernization and sustainability in sports.

This collection of papers offers valuable insights and research results that can serve as a foundation for further studies and practical applications in improving the health of students and the entire academic community. We hope these papers will provide you with inspiration and useful information, and encourage further collaboration and innovation in this important area.



PRESIDENT OF THE CONFERENCE ORGANISING COMMITTEE

Assoc. Prof. Sanja Ćurković

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Keynote Speakers



**Assc. Prof.
Alessandro Bortolotti**
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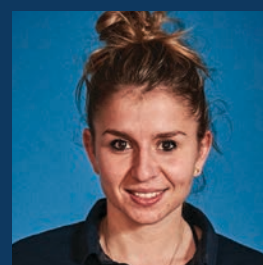
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Proceedings

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SPORTS AND CULTURES. THE NEED OF A "SUITABLE SPORT" APPROACH.¹

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ABSTRACT

Main aim of this work is to introduce a subject that can provide a positive impact on the epistemology of Physical Education: the *Motor Praxeology*. Developed along the last decades of XX century by Pierre Parlebas, Parisian professor of both Sociology and Physical Education, Motor Praxeology highlights the structural dimensions of socio-motoric interactions. The analysis of those "play areas" that arise matching socio-motoric interactions along with environmental conditions sheds light about the great impact of Physical Education projects on personal and social development. So, Motor Praxeology offers interesting analytical tools, that may facilitate the recognition of what makes sports and motor games effective, in order to improve both personal and social development.

Keywords: Motor Praxeology, Motor Conduct, Deep Play, Socio-Motoric Interactions, Epistemology of Physical Education.

INTRODUCTION

Motor Praxeology (Parlebas, 1987) is a little-known scientific theory; however, I believe that its principles can provide the field of study and research of Physical Education with an important epistemological contribution, allowing in-depth analyses of the motor practises, of which sport is undoubtedly the best-known and most successful expression, but not the only one. This contribution focuses precisely on the definition of sport and highlights some of its specific characteristics. In the light of a framework defined by interactions with both players and environments, I will attempt to identify some models of what could be called "suitable sport", so capable of adapting its forms to the participant, rather than the other way around. All this is aimed at recognising the enormous educational and cultural value of motor activities and sports.

1. PLAY AS A CULTURAL PHENOMENON

Johan Huizinga, in the preface to *Homo Ludens* (1949), recounts an episode that is both curious and significant: he had originally titled one of his lectures "The Play Elements of Culture", which the organizers had changed to "The Play Elements in Culture". This modification reflected an implicit but strong

¹ Freely translated from the original: Bortolotti Alessandro, 2017, La Prasseologia motoria: per un rinnovamento epistemologico dell'attività motoria e sportiva, *Formazione & Insegnamento*, XIV -3:(2016), pp. 75-83.

resistance to recognizing play as an integral component of culture, rather than merely a form of leisure. Huizinga's fun-damental thesis was that culture originates *sub specie ludi* (Latin sentence for: *in the form of a game*), sug-gesting that culture arises as a game, so through playful processes. In addition to Huizinga, Caillois (1967) and Geertz (1973) also assert that play activities are fully integrated into the elaboration of cultural phe-nomena. These activities express social trends and customs while influencing their reproduction, thereby serving as a powerful pedagogical tool. This conviction is supported by Pierre Parlebas (1987), who argues that learning to play also entails learning how to navigate one's social environment.

Considering that social phenomena are more easily recognized when examining situations that are distant from us rather than those in which we are immersed, I refer to an insightful comparison made by Eric Dugas (2011). Let us therefore analyse three sports that are extremely popular in the United States but not as much in Europe: Baseball, American Football, and Ultimate Frisbee. We will compare the latter ones with other three sports created and popular in Europe but not widely embraced in the USA: Football (Soccer), Handball, and Rugby. This comparative analysis will be based on dimensions known as "ludic universals" (Staccioli, 1998), which include the comparison of rules concerning spaces, times, objects, and game scores, as well as the relationships between both teams and players.

Compared to the European sports, American Sports exhibit several distinctive characteristics, particularly in the following aspects:

1. Greater asymmetries in the relationships between opponents, in terms of both organization of space and time;
2. Scoring is achieved by emphasizing cooperation, so through 'team play';
3. A kind of 'neatness' in the different phases of the games: for example, teams are either attacking or defending, but there are not opportunity of 'reversal of the front' or 'counter-attacks';
4. There is considerable variation in the patterns of play.

These differences are not accidental; rather, they indicate a clear trend which differs from the European one. From this perspective, a correlation can be observed: North American sports exhibit a greater propensity for innovation and the development of varied relational models, while European sports tend to follow a more traditional, constant, and fixed model. Additionally, in the American (and broader Anglo-Saxon) mindset, there is a greater adherence to certain principles. To achieve the final result (scoring points), 'team play' and mutual cooperation are fundamental. In contrast, European sports often facilitate changes in the field and personal action, emphasizing counter-attacks and individual efforts to resolve challenging game situations. So, the hypothesis that playful activities reflect and simultaneously reinforce certain typical socio-cultural characteristics of the society that produces them, is confirmed.

To comprehend the ways in which sports games can reflect elements of culture, let's consider the quintessential American national game: Baseball, famously associated with the Peanuts (characters created by Schulz, who crafted an almost mythological social portrayal). Its rules dictate that players are 'safe' if they stand on a base, while they can be 'eliminated' when caught in the open field. This sporting mechanism lends itself perfectly to emblematic interpretations of typical American situations: on one hand, it evokes the frontier era of the American Far West, where safety was assured only within the confines of a fort (equivalent to the baseball base), while the open territory posed numerous dangers such as Indians, bandits, and hostile terrain. On the other hand, it mirrors a contemporary American educational scenario, where students navigate between classrooms, which represent safe zones under the supervision of teachers; but unfortunately, even today, particularly in the USA, school grounds are tragically susceptible to violence, often witnessing horrific massacres of defenseless students, who can be "eliminated" just like in baseball!

So, this sport encapsulates a segment of national history while contemporaneously facilitating the integration of young Americans into its specific social reality. This reality encompasses customs and relationships between spaces and individuals that mirror those found within school organizations and the most popular sports game. These factors likely contribute significantly to its popularity within the United States yet hinder its widespread adoption in Europe. In Europe, baseball cannot replicate the same historical, symbolic, or organizational significance across its various levels. In summary, the decision people make about participation in, and the subsequent popularity of, certain sports, cannot solely hinge on physical or practical considerations. Rather, the symbolic meanings associated with the activity play a fundamental role in motivation, often embodied in the persona of a champion.

It is also relevant and insightful to consider the concept of the "deep game," as defined by Geertz (1987), which describes playful expressions rich with elements that encapsulate a particular culture, thereby facilitating its vibrant reproduction. Football, currently the most globally widespread professional game in our society, exemplifies this phenomenon. However, our analysis should not be confined solely to the game itself but should extend to its ability to encapsulate certain social characteristics that permeate societal dynamics through evocative and metaphorical narratives (Hernán-Gómez Prieto, 2009). Expressions such as 'take the field,' 'defend a corner,' 'counterattack,' or 'win in the last second' are universally comprehensible and commonly used beyond their original context. Sport has been characterized as a total social phenomenon (Greco, 2004), yet this also exposes it to the risk of distortion by broader mechanisms, particularly commercial interests, which have increasingly dominated it. Paradoxically, the very success of elite-level sport jeopardizes its authenticity—essentially, it runs the risk of having "sold its soul to the devil."

However, I am not inclined towards moralizing speeches; rather, to maintain a scientific approach, and, hopefully, it is now sufficiently clear that sport can be identified as a quintessential cultural expression. Our current focus should therefore shift towards comprehending, from an educational standpoint, how is possible to implement a Physical Education Curriculum that is scientifically grounded and, consequently, not ideological, traditional, or based solely on 'common sense' (Bertolini, 1988).

2 - AN OPERATIONAL DEFINITION OF SPORT

An operational definition of sport is unfortunately hindered by the epistemological challenges within Physical Education, which struggles to establish an independent vision regarding its formative value, especially through a humanistic viewpoint. This difficulty complicates relevant and sound analysis on the field. Ambiguity arises not primarily from individual responsibility, but rather from structural deficiencies. Physical Education often finds itself marginalized, akin to a 'Cinderella' among academic subjects, a phenomenon that has been widely criticized. For example, Marcel Mauss (1936) pointed out that discussions about the body—a frequently discussed but often oversimplified concept—are often approached from personal perspectives, assuming legitimacy simply based on personal bodily experience.

When it comes specifically to sport, it is particularly interesting to note that even the definition expressed in the "European Sports Charter" of the Council of Europe is deficient on several fronts, illustrating how the issue is not well delimited even at certain levels of political direction. The Charter defines sport as follows:

"Sport means any form of physical activity that, through organized or non-organized participation, aims at expressing or improving physical and mental well-being, developing social relationships, or achieving results in competitions at all levels (Article 2, paragraph 1; CDDS, 1992)"

The application of such a definition at a scientific level appears challenging due to its inherent lack of operational differentiation. Conversely, it is within this context that Motor Praxeology proves particular-

ly valuable. According to Parlebas (1987), sport is an institutionalized competitive motor game with element of uncertainty relating to its results. The French sociologist identifies motricity, competition, uncertainty of result, and institutionalization, as significant characteristics of sport, emphasizing that institutionalization, often overlooked in scientific discourse, holds paramount social significance: it is at the institutional level where criteria determining sports are established, with institutions categorizing activities accordingly. So, the criterion of institutionalization is ultimately decisive to select these activities with privileged status.

To understand the theoretical significance of the French sociologist's analysis, consider a hypothetical scenario: a group of children engaged in street football or basketball game, waiting for the followed training session in the same sport at a sports facility. Although the participants appear to be engaging in the same activity on both occasions, there is a significant contextual shift between the two settings. The institutional context fundamentally alters the "nature" of their activity: what was previously a kind of spontaneous play on the street, later assumes institutional significance because is conducted in a sports facility. Consequently, these two contexts cannot be regarded as identical, despite the motor and technical similarities in the performed actions. From an educational perspective, it is evident that these experiences carry distinct meanings: the first one is characterized as non-formal, the second as informal. Furthermore, there exists a formal educational level, typically within the school environment; nevertheless, delving into this aspect would diverge from the current focus...

Essentially, without a pertinent theory of reference, there is a risk of overlooking the inherent meanings of the activity. This underscores the importance of comprehending its structural essence. As educators and researchers, we should emphasize the significance of understanding these contextual dimensions, given that training opportunities hinge upon them primarily.

3. THE 'SUITABLE SPORTS'

Being part of a group or team primarily entails membership in a community. Therefore, it is essential to analyze both the interpersonal relationships and the motor skills that motor situations demand in order to propose interventions tailored to the needs and capabilities of our students. At this level, Motor Praxeology provides a framework for understanding sociomotricity—a perspective within the epistemology of physical education that examines interactions among individuals in motor contexts. The concept of motor behaviors is thus invoked to emphasize how motor activities engage the wholeness of individuals' personalities, encompassing not only their physiological, psychological, and cognitive dimensions, but also, and perhaps predominantly, their social dimensions in a comprehensive and holistic manner. In essence, motor behavior can be viewed as the outward expressions of personality as it interacts with both the physical environment and social surroundings.

The sociomotor domain encompasses interactions involving motor activities among participants. When an individual performs a motor action without interacting with others, it constitutes a psychomotor situation in the broader sense, where the focus lies on the environment or objects rather than on interpersonal engagement. This category includes activities such as individual skill-based games or lane sports, which typically do not entail interaction with other athletes during performance.

Conversely, interactions in sociomotor contexts involve two distinct types: cooperative interactions among teammates and oppositional interactions such as duels against opponents. In team settings, interactions may be mixed, involving both cooperation with teammates and competition against opponents. When no competitive element is present, interactions are purely cooperative.

Sports Categories (Parlebas, 1987, pp. 110-11)

Sociomotric Interactions	Standard Environment	Unpredicatable Environment
Psychomotricity	Track and Field, Swimming	Individual climbing,
Individual duel	Boxe, Tennis, Fencing	Ciclocross
Cooperative activities	Relay, Pairs skating	Rope climbing, Team canoeing and kayaking
Teams Sport (Teams duel)	Football, Rugby, Volleyball	Teams Regatta, Orientation Raid

These categories serve as a crucial framework for understanding potential relational motor experiences and are equally valuable from an educational standpoint. Providing a comprehensive range of socio-motor situations involves organizing activities not primarily based on various sports (from a technical perspective), but on interpersonal dynamics. In other words, from a socio-motor perspective, offering basketball, football, or volleyball aims to facilitate essentially similar experiences.

Activities that may appear similar due to their individual nature, such as wrestling or sprinting, actually differ significantly: wrestling involves oppositional interactions, whereas sprinting is characterized as psychomotor in nature.

Another dimension that can characterize motor experiences is the environment, which the sports world increasingly seeks to regulate. It has been observed, for instance, that the Olympic Games have progressively phased out outdoor events in favor of indoor facilities, where conditions are more controlled (Parlebas, 1986). This trend mirrors a broader societal inclination: when possible, individuals tend to minimize risks to exert maximum control over situations.

By integrating social and environmental interactions, a new framework emerges that defines different "environments," shaped by the unique characteristics of socio-motor and environmental interactions. Each environment, based on its distinct features, influences individuals to engage in specific motor behaviors differently. This conceptual framework facilitates a coherent design and interpretation of diverse motor play experiences, spanning from formal to informal settings.

ULTIMATE REFLECTIONS

In conclusion, the current epistemological framework within the fields of motor and sport sciences, particularly in scientific inquiry regarding intrinsic structural aspects, appears somewhat ambiguous. To facilitate both pertinent analyses of the specific nature of motor experiences and the development of clearer and more deliberate educational programs concerning their pedagogical value—especially for marginalized groups such as individuals with disabilities, very young children, and those facing socio-economic challenges—it may be beneficial to explore how environments, as defined by Praxeology, stimulate personal capabilities. For instance, research could investigate which motor behaviors are triggered in diverse contexts, evaluate their appropriateness as responses, identify influential factors, and pursue related inquiries.

A final reflection pertains to models of playful-motor activity. A frequently cited adage in praxeology asserts: "the teacher of the game is the game, not the teacher." This implies that regardless of the empathetic, didactic, or pedagogical skills of the teacher, the nature of the activity itself largely determines

the quality of the experience. While sport represents a significant context that should not be overlooked for those who excel in it, there is a risk that it may limit interpersonal relationships and engagement with the external environment. Moreover, it is often perceived as accessible only to a privileged few, labeled as an aristocratic pursuit.

Indeed, the traditional sporting model, epitomized by events such as the Olympic Games (including the Paralympics), tends to confine participants within clearly defined paths, predominantly characterized by individual or team competitions in largely predictable environments.

However, I do not find it useful or appropriate to demand that sports clubs alter their offerings. Conversely, it would be beneficial at a formal level—particularly within public schooling—to reintroduce traditional sports games. Although these games may lack spectacle and thus garner less popularity among federations, they are generally inclusive from a social relations standpoint. Very formative in the sense of 'team building' would also be cooperative activities in the open air, another area to invest in to counteract the tendency to lock ourselves up in indoor settings, or expressive-motor activities such as collective dances and 'human pyramids'. In this regard, educational institutions and local authorities should serve as centers for development, equipped with both material and conceptual resources. Moreover, recognizing motor behaviors as expressions of individual personality suggests the importance of providing diverse stimuli. The goal of Physical Education to improve psychophysical adaptability extends beyond organic adaptations, in particular by emphasising the social, educational and cultural relevance of sports and motor activities.

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TACKLING THE GAPS AND WORKING TOGETHER TOWARDS A BETTER UNIVERSITY SPORT USING THE HEALTHY CAMPUS STRATEGY

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1. INTRODUCTION

The hierarchical structure of sports systems, often referred to as the "sports system pyramid," organizes the different levels of competition and participation within a given sports context. This pyramid typically includes various levels, from the base to the top, and can differ depending on the sport, sporting organization, and country. Generally, the pyramid consists of the following levels:

Base or Initiation: Involves children and young people engaging in basic sporting activities, promoting initiation and physical education. School programs and local clubs are common at this level;

Recreational Sports: Focuses on sports practiced for recreational and leisure purposes without emphasizing high competition;

Training and Development Sports: Athletes begin structured and competitive training, usually in sports clubs and specialized schools, crucial for identifying talents and developing skills;

High Performance Sport: Athletes compete in high-level leagues, championships, and competitions, receiving intensive training and professional support to achieve high performance; and

Elite Sports: The pinnacle of the pyramid, featuring athletes who compete at the highest levels, including world championships, Olympic Games, World University Games, and other international competitions, requiring advanced support from specialized trainers, nutritionists, sports psychologists, and other professionals.

Despite the structured nature of this pyramid also "present" in the higher education environment, university sport remains an "Unknown Giant." It significantly impacts a vast number of students, teams, higher education institutions, and competitions, ranging from intramural levels to global events. However, it remains relatively unknown, under-promoted, and underreported in the media across most countries and regions worldwide.

2. THE SIGNIFICANCE OF UNIVERSITY SPORT

University sport holds a vital position in the broader landscape of sports development, providing a unique and robust framework that supports the athletic, academic, and personal growth of students. The university sports market is vast and well-regulated, playing a crucial role in shaping the future of both recreational and competitive sports. The International Federation of University Sports (FISU), recognized by the International Olympic Committee (IOC), oversees this sector on a global scale. FISU's governance ensures standardized and quality-driven university sports programs worldwide.

FISU's influence extends through its five continental federations and 165 national members, each representing their respective countries. This extensive network creates a cohesive structure that supports

university sports from local to international levels. The organization's reach is substantial, encompassing over 40,000 higher education institutions globally, which together host approximately 200 million students. This scale underscores the vast potential of university sports to foster widespread athletic participation and excellence.

2.1. Bridging the Gaps in University Sports Ecosystem

Despite the impressive numbers and structured framework provided by FISU, significant gaps exist between different stakeholders in the university sports ecosystem. These gaps manifest in various forms, from disparities in resources and facilities to differences in the emphasis on sports within academic institutions. These challenges are present at all levels of the university sports pyramid:

Base or Initiation Level: At the grassroots level, the integration of sports into the daily lives of students can be inconsistent. Some institutions may lack adequate funding or facilities to support basic sports programs, leading to unequal opportunities for student participation;

Recreational Sports: Recreational sports programs are essential for promoting overall well-being and a healthy lifestyle among students. However, varying levels of support and engagement can result in fragmented participation rates, with some students having limited access to recreational sports;

Training and Development Sports: Identifying and nurturing talent requires structured and competitive training environments. Disparities in coaching quality, training facilities, and financial support can hinder the development of student-athletes, creating gaps in talent identification and skill development;

High Performance Sport: Competing at high levels demands significant investment in training, coaching, and support services. Not all universities can provide the necessary resources, leading dual-career programs to imbalances in the performance and success of their athletic programs; and

Elite Sports: At the top of the pyramid, elite athletes require advanced support systems, including specialized trainers, nutritionists, sports psychologists and other experts and specialists.

2.2. The Role of FISU and Healthy Campus Programme

To address these gaps, the role of FISU is pivotal. FISU not only regulates but also promotes the development of university sports through various initiatives and programs. One such initiative is the Healthy Campus Programme, which aims to enhance the overall well-being of students by integrating health and wellbeing into the sports framework. This programme encourages universities to adopt a holistic approach, promoting physical activity, mental health, and social engagement as integral parts of student life, and new trends associated to a healthy lifestyle related with sustainability, social responsibility, disease prevention, risk behavior, and nutrition.

The Healthy Campus Programme also emphasizes the importance of collaboration among universities, national sports federations, and continental structures. By fostering a cooperative environment, these stakeholders can share resources, best practices, and innovative solutions to common challenges. This interconnected approach helps bridge the gaps within the university sports ecosystem, ensuring more equitable opportunities and enhancing the quality of sports programs.

3. ADDRESSING THE GAPS WITH THE HEALTHY CAMPUS PROGRAMME

The Healthy Campus Programme is a transformative initiative designed to bridge the existing gaps within the university sports ecosystem. By focusing on the holistic well-being of university students and the academic community, this programme fosters stronger relationships among key stakeholders, including National University Sports Federations and continental structures. The interconnected nature of these entities necessitates cooperation to empower each other and facilitate communication beyond the traditional sports pyramid model.

3.1. Enhancing Well-Being

The primary goal of the Healthy Campus Programme is to enhance the well-being of students. This holistic approach encompasses physical, mental, and social health, recognizing that a healthy student body is more likely to engage actively and effectively in sports. The programme encourages universities to: implement comprehensive wellness strategies to promote regular physical activity through accessible sports facilities, fitness programs, and recreational activities, that ensures that all students, regardless of their level of athletic ability, have opportunities to participate in physical exercise; to provide resources and support systems for mental health, such as counseling services, stress management workshops, and peer support groups, addressing mental health is crucial for the overall well-being and performance of student-athletes; and fostering a sense of community through team sports, intramural competitions, and social events. These activities help build relationships, enhance teamwork, and create a supportive environment for all students.

3.2. Fostering Stronger Relationships

The Healthy Campus Programme emphasizes the importance of strong relationships among universities, national sports federations, and continental organizations. By creating a network of interconnected stakeholders, the programme facilitates the sharing of resources, expertise, and best practices. This collaborative approach helps to: ensure consistency in the quality and delivery of sports programs across different institutions and regions. This reduces disparities and promotes a more equitable sports environment for all students; share collective resources to enhance sports facilities, training programs, and support services. Smaller institutions or those with limited funding can benefit from the pooled resources and expertise of larger or more established organizations; and to facilitate the exchange of successful strategies and innovative solutions. By learning from each other, institutions can implement effective programs and avoid common pitfalls.

3.3. Moving Beyond the Traditional Sports Pyramid

The traditional sports pyramid, while useful in certain contexts, may not fully capture the dynamic and interconnected nature of university sports. The Healthy Campus Programme advocates for: a more flexible and adaptive structure, where stakeholders can reposition themselves based on evolving needs and opportunities. This approach, allows institutions and organizations to adapt their roles and contributions based on current challenges and opportunities. This flexibility ensures that all stakeholders can respond effectively to changing circumstances; Creates integrated networks that facilitate seamless communication and cooperation among different levels of the sports ecosystem. This holistic view promotes a more cohesive and efficient sports environment; contributes for an positive and holistic development of students as well-rounded individuals. This includes focusing on academic achievements, personal growth, and civic engagement alongside athletic performance.

4. DYNAMIC POSITIONING USING TRADITIONAL HIERARCHIES

The traditional sports pyramid, while effective in certain contexts, may not fully capture the dynamic and interconnected nature of college sports. Recognizing this limitation, the Healthy Campus Programme, using Higher Education Institutions, advocates for a more homogeneous and dynamic structure, allowing various stakeholders to adapt and reposition themselves based on evolving needs and opportunities. This flexible approach facilitates more effective responses to challenges and maximizes the potential for growth and development within university sports.

4.1. Adapting Traditional Hierarchies

Traditional hierarchies in sports often involve rigid structures where roles and responsibilities are clearly defined and fixed. While this can ensure order and predictability, it may also lead to inefficiencies and slow responses to emerging challenges. In contrast, dynamic positioning encouraging: flexibility

in roles and responsibilities allows stakeholders to step into different positions as needed; responsive leadership within the university sports ecosystem should be adaptable. Leaders must be able to pivot strategies and approaches based on real-time feedback and changing circumstances. This might involve shifting focus from competitive achievements to wellness programs during periods of high stress or academic demand for students; and collaborative decision-making processes are more inclusive. Various stakeholders, including students, coaches, administrators, and external partners, are involved in discussions and decisions, ensuring that diverse perspectives are considered and the most effective strategies are employed.

4.2. Maximizing Growth and Development

Dynamic positioning within traditional hierarchies supports the growth and development of university sports by leveraging diverse strengths, different stakeholders bring unique strengths and perspectives to the table. By allowing for fluid roles, these diverse strengths can be leveraged more effectively. For instance, students might lead wellness initiatives, bringing fresh ideas and peer insights that resonate more with their fellow students; enhancing Innovation, more flexible and dynamic structure encourages improvements. Stakeholders are more likely to experiment with new approaches, technologies, and programs when they are not constrained by rigid roles and expectations. This can lead to the development of more engaging and effective sports programs; and, promoting Inclusivity by ensuring that all voices are heard and valued. This approach can help address gaps and disparities within the sports ecosystem, ensuring that programs are more equitable and accessible to all students, regardless of their background or skill level.

4.3. Effective Response to Challenges

The ability to respond effectively to challenges is crucial for the sustainability and success of university sports programs. Dynamic positioning aids in this by a dynamic system, stakeholders can quickly adapt to new challenges, whether they be financial constraints, changes in student interests, or public health crises. This ensures continuity and resilience in sports programs. In other way, by allowing for flexible roles, resources can be allocated more efficiently. For example, during periods of low sports activity, resources can be redirected towards planning and development, ensuring that facilities and programs are continually improved and maintained, the needed continuous improvement, with a dynamic positioning fosters a culture of continuous development. Stakeholders are encouraged to regularly assess and refine their strategies, leading to ongoing enhancements in the quality and effectiveness of sports programs.

5. CONCLUSION

The Healthy Campus Programme represents a significant step forward in addressing the gaps within the university sports ecosystem. By advocating for dynamic positioning within traditional hierarchies, the programme fosters a more adaptable and responsive university sports environment. This approach enhances the ability to address and overcome challenges, maximizing growth and development opportunities.

Through the promotion of student well-being, fostering stronger relationships among stakeholders, and moving beyond the traditional sports pyramid model, the Healthy Campus Programme creates a more equitable and supportive environment for university sports. By encouraging fluid roles, responsive leadership, and collaborative decision-making, the programme ensures that university sports programs are more innovative, inclusive, and resilient.

University sport, while a significant yet underrecognized component of the global sports landscape, holds vast potential for impacting students' lives and developing athletic talent. Addressing the persistent gaps within the sports pyramid requires a concerted effort from all stakeholders. Leveraging

initiatives like the Healthy Campus Programme, universities, sports federations, and other stakeholders can promote well-being, foster cooperation, and enhance the overall quality and impact of university sports worldwide.

This holistic and dynamic approach ensures that all students have the opportunity to thrive, both on and off the field, empowering the next generation of athletes, scholars, and leaders. Through collaboration and innovation, the university sports community can work together to bridge gaps and work towards a brighter future in university sports.

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HEALTH AND HEALTHY LIFESTYLE

ASSOCIATION BETWEEN BODY HEIGHT AND POSTURAL CONTROL PARAMETERS

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ABSTRACT

This study explores the relationship between body height and postural control in adolescents. It found that height significantly affects balance parameters such as mediolateral and anteroposterior movements during single stance tests. Taller individuals may have a larger base of support, contributing to increased stability. Other research suggests that height influences balance variables, with taller individuals exhibiting increased postural sway and higher sway velocity. Additionally, body length, especially leg length, plays a significant role in balance, affecting the body's center of mass and load distribution. Overall, understanding how height impacts postural control is crucial for developing interventions to enhance balance in adolescents.

Keywords: balance, adolescents, single stance test

INTRODUCTION

Body movements are crucial for children's interaction and engagement in physical and social settings (Lara et al., 2017). However, for them to effectively participate, they require a foundation of body balance (Westcott, S. L., & Burtner, P. A. 2004). Balance and postural control are closely linked to the functions of the visual, proprioceptive, and vestibular systems, as well as neuromuscular control (Mignardot et al., 2013).

Posture control or body position control can be defined as balance. Maintaining postural balance is essential to ensure that the body's center of mass remains stable over its support base throughout everyday tasks (Ko et al., 2021). Most often, balance is divided into dynamic balance, which refers to the skill of maintaining the body position in the middle of movement or on an unstable surface, and static balance, which refers to the capability of maintaining a stable body position with minimal swaying while on a firm surface (Nardone & Schieppati, 2010; Davlin, 2004).

As children grow and develop, they experience improvements in their postural control abilities, with the proprioceptive function maturing around 3 or 4 years of age while their vestibular and visual systems typically reach adult-level functioning between 15 and 16. (Steindl et al., 2006).

Since adolescence is a time of intense growth in height, and that boys experience peak growth usually between 13 and 15 years (>10 cm growth acceleration), while girls between 11 and 13.5 years (up to 9 cm growth acceleration) and that shorter and overweight children have poorer balance, the aim of this study was to investigate the potential correlation between body height and postural control parameters (i.e. balance parameters) in adolescents.

METHODS

Participants

The study involved a total of 40 high-school adolescents (29 female, 11 male) from Osijek-Baranja County, Croatia. The participants' average age was 15.53 ± 0.5 years, with an average weight of 62.54 ± 10.95 kg and an average height of 169.22 ± 8.30 cm. Testing was conducted during regular Physical and Health Education classes over three weeks. Before participation, parental consent was obtained, and participants themselves were required to provide written consent. The testing took place over three weeks in March 2024, during regular Physical and Health Education classes. The study was approved by the Ethics Committee of the Faculty of Kinesiology, University of Osijek (classification code 029-01/24-01/05 and registration number 2158-110-01-24-3), and was conducted by the current Helsinki Declaration.

Measurement Instruments

The balance of the participants will be assessed using the Gyko device (Microgate, Bolzano, Italy). The device provides measurements of angular velocities up to $2000^\circ/\text{s}$ and accelerations up to 16 g at a data collection rate of 1000 Hz, while body height was measured using a validated anthropometer (Seca 217 Stadiometer Mobile Height Measurement Scale).

Variables

The following variables were used from the balance parameters obtained using the Gyko device: (Gyko, 2022): Ellipse area (EA) - The area of the ellipse encompassing approximately 95% of the trajectory points is expressed in square millimeters (mm^2). Length (D_L) - The total length of the trajectory, expressed in millimeters (mm), is the sum of distances from one point to the next. Mean velocity (D_V) - represents the average velocity of trajectory movement. Medio-lateral length (ML_L) - the medio-lateral length is the total distance in the medio-lateral plane, calculated as the sum of absolute distances between two points in the medio-lateral direction. Mean velocity ML (ML_V) - represents the average velocity of trajectory movement in the mediolateral plane. Antero-posterior length (AP_L) - the antero-posterior length is the total distance in the antero-posterior plane, calculated as the sum of absolute distances between two points in the antero-posterior direction.

Mean velocity AP (AP_V) - represents the average velocity of trajectory movement in the anteroposterior plane.

PROTOCOL

All measurements were conducted barefoot. Participants began by having their body height measured using an anthropometer. Subsequently, they performed a single-leg stance test with eyes open. The Gyko device was attached to a special belt and positioned on the T1 vertebra, identified by manual palpation according to the manufacturer's instructions (Gyko, 2022). After device placement, height was measured, and the obtained values were entered into the GykoRePower program. The duration of the test itself was 30 seconds per leg, with participants first lifting their left leg and then their right. The GykoRePower program selected a movement test with a stabilization time of 1 second, which was not included in the calculation of results.

The Tibco Statistica Enterprise program (version 14.0.1.25) was used for data analysis. The Shapiro-Wilk W test was employed to assess the normality of distribution, revealing that all variables related to balance parameters were not normally distributed, while the variable "body height" was normally distributed. The Wilcoxon signed-rank test was used for comparing the left and right legs in balance parameters, and the Spearman correlation test was utilized to determine the association between body height and balance parameters of the left and right legs. The level of association is described as negligible if the correlation coefficient is less than 0.29, low within the range of 0.30 to 0.50, moderate between 0.50 and 0.70, high between 0.70 and 0.90, and very high if the coefficient is between 0.90 and 1.00 (Mukaka, 2012). Statistical significance was set in all tests at $p < 0.05$.

RESULTS

Table 1: Results of the Wilcoxon signed-rank test for paired samples between the left and right legs in balance parameters.

Variables	Number	T	Z	p
1-EA & 2-EA	40	384,00	0,35	0,73
1-D_L & 2-D_L	40	401,00	0,12	0,90
1-D_V & 2-D_V	40	401,00	0,12	0,90
1-ML_L & 2-ML_L	40	353,00	0,77	0,44
1-ML_V & 2-ML_V	40	348,00	0,83	0,40
1-AP_L & 2-AP_L	40	338,00	0,97	0,33
1-AP_V & 2-AP_V	40	312,50	1,31	0,19

Legend: T - t value of the test; Z - z value of the test; p - statistical significance $p < 0.05$, 3-EA- Ellipse area right leg, 3-D_L- Length right leg, 3-D_V- Mean velocity right leg, 3-ML_L-Medio-lateral length right leg, 3-ML_V- Mean velocity ML right leg, 3-AP_L -Antero-posterior length right leg, 3-AP_V- Mean velocity AP right leg, 4-EA- Ellipse area left leg, 4-D_L- Length left leg, 4-D_V- Mean velocity left leg, 4-ML_L-Medio-lateral length left leg, 4-ML_V- Mean velocity ML left leg, 4-AP_L -Antero-posterior length left leg, 4-AP_V- Mean velocity AP left leg

According to the Wilcoxon signed-rank test for paired samples, there were no significant differences between the left and right legs in balance parameters. The results indicate that students do not exhibit significant body asymmetry in the single stance test with open eyes.

Table 2: Association of body height with body balance parameters

Variable	Valid	r	p
BH & 1-EA	40	0,23	0,16
BH & 1-D_L	40	0,37	0,02
BH & 1-D_V	40	0,36	0,02
BH & 1-ML_L	40	0,30	0,06
BH & 1-ML_V	40	0,30	0,06
BH & 1-AP_L	40	0,32	0,04
BH & 1-AP_V	40	0,33	0,04
BH & 2-EA	40	0,41	0,01
BH & 2-D_L	40	0,36	0,02
BH & 2-D_V	40	0,36	0,02
BH & 2-ML_L	40	0,35	0,03
BH & 2-ML_V	40	0,37	0,02
BH & 2-AP_L	40	0,32	0,05
BH & 2-AP_V	40	0,36	0,02

Legend: BH - body height; r - Spearman correlation coefficient, 1-EA- Ellipse area right leg, 1-D_L- Length right leg, 1-D_V- Mean velocity right leg, 1-ML_L-Medio-lateral length right leg, 1-ML_V- Mean velocity ML right leg, 1-AP_L -Antero-posterior length right leg, 1-AP_V- Mean velocity AP right leg, 2-EA- Ellipse area left leg, 2-D_L- Length left leg, 2-D_V- Mean velocity left leg, 2-ML_L-Medio-lateral length left leg, 2-ML_V- Mean velocity ML left leg, 2-AP_L -Antero-posterior length left leg, 2-AP_V- Mean velocity AP left leg

According to the results, statistically significant differences were found between the variables of Body height (BH) and Length right leg (1-D_L) ($p=0.02$); BH and Mean velocity right leg (1-D_V) ($p=0.02$); BH and Antero-posterior length right leg (1-AP_L) ($p=0.04$); BH and Mean velocity AP right leg (1-AP_V) ($p=0.04$); BH and Ellipse area left leg (2-EA) ($p=0.01$); BH and Length left leg (2-D_L) ($p=0.02$); BH and Mean velocity left leg (2-D_V) ($p=0.02$); BH and Medio-lateral length left leg (2-ML_L) ($p=0.03$); BH and Mean velocity ML left leg (2-ML_V) ($p=0.02$); BH and Antero-posterior length left leg (2-AP_L) ($p=0.05$); BH and Mean velocity AP left leg (2-AP_V) ($p=0.02$).

DISCUSSION

Based on the obtained results of this study, the height significantly influences balance parameters such as mediolateral and anteroposterior movements, and the ellipse area of both feet during the performance of the single stance test. Body height affects the dimensions of the base of support, which is the area beneath the body that provides stability during standing or locomotion. Taller individuals may have a larger base of support due to longer limbs, which can contribute to increased stability. In some research, height was the only variable significantly correlated with balance variables, and increasing the support base area reduces the distance from the center of gravity to the base and enhances stability (Alonso et al., 2012). Body height affects the location of the center of mass. Taller individuals typically have a higher center of mass compared to shorter individuals. This can influence balance control and stability, as the higher center of mass may require greater muscular effort to maintain equilibrium. Increased height worsens balance (Kejonen, Kauranen & Vanharanta, 2013). Lee & Lin (2007) found that individuals with an ectomorphic body type exhibit increased postural sway, which they attributed to a raised center of mass. Tiribello (2019) obtained similar results, where the group taller than 1.90 meters showed higher sway velocity, larger sway area, and greater excursion in both directions compared to shorter volunteers. Body length, especially leg length, plays a significant role in balance. Leg Length Discrepancy results in a displacement of the body's Center of Mass, resulting in asymmetrical load distribution on the lower extremities (Vrhovski et al., 2019). The subject's height could influence the test-retest reliability, especially in terms of sway size and area variables. (Eom et al., 2022)

CONCLUSION

Overall, body height interacts with various physiological and biomechanical factors to influence balance control and stability. Based on the results of this research, body height plays a significant role in balance parameters. It influences balance and stability by affecting the center of mass, the base of support, and other factors. Taller individuals may face challenges related to their higher center of mass, while shorter individuals may have difficulty maintaining stability. These factors impact mediolateral and anteroposterior movements, as well as the ellipse area. Understanding these relationships is crucial for developing effective interventions to improve balance in diverse populations.

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ASSOCIATION BETWEEN PHASE ANGLE FROM BIOELECTRICAL IMPEDANCE ANALYSIS AND PHYSICAL ACTIVITY IN NON-ATHLETE COLLEGE STUDENTS

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ABSTRACT

Phase angle is an important parameter which reflects cellular health, body cell mass and the integrity of the cell wall. It is a valuable prognostic factor for chronic disease, while the adequate level of physical activity is key to prevent those diseases. This study aims to evaluate association between self-reported habitual physical activity level and phase angle from bio-impedance analysis in college students who are not actively involved in sports. 163 students of both sexes (92 women and 71 men) were involved in this cross-sectional study. Habitual physical activity was evaluated by standardized questionnaire IPAQ-short version. Phase angle and body composition were assessed by bioelectrical impedance analysis using Tanita MC780MA. Results showed that most of the students (71%) reported that they were moderately active (MET/week score between 600 and 3000), while the rest (29%) were in category low active (MET/week < 600). Students who are moderately active have higher phase angle compared to low active students ($p < 0.005$). Phase angle is positively correlated with MET-score ($r = 0.32$, $p < 0.05$), but also correlates with different variables of body composition. After adjustment for sex and BMI, correlation between phase angle and physical activity is no longer statistically significant. Association between phase angle and self-reported habitual physical activity is very complex and under the influence of body composition and sex. However, with higher physical activity level phase angle is also higher, which confirms positive effects of everyday physical activity to cellular health in non-athletic student population.

Key words: phase angle, physical activity, college students

INTRODUCTION

Bioelectrical impedance analysis (BIA) is used for assessment of the body composition since the 1960s (Thomaset, 1962). It measures the impedance of the human body and uses different models and equations to assess human body composition. Models and equations used in BIA measurements must be sex-specific, age-specific, ethnicity-specific, as well as health condition-specific to produce useful body composition results (Yamada et al, 2022). However, raw BIA data, such as reactance, resistance and phase angle (PhA) are obtained directly from measured impedance, and as such, results are not influenced by the choice of model or equation. Phase angle is computed as arctangent of bioelectrical reactance divided by resistance. Since resistance and reactance are associated with cell density and body fluid content, phase angle has been recognized as indicator of cell quantity and quality (Norman et al, 2012). Higher phase angle is associated to higher muscle mass and higher ratio of intracellular and extracellular water (Francisco et al, 2020). It has been shown that athletes have higher values of

phase angle than general population (Mattiello et al, 2020) On the other hand, low value of phase angle is considered as a predictor of malnutrition (Wilhelm et al, 2014; Basile et al, 2014), low muscle strength (Slee, Birch i Stokoe, 2015), frailty (Kilic et al, 2017) and mortality (Basile et al, 2014; Kilic et al, 2017). The body of evidence suggests predictive value of phase angle for mortality risk, staging and severity of various diseases (Pereira et al, 2018; Belarmino et al, 2017; Maddocks et al, 2015; Genton et al, 2017) There is strong scientific interest in usefulness of phase angle in different areas of clinical research, such as: oncology, cardiology, critically ill patients, nephrology, infectious and metabolic diseases (Bellido et al 2023) Although scientific interest in phase angle is increasing, most of the studies focus on clinical trial of different diseases or on values of phase angle is athletes, since it has been shown that phase angle is associated to strength and sport performance (Campa et al 2022). There is limited evidence on phase angle determinants in general population, especially on association between phase angle and habitual physical activity. Since there is a substantial amount of college students who are not actively involved in any kind of sport, results of phase angle measured on athletes or subjects of clinical studies are not applicable to them. The aim of this research is to evaluate association between self-reported habitual physical activity level and phase angle from bio-impedance analysis in college students who are not actively involved in sports.

MATERIALS AND METHODS

This cross-sectional study consisted of bioelectric impedance analysis and assessment of habitual physical activity level. Some additional data were collected: height, gender and age. Upon arrival participants were measured for height, followed by BIA measurement and after that they fulfilled a questionnaire.

163 students of both sexes (92 women and 71 men) at the University of Applied Sciences Lavoslav Ružička in Vukovar volunteered to participate in this survey. Participants were 18-22 years old, with average age of 20.5 years. Criteria for inclusion was good general health, and specially the absence of any chronic noncommunicable disease. Exclusion factor was active involvement in sports. They were informed about goals of the study and gave their informed consent to be involved in the survey.

Height of all participants was measured using stadiometer Seca 711 (Seca GmbH, Hamburg, Germany) according to instructions of the manufacturer. Bioelectric impedance analysis (BIA) using the multi-frequency body composition analyzer Tanita MC780MA (Tanita Co, Tokyo, Japan). The measurement results included phase angle and the body composition variables: the body mass index (BMI), mass of body fat, lean body mass and total body water. All measurements were performed in the morning (at 7-9 AM), by the same trained technician, following the recommendation on overnight fast.

Physical activity level was assessed by International physical activity questionnaire (IPAQ) an reliable, validated questionnaire, which was verified in a Croatian version (Sember et al, 2020) This is self-reported questionnaire which assesses physical activity in the last 7 days in four domains of physical activity: work, transport, domestic and garden and leisure time. The questionnaire provides separate scores for walking, moderate-intensity activity and vigorous-intensity activity. The results were presented as the estimation of energy expenditure in metabolic equivalent-minutes per week (MET hours/week). According to IPAQ scoring protocol (IPAQ, 2005), MET min/week of specific activity is computed by multiplying MET value of particular activity (3.3 for walk, 4 for moderate intensity activity, and 8 for vigorous intensity activity) by the minutes the activity was carried out and again by the number of days that that activity was undertaken To calculate physical activity scores, only the activities lasting at least 10 minutes at the time were taken into account. Total physical activity score was calculated. Level of physical activity was scored according to MET min/week. Score below 600 MET min/week was characterized as low activity level, moderate activity level was with MET min/week score between 600 and 3000, while score above 3000 MET min/week is considered high activity level.

Statistical analysis

The statistical analysis was performed using IBM SPSS Statistics 20. The level of statistical significance was set at $p=0.05$. The Kolmogorov-Smirnov tests were applied to test the normality of data. Descriptive statistics included mean, standard deviation, minimum and maximum. To check for differences one way Anova with Bonferroni corrections was used. Correlation was tested using Pearson correlation coefficient, and partial correlation.

RESULTS

Results of bioelectric impedance analysis are presented in Table 1.

Table 1. Results of bioelectric impedance analysis measurements (N=163)

VARIABLE	ARITHMETIC MEAN	STANDARD DEVIATION
Phase angle (°)	5.8	0.8
BMI (kg/m ²)	22.2	4.6
Height (cm)	174	10.5
Body mass (kg)	67.5	16.1
Mass of body fat (kg)	15.4	4.8
% of body fat	22.3	5.7
Lean body mass (kg)	52.3	13
Total body water (kg)	38.8	8.7

Most of the participants (72%) were in the category of normal body weight (BMI between 18.5 and 25), 19% are overweight (BMI>25), and 9% are underweight (BMI<18.5). Phase angle varied from minimal 4.5° to maximal 7.9°. Men had higher value of phase angle (6.6°) than women (5.4°), and this difference was statistically significant ($p<0.001$). Difference in phase angle between weight categories was also statistically significant ($p=0.002$) with the highest phase angle value among overweight, and lowest among underweight. Differences in phase angle between BMI categories are presented by Figure 1.

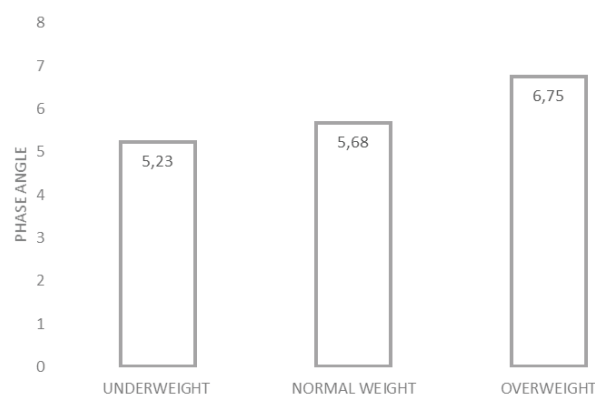


Figure 1. Differences in phase angle between BMI categories ($p=0.002$)

Results of physical activity questionnaire as MET min/week are presented in Table 2.

Table 2. Results of IPAQ in MET min/week

	ARITMETIC MEAN	STANDARD DEVIATION
VIGOROUS ACTIVITY (METmin/week)	407.4	838.4
MODERATE ACTIVITY (METmin/week)	506.8	579.3
WALKING (METmin/week)	925.3	909.7
TOTAL PHYSICAL ACTIVITY (MET min/week)	1839.5	783.3

According to obtained MET min/week participants are divided to different categories of physical activities. Most of the participants (71%) were moderately active, and the rest (29%) were in the low activity category. There was no highly active person among participants. Moderately active participants had statistically significant ($p=0.03$) higher mean phase angle (6.2°) compared to low active persons (5.6°) as could be seen in Figure 2.

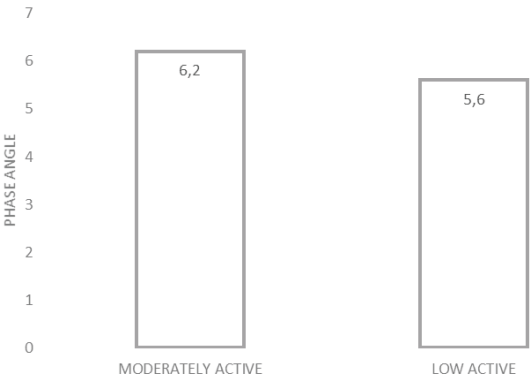


Figure 2. Difference in phase angle between moderately active and low active participants ($p=0.03$)

Phase angle correlated positively to total physical activity ($r=0.32$, $p=0.03$). Similar correlation was observed between phase angle and different types of activity(vigorous, moderate, walking). However, phase angle correlated positively to BMI as well ($r=0.42$, $p=0.02$), and to body weight ($r=0.58$, $p=0.04$), and height ($r=0.62$, $p=0.036$).

Table 3. presents correlation between phase angle and habitual physical activity after adjustment for sex and BMI (partial correlations). It could be seen from the table that correlation between physical activity and phase angle is no longer statistically significant after the adjustment.

Table 3. Partial correlation between phase angle and physical activity (after controlling for sex and BMI)

		PHASE ANGLE
VIGOROUS ACTIVITY (METmin/week)	r	0.199
	p	0.146
MODERATE ACTIVITY (METmin/week)	r	0.147
	p	0.466
WALKING (METmin/week)	r	-0.052
	p	0.687
TOTAL PHYSICAL ACTIVITY (MET min/week)	r	0.128
	p	0.489

DISCUSSION

Participants involved in this study, even though they are not actively involved in any sport, were mostly of healthy weight, with BMI value between 18.5 and 25 kg/m². However, there is 1 in 5 students in overweight category, indicating that some involvement in sports activity or exercise would be beneficial. Their habitual physical activity is mostly consisted of walking, while they spend much less energy in vigorous and moderate physical activity. Most of them walk to the college, and that is probably the main reason for these results of walking being the greatest part of their habitual activity. Almost one third of participants are in category of low activity, indicating that their habitual involvement in physical activity is minimal, with less than 600 MET min/week. This is much less than recommended level of physical activity by World Health Organization. Regular physical activity is very important factor for the prevention of different types of diseases, such as cardiovascular diseases and some types of cancer (Vavie et al, 2019; Lynch, 2010). Phase angle measured by bioelectric impedance analysis is slightly below the average values for that age. According to Mattiello et al (2020), who calculated reference values for phase angle measured by BIA in their meta-analysis, average phase angle for males of age 19-28 is 6.9 (95%CI: 6.6-7.2), while average phase angle for females of same age is 6.1 (95%CI: 5.9-6.3). Male participants in this study had average phase angle of 6.6 which is 0.3 or 4% lower than reference value, while females had average phase angle of 5.4 which is 0.7 or 11.5% lower than reference value. Phase angle value is usually connected to integrity and functionality of the cell membrane, intracellular composition and enhanced tissue capacity (Gonzales et al, 2016). It has been shown that phase angle is associated to muscle strength (Mala et al, 2017). Athletes have higher values of phase angle than general population (DiVincenzo et al, 2019), and it is inevitably proven that regular exercise is associated to higher phase angle, but even in people who are not regularly exercising or playing sports, physical activity should be involved in everyday life through habitual activities to preserve health. Participants of this study are low or moderately active, and their phase angle is also below reference value for age indicating that body composition and cell integrity could also be affected by lack of physical activity. Correlation between habitual physical activity and phase angle is influenced by covariates BMI and sex, and after adjustment for those variables, correlation between MET min/week of total physical activity and phase angle is not statistically significant. The reason for this result could be in lack of participants with high physical activity, which were absent in this sample. It seems that the difference of moderate and low activity is not big enough to produce some detectable trends in phase angle. Some other studies (Yamada et al, 2022) reported correlation between moderate to vigorous daily activity and phase angle which is different than results of this study, but we believe that this difference could be result of difference in examined population and the lack of vigorous activities among participants of this study.

The main limitation of this study was the use of subjective measure for assessment of habitual physical activity. The questionnaires are not as accurate in assessing physical activity level, but since the IPAQ, the questionnaire which we used in this study, is standardized and validated questionnaire, we believe that it is accurate enough to assess habitual physical activity without great bias. Another limitation of this study is its cross-sectional design which does not allow causal interpretation of the results. However, this study aimed to assess association between phase angle and level of habitual physical activity in students who are not involved in sports, and causal interpretation was not in the scope of this study.

CONCLUSION

Results of this study showed that there is no direct correlation between phase angle and habitual physical activity in college students which are not actively involved in sports, but the relationship between two variables is very complex and influenced by body composition and sex. However, with higher physical activity level phase angle is also higher, which confirms positive effects of everyday physical activity to cellular health in non-athletic student population.

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CORRELATION OF FOOT LOAD DISTRIBUTION AND CONTACT SURFACE WITH BALANCE IN PROFESSIONAL ATHLETES AND STUDENTS: RESEARCH

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ABSTRACT

Introduction: Being affected by intrinsic and extrinsic factors, load distribution is mostly higher on one of the lower extremities. It is hypothesized that the foot with a higher percentage of load distribution could potentially correlate with better balance because of better stimulation of the proprioceptors. It is also hypothesized that better balance could potentially correlate with the bigger plantar contact surface of the midfoot, which is derived from the fact that the mentioned part of the foot is more sensitive to tactile and vibration stimuli.

Methods: With this paper, we examined whether there is any correlation between the bigger load distribution on one of the extremities and better balance on the same side. We also examined whether there is a correlation between the bigger plantar contact surface of the midfoot and better balance on the same side. The parameters were analysed in two groups. Experimental group contains 27 male professional athletes, while the control group contains 30 male students. Parameters were measured using baropodometry and Posturomed device.

Results: We found statistically significant weak correlation between the bigger load distribution on the left foot and better balance on the same side in the group of students ($r = 0,390664$, $p = 0,032803$).

Conclusion: No correlation can be found between any parameters in either group except the load distribution and stability on the left leg in the group of students. In conclusion, the quality of evidence is scarce and requires a study with more participants.

Keywords: balance; contact surface; load distribution; proprioception; sport

INTRODUCTION

During contact with the ground, feet are constantly loaded with bodyweight. Load provides sensory information by stimulating several types of receptors which manifests as a sense of proprioception (Ohlendorf et al., 2020). While maintaining upright position, in ideal conditions, load is evenly distributed on both feet. However, these ideal conditions are barely achievable. Being affected by intrinsic and extrinsic factors, load distribution is mostly higher on one of the lower extremities (Fullin et al., 2022). Mentioned load can be measured using baropodometry providing data about the load distribution between the two lower extremities (Morasiewicz et al., 2018).

Besides the load distribution, the baropodometer used during this research also provides data about a plantar contact surface of the foot displayed as forefoot, midfoot and rearfoot contact surface. Various factors affect the structural changes of the foot which consequently leads to its different shapes and types. These differences can be observed between the feet of different people and also comparing the feet of the same person, so it is not a rarity that the different plantar contact surfaces can be observed in both cases (Kramer & Lautzenheiser, 2022).

Postural balance is an ability to maintain an upright position over the support base while participating in everyday activities (Onofrei & Amaricai, 2022). Feet have a big role in the process of maintaining balance through the mechanisms of postural control. With the goal of maintaining balance, a synergistic activation of the muscles must be present (De Blasiis et al., 2023). For that to happen, brain must be provided with afferent informations that including the vestibular and visual system, are also provided by the sense of proprioception (Henry & Baudry, 2019). The ability of maintaining balance can be quantified by the usage of a Posturomed device which is also used in this research (Petró et al., 2018).

Researching the databases, we found no common studies on the topic of our research. However, there is an assumption that a bigger load of the foot leads to a better stimulation of the proprioceptors, which have a role in maintaining balance (Ohlendorf et al., 2020). Also, there is an assumption that a bigger sensibility of the midfoot to tactile and vibration stimuli could potentially influence the mechanism of postural control (De Blasiis et al., 2023).

We hypothesised that there is a correlation between the bigger load distribution and better balance. It is also hypothesised that there is a correlation between the bigger plantar contact surface of the midfoot and better balance.

METHODS

Following the hypotheses, we examined whether there is any correlation between the bigger load distribution on one of the extremities and better balance on the same side. We also examined whether there is a correlation between the bigger plantar contact surface of the midfoot and better balance on the same side. The parameters were measured in two groups of participants. Experimental group consisted of 27 male professional football players, while the control group consisted of 30 male students from the Faculty of Health Studies in Rijeka. The mean age value in the experimental group was $25,19 \pm 3,96$ years. In the control group, the value of age is presented with median because of the normality ($p < 0,05$). Therefore the median value was 20 years with a range from 19 to 37 years. The mean height value of the experimental group was $180,89 \pm 6,31$ cm, while in the control group it was $184,03 \pm 5,79$ cm. The mean weight value of the experimental group was $78,15 \pm 6,65$ kg and in the control group it was $79,53 \pm 8,87$ kg.

Load distribution (%) and plantar contact surface of the midfoot (cm²) were both measured using a baropodometer (Letsense) on a Biomech platform consisted of four connected modules with dimensions 49 cm x 54 cm (Hawrylak & Gronowska, 2020). Stability left and right (%) were measured using a Posturomed device (Haider Bioswing) with a platform of dimensions 60 cm x 60 cm (Munoz-Martel et al., 2019).

At the moment of measurement using the baropodometer, the participant had to stand on a platform and maintain an upright position while standing still. The measurement lasted ten seconds and the results were calculated by a Biomech software.

At the moment of measurement using a Posturomed device, the participant had to stand on a surface placed in front of the Posturomed at a distance marked with the person's height. After the audio sign produced by the computer, the participant had to place a measured lower extremity on the platform previously set to the highest instability. The non measured leg had to be lifted above the surface and the participant had to stand as still as possible. If the lifted leg touched the platform or the participant

grabbed onto a protective fence, the measurement was repeated and the errors were counted. There were ten measurements for each leg, but the first two were probational, so only the last eight measurements were used by the software Bioswing to calculate the results. Each measurement lasted for ten seconds with a break between the measurements of also ten seconds.

Before the measurements with both devices, a calibration was made and the data of age and previously measured weight and height were collected.

The inclusion criteria for both groups were male gender, capability of maintaining balance during at least ten seconds on the Posturomed platform set to the highest instability setting, absence of a neurological impairment and absence of a visual impairment, except with the usage of an adequate visual aid like glasses or contact lenses.

The exclusion criteria for both groups were absence of the mentioned inclusion criteria, female gender, an acute injury or participation in a rehabilitation process.

RESULTS

Table 1. Pearson correlation of the parameters in the group of students

	r	p
Load distribution and stability of the left foot	0,391*	0,033* ¹
Load distribution and stability of the right foot	-0,122	0,521
Midfoot contact surface and stability of the left foot	-0,080	0,673

Table 2. Spearman correlation of the parameters in the group of students

	Spearman R	p
Midfoot contact surface and stability of the right foot	-0,074	0,696

Table 3. Pearson correlation of the parameters in the group of professional athletes

	r	p
Load distribution and stability of the left foot	-0,043	0,829
Load distribution and stability of the right foot	0,042	0,834
Midfoot contact surface and stability of the left foot	-0,024	0,906
Midfoot contact surface and stability of the right foot	0,003	0,988

Tables 1. and 3. show the results of the Pearson correlation between the named parameters. Table 2. shows the results of the Spearman correlation of the named parameters. The Spearman correlation was made because the Kolmogorov-Smirnov test showed normality $p < ,05$ of the midfoot contact surface of the right foot data in the group of students. The correlation coefficient (r) and the p-value (p) presented that there is a weak statistically significant correlation between the load distribution and the stability of the left foot.

¹ *statistically significant correlation

DISCUSSION

The reason why the professional athletes as an experimental group and the students as a control group are included in this research is the willingness of comparing the measured values between the physically extraordinarily active and less active people. Another reason is the hypothesis that the professional athletes have more developed motor abilities like balance. However, the results presented contrary outcome. The control group had the mean balance value of $41 \pm 21,09$ % on the left leg and $43,10 \pm 19,33$ % on the right leg, while the experimental group had the mean balance value of $35,70 \pm 23,37$ % on the left leg and $35,48 \pm 25,35$ % on the right leg. Comparing the contralateral values of the feet of the same participant, we found that the bigger value of load distribution and contact surface was connected with the better stability of the same extremity in 16/27 professional athletes. However, the Pearson correlation has shown no correlation between the load distribution and stability, neither between the plantar contact surface of the midfoot and stability. The first reason for that could be the fact that postural balance is multifactorial and only one factor such as load distribution may not be enough to predict its quality (Yamamoto et al., 2023). The second reason could be the fact that the proprioceptors in a human body are not only stimulated while standing in an upright position, they are also stimulated in any other position or during any other activity like sitting or walking (Ferlinc et al., 2019). The third reason could be that during the day, people are rarely standing in a still, upright position without changing the center of gravity from one side to another (Henry & Baudry, 2019). That also changes the side of the bigger load distribution, so the fact that during the position in which we measured the participants, the load distribution is bigger on one of the lower extremities, may not make a big impact on balance. The mentioned explanations are applied on all of the results, even in the control group. We hypothesise that the exception that we found a weak statistically significant correlation between the bigger load distribution and better stability of the left foot in the group of students, could be a coincidence because the correlation was weak. However, we suggest a study with more participants and better control of conditions like feet positioning before the beginning of the measurement using the baropodometer, which should be the same in all of the participants. During this research, the named factor was not controlled, but Chiari et al. concluded that it makes a difference in the results (Chiari et al, 2002). The interesting finding of this research is the fact that a 100% of the students had a bigger value of load distribution and contact surface of the midfoot on the left leg, while a 100% of the professional athletes had a bigger value of load distribution and contact surface of the midfoot on the right leg. The suspicion of it being a product of a potential malfunctioning device used in the process of research was rejected by the fact that the medio-lateral transfer of the bodyweight was precisely and continuously shown on the monitor while testing the mentioned theory. Hébert-Losier and Murray concluded that the percentage of bodyweight distribution and contact surface were one of the most reliable parameters measured using baropodometry (Hébert-Losier & Murray, 2020). Taking that into account, the mentioned occurrence can also be a material for a future study with more participants and better control of the conditions mentioned previously.

CONCLUSION

Postural balance is very complex and influenced by many different factors. Its complexity makes it difficult to test if a single separate factor significantly predicts it. Even though we found a weak statistically significant correlation between the bigger load distribution and better stability of the left foot in the group of students, the fact that the better balance in that case can be predicted by the bigger load distribution must be tested additionally with a bigger number of the participants and better control of the conditions.

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DIFFERENT TREATMENT OPTIONS FOR TRAUMATIC MYOSITIS OSSIFICANS IN ATHLETES: REPORT OF TWO CASES

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ABSTRACT

Myositis ossificans traumatica (MOT) is a form of benign bone formation within skeletal muscle and soft tissue and occurs in patients with a history of recent or chronic sports trauma. Although the mechanism of bone formation in the muscle is not fully understood, the process occurs with an incidence of 9% to 20% in active young men as a result of intense physical activity with muscle injury. As most MOT lesions resolve on their own, conservative treatment is chosen as a first step. Surgical treatment is reserved for cases where conservative therapy fails and is usually performed at least 6 months after the injury to minimize the likelihood of recurrence. This case report shows the different treatment procedures for MOT in a professional athlete and a recreational athlete. In the first case, a recreational athlete was treated with a conservative approach and made a full recovery within five months. In contrast, a professional athlete who underwent surgery made a full recovery after three months. The difference in recovery time suggests a possible benefit of early surgery compared to a conservative approach in the treatment of MOT. Although conservative treatment is a reasonable first-line approach, early surgical removal may improve the recovery process and allow the athlete a quicker return to training and competition. Therefore, there is an objective need for comprehensive research that should focus on defining optimal conservative and postoperative protocols to help patients recover faster and with better quality.

Key words: case report, myositis ossificans, rehabilitation, surgery

INTRODUCTION

Myositis ossificans is a rare disorder characterized by solitary, benign bone formation that develops within muscle or soft tissue (Savvidou et al., 2021). A functionally self-limiting, mature bone formation can affect any tissue including subcutaneous fat, tendons and nerves. MO mostly occurs in skeletal muscles such as the brachialis, quadriceps and adductor muscles (Savvidou et al., 2021; Devilbiss et al., 2018). In the literature, MO is categorized into three types: MO progressiva (hereditary type), atraumatic MO (associated with burns, hemophilia and neurological diseases) and MO circumscripta or traumatic MO (Savvidou et al., 2021; Devilbiss et al., 2018). Traumatic myositis ossificans (MOT) is the most common form and accounts for 60-75% of all cases of MO (Devilbiss et al., 2018; Li et al., 2016). In the orthopaedic literature, MOT is most commonly described as a result of repetitive injury or direct impact (Abate et al., 2011; Martins et al., 2016). It is most common in athletes since they are consistently exposed to injuries characteristic of specific sports, especially contact sports (Devilbiss et al., 2018). Muscle contusions in sports account for 12.1% of all sport-related injuries and are more frequently observed in male athletes (15.1%), while they account for 6.3% in female athletes (Li et al., 2016). The pathophysiology of MOT is poorly understood. It is hypothesized that the lesion is primarily a proliferative mesenchymal response

to the resulting soft tissue injury (Walczak et al., 2015; Medici and Olsen, 2012). Following injury, an inflammatory cascade is stimulated, triggered by a large number of cytokines, mainly morphogenetic proteins 2 and 4 (BMP-2 and BMP-4) and transforming growth factor (TGF). In response to the cytokines, vascular endothelial cells induce the mesenchymal stem cells to differentiate into chondrocytes or osteoblasts, leading to the formation of new bone. The histological features of MOT typically progress through three stages: early, intermediate and mature (Walczak et al., 2015; Medici and Olsen, 2012).

On physical examination, patients usually report a history of trauma. Patients usually present with persistent pain, swelling, decreased range of motion and joint stiffness (Walczak et al., 2015). Calcifications within the muscle are usually visible on X-rays in the early stages of the disease. Due to its sensitivity, computed tomography (CT) is one of the best diagnostic tools in the early stages (4 – 6 weeks). The diagnostic gold standard for most soft tissue injuries is magnetic resonance imaging (MRI). Ultrasound scanning (USS) is used when differentiating the consistency of the resulting mass (Devilbiss et al., 2018; Lacout et al., 2012). Less known laboratory diagnostics favor an increase in C-reactive protein, erythrocyte sedimentation and prostaglandin E2 serum in the early stages. (Singh et al., 2003). Conservative treatment is the treatment of choice as most MOT lesions resolve on their own. Initial treatment usually starts with classic RICE (rest, ice, compression and elevation) treatment, followed by physiotherapy to restore range of motion and to decrease pain (Walczak et al., 2015). However, if the lesion remains symptomatic despite conservative measures, surgical treatment may be considered. It is advisable to delay surgical removal until the mature stage to minimize the likelihood of recurrence (Coner and Duffy, 2009). However, the available data do not favor delayed surgical treatment and it is suggested that early excision also carries a minimal risk of recurrence (Orava et al., 2017; Ogilvie-Harris and Fornasier, 1980). We report two cases of MOT in athletes, the first case of a 24-year-old recreational kickboxer who completed conservative treatment of MOT and the second case of a 27-year-old professional football player who underwent surgical excision one month after injury.

CASE REPORTS

Patient 1

History: A 24 year-old recreational kickboxer was referred to the Polyclinic for orthopedics, physical medicine and physical therapy „Scipion“ with pain and swelling in the left anterior thigh. The contusion of the left thigh occurred a month earlier during sparring when he received several low kicks to the left quadriceps. During the last month, the patient reports worsening symptoms with constant pain and tightness in the left thigh. He reported difficulty walking, going up or down stairs and difficulty sleeping due to pain.

Physical examination: A visible painful mass was located ventrally in the distal third of the left thigh. Lower limb sensation and muscle activity was intact. He performed a squat up to 30° of left knee flexion. The passive range of motion of the left knee ranged from -10° to 50° of flexion, with firm end range point and with severe pain.

Ultrasound: Demonstrated a sharply limited and irregularly formed hypoechoic zone with focal calcifications of about 20x2.7 centimeters along the course of the vastus intermedius muscle. The lesion was well separated from underlying bone which an X-ray confirmed.

Treatment: In the following days, he was put to rest and started taking indomethacin (75 mg daily) for 21 days. Immediately after the examination he started with gradual physical therapy that included laser, functional massage of the quadriceps and popliteus, soft tissue mobilization, post-isometric relaxation of the hip and knee, osteoarticular mobilization of the hip and knee (Mulligan concept) and passive stretching of the quadriceps and hip flexors muscles. Due to the lack of knee flexion, cycling was performed later in therapy; first aerobic machine that was performed was elliptical machine for 10-20 minutes every session. After increasing the range of motion, low and moderate intensity aerobic exercises

were performed for 15-30 minutes both on bicycle and elliptical machine. After the aerobic warm-up, bodyweight exercises were performed in a closed kinetic chain. As the recovery progressed, the patient engaged in single-leg exercises, proprioception exercises, upper extremity exercises with added weight, isokinetic exercises for the legs, and aerobic interval training. At five-month follow up, the patient was asymptomatic and had completed a physiotherapy program to restore muscle strength and range of motion. A repeat USS revealed a hyperechoic irregular lesion measuring about 20x2.7 centimeters in the vastus intermedius muscle. The patient was advised to avoid direct hits to the injured area and to gradually return to sport and regular exercise at the gym.

Patient 2

History: A 27 year-old male professional football player was presented to the Polyclinic for orthopedics, physical medicine and physical therapy „Scipion“ for further physical therapy of the right quadriceps contusion after surgical treatment. The contusion of the right thigh occurred two months before during a football match. After about a month of unsuccessful physiotherapy in his club, patient underwent surgical excision of a calcified hematoma measuring 15x5x5 centimeters from the vastus intermedius muscle. One month after the surgical procedure, he started with physical therapy at the polyclinic.

Physical examination: The examination of patient's right leg showed the postoperative scar on the anterior thigh without visible swelling and palpable pain. He also reported a loss of sensation in the middle third of the right thigh on the medial side of the scar. Passive range of motion of the right knee ranged from 0° to 100° of flexion, with elastic end range point and with pain at the end of the movement. Hip range of motion was intact.

Ultrasound: Postoperative diagnostic ultrasound showed scar tissue in the operated area and small remains of a calcified hematoma in close proximity to the bone but without enlargement during four-week of ultrasound follow-up.

Treatment: The patient started with physical therapy for the next 30 days to restore muscle strength and range of motion. After surgery, patient was taking indomethacin (75 mg daily). Before and after the kinesiotherapy, physiotherapy procedures were performed to warm up the operated leg, mobilize the locally injured tissue, improve flexibility and lymphatic drainage and reduce pain. Physiotherapy procedures for the operated segment included TECAR therapy, laser, functional magnetic stimulation, lymphatic drainage device and manual therapy consisting of scar and muscle mobilization, functional massage, post-isometric relaxation of the hip and knee muscles, osteoarticular mobilization of the hip and knee according to Mulligan's concept and passive stretching. In the first week of kinesiotherapy, the muscles of the entire body were activated with elastic band alongside with low-intensity aerobic training. Due to the gradual decrease in symptoms, physiotherapy procedures were continued in conjunction with kinesiotherapy. After four weeks of rehabilitation (three months post-injury), the patient was considered to be fully recovered and returned to the match.

DISCUSSION

The main finding of our review of two case reports was that surgical removal of symptomatic MO resulted in effective clinical improvements and allowed a faster return to sports activities. The professional football player returned to sport just three months after the initial injury, while the kickboxer completed conservative treatment five months after the injury. In both cases, the MOT was localized in the vastus intermedius muscle, due to a direct contusion that resulted in a significant local hematoma leading to the formation of a calcified lesion. In approximately 80% of athletes, the MOT was localised in a thigh muscle, and it has been shown that 80% of injuries in players are due to direct trauma (Anderson et al., 2001). In addition, eccentric overuse injuries as a second mechanism for muscle tears accounted for only 20% of injuries (Daly et al., 1990). MOT lesions mostly heal conservatively and regress spontaneously within 1 to 2 years, which is why a conservative approach is the treatment of choice. Initial

treatment begins with rehabilitation, which should be moderate and cautious (Anderson et al., 2001). In the literature athletes mostly completed healing and returned to sport after 6-12 months. However, one year is too long a period in the career of a professional athlete to be excluded from competition because of a delayed surgical treatment. This should emphasize the need to establish optimal rehabilitation protocols to shorten the time to return to exercise. The indications for the optimal timing of the decision to surgically remove the MOT are not well established aside from neurological and vascular complications. This may be the case if the symptoms are prolonged and prevent the athlete from participating in professional sports or if the symptoms are significant and interfere with activities of daily living despite conservative treatment. Therefore, if the lesion remains symptomatic and associated with constant pain despite conservative treatment, surgical removal should be considered. Most authors are of the opinion that surgical excision should be performed no earlier than about 6 months after the initial injury, as excision of the mature MO may prevent recurrence of the lesion (Beiner and Jokl, 2002; Coner and Duffy, 2009). However, some studies have shown that early excision carries a minimal risk of recurrence (Orava et al., 2017; Ogilvie-Harris and Fornasier, 1980). In this case, surgical excision of the MO lesion was performed one month after the initial injury with a planned and well-monitored rehabilitation protocol that allowed the football player to return to pre-injury sporting levels. One month after surgery, the patient began the advanced rehabilitation program, and two months after the surgery, he resumed sport-specific training. Although there are no specific guidelines for return to sport for athletes with MO, an individualized approach for each athlete is very important to prepare them to return to their sports career as soon as possible. This implies that every calcified lesion excision should be based on the expected benefits of the operation versus its potential complications. Every therapeutic procedure should be adapted to the athlete and his needs and expectations in order to recover as quickly as possible and return to professional sports.

CONCLUSION

Our review of two case reports showed that professional athletes who had posttraumatic MO that interfere with their career, surgical removal of the calcified lesion results in effective clinical improvement with faster return to sports. There is a lack of scientific data in relation specifically to MO and return to sports criteria. Therefore, the treatment decision should be well planned in agreement not only with the athlete but also with the entire health team involved in the rehabilitation process.

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PREVALENCE OF EXERCISE-INDUCED BRONCHOSPASM IN STAPS STUDENTS IN A HOT, HUMID ENVIRONMENT IN BRAZZAVILLE, CONGO

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ABSTRACT

Introduction: There are links between physical exercise, fine particles and the prevalence of exercise-induced bronchospasm (EIB). The aim of this study was to assess the prevalence of EIB in students of sciences and techniques of physical activities and sports exercising in a hot, humid environment relatively polluted with fine particles. **Method:** Twenty-two first year undergraduates, including 11 in PE and 11 in SPORT, aged 21.64 ± 1.80 years, took part in a soccer match. They performed resting spirometry before and 5 minutes after the match. Measurements of fine particles (PM_{2.5} and PM₁₀) were carried out around the football field during the match every 10 minutes. Ambient temperature and relative humidity were recorded. An ISAAC questionnaire for respiratory disease symptoms was used. Bronchospasm positivity was confirmed when the percentage fall in post-exercise forced expiratory volume in one second (FEV₁) was greater than or equal to 10% of pre-exercise FEV₁. **Results:** Seven subjects were positive for exercise-induced bronchospasm, a percentage of 32%. No subject had a history of BIE or asthma. The ambient temperature and relative humidity were $34.22 \pm 1.38^\circ\text{C}$ and $52.2 \pm 4.97\%$, respectively. The concentrations of PM_{2.5} and PM₁₀ were between 53.3 - 115.5 $\mu\text{g}/\text{m}^3$ and 75.5 - 168.2 $\mu\text{g}/\text{m}^3$, respectively, exceeding WHO limits. **Conclusion:** These results show a high incidence of EIB in students with no prior signs of asthma but living in a hot and humid environment polluted with fine particles. Fine particles are thought to play an important role in the exacerbation of EIB.

Keywords: air pollution, exercise-induced asthma, physical exercise, STAPS students

INTRODUCTION

The term exercise-induced bronchoconstriction (EIB) describes the transient narrowing of the airways after exercise. This phenomenon frequently occurs in athletes who may, have no diagnosis of asthma or even no respiratory symptoms (Sue-Chu et al., 2012, Drazen et al., 2015; Parsons et al., 2013). The child, the athlete or the atopic patient are prone to EIB. Rhinitis or respiratory tract infection during physical activity can promote the onset of EIB (Parsons et al., 2013, Dickinson et al., 2011, Carlsen et al., 2008). Johansson et al. (2015) reported a prevalence of IBE in the general population at around 5% to 20%. Studies by Dickinson et al. (2011) and Burnett et al. (2016) have shown that the prevalence of EIB in athletes participating in individual sports as well as team sports is relatively high (18% to 62%). It also varies according to the type of sport, the ventilatory demand and the environmental conditions in which the sport is practiced. Drazen et al. (2015) have shown that there is a greater prevalence of EIB in elite athletes compared to the general population (21% vs. 10%). Similarly, studies by Anderson and Kippelen, (2003); Carlsen et al. (2008) have shown that the prevalence of EIB in athletes trained in high-level endurance competitions ranges from 10% to 55%.

Consequently, it is not surprising that, compared with non-athletes, high-level endurance athletes exercising in a hot, humid polluted environment have an increased prevalence of various respiratory conditions, such as asthma, rhinitis and EIB (Weiler et al., 2010; Fitch et al., 2008).

While EIB is strongly correlated with hot, humid conditions and training levels, it should also be noted that EIB can be triggered by pollutants such as fine particles. The Higher Institute of Physical and Sports Education is a university establishment (Brazzaville, Congo) located close to major roads, with dust-covered playing fields. It is also located close to Brazzaville's largest market (total market), whose unhygienic environment and garbage odors can lead to respiratory problems.

The aim of this study was to assess the sensitivity to EIB in Bachelor's degree students exposed to high concentrations of fine particles. We hypothesized that soccer, which is a long-duration intermittent sport practiced in a hot, humid environment, might impair pulmonary function and induce bronchospasm in students.

MATERIALS AND METHODS

Study participants

Twenty-two students (age: 21.62 ± 0.62 years, weight: 63.91 ± 3.09 kg, height: 173.27 ± 1.92 cm) participated in this study. Participants were first-year undergraduate students, including 11 in EPS and 11 in SPORT, practicing at the Higher Institute of Physical and Sports Education (HIPSE) of Marien Ngouabi university, Brazzaville, Republic of Congo. All practical courses are held outdoors. Measurement of forced expiratory volume in seconds enabled us to determine positivity to exercise-induced bronchospasm. None of the subjects had a respiratory antecedent, nor did they suffer from any restrictive or obstructive ventilatory disorder. They had been working near road traffic for one year. The study was approved by the Scientific Council of the Higher Institute of Physical and Sports Education of Marien Ngouabi University in accordance with the 1975 Helsinki declarations on ethics. Written informed consent was obtained from all study participants.

Experimental design

This experimental study was carried out using a repeated measures design at the Higher Institute of Physical and Sports Education (HIPSE), Marien Ngouabi University, Brazzaville, Republic of Congo, in February 2023. The students had familiarized themselves with spirometry testing before entering a two-phase protocol that took place (1) before the soccer match and (2) 5 minutes after the match. They performed a general warm-up followed by specific stretching for 15 minutes. Each phase included heart

rate (HR) measurements, spirometry tests and fine particle measurements. Spirometric measurements were assessed before the soccer match and 5 minutes after the match. The match lasted 90 minutes, separated into two 45-minute periods with a 15-minute rest between the two periods. The soccer match was played from 12pm to 2pm at the HIPSE. It took place in compliance with national and international soccer regulations. Measurements of fine particulate matter (PM_{2.5} and PM₁₀) were taken every 10 minutes during the match in the vicinity of the soccer pitch, and measurements of ambient temperature and relative humidity were taken before and after the first half, and before and after the second half of the match. Ambient temperature was 34°C with a maximum of 35.7°C and relative humidity was 52% with a maximum of 59%. Subjects were instructed not to consume alcohol, drugs or caffeine, and not to exercise in the 24 hours prior to the protocol. They were allowed to go for a short jog on the day of the experiment. During the tests, verbal encouragement was provided.

Pulmonary function test

Spirometric parameters were measured in the sitting position. Forced expiratory volume in one second (FEV₁), forced vital capacity (FVC), and peak expiratory flow rate (PEFR) were measured using a portable Spirobank G-type spirometer manufactured by Medical International Research (Spirobank G USB, MIR, ROMA, Italy) (volume precision: $\pm 3\%$ or 50 ml and flow rate precision: $\pm 5\%$ or 200 ml/s) according to standard techniques and procedures. The Spirobank G consists of a central unit, monitor and turbine with Winspiro PRO software installed in the central unit.

Environmental measures

Measurements of fine particles (PM_{2.5} and PM₁₀) were carried out from 12 a.m. to 14 p.m. every 10 minutes using a "Temtop Airing-1000" portable particle detector (China). Ambient temperature and relative humidity were also measured from 11:00 a.m. to 14:00 p.m. using an electronic "SUNROAD" type hygrometer (Japan). Only the minimum and maximum values of PM_{2.5}, PM₁₀, ambient temperature and relative humidity recorded during the day were taken into account.

Statistical analysis

Descriptive statistics were used to generate means and standard deviations for fine particles (PM_{2.5} and PM₁₀) and ambient temperature and relative humidity. Mean values of lung function variables recorded before the match and 5 minutes after the end of the match were compared by Student's t-test for repeated measures. The non-parametric Man Whitney test was used to compare anthropometric and respiratory characteristics between subjects in the IEB-sensitive group and those in the non-IEB-sensitive group. Variable data were recorded and processed using SPSS software, version 21.0, and the significance level was set at $p < 0.05$.

RESULTS

Anthropometric parameters

The anthropometric characteristics of the students (age, height, weight and body mass index (BMI)) and the fall in forced expiratory volume in the first second (FEV₁) are presented in Table 1.

Table 1: Anthropometric characteristics of the study population and exercise-induced bronchoconstriction (EIB) with 10% fall in FEV1

Parameters	EIB – (n=15)	EIB+ (n=7)	P Value
	mean ± SEM	mean ± SEM	
Age (an)	21.64 ± 1.80	20.40 ± 1.94	0.21
Taille (Cm)	171.35 ± 5.26	175.20 ± 3.83	0.10
Poids (Kg)	60.82 ± 8.40	67.00 ± 6.89	0.06
IMC (Kg/m ³)	20.66 ± 2.04	21.79 ± 1.57	0.19
FEV1 before (l)	3.63 ± 0.54	3.71 ± 0.23	0.272
FEV1 after (l)	3.53 ± 0.45	3.05 ± 0.34	0.021*?

Abbreviations: EIB-, non-bronchospasm-positive subjects; EIB+, bronchospasm-positive subjects, SEM, standard error of the mean; BMI, body mass index; FEV1, forced expiratory volume in the first second; * Significant difference, between before-exercise versus after exercise (p<0.05). $\geq$, fall of 10% or more of FEV1, expressing positivity to exercise-induced bronchospasm.

Spirometric parameters

Table 2 shows the spirometric test values obtained before and 5 minutes after the match. The mean values of FEV1, FVC and PEF obtained 5 minutes after the test were significantly lower than those obtained before (P<0.05).

Table 3 shows the number of EIB-positive subjects and the percentage of positivity to the exercise-induced bronchospasm test (FEV1, FVC and PEF values).

Table 2: Mean spirometric values measured before exercise and 5 min after soccer match and comparison between EIB- and EIB+. Values are expressed as mean ± SEM.

Parameters	EIB –	EIB+
	mean ± SEM	mean ± SEM
FEV1 before (l)	3.63 ± 0.54	3.71 ± 0.23
FEV1 after (l)	3.53 ± 0.45	3.05 ± 0.34*
FVC before (l)	4.21 ± 0.64	4.51 ± 0.54
FVC after (l)	3.96 ± 0.49	3.76 ± 0.58*
PEFR before (L.min ⁻¹)	7.46 ± 1.25	7.75 ± 2.08
PEFR after (L.min ⁻¹)	7.24 ± 1.23	6.62 ± 1.40*

Abbreviations: SEM, standard error of the mean; EIB-, non-bronchospasm-positive subjects; EIB+, bronchospasm-positive subjects; FEV1, forced expiratory volume in the first second; FVC, forced vital capacity; PEFR, peak expiratory flow rate; * Significant difference, between before-exercise versus after exercise (p<0.05).

Table 3: Spirometric parameters and percentage fall and positivity to exercise-induced bronchospasm.

Spirometric parameters	fall of 10% or more (EIB+)		No drop or insignificant drop (EIB-)	
	n	%	n	%
FEV1 (l)	7	32	15	68
FVC (l)	5	22	17	77
PEFR (Lmin ⁻¹)	8	36	14	63

Abbreviations: EIB+, bronchospasm-positive subjects; EIB-, non-bronchospasm-positive subjects; n, number of subjects; FEV1, forced expiratory volume in the first second; FVC, forced vital capacity; PEFR, peak expiratory flow rate.

Fine particles

Table 4 shows the concentration of fine particles in the vicinity of the stadium. The increase in particulate matter is higher than that recommended by the WHO.

Table 4: Concentration of fine particles (PM2.5 and PM10) recorded during the match.

Sampling site	Sampling time	PM2.5 concentration measured (µg/m ³)	WHO recommended 24-hour threshold (µg/m ³)	PM10 concentration measured (µg/m ³)	WHO recommended 24-hour threshold (µg/m ³)
Around the ISEPS soccer field	90 minutes	78,79 ± 23,11 [53,3 ; 115,5]	15	109,33 ± 29,67 [75,5 ; 168,2]	45

WHO: World Health Organization; PM2.5: Particulate matter or fine particles with a diameter of less than 2.5 µm; PM10: Particulate matter or fine particles less than 10 µm. The results in Table 4 show that PM2.5 and PM10 concentrations measured in the vicinity of the pitch throughout the soccer match were well in excess of WHO 24-hour limits.

DISCUSSION

The main results of this study show a prevalence of exercise-induced bronchospasm of 32% in students. We also showed a decrease in forced vital capacity and peak expiratory flow. The decrease in these last two parameters is due to a disturbance in pulmonary function and reinforces the idea of exercise-induced bronchospasm. There was also an increase in PM2.5 and PM10 concentrations measured in the vicinity of the pitch throughout the soccer match. These parameters are above the values set by the WHO.

EIB prevalence has been reported to range from 5% to 20% in the general population (Kuti et al., 2017), rising to 90% in asthmatic subjects (Drazen et al., 2015). In the present study, students were not asthmatic but are susceptible to EIB, with a prevalence of 32% (Table 3). This prevalence is higher than that of the general population (5-20%) but lower than the EIB prevalence values reported in elite athletes (Weiler et al., 2010). Our results corroborate those of studies conducted by Nsompí et al. (2018), who reported a prevalence of 33% in athletes in a hot, humid environment. Athletes training in cold air environments and/or a dry atmosphere would be more susceptible to bronchoconstriction and have a higher prevalence (Wilber et al., 2000).

Although beneficial, exercise with high demands and deleterious environmental conditions is also likely to cause respiratory distress and EIB (Parsons et al., 2013). Indeed, the prevalence of 32% observed in our subjects differs from the hypotheses of studies conducted by Wilber et al. (2000), this can be explained by the fact that bronchoconstriction is influenced by several variables, including environmental and climatic conditions as demonstrated in studies by Dickinson et al. (2011) and Burnett et al. (2016). These authors have shown that the prevalence of EIB in athletes participating in individual and team sports is relatively high (18% to 62%), and varies according to the type of sport, ventilatory demand and environmental conditions in which the sport is practiced. In our work, these factors and conditions cited could account for this high prevalence.

We showed a post-exertion reduction in FVC (4.51 ± 0.54 (l) versus 3.76 ± 0.58 (l)) and PEF (7.75 ± 2.08 versus 6.62 ± 1.40 (l.min⁻¹) in BIE (+) students (table 2). These results show that soccer led to a reduction in lung function capacity. Our results are similar to those reported by our group (Nsompi et al., 2018), who showed altered lung function in professional athletes specializing in long distances. This alteration in association with air pollution can cause respiratory disorder and respiratory muscle fatigue (Smith et al., 2014). Our findings are in line with the results of studies conducted by Zavorsky et al. (2019), who showed an acute reduction in FEV1 and FVC after prolonged exercise in recreational runners.

On the other hand, due to the extensive mixing of air during exercise, the respiratory tracts of these athletes are frequently exposed to numerous allergens and particles (PM2.5 and PM10). In fact, the concentrations of PM2.5 (78.79 ± 23.117 µg/m³) and PM10 (109.33 ± 29.672 µg/m³) measured in the vicinity of the student's pitch were well above those recommended by the WHO for 24 hours (table 3). The WHO requires 24-hour values of 15 µg/m³ for PM2.5 and 45 µg/m³ for PM10. Studies by Weiler et al. (2010) have shown that EIB prevalence ratios vary according to the environment in which the sport is practiced, the type of sport and the maximum intensity reached.

It should be pointed out that, the environment in which the match took place was close to main roads and the large market, the air was polluted by combustion engines, in particular fine particles, rubbish and is considered very harmful to the respiratory tract (Rundell, 2012, 2015, 2018). Giles et al. (2012) and Rundell et al. (2018) claimed that pre-exposing participants to diesel exhaust significantly attenuated with the respiratory effects of physical activity on lung function.

The ambient temperature was 35°C and relative humidity was 59%. Our results are similar to those reported by Maughan et al. (2012), who showed that exercise performed at an intensity of around 70% in a warm environment (30°C) at relative humidity levels of 24%, 40%, 60% and 80%, were associated with a decrease in exercise capacity as humidity increased.

CONCLUSION

In our study, we reported a fall in post-exertion FEV1 (13.45%) and an EIB sensitivity rate of 32% concomitant with a drop in forced vital capacity and peak expiratory flow, suggesting a decrease in lung compliance or small airway closure. The soccer match was played in a hot, humid environment, with a high concentration of particulate matter, well in excess of the 24-hour standards set by the WHO. These factors are likely to deteriorate lung function and aggravate the onset of exercise-induced bronchospasm.

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RELATIONSHIP BETWEEN SLEEP TIME AND CASES OF INJURY IN STUDENT JUDOKAS STUDYING SCIENCE AND TECHNIQUES OF PHYSICAL AND SPORTS ACTIVITIES (STAPS) DURING THE 2023-2024 SPORTS SEASON

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ABSTRACT

Judo is a high-intensity combat sport based on direct contact between two opponents, which can lead to injuries during combat. One of the determining factors in these injuries is the quality of sleep. The aim of this study was to estimate the frequency of injuries in student judokas and to examine their association with sleep time. A total of 76 judokas and STAPS students (80.2% men and 19.8% women) took part in the study (age: 18.68 ± 1.33 years). They completed a questionnaire measuring the following variables: gender, injuries (frequency, location, type) and sleep duration. The results showed that the neck (18.2%), knees (6.2%) and shoulders (12.7%) were the anatomical locations most commonly injured. The most common injuries reported were sprains (35.6%) and contusions (17.4%). Logistic regression showed that athletes with less than 8 hours sleep per day were the most exposed to various injuries. During the 2023-2024 sports season, a high incidence of injuries was recorded among student judokas. This study provides an overview of the effective elements for implementing injury prevention strategies among students.

Keywords: injury, sleep etudiant, Republique of Congo

INTRODUCTION

Judo is a grappling sport in which athletes perform multiple high-intensity intermittent efforts to gain a competitive advantage by throwing an opponent to the ground or demonstrating control in groundwork through pins or submission (Franchini et al., 2014). Judo is sufficiently popular accounting for 25% of all Olympic medals (Japanese Olympic Committee, 2023). The practice of judo is closely linked to the risk of injury because it frequently involves throwing and immobilising the opponent (Mackala et al., 2019).

Sports injury is defined as damage to a part of the body resulting in the inability to practice or compete normally (Perez et al., 2013). Recent estimates place the overall rate of competitive injury at around 30% of judokas (Jäggi et al., 2015). One study compared combat sports at three consecutive Olympic Games and found the highest injury incidence rate in judo compared to other combat sports (Lystad et al., 2021). There are several reasons for the increased incidence of judo injuries, the most important of which is sleep.

More or less recent studies show that sleep is essential for maintaining normal homeostasis (Nedelec et al., 2018). Disruption of the sleep-wake cycles essential to human circadian rhythms can have adverse consequences on behaviour and performance (Reilly & Edwards, 2007). Sleep disorders affect an athlete's alertness and judgement and can lead to accidents. Research indicates that sleep can have an impact on susceptibility to injury and increase the number and severity of musculoskeletal injuries (Stavrou et al., 2019). Another recent study found that up to 70% of injured athletes reported short- and long-term sleep disturbances during recovery (Hoffman et al., 2020).

It is true that the combat sports are the subject of much research in the world, but the current state of knowledge, studies on judo treating the determining factors of the injuries during the trainings or the competitions are rare. It should be noted that in sub-Saharan countries, little is known about the quality of sleep, which is a significant factor in the occurrence of injuries in judokas, and no study has been conducted among students practicing judo in sports training schools. The aim of this study was therefore to estimate the frequency of injuries in student judoka and to examine their association with sleep time.

METHODS

Participants

This study involved 76 judoka students at the Institut Supérieur d'Éducation Physique et Sportive (ISEPS) at the Université Marien Ngouabi in Brazzaville, Republic of Congo. The participants included university students specialising in judo and enrolled in the 2022-2023 academic year. They had at least 5 years' experience in judo and were taking part in the various competitions organised by the university. Of these participants, 61 were men and 15 women. All participants were informed of the aims, objectives and procedures of the study and gave written informed consent. The study was approved by the scientific committee of the Institut Supérieur d'Éducation Physique et Sportive of the Université Marien Ngouabi (Congo) and was conducted in accordance with the latest Declaration of Helsinki.

Data collection

A specially designed questionnaire was used for this study. This questionnaire was completed directly by the participants under the supervision of the researcher. It consisted of three parts: A first part entitled "socio-demographic characteristics", included the participants' characteristics (7 items); the second part entitled "sleep habits" included (6 items); the last part concerned "Nature and location of injury". Cronbach's alpha (equal to 0.71 as an acceptable value) was used to assess the validation of the questionnaire recording sleep and injury characteristics.

Statistical Analysis

Data were entered using EPI info version 7 and analysed using SPSS version 2.5 (Windows, SPSS, Inc., Chicago, Illinois). The results were presented in the form of means and standard deviations for quantitative variables and frequencies and percentages for qualitative variables. Logistic regression models with calculation of the corresponding odds ratio (OR) and 95% confidence interval (CI) were used to examine the association between sleep time and the occurrence of injuries.

RESULTS

Descriptive data, mean years older (18.68 ± 1.33), sex (80.2% men and 19.8% women) and length of practice (7.16 ± 1.42), are shown in Table 1.

Table 1: Socio-demographic characteristics (n=76)

	n	%(IC)	Means	Max	Min
Age (years)			18.68 ± 1.33	22	18
Genre					
Male	61	80.2 (53.5-93.9)			
Female	15	19.8 (16.1-25.2)			
Seniority (years)			7.16 ± 1.42	9	5

Table 2 shows the sleep data. 21.7% of participants slept less than 6 hours a day, 65.2% between 6 and 8 hours and 13% less than 8 hours.

Table 2: Distribution of subjects according to sleep time per day

	Frequencies (n = 76)	Percentages (IC)
Less than 6 hours	16	21.7 (10.9-34.8)
Between 6 and hours	50	65.2 (52.2-78.3)
Less than 8 hours	10	13.0 (4.3-23.9)
Total	76	100

In total, out of 76 judoka students, 17 (22.4%) suffered injuries, the most commonly recorded being sprains (35.6%), followed by contusions (17.4%), dislocations (11.7%) and fractures (6.8%) (table 3).

Table 3: Distribution of subjects by type and location of injury

	Frequencies (n = 17)	Percentages (IC)
Type of injury		
Sprains	6	35.6 (18.7-43.1)
Contusions	3	17.4 (10.6-21.4)
Fractures	1	6.8 (1.3-11.6)
Luxations	2	11.7 (6.1-19.3)
Other	5	28.5 (18.3-34.1)
Localisation anatomique des blessures		
Neck	4	18.2 (10.9-25.2)
Shoulder	2	12.7 (8.2-19.1)
keens	1	6.2 (4.1-10.3)
Other	11	62.5 (48.3-74.6)

After adjustment, a positive association was found between the occurrence of injuries in students and the duration of sleep between 6 and 8 hours (OR = 1.91) (table 4).

Table 4: Association between sleep duration and the occurrence of injuries in students

	Injured (n=17)	OR brut (IC à 95%)	OR ajusted (IC à 95%)
Sleep time			
- Less than 6 hours	2	1.00	1.00
- Between 6 and hours	12	1.83 (0,73-5,05)	1.91 (0.97- 4.30)**
- Less than 8 hours	3	0.15(0,070,27)	0.58(0.261.35)

DISCUSSION

In this study we explored injury rates and identified their relationship with sleep time. The main result of our investigation revealed that the frequency of injury was high during judo practice during this academic year. Interestingly, our results suggested that participants' sleep duration was a factor related to the cases of injury identified.

The high incidence of injuries found in this survey does not seem at all surprising. Given the increasing popularity of judo among students, it was reasonable to expect a higher incidence of injury. In a study of 28297 European judokas over a period of 15 years (between 2005 and 2020), 2.5% (n = 699) of injuries occurred in these athletes (Balsh et al., 2021). Another found a significantly higher prevalence (83%) of injuries among 212 judokas (Carvalho, 2018). A separate study of a large population (all ages and performance levels) of judokas in France found a much lower proportion of injuries: 3511 injuries in 316,203 judokas (prevalence 1.1%). The most common injuries identified were sprains and contusions. These results are very similar to those of Balsh et al. (2021) who recorded more than 42.2% of sprains and (23.1%) of contusions in European judokas.

Regarding the location of injuries in the present study, the neck, knees and shoulder were the most commonly injured anatomical locations. These results confirm those obtained by Balsh et al. (2021) who revealed that the knee (17.4%) and the shoulder (15.7%) were the most common anatomical locations in the judokas in this study. The high rate of sprains in the neck, shoulder and knee may be due to falls or to the use of defensive means against a throwing attack (Frey et al., 2019).

Statistical analysis of this survey showed that sleep duration was a risk factor for the different injuries identified. Our results corroborate those of Jones et al (2018) who showed that athletes sleeping less than 8.1h per night are 1.7 times more likely to have sustained an injury than their peers. These findings align with that of a study of Australian professional football athletes which found that a large reduction in sleep was associated with a high incidence of injury (Fitzgerald et al. 2019). It is therefore important to know the effects of these reductions in sleep on the various physiological mechanisms that influence the onset of injuries. One study has demonstrated the adverse effects of poor sleep health on hormones (testosterone and cortisol) that play a central role in musculoskeletal growth and repair (Silva et al., 2022).

Although this survey is one of the first to address injuries in a student context, it is not without its limitations. Firstly, the sample size was relatively limited even though resources for a large sample of student judokas are difficult due to their limited numbers in university institutions. Secondly, the answers to the questions were self-declared by the judokas, which may increase the risk of bias and desirability, thus limiting the reliability of the answers.

CONCLUSION

In the academic year 2022-2023, the overall incidence of injuries among STAPS students was 22.4%. Sprains and contusions were the most frequent types of trauma. The neck, shoulder and knees were the areas most affected by these injuries. However, these injuries were associated with less than 8 hours' sleep. This study provides an overview of effective elements for implementing injury risk prevention strategies for students.

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CHALLENGES OF SPORTS INJURIES IN STUDENT-ATHLETES: ETIOLOGY, PREVENTION AND REHABILITATION

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SUMMARY

This study analyses causes, prevalence, prevention methods and rehabilitation of sports injuries in student-athletes. There were 263 participants in this study and the results have shown high prevalence of injuries, with most frequent being injuries to the extremities. The most common causes of injuries are inadequate warm up, fatigue and lack of physical preparation. The majority of participants use warm-up and stretching for injury prevention, whilst electrotherapy and manual techniques are most frequently used in rehabilitation. Continuous research in this area is crucial to develop better prevention and rehabilitation strategies and improve the current practices in sports environment.

Key words: *sports injuries, students, etiology, rehabilitation*

INTRODUCTION

Sport performers encounter a variety of challenges and obstacles, sports injuries being amongst those that can have long-term consequences. During adolescence our bodies undergo a number of growth-related developmental changes which can result in structural imbalances of the musculoskeletal system and increased susceptibility to injury (Prieto-González et al 2021). Weakness of postural muscles and asymmetry in leg strength increase the risk of sports injuries. Adolescent sport performers experience a lot of pressure to achieve top results which in turn leads to overtraining and insufficient recovery time resulting in muscle fatigue and decreasing body's ability to recover. Besides, insufficient warm-up and inadequate flexibility of muscles prior to training or competition can increase the risk of injury. Studies have shown that a proper warm-up prior to activity reduced the risk of injury (Field et al 2019), while lack of flexibility results in incorrect biomechanics of movement by increasing the pressure on certain body parts which can then lead to injury. Prieto-González et al (2021) reported that 40.4% of young sport performers between the ages of 14-21 sustained sports injuries, with football having the highest incidence of injuries. The most common injuries included lumbar muscle strains, ankle sprains and bone fractures. Significant risk factors related to increased incidence of injury included greater number of hours of practice and not performing warm-ups before the activity. It is important to mention the

role of social and psychological factors in the etiology of injuries in young sport performers. Parental and coach pressure as well as peer pressure paired with the lack of support and understanding can contribute to stress and anxiety both of which can influence focus and performance (Daley et al 2023). Studies have also shown that lack of sleep has an effect on reflex responses and performance (Mason et al 2023) whilst poor nutrition can affect muscle and soft tissue recovery due to the lack of essential nutrients. There has been a small number of studies conducted into etiology of injuries during the sports career of Croatian student-athletes. The purpose of this paper is to investigate etiology of injuries amongst student-athletes; to investigate which methods and techniques were used in prevention and rehabilitation; to ascertain whether there is a difference in incidence and type of sports injury based on sex and to find out if there is a difference in the level of knowledge about prevention and rehabilitation amongst student-athlete population.

METHODOLOGY

Sampling: There were 263 participants in this study (145 males, 118 females), all student-athletes were participants in the semi-finals or finals of the Croatian University Sports Competitions in academic year 2022/2023. Student-athletes came from different universities in the Republic of Croatia.

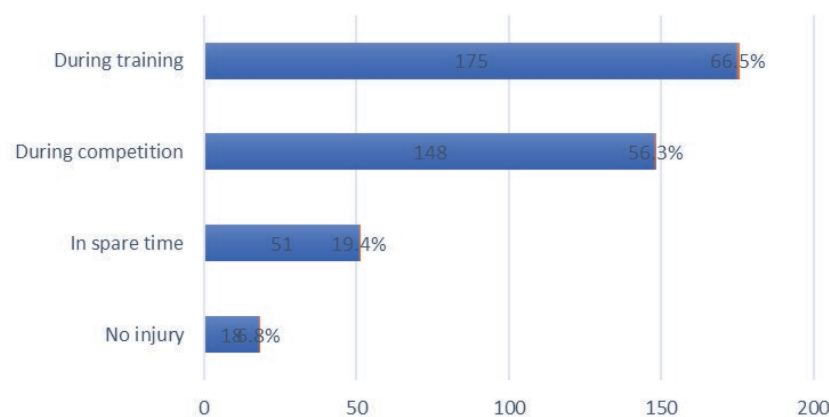
Variables: Participants were asked to complete an anonymous questionnaire about sport injuries, prevention and rehabilitation. The questionnaire was available on "Google Forms". Student-athletes consented and willingly filled in the questionnaires based on the guidelines of the Declaration of Helsinki. The questionnaire consisted of 17 variables relating to the number of years participated in sport, quitting sports, etiology of injury (which part of the body was injured, type of injury, causes of injury), recurrence of sports injury and methods used in personal prevention and rehabilitation, ways of informing oneself about prevention. Socio-demographic variables include age, sex and the type of sport actively trained.

Data analysis: Professional tool Statistica was used to analyse the collected data. Proportions were calculated for each variable. Differences were examined by chi-squared test.

RESULTS

Age analysis shows that the majority of the respondents were aged 19 (20.91%), 20 (19.39%), 21 (18.25%), 22 (13.69%) and 23 (9.89%). The majority of current student-athletes started their sports career aged 7 (63.5%). By the age of 10 – 86.69% of student-athletes were involved in sports. The majority were involved in football (69), handball (37), volleyball (33), martial arts (29). A smaller proportion of students were involved in swimming, basketball, badminton, table tennis and rowing. By the time they enrolled into university most students (59.46%) have quit active sport. The earliest they quit sport was aged 14 (4.05%). Ages 15 and 16 saw another 13.52% of students quit active participation in the sports clubs, and another 9.46% quit sport aged 17. After enrolling into university another significant proportion of students quit sport (29.73%), aged 19 sees 25.68% of students quit active training in the sports clubs and aged 20 13.51% leaves clubs and quits active sport training. The reasons cited for quitting sport were mostly related to inability to co-ordinate educational and sporting obligations (52%), injuries (21%), loss of interest (16%) and 10% cite disagreeing with the club politics, dissolution of the club and similar. A big proportion of student-athletes have had experience with injuries (90.9%). Only 9.1% of respondents reported not sustaining any sport injuries during their sports career. The biggest number of injuries occurred during training and competition (Graph 1)

Graph 1



Graph 1 - Injury occurred (263 responses)

There were 432 different injuries reported, most of them relating to strains (33.80%), ruptures (27.08%), sprains (18.29%) and fractures (10.88%). Table 1 shows male students reporting more injuries than female students but it's interesting that there is a higher incidence of fractures in female students (13.19%) compared to their male colleagues (9.20%).

Types of injuries (total, M, F)						
	M	M%	F	F%	TOTAL	%
Contusion	18	7,20%	13	7,14%	31	7,18%
Strain	88	35,20%	58	31,87%	146	33,80%
Sprain/dislocation	49	19,60%	30	16,48%	79	18,29%
Rupture	65	26,00%	52	28,57%	117	27,08%
Fracture	23	9,20%	24	13,19%	47	10,88%
Jumper's knee	0	0,00%	2	1,10%	2	0,46%
Inflammation	3	1,20%	0	0,00%	3	0,69%
Intervertebral discs – protrusions, extrusions, fractures	1	0,40%	3	1,65%	4	0,93%
Chondromalacia	1	0,40%	0	0,00%	1	0,23%
Cuts	2	0,80%	0	0,00%	2	0,46%
TOTAL:	250		182		432	

Table 1 - Types of injuries (total, M, F)

Examination of topology of injuries (Table 2) shows that the largest number of injuries were related to the extremities: lower leg and foot (28.84%), knee (23.58%), forearm (15.16%) and shoulder (12.42%). Female students reported a larger number of injuries related to the forearms, hands and fingers (19.31%) compared to male students (12.09%). Male students had a larger number of injuries related to the hip (9.89%) and lower leg and foot (31.14%) compared to the female students. These results follow the same trends as other studies which suggest there is a high rate of injuries in student-athlete population Prieto-González et al (2021), Danes-Daetz et al (2020) and Lemoyne et al (2017).

<i>Topology of injuries (M,F)</i>						
	M		F		TOTAL:	%
Head and neck	17	6,23%	9	4,46%	26	5,47%
Spine	15	5,49%	13	6,44%	28	5,89%
Shoulder/upper arm/elbow	35	12,82%	24	11,88%	59	12,42%
Forearm/hand/fingers	33	12,09%	39	19,31%	72	15,16%
Hip/pelvis/thigh	27	9,89%	14	6,93%	41	8,63%
Knee	61	22,34%	51	25,25%	112	23,58%
Lower leg/foot	85	31,14%	52	25,74%	137	28,84%
TOTAL:	273		202		475	

Table 2 - *Topology of injuries*

Half of the surveyed respondents (53.85%) pointed out that their injury was recurring with more incidence of recurring injuries in male students (54.89%).

The most common causes of injuries as reported by students in this sample were: inadequate warm-up (21.52%), high level of fatigue (16.31%), not being careful (15.37%), poor physical preparation (15.11%), lack of flexibility (9.36%) and poor training conditions (8.82%). Similar results were reported by Danes-Daetz et al (2020) in their study on Chilean student-athletes and Arthur-Banning et al (2018) on American student-athletes. The number of injuries on the surveyed sample didn't show a statistically significant difference in the analysis based on sex (P-value = 0.164). The results of other studies aren't consistent based on the sex differences. Some reported differences based on sex (Danes-Daetz et al 2020). Research conducted by Pujals et al (2016) didn't reveal significant differences based on sex in prevalence of injuries amongst the Spanish athletes, which is similar to the findings in this study.

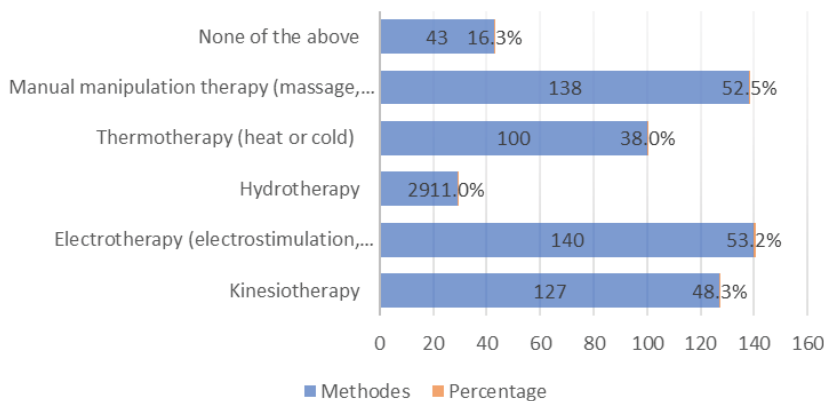
Observed Frequency				
	Injuries			
Gender	No	Yes	Grand Total	
F	14	104	118	
M	10	135	145	
Grand Total	24	239	263	
Expected Frequency				
	Injuries			
Gender	No	Yes	Grand Total	
F	10.7680608	107.23194	118	
M	13.2319392	131.76806	145	
Grand Total	24	239	263	
Total	263			
P-Value	0,16408938			

Table 3 - *Sex based differences in injury rates*

Apart from etiology of injuries we have also investigated their knowledge of preventative measures and rehabilitation and the degree to which those were being used. The majority of participants used the following methods of injury prevention: warm-up (24.72%), stretching (20.43%), targeted body area exercises

(14.61%), special aids (inserts, compression support and similar) (14.40%), gradual increase of intensity (11.03%), bandaging (8.38%) and massage (6.33%). It is interesting to note that only one student has indicated the use of mobility exercises. When it comes to rehabilitation (Graph 2) the method most used is electrotherapy (53.2%), manual techniques (52.5%), kinesiotherapy (48.3%) and hydrotherapy (11%).

USED REHABILITATION METHODS



Graph 2 - Rehabilitation methods used by student-athletes

Respondents received most information about prevention from the physiotherapist (34.70%), coach (27.61%), doctor (22.95%) and via open public resources (12.87%).

When asked to give an individual self-estimate of how familiar they were with preventative measures and rehabilitation of sport injuries the majority of respondents (68%) indicated they were partially familiar, while 28% of students believe they are fully acquainted with the preventative measures and rehabilitation of sport injuries. The majority of students who didn't have a history of injuries were significantly less familiar with preventative measures and rehabilitation of sports injuries which points to the variation in the level of familiarity with prehabilitation and rehabilitation amongst the students. These findings were also confirmed in studies by Al-Qahtani et al (2023) , Danes-Daetz et al (2020) both of which can be a useful basis for development of education programmes on injuries and rehabilitation of sport performers.

Observed frequency				
	prevention and rehabilitation			
Sports injuries	I am fully acquainted	I'm not familiar at all	I'm partially familiar	Grand Total
No	3	4	17	24
Yes	70	6	163	239
Grand Total	73	10	180	263
Expected frequency				
	prevention and rehabilitation			
Sports injuries	I am fully acquainted	I'm not familiar at all	I'm partially familiar	Grand Total
No	6.661596958	0.912547529	16.42585551	24
Yes	66.33840304	9.087452471	163.5741445	239
Grand Total	73	10	180	263
Total	263			
P-value	0.001042821			

Table 4 - Familiarity with prehab/rehab procedures amongst student population

The study doesn't make it clear which student-athletes are better acquainted with prehabilitation and rehabilitation procedures, as this can vary depending on different factors such as the type of sport, experience, training and education. However, some studies have shown that sport performers who were participating in highly structured sport programmes or those who have had access to trained professionals such as coaches and physiotherapists, often had better understanding of prehabilitation and rehabilitation procedures and their implementation. Similarly, older sport performers or those with previous injuries can be seen as being more aware of the importance of these procedures and as a result have a better knowledge of them.

CONCLUSION

Data collection on patterns of injuries and related risk factors helps design new strategies for prevention of injuries in sport performers. Further research should focus on collecting even more specific data in order to get a detailed picture on the profile of injuries amongst the student-athletes. High prevalence of injuries noted in this study points out that more vigilance is needed when working with young sport performers and better ways of designing a tailored approach for prevention of sport injuries are needed. Future studies should include sport performers from different sports and (should) consider prospective research designs with the aim of presenting a comprehensive picture of the profile of injuries amongst student-athletes.

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STUDENTS' AWARENESS LEVEL IN THE IMPLEMENTATION OF HEALTHY HABITS

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ABSTRACT

The aim of this research was to analyse the level of awareness of male and female students about the importance of engaging in physical activities, healthy diet, their willingness to pay monthly for these activities, and the differences in awareness by gender. The research included 296 respondents (183 female students and 114 male students) with an average age of $21,51 \pm 1,03$ years. Respondents filled out a questionnaire where they expressed their awareness of physical activities on a Likert scale (1 = not at all / 5 = extremely). Canonical discriminant analysis of two groups was used to determine the differences between male and female students. Canonical discriminant analysis shows the difference in arithmetic mean between female and male consumers $CanR=0.32$ with statistical error $p=0.00$. Although the results show small differences between male and female students in most of the measured variables, there is a significant difference between the groups (female and male students) in three variables. These are POZ = assessment of the level of awareness/information in general about healthy diet and healthy lifestyle, KTI = assessment of how physical/sporting exercise can affect an improved image in society and MIS = how much money they are willing to spend per month for participating in physical/sports activities. Female students are significantly more aware/informed in general about healthy nutrition and a healthy lifestyle than male students, but male students have a more positive attitude towards the connection between physical activities and image improvement and are ready to monthly allocate more funds than female students for participation in physical/sports activities. Recognizing the importance of healthy lifestyle habits and their practice are an important factor in the balanced psycho-physical development of young people.

Keywords: students, awareness, exercise, proper nutrition

INTRODUCTION

The awareness of young people about a healthy lifestyle is an important topic that, apart from the theoretical level of scientific circles of health and kinesiology experts, is increasingly being implemented in working with students. The term "quality of life" includes kinesiological activity, eating habits, self-assessment of health and life satisfaction (Privitellio, 2021). Systematic physical exercise implies the regularity of exercising according to an established plan and program with a defined goal that determines the form, frequency and intensity and duration of exercise (Mišigoj-Duraković et al., 1999). In addition to health, poor physical activity also affects other aspects of life. "Insufficient level of physical activity is a growing global problem because, in addition to negative effects on health, it causes increased costs of treatment, greater absence from work and other numerous consequences" (Amlani and Munir, 2014).

The importance of physical activity is also confirmed by studies that state a positive connection between the frequency of doing sports and subjective health assessments (Olchowski et al., 2009). Health prevention among students plays a key role in their well-being during their studies. During their studies, they often go through stressful periods, lifestyle changes and the pressure of academic requirements, which can affect their physical and mental health. Many pupils and students perceive exams and exam failure as stressful events (Stanić, 2016; according to Lacković-Grgin, 2000). Therefore, awareness of physical activity and proper nutrition are extremely important because healthy eating habits are an ally in fighting against disease and in preserving body and mind balance (Verbanac et al., 2019; according to Martinić, 2023).

METHODS

Examinee sample

The sample consisted of 296 students, with an average chronological age of 21.51 ± 2.03 years. The sample comprised 61.61% (183) female respondents and 38.38% (114) male respondents. All participants voluntarily and anonymously completed the online questionnaire. The questionnaire was distributed through social networks from March 7th to April 3rd, 2023, during a period with no exam deadlines, holidays or vacations, allowing respondents to assess the selected kinesiology features more realistically.

Variable sample

For the purposes of determining the differences between female and male students, a questionnaire was used in which the respondents indicated their degree of agreement with each statement on a 5-point Likert scale (1=not at all /5=exceptional). DOB = chronological age of the examinee; SOA = Average weekly participation in organized physical/sports activities for most of the year (not including classes); POS = Assessment of the level of awareness/information about the need to engage in physical/sports activities in general in life; PVS = Assessment of the importance/need of practicing physical/sports activities in general in life; POZ = Assessment of the level of awareness/information in general about healthy diet and healthy lifestyle; PRK = Assessment of the level of consumption of generally healthy food; KTV = Assessment of how much continuous physical/sports exercise is positively related to quality of life; KTI = Assessment of how physical/sporting exercise can affect an improved image in society; MIS = How much money are you willing to spend per month for participating in physical/sports activities.

Methods of data processing

The methods used for data processing involved calculating descriptive statistical parameters for all variables, including arithmetic mean (AS), standard deviation (SD), minimum (Min), and maximum (Max) results. To determine significant differences between female and male students, canonical discriminant analysis was conducted on the two groups. This analysis included determining the coefficient of canonical discrimination, assessing the groups' positions on the discriminant function and examining the correlation between the variables and the discriminant function. The significance of the coefficients of canonical discrimination was tested using Bartlett's test. Data analysis was performed using the statistical package STATISTICA 13.0.

RESULTS

Table 1. shows descriptive indicators of variables for the total sample of consumers and also for the both groups female and male students.

Table 1. Descriptive indicators of measuring variables.

Variable	Total sample (N=296)			Female students (N=186)			Male students (N=113)		
	AS±SD	Min	Max	AS±SD	Min	Max	AS±SD	Min	Max
DOB	21,51±1,03	18,00	24,00	21,77±1,88	18,00	24,00	20,47±1,73	18,00	23,00
POS	3,64±0,91	1,0	5,0	3,58±0,93	1,0	5,0	3,74±0,87	1,0	5,00
PVS	4,19±0,87	1,0	5,0	4,20±0,85	1,0	5,0	4,18±0,90	1,0	5,00
POZ	3,72±0,92	1,0	5,0	3,77±0,84	1,0	5,0	3,65±1,05	1,0	5,00
PRK	4,14±0,84	1,0	5,0	4,16±0,82	1,0	5,0	4,11±0,87	1,0	5,00
KTV	4,36±0,81	1,0	5,0	4,33±0,85	1,0	5,0	4,41±0,75	1,0	5,00
KTI	3,43±1,08	1,0	5,0	3,25±1,11	1,0	5,0	3,72±0,97	1,0	5,00
MIS	4,74±3,63	1,33	39,82	4,19±2,52	1,33	26,54	6,96±4,82	1,33	39,82

AS–arithmetic mean, SD–standard deviation, Min–minimal result, Max–maximum result

Table 2. Differences of arithmetic means and canonical discriminant analysis between group female consumers and male consumers.

CANR	λ	h^2	df	p
0,32	0,90	30,62	7	0,000

CanR–canonical correlation coefficient, λ –lambda, h^2 –Chi square, df – degrees of freedom, p – level of significance

Table 2. shows a canonical discrimination coefficient (canonical correlation of the discrimination function) of CR=0.32, indicating a relatively small difference between female and male students in terms of the mentioned variables. Nevertheless, the discrimination function significantly differentiates the groups. Testing the significance of this coefficient using Bartlett's Chi-square test yielded a statistically significant result ($p=0.000$), indicating that the observed difference in "selected indicators" is highly unlikely to have occurred by chance, with more than 95% certainty. These results highlight the significant differences between female and male students in their awareness of the need to engage in sports activities in general, the assessment of how much physical/sports exercise can influence the improvement of the image in society, as well as how much they are willing to spend per month for participating in physical/sports activities, i.e. training.

Table 3. Arithmetic means of groups of male and female students on the discriminant function

	DF
female students	0,261
male students	-0,423

DF–correlation coefficients of discriminant function and variables

From Table 3. we can see that the group female students positioned itself at the positive pole of the discrimination function (their average is at 0.286 standard deviation of the discrimination function), while the group male students positioned at the negative pole (their average is at -0.463 standard deviation of the discriminant function). Accordingly, female students have higher average results than the male students in those variables that have a positive correlation with the discriminant function.

From Table 4. we can see that the students are significantly different in three (3) variables. Those are: POS = Assessment of the level of awareness/information about the need to engage in physical/sports activities in general in life, KTI = Assessment of how physical/sporting exercise can affect an improved image in society; MIS = How much money are you willing to spend per month for participating in physical/sports activities.

Table 4. Differences between groups female and male students in individual variables

	λ	p
POS	0,906	0,179
PVS	0,901	0,500
POZ	0,912	0,048*
PRK	0,900	0,789
KTV	0,900	0,840
KTI	0,941	0,000*
MIS	0,932	0,001*

λ -lambda, p- significance level

Table 5. also shows the structure of the discrimination function, i.e. the correlation of the manifest variables with the discrimination function. Here again we can see the same variables that contribute most to the difference between the groups. Obviously, the level of awareness/information in general about a healthy diet and a healthy lifestyle is the variable that most determines and creates the difference between male and female students.

Table 5. Differences in arithmetic means and canonical discriminant analysis between group of female and group of male students

Variables	Female students	Male students	DF
	AS $\pm$ SD	AS $\pm$ SD	
POS	3,58 $\pm$ 0,93	3,74 $\pm$ 0,87	-0,264
PVS	4,20 $\pm$ 0,85	4,18 $\pm$ 0,90	0,042
POZ	3,77 $\pm$ 0,84	3,65 $\pm$ 1,05	0,175
PRK	4,16 $\pm$ 0,82	4,11 $\pm$ 0,87	0,101
KTV	4,33 $\pm$ 0,85	4,41 $\pm$ 0,75	-0,143
KTI	3,25 $\pm$ 1,11	3,72 $\pm$ 0,97	-0,643
MIS	31,51 $\pm$ 18,97	42,41 $\pm$ 36,28	-0,592
Centroid	0,26	-0,42	CanR = 0,32

CONCLUSION

The research results showed that there are statistically significant differences between male and female students in certain variables. Female students are significantly more aware of healthy eating and a healthy lifestyle in general than male students, while male students have a more positive attitude towards the connection between physical activities and image improvement. Male students are significantly more willing to monthly allocate more funds for participating in physical/sports activities than female students. Based on the obtained results, the authors conclude that a certain level of awareness among male and female students about healthy nutrition and a healthy lifestyle is present but work on further information and learning about the importance of proper nutrition and a healthy lifestyle still needs to be carried out through physical and health education classes and through extracurricular sports activities in higher education institutions.

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KNOWLEDGE AND HABITS OF STUDENT ATHLETES OF THE FACULTY OF HEALTH STUDIES, UNIVERSITY OF RIJEKA RELATED TO SPORTS NUTRITION

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ABSTRACT

The nutrition of athletes plays a key role in their sports success and health. In order to achieve optimal results, athletes must adapt their diet to their individual needs, sport, training intensity and personal goals. The basic principles of sports nutrition include the balance of macronutrients and micronutrients as well as adequate intake of calories and fluids. Macronutrients such as protein, carbohydrates and fats are essential for muscle building, energy and body restoration after training. Proteins are important for muscle recovery whereas carbohydrates provide energy for high-intensity training. Fats are a long-term source of energy and they are important for hormonal balance and brain health. Micronutrients such as vitamins and minerals support many biological processes in the body and they are essential for the athletes' overall health and well-being. Furthermore, fruits, vegetables, nuts, whole grains and dairy products should be structural part of the diet to ensure adequate intake of micronutrients. Hydration is also important, especially for athletes who exercise intensively and/or train in high temperatures. Fluid loss through sweating should be compensated with a sufficient amount of water or drinks with electrolyte. Individual factors such as body mass, body type, metabolism and specific goals affect the nutritional needs of athletes.

Key words: sport nutrition, student athletes, health habits

INTRODUCTION

Sports nutrition is a powerful force in improving athletic performance, promoting recovery, and improving the overall health of athletes and exercisers. At the intersection of science, physiology and nutrition, sports nutrition encompasses many principles and strategies aimed at meeting the unique nutritional needs of athletes and people who strive hard in various sports. In recent years there has been increasing awareness of the important impact of nutrition on physical activity. Athletes and coaches have turned to evidence-based nutrition strategies to gain a competitive advantage, increase training adaptations, and maximize performance. Moreover, the role of nutrition is not limited to performance; It also plays an important role in injury prevention, physical functioning and overall well-being in the field. This introduction is a gateway to exploring more aspects of sports nutrition, covering the basics of energy metabolism, macronutrient and micronutrient needs, hydration strategies, and timing of food intake.

METHODS

The research of this paper aims to examine the knowledge and habits of students of the Faculty of Health Studies of the University of Rijeka about sports nutrition. The respondents in the research were students of the 1st year of regular undergraduate nursing studies at the above mentioned Faculty. There were 29 students participated in the research, represented both sexes and aged from 19 to 23. The measuring instrument was a questionnaire created exclusively for the purpose of this research and the survey was conducted in April/ 2024. The questionnaire was divided in three parts, consisted of 18 questions, namely the sociodemographic part, the part related to the habits of students related to a healthy lifestyle in terms of nutrition and sports activities and the part related to knowledge about sports nutrition. The time required to fill out the questionnaire was 5 minutes. The data were processed using Microsoft Office Excell 2007, processed with descriptive statistics, and the results were presented with percentage values.

THE RESULTS

In this research participated 29 respondents of which 3 men (10.3%) and 26 women (89.7%). The age range was from 19 to 23 years old with the majority of respondents being 20 years old (72.4%). Furthermore, five respondents aged 19 (17.2%), two respondents aged 21 (6.9%) and one respondent aged 23 (3.4%) participated.

Respondents were asked what sport they play, and the results show that seven respondents (24.1%) do not play any sport. Two respondents play football (6.9%), one respondent plays volleyball (3.4%) and one respondent plays basketball, volleyball and football (3.4%). Furthermore, the students listed sports activities or activities related to maintaining physical health that they engage in in their free time, namely: one respondent recreational running and swimming (3.4%), three respondents gym (10.3%), one respondent dancing (3.4%), two respondents with recreational rollerblading (6.9%), five respondents with walking/walking (17.2%), one respondent with badminton and volleyball (3.4%), one respondent with tennis (3.4%), two respondents with table tennis (6.9%), one respondent with cycling and walking (3.4%) and one respondent with yoga (3.4%).

Furthermore, the survey questionnaire were related to training. Of overall number of respondents, fourteen of them do not train at all (48.3%), while one respondent trains 4 or more days a week (3.4%), three respondents train once a week (10.3%) and eleven respondents 2-3 days per week (37.9%). However, the overall number of students who train, seven respondents have training lasting 2-3 hours (46.7%), and eight respondents have training lasting one hour (53.3%).

Moreover, nineteen respondents pay attention to their diet (65.5%), while ten respondents answered the question "Do you pay attention to your diet?" in the negative (34.5%). The overall number of respondents who do not pay attention to their diet, 90% are female respondents, and 10% are male respondents.

In continuing, the overall number of respondents, 27 of them (93.1%) stated that their diet consists of a balanced intake of proteins, carbohydrates, fats, vitamins and minerals, one respondent stated that the diet mainly consists of proteins (3.4%) and one respondent as the diet mainly consists of carbohydrates (3.4%).

Furthermore, sixteen respondents (55.2%) believe that they consume a sufficient amount of vitamins, while thirteen respondents (44.8%) believe that they do not consume a sufficient amount of vitamins.

In total number of respondents, eighteen of them (62%) consume 1.5-2 liters of water per day, seven of them less than 1 L (24.1%) and four of them 2.5 L or more (13.8%).

Speaking of supplements, twenty-three respondents (79.3%) do not use any supplements in their diet, while six of them (20.7%) use supplements mostly omega 3 fish oil, proteins, creatine monohydrate, iron, vitamins A, B and C and spirulina.

In the last part of the research, the respondents' knowledge about sports nutrition was examined, and the following results were obtained:

Table 1. *Knowledge about (sport) nutrition*

Question	Answer „YES“ Number of respondents (percentage)	Answer „NO“ Number of respondents (percentage)
Probiotics stimulate the immune response.	21 (72,4%)	8 (27,6%)
Omega 3 has a strong anti-inflammatory effect.	25 (86,2%)	4 (13,8%)
Zinc activates lymphocytes.	19 (65,5%)	10 (34,5%)
It is not necessary to drink liquid before training.	4 (13,8%)	25 (86,2%)
Water makes up over 70% of body mass.	29 (100%)	0 (0%)

DISCUSSION

In the research conducted in April 2024, 29 respondents participated in the 1st year undergraduate university nursing studies at the Faculty of Health Studies, University of Rijeka, of which the largest percentage were women (89.6%), and the age ranged from 19 to 23. The majority of respondents are 20 years old (72.4%). The overall number of respondents, 24.1% do not engage in any sports activities, while the rest of respondents engage in one or more sports activities or activities related to health preservation, mostly recreationally. There are 48.3% of respondents who do not train at all but the majority of respondents train 2-3 times a week for one hour. Of all respondents in this survey, 65.5% of them pay attention to their diet, mostly female. In 93.1% of the respondents, the diet consists of a balanced intake of all nutrients (proteins, carbohydrates, fats, vitamins and minerals) and 55.2% of the respondents believe that they consume a sufficient amount of vitamins in their body. Furthermore, 62.1% of respondents drink 1.5-2 L of water per day, and 79.3% of them do not take any supplements. The most frequently consumed supplements by the respondents are omega 3 fish oil, proteins and creatine monohydrate, vitamins A, B and C, iron and spirulina. In the part of the questionnaire that examines students' knowledge of (sports) nutrition, the most correct answers (100%) were obtained to the question related to the percentage of water in the body, while the least correct answer was related to the question whether zinc activates lymphocytes (65.5%).

CONCLUSION

In conclusion, 24% of students do not engage in any physical activity, and those who engage in physical activity do so recreationally for one hour 2-3 times a week. About 65% of respondents pay attention to their diet, and in 93% of respondents, this diet is balanced in terms of an even intake of nutrients. Most respondents drink 1.5-2 L of water per day, and about 79% of them do not consume any supplements. The level of knowledge related to sports nutrition refers to the percentage of correct answers, where the range of these percentages to the questions asked is from 65% to 100%.

In short, sports nutrition plays an important role in improving athletic performance and overall well-being. Proper intake of macronutrients, micronutrients and nutrition allows athletes to optimally fuel their bodies, support growth and recovery, and maintain energy during training and competition. A nutrition plan personalized to the needs of the individual athlete produces the best results. As the field continues to evolve thanks to advances in research and technology, unique process offers new ways to improve performance. Athletes who prioritize evidence-based training can reveal their full potential and achieve lasting success in their athletic careers.

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GENDER DIFFERENCES IN PHYSICAL ACTIVITY AND QUALITY OF LIFE IN UNIVERSITY STUDENTS OF RIJEKA

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ABSTRACT

Physical inactivity and sedentary behaviour in college students negatively affect the quality of life (QoL) and sleep quality (SQ). The aim of this study was to investigate the gender differences in physical activity (PA), time spent sitting, QoL and SQ in college students of the University of Rijeka aged 18 to 25 years. The study included 82 college students (41% male, 59% female). Outcome measures included self-reported tests: International Physical Activity Questionnaire-Long Form (IPAQ-LF); Pediatric Quality of Life Inventory Young Adult Version (PedsQLTM 4.0 Young Adult Version) and Pittsburgh Sleep Quality Index (PSQI). Differences were analyzed using T-test for independent variables, and considered as significant if $p \leq 0.05$. Results are presented as means $\pm$ standard error. This study has been supported by the University of Rijeka. Overall, male students are more physically active than female students are, but without statistical significance. Male students practice significantly more vigorous PA ($p=0.020$) and are significantly more physically active during recreation, leisure and sports ($p=0.026$). Female students, however, are significantly more physically active at work ($p=0.055$). They are also more physically active at home but without a significant difference. Although the male students have a slightly better QoL, there is no significant difference. The SQ is the same for both genders. This study has shown that male students practice more vigorous PA and are more physically active during recreation, sports and leisure. Female students practice more moderate PA and are more physically active at home and at work. However, both genders have a similar QoL and SQ.

Keywords: college students, gender differences, physical activity, quality of life, quality of sleep.

INTRODUCTION

Physical inactivity and sedentary behavior among young people are a growing public health problem worldwide (Haseler & Haseler, 2022). The current World Health Organization (WHO) recommendations of the WHO's Global Action Plan on Physical Activity 2018–2030 (GAPPA) for adults aged 18 to 64 years are as follows: at least 150 min of moderate and 75 min of vigorous physical activity (PA) per week (wk) and limiting time spent sitting (<https://www.who.int/publications/i/item/9789241514187>). Yet today, more than 80% of adolescents and 27% of adults do not achieve the WHO's recommended levels of PA. College students, i.e., young adults, are spending increasing amounts of time sitting while studying,

watching TV, or playing computer and console games, and these risky behaviors pose a threat to their health causing lower quality of life (QoL), and making them a particularly vulnerable population (Ge et al., 2019). Additionally, studies have shown the negative impact of physical inactivity and sedentary behavior on sleep quality (SQ) (Ge et al., 2019). SQ can, however, be directly improved by regular PA (Štefan et al., 2018). Nevertheless, regular PA leads to positive changes in the human body that make it possible to prevent chronic diseases and improve QoL (Ge et al., 2019; Štefan et al., 2018). In the relevant literature, there are many research reports worldwide investigating the relationship between PA and QoL in healthy populations, including university students (Ge et al., 2019; Štefan et al., 2018). Furthermore, the research notes differences in PA of male respondents versus females (Espada et al., 2023). Despite an increasing volume of research focusing on college students, i.e., young adults aged 18-25 years, there remain major gaps in our knowledge about the gender differences in type and intensity of PA and furthermore, QoL and SQ. Given that QoL and SQ are affected by type and intensity of PA, the present study explored gender differences among these variables in college students aged 18-25 years.

METHODS

The present study was a cross-sectional study conducted at the University of Rijeka, Croatia during the 2022–2023 academic school year. Participants were recruited from University in Rijeka. Interview was conducted with 145 volunteers. Of these, 126 volunteers met the inclusion criteria and were enrolled in the study. The inclusion criteria were healthy university students aged between 18 and 25, i.e., young adults, with no cardiovascular, respiratory, or other systemic diseases and/or musculoskeletal pathologies. The researchers obtained the necessary approvals from the Ethics Committee of the Faculty of Health Studies Rijeka.

QoL was measured using the Pediatric Quality of Life Inventory 4.0™ (PedsQL™ 4.0 Young Adult Version) self-report for young. It is a 23-item questionnaire composed of: physical and psychosocial functioning. Scale scores are computed as the sum of the items divided by the number of items answered.

SQ was measured using the Pittsburgh Sleep Quality Index (PSQI). It is a self-report questionnaire that assesses SQ and disturbances over a 1-month time interval. A score ≥ 5 represents poor sleepers and score < 5 represents individuals with normal SQ.

The IPAQ-long form (IPAQ-LF) was administered by trained interviewers to assess participants' self-report PA and sedentary behavior. A detailed description of the IPAQ assessment protocol is available online (<https://sites.google.com>). An estimation of the appropriate sample size for the study was conducted using the MedCalc program that estimated a minimum of 123 subjects was needed to achieve 80%. Data were analyzed using Statistica, version 13. Differences were analyzed using T test for independent variables. For detecting a statistical significant difference in number of HEPA (health enhancing PA) and number of moderately active college students according to IPAQ categorical score of PA, Fisher's exact test was used. The significance level of the statistical analyses was set at $p < 0.05$. Results are presented as means $\pm$ standard error and total number of participants and certain sex as n (%).

RESULTS

At baseline, a total of 126 subjects were enrolled in the study, and after the exclusion of 44 subjects who did not complete all required assessments, the study was completed with 82 subjects. Of these, 48 (58.5%) were female and 34 (41.5%) were male (Table 1). The mean age of the participants was 21.5 ± 1.4 years.

Table 1. Distribution of participants. Legend: n, number.

Total: n (%)	Females: n (%)	Males: n (%)
82 (100%)	48 (59%)	34 (41%)

Overall, male students are more physically active than female students are, but without significant difference ($p=0.102$) (Table 2).

Table 2. Gender differences in physical activity, time spent sitting and quality of life and sleep.

Variable	Females (mean $\pm$ SE)	Males (mean $\pm$ SE)	P value
Physical activity/IPAQ-LF (MET/min/wk)			
Total physical activity	4909.9 $\pm$ 652.0	6560.0 $\pm$ 735.0	^a 0.102
Intensity of physical activity			
Walking	1998.8 $\pm$ 267.0	2461.2 $\pm$ 386.1	^a 0.311
Moderate	1628.4 $\pm$ 292.3	1367.2 $\pm$ 233.8	^a 0.521
Vigorous	1282.8 $\pm$ 349.7	2731.6 $\pm$ 531.4	^a 0.020*
Type of physical activity			
Recreation, leisure, sports	1808.3 $\pm$ 231.2	3053.1 $\pm$ 577.6	^a 0.026*
At home	1160.6 $\pm$ 182.9	879.3 $\pm$ 287.4	^a 0.388
In transport	978.2 $\pm$ 130.0	1099.6 $\pm$ 206.7	^a 0.602
At work	1819.1 $\pm$ 469.9	637.8 $\pm$ 242.0	^a 0.055*
Categorical score	n/total (%)	n/total (%)	
Moderate	28/48 (58%)	14/34 (41%)	^b 0.095
HEPA	20/48 (42%)	20/34 (59%)	^b 0.095
Sitting (h/day)	6.2 $\pm$ 0.3	5.5 $\pm$ 0.4	^a 0.130
Health related quality of life/PedsQL™ 4.0 Young Adult Version			
Physical health	76.3 $\pm$ 3.6	84.5 $\pm$ 3.4	^a 0.120
Psychosocial health	74.7 $\pm$ 3.7	78.8 $\pm$ 3.1	^a 0.421
Total score	75.2 $\pm$ 3.6	80.8 $\pm$ 3.1	^a 0.271
Sleep quality/PSQI	5.4 $\pm$ 0.3	5.4 $\pm$ 0.5	^a 0.938

Legend: MET, Metabolic Equivalent of Task; wk, week; IPAQ-LF, the International Physical Activity Questionnaire-Long Form; PedsQL, Pediatric Quality of Life Inventory; PSQI, Pittsburgh Sleep Quality Index; HEPA, health-enhancing physical activity; SE, standard error; h, hours; * statistical significance; ^a analyzed using T test; ^b analyzed using Fisher exact test.

Male students significantly practice more vigorous PA ($p=0.020$) (Table 2) and are significantly more physically active during recreation, leisure and sports ($p=0.026$) (Table 2). Female students, however, are significantly more physically active at work ($p=0.055$) (Table 2). They are also more physically active at home, but without the significant difference ($p=0.388$) (Table 2). According to IPAQ-LF categorical

scoring, half of the students belonged to the highly active HEPA category (N=41;50%), i.e., category of PA that includes 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-min/wk. The results showed more male students to be HEPA category (59%) than female (41%). Although the male students have a slightly better QoL, including QoL related to physical health ($p=0.120$) (Table 2), QoL related to psychosocial health ($p=0.421$) and total QoL score ($p=0.271$) (Table 2) there is no significant difference registered. The SQ is the same for both genders, reflecting lower level of poor sleepers (Table 2). In addition, although without the statistically significant difference, female students spent more hours per day sitting ($p=0.130$) (Table 2).

DISCUSSION

According to the top priorities of the WHO's GAPP 2018–2030 (<https://www.who.int/publications/i/item/9789241514187>), young adults should not only consider more PA during the wk, but also reduce the amount of time they spend sitting. In addition, research finds that young men are more physically active due to a greater general interest in sports and sporting events and are more likely to engage in team sports, while girls tend to exercise more individually and favor sedentary activities (Espada et al., 2023). In our study, male students practiced more PA, especially PA of vigorous intensity, while the female students practiced moderate PA. Similar results were reported in Special Eurobarometer survey on Sport and Physical Activity, which was carried out in the 27 EU Member States (<https://europa.eu/eurobarometer>). As for adults, 18% of male students and only 10% of female students in Europe are physically active for 91 min or more of vigorous activity per day when they are physically active. More specifically, for male students, TV watching was not related to any of the exercise or PA indicators, but computer use was negatively correlated with days per wk they engaged in vigorous exercise and strength training. In contrast, among female students, computer use was not related to any of the indicators of exercise or PA, but TV watching was negatively correlated with the number of days per wk they had engaged in vigorous physical activity in the past year (Espada et al., 2023). In our study, female students spend more time sitting than male students, but without statistically significant differences. It has already been reported that the negative health effects of sitting during the day are more pronounced when sitting time is more than ≥ 7.5 h/day (Cicek, 2018). A recent study by the Finnish Student Health Services has revealed that students spend an average of 11h per day sitting, which is more than the average sitting time of young adults (<https://datacatalogue.cessda.eu/detail?q=b540058a77bdd35664aeb2d-3fadd9198990d691634e5fd43b141662a467a379>). In addition, self-reported data showed that university students spend 7.3h per day sitting, but the level of overall sedentary behavior was significantly higher when measured with accelerometers (mean=9.8h per day) (Castro et al., 2020). This in fact suggests that the actual time spent sitting may be higher than the 6.2h (women) and 5.5h (men) reported in our study. In the study by Çiçek (2018), which examined PA and QoL of sports department students, male students had a higher overall PA level than female students, just as in our study. There was also no significant difference in the variable of sitting duration. The QoL related to physical and psychological health was similar between genders, and the only significant difference was found in QoL related to social relationships, which was higher in male students. In our study, we found a slight difference between genders with a better QoL in male students, especially in QoL related to physical health, but with no significant difference. In the study by Craft (2014), exercise is positively associated with QoL in both men and women. However, this study found that exercise does not have a positive effect on women's QoL in all conditions. In studies investigating SQ, the results showed that students with high levels of PA have better SQ (Ge et al., 2019; Štefan et al., 2018). In our previous results, we found significantly better SQ at higher levels of PA, i.e., PA during recreation, leisure and sport. In addition, students with low PA levels and with more time spent sitting have poorer QoL and sleep (Marijančić et al., 2023). Our study showed a slight decrease in SQ in both genders. However, both sexes have the same SQ, although men have higher levels of PA. The results of similar studies also showed no significant difference between male and female students in SQ scores (Han, 2024). Specifically, in a study by Glavin (2022), males who adhered to PA guidelines reported falling asleep faster than those who did not adhere to the guidelines, while no association was found between adherence to the guidelines and sleep latency in females.

CONCLUSION

This study has shown that male students practice more vigorous PA and are more physically active during recreation, sports and leisure. Female students practice more moderate PA and are more physically active at home and at work. However, both genders have similar QoL and SQ.

Awareness of the importance of PA should be raised among students, including both genders. Accordingly, it is critical to incorporate active lifestyles into university curricula to counteract sedentary-related problems. Replacing sedentary time with PA of any intensity in everyday life, including light ones, provides health benefits: by choosing to go by foot or bicycle to the school instead of a car or a bus, and similar. Future research should include specific investigations for choosing a particular type of PA and motivation for PA.

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THE CORRELATION BETWEEN STUDENTS' ATTITUDES AND PHYSICAL ACTIVITY LEVELS WITH THE INFLUENCE OF PARENTS AND FRIENDS

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ABSTRACT

This study aimed to determine the relationship between the attitude and level of physical activity (PA) of students depending on the influence of those closest to them, such as parents and friends. The respondent pool consisted of the first two years of students from two different Zagreb higher education institutions. However, besides the aforementioned relationship, also the differences between students who finished gymnasiums or vocational schools were observed.

The results showed that students from the two faculties have a mostly positive attitude towards PA with 73% participating in additional PA outside of regular PE classes. A significant, but weak association between friends and attitude towards exercise was observed similar to the involvement in additional sports and recreational activities in which a significant but weak association with parents was observed. A significant, but moderate association was found between attitude towards exercise with leisure-time exercise which higher values were shown by students who have completed vocational education as opposed to those who have completed gymnasiums.

Keywords: *higher education, high school, exercise, parent support, peer support*

INTRODUCTION

Promoting physical activity (PA) and physical exercise (PE) has been an important and unavoidable topic for many years when it comes to health. Regular PA contributes to the primary and secondary prevention of several chronic diseases and has been associated with a reduced risk of premature death. As such it contributes to the preservation and improvement of an individual's overall health, but also provides multiple benefits for society and community as a whole (Warburton et al., 2006). The World Health Organization's (WHO) action plan to promote PA has been created on the global level and involves governments of numerous countries as well as stakeholders from various sectors. The plan is aimed at promoting an increase in overall PA in all periods of life, from childhood to old age since the risk of chronic disease begins as early as childhood and only increases with age (WHO 2018, Warburton et al., 2006). According to data available in the 2019-2026. Croatian National Sports Program (Croatian Government, 2019.), only 37.5% of the Croatian population over the age of 15 participates in PA, while 62.5% of the population is physically inactive. The most active is the population between 15 to 20 years old (75.4% active and 24.6% inactive), however, by the time they enter their twenties, this percentage

is reduced to 45% active and 55% inactive, and approximately the same values are retained until they enter their forties.

Encouraging the formation of PE habits in children and young people can be challenging, but it is important to provide them with support and incentives to develop and maintain a healthy lifestyle. Therefore, the role of parents in the formation of habits and patterns of such behavior is very important. Systematic research on the relationship between the PA of children and parents showed a positive but generally weak association regardless of the child's age and sex, including adolescent age during which peers are commonly thought to have a greater influence on behavior (Petersen et al., 2020). The parents' influence, their encouragement, and the creation of behavior in the PA domain have the greatest effect on the child's PA, however, it decreases as the child is growing up due to the significant role played by peers in the young people's free time. (Yao and Rhodes, 2015). A study conducted in 74 countries shows a strong and positive association between high levels of parental and peer support with appropriate levels of PA in young people (Khan et al, 2020). Research on the level of physical activity of young people, their involvement in sports competitions, motivation, and attitude towards physical exercise and health are conducted precisely to better understand but also promote PA in children and young people. According to WHO recommendations, children, and adolescents (5-17 years old) should have at least 60 minutes of moderate to high-intensity PA daily, and three times a week it is recommended they exercise to strengthen muscles and bones. Adults (18-64 years) should have at least 150-300 minutes of moderate-intensity PA or 75-150 minutes of high-intensity PA weekly, and at least twice a week muscle strengthening exercises involving all major muscle groups should be performed (WHO, 2020).

Most students of Zagreb's higher education institutions have compulsory Physical Education (PE) classes during the first two years of their studies. For many, this is the only physical exercise, but a part of them still engage in kinesiological activities at the recreational or competitive level. The surveyed University of Split students stated that they exercise on average 3-4 times a week, and as the most important reason for engaging in exercise, they emphasized the positive effect of exercise on health, reducing stress, and improving physical appearance. However, socialization was considered the least important reason (Kelić et al., 2023).

This research aimed to determine the attitude of students towards PA and exercise, whether they exercise in addition to the regular PE classes, and to what extent, as well as the level of PA of those closest to them: parents and friends concerning their PA level. The aim was also to determine the potential differences between the students of the two different faculties at which the research was conducted alongside potential differences between the students who finished gymnasium or vocational school education.

METHODS

This respondent pool consisted of students enrolled in the first two years of two different higher education institutions, Zagreb University of Applied Sciences (UAS) and University of Zagreb, Faculty of Science (FoS). All surveyed students are obliged to participate in 60 hours of exercise per year as part of the compulsory PE course during the first two years. The survey was conducted following research ethics, and the data was collected online through Google Forms, which was anonymous and voluntary. The survey was available through the servers of each faculty during the first two weeks of the summer semester of the academic year 2023/2024 and could only be accessed once with a personal account. A total of 760 students (UAS – 348, FoS – 412) participated in the study, of which there were 393 male (M), 344 female (F), and 23 neutral (N) who did not want to declare.

The survey contained fifteen questions, nevertheless, for purposes of this paper six were processed: 1) Gender (M, F, N); 2) Affiliation to the faculty (UAS, FoS); 3) Completed high school education - gymnasium, vocational (Gymn, Voca); 4) Attitude towards physical exercise and physical activity in general (Attit) with the answer range from 1 to 7: 1) I have always been excused for health reasons; 2) I do not like to

exercise, I avoided it whenever I could; 3) I only exercise when I have to (school or faculty); 4) I exercise occasionally, not regularly; 5) I like to exercise; 6) I love to exercise; 7) I have been involved in sports since a young age, I train regularly. The fifth question was aimed to determine how many times a week students participate in additional sports and recreational activities outside of regular PE classes (Extra). The answers offered were: 1) I only engage in PE during the compulsory course 2) 1-2x per week; 3) 3-4x per week; 4) 5-6x per week. Lastly, the sixth question referred to their family and friends' interest and participation in physical activity: According to your assessment, how physically active are the people close to you as well as those you are in regular contact with? It was necessary to choose one of the offered answers for each person: Mother (Mum), Father (Dad), or Friend (M and F). Students could choose the following answers: 1) Almost completely inactive; 2) Less active than me; 3) Similarly active as me; 4); More active than me; 5) Much more active than me.

For the purposes of this research, the Tibco Statistica Enterprise application system was used.

RESULTS

Since the analyzed variables were ordinal, median, and interquartile range were used for descriptive parameters. The Mann-Whitney U test was utilized to assess differences between faculties and between the high schools previously attended by the participants.

Table 1. Descriptive parameters for all participants are displayed, as well as subgroup analyses stratified by gender, faculty and finished high school.

Variables	ALL (N=760)	Gender			Faculty		Finished High School	
		Male (N=393)	Female (N=344)	N/A (N=23)	UAS (N=348)	FoS (N=412)	Gymn (N=510)	Voca (N=250)
		Median (IQ)	Median (IQ)	Median (IQ)	Median (IQ)	Median (IQ)	Median (IQ)	Median (IQ)
Attit	4 (4-5)	5 (4-6)	4 (4-5)	4 (4-6)	5 (4-6)	4 (4-5)	4 (4-5)	5 (4-6)
Extra	2 (1-3)	2 (2-3)	2 (1-3)	2 (1-3)	2 (2-3)	2 (1-3)	2 (1-3)	2 (2-3)
Mum	2 (2-3)	2 (1-3)	2 (2-3)	2 (1-3)	2 (1-3)	2 (2-3)	2 (2-3)	2 (1-3)
Dad	2 (2-3)	2 (2-3)	2 (2-3)	3 (2-3)	2 (2-3)	2 (2-3)	2 (2-3)	2 (1-3)
FrendF	3 (2-3)	2 (2-3)	3 (2-3)	2 (2-3)	2 (2-3)	3 (2-3)	3 (2-3)	2 (2-3)
FrendM	3 (3-4)	3 (3-4)	3 (3-4)	3 (3-4)	3 (3-4)	3 (3-4)	3 (3-4)	3 (3-4)

Legend: IQ – Lower-Upper Quartil

Attit- Attitude towards physical exercise and physical activity in general

Extra – Exercise in leisure time outside of regular PE classes

Mum, Dad, Friend (F, M) - Level of physical activity of those closest to the participants

To explore the association between attitudes towards exercise and leisure-time exercise, Spearman Rank Order correlation was used. Similarly, Spearman Rank Order correlation was employed to explore the association between the levels of parental activity during growing up and their exercise habits. Additionally, Spearman Rank Order correlation was used to assess the association between friends' exercise habits and exercise tendencies. Spearman rank correlation coefficient was interpreted as weak ($r < 0.29$), moderated ($0.30 < r < 0.69$) and strong ($0.70 < r < 1$). A statistical significance level of $p < 0.05$ was set.

Table 2. Differences between faculties

Variables	Rank Sum Fo5	Rank Sum UAS	U	Z	p
Attit	141262,00	147918,00	56184,00	-5,14	0,00
Extra	140948,50	148231,50	55870,50	-5,25	0,00
Mum	165854,00	121049,00	60323,00	3,62	0,00
Dad	162273,50	124629,50	63903,50	2,42	0,02
FriendF	176135,00	109255,00	49570,00	7,09	0,00
FriendM	163606,00	121029,00	60651,00	3,34	0,00

Legend: U – U value; Z – Z value; p – p value

Attit- Attitude towards physical exercise and physical activity in general

Extra – Exercise in leisure time outside of regular PE classes

Mum, Dad, Friend (F, M) – Level of physical activity of those closest to the participants

Table 3. Differences between High school attended by the participants

Variables	RANK Sum Gymn	Rank Sum Voca	U	Z	p-value
Attit	104151,50	185028,50	54723,50	3,17	0,00
Extra	102708,50	186471,50	56166,50	2,67	0,01
Mum	90267,00	196636,00	58892,00	-1,58	0,11
Dad	89471,50	197431,50	58096,50	-1,87	0,06
FriendF	78877,50	206512,50	48001,50	-5,28	0,00
FriendM	86571,50	198063,50	55446,50	-2,64	0,01

Legend: U – U value; Z – Z value; p – p value

Attit- Attitude towards physical exercise and physical activity in general

Extra – Exercise in leisure time outside of regular PE classes

Mum, Dad, Friend (F, M) – Level of physical activity of those closest to the participants

Students in Croatia who want to enroll in a university are obliged to pass *Matura*, a type of mandatory state examination that is considered as confirmation of completion of high school education. For students at vocational schools, *Matura* isn't considered a confirmatory of the education, therefore it is optional. However, should they want to enroll in a higher education institution, the act of succeeding in the examination becomes obligatory. A larger percentage of Fo5 students completed gymnasiums, i.e. 91.02% of them, compared to UAS students, of whom 38.5% finished a gymnasium, while 61.5% completed vocational school education. The aim of this study was also to determine whether the fact that a student finished a gymnasium or a vocational school has an impact on any of the offered variables. The results showed higher values in the variables Attit and Extra in those who completed vocational education, and higher values in the variables of parents and friends in those who finished gymnasiums.

Table 4. Association between attitudes towards exercise with leisure-time exercise and friends' activity.

Variables	r	t(N-2)	p-value
Attit & FriendF	-0,29	-8,27	0,00
Attit & FriendM	-0,25	-7,23	0,00
Attit & Extra	0,67	24,81	0,00

Legend: r – Spearman correlation

Table 5. Association between parental level of activity and participants exercise habits.

Variables	r	t(N-2)	p-value
Mum & Extra	-0,16	-4,47	0,00
Dad & Extra	-0,19	-5,40	0,00

Legend: r – Spearman correlation

DISCUSSION

The Mann-Whitney U test showed that differences in attitude towards PE and exercise in leisure time outside of regular PE courses exist depending on the affiliation with a particular faculty. The UAS students have a more positive attitude towards physical exercise when compared to FoS students. Moreover, differences in the influence of those in the students' near environment have also been observed. FoS students' friends and family members have a similar level of PA when compared to UAS students. It is interesting to note that students who finished vocational school have a more positive attitude towards exercise, as opposed to those who finished gymnasiums as well as the fact that they exercise more, in their free time, regardless of the compulsory PE classes.

In Tables 4 and 5 the Spearman rank correlation coefficient between the listed variables has been calculated. Attitude towards physical exercise shows a significant but weak association with male and female friends, while a significant moderate association between Attit & Extra variables is visible.

A significant but weak correlation was obtained between Extra and parent variables (Mum and Dad) confirming the positive role of parents and PA levels, primarily through their behavior and incentive to engage in sports activities (Petersen et al., 2020).

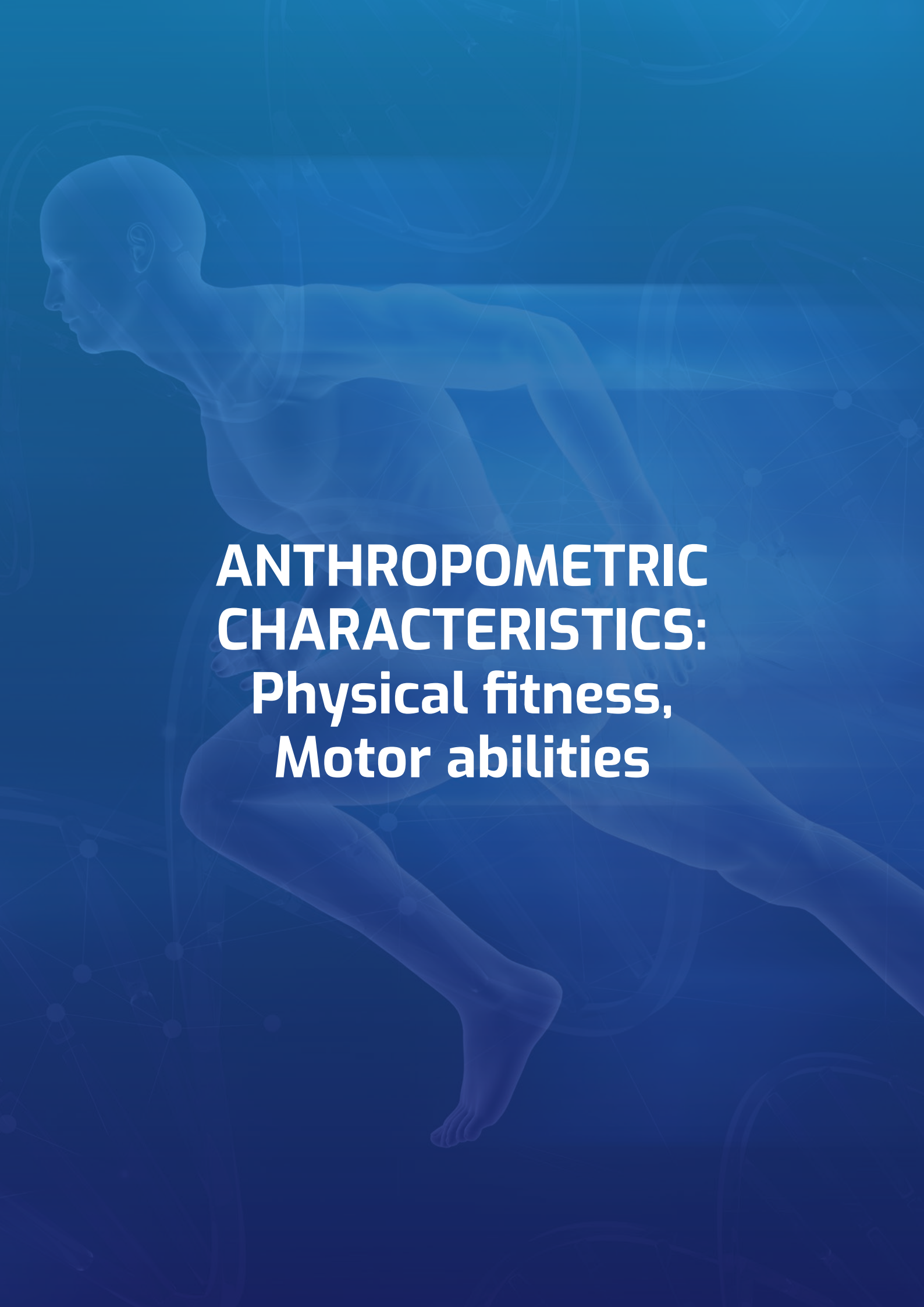
CONCLUSION

According to the research, it can be concluded that students from these two higher education institutions have a mostly positive attitude towards PA, and 73% of them participate in additional PA outside of regular PE classes. Parents have a significantly weak influence on additional PA outside of regular PE classes. Moreover, attitude towards exercise shows a significant but weak association with male and female friends, while there is a significant moderate association between Attit and Extra variables confirmed by previous research (Petersen et al, 2020, Yao and Rhodes, 2015).

Higher values in Attit and Extra variables are shown by students who have completed vocational high school education as opposed to those who have completed a gymnasium education. For more information, the research should be expanded to explore the extent of a high school education of a student but also the parents' education has an impact on the level and the attitude towards PA.

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ANTHROPOMETRIC CHARACTERISTICS: Physical fitness, Motor abilities

ANALYSIS OF COORDINATION LEVELS AMONG STUDENTS AT THE FACULTY OF KINESIOLOGY UNIVERSITY OF ZAGREB

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ABSTRACT

Given the prevailing assumption of declining motor skills across successive generations of students, this study aimed to investigate whether there are statistically significant differences in coordination levels among various cohorts of female and male students at the Faculty of Kinesiology, University of Zagreb. The study encompassed five generations of regular students enrolled in the first year of university integrated undergraduate and graduate study of Kinesiology. The mean height of female students was 168.4 ± 6.31 cm, and for male students, it was 182.39 ± 6.16 cm, while the mean weight of female students was 60.51 ± 6.84 kg and for male students, it was 77 ± 9.07 kg. Motor coordination ability was evaluated utilizing the Backward Locomotion Test (MKOPOL) for reorganization of movement stereotypes (Metikoš et al., 1989) and Turning Test (MKOPLO) to evaluate the coordination of the entire body (Neljak et al., 2012). Statistical data analysis was conducted using the Statistic 14.0 software. Descriptive statistics (mean, standard deviation, minimum, maximum) were used to characterize the participant sample, and the Shapiro-Wilk test was employed to assess the normality of variable distributions. Given significant deviations from normal distribution, differences in coordination tests between generations were examined using the non-parametric Kruskal-Wallis test. The findings revealed statistically significant disparities between generations in the tested variables.

Keywords: *tests, backward locomotion, turning test*

INTRODUCTION

Motor coordination has a crucial role in various physical activities and sports, its significance is highlighted in overall movement proficiency and performance (Stanković et al., 2023), and it is defined as the ability to perform complex motor tasks in a time and space efficient and energetically rational manner (Sekulić & Metikoš, 2007). All movements, voluntary movements, but also reflex (automatic) ones, created as a reaction to an external stimulus, are realized by contractions. When we talk about coordination, we are talking about precise, regular and purposeful movements that achieve a specific goal (Grbavac, 2003). Coordination is the ability to perform simple and complex movements, but also to quickly learn new movements and quickly change one movement to another. (Drabik, 1996) and specialized movements, drawing upon a spectrum of fundamental movement skills (Burns, Fu, Hannon & Brusseau, 2017).

The mechanism for movement structure (Metikoš & Hošek, 1972; Gredelj et al., 1973; Gredelj et al. 1975; Metikoš, Gredelj & Momirović, 1979) also referred to as the general coordination factor (Metikoš, et al., 2003) defines the proficiency level for executing complex movement structures, it is also responsible for coordination as «the ability to perform complex motor tasks by activating different muscle (synergy) groups efficiently in space, time and energy». General coordination factor consisting of a number of independent factors, among others agility, the ability to efficiently change direction and/or direction of movement (Sekulić & Metikoš, 2007; Horvatin, Topolovec & Vlašić, 2023).

In this study, we observed dimensions of coordination: *reorganization of movement stereotypes* - as the ability to adapt learned motor programs and movement structures to new conditions, whereby the adopted, stable motor program changes according to given conditions, as well as observing the *coordination of the whole body* - as the ability to manage the whole body in space in the realization of various complex motor structures (Metikoš et al., 2003; Gredelj et al. 1975; Sekulić & Metikoš, 2007; Neljak et al, 2012).

It is well known that children develop motor coordination by the maturation process (Goodway, Ozmun & Gallahue, 2019). However, the best possible form of motor coordination could be achieved with the appropriate training. This was confirmed by Fransen et al., who stated that spending many hours in various sports is important for the proper development of gross motor coordination (Stanković et al., 2023). The absence of physical activity and the adoption of an unhealthy lifestyle characterized by sedentary behaviors, can significantly impact health and hinder the development of movement skills (Hidayat, Asdi, & Fitria, 2020).

This transversal research aims to provide information about the state of coordination motor skills among kinesiology students over the years.

METHODS

This research observed five generations of full-time, first year students spanning five consecutive academic year generations: 2019/2020, 2020/2021, 2021/2022, 2022/2023, 2023/2024. enrolled in the university's integrated undergraduate and graduate studies in Kinesiology, Faculty of Kinesiology, University of Zagreb, aged 19 ± 1.3 years. The students' morphological characteristics were assessed by measuring body height and body weight.

During the fifth week of regular classes of the winter semester, at Basic Kinesiology Transformations 1, the students' coordination ability was assessed during theoretical-practical classes and exercises using the following tests: Backward Locomotion Test (MKOPOL) for the reorganization of movement stereotypes (Gredelj et al., 1975; Metikoš et al., 1989) and Turning test (MKOPLO) to evaluate the coordination of the entire body (Gredelj et al., 1975; Neljak et al., 2012).

These motor tests were conducted in three measurements, with the result of each measurement recorded in seconds, and the data processed by calculating the mean value of all three measurements. The results of the measured variables were analyzed using the Statistic 14.0 software. The sample characteristics were outlined using descriptive statistics, and the normality of the data distribution was tested using Shapiro-Wilk test. Due to deviations from normal distribution, differences between generations in motor variables were analyzed using non-parametric Kruskal-Wallis test.

RESULTS

Morphological characteristics were measured on a total of 959 students; 322 females with average body height 168.42 ± 6.29 cm and body weight 60.37 ± 6.53 kg; and 637 males, body height 182.2 ± 6.84 cm and body weight 76.95 ± 8.97 kg.

Table 1. Descriptive parameters of Backward Locomotion Test (MKOPOL) and Turning Test (MKOPLO) (s) – females

Backward Locomotion Test (MKOPOL) (s); female					Turning Test (MKOPLO) (s); female			
generation	N	Mean $\pm$ SD	Min	Max	N	Mean $\pm$ SD	Min	Max
2019	62	$9,72 \pm 1,55$	7,06	13,60	58	$7,14 \pm 1,08$	5,33	10,26
2020	49	$11,48 \pm 1,62$	7,89	15,71	43	$7,87 \pm 1,11$	5,60	10,52
2021	68	$10,32 \pm 1,55$	7,12	17,88	64	$7,25 \pm 0,99$	5,38	9,88
2022	70	$10,23 \pm 1,48$	6,70	13,43	71	$7,47 \pm 1,34$	4,90	11,83
2023	80	$10,29 \pm 1,53$	7,14	16,08	52	$7,47 \pm 0,96$	5,69	9,88
Total	329	$10,41 \pm 1,55$	7,18	15,34	288	$7,44 \pm 1,10$	5,38	10,47

Legend: N=number of students, Mean=average value, SD=standard deviation, Min=minimum, Max=maximum, 2019=generation 2019/2020; 2020=generation 2020/2021, 2021=generation 2021/2022, 2022=generation 2022/23, 2023=generation 2023/2024.

Table 2. Kruskal-Wallis test of differences for Backward Locomotion Test (MKOPOL) and Turning Test (MKOPLO) (s) - females.

Backward Locomotion Test (MKOPOL) (s); female						Turning Test (MKOPLO) (s); female					
Kruskal-Wallis test: p<0,01						Kruskal-Wallis test: p<0,03					
	2019	2020	2021	2022	2023		2019	2020	2021	2022	2023
2019		0,00*	0,31	0,29	0,56	2019		0,01*	1,00	0,86	0,52
2020	0,00*		0,00*	0,00*	0,00*	2020	0,01*		0,14	0,56	1,00
2021	0,31	0,00*		1,00	1,00	2021	1,00	0,14		1,00	1,00
2022	0,29	0,00*	1,00		1,00	2022	0,86	0,56	1,00		1,00
2023	0,56	0,00*	1,00	1,00		2023	0,52	1,00	1,00	1,00	

Legend: *=significant differences between generations at p<0.01 (Backward Locomotion Test) and p<0.03 (Turning Test) error levels.

The results show that female generation of 2020/2021, also known as the "Covid generation," significantly differs from other generations in the measured values of both observed tests. In the Backward Locomotion Test (MKOPOL), they significantly differ from all observed generations, with the lowest average result of 11.48 ± 1.62 s, while in the Turning Test (MKOPLO), they significantly differ only from the 2019/2020 generation. The difference in the average result between the 2019/20 and 2020/21 generations in the Turning Test is 0.73 seconds.

Table 3. Descriptive parameters of Backward Locomotion Test (MKOPOL) and Turning Test (MKOPLO) (s) -males.

Backward Locomotion Test (MKOPOL) (s); male					Turning Test (MKOPLO) (s); male			
generation	N	Mean $\pm$ SD	Min	Max	N	Mean $\pm$ SD	Min	Max
2019	118	8,37 $\pm$ 1,28	5,59	11,64	130	5,98 $\pm$ 0,88	3,51	8,08
2020	104	9,90 $\pm$ 1,78	6,00	16,00	105	6,47 $\pm$ 1,19	4,28	11,29
2021	111	8,84 $\pm$ 1,33	6,12	12,39	128	6,45 $\pm$ 1,55	4,28	13,37
2022	124	8,94 $\pm$ 1,22	6,20	12,56	138	6,44 $\pm$ 0,96	4,67	10,25
2023	102	8,49 $\pm$ 0,93	6,08	11,16	71	6,03 $\pm$ 0,70	4,17	7,68
Total	559	8,91 $\pm$ 1,31	6,00	12,75	573	6,27 $\pm$ 1,06	4,18	10,13

Legend: N=number of students, Mean=average value, SD=standard deviation, Min=minimum, Max=maximum, 2019=generation 2019/2020; 2020=generation 2020/2021, 2021=generation 2021/2022, 2022=generation 2022/23, 2023=generation 2023/2024.

Table 4. Kruskal-Wallis test of differences for Backward Locomotion Test (MKOPOL) and Turning Test (MKOPLO) (s) - males.

Backward Locomotion Test (MKOPOL) (s); male						Turning Test (MKOPLO) (s); male					
Kruskal-Wallis test: p<0,05						Kruskal-Wallis test: p<0,03					
	2019	2020	2021	2022	2023		2019	2020	2021	2022	2023
2019		0,00*	0,04*	0,00*	1,00	2019		0,01*	0,66	0,00*	1,00
2020	0,00*		0,00*	0,00*	0,00*	2020	0,01*		1,00	1,00	0,24
2021	0,04*	0,00*		1,00	0,56	2021	0,66	1,00		0,80	1,00
2022	0,00*	0,00*	1,00		0,10	2022	0,00*	1,00	0,80		0,10
2023	1,00	0,00*	0,56	0,10		2023	1,00	0,24	1,00	0,10	

Legend: *=significant differences between generations at p<0.05 (Backward Locomotion Test) and p<0.03 (Turning Test) error levels

Results of the 2020/2021 generation of students show significant statistical differences from all the observed generations in the measured values of the Backward Locomotion Test (MKOPOL) with the lowest average result of 9.90 $\pm$ 1.78 s. In the Turning Test (MKOPLO), there is a statistically significant difference between the generation of 2019/2020 and 2020/2021, and 2019/2020 and 2022/2023.

DISCUSSION

A significant deviation from the normal distribution of results is attributed to the sample of participants, consisting of selected students admitted to the Faculty of Kinesiology based on their above-average level of motor skills and knowledge. These students regularly engage in various sports activities through practical classes at the university, elite sports, and/or recreational pursuits, thereby preserving and enhancing their acquired motor skills during critical life phases (Horvatin, Topolovec, & Vlašić, 2023).

The total number of female and male students measured varies for each test, as the Backward Locomotion Test (MKOPOL) was conducted during theoretical-practical classes, while the Turning Test was administered as part of the exercises. Female students of the Covid 2020/2021 generation significantly differ from all other generations in the Backward Locomotion Test, which is attributed to their inactive lifestyle during the Covid-19 pandemic (Narici et al., 2021; Sekulić et al., 2020; Horvatin, 2023) due to strict epidemiological measures that prevented various physical and sports activities. There is a statistically significant difference in the Turning Test between the 2020/2021 generation and the 2019/2020 generation, while there is no statistically significant difference between other generations. There is a significant decrease in the mean value of the Backward Locomotion Test among male students between the 2019/2020 and Covid 2020/2021 generations. In the generations after 2020/2021, there is no visible decline in results, but rather a gradual improvement, which has almost equalized the generations of 2019/2020 and 2023/2024, with no statistically significant difference between them. After the decline in average results in the Turning Test, a gradual improvement in results is evident, but the test values are still only approaching the results of the year 2019/2020, corroborating the hypothesis that newer generations exhibit weaker abilities compared to their predecessors.

CONCLUSION

Stanković et al. (2023) emphasize that individuals exhibiting proficient motor coordination often demonstrate superior sports performance, enhanced fine motor skills, and overall improved physical functioning, underscoring the significance of motor coordination in everyday activities (Cortis et al., 2009). Numerous studies have consistently shown that regular physical activity positively influences the development of motor coordination and contributes to overall physical well-being in children (Bai et al., 2012). Unfortunately, what is observed among contemporary generations of adolescents is a sedentary lifestyle, characterized by reduced physical activity. Since the beginning of 2020, in response to the COVID-19 pandemic, various restrictions in the manner of remote work and study were implemented by worldwide governments, limiting outdoor activities (Ayubi & Komaini, 2021). Although these adjustments have become necessary to maintain individual health, it's crucial to recognize that the population continues to shape their motor skills through physical activity and engagement (Ayubi & Komaini, 2021). Regardless of age and developmental stage, consistent engagement in activity requiring specific motor skills is essential, and neglecting these activities or reducing their frequency may result in a significant decline in the observable level of coordination ability essential to daily life.

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COMPARISON OF THE STUDENTS MORPHOLOGICAL CHARACTERISTICS, LUNG VOLUMES AND CAPACITIES WITH THE RESULTS IN THE COOPER TEST

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ABSTRACT

The aim of this work was to examine the relationship between morphological characteristics and spirometry results, and to compare the results of spirometry with the results of the Cooper running test. Methods: 20 students (11 male students and 9 female students) of the University of Zadar participated in the research. Morphological characteristics were measured (body height, body mass, thigh, waist, calf, upper-arm circumference) body composition values was assessed with segmental body composition analyzer. Also static, dynamic lung volumes and capacities were measured alongside with maximum and average heart rate during the Cooper's test. As for the results, statistically significant correlation is found among students with higher body mass and a higher percentage of fat tissue to have lower values of lung capacity. Analysis of variance reveal that students who train four or more times a week have a significantly lower maximum heart rate when performing the Cooper test. Also, students who had higher values of FVC, FEV1 and FEV6, ran a greater distance in a time period of 12 minutes. Students who have more muscle mass and less fat tissue have greater lung capacity. Students with higher values of FVC, FEV1 and FEV6 had better Cooper test results. This research, as well as previous research, confirms that regular exercise can affect lung capacity.

Keywords: Students, Lung functions, body composition, heart rate, Cooper test.

INTRODUCTION

Engaging in sports or physical activity results in numerous positive adaptation processes for the body, such as changes in the composition of the body, the development of motor skills, functional abilities such as lung functionalities. therefore, the goal of this paper was to determine whether training and the amount of training has an effect on morphological changes in students specially in lung functionalities. According to several authors lung function parameters tend to have a relationship with lifestyle such as regular exercise and non-exercise. Due to regular exercise athletes tend to have an increase in pulmonary capacity when compared with non-exercising individuals (Wasserman et.al , 2004). Age, sex, race, height and weight, pulmonary function depends on lot of factors the balance between lung recoil and chest elasticity, strength of the thoracic and abdominal muscles, individual posture and lung elasticity Cooper test is among best cardiorespiratory indirect field tests for predicting the athlete's aerobic endurance and to obtain an estimate of their VO2 max, specially while keeping track of participants heart rate with chest heart rate sensors. Spirometry is the most important and frequently performed pulmonary function test measuring inhaled and exhaled volumes of air as a function of time which are necessary for diagnosis, moni-

toring, evaluation of disability/impairment and public health purposes (Miller, et.al, 2005). Spirometry is a gold standard for measuring individual pulmonary function that measures how an individual inhales or exhales volumes of air as a function of time. It is the most commonly used pulmonary function test in the objective assess respiratory system function. Lung volume is fairly well predicted on the basis of age, height and weight, but lung volumes which are larger than predicted have been repeatedly observed in athletes compared to their control counterparts who are not engaged in any kind of regular physical exercise. There are some physiological explanations as to why athletes. There is evidence that even mild exercise in the general population may affect spirometric indices leading to higher FEV1 and FVC. According to *U.S. Department of Health and Human Services. Physical Activity and Health* It is generally accepted that people with higher levels of physical activity tend to have higher levels of fitness and that physical activity can improve cardiorespiratory fitness. Some studies have reported positive adaptive changes in lung function in comparison with sedentary individuals (Doherty et.al. 1997), on the other hand other studies have reported no such changes (Biersteker et.al., 1985.) The aim of this paper is to determine the relationship between morphological characteristics and spirometry results of students and to determine the differences between spirometry results and Cooper's running test. The first hypothesis is that students with a higher percentage of subcutaneous fat tissue have worse spirometry results. Another hypothesis is that students who have higher spirometry values also have better results on the Cooper Running Test.

METHODS

Research was carried out in academic year 2023/2024 during the summer semester as part of the elective course Sport and Health, implemented by Center for Exercise and Student Sports of Zadar University on a sample of 20 respondents, 11 male and 9 female. Morphological variables were measured (body height, body mass, Fat Mass (kg), Fat range %, Skeletal muscle mass, Skeletal muscle mass range % Visceral fat (level), Fat free mass (kg), upper arm, waist, upper leg and lower leg circumference, FVC (Forced vital capacity), FEV1 (Forced expiratory volume in first second), FEV1/FVC (ratio of the forced expiratory volume in the first one second to the forced vital capacity- Tiffeneau-Pinelli index), FEV6 = forced expiratory volume in 6 s, Max HR (maximum heart rate), AvgHR (average heart rate), and during 12 minutes run. Spirometry testing was performed by using the computerized spirometer (Minispir model, PC based USB spirometer, Mir, Rome, Italy) . The testing took place in a laboratory setting, and all tests were performed at the same time of day between 13.30-15.00., with the same instruments and techniques. All the testing procedures was described and taught to the patient. Subjects carried out 3 FVC manoeuvres. All tests were carried out in accordance with European Respiratory Society technical standards for conducting spirometry. Spirometry was performed in sitting position in armed chairs wearing a nose clip. One hour before testing, subjects did not smoke, exercise, or eat any meal. All subjects took about 2 minutes of inactive rest after each FVC manoeuvre. The highest rate of three attempts was recorded. The device does not require calibration and applies a disposable turbine flow meter for its measurements. Body composition and body weight were measured and assessed by bioelectrical impedance measurement performed with the Tanita, model MC780(Tanita, Tokyo, Japan) multi frequency segmental body composition analyzer. Information concerning the subject date of birth, gender and height are entered in Gmon software. Students were referred not to eat, drink or participating in physical activities two hours before measurement. Height was measured to the nearest 0.1 cm with a portable stadiometer Seca 222 (Seca, Hamburg, Germany), circumferences were measured by Seca 201 (Seca, Hamburg, Germany) centimeter tape. Copper test was conducted on the 400 meter track on athletic stadium while keeping track of participants heart rate with Polar H10 (Polar Electro, Kampele, Finland) chest heart rate sensors connect to a Polar mobile application Polar Beat during 12 minutes run. Average heart rate and maximum heart rate was noted. Vo2max was not measured directly, so calculation was made to estimate VO2 max from distance score using the equations ($VO_2 \text{ max} = (\text{distance covered in meters} - 504.9) / 44.73$) (Cooper, 1968). Correlations were calculated to determine the connection between morphological and functional characteristics of students. Analysis of variance for dependent samples was used to determine the differences in morphological and functional characteristics with regard to the results of the Cooper test. The results are presented tabularly and graphically. The accepted level of statistical error is $p \leq 0.05$. Samples or variables were collected and processed in Statistica for Windows 13.

RESULTS AND DISCUSSION

The results of the correlations between morphological and functional characteristics of students (Table 1.) show that students with a higher body mass have a lower FEV1/FVC ratio, while taller students have a higher FVC. Also, the results show that the percentage of fat mass (FM%) is negatively correlated with spirometry values, so the first hypothesis is confirmed while muscle mass and the total percentage of muscle mass are positively correlated. These results suggest that body composition in college students may be helpful in monitoring respiratory function (Komici, 2022). Similar results were obtained in previous studies (Wannamethee et.al,2005; . Maiolo, 2003. Amara, 2001). Higher FEV1 in athletes could be explained by the lowest value of FM%, highlighting obesity as a limiting factor for FEV1 in athletes (Brown,2013).

Table 1. Correlations between morphological and functional characteristics

Variables	Correlations Marked correlations are significant at $p < 0,05$ N=20								
	FEV6	FEV1 /FVC	FEV1	FVC	Max HR T	Avg HR T	Distance (m)	Cooper rank	PV02 max
Body mass	0.49	-0.67*	0.16	0.50	0.11	0.22	0.26	0.20	0.26
Body height	0.59	-0.58	0.40	0.62*	-0.40	-0.16	0.45	0.23	0.45
FATT MASS	-0.36	0.04	-0.49	-0.35	0.38	0.27	-0.40	-0.15	-0.40
FM%	-0.61*	0.34	-0.62*	-0.61*	0.41	0.23	-0.58	-0.29	-0.58
VFATT	0.31	-0.34	0.12	0.36	0.18	0.16	0.11	-0.04	0.11
FFM/KG	0.83*	-0.82*	0.53	0.84*	-0.14	0.07	0.59	0.35	0.59
SMM	0.84*	-0.65*	0.65*	0.87*	-0.01	0.12	0.55	0.12	0.55
%SMM	0.78*	-0.33	0.80*	0.81*	-0.09	0.00	0.57	0.00	0.57

* determined statistically significant difference at the $p<0.05$ level

Abbreviations: FM%(percentage of fat mass), VFATT (level of Visceral fat), FFM/KG (Fat free mass in kilograms), SMM (Skeletal muscle mass)m, %SMM (percentage of % Skeletal muscle mass)

Table 2. shows the arithmetic means, standard deviations, minimum and maximum values of the students' morphological and functional characteristics and their differences with regard to the results of the Cooper test. Statistically significant differences were found in the results of spirometry, in the variable FVC, FEV1 and FEV6. Students who had higher values of FVC, FEV-1 and FEV6, ran a greater distance in a time period of 12 minutes so the second hypothesis is also confirmed. According to the results of the study conducted by Durmić et al. (2017), the respiratory parameters of endurance athletes are highly significantly different in the observed values of FVC, FEV1 and VC from those of strength athletes, while this fact was not significant in the lung function parameter—FEV1/FVC. Namely, there is evidence that exercise can influence spirometric indices leading to higher FEV1 and FVC even during mild physical activity, especially during prolonged type of physical activity (Cheng, 2003). This can be explained by the decrease in airway resistance, the increased expansion of the alveoli, and the increase in overall lung elasticity caused by continuous physical activity. Moreover, endurance physical activity also improves respiratory muscle strength (Leischik, 2014; Park, 2012).

Table 2. Morphological and functional abilities with regard to the results of the Cooper test (Cooper, K. H., 1968).

Variables	Cooper test normative	$\bar{x} \pm sd$	Minimum	Maximum	f	p
FATT MASS	1	13.09+5.80	4.70	21.0	0.58	0.57
	2	14.92+4.23	11.10	23.20		
	3	13.33+6.32	5.00	22.50		
FM%	1	16.44+5.13	7.30	22.60	3.65	0.05
	2	21.43+5.94	15.30	32.20		
	3	19.26+7.76	6.80	31.10		
VFATT	1	2.38+1.60	1.00	5.00	0.26	0.78
	2	1.83+0.75	1.00	3.00		
	3	2.00+2.07	1.00	7.00		
FFM/KG	1	53.99+11.29	37.60	72.80	1.91	0.19
	2	54.98+6.69	48.10	64.40		
	3	56.37+9.34	47.90	70.20		
SMM	1	28.23+6.89	20.00	39.30	1.62	0.23
	2	27.42+5.80	22.50	35.50		
	3	27.73+7.10	21.80	39.80		
%SMM	1	42.74+3.12	37.60	45.80	2.32	0.13
	2	39.00+6.18	32.10	48.80		
	3	40.13+5.60	33.60	48.80		
Max HR	1	185.14+11.42	167.00	200.00	0.27	0.77
	2	199.00+5.43	191.00	205.00		
	3	180.50+11.45	165.00	192.00		
Avg HR	1	166.86+14.65	140.00	188.00	0.74	0.50
	2	178.00+19.85	144.00	194.00		
	3	166.75+10.72	153.00	179.00		
FVC	1	5.33+1.12	3.76	7.04	5.88*	0.01*
	2	5.42+1.13	4.16	6.72		
	3	5.56+1.02	4.35	6.76		
FEV1	1	4.63+0.63	3.75	5.24	3.75*	0.05*
	2	4.93+0.91	3.85	5.90		
	3	4.91+0.97	3.88	6.06		
FEV1/FVC	1	89.20+8.62	74.40	100.00	1.74	0.21
	2	91.36+4.69	86.90	98.70		
	3	87.51+2.86	83.40	90.90		
FEV6	1	5.26+1.12	3.76	7.04	5.31*	0.02*
	2	5.42+1.13	4.16	6.72		
	3	5.57+1.14	4.08	6.76		

* determined statistically significant difference at the $p < 0.05$ level; Normative 1-below average, 2-average, 3-above average; .

Abbreviations: FM%(percentage of fat mass), VFATT (level of Visceral fat), FFM/KG (Fat free mass in kilograms), SMM (Skeletal muscle mass)m, %SMM (percentage of % Skeletal muscle mass), Max HR (maximum heart rate), Avg HR (average heart rate), FVC (Forced vital capacity), FEV1 (Forced expiratory volume in first second), FEV1/FVC (ratio of the forced expiratory volume in the first one second to the forced vital capacity- Tiffeneau-Pinelli index), FEV6 (forced expiratory volume in 6 seconds)

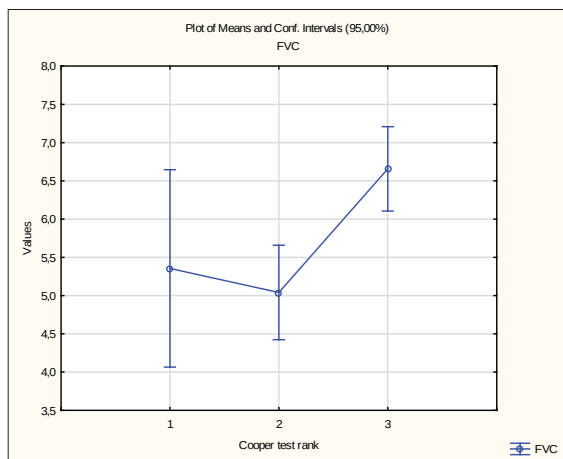


Figure 1. Differences in FVC and Cooper's test results

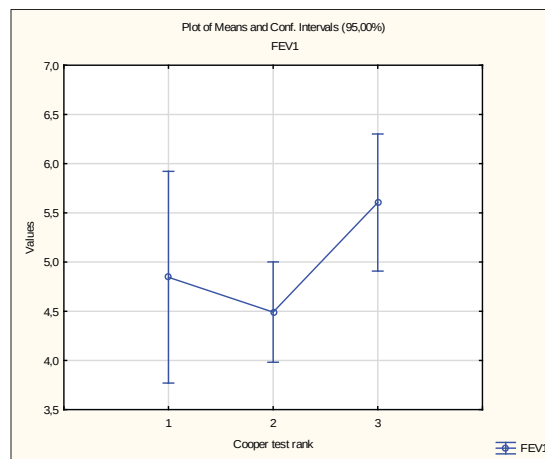


Figure 2. Differences in FEV1 and Cooper's test results

According to the tables of the Cooper test normative, the achieved results of the students are ranked in three categories according to age and gender and distance in meters: below average, average and above average. Figure 1. and Figure 2. graphically show statistically significant differences in FVC, FVC1 and Cooper's test results, where it can be seen that students with poor and average results have lower FVC and FVC1 compared to students who had good Cooper's test results. Cheng, (2003) also found that subjects who remained active had higher forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) than the other less active and inactive groups.

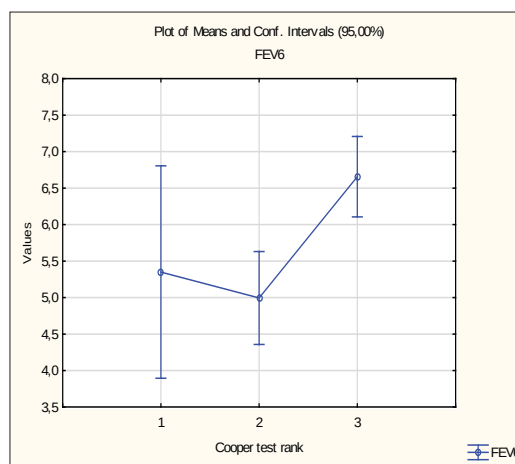


Figure 3. Differences in FEV6 values based on Cooper's test results

Higher results of forced expiratory volume in 6 seconds (Figure 3.) were obtained by students with good results of the Cooper test, that is, they ran longer distances in a time period of 12 minutes. Spirometry parameters can vary between athletes who play aerobic and anaerobic sports (Rajaure , 2023). Although in this paper we do not have data on which sports the students play, these results point to a connection between lung capacity and sports performance.

CONCLUSION

In this paper, we presented the connection between morphological characteristics and functional abilities of students and compared respiratory functions and the performance of the Cooper's running test. The results indicate a positive correlation between the percentage of total muscle mass and lung capacity, while higher percentages of adipose tissue have a negative correlation. The obtained results are in accordance with previous research and point to the importance of body composition on the respiratory functions of students. The results of the variance analysis show statistically significant differences in the forced vital capacity of the lungs (FEV), forced expiratory volume in the first second (FEV1) and after 6 seconds (FEV6) with the results of the Cooper test. Students who have better results in the Cooper test, also have higher lung capacity values. We assume that students who are physically active have better respiratory lung functions. In the future research, a larger number of respondents and data, type and frequency of physical activity should be included.

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CONNECTION BETWEEN DISRUPTIVE FACTORS AND THE AMOUNT OF ACQUIRED KNOWLEDGE IN WINDSURFING

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ABSTRACT

The aim of this study was to determine the connection between disruptive factors and the amount of acquired knowledge in windsurfing. The research was conducted with 94 participants, students of the Faculty of Kinesiology Zagreb. All the participants had no previous windsurfing experience. The measured and analyzed disruptive factors included wind strength, wind variability, wave height, air temperature, water temperature, and the anxiety level of students measured using the Endler Anxiety State Questionnaire. The measurement of disruptive factors and anxiety occurred on the last day of the study, just before the demonstration of test elements. The amount of acquired knowledge was assessed using grades on a Likert scale ranging from 1 to 5. Four elements of windsurfing were graded: start, upwind turn, downwind turn, and the board control. The results suggest that the amount of acquired knowledge in windsurfing can be partly explained by disruptive factors and the level of anxiety. Anxiety level proved to be more predictive in its impact to the amount of acquired knowledge compared to disruptive factors, as participants with higher anxiety levels received lower grades, while those with lower anxiety levels received higher grades. There are numerous factors that could influence the amount of acquired knowledge in windsurfing due to the complexity of the sport and exposure to unfamiliar conditions, making it an intriguing and new environment for the participants, taking them out of their comfort zones. Therefore, it is crucial to gain a deeper understanding not only of external disruptive factors but also of internal psychological factors that can significantly impact sports performance and knowledge acquisition in windsurfing.

Keywords: external factors, anxiety, grades, windsurfing

1. INTRODUCTION

Windsurfing is an incredibly interesting and increasingly popular sport that offers a unique combination of challenges and pleasures for its enthusiast. The rapid acquisition of basic knowledge plays an important role in the development of the sport's popularity (Bornhoft, 2001), making it attractive to people of various ages. Given that the Croatian coast provides excellent conditions for water sports during the summer months, numerous windsurfing centers have been opening year after year, attracting tourists from all over the world. These centers offer equipment rental options as well as courses for beginners who have never tried this sport or wish to improve their skills. In order to learn and acquire knowledge in windsurfing, it's essential to investigate which factors may influence learning, especially among individuals who are encountering this sport for the first time. Today, we know that the level of motor skills, functional abilities, and morphological characteristics influence the ability to learn and acquire new elements in windsurfing (Ošlak Kranjc, 2011; Prlenda et al., 2012; Kralj, 2022). Various abilities and

characteristics affect the acquisition of knowledge in windsurfing, but there are also numerous external factors, such as wind strength, wind direction variability, wave height, and air and water temperatures. External factors could significantly impact windsurfer performance, thus necessitating a careful understanding of their characteristics to facilitate easier learning. Wind strength and variability in wind direction are undoubtedly factors that can affect performance in windsurfing. They can influence windsurfers stability and, consequently, the speed of knowledge acquisition. Experienced windsurfers have enough experience in „reading“ wind signs and its variability, while beginners still need to learn how to deal with unpredictable wind changes. Depending on the season, environmental temperature can be a crucial factor in the sporting environment. For most people, windsurfing represents an opportunity to enjoy the sun, warm temperatures, and the beauty of the sea, but for some individuals, falling into the water, getting wet, and exposure to lower temperatures can cause discomfort (Sleight, 1999). In addition to external factors that may be associated with the amount of knowledge acquired in windsurfing, there are also internal factors, such as anxiety. Anxiety can be defined in two ways: as a current state describing fear, worry, and tension, and as a trait that is a personality predisposition (Cox, 1998). Anxiety can make concentration difficult, instill fear of mistakes, or reduce the ability to cope with challenges (C. Beck, 2000). The occurrence of anxiety in the learning process can have a profoundly negative impact on learning outcomes. Participants are encountering this type of activity conducted on water for the first time, which is an intriguing and new environment for them that can lead to increased levels of insecurity and fear. The aim of this research is to determine the correlation between external factors, such as wind strength, wind direction variability, wave height, air and water temperatures, and the level of anxiety on the amount of acquired knowledge in windsurfing.

2. METHODS

The sample consisted of 94 3rd-year male and female students of the Faculty of Kinesiology, University of Zagreb. All respondents participated in the research voluntarily and had no previous experience in windsurfing. The research included 65% of men ($n=61$) and 35% ($n=33$) of women. The independent variable, i.e. disturbing factors observed in the research were: wind strength, wind variability, wave height, air temperature, water temperature and anxiety level. The dependent variable is the grades from the exam elements, assessed by the examiner on a Likert scale from 1 to 5. Students were graded in 4 four elements of windsurfing - start, upwind turn, downwind turn and board control. Wind strength was measured with an anemometer, while wind variability was measured with a wind vane. The height of the wave was measured based on the subjective assessment of the examiner. Air temperature and water temperature were measured with a thermometer. The level of anxiety was measured with Endler's questionnaire, namely the EMAS-S questionnaire for measuring the current state of anxiety. The collected data were analyzed and processed in the SPSS 21 program ("Statistical Package for the Social Sciences"). Disruptive factors were measured on the last day. The data were analyzed using descriptive statistics methods and procedures. The Spearman correlation coefficient was used to determine the association between disruptive factors and windsurfing knowledge (exam grades).

3. RESULTS

3.1. Grades

Considering the grades from the exam elements of start, upwind turn, and downwind turn, the largest proportion of participants were rated as "Very Good (4)," while the highest number of participants in the steering element were rated as "Excellent (5)". According to descriptive indicators (Table 1), participants received the highest ratings in the start element ($M \pm SD = 3.90 \pm 0.86$) and steering ($M \pm SD = 3.90 \pm 1.04$), while they received the lowest ratings in the downwind turn element ($M \pm SD = 3.32 \pm 1.16$).

Table 1. Descriptive analysis of exam grades

Exam elements	Mean	Standard deviation
Start	3,90	0,86
Board control	3,90	1,04
Upwind turn	3,86	0,92
Downwind turn	3,32	1,16

3.2. Anxiety level

The average values of anxiety level indicators show a low level of anxiety among participants ($M \pm SD = 1.96 \pm 0.43$). It was found that grades from all analyzed elements are statistically significantly negatively correlated with the level of anxiety. Participants who expressed higher levels of anxiety were rated lower, while participants who expressed lower levels of anxiety were rated higher (Table 2).

Table 2. Spearman rank *R* between anxiety level and exam grades

	Anxiety level
Start	-0,44***
Upwind turn	-0,55***
Downwind turn	-0,51***
Board control	-0,56***

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

3.3. Disruptive factors

Testing whether the measured disruptive factors are correlated with the amount of acquired knowledge in windsurfing (grades), it was found that grades from the start element are statistically significant negative correlated with air and water temperatures (Table 3). The grade from the upwind turn is statistically significant negative correlated with air temperature.

Table 3. Spearman rank *R* between disruptive factors and exam grades

	Start	Upwind turn	Downwind turn	Board control
Wind strenght	0,04	0,18	0,05	-0,05
Wind direction variability ¹	.	.	.	.
Wave height	0,04	0,18	0,05	-0,05
Air temperature	-0,22*	-0,36***	-0,02	-0,04
Water temperature	-0,20*	-0,20	0,03	-0,10

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

¹ Correlations of acquired knowledge in windsurfing (windsurfing grade) could not be calculated for the variable of wind variability, as all three groups had identical wind variability on the sixth day of the study, i.e., because wind variability represents a constant.

4. DISCUSSION

The acquisition of knowledge in windsurfing can be influenced by various external factors encountered by individuals during the learning of basic elements. According to the results, it was found that scores from the starting element were statistically significant negative correlated with air and water temperature, while scores from the upwind element were only statistically significant negative correlated with air temperature. Participants who were evaluated under higher air and water temperatures during the start were given lower scores, while participants evaluated under lower air and water temperatures received higher scores. Similar results were obtained for the upwind turn, where higher air temperatures led to lower grades. The results indicate a correlation between disruptive factors (air and water temperature) and the amount of acquired knowledge, but due to weak negative correlations, it cannot be confidently stated that these factors have a significant impact on the amount of acquired knowledge. The measured air and water temperatures did not vary greatly, so it would be beneficial to conduct longer-term research in the future to clearly observe sufficiently large differences in the measured disruptive factors. This would enable a more detailed analysis and a more precise identification of the relationships between the mentioned factors and the amount of acquired knowledge. Given that it was found that scores from all analyzed elements were statistically significant negative correlated with the level of anxiety, where participants who expressed higher levels of anxiety were given lower scores, while those who expressed lower levels of anxiety were given higher scores. The results point to the importance of students' emotional state as a key factor in sports learning. Students who expressed higher levels of anxiety achieved lower results, suggesting that increased levels of anxiety can hinder the process of knowledge acquisition and sports performance. La Fratta et al. (2021) conducted a study on soccer players and found that those who achieved good results in a soccer tournament had lower levels of cognitive anxiety and higher self-confidence than those who achieved lower results. Related to this, Lundkvist et al. (2021) demonstrated a relationship between golfers' skill levels and better results, as well as the ability to limit the impact of negative emotions on performance, indicating that it is possible to address negative emotions to improve sports performance. Although this study provides significant insight into the relationship between anxiety and knowledge acquisition in windsurfing, future research could deepen the analysis by testing multiple dimensions of anxiety, and moreover, longitudinal studies could follow participants over a longer period of time to provide deeper insights into the dynamics between anxiety and knowledge acquisition in windsurfing. After all the aforementioned, anxiety has proven to be more closely associated with the amount of acquired knowledge than other disruptive factors. Anxiety was measured before the actual exam to determine its exact level during the administration of the test elements and to consider only anxiety as a current state, based on somatic and cognitive levels. Other disruptive factors measured did not vary greatly on the days when the windsurfing exams were conducted, which did not allow for a detailed understanding of their correlation with the amount of acquired knowledge or with grades. Air and water temperature were the only factors that had a minor impact on the grades from windsurfing exams, and given the small variations, it cannot be significantly asserted that their impact is sufficiently large on the amount of acquired knowledge. Furthermore, the classes were conducted in a completely enclosed bay, creating optimal teaching conditions, which involve less variation in measured factors, especially in wave height, where greater variations could be expected in more open seas, conditions that could provide better testing of the correlation between disruptive factors and the amount of acquired knowledge.

5. CONCLUSION

Windsurfing is a highly challenging sport that involves many unpredictable factors that practitioners of this sport may encounter, and they are fundamental to sports performance. Due to the complexity of this sport, it is important to understand the extent to which certain external factors can impact it, considering that actual conditions are unpredictable and uncontrollable. Additionally, the complexity of this sport raises a range of demands in assessing psychological factors that are crucial for practicing and acquiring knowledge in windsurfing. Internal factors, including anxiety and emotional reactions of students, represent a key dimension, which is also difficult to measure in certain conditions, far from ideal. This research further highlights the need for multidimensional approaches to carefully evaluate specific factors to more precisely establish and obtain more accurate results. Considering the obtained results, which statistically significantly demonstrate that anxiety among students is a significant predictor affecting the amount of acquired knowledge in windsurfing, it is possible to conclude that internal factors play a significant role in the presentation of specific skills, emphasizing how psychological factors often have a decisive impact on students' sports performance.

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DIFFERENCES IN EFFECTS BETWEEN DRYLAND AND AQUATIC TRAINING AMONG STUDENTS IN AN ELECTIVE APNEA DIVING COURSE

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ABSTRACT

The diving response (DR) is a combination of vasoconstriction and bradycardia. The aim of the research is to determine the differences in the effects of apnea training between a group of subjects who trained on dryland and a group who trained in water. Measurements were conducted on a sample of 12 students. The variables used to determine differences were: static dry apnea (STA dry), static apnea in water (STA w), dynamic dry apnea (DYN dry), vital capacity (VC), and dynamic apnea in water without fins (DNF). To test the differences at individual measurement points between the group of subjects who trained apnea in water versus the group who trained apnea on dryland, a 2×2 repeated measures ANOVA was used, with the training method as the between-subjects factor and measurement points as the within-subjects factor. Determination of differences in results between factor interactions was conducted using the Tukey post-hoc test. Based on the obtained results, it cannot be concluded that there are differences between the groups in the final measurements. The group that trained in water achieved statistically significant differences between initial and final measurements in: STA w $p < 0.01$, STA dry $p < 0.001$, VC $p < 0.01$. The group that trained on dryland achieved statistically significant differences between initial and final measurements in: STA water $p < 0.001$ and VC $p < 0.03$. Based on the obtained results, it can be concluded that apnea training should be incorporated into every aspect of specific preparation for breath-hold divers.

Keywords: diving response, apnea diving, adaptation to water

INTRODUCTION

Apnoea diving is an almost mystical sport in which scientists today try to explain deeper dives and longer periods spent in apnoea. Like any sport, free diving is a complex activity due to the intricate coordination of numerous required dimensions of abilities and characteristics with the diver's current mental state (Drviš, 2010). Although diving has been practiced since ancient times, some evolutionists confirm that swimming and diving among our earliest ancestors led to the development of certain unique human abilities (Hardy, 1960). From a kinesiological perspective, free diving belongs to the group of young and insufficiently explored sports where there is ample room for improvement. Just as every elite athlete seeks continuous progress in their specific sports discipline, free divers are interested in how to adapt the body to apnoea and how to extend their stay beneath the water's surface. Since the 1980s, sports medicine has made significant progress in explaining the phenomena and principles of the

human body present during deep dives in free diving. For example, in 1940, when the first dives began to be recorded, medicine held a theory that humans couldn't dive deeper than 30 meters. It was argued that greater depths would be fatal for divers because the pressure at those depths would "crush" the chest. Today, it is known that this claim is entirely incorrect, and medicine and physiology have explained many other things that occur during dives (such as the diving reflex and the spleen effect). Human life begins in an aquatic environment very similar to seawater, where for the first 9 months, the fetus floats in the mother's womb. Numerous studies have shown that a newborn submerged below the surface instinctively holds its breath for up to 40 seconds. Additionally, it swims without swallowing water and keeps its eyes open without any signs of anxiety. This demonstrates how all newborns are perfectly adapted for life in a liquid environment, although they lose this ability after just a few months of life (Pelizzari & Tavaglieri, 2004). Due to our "aquatic" past in our origins, we carry within us many reflexes designed to enable various adaptations when entering a watery environment. What describes the high level of adaptation of the human body to water is called the diving response (DR). The diving response or dive response is a combination of vasoconstriction and bradycardia studied in humans and marine mammals and it was first studied in pelagic pinnipeds (Panneton, 2013). It is predominantly triggered by breath-holding but is largely influenced by various factors such as submersion of the face in water, hypoxemia, and hypercapnia (Drviš, 2012; Panneton, 2013). The diving reflex is enhanced by immersing the body in water (Andersson et al., 2000), delaying oxygen consumption during apnoea and reducing the amount of blood the heart pumps, directing blood flow primarily to the brain and heart while the rest of the body receives less blood (Schagatay et al., 2007; Drviš, 2012), increasing arterial blood pressure, and decreasing cardiac output.

METHODS

The sample of participants

The measurements were conducted on a sample of 12 participants (all male). The sample consisted of students from the Faculty of Kinesiology at the University of Zagreb, beginners in free diving aged 22-25 years who enrolled in the elective course Apnoea diving. All 12 students had completed and passed the exam in the courses Teaching Methodology of Swimming and Competitive Swimming, meaning they were familiar with water movement structure and proficient in all four swimming techniques. Participants were randomly divided into 2 groups. One group consisted of students who underwent the training program in water, while the other group consisted of students who underwent the program outside the water. All measurements were conducted following the ethical principles of the Faculty of Kinesiology at the University of Zagreb. Each participant involved in the study was provided with an explanation of the study, potential health risks, and the anticipated measurement procedure. Participants signed a consent form confirming their awareness of the purpose and objectives of the measurements, measurement protocol, and their voluntary participation. Apnoea diving training program, both in water and outside, lasted for 8 weeks. Two training sessions were conducted each week, totalling 14 sessions. The same number of sessions was conducted both on dry land and in water, within the same timeframe. Each training session lasted approximately 60 minutes. Group who underwent the training program in water, which conducted the program in water, had training sessions at the SRC "Mladost" swimming pool. Equipment required for each session included stereo fins and a mask. The group outside the water trained on the embankment of the Jarun Sports Center. Equipment required included athletic footwear, sneakers, and a stopwatch. Before commencing work, participants were thoroughly briefed on each task to ensure smooth workflow and proper execution of tasks.

Variables

The set of variables consists of tests specific to free diving: Dry Static (STA dry), Static (STA wat), Walking Apnoea (DYN dry), Dynamic no fins (DNF wat), Forced Vital Capacity (FVC)

To test differences at individual measurement points between the group of participants who trained apnoea in water versus the group of participants who trained apnoea outside the water, a 2 × 2 repeated measures ANOVA was used, with the training method as the between-subjects factor (2 levels: training in water, training outside the water) and measurement points as the within-subjects factor (initial and final measurements). Determination of differences in results between each interaction of factors was conducted using the Tukey post-hoc test. Statistical significance was set at $p < 0.05$.

RESULTS

The results obtained from testing the participants were processed using the STATISTICA (data analysis software system), version 14.0. To describe the variables, the following parameters were calculated: mean, standard deviation (SD), minimum value (MIN), maximum value (MAX)- To test differences at individual measurement points between the group of participants who trained apnea in water versus the group of participants who trained apnoea outside the water, a 2 × 2 repeated measures ANOVA was used, with the training method as the between-subjects factor (2 levels: training in water, training outside the water) and measurement points as the within-subjects factor (initial and final measurements). Determination of differences in results between each interaction of factors was conducted using the Tukey post-hoc test. Statistical significance was set at $p < 0.05$.

Table 1. Descriptive statistic

VAR	GROUP 1					GROUP 2				
	N	Mean	MIN	MAX	SD	N	Mean	MIN	MAX	SD
STA wat 1	6	134.83	95.00	159.00	22.27	7	125.29	56.00	227.00	53.60
DNF wat 1	6	39.50	15.00	54.00	15.71	7	47.43	28.00	61.00	10.06
STA dry 1	6	104.67	59.00	163.00	41.49	7	141.57	44.00	247.00	74.60
DYN dry 1	6	88.83	60.00	120.00	19.27	7	109.43	54.00	174.00	41.27
FVC 1	6	5.99	4.78	7.24	0.99	7	5.80	2.46	7.12	1.65
STA wat 2	6	169.83	128.00	213.00	30.41	7	191.29	129.00	325.00	69.28
DYN wat 2	6	45.33	25.00	57.00	11.34	7	58.86	39.00	81.00	16.58
STA dry 2	6	167.16	97.0	260.0	62.27	7	173.43	70.00	279.00	73.31
DYN dry 2	6	117.50	82.00	150.00	25.09	7	127.43	73.00	180.00	31.92
FVC 2	6	6.66	5.31	8.58	1.17	7	6.34	3.02	7.94	1.63

STA wat 1 – initial water statics, **STA wat 2** – final water statics, **DNF 1** – initial dynamic no fins, **DNF 2** – final dynamic no fins, **STA dry 1** – initial dry statics, **STA dry 2** – final water statics, **DYN wat 1** – initial walking apnea, **DYN wat 2** – final walking apnea, **FVC 1** – initial force vital capacity, **FVC 2** – final force vital capacity, **Mean.** – arithmetic mean, **MIN** – minimum result, **MAX** – maximal result, **SD** – standard deviation, **GROUP 1** – who trained in the water, **GROUP 2** – who trained on dry land

Table II. Tukey HSD test - Post Hoc Tests

STA wat MS = 2415,3, df = 12,088						
	GROUP	Measurement Points	{1}	{2}	{3}	{4}
1	1	1		0,01	0,99	0,22
2	1	2	0,00		0,39	0,86
3	2	1	0,98	0,39		0,00
4	2	2	0,22	0,86	0,00	
DNF MS = 187,88, df = 15,513						
	GROUP	Measurement Points	{1}	{2}	{3}	{4}
1	1	1		0,62	0,73	0,09
2	1	2	0,62		0,99	0,32
3	2	1	0,73	0,99		0,09
4	2	2	0,09	0,32	0,09	
STA dry MS = 4256,2, df = 12,244						
	GROUP	Measurement Points	{1}	{2}	{3}	{4}
1	1	1		0,00	0,74	0,28
2	1	2	0,00		0,89	0,99
3	2	1	0,74	0,89		0,072
4	2	2	0,28	0,99	0,072	
DYN dry MS = 969,90, df = 14,979						
	GROUP	Measurement Points	{1}	{2}	{3}	{4}
1	1	1		0,07	0,64	0,16
2	1	2	0,07		0,97	0,94
3	2	1	0,64	0,97		0,27
4	2	2	0,16	0,94	0,27	
FVC MS = 2,0048, df = 11,537						
	GROUP	Measurement Points	{1}	{2}	{3}	{4}
1	1	1		0,01	0,99	0,97
2	1	2	0,01		0,67	0,97
3	2	1	0,99	0,69		0,04
4	2	2	0,97	0,97	0,04	

STA wat - water statics, **DNF** – dynamic no fins, **STA dry** –dry statics, **DYN wat** – walking apnea, **FVC 1**– force vital capacity

Table II shows that in Group 1, there are statistically significant differences between the initial and final measurements in the variable **STA water** (STA w $p < 0.01$). In Group 2, there are statistically significant differences between the initial and final measurements in the variable **STA water** (STA wat $p < 0.001$). There are no statistically significant differences between Group 1 and Group 2 when considering measurement results. In variable Dynamic no fins (DNF) there is no statistically significant difference in measurement points within individual groups or between groups. In Group 1, there is a statistically significant difference between the initial and final measurements in the variable STA dry (STA dry $p < 0.001$). In Group 2, there are no statistically significant difference in measurement points in the variable STA dry and there are no statistically significant difference between Group 1 and Group 2 when considering measurement results (neither initial nor final).

In Group 1, there is a statistically significant difference between the initial and final measurements in the variable Force vital capacity (FVC $p < 0.01$). In Group 2, there is a statistically significant difference between the initial and final measurements in the variable FVC (FVC $p < 0.04$). There are no statistically significant differences between Group 1 and Group 2 when considering measurement results (neither initial nor final).

DISCUSSION

The diving response (DR) is potentially the most powerful autonomic reflex (Panneton et.al., 2010), which by immersing the face in the water and starting to hold the breath triggers increased activity of the Vagus nerves, which is connected to the parasympathetic nervous system (Godek & Freeman, 2022) and directly saves consumption Oxygen (Bain et al., 2018) and sympathetic nerve activity transiently reduces blood flow to non-essential organs (Brick, 1966; Heistad et al., 1968; Patrician et al., 2021).

In the STA dry variable, there is no statistically significant difference between the groups in the final testing, but there are statistically significant differences in the progress of the group that trained in water (GROUP 1; STA w $p < 0.01$). In the STA wat variable, there is no statistically significant difference between the groups in the final test, but there is a statistically significant difference in the progress of both groups (G1; STA w $p < 0.01$; G2; STA wat $p < 0.001$). However, the group that trained in the water showed greater progress and greater improvement in the static variables at the final test. The full effect of the diving response is activated only by holding the breath while immersing the face in the water, which triggers an afferent neuronal response via the trigeminal nerve (Godek & Freeman, 2022) and because of the above, holding the breath outside the water can be said to represent difficult conditions, whereby the activation of sympathetic and of the parasympathetic nervous system later includes via chemoreceptors and prolongs the initial stimulation of the afferent neural pathways. Based on this, holding your breath outside the water can be an additional training for scuba divers in order to numb the chemoreceptors to the increased concentration of CO₂ as much as possible and thus improve the result in the water because the main goal of DR is to save oxygen while maintaining homeostasis within the body which is suitable to sustain life. Such a result indicates that the diving reflex did appear in the group that carried out training in the water and it was this reflex that contributed to such great progress in the initial testing. The main mechanisms that occur during any apnea involving DR are slowed heart rate, decrease in cardiac output, constriction of peripheral blood vessels, and an increase in arterial blood pressure (Andersson et al., 2002). These mechanisms temporarily reduce the oxygen intake in peripheral tissues, and increase the amount of oxygen in vital organs, which increases the duration of apnea, especially in trained free-breath divers, in whom this effect is even more pronounced (Palada, 2007). According to the above, precisely because of DR, which was more pronounced in the group that trained in water, the progress was greater and statistically significant compared to the group on dry land. This claim is confirmed by the research done by Schagatay et.al., (2007) in which they proved that in face-plunge apnea, in contrast to apnea on dry land, there is a stronger effect of the diving response, which is directly related to greater oxygen conservation. In the variables DYN dry and DNF, there is no

statistically significant difference either by measurement points within an individual group or between groups. It should be emphasized that all the respondents passed the courses Swimming Teaching Methodology and Sports Swimming, so they are familiar with performing underwater breaststroke strokes, that is, they perform the technique satisfactorily and correctly in the dynamic variable in the pool without fins. The group that trained in the water showed a little more progress in improving the results in the final test. Statistically speaking, the difference in the progress of the group that trained in water is not statistically significant ($p = 0.66$). Unlike the static test in the pool, where DR is solely responsible for the progress achieved and the statistically significant difference between group 2 and group 1, in water dynamics, the body's anaerobic response to apnea and effort is also important. Since the subjects who trained in dry conditions were also exposed to anaerobic ways of functioning the organism, it is assumed that this fact contributed a lot to the improvement of the results in this variable. The greater improvement, which was nevertheless shown by the group that trained in water, is probably due to the increased influence of DR in that group during apnea, as well as the technical performance itself. The results of previous research (Andersson et al., 2002; Palada, 2007; Schagatay et al., 2007) have shown that by training apnea in water, we improve diving performance due to the appearance of DR. These studies show that even in untrained divers bradycardia occurs during apnea in cold water up to 40%. Trained divers can produce better results, up to an unimaginable 20 beats per minute, which would mean that DR will be more pronounced in trained divers than in people who are not experienced in diving (Valić, 2006).

This claim is considered to be the reason why the group that trained in the pool made more progress. In that group, however, DR appeared to a greater extent due to training in water, than in the group that trained on dry land. There is no statistically significant difference between the groups of subjects in the final test, but there is a statistically significant difference in the progress of one and the other group. We find the reason for the improvement in vital capacity in the assumption that all subjects during training increased the possibility of taking in a larger amount of air during inhalation. This is supported by the fact that at the beginning of every second training session, both groups practiced breathing techniques, during which they were encouraged to take in as much air as possible during inhalation and expel as much air as possible during exhalation (maximum inhalations and exhalations). This is exactly the procedure used for the vital capacity test.

CONCLUSION

From the data, we can conclude that both the group that trained on dry land and the group that trained in the pool showed a significant improvement in results compared to the initial testing in all variables. With this knowledge, it can be determined that the diving reflex appears already after a short apnea training even in beginners, and in this way greatly contributes to prolonging the time spent underwater. For a long time, it was considered that the training of scuba divers was exclusively related to the pool or the sea, but in recent times, more and more competitors of this young sport have spent their time training on dry land. This research has shown that they have a sufficient number of reasons to continue with the same. Also, dry-land apnea training should contain elements of dry-land dynamics (whether running, walking, or combined) and dry-land statics. According to the obtained data, it can be concluded that subjects who trained only on dry land showed very good progress in specific tests for diving, such as statics and dynamics in the pool without apnea training in water. We conclude that dynamic and static training on dry land should not be neglected in the preparation of top scuba divers, and such apnea training should be included in every part of the specific preparation of scuba divers.

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ASSESSMENT OF THE QUALITY OF FOREARM PASSING REGARDING HAND GRIP

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ABSTRACT

The aim of this research was to compare the quality of the forearm passing of two groups of students who differently form a grip in the preparatory phase of the performance of the element. The research was conducted on full-time students, freshmen's, enrolled on university integrated studies at the Faculty of Kinesiology, University of Zagreb. All subjects were male ($n=92$; age= 19.5 ± 0.8 years; body height= 181.39 ± 6.6 cm; body weight= 77.43 ± 7.9 kg). They were not former or active volleyball players and had no experience in volleyball before starting the class. Students attended volleyball course during the winter semester in the 2018/2019 academic year. For sample description, the body height, body mass and age of the subjects were registered. Regarding the way of forming the grip for forearm passing, the subjects were stratified into two groups (GripR – left hand in right or GripL – right hand in left). The quality of the performance of the forearm passing (Quality) was assessed on a modified 5-point Likert scale. The Mann-Whitney U test did not reveal a statistically significant difference in the quality of the performance of the forearm passing between the two tested groups, so it can be concluded that the way the students form their grip does not affect the quality of the forearm passing.

Key words: forearm passing, hand grip, Mann-Whitney U test, volleyball

INTRODUCTION

Forearm passing is one of the fundamental techniques in volleyball. It is applied in both complexes of volleyball gameplay, during serve reception and setting for a spike in Complex I, as well as in court defense and setting for a counterattack in Complex II. It is used in game transition phases for covering own attacks and counterattacks, as well as for passing easy balls to setters. Better efficiency in serve reception significantly contributes to victory in volleyball matches (Peña et al., 2013; Silva, Lacerda & João 2014), while higher efficiency in serve reception enhances effectiveness in attacking actions (Laios and Kountouris, 2005; Costa et al., 2011). It is unknown who and when first applied forearm passing with joined forearms. Throughout volleyball history, it is known that the "bump" (the initial term for forearm passing) first appeared in Czechoslovakia, and the national team of that country successfully implemented the new technique during the defensive phase of the game at the 1958 European Championship (Janković and Marelić, 2003). The way the "platform" is formed can significantly affect the accuracy of passing. Joining hands and forming the "forearm passing platform" (the lower part of the forearms) is executed in the preparatory phase of the technique, after stretching out the arms with parallel forearms placed next to each other. The traditional way of forming the grip (Nichols, 1986), used by over 90% of players (<https://sportsedtv.com/blog/what-is-the-correct-way-to-hold-hands-during-passing-for-volleyball>), involves placing one palm over the other. Thumbs are positioned parallel and symmetrically next to each other, with wrist joints also parallel and symmetric, and hands extending downward (to-

wards the ground) at the wrist joint to create a better and flatter "platform" for passing, which is flat from the shoulder to the wrist (Shondel, 1990). This method of forming the "platform" for forearm passing is advocated by most coaches, including top coaches such as Velasco, Tilly, and Kiraly (<https://sportsedtv.com/blog/what-is-the-correct-way-to-hold-hands-during-passing-for-volleyball>). Some older authors (Selinger, 1986; <https://www.fipavliguriaponente.it/pagine/allenatori/Materiale%20didattico/Bagher%20-%20Oricezione%20-%20libero/bagherattacco%20.pdf>) instruct that the grip should be executed in a way that the "stronger" hand grasps the weaker, suggesting that right-handers should have GripR and left-handers GripL. Two versions of the traditional grip are shown in Figure 1. GripR (left hand over right) in Figure 1 and GripL (right hand over left) in Figure 2.

Figure 1. GripR - left hand over right



Figure 2. GripL - right hand over left



It is interesting to note that when teaching forearm passing, coaches describe and demonstrate the correct (traditional) way of forming the "platform" but do not insist on practicing GripR or GripL. This practice is grounded in a series of studies confirming that the way an individual crosses legs, arms, or fingers is influenced by genetics and environmental factors, primarily influenced by family (Reis, 1994, 1998, 1999).

METHODS

The sample in this study consisted of 92 students (age= $19,5 \pm 0,8$ years; body height = $181,39 \pm 6,6$ cm; body weight = $77,43 \pm 7,9$ kg) from the Faculty of Kinesiology in Zagreb who attended the Volleyball course for 75 hours during the academic year 2018/2019. Only students who had no prior volleyball experience were selected for the study. Measurements of height, weight, and age of the participants were taken. Students spontaneously chose one of two hand grips for forearm passing technique (GripR or GripL). The hand grip model was registered, and participants were stratified into two groups: GripR (left hand over right) or GripL (right hand over left). Each participant was evaluated after forearm passing to the right side (GR) and forearm passing to the left side (GL).

Test Description: The participant stood 7.5 meters away from the net (see Figure 3.) in the middle of the court in the basic volleyball stance. An assistant positioned in the middle of the net, one meter away from the net, tossed the ball upward with both hands from below, approximately 1-1.5 meters from the participant. The participant performed a sidestep movement to the left and then used forearm passing technique to return the ball back to the assistant, who attempted to catch it and remain on the chair. If the assistant failed to catch the ball or had to leave the chair due to imprecise passing, the participant was given a score of 1. Three attempts were made, and the final score was the average of the three attempts. The test was then performed to the right side. The arithmetic means of these two scores represented the overall score of the participant (QO). An evaluator with extensive teaching and coaching experience assessed the quality of the passing. Ratings were distributed on a 5-point Likert scale, with 1 being the worst performance and 5 being the best. Evaluation considered the technique execution (from the initial to the final phase) as well as the accuracy and trajectory of the passed ball.

Figure 3. Student performs the test



The aim of the study was to investigate whether there is a statistically significant difference in the quality of forearm passing based on the type of hand grip formation for the "platform" (GripR or GripL). The hypothesis was that there would be no statistical difference among groups of participants who formed the "traditional" volleyball grip differently. For data analysis, the Statistica software package was used. Descriptive statistics were calculated, and a comparison between the two groups was performed using the Mann-Whitney U test.

RESULTS

Out of the total number of participants, 49 (53.8%) placed their right hand above the left, while 43 (46.2%) placed their left hand above the right, indicating that slightly more participants had the so-called GripL. The average score of all participants was better after moving to the left side – QL (2.48+0.86) compared to the right side – QR (2.36+0.95). The overall average score of all participants was 2.42+0.77. Table 1. presents the descriptive statistics of scores obtained for forearm passing performance after moving to the right side, after moving to the left side, and the overall score for both groups of participants. The group of participants forming GripR performed forearm passing slightly better after moving to the right side – QR (GripR 2.39+1.09; GripL 2.34+0.8), while the group of participants forming GripL performed better after moving to the left side – QL (GripL 2.49+0.87; GripR 2.48+0.87). A possible reason is the stronger contraction of the lower arm (which "grabs" the upper arm), thus leading to better control when the ball comes to that side. The group of participants forming GripR performed forearm passing slightly better overall – QO (GripD 2.44+0.84; GripL 2.41+0.7).

Variable		QR	QL	QO
GripR (n=43)	AM	2,39	2,48	2,44
	Md	1,89	2,44	2,39
	SD	1,09	0,87	0,84
GripL (n=49)	AM	2,34	2,49	2,41
	Md	2,33	2,44	2,22
	SD	0,8	0,87	0,7

Legend:AM (arithmetic mean), Md (median), SD (Standard deviation), n=number of respondents

Table 1. Descriptive indicators of forearm passing quality assessment on the left side, right side, and overall

The Mann-Whitney U Test did not detect a statistically significant difference in the variable QR ($p=0.79$) between the group of students with GripR ($Md=1.89$, $n=49$) and GripL ($Md=2.33$, $n=43$), $U=1019.50$, $z=-0.27$. Similarly, in the variable QL ($p=0.92$), there was no statistically significant difference between the group of students with GripR ($Md=2.44$, $n=49$) and GripR ($Md=2.44$, $n=43$), $U=1040.50$, $z=-0.10$. Furthermore, in the variable QO ($p=0.99$), there was no statistically significant difference between the group of students with GripR ($Md=2.39$, $n=49$) and GripL ($Md=2.22$, $n=43$), $U=1052.00$, $z=-0.01$.

DISCUSSION

In this article, the authors aimed to examine whether there is a statistically significant difference in the quality (QO) of forearm passing based on the type of hand grip formation in the traditional method of forming the "platform" (GripR – left hand over right or GripL – right hand over left). The null hypothesis was formulated with the assumption that there would be no statistically significant difference among groups of participants in the quality of forearm passing. The quality of performance was assessed on a five-point scale, with both correct technique and precision of ball passing being important factors. Students with no prior volleyball experience were selected for the study and divided into two groups based on the hand grip formation. The number of participants forming GripL was slightly higher (49:43). Upon reviewing the literature, the authors did not find any studies addressing the metrics of this issue. Therefore, no study examining the hand grip formation and its impact on the precision of forearm passing technique was found. Although numerical differences in the performance quality of the two groups were noted, they were not statistically significant, so the hypothesis can be accepted.

CONCLUSION

The Mann-Whitney U test did not detect statistically significant differences in the quality of forearm passing between the two groups. It can be concluded that the hand grip model preceding forearm passing does not affect the quality (correct technique and precision) of passing. Considering the obtained results and experiences related to motor patterns in some simple movements, such as clasping hands by intertwining fingers, crossing arms over each other, or crossing legs while sitting (genetic and environmental influences), it is believed that when teaching forearm passing, students should not be instructed on how to form the hand grip, as they will naturally do it in the most suitable way for them. In future research, it would be interesting to compare the effectiveness of serve reception between volleyball players using two grip versions, especially on the left and right sides.

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THE ROLE OF DANCE IN PE: ANALYSIS OF APPLICATION AND INTEREST AMONG STUDENTS OF THE UNIVERSITY OF ZAGREB FACULTY OF KINESIOLOGY

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ABSTRACT

Physical and health education is practiced throughout the educational system in Croatia and is an integral part of the physical and health education area. Dance is one of the sports through which it is possible to achieve the requirements of all areas of learning outcomes in physical education classes. Due to insufficient application of dance in high schools, the majority of students at the Faculty of Kinesiology of the University of Zagreb enroll with insufficient prior knowledge of dance. With the aim of determining the prevalence of dance application in physical and health education classes in high schools, as well as the prevalence of implementation of sports or recreational dance activities and interest in dance content, a survey was conducted in the form of an anonymous questionnaire among students at the University of Zagreb Faculty of Kinesiology who had attended and passed the Dance course. A total of 106 responses were collected to questions grouped into four categories. The categories accumulated general data about the participants, the application of dance in high school and during college education, and attitudes towards dancing and after passing the Dance course. This paper will contribute to understanding the possibilities and ways of applying learned dance content in the work of future kinesiology masters, as well as to improving the university Dance course by introducing content that current and future teachers can easily apply to achieve learning outcomes in physical and health education classes.

Keywords: students, dance, learning outcomes

INTRODUCTION

Physical and health education is practiced throughout the entire educational system of the Republic of Croatia and is an integral part of the physical and health education area, along with extracurricular and outside-of-school (kinesiological/sports) activities. Physical and health education classes should be based on scientifically established knowledge from the field of kinesiology, through subject areas: kinesiological theoretical and motor knowledge, morphological characteristics, functional and motor abilities, motor achievements, and health and educational effects of physical exercise. In a wide range of values, physical and health education contributes to familiarizing students with the Olympic movement, developing national identity, preserving traditional culture, and fostering social cohesion, trust, and nurturing quality interpersonal relationships. It also holds an important place in the National Sports Program in terms of timely identification and guidance of students into activities that match their levels

of talent, interests, and abilities. The content of this subject, by promoting appropriate behavior and accepting universal values, are significant educational elements that promote non-violent conflict resolution, enhance the capacity to regulate and manage inappropriate behaviors, and foster emotional self-regulation. Physical and health education acts as a stress reliever for students and represents a planned and effective way of active rest (Curriculum of physical and health education subjects for primary schools and high schools in the Republic of Croatia, 2019). To achieve the above within the physical and health education subject, dance is used as one of the teaching contents, meeting the majority of the stated goals with its characteristics.

In terms of structural complexity, dance belongs to aesthetic sports, i.e., activities that combine aesthetics with performance and technique. By using dance in physical and health education classes, we act both educatively (learning new motor contents) and educationally (aesthetic shaping of movement) (Ladešić and Mrgan, 2007). The educational effects in dance can be observed through several aspects: national (learning about one's own and other cultures), social (development of a sense of belonging to the group and equality within the group), aesthetic (development of a sense of harmonious movement), and health education (impact on improving and preserving health) (Srhoj and Miletić, 2000). The health benefits of dance are evident when dance becomes a regular physical activity as it contributes to strengthening individuals' health, improving physical fitness, and reducing the risk of illness. Besides the positive effects on physical health, it has a significant impact on mental health. Children engaged in dance are more fulfilled, happier, full of energy, and less sensitive to negative emotions and conditions such as stress, anxiety, depression, etc. (Ratkajec, 2022). Furthermore, dance has positive effects on transforming the anthropological status. Through the application of dance, improvement in body composition, blood biochemistry, and musculoskeletal system function can be achieved, resulting in a greater reduction in body mass index and overall fat mass (Fong Yan, Cobley, Chan, et al., 2018). Numerous studies speak to the impact of engaging in dance on the development of speed, strength, explosiveness, flexibility, coordination, balance, endurance, and agility (Kostić, Uzunović, Zagorc, Oreb, & Jocić, 2006; Vlašić, 2010). Dance, as an intensive physical activity that engages both aerobic and anaerobic energy systems (Allen & Wyon, 2008), belongs to the group of aerobic-anaerobic activities (Bria, Bianco, Galvani, Palmieri, Zeppilli, & Faina, 2011) and thus, physiologically, it belongs to moderate-intensity activities with high energy consumption (Zancini and Malaguti, 2014). Žagar Kavran, Trajkovski & Tomac, (2015) proved that dance develops kinesthetic sensitivity, fine motor skills, encourages a creative approach, enables expression of feelings, develops a sense of aesthetics, observation, concentration, and memory. Additionally, it has a positive impact on developing self-discipline and increasing focus, encourages mutual respect and collaboration (Bartolović, 2019). Dance is an activity predominantly carried out with musical accompaniment, which contributes to a pleasant atmosphere in class. What makes dance a great advantage is the fact that each student can express themselves in their own way, be creative, and stand out.

Considering all the aforementioned benefits of engaging in dance, it is clear why dance is an integral part of the physical and health education curriculum. For this purpose, a study was undertaken to assess the presence of dance within physical and health education curricula in high schools across the Republic of Croatia, and how learned dance structures are applied in further work as physical education teachers, thus improving teaching.

METHODS

The participants of the study were students of the Faculty of Kinesiology who have attended and passed the course Dance. Through an anonymous online questionnaire, where questions were grouped into four categories: *General information*, *Dance experience in high school*, *Dance experience in college education*, *Attitudes and application of dance after passing the course Dance*, 106 responses were complied. Each participant answered 22 questions, through which quantitative and qualitative data were collected.

The data were retrieved and processed using Microsoft Excel software. 52% of the participants were male (N=55) and 48% were female (N=51), with more than half of the students attending high school education in the City of Zagreb (54%). Previous high school education indicated that 64% of the participants graduated from various gymnasium programs, 26% attended vocational schools, 9% completed their education at an economics high school, and 3% attended art high schools. Using Statistica 14.0 software, the normality of the distribution of attitudes towards dance by gender was assessed using the Shapiro-Wilk test. Subsequently, a Mann-Whitney U test was performed to examine differences between groups.

RESULTS

Responses to questions from the *Dance through High School* group gathered information about dance and its representation in the high schools attended by the respondents, as well as their previous dance experiences. 27% of participants encountered dance before high school, either in kindergarten, at home, during physical education classes in elementary school, or through various extracurricular dance activities. 21% of participants indicated that one of their family members is involved in music or dance, and 8% of participants simultaneously attended a music or art dance school during regular education.

Further questions investigated the representation of dance content in physical education classes in high schools. The results showed that 19% of participants did not dance in high school during PE classes. Among those who encountered dance in PE classes (81%), 68% of students danced only social dances, 3% only folk dances and both techniques danced only 10% of participants.

Graph 1. Percentage of students exposed to Dance in Physical Education classes in Croatian high schools and percentage of included dance techniques



Graph 1. Legend: HS=high school

Among social dances, English and Viennese waltz, Tango, Cha-cha-cha, Rumba, and Disco fox were most frequently covered, while less common were Tango, Slow foxtrot, Samba, Polka, and Quadrille. The most selected folk dances were Slavonsko kolo and Balun. When considering the inclusion of dance in school activities and events, 73% claimed that their high schools organized activities or events involving dance, while others did not. 98% of participants agreed that dance should be a mandatory part of physical education classes.

Table 1. Differences in attitudes towards dancing by gender

GENDER	N	Attitude	Mann-Whitney U test	
		Mean±SD	Z	p
Male	55	3.58±1.05	-3.30	0.00*
Female	51	4.27±0.87		

Table 1. Legend: N=number of correspondents; Mean±SD=mean value ± standard deviation of attitudes; Z=z-value of Mann-Whitney U test, p=probability value with level of significance $p<0.01$

The normality of the distribution of attitudes towards dance by gender was tested using the Shapiro-Wilk test, which revealed deviations from normality (male students: $p=0.00$; female students: $p=0.00$). Consequently, a Mann-Whitney U test was conducted to compare attitudes by gender in male and female students. The results indicated a significant difference in attitudes towards dancing between male and female students; $z = -3.30$, $p = 0.00$.

Since the sample of participants included students from the Faculty of Kinesiology who attended and passed the university course Dance, their attitudes toward the course were also examined. While only 2% of students expressed dissatisfaction with the course, 98% were highly satisfied. Furthermore, 88% of participants was satisfied with their final grade from the course. 23.5% of participants recommended adding other dance techniques to the course program, while 2% believed that the number of folk dances in the current curriculum should be reduced. The overall interest in dance among the surveyed population was 35%, with only one participant expressing disinterest. 91.5% of participants do apply the knowledge gained during the Dance course in activities outside the university, such as outings or weddings. On the other hand, 60% of participants would not accept jobs related to any form of dance, with only 5% currently working in a dance-related profession, or in rhythmic and sports gymnastics.

DISCUSSION

The questionnaire investigated attitudes and satisfaction towards dance content in physical education classes, as well as the frequency of their use, the presence of dance in teaching, how future physical education teachers perceive the role of dance, and whether they plan to use it in their future work. The results obtained in the group of questions related to dance during high school education show that 60% of students had not encountered or had very little exposure to dance, or specific dance techniques, before enrolling in the university Dance course. This indicates that dance activities may not have been conducted or adequately promoted in some high schools. This supports the view of dance as predominantly a female activity, which is one of the reasons for the insufficient implementation of dance content in physical education, and for the development of dance as a sport, it is necessary to educate young people free from gender limitations (Vlašić, 2010). Promoting dance is easiest through physical education classes, where teachers, as role models for students, can influence the formation of positive attitudes towards dance. Although attitudes towards an activity do not necessarily have to change due to engaging in that activity, attitudes are possibly changeable, as demonstrated by Neal (1986) in a study of elementary school students who had never danced but changed their attitudes about dance after three dance sessions. Therefore, a change in attitude arises from familiarity with the activity and experiential involvement. The conducted research confirmed an increase in interest in dance due to engagement in dance, as 91.5% of participants apply their acquired dance knowledge in everyday life activities. This indicates a high purposefulness and applicability of the course content even after completing the university Dance course, and that participants recognize the benefits of implementing dance and find

the content interesting and useful. On the other hand, a large portion of respondents would not engage in jobs related to dance. However, the fact that only 5% of respondents work in areas related to dance is alarming information for improving university Dance course. Modernizing the course syllabus should pay more attention to dance forms in terms of applicability in different parts of the class and in various sports activities, as supplementary content to improve anthropological status.

CONCLUSION

By incorporating dance into everyday activities, a positive impact on the overall anthropological status can be achieved. Furthermore, by analyzing the prevalence of dance in high schools within the Physical Education curriculum, the quality of the Dance course implementation at the University of Zagreb's Faculty of Kinesiology, and the application of dance in practice after completing their education, it was observed that, despite satisfaction with the conduct of the Dance course, students believe there is room for improvement by introducing additional dance techniques into the course curriculum to ensure diversity and comprehensive applicability. These results can be used in program reforms by providing a realistic assessment from participants' perspectives. Based on specific data and needs, it is possible to enhance and modernize the university Dance course syllabus, making it more accessible and applicable in future teaching purposes.

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SPORTS AND SPORTS ACTIVITIES IN WHICH THE STUDENTS OF THE UNIVERSITY OF RIJEKA WOULD LIKE TO PARTICIPATE

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ABSTRACT

Sports and health-oriented physical exercise of students increases the quality and satisfaction with the life of students during their studies. Students, as key stakeholders in the University, should provide feedback on the services provided, which should serve as an important source of guidance for improvement. According to the available research students like to be heard; they are happy to share ideas and informations if they believe that they are valued and that their wishes are respected. In order to create attractive extracurricular activities, sports and organized exercise and improved awareness of what is on offer, it is important to gather feedback from students about what sports activities interest them. From 2021/2022 to 2023/2024, the Sports Office of the University of Rijeka surveyed 8749 students using structured questionnaires. The aim of this study was to compare the results of the questionnaires on what sports and physical activities the students would like to take part in. The differences between the three years studied were determined, which showed a significant difference between the number of participants who want to participate in sports; swimming ($p=0.031$), water polo ($p=0.044$), tennis ($p<0.001$), cross country running ($p=0.044$), climbing ($p=0.00008$), recreational exercise ($p=0.0003$), darts ($p<0.001$) and dance ($p<0.001$). The difference between male and female students who wanted to participate in recreational exercise ($p=0.05$) and darts ($p<0.001$) was also shown. The results are interesting because they can help the Sports Office to create programmes and free sports activities at the University.

Keywords: exercise, sport, students

INTRODUCTION

The University Center for Sports together with the Sports Office University of Rijeka is an organizational unit of the University of Rijeka for carrying out professional activities in the field of improving student standards, primarily in the field of sports, recreation and health preservation. Some activities they carry out that are related to students are improvement of student standards in the field of sports, recreation and health of students development of a physical education and sports as an inseparable part of physiological, mental and social health, administrative and professional support for sports and recreational programs and activities (<https://sport.uniri.hr/o-nama/centar-za-sport/>). Continuous improvement principles dictate that, all Higher Education Institutions focus on the requirement to improve organizational processes and achieve quality, create added value and achieve stakeholders' satisfaction (Degtjarjova et al., 2018). According to the available research, students like to be heard; they are happy to share ideas and informations if they believe that they are valued and that their wishes are respected (Bayat F.,

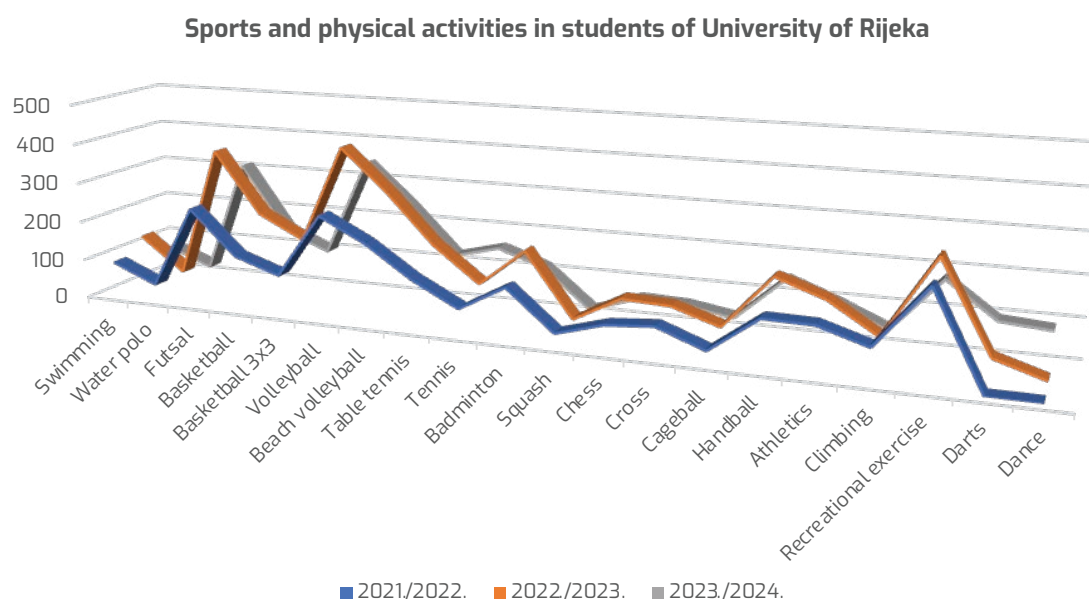
2015). These ideas guide the Sports Office University of Rijeka, which at the beginning of each academic year uses structured questionnaires to collect data important for organizing training and competitions in popular sports, sports activities, events and recreational exercise. The purpose of the surveys was to find out which sports are the most popular and most requested to be introduced in the range of sports offered at the University of Rijeka. We hypothesized that they will be no significant differences between three academic years in sports which are traditionally popular in the University of Rijeka such as team sports (volleyball, futsal, handball, basketball) and also between male and female students.

METHODS

The participants in the study were university students ($n = 8749$) surveyed by the Sports Office of the University of Rijeka over three academic years: 2020/2021 ($n = 2856$), 2021/2022 ($n = 2697$), and 2022/2023 ($n = 2563$). The observed variables included academic year, gender (male, female), sports and physical activities the students would like to take part in. Statistica 14.0.0.15 (Tibco Software Inc.) was utilized for all calculations. To assess differences among student responses across three academic years, a Chi-square test was conducted, with a significance level set at 95%.

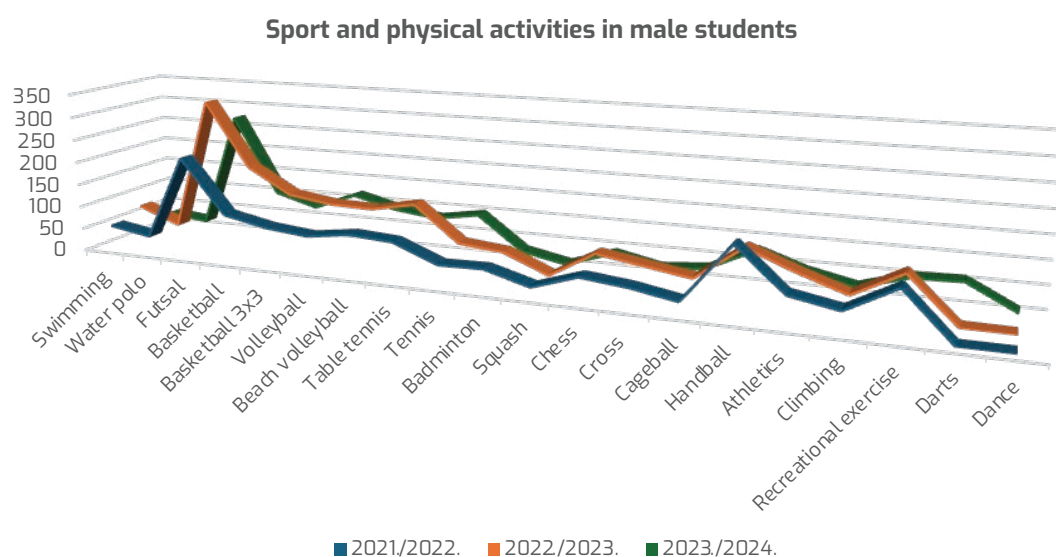
RESULTS

Of the total number of students who answered the *questionnaire in three academic years*, 3427 (39.9%) were male and 5322 (60.1%) were female.



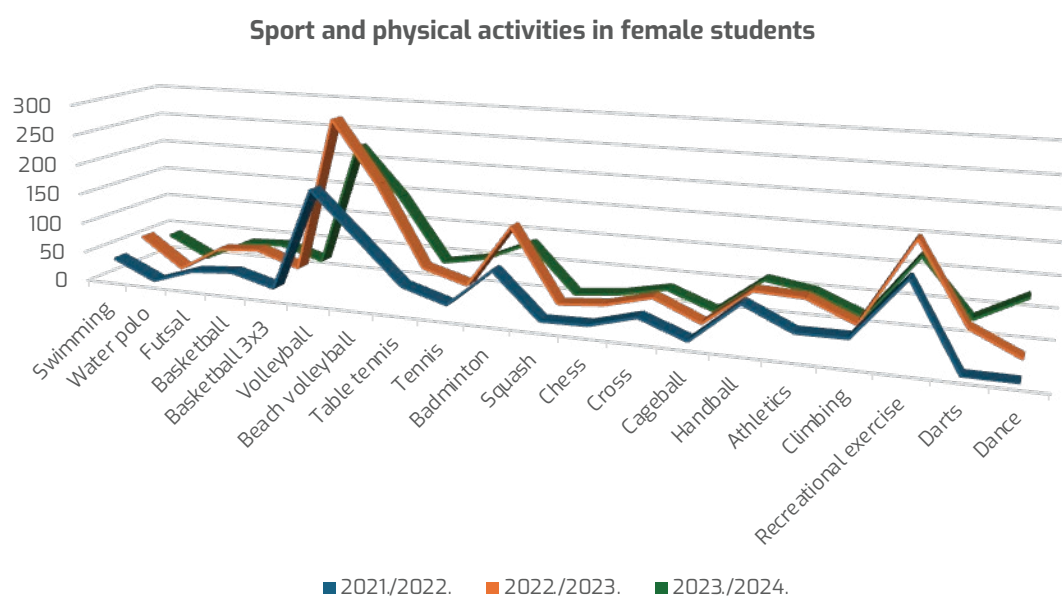
Picture 1: *Popularity of sports and physical activities at the University of Rijeka*

In Picture 1. The number of responses reveals the popularity among different sports in the three academic years among university students in Rijeka.



Picture 2: Popularity of sports in male students at the University of Rijeka

In Picture 2. The number of responses reveals the popularity among different sports in the three academic years in male students.



Picture 3: Popularity of sports in female students at the University of Rijeka

In Picture 3. The number of responses reveals the popularity among different sports in the three academic years in female students.

Table 1: *Sports and physical activities the students would like to take part in*

Sport	AY 2021./2022.	AY 2022./2023.	AY 2023./2024.	Chi square	p
Swimming	89	129	71	6.93	0.031
Water polo	42	44	26	6.26	0.044
Tennis	66	94	154	44.25	<<0.001
Cross	76	89	56	6.26	0.04
Climbing	82	68	47	18.72	0.00008
Recreational exercise	232	266	181	16.23	0.0003
Darts	0	47	95	153.01	<<0.001
Dance	0	9	86	83.43	<<0.001

In Table 1. Chi square reveal significant differences between three academic years in swimming, water polo, tennis, cross, climbing, recreational exercise, darts and dance.

Table 2: *Recreational exercise*

Recreational exercise	AY 2021./2022.	AY 2022./2023.	AY 2023./2024.	Chi square	p
men	99	96	57	5.98	0,050
women	133	170	126		

In Table 2. Chi square reveal significant differences between three academic years in recreational exercise between men and women.

Table 3: *Darts*

Darts	AY 2021./2022.	AY 2022./2023.	AY 2023./2024.	Chi square	p
men	0	1	60	47.8	<<0.001
women	0	46	35		

In Table 3. Chi square reveal significant differences between three academic years in darts between men and women.

DISCUSSION

The Sports Office of the University of Rijeka, as part of the enrolment process for the academic years 2021/2022, 2022/2023, 2023/2024, offered students a questionnaire about physical activities and sport. The number of responses reveals the popularity among different sports in the three academic years among university students in Rijeka. In all three observed years, volleyball is the most popular sport, while futsal is in the second place. In the third place in terms of popularity in 2021/2022 is rec-

reational exercise, while in the remaining two years it is beach volleyball. We can see that team sports dominate. In the USA and the United Kingdom, the great popularity one of the team sport, football has been proven (Isaacson, Theofilou, 2024). In the study of Johnston et al. the results showed that team sports may help reduce depression and poor sleep quality in college students. Our study hypothesis that they will be no significant differences between three academic years in sports which are traditionally popular in the University of Rijeka such as team sports was confirmed. Among male students, the most popular sport in all three observed years is futsal. Very popular team sports are basketball, volleyball and handball. The three most popular sports among women in the observed years are volleyball, beach volleyball and recreational exercise. Chi square reveal significant differences between three academic years in swimming, water polo, tennis, cross, climbing, recreational exercise, darts and dance. The results show that the interest in team sports did not vary during the observed years, except for water polo. Significant differences in students' interest in certain sports appeared in unpopular sports and recreational exercise in which interest decreased in the last observed year. Chi square also reveal significant differences between three academic years in recreational exercise between men and women. Women are more interested in recreational exercise than men. A study by Kilpatrick et al. showed that participants were more likely to report intrinsic motives, such as enjoyment and challenge, for engaging in sport, whereas motivations for exercise were more extrinsic and focused on appearance and weight and stress management. The motive of weight management is more strongly linked to exercise than sport participation and difference was particularly true for women. Men are more motivated by activity that includes some performance factor. Chi square reveal significant differences between three academic years in darts between men and women mostly because in 2022/2023 academic year only one male student was interested in darts. Our study hypothesis that they will be no significant differences between three academic years in sports which are traditionally popular in the University of Rijeka such as team sports between male and female students was confirmed.

CONCLUSION

The differences between the three years studied were determined, which showed a significant difference between the number of participants who want to participate in swimming, water polo, tennis, cross country running, climbing, recreational exercise, darts and dance. The difference between male and female students who wanted to participate in recreational exercise and darts was also shown. The results showing that are team sports popular in male and female students, as well as recreational exercise in female students. In order to create attractive extracurricular activities, sports and organized exercise and improved awareness of what is on offer, it is important to gather feedback from students about what sports activities interest them. The results are interesting because they can help the Sports Office to create programmes and free sports activities at the university.

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DIFFERENCES BETWEEN STUDENTS IN KINESIOLOGICAL ACTIVITIES DEPENDING ON THE FIELD OF SCIENCE AT THE UNIVERSITY OF RIJEKA

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ABSTRACT

The aim of the study is to determine whether there are differences in kinesiological activities (KA) of students at the University of Rijeka, depending on: the field of science, gender and level (year) of the study programme. **Methods:** The study involved 1159 undergraduate and postgraduate students (403 males and 756 female) of the University of Rijeka from various scientific fields of science. The number of students who participated in the study was determined in proportion to the total number of students enrolled in individual scientific fields. Descriptive parameters, expressed as relative response frequencies, were calculated for all analysed variables. To test for differences in engagement in KA by science fields, a one-way ANOVA was calculated and differences between groups (post-hoc) were tested with 95% confidence intervals. **Results:** The results of this study confirm the current scientific findings about the student population: an unsatisfactory level of engagement in KA and a significant difference in KA engagement by gender and by scientific field, with students of technical and biotechnical sciences spending more time in KA than students of other subjects.

Key words: engagement, differences, field of science, students' preferences

INTRODUCTION

In 2023/2024 academic year, we can celebrate the 60-year tradition of physical education at the University of Zagreb. One of the reasons that Physical Education is still included as a compulsory subject in the study programme for first and second year students is a higher percentage of students who do not regularly participate in exercise programmes in their free time (Caput-Jogunica et al 2008; Ćurković, 2010; De Privitellio, 2022). According to the studies of the last two decades, there is a trend towards a decrease in physical activity in the older years of study, students in the first two years of study are more committed to KA than students in higher years of study (Leslie et al., 2001; Huang et al., 2003); students are significantly more active during the week than at weekends (Behrens and Dinger, 2003). Freshmen and undergraduate students participate in more different kinesiology activities during the week than graduate students (Reed and Phillips, 2005). According to Keating et al. (2005), students who regularly participate in kinesiology activities during their studies remain active as adults. Sparling and Snow (2002) found that 84.7% of students who participated in regular exercise during their studies maintained their exercise habits over the next 5-10 years, while 81.3% of students who were inactive during their studies maintained a sedentary lifestyle. Buckworth and Nigg (2004) found that the physical activity of students was lower in the winter semester than in the summer semester.

When analysing the results of the study to determine the level of physical activity of Croatian students in the last two decades, a downward trend was found, as in the previously mentioned study. The trend of a decline in the level of physical activity after enrolment in a study programme was confirmed in the study by Fučkar-Reichel et al. (2008): 41.53% of inactive male and 15.52% of inactive female students before enrolment in a study programme at 66.45%. Caput-Jogunica et al. (2008) found that a sedentary lifestyle is becoming increasingly widespread, particularly among female students: 11.0% of students actively engage in sport (f 5.42%; m 15.72%), and 22.0% in leisure time (f 14.76%; m 23.57%). Ćurković et al. (2014), based on a sample of 1.646 students at the University of Zagreb (745 men and 901 women), identify the differences between the genders: male are more physically active than female students and there are differences in terms of scientific fields, where students of technical field of science are more involved in physical activity than students of other scientific fields. Romero-Blanco et al. (2020) state the strategic goal of the World Health Organisation (WHO) to reduce the prevalence of inactivity in the world by up to 15% by 2030. Analysing the research findings on the impact of the Covid-19 pandemic on students' physical and mental activity and health should prompt the academic community to invest more in physical education and health classes, extracurricular kinesiology activities and student sports, as well as professional support for students who need it to overcome various anxiety and depressive disorders. The aim of the study is to determine whether there are differences in the level of physical activity of students at the University of Rijeka depending on the field of study. The second aim is to analyse whether undergraduate students are more involved in kinesiological activities than graduate students.

METHODS AND RESULTS

The study involved 1159 undergraduate and postgraduate students (403 males and 756 female) of the University of Rijeka from various scientific fields of science. The majority of students are between 18 and 21 years old (70.5%). In addition to the socio-demographic characteristics of the students (gender, age, level and year of study, institution and name of the study), students completed a questionnaire on the level of engagement in kinesiology activities (KA) "KINAKT" (Ćurković, 2010). The study, approved by the Committee for Scientific Work and Ethics of the Faculty of Kinesiology at the University of Zagreb, was conducted on students at the University of Rijeka in the 2017/2018 academic year. The number of students who participated in the study was determined in proportion to the total number of students enrolled in individual scientific fields. Descriptive parameters, expressed as relative response frequencies, were calculated for all analysed variables. To test for differences in engagement in KA by science fields, a one-way ANOVA was calculated and differences between groups (post-hoc) were tested with 95% confidence intervals.

Table 1. Descriptive parameters of the questionnaire on engagement in (KA)

Factor	N	MEAN	SD	N	α	Average r
Engagement in KA	1170	3.85	0.68	25	0.94	0.38

The questionnaire on engagement in KA shows extremely high reliability, while its mean score is in the theoretical centre of the scale (3), indicating the symmetry of the distribution of the construct presented. As a measure of engagement in KA, respondents also estimated the number of hours they spend in KA (Table 2). The range of values obtained is relatively wide, with a minimum of 0 and a maximum of 25 hours per week. The distribution of the results is clearly positively asymmetrical with an arithmetic mean of 3.38.

Table 2. Results of number of hours per week in KA

MEAN	SD	Minimum	Maximum	N
3.38	3.98	0	25	1170

The results of KA engagement by scientific field are shown in Table 3. The statistical significance of the differences was determined ($F_{7,1084}=7.91$; $p<.001$) (Table 3).

Table 3. Results of KA engagement by scientific field

Field of science	Means	SD	95% interval reliability		Hours in KA/per week	
			lower	higher	median	Interquartile dispersion
Natural sciences	3.64	0.68	3.37	3.90	0.00	4.25
Technical sciences	3.92	0.65	3.84	4.00	3.00	6.00
Biomedicine and healthcare	3.97	0.64	3.89	4.04	2.00	3.50
Biotechnical sciences	3.88	0.72	3.70	4.07	3.00	4.00
Social sciences	3.81	0.64	3.74	3.88	2.00	5.00
Human sciences	3.81	0.71	3.66	3.97	2.00	3.88
Artistic field	3.09	0.88	2.75	3.43	2.50	4.00
Interdisciplinary areas of science	3.69	0.65	3.49	3.90	2.00	3.00

We note that the lowest values in all analysed parameters are found among students of artistic field. Given the marked asymmetry in the number of hours' students spend in KA, the Kruskal-Wallis test was calculated as a non-parametric proxy for ANOVA to test the influence of the field of science domain. There was a statistically significant relationship between the science field and the number of hours spent in KA per week ($\chi^2=26.56$, $df=7$; $p<.001$) (Table 4). On average, students of technical and biotechnical sciences spend more time in KA than students of other subjects.

Table 4: T-test and descriptive results on student engagement in KA in terms of number of hours and degree level

	Z	median		Interquartile dispersion	
		undergraduate	postgraduate	undergraduate	postgraduate
Engagement in KA/ hours per week	0.90	2.00	2.50	5.00	5.00

$p<05$; $p<01$; $p<001$

No statistically significant difference was found in student engagement in terms of the number of hours per week according to level of study, leading us to conclude that students are involved in KA for the same number of hours per week in all years of study. The results of this study confirm the current scientific knowledge about the student population: unsatisfactory level of engagement in KA in general and a significant difference in KA engagement is found by field of science for students of technical and biotechnical fields of science.

Table 5. Descriptive results and differences in engagement and number of hours in KA and in relation to gender

Factor		Mean		Standard deviation	
	t	male	female	male	female
Engagement in KA	3.16**	3.93	3.80	0.66	0.68
Hours per week in KA	-8.14**	4.00	2.00	6.00	4.00

* $p < .05$; ** $p < .01$; *** $p < .001$

According to the results shown in Table 5, the significant difference is in the number of hours of participation in KA/per week: male students spend on average twice as much time in KA as female students. Comparing the responses on students' preferences for KA by gender, male (164, 40.60%) and female (167, 25.80%) students preferred sports games as their first choice, while we can see differences in preferences as second choice: male students were more likely to prefer individual fitness programme (44, 12.50%) and athletics (40, 11.40%), while female students preferred athletics (156, 24.10%) and outdoor activities (105, 16.20%). As a second choice, most male students selected sports games (121, 37.60%), athletics (54, 16.20%) and individual fitness programme (52, 16.10%) and female students indicated outdoor sports (123, 20.80%), sports games (110, 18.60%) and athletics (97, 16.40%). The third choice given by most males was sports games (95, 34.40%), athletics (37, 13.40%), individual fitness programme (35, 12.70%) and aquatic sports (35, 12.70%), while females interested in outdoor sports (123, 20.80%), sports games (90, 17.30%) and athletics (97, 16.40%).

CONCLUSION

The results of this study are consistent with previous studies that have found the worrying trend of unsatisfactory level of engagement in KA. Differences in engagement in KA were found according to gender; male students are more engaged in KA than females and according to scientific field: engineering and biotechnology students are more engaged in KA. No statistically significant difference was found between KA and student age, i.e. between graduate and postgraduate students. Students from the technical field at the University of Rijeka, like students in Zagreb (Ćurković, 2010) and Split (Bjelajac et al., 2010), are the most involved in KA during their studies. The results of the research show the problem of the unsatisfactory level of physical activity of students at the University of Rijeka and the need to implement and improve the quality of physical education and health education in all components, as well as greater promotion of student sports and evaluation of student athletes.

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DIFFERENCES IN CARDIORESPIRATORY FITNESS BETWEEN 5TH AND 6TH-GRADE STUDENTS WHO TRAIN IN TEAM SPORTS COMPARED TO STUDENTS WHO DO NOT TRAIN

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SUMMARY

INTRODUCTION - Aerobic or cardiorespiratory endurance is considered an extremely important indicator of physical and mental health, as well as academic success in children and youth. The aim of this study was to investigate the impact of additional 2 to 3 training sessions per week in team sports on the cardiorespiratory fitness of 5th and 6th-grade students compared to students who do not engage in any sports activities other than physical education. **METHODS** - For the purposes of this research, a sample of 60 students from two primary schools in Zagreb was used. The first group of participants included students of both genders (15M/15F) who, besides attending physical education classes, do not train in any sport outside of school in the last year. The second group of participants also included students of both genders (15M/15F) who, in addition to physical education classes, train 2-3 times a week in some of the team sports such as basketball, handball, football, or volleyball. Initial measurements of cardiorespiratory fitness using the beep test were conducted in early September and Early January. The Wilcoxon Signed Rank test for repeated measurements was used to determine the difference between the initial and final outcomes within each group of students. Then, the Mann-Whitney U test was used to compare the differences between groups. The level of statistical significance was set at $p < 0.05$. **RESULTS** - The results of this study indicate that attending two hours of physical education per week can significantly improve the cardiorespiratory fitness of 5th and 6th-grade students who do not train in any sport. Also, very important data from this research indicate that students who, in addition to physical education classes, train an additional 2-3 times a week in some of the team sports, show significantly greater improvement in cardiorespiratory fitness compared to students who do not train in any sport. **CONCLUSION** - It is a known fact that for the health and harmonious growth and development of a child, is needed much more kinesiological activity than two hours of physical education classes per week, which is also evidenced by this conducted research.

Keywords: health, sport, physical education.

1. INTRODUCTION

Aerobic or cardiorespiratory endurance is considered a crucial indicator of physical and mental health, as well as academic success in children and youth (Raghuveer et al., 2020). Higher levels of aerobic endurance in youth are associated with better cardiovascular health indicators later in life (Ruiz et al., 2009), as well as a lower risk of work disability due to chronic cardiovascular diseases (Henriksson et

al., 2020). Specifically, projections show that improving the aerobic endurance of the population by one decile in youth can reduce the number of work-disabled individuals later in life by 16.2% (Henriksson et al., 2021). All segments of kinesiological characteristics are of utmost importance as their monitoring is fundamental for the development and guidance of students in sports. These are organized systems of all abilities, traits, motor information, and their mutual coordination (Prskalo, 2004). Physical education teachers, through the measurement and monitoring of physical fitness and the provision of purposeful and appropriate feedback, can encourage the development of healthy and sustainable lifestyles in children and adolescents (Garcia-Hermoso et al., 2022). One of these motor abilities that are monitored is cardiorespiratory fitness, which is also one of the most important components of general fitness. "Cardiorespiratory fitness is the ability to perform dynamic exercises that activate large muscle groups, of medium to high intensity, for a prolonged duration. Each fitness assessment should include an assessment of cardiorespiratory functions during rest and exercise" (Heyward, 2010). Previous research indicates that children in Croatia who do not engage in sports activities in their free time achieve below-average results in motor skills, while children who participate in additional sports activities achieve only average results compared to norms obtained for the United States (Krmpotić et al., 2014). It is also known that for the health and harmonious growth and development of a child, much more kinesiological activity is needed than two hours of physical education classes per week (Breslauer, 2007). Therefore, the aim of this study was to investigate the impact of additional 2 to 3 training sessions per week with a weekend match in team sports on cardiorespiratory fitness compared to students who do not engage in any sports activities other than physical education.

2. METHODS

For the purposes of this research, a sample of 60 students from two primary schools in Zagreb was used. The students were divided into 2 groups. The first group of participants included students of both genders (15M/15F) who, besides attending physical education classes, did not engage in any sports activities outside of school in the last year. The second group of participants also included students of both genders (15M/15F) who, in addition to physical education classes, trained 2-3 times a week with a weekend match in some of the team sports such as basketball, handball, football, or volleyball. To include students in this group of participants, they had to provide a confirmation from the club about regular training. Before participating in the study, all parents of the participants were informed about the research objectives, the manner of its execution, and potential risks. They all received an information sheet for participants, and signed parental consent was required for participation in the research. Initial measurements of cardiorespiratory fitness for both groups of students were conducted in the second week of physical education classes in early September, while the final measurement was conducted after 4 months, i.e., at the end of the first semester.

Cardiorespiratory fitness of students was assessed using the Beep Test. Most European and world organizations that define sets of field tests for assessing physical fitness in children and adolescents recommend the use of a multistage shuttle run test (commonly known as the beep test) for assessing aerobic endurance (Bianco et al., 2015). Description and aim of the test: The Beep Test was developed by Léger in 1982 and is used to assess cardiorespiratory fitness and monitor progress during training in boys and girls aged 5-18 years, and it can also be used to assess aerobic capacity in adults. The test has demonstrated satisfactory reliability and validity ($r = 0.975$, $SEE = 2.0 \text{ ml} \times \text{kg}^{-1} \times \text{min}^{-1}$) (Léger & Lambert, 1982). The test consists of 21 or more levels with 7 or more shuttle run intervals of 20 meters each. Each level lasts about 1 minute, during which the participant's running pace is determined by an audible signal emitted through an appropriate sound reproduction device. In each interval, the participant runs a 20-meter distance (marked with markers, cones, or any other indicators) with the goal of being within 3 meters of the marker at the moment the beep is emitted. The running pace increases by shortening the interval between audible signals. Results are recorded numerically based on the number of completed levels and intervals. Each level completed at the same pace consists of multiple intervals, so a participant who completes 8 intervals at level 12 achieves a score of 12.8. Both groups of students attended regular physical education classes twice a week.

Statistical Methods

Standard statistical methods were used for determining basic descriptive parameters, and the Shapiro-Wilk test was used to check the level of deviation of the empirical distribution from normal. For parametric methods, the independent samples t-test was used to determine the difference in initial measurements between the group of students who did not train outside of school compared to the group of students who trained 2-3 times a week. Due to deviations from normal distribution of variables, non-parametric statistical methods were used. The Wilcoxon Signed Rank test was used for repeated measurements between the initial and final outcomes within each group of students. To compare groups, the difference variable between measurement time points was calculated: 1. the difference between the final and initial measurements (variable FIN-IN difference). Then, the Mann-Whitney U test was used to compare differences between groups. The level of statistical significance was set at $p < 0.05$.

3. RESULTS

The independent samples t-test revealed that there was no statistically significant difference in the initial measurement of the Beep Test between the group of students who did not engage in any sports activities and the group of students who trained 2-3 times a week in team sports (Table 1). The Wilcoxon Signed Rank test was used for repeated measurements to determine the statistical significance between the initial and final states of the Beep Test performance for the group of students who did not engage in any sports activities (Table 2) and for the group of students who trained 2-3 times a week (Table 3). To compare the progress from the initial to the final state in the Beep Test between the 2 groups of students, the Mann-Whitney U test was conducted (Table 4).

Table 1. Difference between the group of 5th and 6th-grade students who do not engage in any sports activities and the group of 5th and 6th-grade students who train 2-3 times a week in the initial measurement of the Beep Test

VARIABLE	INACTIVE STUDENTS $\bar{x}$	TRAINING STUDENTS (2-3 TIMES PER WEEK) $\bar{x}$	T-VALUE	p
BIP TEST	3,30	3,61	-1,24	0,21

Table 2. Difference between the initial and final states of the Beep Test for 5th and 6th-grade students who do not engage in any sports activities

STUDENTS WHO DON'T TRAIN	AS	SD	p
BIP TEST INITIAL	3,30	1,04	0,00*
BIP TEST FINAL	4,61	1,61	

The significance of the p-test is less than 0.05 ($p=0.00$) for the Beep Test in both the initial and final measurements, indicating that the group of students who do not engage in any sports activities achieved a significantly better result in the final measurement compared to the initial measurement. Therefore, we can conclude that with 2 hours of physical education per week, there can be a significant improvement in the cardiorespiratory fitness of students who do not engage in any sports activities.

Table 3. Difference between the initial and final states of the Beep Test for students who train 2-3 times a week in team sports

STUDENTS WHO TRAIN 2-3X WEEK	AS	SD	P
BIP TEST INITIAL	3,61	0,93	0,00*
BIP TEST FINAL	5,56	1,25	

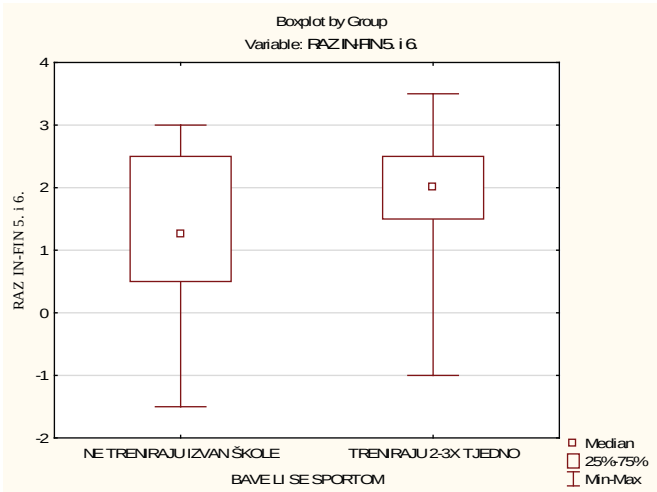
The significance of the p-test is less than 0.05 ($p=0.00$) for the Beep Test in both the initial and final measurements, indicating that the group of students who additionally train 2-3 times a week in team sports experienced a significant improvement in cardiorespiratory fitness in the final measurement compared to the initial measurement.

Table 4. Difference in effectiveness between the two groups of students in the Beep Test

Varijable	p - value
DIFF IN-FIN INACTIVE STUDENTS	0,03*
DIFF IN-FIN STUDENTS WHO TRAIN 2-3 TIMES A WEEK.	

A statistically significant improvement in cardiorespiratory fitness was observed in the group of students who, in addition to attending physical education classes, also trained 2-3 times a week in team sports outside of school, compared to students who did not engage in any additional sports activities beyond physical education classes (Figure 1).

Figure 1



4. DISCUSSION

The results of this study indicate that attending two hours of physical education per week can significantly improve the cardiorespiratory fitness of 5th and 6th-grade students who do not engage in any sports activities. Additionally, crucial data from this research suggest that students who, in addition to physical education classes, train 2-3 times a week in team sports, experience significantly greater improvement in cardiorespiratory fitness compared to students who do not engage in any sports activities. These results suggest that the introduction of two additional hours of physical education classes could significantly enhance the cardiorespiratory fitness of 5th and 6th-grade students. It is well known that for the health and balanced development of children, much more physical activity is required than just two hours of physical education per week. Therefore, these results were expected given that one group of students had 2-3 additional training sessions per week compared to the other group. The study aimed to highlight the fact that with an additional 2 hours of physical education classes, significant improvements in cardiorespiratory fitness could also be achieved in students who do not engage in sports. This could lead to a more work-capable and healthier population with better cardiovascular health in later years. Previous research by Kalčík et al. (2011) indicated a significant correlation between the 6-minute running test, commonly used in primary schools, and the beep test used to assess cardiorespiratory fitness in this study. The results of their study support the idea that the 6-minute running test is suitable for assessing aerobic capacity, while the beep test is more suitable for specific situations in team sports where there is an expression of acyclic movement structure. Therefore, the reason for significantly better results in cardiorespiratory fitness in the group of students who train 2-3 times a week may be due to the fact that team sports predominantly involve acyclic movement structures, which are best measured by the beep test. De Jonge et al. (2020) conducted a study on 659 students in grades 5 through 8, indicating that running for 15 minutes 3-4 times a week over a period of 12 weeks can significantly improve the cardiorespiratory fitness of students. In the future, it would be beneficial to introduce more hours of physical education classes in primary schools to enable running three times a week and positively impact the health of students. Armano (2019) conducted a study on the health fitness of a primary school from 1988 to 2014, covering 4448 students from grades 5 through 8. The results indicated a negative trend in all grades, with statistically significant deterioration observed in students in grades 5, 6, and 7. Their study used the 6-minute running test to assess health fitness. Additionally, research by Tomkinson and Olds (2007) identified a significant decrease in the aerobic fitness of children and adolescents aged 6 to 19 across 27 countries, especially after 1970. Each year, the aerobic fitness of children decreases by 0.36%. The decrease in children's aerobic fitness can be attributed to sedentary lifestyles, to which parents consciously or unconsciously contribute. Considering the relatively small sample size, which cannot be considered representative of the entire population of children and adolescents in Croatia, it is essential to acknowledge the limitations in drawing conclusions. Further research in this area are necessary to gain a clearer picture, and the authors suggest longer-term monitoring of students and analysis of effects on a larger number of participants.

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DIFFERENCE IN THE MOTOR SKILLS OF PRESCHOOL BOYS AND GIRLS

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ABSTRACT

The child's motor activity is based on phylogenetic and ontogenetic motor patterns of movements. Motor development is the process by which children learn new movement patterns and skills, an important role in this process is played by the child's environment and parents. Motor skills are responsible for movement, and enable the body to perform a motor task quickly, efficiently, precisely, powerfully and in a coordinated manner. Motor skills such as strength, speed, coordination, agility, balance, precision, flexibility/mobility can be measured and described.

The aim of this research was to compare the motor skills of boys and girls of preschool age. 39 children participated in the research, 21 boys and 18 girls, with an average age of 6 years. The research was conducted by using the PREFIT battery test that assess morphological characteristics, motor skills and functional abilities. The obtained results of measuring motor skills were compared by gender. The t-test for independent samples was used to determine gender differences. According to the obtained results, it can be concluded that there is no significant difference in the motor skills of boys and girls of preschool age. Physical activity has a positive effect on the future growth and development of children regardless of gender or type of physical activity, it also has a positive effect on the development of motor skills and anthropological characteristics of preschool children, so it should definitely be encouraged.

Keywords: motor skills, PREFIT, preschool age

INTRODUCTION

Motor skills belong to latent motor structures. They enable the body to perform a motor task quickly, efficiently, precisely, strongly and in a coordinated manner (Milanović, 2013). Preschool age is the most favorable period for the development of motor skills. Abilities that children develop from an early age are coordination, balance, general precision, general strength, general endurance, flexibility and reaction to sound and visual stimuli (Neljak, 2009). It is important to emphasize that motor skills are developed in an integrated manner. It can be said that no motor skill develops independently, but is always related to one or more other motor skills (Kosinac, 2011). In this research were used tests to assess motor skills suitable for children of preschool age.

There are numerous studies that have studied gender differences in preschool age. Most of them show that there is a gender difference and that boys have better results in some motor skills such as explosive strength and coordination, while girls are better in tests of repetitive strength, flexibility and balance (Horvat et al, 2013; De Privitellio et al, 2007; Zegnal Koretić et al 2015). This research will analyze the results of tests for the assessment of motor skills in preschool children. The aim of the work is to determine the differences in motor skills in boys and girls aged 6 to 7 years.

METHODS

39 children of preschool age from two kindergartens in Osijek participated in the research. The population consisted of 21 boys and 18 girls with an average age of 6 years. Using the PREFIT battery tests, it was determined that the average height of the boys was 123.895 cm, the weight was 26.795 kg, and the waist circumference was 58.371 cm. While girls were slightly taller on average with an average height of 124.456 cm, an weight of 25.75 kg and an average waist circumference of 56.886 cm.

Motor skills were assessed using the PREFIT battery tests, which consists of nine different tests for the assessment of morphological characteristics and motor and functional abilities. The tests evaluated coordination, agility, balance, explosive strength, isometric strength and speed. The tests for assessing motor skills and functional abilities that were used in the research are: *Handgrip strength* (MIS), *Standing long jump* (MSDM), *One-leg stance* (MSN), *4x10m shuttle run* (F40), *20m shuttle run* (F20).

All tests were performed twice except for the *4x10m shuttle run* (F40) and *20m shuttle run* (F20) which were measured only once. With tests measured twice, the arithmetic mean of the two results was calculated.

The collected data were processed in the Statistica 10 program. The basic descriptive parameters in each variable were calculated separately for each gender. Parameters were calculated for all variables: arithmetic mean (AS), standard deviation (SD), minimum (MIN) and maximum (MAX). The t-test was used for independent variables to determine gender differences.

RESULTS

Descriptive indicators of the motor skills results of boys and girls are shown in Table 1. The reported values of the measurement variables F40 (4x10m shuttle run) and F20 (20m shuttle run) are inversely scaled, which means that a lower value of the result is a better result, while in all other values, a higher value means a better result.

Table 1. Basic descriptive parameters of results in boys and girls

	BOYS					GIRLS				
	N	AS	SD	Min	Max	N	AS	SD	Min	Max
ATV	21	123.895	5.152	115.400	131.600	18	124.456	5.624	115.600	132.900
ATT	21	26.795	7.654	18.400	49.000	18	25.750	4.397	19.800	33.900
BMI	21	17.233	3.830	13.700	28.300	18	16.528	1.713	13.600	19.200
MOS	21	58.371	9.952	30.100	77.500	18	56.886	4.865	49.050	66.700
MIS	21	9.374	2.031	6.050	14.100	18	10.361	1.890	7.300	14.400
MSDM	21	104.548	26.263	54.000	149.500	18	105.828	20.426	76.200	149.000
F40	21	14.926	1.927	12.210	19.970	18	15.627	1.508	13.020	19.060
MSN	21	25.458	28.106	3.500	120.320	18	27.469	26.219	3.700	89.300
F20	21	6.861	1.017	5.590	9.410	18	7.091	0.788	5.810	8.740

Legend: Body height (ATV), Body weight (ATT), Body Mass Index (BMI), Waist circumference (MOS), Handgrip strength (MIS), Standing long jump (MSDM), One-leg stance (MSN), 4x10m shuttle run (F40), 20m shuttle run (F20).

Table 2 shows the results of the measured motor skills. The results of boys and girls were compared. According to the obtained results, it can be concluded that there is no big difference between genders. The reason for this may be the slow phase of development, which is the same for boys and girls at that age (Mišigoj-Duraković, 2008).

Table 2. *The difference between boys and girls in the observed variables*

	AS boys	AS girls	t-value	p
ATV	123.895	124.456	-0.325	0.747
ATT	26.795	25.750	0.511	0.612
BMI	17.233	16.528	0.721	0.475
MOS	58.371	56.886	0.576	0.568
MIS	9.374	10.361	-1.562	0.127
MSDM	104.548	105.828	-0.168	0.868
F40	14.926	15.627	-1.250	0.219
MSN	25.458	27.469	-0.230	0.820
F20	6.861	7.091	-0.778	0.442

Legend: Body height (ATV), Body weight (ATT), Body Mass Index (BMI), Waist circumference (MOS), Handgrip strength (MIS), Standing long jump (MSDM), One-leg stance (MSN), 4x10m shuttle run (F40), 20m shuttle run (F20).

DISCUSSION

Based on the obtained results, it can be concluded that there is almost no difference between genders due to the stage of development in which the differences between boys and girls are minimal. These differences are more pronounced in the later developmental stages of children.

In the research by Robinson et al (2012), no significant differences were found between boys and girls in locomotor skills (e.g., running, jumping, sliding, etc.), but they found differences in object control skills (e.g., hitting, catching ball, kicking, etc.), Barnett et al (2013) had similar results.

Examining age and gender differences in the standing long jump of preschool children aged 3 to 6 years was the aim of the research by Latorre-Román et al (2017). Explosive power of the legs was measured by the standing long jump test. The results showed that boys performed better than girls at the age of 3 to 5 years, but no differences were found at the age of 6 years. Looking at the whole group, the standing long jump score was higher with the age of the children. However, no significant differences were found between boys aged 5 to 6 years.

Mraste et al (2009) conducted research on a sample of 81 subjects using a battery of 6 motor tests and two morphological measures and concluded that there is no difference between girls and boys at the age of 6 in terms of explosive strength, repetitive strength, flexibility, coordination and balance. We obtained similar results in our research.

In the research by Cadenas-Sanchez et al (2019), gender differences in preschool children were studied and a reference standard of physical fitness was determined. 3179 children of preschool age participated in the research. Physical fitness was measured using the PREFIT battery tests. Boys had better results in cardiorespiratory tests, muscle strength, agility and speed tests throughout the testing period.

and girls had slightly better results in the balance test. The older the children, the better their score in all PREFIT tests.

In the meta-analysis by Zheng et al (2022), statistically significant differences by gender were found in fundamental motor skills, which include locomotor skills and object control skills. Locomotor skills proved to be better in girls.

The ability to balance was measured by a test of standing on one leg, and in the research of Jertec (2011) a gender difference was found in favor of girls, while in the research of Horvat et al (2013) boys achieved better results.

It is assumed that motor skills in preschool age can be influenced by the environment rather than biological factors. Depending on which game the child prefers, they can better develop motor skills that are elements of that game (Iivonen & Sääkslahti, 2014; Antunes et al, 2018). The different representation and interests in certain activities and games expressed by boys compared to girls in preschool age can lead to the appearance of differences in the period of preschool age (Jertec, 2011; Horvat et al, 2013).

Physical activity has a favorable effect on the future growth and development of children, regardless of gender or type of physical activity. Also, physical activity has a positive effect on the development of motor skills and anthropological characteristics of preschool children.

This research determined that there is no significant difference in the results of the motor skills of boys and girls of preschool age. It is necessary to take into account the limitation of this research, such as the small sample size of preschool children from one geographical location. While the results of previous studies are diverse, with some in favor of girls and others in favor of boys, individual studies, including this one, did not find statistically significant differences by gender. Therefore, it is necessary to interpret the results with caution.

CONCLUSION

A lack of physical activity leads to an increase in cardiovascular and autoimmune diseases, as well as a decrease in cognitive abilities. Encouraging physical activity has a positive effect on children's growth and development of motor skills and functional abilities and anthropological characteristics.

Based on the results of this research, it can be concluded that there is no statistically significant difference by gender in all the conducted PREFIT tests. This is due to the phase of growth and development, which at that age is equal in both gender. However, numerous studies that find differences between boys and girls show different preferences by gender or motor skill.

We suggest future research on a larger number of subjects and the influence of environmental factors on motor skills, given that, unlike this research, numerous studies have proven the existence of gender differences in preschool children.

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IDENTIFICATION OF SELECTED KINESIOLOGICAL FEATURES IN PRE-SCHOOL EDUCATORS

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ABSTRACT

The main scope of the research is to identify and examine differences in selected kinesiological features among pre-school educators with different levels of work experience. The sample comprised 246 pre-school educators from 20 counties of the Republic of Croatia, including Zagreb, with an average chronological age of 36.79 ± 10.79 years and average work experience of 109.90 ± 119.64 months. Based on work experience, participants were categorized into three groups: 0-12 months, 13-120 months and 121+ months. Additionally, 32.92% (81) of educators were identified as students, currently enrolled in the education system. Participants completed an online questionnaire consisting of 12 items, where they indicated their degree of agreement with each statement on a 5-point Likert scale. Canonical discriminant analysis revealed a statistically significant difference between the three groups by one discriminant function ($\text{CanR}=0.37$, $p=0.001$). The findings indicate that awareness of healthy lifestyle, understanding of basic kinesiology knowledge and personal interest in non-kindergarten sports activities of pre-school children were the variables that significantly differentiated between the three groups of pre-school educators with varying work experience. These results emphasize the importance of additional determination of the kinesiology features of educators in pre-school institutions and may suggest the need for continuous customized professional development programs aimed at improving the knowledge and practices of educators related to physical activity and promoting a healthy lifestyle.

Keywords: pre-school educators, awareness, sport, differences

INTRODUCTION

The key role that pre-school educators play in shaping the health and well-being of young children has always been recognized. Following parents, educators serve as the primary influencers and caretakers for young children, with their impact extending beyond academic learning. (Blažević, Božić, Dragičević, (2012), as cited by Prskalo, Horvat, Hraski (2013)), emphasizes the significant role of parents and pre-school teachers in meeting the needs of young children who are not yet independent. During the pre-school period, children undergo critical stages of development, where education serves as a deliberate effort to instil societal-appropriate traits and habits (Eret, 2011). In this context, educators serve not only as caregivers but also as role models and facilitators of physical and health education (Prskalo, Findak, Neljak 2007). Tomac, Vidranski and Ciglar (2015) underscore the influence of educators in determining the timing and extent of physical exercise for preschool children. Promoting a healthy lifestyle, including regular physical activity, is among the pivotal roles of educators, contributing to children's overall development and long-term well-being. The effectiveness of such efforts hinges greatly on educators' attitudes, behaviour's and competence, which shape the learning environment and opportunities for children (Petrović-Sočo, Miljević-Ridički, Šarić 2013). Thus, educators wield considerable influence in guiding children towards fulfilling their developmental and individual needs within an enriching educa-

tional setting. If the educator has a positive attitude towards physical exercise and is physically active himself, then it will be easier to transfer this to the children.

Despite the acknowledged importance of physical activity in early childhood, there remains a need for a deeper understanding of educators' perceptions, knowledge and practices in this area. This research seeks to address this gap by examining the selected kinesiology features among pre-school educators. This research tries to determine how pre-school educators' levels of work experience may influence their attitudes and practice related to physical activity. The results of a similar study, according to Dvorski et al. (2015) show a gap between the professional and personal beliefs of educators and their actions in practice. Therefore, the following hypothesis was formed: H1: Pre-school educators with different levels of work experience will have different attitudes and practice in selected kinesiological features. Understanding these factors is crucial for designing targeted interventions and professional development programs aimed at equipping educators with the necessary knowledge and skills. Through this research, we endeavour to contribute to the growing body of literature on early childhood education and highlight the importance of supporting educators in their efforts to create environments that nurture the physical, social and emotional well-being of young children. According to (NKRPOO), the development of kindergarten educational practice and curriculum aligns with the evolving values, understanding and knowledge of educators. Continuous professional development is crucial to ensure educators' growth, resulting not only in knowledge advancement but also in changes in beliefs and actions. Hence, professional development programs with transformative potential, such as those incorporating research features, are essential. Beliefs shape educators' behaviour, highlighting the need to question and change these beliefs alongside educational philosophy to improve practice.

METHODS

Examinee sample - The research included a sample of 246 pre-school educators from 20 counties of the Republic of Croatia, including the city of Zagreb. The largest proportion of examinees hailed from the 5 Slavonian counties, constituting 43.49% (107) of the sample. Furthermore, 23.17% (57) were from the Adriatic counties, while 33.33% (82) were from Zagreb and other continental counties. The average chronological age of the participants was 36.79 ± 10.79 years, ranging from 19 to 64 years. The majority of the sample comprised female educators, accounting for 97.56% (240) of the total examinees. Among the participants, 93.90% (231) were employees, with 61.38% (151) possessing three or more years of teaching experience. Additionally, 32.92% (81) of educators were identified as students, currently enrolled in the education system. According to work experience, the total sample (109.90 ± 119.64) is divided into 3 groups: Group 1 22.76% (56) - Work experience₁=0-12 months (3.66 ± 3.84), Group 2 43.50% (107) - Work experience₂=13-120 months (54.78 ± 33.24) and Group 3 33.74% (83) - Work experience₃=121+ months (252.65 ± 95.03).

Variable sample - For the purpose of analysing the identification of selected kinesiology features of educators, a survey questionnaire comprising 34 questions was utilized. From this questionnaire, 12 questions were selected for the current research. The examinees expressed their degree of agreement with each statement on a 5-point Likert scale, where 1 represented "not at all" and 5 represented "completely." Except for the categorical variables RAD - *which represent the work experience of educators (including the current year)* and DOB - *which represent the chronological age of the examinees, respectively*, the remaining variables were assessed on a Likert scale: POS - *assessment of the level of awareness/information about the need to engage in physical activities*; PVS - *assessment of the importance/need for practicing physical activities*; PVD - *assessment of the importance of physical appearance from a social aspect*; POZ - *assessment of the level of awareness in general about a healthy diet and lifestyle*; PRK - *assessment of the level of consumption of a generally healthy diet*; PSK - *assessment of the ability to independently create a plan and program of the exercise process*; ROK - *understanding the basic kinesiology knowledge about the influence of physical activity on different segments of the anthropological status of pre-school children*; PVI - *assessment of personal interest in non-kindergarten sports activities of pre-school children*;

SPT - ability to independently conduct spontaneous and thematic exercise on snow; TPA - knowledge of theoretical and practical aspects of the organization of winter holidays with pre-school-age children.

Methods of data processing - The methods used for data processing included calculating descriptive statistical parameters for all variables: arithmetic mean (AS), standard deviation (SD), minimum (Min) and maximum (Max) result. In order to determine if there are significant differences between the three groups the canonical discriminant analysis conducted on the groups according to work experience. Within the canonical discriminant analysis the coefficient of canonical discrimination was determined, as well as groups position on discriminant function and correlation between the variables and the discriminant function. The significance of coefficients of canonical discrimination was tested by Bartlett's test. The data was classified by statistical package STATISTICA 13.0.

Description of experimental procedure - All examinees voluntarily and anonymously filled out the online survey questionnaire. The questionnaire conducted during the period of 7th to 3rd April 2023. through social networks, in a period in which there are no exams, holidays and vacations distractions, so the examinees could provide a more realistic self-assessment of the selected kinesiological features.

RESULTS

Table 1. shows descriptive indicators of variables for the total sample of consumers and also for the all three work experience groups.

Table 1. Descriptive indicators of measuring variables.

Var	Total sample (N=246)		WEXP1 (N=56)		WEXP2 (N=107)		WEXP3 (N=83)	
	AS±SD	Min - Max	AS±SD	Min - Max	AS±SD	Min - Max	AS±SD	Min - Max
RAD	109,90±119,64	0 - 484	3,66±3,84	0 - 12	54,78±33,24	13 - 120	252,65±95,03	121 - 484
DOB	36,79±10,79	19 - 64	27,93±6,25	19 - 45	34,05±9,03	23 - 62	46,31±7,80	33 - 64
POS	3,97±0,84	2 - 5	4,11±0,85	2 - 5	4,05±0,85	2 - 5	3,77±0,80	2 - 5
PVS	4,50±0,62	3 - 5	4,61±0,59	3 - 5	4,54±0,60	3 - 5	4,39±0,64	3 - 5
PVD	3,67±0,89	1 - 5	3,70±1,08	1 - 5	3,79±0,84	1 - 5	3,49±0,79	1 - 5
POZ	3,91±0,76	2 - 5	3,89±0,85	2 - 5	3,87±0,75	2 - 5	3,98±0,70	2 - 5
PRK	3,35±0,80	1 - 5	3,25±0,64	2 - 5	3,33±0,89	1 - 5	3,43±0,77	1 - 5
PSK	3,02±0,99	1 - 5	3,07±1,02	1 - 5	3,02±1,01	1 - 5	3,89±0,73	2 - 5
ROK	3,87±0,86	1 - 5	3,64±1,00	1 - 5	3,97±0,86	2 - 5	2,98±0,96	1 - 5
PVI	3,50±0,98	1 - 5	3,75±0,96	1 - 5	3,57±1,01	1 - 5	3,24±0,89	1 - 5
SPT	2,99±1,14	1 - 5	3,04±1,22	1 - 5	3,19±1,06	1 - 5	2,70±1,13	1 - 5
TPA	2,93±1,10	1 - 5	2,82±1,11	1 - 5	3,07±1,13	1 - 5	2,84±1,04	1 - 5

AS–arithmetic mean, SD–standard deviation, Min–minimal result, Max–maximum result, Var–Variables, WEXP– work experience group

Across all groups (WEXP1 AS=4.61; WEXP2 AS=4.54; WEXP3 AS=4.39), pre-school educators consistently recognized the importance of physical activity, as evidenced by the highest average value for the variable "Assessment of the importance/need for practicing physical activities" (AS=4.50). Conversely, the variable "Knowledge of theoretical and practical aspects of the organization of winter holidays with

pre-school-age children" had the lowest average value at the total sample ($AS=2.93$) and also across all groups ($WEXP1\ AS=2.82$; $WEXP2\ AS=3.07$; $WEXP3\ AS=2.84$), suggesting a potential area for improvement in educators' knowledge and practices related to winter holiday organization. Interestingly, the group with the least work experience ($WEXP1$) demonstrated higher average values in the variables "Awareness of physical activities" and "Importance of physical activities." However, these values decreased with increasing work experience, indicating a potential shift in attitudes and perceptions over time ($POS - WEXP1=4.11$; $WEXP2=4.05$; $WEXP3=3.77$ and $PVS - WEXP1=4.61$; $WEXP2=4.54$; $WEXP3=4.39$). The average value of "Assessment of the level of awareness/information about the need to engage in physical activities" was below 3.97 across all groups, raising questions about the overall level of awareness among educators regarding the importance of physical activity. Additionally, all other average values of the dependent variables were observed to be below 4.00. While standard deviation values were mostly uniform across groups, greater variability was observed in the variables "Assessment of the level of consumption of a generally healthy diet" and "Assessment of the importance of physical appearance from a social aspect." The minimum results for seven dependent variables were 1, indicating areas of potential improvement in educators' perceptions and practices across the board. According to Table 2, which illustrates the differences in arithmetic means and canonical discriminant analysis between the three groups, it is evident that these differences are statistically significant (1. canonical correlation of the discrimination function; $CanR=0.37$, $p=0.001$). This coefficient suggests that while the difference between the three groups in terms of the mentioned variables may be relatively small, one discrimination function still significantly distinguishes between the groups.

Table 2. Differences of arithmetic means and canonical discriminant analysis between groups.

CANR	λ	h^2	df	p
0,37	0,82	46,40	20	0,001*
0,22	0,95	11,34	9	0,253

CanR–canonical correlation coefficient, λ –lambda, h^2 –Chi square, *df* – degrees of freedom, *p* – level of significance

Furthermore, the significance of the specified coefficient was tested using Bartlett's Chi-square test, which yielded a statistically significant result with an error of $p=0.001$. This confirms the robustness of the observed differences between the groups and underscores the importance of the variables in distinguishing among them. Overall, these findings highlight the relevance of the variables examined in Table 2. and their potential impact on the features of the groups under research. From Table 3. we can see the positioning of the groups $WEXP1$, $WEXP2$ and $WEXP3$ along the discrimination function. It is evident that groups $WEXP1$ and $WEXP2$ are situated at the positive pole of the discrimination function, with their averages at 0.442 and 0.185 standard deviations of the discrimination function, respectively. Conversely, group $WEXP3$ is positioned at the negative pole, with its average at -0.536 standard deviations of the discriminant function.

Table 3. Arithmetic means of groups on the discriminant function.

	DF1
WEXP1	0,442
WEXP2	0,185
WEXP3	-0,536

DF–correlation coefficients of discriminant function and variables, *WEXP*– work experience group

From Table 4. we can see that according to work experience three groups are significantly different in four (3) variables. Those are: *assessment of the level of awareness in general about a healthy diet and lifestyle; understanding the basic kinesiology knowledge about the influence of physical activity on different segments of the anthropological status of pre-school children; assessment of personal interest in non-kindergarten sports activities of pre-school children.*

Table 4. Differences between groups in individual variables.

	λ	p
POS	0,843	0,059
PVS	0,825	0,730
PVD	0,837	0,149
POZ	0,846	0,041*
PRK	0,825	0,783
PSK	0,828	0,540
ROK	0,857	0,009*
PVI	0,855	0,012*
SPT	0,842	0,071
TPA	0,824	0,874

λ -lambda, p- significance level

DISCUSSION

The findings of this research provide valuable insight in identifying the perceptions and practices of pre-school educators regarding selected kinesiology features. A significant observation is the consistent recognition of the importance of physical activity among educators, as evidenced by the highest average value of the variable "Assessment of the importance/need for engaging in physical activity" in all groups.

However, can it be considered that the average value of the variable Assessment of the importance/need for practicing physical activities in the amount of 3.97 ± 0.84 is good enough at all. This underscores the need for targeted efforts to improve educators' understanding of the benefits of physical activity for pre-school children's health. Observed differences in attitudes and perceptions towards physical activity among groups with different work experience also deserve attention. While the group with the least work experience showed higher average values in the variables "Awareness of physical activities" and "Importance of physical activities", these values decreased linearly with increasing work experience. This suggests potential change in attitudes over time, influenced by factors such as professional development, exposure to educational resources and practical experience in pre-school settings. Lower average values were also observed for other observed variables, all of which average values are less than 4.00. Not even in individual groups is this value higher. Furthermore, Group WEXP2 had the highest average value of all average values for all dependent variables in all groups (WEXP1=3.59; WEXP2=3.64; WEXP3=3.47), while group WEXP3 exhibited the most homogeneous variability of results based on the average values of all of the standard deviation of all dependent variables in all groups (WEXP1=0.93; WEXP2=0.90; WEXP3=0.85). Educators who recognize the importance of physical activity are more likely to prioritize it and integrate it into daily routines, planning and interactions with children, thus fostering a culture of active living in the pre-school environment. The analysis reveals notable disparities among the three groups based on work experience in several key variables. Specifically, significant differences were observed in three variables: *"level of awareness in general about a healthy diet*

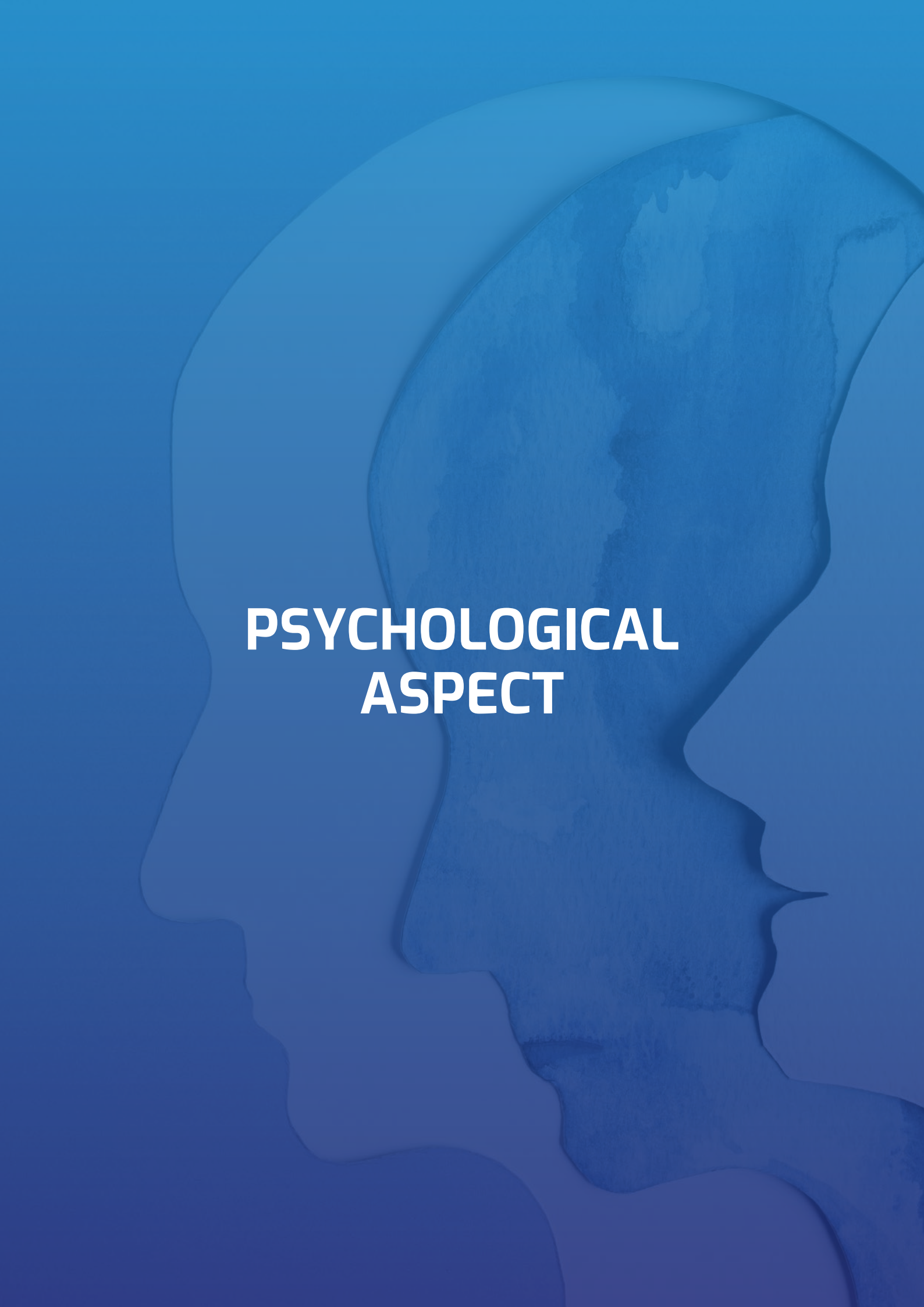
and lifestyle", "understanding the basic kinesiology knowledge about the influence of physical activity on different segments of the anthropological status of pre-school children" and "personal interest in non-kindergarten sports activities of pre-school children". These findings suggest that educators with varying levels of work experience may exhibit distinct levels of awareness, knowledge and personal interest in promoting healthy lifestyle behaviours and physical activity. Educators with less work experience may demonstrate a higher level of awareness and interest in these areas, potentially reflecting recent exposure to updated educational materials, training programs and professional development opportunities focused on health promotion and kinesiology principles. Conversely, educators with more extensive work experience may exhibit differences in their levels of awareness and knowledge, possibly influenced by factors such as varying levels of exposure to evolving educational practices, institutional norms and professional development initiatives over time. Additionally, personal interest in non-kindergarten sports activities may vary among educators based on their individual experiences, preferences and background in physical education and sports.

CONCLUSION

The main scope of the research was to identify and examine differences in selected kinesiological features among pre-school educators with different levels of work experience. The findings reveal significant differences among pre-school educators, confirming the hypothesis of varying in selected kinesiological features based on work experience. The findings highlight the consistent recognition of the importance of physical activity among pre-school educators, alongside areas for improvement in understanding and prioritizing its practice. Moreover, observed differences in attitudes and perceptions among educators with varying work experience underscore the dynamic nature of educator development. By acknowledging and addressing these differences, stakeholders can better support educators in fostering environments that promote lifelong health and well-being among young children. Overall, this paper emphasizes the importance of ongoing professional development and targeted interventions in enhancing educators' capacity to promote healthy lifestyle in pre-school settings.

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The background is a solid blue color. Overlaid on this is a large, semi-transparent profile of a human head facing right. Inside the head's silhouette is a faint, textured image of the Earth's globe. The text "PSYCHOLOGICAL ASPECT" is centered in the middle of the image in a white, bold, sans-serif font.

PSYCHOLOGICAL ASPECT

DEPRESSION AND ANXIETY IN SPORTS

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ABSTRACT

The paper presents a review of contemporary research on depression and anxiety among athletes. Research findings on the benefits of sports on overall psychological functioning demonstrate advantages for athletes compared to non-athletes, but the examination of depression reveals inconsistency in the data in this area. Some of the researched factors contributing to higher levels of depression among athletes include physical or somatic stress associated with intense training programs, injuries, performance expectations, fear of future and ongoing uncertainties in their professional environment. Some authors imply the existence of specific coping mechanisms for depression among athletes, leading to differences. Longitudinal studies indicate that individuals who participated in team sports during adolescence report lower levels of depression in adulthood, suggesting that sports can act as a protective factor. On the other hand, given that anxiety disorders can negatively impact athletes' performance, understanding anxiety and predictors contributing to its occurrence is important. In the context of sports, competitive anxiety is defined as fear of failure or fear that athletic performance will not be successful before and/or during sports competition. Regarding determinants of anxiety disorders and symptoms among elite athletes, research has shown that female athletes, younger athletes, and those who have experienced unwanted life events are more prone to anxiety symptoms. Furthermore, anxiety contributes to musculoskeletal injuries and dissatisfaction with sports careers. When it comes to anxiety in individual and team sports, higher levels of competitive anxiety are found among athletes engaged in individual sports compared to those engaged in team sports.

Key words: depression, anxiety, sports, athletes

INTRODUCTION

The field of sports and mental health is becoming increasingly popular both in the scientific paradigms and in folk psychology, which is why review papers have to follow the trend and results of recent research. This paper includes new research whose findings are compared with the old one through different groups of athletes. In this way, an unsupervised understanding of depression and anxiety through specific levels and groups in the world of sports is enabled, as well as a critical view of the research findings themselves. Great attention is paid to the connection between sport and mental health, so in modern literature can be found a large number of researches. Participation in sports activities has shown significant potential for improving mental functioning (Hajkowicz et al., 2013), including improving social and emotional functioning, quality of life, self-confidence and social relationships, especially in young people (Fraser-Thomas & Côte, 2009; Holt, 2016; Holt et al., 2017). Johnsgard et al. (1989) showed this in the first studies of this issue through findings on reducing symptoms of stress and depression in patients after 21 months of regular sports, compared to the control group. Research during the pandemic has also shown that regular physical activity relieves anxiety, sadness and depression (Lange et al., 2023). Sport has proven to be a protective factor in adolescents and young people in sui-

cidal thoughts and suicide attempts (Southerland et al., 2016), but this does not mean that athletes are immune to mental illness. This is also shown by the fact that the prevalence of depression among them ranges from 15.6% to 21% (Yang, 2007). The strongest statistical predictors of depression were female sex, lower self-esteem levels, less social networking and decreased sleep. However, the findings so far have not been consistent. On the one hand, it is claimed that athletes are very sensitive to the development of depressive symptoms due to their exceptional position in society, enormous pressure and the level of stress they experience and a number of other factors studied. On the other hand, it is claimed that athletes are particularly resilient and therefore less sensitive. Meta-analyses (Brand et al., 2013 and Gorezynski et al., 2017) found that high-performance athletes are just as prone to reporting depressive symptoms as the general population which is consistent with claims that elite athletes are not necessarily protected from mental health symptoms by their sporting role alone. Research also shows the importance of continuous participation in sports as a potentially protective factor for mental health at a later age (Doré et al., 2018). At the same time, the results of research by Morgan et al. (2015) showed that the reciprocal relationship between depression and sports performance changes over time and through the change of hobbies into a career; While sports can provide escape from depressive symptoms at first, over time the demanding nature of sports can change the relationship from stimulating to disabling. This highlights the importance of considering the positive and negative aspects of engagement in sports through qualitative and quantitative research due to the complexity of the problem itself and the need to investigate the causes of depression in elite athletes. When the sample was limited to highly elite athletes 66% of athletes met the DSM-IV-TR criteria and 41% of athletes reported mild to moderate symptoms (Hammond et al., 2013). After these results special attention was focused on the research of the causative agent.

CAUSES OF DEPRESSION IN ATHLETES

In general, the development of depressive disorders can be described by a multifactorial model of causality. Biological factors, psychological factors and social factors are assumed to be factors that cause the onset of depressive disorder. By studying the structures in sports systems and requirements on athletes, factors related to the occurrence of symptoms of depression can be identified (Frank et al., 2015). The results of a qualitative study by Doherty and collaborators (2016) on the experiences of professional athletes revealed a strong association between athlete's identities, public performance evaluation, and intense desire to win, which they cite as factors contributing to depression. They pointed out that an elite sports environment, with an emphasis on masculinity, can exacerbate depression, highlighting typical symptoms of depression such as feelings of failure, shame, negative self-assessment and the belief that depression is unacceptable. In addition, some high-performance athletes also face body image problems, especially those competing in aesthetic sports, which can also result in eating disorders and substance use (Reardon, 2010). Periods of transition, especially withdrawal from sports and sudden retirement, are another period of risk for psychological disabilities in elite athletes that leave them with feelings of vulnerability and depression (Reardon and Factor, 2010; Hughes and Leavey, 2012). For some athletes, the transition from an active competitive sport to a sports retirement passes without difficulty. Wippert and Wippert (2010) showed the difference that involuntary career cessation was associated with significantly greater psychological symptoms, including symptoms of depression, compared to voluntary career cessation among skiers. There is all the overwhelming body of evidence to suggest that sports injuries can result in changes in emotional state and have long-lasting emotional consequences. A recent survey conducted by Brett (2019) among 1,044 retired National Football League players found that the 9-year risk of being diagnosed with depression increased with the number of self-reported injuries. According to the survey, retired athletes who reported three or more injuries were three times more likely to be diagnosed with depression compared to athletes with no history of injuries. There were also questions about the types of injuries where concussions were assumed to leave the most psychological consequences, but it was shown that some injuries cause even more consequences, e.g. a study conducted by Mainwaring and collaborators (2010) found that athletes with ACL injuries showed more serious symptoms of depression that even last longer.

COPING MECHANISMS

From a psychological perspective, it has been shown that different psychological skills stimulate development and performance at an elite level (Bartulović, Young & Baker, 2017; Collins et al., 2016). Athletes experience physical and psychological stress during training and competitions that can inhibit performance and foster negative health implications without proper coping mechanisms (McCormick et al., 2018; Sakar & Fletcher, 2014). Doherty et al. (2016) found that elite athletes with depression also used maladaptive (e.g., isolation from social support, alcohol consumption, lack of understanding of depression by others, excessive training) and adaptive (e.g., commitment to recovery, acceptance and expression of their true self in therapy, and support for significant others) coping strategies. Perhaps associated with the use of these coping strategies, Beable and colleagues (2017) highlighted the relatively low use of antidepressants among athletes compared to the general population. In research into the mechanisms of coping with depression in elite athletes, social support is consistently found. Higher degrees of social support, particularly tangible support from sporting sources and personal sources, are associated with minor symptoms of depression. Teammates stood out as one of the most useful sources of support, while athletes expressed a desire for more support than coaches (Sullivan et al., 2020).

ANXIETY IN SPORTS – COMPETITIVE ANXIETY

Anxiety disorders encompass a group of conditions characterized by excessive worry, tension, and excessive fear related to anticipating future events (American Psychiatric Association, 2013). In other words, anxiety arises as a reaction to situations that an individual perceives as threatening. These situations can range from threats to self-confidence, uncertain or frustrating circumstances, to situations where pressure is present, such as the pressure to win (Sanader et al., 2021). Some authors, like Mascarenhas and Smith (2011), consider anxiety a multidimensional emotion that includes both somatic and cognitive components. Given that anxiety impacts attention, information processing, executive functions, and muscle tension, understanding anxiety in sports is crucial due to its repercussions on athletic performance (Rice et al., 2019). In sports psychology, the construct of *competitive anxiety* represents the fear that arises during sports competition, even before it begins. This fear implies that performance may not be optimal, unexpected events might occur, or the competition will be too demanding for the athlete. All of this results in specific physiological arousal, behavioral responses, and anxious thoughts (Reardon et al., 2021). According to Mascarenhas and Smith (2011), one of the reasons why the presence of anxiety leads to changes in athletic performance is that thoughts about potential failure act as distractions, hindering effective decision-making in sports. Another reason is that cognitive anxiety interferes with the cognitive processes necessary for processing athletic performance itself (Mascarenhas & Smith, 2011). Furthermore, it has been established that the interpretation of anxiety is linked to coping strategies - whether an avoidance approach or a problem-focused approach is used. Athletes who interpret anxiety positively tend to employ more effective coping strategies compared to those who interpret it negatively (Hatzigeorgiadis & Chroni, 2007). The authors imply that it is essential to educate athletes and their coaches not only on regulating anxiety symptoms but also on understanding that anxiety is a normal occurrence in stressful situations, such as sports competitions, and that its symptoms are not inherently negative (Hatzigeorgiadis & Chroni, 2007). In support of the importance of interpreting anxiety in sports, there are findings from Jones and colleagues (1994) who dealt with differences in anxiety between elite and non-elite swimmers. Although the two groups did not significantly differ in experiencing cognitive and somatic anxiety, they differed in the ways of interpreting anxiety symptoms, which certainly contributes to sports performance. Specifically, elite athletes interpreted their anxiety symptoms before competition more positively, which is related to their higher levels of self-confidence. This research is an example of how the interpretation of anxious symptoms can greatly contribute to overall performance. For example, if an athlete does not perceive their cognitive and physiological symptoms of anxiety as anxiety, but quite the opposite, as a state of motivation and positive excitement, they will be facilitators for the performance itself (Jones et al., 1994).

COMPETITIVE ANXIETY IN INDIVIDUAL AND TEAM SPORTS

Researchers in the field of sports psychology were also interested in whether anxiety levels are higher in athletes who engage in individual sports or team sports. This research question was addressed by Pluhar and colleagues (2019) who found that anxiety is more present in young athletes who engage in individual sports than in athletes who engage in team sports. The reason they cite is that athletes who engage in individual sports are more goal-oriented and less focused on the fun that sport provides. Also, as a possible reason, they mention the nature of individual sports where athletes are lonelier, which can lead to internal attributions after experiencing failure and setting too high goals that are not good for the athlete himself. On the other hand, in team sports, there is greater social support which makes the sport more fun and thus reduces stress (Pluhar et al., 2019).

DETERMINANTS OF ANXIETY IN ELITE SPORTS

In addition to understanding the field of anxiety in sports, it is necessary to know what the determinants of anxiety in elite sports are. Rice and colleagues (2019) conducted a meta-analysis with the aim of determining the determinants of anxious symptoms and disorders in the population of elite athletes. The determinants of anxiety among elite athletes were found to be female gender, younger age, and recent experience of unexpected life events. Also, determinants include musculoskeletal injury and dissatisfaction with a sports career. Therefore, the authors suggest that in working with elite athletes, some broader environmental factors that contribute to athletes' injuries and their dissatisfaction with their career should certainly be taken into account. Furthermore, the importance of early prevention of anxiety disorders in elite athletes is emphasized in order to reduce the likelihood of the occurrence of other mental health problems (Rice et al., 2019). Furthermore, one of the constructs that is also associated with competitive anxiety is perfectionism, which is defined as striving for flawlessness and setting extremely high goals that lead to excessive critical evaluation of one's own behaviour (Flett and Hewitt, 2002). As some authors consider perfectionism maladaptive, while others consider it adaptive, Stoeber and colleagues (2007) conducted a study with the aim of determining the relationship between competitive anxiety and perfectionism in athletes, using two facets of perfectionism - striving for perfection which is associated with adaptive perfectionism and negative reactions to imperfection, which is associated with maladaptive perfectionism. The authors found a positive correlation between overall perfectionism and cognitive and somatic anxiety present during competition, suggesting that perfectionism is generally associated with dysfunctional features in sports. However, further processing revealed that adaptive perfectionism was not significantly associated with competitive anxiety, while maladaptive perfectionism was positively correlated with anxiety. These findings imply that striving for perfection in athletes does not necessarily have to be bad. Namely, those athletes who are focused on achieving the best possible performance and who do not react negatively if they fail in this endeavour, potentially have lower levels of cognitive and somatic anxiety and also have greater self-confidence (Stoeber et al., 2007).

CONCLUSION

Knowledge about depression and anxiety in sports is crucial not only for sports psychologists but also for the entire team supporting athletes – coaches, doctors, physiotherapists, nutritionists, and the athletes themselves. Early recognition of depressive and anxious symptoms in athletes enables the prevention of further development of depressive and anxiety disorders, which consequently impacts sports performance.

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IMPACT OF PHYSICAL ACTIVITY ON PERCEIVED STUDENT STRESS LEVEL AND MENTAL HEALTH - EVIDENCE-BASED RESEARCH

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ABSTRACT

The brain wants two main things for us: to keep us alive and to keep us moving. The part that keeps us alive is controlled by the autonomic nervous system, which regulates breathing, heart rate, digestion and much more. Physical activity and exercise are voluntary, and we are responsible for it.

The World Health Organization (WHO) and the Centre for Disease Control and Prevention (CDC) have recommended that adults should aim for at least 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity aerobic activity per week, or an equivalent combination of both.

Data for this study were collected using standardized questionnaires and self-assessment tests. This combined quantitative study was conducted to compare the way in which 1st and 2nd year physiotherapy students fulfil the recommended 150 minutes of physical activity per week and how this relates to their perceived stress levels and depression score according to the Zung Self-Rating Depression Scale (SDS). In this way, an attempt was made to assess the impact of physical activity on the mental health of 1st and 2nd year physiotherapy students. The results suggest a potentially significant positive correlation between the frequency of physical activity and mental health/quality of life. The recommendations should be put into practice to maintain the mental health of current students in the future.

Key words: students, stress level, depression, physical activity

1. INTRODUCTION

Physical activity, which is a key element of a healthy lifestyle, is widely recognised for its impressive contribution to physical health (including optimising cardiovascular fitness, muscle strength, bone mineral density and neuromusculoskeletal form), but its positive impact also extends to mental health.

Research shows that physical activity also plays a key role in this area and is an important strategy for coping with stress, especially in students (Mahindru et al., 2023; Rodríguez-Romo et al., 2023).

According to the World Health Organisation (WHO), mental health is a state of well-being in which a person recognises their strengths, copes with normal stress, works productively and contributes to the community. This is more than the absence of mental disorders, but a state in which a person realises their full potential and leads a fulfilled and productive life. In the context of students, academic stress, physical inactivity and lack of sleep can significantly affect this well-being (Zhu Et al., 2021). Research confirms a significant positive correlation between physical activity and mental health. However, this relationship can be influenced by factors such as age, gender, level of physical activity and amount of physical activity (Rodríguez- Romo Et al., 2023).

This study aims to deepen the understanding of the different types and levels of physical activity in relation to students' perceived stress and mental health. The aim is to fill a gap in knowledge and provide practical guidance to improve student wellbeing. The research focuses on the effects of different types and intensities of physical activity on mental health and the ability to cope with stress.

2. PARTICIPANTS (MATERIALS) AND METHODS

2.1. PARTICIPANTS

The study was conducted among first- and second-year physiotherapy students at the Faculty of Health Studies in Rijeka. 48 participants of both sexes (37 women and 11 men) aged between 19 and 23 years. Participation in the study was voluntary and anonymous.

2.2. Procedure and instruments

In a cross-sectional study conducted in March and April 2024, quantitative methods were used to compare how first and second year physiotherapy students completed their 150 minutes of recommended physical activity per week and how this related to their perceived stress levels and depression.

2.2.1. IPAQ questionnaire

The International Physical Activity Questionnaire (IPAQ) was used to assess physical activity. The questionnaire is aimed at people aged 15 to 69 years and aims to assess physical activity during the last seven days. The results are expressed as continuous variables in units of MET (Metabolic Equivalent Task) – (1 MET corresponds to an oxygen consumption at rest of 3.5 ml / kg) minutes, especially for each type of activity (Alić, 2015). The reliability of the Croatian version of the IPAQ questionnaire was tested using the test-retest method on a random sample of 122 adult Croatian residents from the general population aged 15 to 65 years (60.1% of whom were women) and on a random sample of 133 students, tenants of student residences in Zagreb (61.1% female) (Pedišić et al., 2011). The results are categorised as high or very physically active, moderate and low intensity according to the defined criteria.

2.2.2. Zung Depression Self-Assessment Scale (SDS)

The Zung Depression Self-Assessment Scale (SDS) consists of 20 questions that participants answer on a Likert scale of 1-4 (1 – rarely and 4 - most of the time) to express the extent to which these statements apply to them. The answers are scored according to the principle that negative questions are scored so that the lowest score is 1 and the highest score is 4, while positive questions are scored the other way round.

The final point total (20-80 points) expresses the state of the respondent. The higher the score, the more pronounced the depressive symptoms. Up to 50 points are regarded as a normal mental state, from 50 to 59 as mild depression, from 60 to 69 as moderate depression and from 70 as severe depression. The scale is anonymous. It measures the cognitive, emotional, physiological and behavioural aspects of depression and provides an insight into the emotional state of the subjects (Tomić, 2018). In accordance with the data obtained, parametric tests with a statistical significance level $p < 0.05$ were used.

3. RESULTS

Physical activity

The study involved 48 first- and second-year students (37 women and 11 men) from the Faculty of Health Studies in Rijeka, aged 19-20 years. The average BMI of all respondents was 21.7 (40.4% of respondents were overweight and 4.3% were obese). Examination of the results of the IPAQ questionnaire shows that 50% of the respondents had a consumption of over 2000 MET-min in the high category, 39% in the moderate category, but 10% of the students were in the low physical activity category (Table 1).

Table 1 Results of average BMI in physiotherapy students and physical activity categories

	N	%
Malnutrition BMI<18.5	1	2,1
normal body weight BMI 18.5-24.9	25	53,2
excessive TT BMI 25-29.9	19	40,4
Obesity >30	2	4,3
IPAQ categories		
High	24	50,0
moderate	19	39,6
Low	5	10,4

22.91% of respondents fulfil the guidelines for the recommended levels of physical activity and adhere to the recommended duration. Of the remaining 77% of respondents, 45.94% do not engage in extremely strenuous physical activity at all. For moderate physical activity, which recommends at least 150-300 minutes of physical activity, participants were found to average 47.29 minutes, again below the recommended level. 14.5% of them did not engage in moderate physical activity at all and no one met the WHO guidelines of 150-300 minutes. A large number of participants walk more than 10 minutes per day, with an average of 5.83 days in the last 7 days and an average duration of 48.36 minutes. A large proportion of respondents spent more than 275.96 minutes a day sitting (4-5 hours). The categorisation of respondents according to the IPAQ questionnaire is shown in Table

Table 2 Average IPAQ questionnaire responses for physical activity

Question for participants for physical activity during the last 7 days	Average response
How many days have you been doing extremely strenuous physical activities such as lifting heavy objects, digging, aerobics or fast cycling?	2.19 days
On days when you performed extremely strenuous physical activities, how much time (expressed in minutes) did you normally spend?	48.02 minutes
How many days have you performed moderate physical activity such as carrying light loads, riding a bike regularly or playing tennis?	3.04 days
On days when you engaged in moderate physical activity, how much time (expressed in minutes) did you normally spend?	47.29 minutes
How many days have you walked for at least 10 minutes without interruption?	5.83 days
On days when you walked for so long, how much time (expressed in minutes) did you normally spend walking?	48.36 minutes
How much time (expressed in minutes) did you normally spend sitting during one working day?	275.96 minutes

Self-assessment of depression

Of the 48 respondents, only three fell into the mild depression category after the Zung self-assessment scale was analysed, while the other 45 remained in the normal mental state category. An analysis of the 1st, 10th and 12th questions of the Zung scale revealed that the majority of participants (54.17%) rarely feel sad and depressed, while 37.5% occasionally experience such feelings. Fatigue without reason is rarely (37.50%) or occasionally (39.58%) experienced by the majority of participants, indicating a relatively good energy level. However, a significant number of participants (18.75%) frequently experience fatigue for no apparent reason. The majority of participants (65%) can perform daily activities without any problems. Only 12.5% can do so rarely and 22.9% have occasional difficulties.

4. DISCUSSION

The results show that physiotherapy students are not predominantly active when it comes to extremely strenuous physical activities. According to WHO guidelines, people between the ages of 18 and 64 should engage in between 75 and 150 minutes of vigorous physical activity, while participants averaged 48.02 minutes (WHO, 2022). Although there are no guidelines for the recommended duration of sitting, as this should generally be as low as possible, a lack of physical activity can have a negative impact on physical health, as a decrease in physical stimulation can lead to a loss of functional abilities and negatively affect the work of the cardiovascular and respiratory systems (World Health Organisation, 2022).

The results obtained indicate that first- and second-year students have moderate levels of physical activity and do not show significant symptoms of depression or poorer mental health. Although the original hypothesis assumed a positive correlation between physical activity and mental health, the results did not confirm the expected relationship in this population. Active and purposeful leisure has a profound impact on an individual's mental health and overall well-being. Research shows that people often feel more happiness and satisfaction when they engage in active and structured leisure activities compared to passive or unstructured activities (Iso-Ahola and Baumeister, 2023; Schmiedeberg and

Schröder, 2017). Studies have shown that the level of physical activity in adolescence and youth can predict the level of physical activity in later years (Horvat et al., 2013). And there was a greater reduction in symptoms of depression, anxiety and burnout in people who had higher levels of activity compared to others (Lindwall et al., 2014.,.).

This may suggest that the potential factors need to be explored further. The causes could be temporary, such as lack of sleep or the effects of stressful situations.

Regardless of the unfinished hypothesis in this context, physical activity remains a key factor in improving mental health. This is of particular importance for physiotherapy students, future health professionals whose practise will involve promoting the physical and mental health of patients.

5. CONCLUSION

Physical activity is associated with the maintenance of mental health in all population groups, including students, and emphasises the importance of physical activity as a protective factor for mental health. The results of this study can provide a valuable basis for the development of programmes in physiotherapy and the wider health sector. These programmes should focus on promoting healthy lifestyles and improving the mental health of students.

Through continued research, education and innovative strategies, we can ensure that physiotherapy students not only develop the knowledge and skills needed to promote physical health but are also able to promote and maintain their own mental wellbeing. This will enable them to become successful and healthy physiotherapists who are prepared to take a holistic approach to working with patients. It is expected that valuable insights will be incorporated into interventions and strategies to promote physical activity in students, with the aim of improving mental health and stress management skills.

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EVALUATION OF MENTAL HEALTH AMONG UNIVERSITY STUDENTS AT THE FACULTY OF KINESIOLOGY UNIVERSITY OF ZAGREB

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ABSTRACT

Introduction: The study aimed to evaluate the mental health of kinesiology students in relation to socio-demographic variables. **Methods:** A cross-sectional study was conducted during the academic year 2022-2023 among all five years of the integrated undergraduate and graduate university kinesiology studies at Zagreb University. After signing a consent form, students anonymously completed a paper questionnaire. A self-constructed questionnaire was used, including socio-demographic items and self-evaluation of economic status (SES), the Generalized Anxiety Disorder 7-item (GAD-7) scale, and the Patient Health Questionnaire (PHQ-9). **Results:** Among the 497 students, there were significantly more men, 64.19% (N=319), than women, 35.81% (N=178). ($p < 0.001$). On average, they were 21.17 years old (18 to 31). According to their SES, 12% were below average, 57% were average, and 30% above average. The average PHQ-9 score was 8.83, and the average GAD-7 score was 4.97. Women had significantly higher PHQ-9 scores than men, 9.99 vs. 8.30, and GAD-7 scores, 6.19 vs. 4.29 ($p < 0.001$). From 1- 5th study year, the average PHQ- scores were 9.68, 7.80, 10.3, 8.12, and 7.71, while the average GAD-7 scores were 5.76, 3.90, 5.53, 4.94 and 4.21. There is a significant positive correlation between GAD-7 and PHQ-9, $r = 0.807$ ($p < 0.001$). **Conclusion:** There are visible differences in the mental health of kinesiology students. Students in their first and third study years experienced higher levels of depression and anxiety, and the prevalence is higher for female students. Higher SES is associated with better mental health in terms of anxiety and depression.

Keywords: kinesiology students, socioeconomic status, PHQ-9, GAD-7

INTRODUCTION

Mental health issues represent a significant health concern for university students (European University Association, 2024) since numerous social and academic pressures negatively influence their physical and mental health (Alshamlan et al., 2020). The student population has an especially high risk for mental disorders since almost two-thirds appear by the mid-20s (American Psychological Association,

2013). It is estimated that 40% of European students are affected by mental disorders (European University Association, 2024), mostly depression and anxiety. Depression is characterized by a low mood and constant unexplained sadness (Andersen & Taylor, 2017). Anxiety is an emotional state characterized by a feeling of anxiety and fear caused by an actual or possible danger (Anuradha et al., 2017).

Mental problems, especially depression and suicide, are strongly associated. The previous study addressed the need for further research on the mental health of student-athletes since suicide rates increased, as well as the prevalence and severity of depression in young adults (Neal et al., 2013). Mental health represents a public health priority, and almost one in two young Europeans report unmet needs for mental health care (European Commission, 2024). Previous studies showed poor mental health of university students in Croatia (Milić et al., 2019; Talapko et al., 2021), but the mental health of kinesiology students has not yet been researched. This study aimed to evaluate the prevalence of anxiety and depression among kinesiology students and its association with selected socio-demographic variables.

METHODS

After obtaining institutional Ethical approval, a cross-sectional study was conducted during the 2022-2023 academic year among students in all five years of integrated undergraduate and graduate kinesiology study at Zagreb University. Prior research students were informed about the objectives of the research. A self-constructed and self-administered paper questionnaire was distributed by convenience sampling method to students during their regular classes. The questionnaire included socio-demographic items such as age, gender, parents' education (primary, secondary, tertiary), first-generation college students (parents did not complete a 4-year college or university degree), and self-evaluation of economic status in below-average, average, and above-average categories. Validated instruments, self-administered Patient Health Questionnaire-9 (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7) were used to determine the frequency and severity of depression and anxiety symptoms. (Kroenke et al., 2001; Levis et al., 2019; Spitzer et al., 2006). GAD-7 is based on seven items scored from 0 to 3, and the score can range from 0 to 21. The cut-off scores for mild, moderate, and severe anxiety symptoms are 5, 10, and 15, respectively (Kroenke et al., 2007).

The PHQ-9 is a screening questionnaire for depressive symptoms that asks participants to rate the frequency of 9 common symptoms of depression within the past two weeks (Richardson et al., 2010). Scores range from 0 to 27, with the following categories for depression: 0 to 4 (minimal), 5 to 9 (mild), 10 to 14 (moderate), 15 to 19 (moderately severe), and 20 to 27 (severe).

Statistical analysis

Descriptive and analytical statistics were used; the results were presented numerically and graphically. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to test the normality of the distribution, and parametric and non-parametric statistical methods were applied. The chi-square test was used to test the differences in proportions, and the t-test or Mann-Whitney test was used to test the difference between two means. ANOVA, or the Kruskal-Wallis test, was used to compare mean values among groups for GAD-7 and PHQ-9. Pearson's or Spearman's correlation coefficient was used to assess the linear relationship between two variables. A p-value less than 0.05 was considered statistically significant. All analyses were conducted in the JAMOV program, v 2.4 (The Jamovi project, 2023).

RESULTS

Table 1. Students according to year of study and sex

Year of study	Males (N, %)	Females (N, %)	Total, N	%
First	84 (26%)	52 (29%)	136	27.36%
Second	62 (19%)	21 (12%)	83	16.70%
Third	62 (19%)	32 (18%)	94	18.91%
Fourth	56 (18%)	38 (21%)	94	18.91%
Fifth	55 (17%)	35 (20%)	90	18.11%
Total, N	319	178	497	100%

N=absolute number, %=percentage

All students (n=497) filled the questionnaire during classes, and response rates across academic years were as follows: 1st year 136/247, 2nd year 83/226, 3rd year 94/175, 4th year 94/149, 5th year 90/133, with an overall response rate of 53.33%.

Among 497 students, there were significantly more males in the total sample ($p < 0.001$). The age ranged from 18 to 31 years, and females and males had a similar average age of 21.3 years vs 21.1 years, respectively. ($p = 0.465$). In the total sample, the largest number of students was in the 1st year. The proportion of students according to sex and academic year was highest in 1st year, both for males and females (**Table 1**).

Table 2. Parents' level of education

Level of education	Mother (N, %)			Father (N, %)		
	Males	Females	Total	Males	Females	Total
primary	8 (2.51%)	3 (1.69%)	11 (2.21%)	3 (0.94%)	2 (1.12%)	5 (1.01%)
secondary	157 (49.22%)	93 (52.25%)	250 (50.30%)	193 (60.50%)	104 (58.43%)	297 (59.76%)
tertiary	154 (48.28%)	82 (46.07%)	236 (47.48%)	123 (38.56%)	72 (40.45%)	195 (39.24%)
Total	319	178	497	319	178	497
	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %

N=absolute number, %=percentage

The highest proportion of maternal and paternal education was secondary for males and females. A higher percentage of mothers had tertiary education compared to fathers. (**Table 2**).

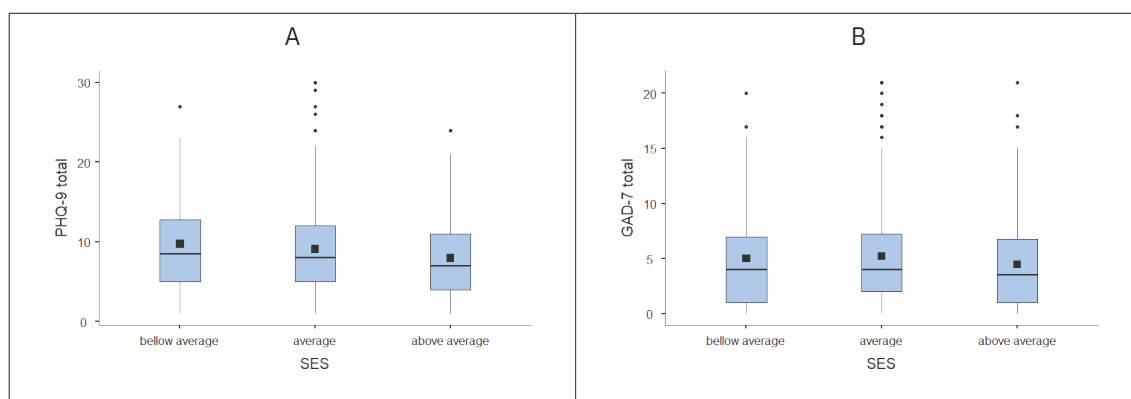
Table 3. Prevalence of anxiety and depression according to categories

	Categories	N	% of total	Cumulative %
GAD-7	minimal	277	55.8%	55.8%
	mild	141	28.4%	84.3%
	moderate	55	11.1%	95.4%
	severe	23	4.6%	100.0%
PHQ-9	minimal	117	23.6%	23.6%
	mild	201	40.5%	64.1%
	moderate	114	23.0%	87.1%
	moderate severe	32	6.5%	93.5%
	severe	32	6.5%	100.0%

N=absolute number, %=percentage, GAD-7= Generalized Anxiety Disorder 7-item, PHQ-9= Patient Health Questionnaire

The most prevalent category for GAD was minimal - 55.8%, and for PHQ-9 mild - 40.5% (**Table 3**).

The average PHQ-9 and GAD-7 scores were 8.83 and 4.97, respectively. Females had significantly higher average PHQ-9 scores, 9.99 vs. 8.30, and significantly higher average GAD-7 scores than males, 6.19 vs. 4.29 ($p<0.001$). From 1st to 5th study year, there was a mild decreasing trend for depression and anxiety, and the average PHQ scores were 9.68, 7.80, 10.3, 8.12, and 7.71, while the average GAD-7 scores were 5.76, 3.90, 5.53, 4.94, and 4.21. The correlation between GAD-7 and PHQ-9 is positive and significant, $r=0.807$ ($p<0.001$) (data not shown).

Figure 1. Self-evaluation of economic status (SES) and mental health.

A) depression (PHQ-9) and SES, B) Anxiety (GAD-7) and SES.

According to the SES, 12% of all students were in the below-average, 57% on average, and 30% in the above-average category. The proportion of males vs. females in the below-average SES category was 12% vs. 14%, in the average SES category 57% vs. 58%, and in the above-average SES category 32% vs. 28%. (data not shown)

Higher SES is associated with lower levels of anxiety and depression. Average PHQ-9 values according to SES categories were as follows: below-average was 9.74 (SD=6.06), in average SES category 9.08 (SD=5.71), and above-average SES category 7.96 (SD=4.86). Differences among SES categories were not

significant ($p=0.08$). Average GAD-7 values in the below-average SES category were 5.00 ($SD=4.97$), in the average SES category 5.21 ($SD=4.66$), and in the above-average SES category 4.49 ($SD=4.02$). No significant difference was found among SES categories according to average GAD-7 values ($p=0.416$) (Figure 1).

Table 4. First-generation college students and mental health

	First-generation college students	N, %	Mean	SD
GAD-7	Yes	196	4.52	4.31
	No	300	5.26	4.64
PHQ-9	Yes	196	8.35	5.31
	No	300	9.14	5.67

N=absolute number, %=percentage, GAD-7= Generalized Anxiety Disorder 7-item, PHQ-9= Patient Health Questionnaire, SD=standard deviation

First-generation college students had lower average GAD-7 scores than those who were not in this category, but the difference was insignificant ($p=0.07$). Average PHQ-9 scores were also lower among first-generation college students, but the difference was insignificant ($p=0.11$) (Table 4).

DISCUSSION

This is the first study that evaluated the prevalence of anxiety and depression among kinesiology students at Zagreb University and the association of mental health issues with selected socio-demographic characteristics.

Among 497 students, the proportion of males is significantly higher - the number and proportion of students according to sex varied across academic years. The decrease in the number of students after the 1st year is most likely attributable to academic challenges at the start (Table 1). The majority of students have parents with secondary education (Table 2), which is the most common level in the educational structure of the Croatian population (Državni zavod za statistiku, n.d.).

There are differences in the relevance of clinical categorization between anxiety and depression. The most prevalent category for anxiety was "minimal", 55.8%, but mild depression affects as much as 40.5% of students. The minimal anxiety category was followed by mild anxiety (28.4%) and moderate anxiety (11.1%), while 4.6% had severe anxiety (Table 3). The comparison of the results is partly limited by the heterogeneity of previous studies, mainly in terms of different study populations. Still, the study conducted in China found that 22% of student-athletes had moderate to severe anxiety disorder (Li et al., 2021), a higher percentage than the kinesiology students in our study. A high proportion of clinically relevant categories of depression in this study, such as mild depression in 40.5% of students, is in line with previous research. Depressive symptoms are quite common among athletes (Proctor & Boan-Lenzo, 2010; Yang et al., 2007). According to a study by McGuire et al. 2017, depression among kinesiology students ranges from 10% to 26% (McGuire et al., 2017). In a study of German athletes, the prevalence of depressive symptoms in athletes was similar to that in the general population (Nixdorf et al., 2013).

The average PHQ-9 and GAD-7 scores were 8.83 ± 5.54 and 4.97 ± 4.52 , respectively. The average value of PHQ-9 was higher than in the Chinese study 4.5 ± 4.4 , respectively (Wang & Li, 2022).

Sex is one of the most widely cited factors regarding mental health issues in the general population, and university settings do not differ in terms of different mental health stratifications according to gender. Being a female is associated with a higher prevalence of mental health issues, such as depression,

anxiety, and psychological distress (Mokhtari et al., 2013). In our study, females had significantly higher average PHQ-9 scores, 9.99 vs. 8.30, and significantly higher average GAD-7 scores than males, 6.19 vs. 4.29. The USA study of female athletes reported higher levels of depressive symptoms, social anxiety, and non-support than male athletes (Storch et al., 2005). A previous study also suggests that female athletes in individual sports face a higher risk of developing anxiety symptoms compared to their counterparts in team sports, as well as male athletes in both personal and team sports (Brenner et al., 2023). This highlights the importance of separate individual and team sports analyses when analyzing anxiety levels.

Our results also confirmed female disadvantage in both GAD-7 and PHQ-9 questionnaires. These findings are in line with previous research, which confirms that female colleagues experience higher levels of anxiety and depression than their male counterparts. (Garver et al., 2021; Herrero et al., 2021). In addition, research by Wolanin et al. showed that female kinesiology students show more depressive symptoms, but the prevalence of depression among kinesiology students was similar to that in the general student population (Wolanin et al., 2016), which somewhat corresponds to the results of this study. Research conducted on kinesiology students in China has shown that physical activity and reducing a sedentary lifestyle contribute to students' mental health (Wang & Li, 2022)

We observed a mild decreasing trend for depression and anxiety from 1st to 5th study year students, and the average PHQ scores were 9.68, 7.80, 10.3, 8.12, and 7.71, while average GAD-7 scores were 5.76, 3.90, 5.53, 4.94, and 4.21. These results were opposed to findings of a previous study of kinesiology graduate students, which reported higher levels of depression, as measured by the PHQ-9 questionnaire, in graduates than among 1st-year kinesiology students and suggested that the length of the study negatively affects students' mental health (Bastemayer & Kleinert, 2021). This may be due to increased concerns about completing the program and fears about future employment. However, our study found the highest average PHQ-9 score in the 3rd (10.3 ± 6.80) and 1st (9.68 ± 6.08) years of study. We also found significant comorbidity between GAD-7 and PHQ-9, $r = 0.807$, and they overlap in the mental health continuum, which is consistent with previous studies (Bártolo et al., 2017).

Previous studies have frequently reported and confirmed a negative correlation between SES and mental health (Vukojević et al., 2017). Low income and lower educational status could deteriorate individual health status (Šućur & Zrinščak, 2007). Still, the multidimensional concept of SES, determined by the three main parameters, household income, education, and occupation, should always be emphasized. As expected, most students categorized themselves in the average SES category (57%), while 12% of all students were below and 30% above average. Students in the 1st and 3rd year have, on average, higher depression and anxiety scores. Students with above-average SES had lower anxiety and depression values, but differences among SES categories were not significant (**Figure 1**).

We also studied anxiety and depression in first-generation college students since they are more likely to experience mental health issues and don't know how to deal with the demands of academic environments (Rockwell & Kimel, 2023). In our study, the difference between anxiety and depression scores in first-generation college students and other students turned out to be non-significant. Surprisingly, they had lower average values of anxiety and depression (**Table 4**). It has been observed that first-generation college students are at a higher risk of attrition than non-first-generation students (Ishitani, 2003). Therefore, the smaller number of students in our sample after the 1st year could be attributable to first-generation college student attrition.

The major strength of this study is the large sample size ($n=497$) which included all students in the classes during the data collection. Additionally, the Faculty of Kinesiology in Zagreb is the largest in Croatia. We used GAD-7 and PHQ-9, psychometrically sound instruments that can be incorporated as an economical and easily applicable screening tool. This single-center study partially limits the generalization of the results to other kinesiology schools. Also, the type of sport could influence the severity of depression, but we did not conduct such a stratified analysis. However, previous studies confirmed that individual athletes experience higher levels of depressive symptoms compared to team athletes. One limitation of the study was the lack of inclusion of psychosocial stressors specific to university study,

such as difficulties with time management, exam anxiety, pressure to succeed, and coping with study. These factors are potentially modifiable and important for making mental health intervention plans. Additionally, due to the cross-sectional study design, causal relationships between risk factors and mental health issues should be interpreted with caution.

CONCLUSION

Mental health represents a major health problem among kinesiology students. This study found that 1st and 3rd-year students are at high risk for anxiety and depression. Mental health disparities are associated with the female gender but also with lower SES, and these groups need more social and professional support. There is significant comorbidity between anxiety and depression. Faculty must put additional effort into raising awareness, conducting research, and increasing resources for vulnerable groups' access to mental health support.

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DIFFERENCES IN WORKING MEMORY DEPENDING ON THE LEVEL OF PHYSICAL ACTIVITY IN FEMALE STUDENTS OF THE FACULTY OF EDUCATION AT THE UNIVERSITY OF OSIJEK

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ABSTRACT

It is known that physical activity brings many benefits in terms of improving health status, as well as cognitive development. The aim of the study was to determine the difference in working memory based on the level of physical activity of female students at the Faculty of Education. In order to determine the differences in the level of physical activity and working memory in a sample of 160 female students from the Faculty of Education were applied the International Physical Activity Questionnaire (IPAQ-SF, short version) and a working memory questionnaire. The results showed that the group of participants with a high level of physical activity achieved the best results in the working memory questionnaire, while the group with a moderate level of physical activity achieved the weakest results in the working memory questionnaire, and the group with the lowest level of physical activity achieved average results in the working memory questionnaire. These results could be attributed to the already known positive impact of physical activity on individuals, as well as the lifestyle of physically active people. Namely, physically active individuals also have a healthier lifestyle, which can contribute to better working memory.

Key words: physical exercise, mental health, memory, students

INTRODUCTION

It is well-known that physical activity has many benefits for improving health and for developing cognitive abilities. Millions of years of evolution have adapted the human body and mind to physical activity, resulting in many positive effects on human health (Marijan, 2016). Physical activity includes every movement of our muscles, whether performing daily tasks or exercising (Best, 2010). The modern technology today enables precise recording of brain activity and has contributed significantly to research into the relationship between cognitive and physical characteristics of individuals, so it can be said that physical, intellectual, and emotional development are inextricably linked (Đonlić et al., 2015). Research has found that physical activity (which includes any movement of the muscles) and exercise (which is the intentional participation in physical activity to improve fitness) play a critical role in a person's cognitive development (Best, 2010). Many studies discuss the relationship between physical activity and improved brain function, as evidenced by the results of better grades of children who had additional classes of physical and health education (Mitar, 2021). Physical activity leads to an improvement in academic and cognitive skills, such as information processing speed and memorization, as well as executive functions (Pintar, 2020). It is critical to promote physical activity as the global prevalence of

insufficient physical activity is high and it is one of the leading risk factors for mortality. A meta-analysis conducted in 2011 included 15 studies and 33 816 respondents, of whom 3210 showed deterioration in cognition during a follow-up period of 1–12 years. A high level of physical activity reduced the risk of cognitive decline by 38% (HR=0.62, 95% CI 0.54–0.70) (Erickson et al., 2019). Memory is defined as “the ability to acquire, retain, and use information” (Zarevski, 2007) and includes the processes of encoding, storage, and retrieval (Stangor and Walinga, 2014). In recent years, “working memory” has been one of the prominent research topics in cognitive psychology. Baddeley (1992) defines working memory as a system that allows us to temporarily store and manage information that we need for complex cognitive tasks such as language comprehension, learning, and reasoning.

The aim of this paper was to determine the difference in working memory concerning the level of physical activity of female students enrolled at the Faculty of Education in Osijek.

METHODOLOGY

Respondents

The sample of respondents consisted of 160 female students studying at the Faculty of Education in Osijek. The research involved female students from the first and second year of the Undergraduate university study programme of Early and pre-school education, Integrated undergraduate and graduate university Class teacher study and Undergraduate study program in Educational Rehabilitation.

Instruments

The International Physical Activity Questionnaire (IPAQ-SF, short version) was used to determine differences in the level of physical activity and working memory. The Working Memory Questionnaire was used to measure difficulties in working memory. The questionnaire was designed by Vallat-Azouvi et al. (2012) based on Baddeley's model of memory, suggesting that the concept of working memory does not only refer to short-term memory, but also encompasses attention and executive functions (Vallat-Azouvi, Pradat Diehl & Azouvi, 2012).

Measurement protocol

The data were collected via an anonymous questionnaire that students completed at the beginning of the 2nd semester of the academic year 2023/2024 as part of the Physical education class.

Data processing methods

Descriptive statistics were carried out to interpret the Working Memory Questionnaire and physical activity level for the observed variables. A t-test for independent samples was carried out to test the hypothesis, i.e., whether there is a statistically significant difference in the assessment of personal working memory regarding the level of physical activity.

RESULTS

A total of 160 students participated in the study, with the fewest students reporting a low level of physical activity (N=44) while slightly more of them reported a medium level of physical activity (N=52). Most students reported a high level of physical activity (N=64). Before testing the hypothesis, the respondents were divided into two groups: the first group consisted of those who were hardly physically active (identified as low physical activity respondents), while the second group consisted of physically active respondents (identified as medium and high physical activity respondents). There were slightly more participants in the first group (N=96) than in the second group (N=64), but there were more participants in each group in comparison to dividing the respondents into three groups.

Table 1 shows the descriptive data for the Working Memory Questionnaire.

Table 1. Descriptive data for the Working Memory Questionnaire

Variable	M	SD	Min.	Max.	K-S	α
Working Memory Questionnaire	3.55	0.61	1	5	0.05	0.91

Legend: M – arithmetic mean; SD – standard deviation; Min. – minimum; Max. – maximum; K-S – the result of the Kolmogorov-Smirnov test; α – Cronbach's alpha coefficient of reliability

The data show that the respondents most frequently rated their working memory with an average score ($M=3.55$, $SD=0.61$). The Kolmogorov-Smirnov test, which checks the normality of the distribution, was carried out to see whether it is justified to use parametric procedures in the further processing of the data. The results show that the distribution of responses to the IPAQ-SF does not deviate from the normal distribution and that it is permissible to use parametric procedures. The reliability of the IPAQ-SF was also examined. It is highly reliable ($\alpha=0.91$) and meets the conditions for use in further statistical processing.

Table 2. Descriptive data for each level of physical activity

Level of physical activity	M	SD
Low	3.48	0.55
Medium	3.43	0.63
High	3.70	0.60

Legend: M – arithmetic mean; SD – standard deviation

The data in Table 2 show that female students with a high level of physical activity have the best working memory, followed by female students with a low and medium level of physical activity.

A t-test of independent samples was done to test the hypothesis, i.e., whether there is a statistically significant difference in the assessment of personal working memory concerning the level of physical activity. The results are shown in Table 3.

Table 3. T-test results

Variable	Physical activity	M	SD	ss	t	p
Working memory	YES	3.70	0.60	158	-2.66	.01*
	NO	3.45	0.59			

Legend: M – arithmetic mean; SD – standard deviation; ss – degrees of freedom in the source; p – significance; * – significant at 5%

DISCUSSION

The paper aimed to determine the difference in working memory considering the level of physical activity of female students at the Faculty of Education in Osijek.

When examining the level of physical activity, 28% of female students reported a low level of physical activity, 32% reported a medium level of physical activity, and 40% of female students reported a high level of physical activity. 28% female students stated that they did not exercise enough, which is high compared to the research findings of Horvat et al. (2011). Out of 180 respondents in their sample, 27 respondents did not engage in enough physical activity. Since students of the Faculty of Education in Osijek are familiar with the positive effects of physical activity on physical and mental health through the Kinesiology Culture course, the result of 28% of inactive female students is worrying. Lovrinčević and Rastovski (2021) in their paper on doing sports before enrolling in studies found that as many as 38% of female students had never engaged in any sports activity before enrolling. Therefore, the observed high percentage of inactive female students in this paper can be attributed to the continuation of their inactivity trend before enrollment. The results of the assessment of personal working memory regarding the respondents' level of physical activity between a group of participants who have almost no physical activity and a group of participants who are physically active show that participants who are more physically active rate their working memory better than participants who are not physically active. These results are consistent with previous research findings (Cassilhas et al., 2016; De Sousa et al., 2018) that physical activity positively affects spatial memory, working memory, and attention. Individuals engaged in physical activity are typically organized and disciplined, which can be a positive factor in this case. Engaging in physical exercise, especially in certain sports, requires a high level of responsibility and perseverance. This fact alone can be a positive factor in the development and assessment of working memory.

CONCLUSION

With the results of this study, we can confirm what has already been observed in some previous studies, i.e., that any level of physical activity has a positive effect on cognitive functions, particularly working memory. Since the research results show that the trend of a high percentage of inactive female students at the Faculty of Education in Osijek continues, perhaps additional education on the importance of physical activity for better working memory is needed not only in higher education but earlier in the educational process. One possible action that would surely yield results would be the introduction of new (electoral colleges) at universities that would further contribute to improving the results of the mentioned problem. It would also be important to educate children from the very beginning of their schooling so that any possible electoral colleges in the university vertical would be linked to the previous outcomes and competencies acquired in primary and secondary school.

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DIFFERENCES IN SATISFACTION WITH BODY IMAGE BETWEEN SUFFICIENTLY AND INSUFFICIENTLY PHYSICALLY ACTIVE FEMALE STUDENTS

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ABSTRACT

The aim of this research was to determine if there are differences in the satisfaction with body image between sufficiently and insufficiently physically active female students. The study was conducted on a convenience sample of students from the University of Zadar, N=312 (AM=21.6 years; SD=1.54 years). A subsample of sufficiently physically active students comprised N=192, while insufficiently physically active students were N=120. The Figure rating scale (Stunkard et al., 1983) was used to assess satisfaction/dissatisfaction with body image. An independent samples t-test was used to determine differences in body image between sufficiently and insufficiently physically active students.

Research results indicate statistically significant differences between sufficiently and insufficiently physically active female students in their assessment of desired body image. Sufficiently physically active students desire a leaner body shape compared to their insufficiently physically active counterparts (AM_sufficiently=3.15; AM_insufficiently=3.38; $p=0.01$). No statistically significant differences were found between these two groups of participants in the assessment of current body image and (dis)satisfaction with body image.

Future research should explore all factors that may influence satisfaction with body image in the student population. By defining factors influencing satisfaction with body image, indirect improvements in the mental health of female students can be achieved.

Keywords: differences; students; physical activity; physical appearance; satisfaction

INTRODUCTION

Body image refers to an individual's mental picture of their own physical appearance, evaluation of that appearance, and the influence of these perceptions and attitudes on behavior (Pokrajac-Bulian & Kandare, 2000). Dissatisfaction with one's body appearance is a component of body image, which relates to perceptual experiences of body appearance and attitudes towards physical appearance (Grabe & Hyde, 2006; Scagliusi et al., 2006). It is defined as a negative evaluation of physical appearance, manifested through dysfunctional and negative beliefs and impressions about body weight and shape (Garner, 2002). The core of dissatisfaction with one's body image is the discrepancy between perceived current body size (CBS) and ideal body size (IBS), whether it be our internal ideal or one imposed by society

(Cleaves et al., 2000). The mechanism that can explain the relationship between physical activity and personal body image assumes three possibilities (Gins et al., 2012):

- 1) Changes in physical condition resulting from physical activity may cause changes in the perception of one's body image. However, it has been proven that this influence is small (less than 15% of explained variance in body image change).
- 2) Observed (experienced) changes in physical condition (increased endurance, muscle mass, strength) resulting from physical activity can trigger changes in body image perception. It should be emphasized that the observed changes have a greater impact on altering one's body perception than actual changes in physical fitness.
- 3) Changes in physical condition resulting from physical activity increase awareness of physical abilities, which in turn increases physical self-efficacy, further affecting the change in body image perception. The basis of this mechanism is linked to the Exercise and Self-esteem model (Sonstroem et al., 1994).

Previous research has concluded that: a) physically active individuals have a better body image than insufficiently physically active individuals; b) individuals who participated in an exercise program had a better body image after completing the program compared to a control group that did not exercise, and c) exercise significantly influences the improvement of body image perception (Hausenblas & Fallon, 2006).

The aim of this research is to determine whether there are statistically significant differences in body image satisfaction between groups of female students who are sufficiently and insufficiently physically active.

METHODS

The population from which a suitable sample of participants was defined consists of female students from the University of Zadar, $N = 312$ (Mean Age = 21.6 years; $SD = 1.54$ years). The sample of participants was stratified according to the criterion of overall level of physical activity into two sub-samples: sufficiently physically active students (meeting the minimum level of physical activity required for health benefits; the threshold value is 10 MET hours/week) and insufficiently physically active students. To assess satisfaction/dissatisfaction with body image, the Figure rating scale was used (Stunkard et al., 1983). The scale consists of nine drawings of female bodies, arranged in ascending order of weight from slimmest to heaviest and labeled with numbers from 1 to 9. It was used to assess perception of one's body image, specifically dissatisfaction with body appearance. The task for the participants was to make two assessments: select the image that they perceive best represents their current appearance and, on the second set of figures, select the image that represents their desired appearance on a scale of assessment from 1 to 9. The difference between the assessment of current and desired appearance (or the difference in numerical values that the participant circles below the figure of current and desired appearance) represents the individual level of dissatisfaction with body appearance. The theoretically possible range of results ranges from -8 to +8. The greater the absolute difference, the less satisfied the person is with their body, while the sign indicates the direction of dissatisfaction (minus sign indicates a desire to increase body mass; plus sign indicates a desire to decrease body mass). Frequencies and percentages of individual responses were calculated for the sub-scales of perceived current body size (CBS) and ideal body size (IBS) and for the scale satisfaction/dissatisfaction with body image.

To determine whether there are statistically significant differences in (dis)satisfaction with body image between sufficiently and insufficiently physically active students, an independent samples t-test was applied. The data were analyzed using the STATISTICA software package, version 13.0., StatSoft, Inc.

RESULTS

The frequencies of responses from female students regarding their current body size (CBS) are presented in Table 1. The highest percentage of students selected figure number four (37.82%) and figure number three (23.72%) as their current body size, with slightly fewer selecting figure number five (18.27%).

Table 1: Frequency and proportion of responses from female students regarding their current and ideal body size

Figure	Assessment of current body size (CBS) (f)	Assessment of current body size (CBS) (%)	Assessment of ideal body size (IBS) (f)	Assessment of ideal body size (%)
1	1	0,32	2	0,64
2	43	13,78	40	12,82
3	74	23,72	160	51,28
4	118	37,82	102	32,69
5	57	18,27	8	2,56
6	15	4,81	0	0
7	3	0,96	0	0
8	0	0	0	0
9	1	0,32	0	0

Legend: f = frequencies; % = percentage

Only one student chose figure 1 for the assessment of her current body size, which represents extreme thinness, and figure 9, which represents extreme obesity. In total, 13.78% of students chose figure 2, furthermore, 4.81% chose figure 6, and 0.96% chose figure 7. No student chose figure 8 for the assessment of their current body size. Among Zadar students, the highest percentage, 51.28%, evaluated figure 3 as the most desirable, followed by figure 4 (32.69%) and figure 2 (12.82%) (Table 1). Figure 5 was chosen by 2.56%, and figure 1 was chosen by 0.64% of students. No student chose figures 6, 7, 8, and 9 for the assessment of their desired body size, indicating that students prefer a normal or thinner body weight. From the presented results in Table 2, it is evident that a total of 39.74% of female students are satisfied with their body image, while 60.26% of female students are dissatisfied with their body image. Among them, 9.29% wish to increase their body weight, and 50.96% wish to decrease their body weight (Table 2). Out of the total number of students, one (0.32%) wants to increase their body weight by two silhouettes, and 28 (8.97%) students want to increase their body weight by two silhouettes. Of the total number of students, 123 students (39.42%) want to decrease their body weight by one silhouette, 30 (9.62%) want to decrease their body weight by two silhouettes, 4 students (1.28%) want to decrease their body weight by three silhouettes, and one each (0.32%) for four and six silhouettes.

Table 2: Body image (dis)satisfaction frequency among female students

Body image (dis)satisfaction	Frequency (f)	Percentage (%)
-2	1	0,32
-1	28	8,97
0	124	39,74
1	123	39,42
2	30	9,62
3	4	1,28
4	1	0,32
6	1	0,32

By examining the differences between the subgroup of sufficiently physically active and insufficiently physically active female students, statistically significant differences in the assessment of desired body image were determined (Table 3). The observed differences obtained by t-test are significant at the 0.01 level. Sufficiently physically active female students, on average, choose a leaner figure (3.15) for the assessment of desired body image compared to insufficiently physically active female students, who, on average, choose a thicker figure (3.38).

Table 3: Differences between the subgroups of sufficiently and insufficiently physically active female students in the assessment of current and desired body image and in (dis)satisfaction with body image.

	Arithmetic Mean (sufficient PA)	Arithmetic Mean (insufficiend PA)	t	df	p
Current body image	3,73	3,92	-1,4	310	0,16
Desired body image	3,15	3,38	-2,7	310	0,01*
(Dis)satisfaction with body image	0,57	0,54	0,3	310	0,77

Legend: t-test, df - degrees of freedom, p - level of significance, PA - physical activity, * statistically significant difference at $p < 0.05$ level

There were no significant differences between sufficiently physically active and insufficiently physical-ly active female students in the assessment of current body image and in (dis)satisfaction with body appearance.

DISCUSSION

Similar results, concerning current body size (CBS) of female students from Zadar, were found in a study involving female students from the University of Osijek (Cvenić and Barić, 2014), where the highest percentage of students selected figures 4 (34.52%), 3 (29.76%), and 5 (20.24%) for their current body size, while students from the University of Zagreb (Leško et al., 2018) selected figures 4 (33.78%), 3 (25.71%), and 2 (22.45%). In a study involving Italian female students (Zaccagni et al., 2014), the highest percentage selected figure 5 (21.3%) and figure 4 (20.7%) for their current body size, indicating that these students perceive themselves as heavier compared to students from Zadar.

From the results obtained in the research, it can be seen that the ideal of thinness is present among students of the University of Zadar. These results are consistent with those of Italian students, who indicate that figure 3 is the most desirable (chosen by 33.3% of them), followed by figure 2 (21.8%) and figure 4 (21.3%). In the study by Bulik et al. (2001) for the age group of 18-30-year-old females, the highest percentage chose figure 3 as their desired body size (58.3% of them), which is slightly higher compared to Zadar students. This was followed by figure 2 (20.9%) and figure 4 (18.7%). In comparison, Zadar students choose figure 4 in a higher percentage, followed by figure 2, suggesting that American students desire to appear thinner than Zadar students. In the same study, figure 5 was chosen by 1.3%, figure 1 by 0.8%, figure 6 by 0.03%, and figure 7 by 0.03%. For the mentioned age group, no one chose figures 8 and 9 for their desired body size, while Zadar students did not choose figures 6 and 7 in addition to the mentioned figures. If the results of this study about body image dissatisfaction are compared with the results obtained from students in Zagreb (Leško et al., 2018), it can be concluded that female students from Zadar are somewhat more satisfied with their body image compared to their colleagues from Zagreb. The results of the study (Zaccagni et al., 2014) conducted on Italian students indicate that 33.3% of female students are satisfied with their body image, which is a similar but slightly lower result than that of Zadar students, while 28.3% of them want to increase their body weight (a higher percentage compared to Zadar students), and 38.4% want to decrease their body weight (a lower percentage compared to Zadar students). In a study on dissatisfaction with their body image among students in Rijeka (Pokrajac-Bulian et al., 2005), it was found that 55.5% of them want to be thinner, which is a slightly higher percentage compared to Zadar students, and only 5.6% want to increase their body weight, which is lower compared to Zadar students. In a study on British children aged 11-14 (Duncan et al., 2006), 63.9% of them want to lose weight, 25.4% want to maintain their current body weight, and 10.7% want to gain weight. Dissatisfaction with body image in more than half of the female students can be explained by socio-cultural pressure whereby the culture we live in and imposed standards of the ideal female body image strongly influence their body perception. The socio-cultural environment can contribute to the development of body (dis)satisfaction by transmitting norms about the ideal body image through media, which daily emphasize the ideal of thinness. Shepeliak (2006) found in his research that female students assess their current body size by choosing a figure with an average value of 3.704, for the desired body size they choose a figure with an average value of 3.06, and the dissatisfaction with body image amounts to 0.634. Compared to Zadar students, American students express greater dissatisfaction with body image. Furthermore, American students perceive their body image as thinner compared to Zadar students, but they choose a thinner figure for the desired image, resulting in greater dissatisfaction with body image. Portuguese students select leaner figures for both current (3.50) and desired (2.80) body image compared to Zadar students, and they exhibit higher dissatisfaction with body image (0.70) than them (Scagliusi et al., 2006). Similarly to Zadar students, the level of body dissatisfaction among Rijeka students (Pokrajac-Bulian et al., 2005) was 0.60. Researching the cultural differences in Israeli female students regarding the assessment of current and desired body image and their satisfaction with body image (Safir et al., 2005), it was found that for Jewish females, the average value of the assessment of current body image was 3.35, and for Arab females, it was 3.18, while the average value of the assessment of desired body size was 3.01 for Jewish females and 3.13 for Arab females, indicating that they perceive both their current body size and desired body size as leaner compared to Zadar students. In the same study, the average satisfaction with body image for Jewish females was 0.35, and for Arab females, it was 0.05, indicating they are more satisfied with their body image compared to Zadar students. The authors also note that 44.21% of the students want to be thin-

ner, 40% do not want to change their body appearance, and only 15.79% want to increase their body weight. Compared to Zadar students, there is a higher percentage of students who want to gain weight (5.75%), while among Zadar students, the percentage is skewed towards those who want to lose weight. The proportion of Zadar and Israeli students who do not want to change their body weight is almost equal (around 40%). Similarly to Zadar's students, with the note that structured physical exercise was compared, not the level of daily physical activity, Zabinski et al. (2001) found that in an experimental study, students who exercise differ from those who do not exercise in the assessment of desired body image, indicating that those who exercise want to appear thinner. In the same study, these groups of students did not differ in body satisfaction. A possible reason why sufficiently and insufficiently physically active students do not significantly differ in body (dis)satisfaction is that these groups have a high level of self-esteem. Strong et al. (2005) mentioned that a higher level of self-esteem is associated with greater satisfaction with body image. Since in the study of Zadar's students both sufficiently and insufficiently active students have a high level of self-esteem, the absence of differences between these subgroups in body (dis)satisfaction is expected. Another possible reason why sufficiently and insufficiently physically active students do not significantly differ in body (dis)satisfaction is that these groups do not differ in terms of nutritional status, which was assessed by body mass index. It is noted that a significant correlation between body mass index and body dissatisfaction has been confirmed (McArthur et al., 2005; Sujoldžić and De Lucia, 2007). Contrary to the results obtained for Zadar's students, Hausenblas and Falon (2006) stated that there are differences in the perception of body image between physically active and inactive individuals, indicating that physically active individuals have a more positive perception of their body appearance. Differences in body satisfaction between female students involved in some university sports club and those who are not involved were obtained in the study by Robinson and Ferraro (2004). The authors stated that athletes are more satisfied with their body image than their "non-athlete" colleagues. Similar results were obtained by Schwartz et al. (2005), who mentioned that body dissatisfaction is higher among non-athlete female students. Duncan et al. (2006) also found differences between more and less physically active individuals, but unlike Hausenblas and Falon (2006), the authors stated that individuals with higher levels of physical activity are more dissatisfied with their body appearance. They attributed this to changes in the perception of their body appearance due to increased physical activity. Physiological changes occur with increased physical activity (increased muscle strength, aerobic endurance, stronger muscle tone) which can increase individuals' perception of their body size. Furthermore, this results in greater body dissatisfaction among more physically active individuals. Therefore, when implementing programs aimed at increasing physical activity among female students, it is necessary to consider that increased physical activity may also have a negative impact on their body satisfaction. For this reason, before implementing kinesiology programs aimed at improving body satisfaction, it is necessary to examine what motivates students to engage in physical activity.

CONCLUSION

Based on the results of this research, it was determined that there are no statistically significant differences in body satisfaction/dissatisfaction among the University of Zadar students regarding their level of physical activity. Sufficiently and insufficiently active students in this sample differ only in the assessment of desired body appearance, and it was found that physically more active students want to appear thinner compared to less active colleagues. Dissatisfaction with body image among female students is associated with lower self-esteem, decreased life satisfaction, and increased feelings of inferiority, which indirectly affects their overall quality of life. Additionally, body dissatisfaction can trigger depressive symptoms and anxiety. Due to these negative effects stemming from body dissatisfaction, it is necessary to investigate the mechanisms that could positively influence changes in female students' body satisfaction. Previous research has demonstrated a positive correlation between physical activity and body image (Bassett-Gunter et al., 2017). Therefore future research should focus on qualitative studies that would provide a more detailed explanation of the relationship between physical activity and body satisfaction.

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ANALYSIS OF SELF-PERCEPTION OF PHYSICAL APPEARANCE AMONG STUDENTS OF THE FACULTY OF KINESIOLOGY AND THE FACULTY OF ECONOMICS IN OSIJEK

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ABSTRACT

The educational environment plays a significant role in shaping students' perceptions of their appearance, reflecting broader societal concerns. Understanding students' views on their physical appearance is important for educators and policymakers, as it can affect mental health and self-esteem. This study explores students' self-perception of physical appearance, highlighting differences between faculties and suggesting the need for further investigation across genders and academic years.

Keywords: Body image, Physical Appearance, Self-Perception

INTRODUCTION

Fostering a favorable body image holds significant importance for the physical and psychological well-being of adolescents, as it plays a pivotal role in shaping self-assurance and fostering enduring personal advancement and maturation across their lifespan (Abdo, Seid & Woldekiros, 2023).

Throughout adolescence, alterations influenced by both individual and environmental factors prompt a reassessment of one's bodily self-conception, which subsequently impacts overall self-perception, identity development, and emotional well-being (Nicolosi & Lipoma, 2016). As students navigate through the educational system, they encounter numerous influences that shape their perceptions of themselves, from societal beauty standards to peer comparisons and media portrayals. Issues concerning physical care and body image, particularly throughout adolescence, are matters of societal concern (Tlaye et al., 2018). The physiological transformations experienced by the body throughout adolescence significantly influence both personal and social identity formation (Manning, 2007).

Understanding how students perceive their physical appearance is crucial for educators, parents, and policymakers, as it can impact self-esteem, body image satisfaction, and overall mental health (Holik et al., 2022). This study aims to explore the self-perception of physical appearance among students, shedding light on factors that contribute to these perceptions and their implications for adolescent well-being.

METHODS

Participants

In the research, 136 students participated, with 68 students from the Faculty of Kinesiology in Osijek and 68 students from the Faculty of Economics in Osijek. 76 students were attending the first year, 38 students in the second year, 10 students in the third year, 7 students in the fourth year, and 5 students in the fifth year.

The Body Shape Questionnaire (BSQ; Cooper, Taylor, Cooper, Fairburn, 1987) was used to assess body image satisfaction. The questionnaire consists of 34 items that measure satisfaction/dissatisfaction with body shape over the past month. Respondents answer on a 6-point Likert scale (never, rarely, sometimes, often, very often, always), with the total score determined by summing the items, where a higher score indicates greater body dissatisfaction. The questionnaire has shown a reliability of 0.93 (Thompson, Penner, Altabe, 1990). The items included in the questionnaire are as follows: 1. Has feeling bored made you brood about your shape?, 2. Have you been so worried about your shape that you have been feeling that you ought to diet?, 3. Have you thought that your thighs, hips or bottom are too large for the rest of you?, 4. Have you been afraid that you might become fat (or fatter)?, 5. Have you worried about your flesh not being firm enough?, 6. Has feeling full (e.g., after eating a large meal) made you feel fat?, 7. Have you felt so bad about your shape that you have cried?, 8. Have you avoided running because your flesh might wobble?, 9. Has being with thin women made you feel self-conscious about your shape?, 10. Have you worried about your thighs spreading out when sitting down?, 11. Has eating even a small amount of food made you feel fat?, 12. Have you noticed the shape of other women and felt that your own shape compared unfavourably?, 13. Has thinking about your shape interfered with your ability to concentrate (e.g., while watching television, reading, listening to conversations)?, 14. Has being naked, such as when taking a bath, made you feel fat?, 15. Have you avoided wearing clothes which make you particularly aware of the shape of your body?, 16. Have you imagined cutting off fleshy areas of your body?, 17. Has eating sweets, cakes, or other high calorie food made you feel fat?, 18. Have you not gone out to social occasions (e.g., parties) because you have felt bad about your shape?, 19. Have you felt excessively large and rounded?, 20. Have you felt ashamed of your body?, 21. Has worry about your shape made you diet?, 22. Have you felt happiest about your shape when your stomach has been empty (e.g., in the morning)?, 23. Have you thought that you are the shape you are because you lack self-control?, 24. Have you worried about other people seeing rolls of flesh around your waist or stomach?, 25. Have you felt that it is not fair that other women are thinner than you?, 26. Have you vomited in order to feel thinner? 27. When in company have you worried about taking up too much room (e.g., sitting on a sofa or a bus seat)?, 28. Have you worried about your flesh being dimply?, 29. Has seeing your reflection (e.g., in a mirror or shop window) made you feel bad about your shape?, 30. Have you pinched areas of your body to see how much fat there is?, 31. Have you avoided situations where people could see your body (e.g., communal changing rooms or swimming baths)?, 32. Have you taken laxatives in order to feel thinner?, 33. Have you been particularly self-conscious about your shape when in the company of other people?, 34. Has worry about your shape made you feel you ought to exercise?

Protocol

For this study, an online questionnaire was created using the Microsoft Forms platform, which students completed as part of their coursework. Questionnaire completion was anonymous and voluntary, requiring approximately 10 minutes to complete. For data analysis, Tibco Statistica Enterprise program (version 14.0.1.25) was utilized. The Kolmogorov-Smirnov test was used to assess the normality of distribution, revealing that the variables were not normally distributed. To determine differences between faculties, the Mann-Whitney U test was employed. In all tests, statistical significance was set at $p < 0.05$.

RESULTS

Table 1. Display of basic statistical parameters and results of the Kolmogorov-Smirnov and Mann-Whitney U tests.

	N	MEAN±SD(MIN-MAX)	max D	K-S	KIF SUM	EFOS SUM	p
1	136	3,00±1,49 (1,00 -6,00)	0,15	p < .01	3779,50	5536,50	0.00
2	136	2,47±1,61 (1,00-6,00)	0,25	p < .01	4387,50	4928,50	0.24
3	136	1,79±1,39 (1,00-6,00)	0,38	p < .01	4214,50	5101,50	0.05
4	136	2,40±1,62 (1,00-6,00)	0,24	p < .01	3902,00	5414,00	0.00
5	136	2,75±1,61 (1,00-6,00)	0,19	p < .01	3880,00	5436,00	0.00
6	136	2,18±1,56 (1,00-6,00)	0,29	p < .01	3959,00	5357,00	0.00
7	136	1,52±1,23 (1,00-6,00)	0,45	p < .01	4059,00	5257,00	0.01
8	136	1,29±0,96 (1,00-6,00)	0,49	p < .01	4208,00	5108,00	0.05
9	136	2,39±1,69 (1,00- 6,00)	0,27	p < .01	4146,00	5170,00	0.03
10	136	1,54±1,29 (1,00-6,00)	0,45	p < .01	3988,00	5328,00	0.00
11	136	1,43±1,13 (1,00-6,00)	0,45	p < .01	4069,00	5247,00	0.01
12	136	2,04±1,47 (1,00-6,00)	0,29	p < .01	4116,00	5200,00	0.02
13	136	1,57±1,15 (1,00-6,00)	0,40	p < .01	4144,00	5172,00	0.03
14	136	1,79±1,43 (1,00-6,00)	0,38	p < .01	3842,00	5474,00	0.00
15	136	2,00±1,51 (1,00-6,00)	0,32	p < .01	3890,00	5426,00	0.00
16	136	1,62±1,39 (1,00-6,00)	0,44	p < .01	4055,50	5260,50	0.01
17	136	2,05±1,62 (1,00-6,00)	0,35	p < .01	4007,00	5309,00	0.00
18	136	1,32±0,92 (1,00-6,00)	0,48	p < .01	4121,00	5195,00	0.02
19	136	1,49±1,25 (1,00-6,00)	0,45	p < .01	4092,00	5224,00	0.01
20	136	1,69±1,24 (1,00-6,00)	0,36	p < .01	3873,00	5443,00	0.00
21	136	1,96±1,49 (1,00-6,00)	0,34	p < .01	4250,00	5066,00	0.08
22	136	1,52±1,20 (1,00-6,00)	0,44	p < .01	4114,50	5201,50	0.02
23	136	1,91±1,47 (1,00-6,00)	0,36	p < .01	4019,00	5297,00	0.01
24	136	1,74±1,53 (1,00-6,00)	0,43	p < .01	4316,00	5000,00	0.14
25	136	1,34±0,93 (1,00-6,00)	0,47	p < .01	4126,00	5190,00	0.02
26	136	1,10±0,64 (1,00-6,00)	0,53	p < .01	4488,00	4828,00	0.46
27	136	1,29±1,00 (1,00-6,00)	0,49	p < .01	4178,50	5137,50	0.04
28	136	1,60±1,19 (1,00-6,00)	0,41	p < .01	4089,00	5227,00	0.01
29	136	1,93±1,43 (1,00-6,00)	0,33	p < .01	4208,00	5108,00	0.05
30	136	2,13±1,43 (1,00-6,00)	0,25	p < .01	4340,00	4976,00	0.17
31	136	1,71±1,41 (1,00-6,00)	0,41	p < .01	3878,50	5437,50	0.00
32	136	1,07±0,50 (1,00-6,00)	0,53	p < .01	4556,00	4760,00	0.66
33	136	2,36±1,70 (1,00-6,00)	0,27	p < .01	4102,00	5214,00	0.02
34	136	2,89±1,93 (1,00-6,00)	0,23	p < .01	4473,50	4842,50	0.42

Legend: Mean - arithmetic mean, SD - standard deviation, MIN - minimum score, MAX - maximum score, MAX D - maximum deviation between empirical and theoretical cumulative frequencies, K-S value - Kolmogorov-Smirnov test value for assessing normality of distribution, p - significance of the Mann-Whitney U test.

Statistically significant differences exist between students of the two faculties on numerous questions; 1 ($p=0.00$), 4-6 ($p=0.00$), 7 ($p=0.01$), 9 ($p=0.03$), 10 ($p=0.00$), 11 ($p=0.01$), 12 ($p=0.02$), 13 ($p=0.03$), 14-15 ($p=0.00$), 16 ($p=0.01$), 17 ($p=0.0$), 18 ($p=0.02$), 19 ($p=0.01$), 20 ($p=0.0$), 22 ($p=0.02$), 23 ($p=0.02$), 25 ($p=0.02$), 27 ($p=0.04$), 28 ($p=0.01$), 31 ($p=0.01$), 33 ($p=0.02$).

DISCUSSION

Based on the results of this study, we can conclude that there is a statistically significant difference in numerous questions regarding satisfaction with one's own body between students of the Faculty of Kinesiology and the Faculty of Economics in Osijek. Students of the Faculty of Kinesiology hold a more favorable opinion about their appearance compared to students of the Faculty of Economics. Our study is supported by numerous other research studies that also indicate the existence of dissatisfaction with one's appearance.

The results of a study conducted on adolescents attending high school-level education in Addis Ababa indicate that the proportion of individuals with a positive self-perception of their body appearance was 48.4% (Abdo, Seid, & Woldekiros 2023). The results of a study conducted in Brazil regarding dissatisfaction with body image among adolescents in public schools revealed that merely 19.5% of adolescents expressed dissatisfaction with their body image (Santana et al., 2013). The 2016 study conducted at Bucharest University of Economic Studies, focusing on a sample of female students participating in physical education classes, revealed that 79% of these young women expressed dissatisfaction with their body image. Each participant indicated a preference for a thinner ideal shape compared to their perceived silhouette (Pop, 2017). Certain results indicate that engaging in upward appearance comparisons on social media platforms could lead to heightened body image concerns among young adult women (Hogue & Mills, 2019). In another study involving 119 high school students, 47.9% who exhibited a normal body weight reported no concerns whatsoever regarding their physical appearance. Within this group, boys displayed significantly lower levels of concern about their physical appearance compared to girls (78.8% vs. 36.0%, $\chi^2 = 23.6$; $p < 0.001$). Moreover, no correlation was observed between body image satisfaction and levels of self-esteem (Holik et al., 2022).

CONCLUSION

Overall, the research findings highlight significant variations in body image satisfaction among different groups, such as students from various faculties and adolescents from diverse cultural backgrounds. While students of the Faculty of Kinesiology tend to hold a more positive view of their appearance compared to those from the Faculty of Economics, similar disparities exist globally, with adolescents from Addis Ababa, Brazil, and Bucharest also exhibiting varying levels of body image satisfaction. Additionally, social media usage appears to play a role in exacerbating body image concerns among young women. Our findings suggest that students who actively engage in sports generally have a more positive body image perception. While this conclusion may seem somewhat logical, dissatisfaction still exists among students of the Faculty of Kinesiology, despite their involvement in healthy lifestyles. This fact underscores a contemporary issue. Future studies should explore these data further across genders and potentially according to the academic year of study.

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STUDENTS AND PHYSICAL ACTIVITY: THE ROLE OF PHYSICAL SELF-EFFICACY IN THE RELATIONSHIP BETWEEN INTENTION TO ENGAGE IN PHYSICAL ACTIVITY AND PHYSICAL ACTIVITY INTENSITY

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ABSTRACT

In students' lives, filled with obligations and activities, it is essential to maintain regular physical activity (PA). Nevertheless, despite growing awareness of the benefits of engaging in PA, attaining that goal is not easy.

Therefore, this study aimed to test whether physical self-efficacy mediates and moderates the relationship between the intention to engage in PA and the intensity of PA. To provide empirical data on this question, we included 98 students ($N_{\text{female}} = 58$) aged between 19 and 27 ($M = 22.90$, $SD = 1.96$). We conducted longitudinal research with two measurement points. We assessed their physical self-efficacy and intention to participate in PA during the initial assessment. In the second measurement, we assessed the actual level of PA intensity.

The results showed mediation and moderator role of physical self-efficacy in the relationship between intention to engage in PA and PA intensity. More specifically, results showed full mediation, i.e. the indirect contribution of intention to PA intensity through physical self-efficacy. Furthermore, the moderating role of physical self-efficacy in the relationship between intention to engage in PA intensity showed that intention to engage in PA positively contributed to the intensity of PA at the medium and the high level of physical self-efficacy. However, intention to engage in PA did not prove to be a significant predictor of PA intensity at the low level of physical self-efficacy. This research offers further empirical insights into possible mechanisms underlying the manifestation of PA among students.

Keywords: *students, physical activity, physical self-efficacy, intention, physical activity intensity*

INTRODUCTION

Maintaining a healthy life is an important aspect, and engaging in physical activity (PA) is a key factor in achieving this goal. The potential health benefit of PA activity, as any body movement produced by skeletal muscles that results in energy expenditure (Caspersen et al., 1985), has been extensively demonstrated in empirical studies (Reiner et al., 2013). Therefore, engagement in physical activity has been demonstrated as a potential protective for mental well-being and even as an effective treatment for mental health. A very recent systematic review and network meta-analysis conducted by Noetel et al. (2024) found that PA may be beneficial in treating depression, particularly when it involves more vigorous exercise. The beneficial impact of PA on overall well-being is supported by other systematic review studies and meta-analyses, demonstrating that PA can be beneficial in treating feelings of sadness and anxiety

(Correia et al., 2024; Rebar et al., 2015) and helpful in improving cognitive functioning (Biddle et al., 2019).

Although these benefits of PA are well known and well communicated by the scientific community (e.g. WHO, CDC), it is common to observe challenges in maintaining consistent physical exercise and the absence of regular PA. Therefore, it is essential to identify and acquire a deeper understanding of the factors and processes that foster regular PA, which will provide efficient guidelines and practical tools that can help individuals in sustained, healthy involvement in PA. A well-known and widespread theory that aims to elucidate the determinants of the manifestation of a particular behaviour is the Theory of planned behaviour (Ajzen, 2020), which posits intention as a main determinant of planned behaviour. Nevertheless, while this theoretical framework has demonstrated efficacy in elucidating certain behaviours, it has encountered limitations in comprehending the expression of more intricate ones, such as PA (Reyes Fernández et al., 2015; Rhodes & Dickau, 2012). This suggests the necessity to include more components to elucidate the disparity between intention and behaviour (intention-behaviour gap) regarding physical activity.

Another theoretical model that aims to address this gap by incorporating other constructs to enhance our knowledge of their role is the Multi-process action control model (Rhodes, 2017; 2021). This model proposes three interrelated and sequential processes that occur between intention and physical action. One of the constructs within this link between the intention for being physically active and PA is physical self-efficacy as one of the reflective components that can possibly help in intention formation (Rhodes, 2021) but also in other phases of behaviour (Scholz et al., 2005). Self-efficacy refers to the belief in one's capability to do a specific activity effectively, accomplish a specific goal, or proficiently handle various circumstances, specifically in the case of regular PA (Bandura, 1997), and physical self-efficacy pertains to an individual's views or confidence in their ability to carry out different physical activities under given circumstances. Notably, the theory of planned behaviour recognised the possible impact of characteristics such as physical self-efficacy on the manifestation of intentions. In that regard, it implies the significance of perceived behavioural control, conceptually related to physical self-efficacy. As a result, these theoretical frameworks imply that perceived behavioural control and physical self-efficacy might predict the occurrence of PA and serve as a mechanism for the impact of the intention to engage in PA. Nonetheless, it is unclear whether the role of physical self-efficacy acts as a mediator, a moderator, or both in the relationship between PA intention and PA intensity (Jemmott et al., 2015; Lewis et al., 2016; Rhodes & Dickau, 2013).

Explaining the role of physical self-efficacy in this transition process from the intention to engage in PA to the actual PA is particularly essential for students who encounter various obstacles and must prioritize looking after their well-being and physical health (Irwin, 2007). Thus, to comprehend how physical self-efficacy affects the connection between the intention to engage in PA and the level of PA intensity, it is essential to investigate its mediating and moderating effects on the relationship between PA intention and PA intensity.

METHODS

Study design

The study used a longitudinal design with two measurement points, measuring intention and physical self-efficacy at the first measurement point and the manifestation of PA (PA intensity) at the second measurement point.

Participants

The study's sample was convenient and consisted of students from universities in Croatia. A total of 98 students ($N_{\text{female}} = 58$) aged between 19 and 27 ($M = 22.90$, $SD = 1.96$) completed questionnaires in both measurement points.

Procedure

This study received approval from the Ethics Committee of Catholic University of Croatia (Class: 602-04/23-11/029; No: 498-15-06-23-001). The online survey was created using the SurveyRock web platform, and it was conducted between July and August 2023. The initial section of the survey in both measurement points contained information regarding the study's objective and the assurance of anonymity and confidentiality of the data. Furthermore, we clearly stated that the data would be analysed exclusively at the group level and underscored the opportunity to choose to discontinue participation in the study without incurring any repercussions. At the end of this section, we asked the participants if they agreed to participate in the study. Upon consenting to participate in the study, individuals clicked the "next" button. After completing the first measurement point of the study, we provided the participants with the option of entering their e-mail address on a new link (which could not be linked to their results) so that a new questionnaire would be sent to them after a month to collect additional data about their PA.

MEASURES

Self-efficacy for physical activity (SEPA)

We measured physical self-efficacy using the *Self-efficacy for Physical Activity (SEPA) scale* (Marcus & Forsyth, 2003; Marcus et al., 1992). The scale comprises five items, with an example of the item "I possess the assurance to engage in routine physical exertion even when fatigued". Participants responded using a five-point scale (from 1 – not at all confident to 5 – extremely confident). The overall score was calculated as a linear combination of responses, with a higher score indicating higher physical self-efficacy. The study also showed satisfactory scale reliability, as evidenced by an internal consistency Cronbach alpha of 0.82.

Intention to engage in physical activity

The instrument for measuring intention to engage in PA was constructed in accordance with the recommendations of Fishben and Ajzen (2010) for their construction. The intention was operationalized with 3 items (example: "I intend to exercise at least three times a week for the next month."), and high reliability was established ($\alpha = 0.98$).

Godin-Shephard Leisure-Time Exercise

To assess PA intensity, *Godin-Shephard Leisure-Time Physical Activity Questionnaire* was used (Godin, 2011; Godin & Shephard, 1985). Participants write how many times during a typical 7-day period (week) they do the 3 types of physical activity for more than 15 minutes on average. Their answers are weighted, and the number they mark for light exercises (example: light walking) is weighted with 3, for moderate exercises (example: more intense walking) with 5, and strenuous exercises (example: football) with 9, and their sum gives the total result.

RESULTS

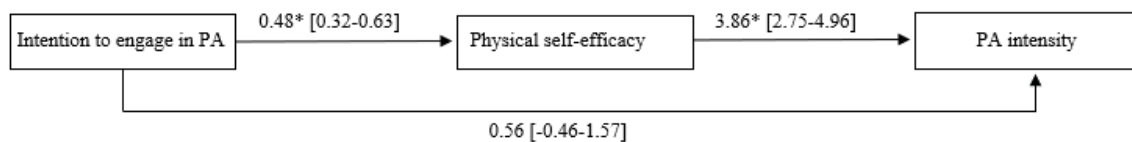
Before we conducted the mediation and moderation analysis (using Hayes Process Macro in the IBM SPSS Statistics 23.0.0 program), we checked the prerequisites for their implementation. Although the Kolmogorov-Smirnov test proved significant for 2 variables, smaller deviations on the P-P plots and skewness and kurtosis values show us a smaller deviation from the normal distribution (Field, 2013).

Table 1. Descriptive statistics and intercorrelations between variables

Variables	M (SD)	Range	Skewness	Kurtosis	1	2	3
Physical self-efficacy	15.48 (4.77)	6-25	0.3	-0.59	-	0.53*	0.67*
PA Intention	15.58 (5.2)	3-21	-0.9	-0.1		-	0.42*
PA intensity	49.93 (29.74)	3-164	0.87	1.25			-

* $p < 0,01$

Pearson's correlation coefficients show a moderate correlation between variables (Table 1). As can be seen, the highest correlation is between physical self-efficacy and PA intensity ($r = 0,67$), and the lowest is between intention to engage in PA and PA intensity ($r = 0,42$).

Figure 1. Graphic representation of the model of the mediating role of physical self-efficacy in the relationship between the intention to engage in PA and the PA intensity* $p < 0,01$

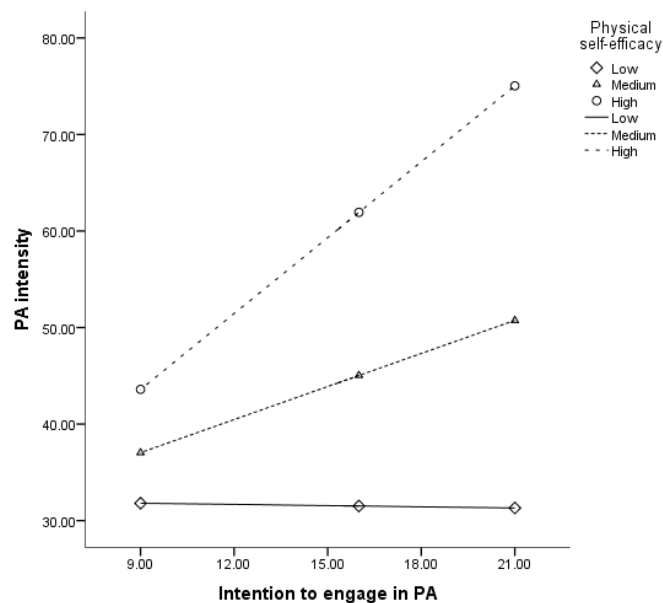
Testing the mediating role of physical self-efficacy in the relationship between the intention to engage in PA and the intensity of PA, the model proved significant ($p < 0.01$) and explained 45% of the variance in the intensity of PA. There was no direct effect of the intention to engage in PA on the intensity of PA ($p > 0.05$). The results show an indirect contribution through physical self-efficacy ($b = 3.86$, $p < 0.01$).

Table 2. The moderating role of physical self-efficacy in the relationship between the intention to engage in PA and the intensity of PA

	b	Standard error	95% confidence limit	
			Lower limit	Upper limit
Intention to engage in PA	3.3*	1.57	0.18	6.4
Physical self-efficacy	1.35	2.1	-5.48	2.78
Intention to engage in PA x Physical self-efficacy	0.3*	0.11	0.07	0.52

 $R^2 = 0,49$ * $p < 0,01$

Figure 2. Presentation of the model of the moderating role of physical self-efficacy in the relationship between the intention to engage in PA and the intensity of PA



Furthermore, a model that assumes the moderating role of physical self-efficacy in the relationship between the intention to engage in PA and the intensity of PA proved to be significant ($p < 0.01$) and explained 49% of the criterium variance. The main effect of the intention to engage in PA ($b = 3.3$, $p < 0.01$), but also the interaction of the intention and physical self-efficacy ($b = 0.3$, $p < 0.01$) proved to be significant (Table 2). More specifically, the intention to engage in PA positively contributes to the intensity of PA at medium ($b = 3.43$) and higher levels ($b = 7.86$) of physical self-efficacy, while it does not contribute significantly at lower levels.

DISCUSSION

In this study, we investigated the mediating and moderating role of physical self-efficacy in the relationship between the intention to engage in PA and PA intensity. The data revealed two feasible underlying mechanisms for this connection to occur.

The first model tested showed the full mediating role of physical self-efficacy. As previously stated, intent alone appears insufficient for a specific behaviour. Our findings identified physical self-efficacy as one of the potential mechanisms underlying PA (Jemmott et al., 2015), which demonstrated to be a possible mediator in this relationship. These findings align with studies conducted in other fields, such as the intention to learn and the process of acquiring knowledge. The study by Tzeng et al. (2022) showed that including self-efficacy led to complete mediation. In various forms, self-efficacy seems to function as a relationship mediator. This mechanism provides a possible explanation for how intention might lead to the realisation of PA.

Regarding the moderating effect, an earlier study has demonstrated that physical self-efficacy moderates the manifestation of PA (Warner et al., 2011). However, only a few studies have specifically examined the relationship between intention and PA (Rhodes & Dickau, 2013). This study showed that a more pronounced intention to engage in PA contributes to a greater intensity of PA in persons with moderate (average) and more pronounced physical self-efficacy.

The results align the assumptions of the multi-process action control model (Rhodes, 2017; 2021) on the presence of constructs within the link between PA intention and PA intensity. Also noteworthy, they may support the hypothesized importance of perceived behavioural control postulated within the theory of planned behaviour (Ajzen, 2020). Although this concept may not be operationally identical to physical self-efficacy (Tavousi et al., 2009), they conceptually overlap, and our study's findings presumably emphasise the relevance of perception of one's own behavioural control in the manifestation of PA.

Simultaneously with the theoretical understanding, this empirical insight informs us of the practical implications. Practitioners should focus on developing skills to improve students' feelings of physical self-efficacy and sense of control over physical activity. This may also be achieved through initiatives to enhance physical activity (PA) among students by providing various resources to support regular exercise, such as expert assistance and access to exercise facilities (Boslaugh et al., 2004; Mota et al., 2005). In addition to developing and enhancing these skills, interventions may involve addressing students' mindsets that hinder their engagement in physical activity by raising their awareness of the mental health benefits of being physically active (Glavaš et al., 2023; Lang et al., 2018).

Despite the notable strength of our study, which lies primarily in its longitudinal design, it is recommended that future investigations address certain limitations of this study. It is imperative to ensure a lower dropout rate from the study and test these effects on a larger sample of students. Furthermore, examining the role of other relevant constructs, such as habits, identity, and planning, could provide fruitful theoretical and empirical avenues for future studies (Rhodes, 2021).

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PHYSICAL ACTIVITY AND RESILIENCE: THE ROLE OF SELF-PERCEPTION OF PHYSICAL ACTIVITY

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ABSTRACT

Although numerous studies have established a positive relationship between physical activity (PA) and resilience, the underlying mechanisms of this relationship remain unclear. Thus, this study aimed to examine the mediating and moderating role of self-perception of PA in the relationship between PA and resilience. The study involved 379 participants (72.1% female), 4th-grade high school and university students in Croatia aged 18 to 29 years.

Participants completed questionnaires assessing their resilience (The Brief Resilience Scale; Smith et al., 2009) and PA intensity (Godin-Shephard Leisure-Time Physical Activity Questionnaire; Godin, 2011), and their self-perception of PA was measured with a single question assessing to what extent they considered themselves regularly physically active.

The mediation analysis revealed a full mediating effect. Specifically, PA intensity did not contribute to resilience directly but indirectly through a more pronounced perception of oneself as regularly physically active. The perception of oneself as being regularly physically active did not have a significant moderating role in the relationship between the intensity of PA and resilience. The results are discussed from the perspective of psychological theories, including Fox's model of physical self-perception and the theory of growth mindset.

Keywords: physical activity, self-perception of physical activity, resilience, students

INTRODUCTION

In contemporary society, substantial changes and challenges characterise the periods of late adolescence and emerging adulthood, and individuals who choose to pursue higher education also face specific challenges related to the transition to and persistence in college (e.g., Arnett, 2000; Zarrett & Eccles, 2006). College students report experiencing different stressors (e.g., Acharya et al., 2018), and higher levels of stress in students are related to poorer academic achievement (Elias et al., 2011) and mental health (Córdova Oliviera et al., 2023).

One factor that may play a significant role in maintaining psychological well-being in challenging and stressful circumstances is resilience (Rutter, 1985). Resilience can be defined as an individual trait pertaining to the ability to recover from experiencing adverse experiences or events (e.g., see Sisto et al., 2019, for review) or the ability to "bounce back and recover from stress" (Smith et al., 2018, p. 195). Research emphasises the importance of resilience in higher education, as it has been shown to play a crucial role in helping students overcome challenges, preserve their well-being, and effectively finish

their studies (Price, 2023), and intrapersonal resilience factors, such as tenacity, spirituality and tolerance of stress, have been found to be significant predictors of college students' academic achievement (Hartley, 2011).

It is worth noting that resilience is also conceptualized as a dynamic process involving the interaction of various internal and external protective and risk factors (Sisto et al., 2019). Physical activity (PA) has been shown to promote resilience in college students (Shanshan et al., 2021). It has been shown that students who engage in PA exhibit greater resilience (San Román-Mata et al., 2020; Xia et al., 2020). Studies have outlined some important neurobiological mechanisms through which PA enhances resilience, mood, and well-being and optimises stress response (e.g. see Silverman & Deuster, 2014, for review). However, our understanding of the psychological processes that underlie the relationship between PA and resilience remains limited. Few studies have contributed to elucidating this relationship, identifying its' possible mediators. For example, Shanshan et al. (2021) demonstrated that the relationship between PA and resilience depends on the mediating effect of basic psychological needs, and Neumann et al. (2022) found that higher levels of self-efficacy serve as a key mediator in the relationship between physical fitness and resilience. In addition to constructs of basic psychological needs and self-efficacy, studies have begun to place significant emphasis on the importance of other cognitive factors, such as the self-perception of PA. Specifically, Baceviciene et al. (2019) demonstrated that the way individuals perceive their own PA alters the relationship between psychosomatic health symptoms and an unhealthy lifestyle. Adolescents who believed they maintained adequate levels of PA reported fewer psychosomatic health complaints (feelings of sadness, irritability, tension, headaches, and backaches) despite the presence of unhealthy habits such as alcohol consumption, cigarette smoking, and consumption of unhealthy food. Similarly, a study conducted by Lang et al. (2018) revealed that adolescents who believe their PA is adequate for maintaining good health reported better psychological functioning despite no observed differences in actual PA levels between groups. Thus, studies indicate that self-perception of PA may moderate the relationship between PA and certain health outcomes.

Considering the empirical findings which emphasise the significance of studying cognitive factors and their impact on the connection between PA and psychophysical health, as well as the lack of empirical evidence addressing the specific role of self-perception of PA in the relationship between PA and resilience, the aim of this study is to examine the relationship of PA and resilience and the mediating and moderating role of self-perception of PA in this relationship.

METHODS

Participants

The study involved 379 students attending 4th grades of high schools and universities in Croatia (72.1% female), aged from 18 to 29 years ($M = 21.51$, $SD = 2.23$). The data used in this study are collected as a part of a larger research project entitled "Physical Activity and Psychological Well-being: From Habit to Identity", funded by the Catholic University of Croatia and approved by the Ethics Committee of the Catholic University of Croatia. The project survey was conducted through the web platform SurveyRock. Prior to completing the survey, participants were presented with an informed consent form containing information about the study's goals, the confidentiality and anonymity of their responses and the option of withdrawing from the study at any time without facing any repercussions. Participants granted their agreement to partake in the study by choosing the "next" button and subsequently accessing the survey.

MEASURES

Resilience

The Brief Resilience Scale (BRS) (Smith et al., 2008) was utilized to assess participants' resilience. The scale consists of 6 items (e.g., "I tend to bounce back quickly after hard times"), and participants rated their agreement with each item on a 5-point scale (from 1= "strongly disagree" to 5= "strongly agree"). The total score was calculated by averaging responses on items (three items are reversely scored), with higher scores indicating higher resilience. The internal consistency of BRS in this study was good (Cronbach $\alpha = .85$).

Self-perception of physical activity

Data regarding participants' self-perception of physical activity was collected using the following question: "In general, do you consider yourself to be regularly physically active?". Participants provided their responses on a ten-point scale, with choices ranging from 0 ("not at all") to 10 ("yes, extremely").

PA intensity

The Godin-Shephard Leisure-Time Physical Activity Questionnaire was used to evaluate the intensity of physical activity. Participants were asked, "How many times, on average, do you engage in the following types of physical exercises for more than 15 minutes?" Following this, three categories of exercise were presented and described: vigorous exercise (where the heart beats rapidly), moderate exercise (not tiring), and mild/light exercise (requiring minimal effort), with examples provided such as running, brisk walking, and leisurely walking, respectively. Participants indicated the frequency of each type of exercise. The overall score was calculated by multiplying each individual score by its corresponding ponder (3 for mild exercise, 5 for moderate exercise, and 9 for strenuous exercise). A greater score indicates a higher intensity of physical activity (Godin, 2011).

Data Analysis

To test the direct contribution of PA intensity on resilience and the mediation and moderation role of self-perception of PA in this relationship, we utilized mediation and moderation analysis using PROCESS macro (Hayes & Montoya, 2017).

RESULTS

The results of the correlation analysis (Table 1) showed a high positive relationship between PA intensity and self-perception of PA ($r = 0.70$, $p < 0.01$). A smaller but also positive correlation was found between PA intensity and resilience ($r = 0.13$, $p < 0.05$) and between PA intensity and self-perception ($r = 0.18$, $p < 0.01$).

Table 1. Descriptive statistics and intercorrelations between variables

	<i>M (SD)</i>	<i>Range</i>	1	2	3
PA intensity (1)	49.52 (26.33)	3 - 186	-	0.70**	0.13*
Self-perception of PA (2)	6.26 (2.28)	0 - 10		-	0.18**
Resilience (3)	3.09 (0.81)	1 - 5			-

* $p < 0.05$; ** $p < 0.01$

The mediation analysis results showed that the model accounted for 48,92% of resilience scores (Figure 1). The direct contribution of PA intensity to resilience was not statistically significant, $b = 0.01$ [-0.13-0.13]. The indirect contribution was statistically significant, $b = 0.12$ [0.02-0.23]. Specifically, PA intensity contributed to resilience through elevated perception of self as regularly physically active. As shown by complete mediation analysis, PA intensity positively contributed to self-perception of PA $b = 0.66$ [0.35-0.73], which further positively contributed to resilience, $b = 0.19$ [0.04-0.33].

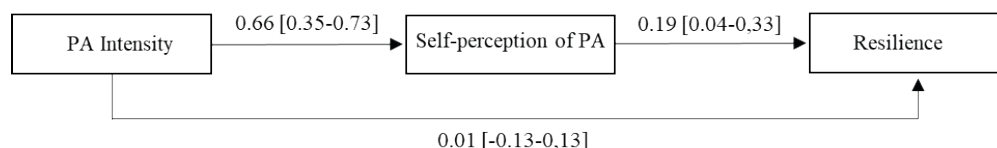


Figure 1. Mediation analysis of the relationship between PA intensity and resilience and the mediation role of self-perception of PA

The results of moderation analysis showed that self-perception of PA did not have a statistically significant moderating role in the relationship between PA intensity and resilience, $b = 0.03$, $p = 0.54$.

DISCUSSION

This study examined the mediation and moderation role of the self-perception of PA in the relationship between PA intensity and resilience. Results showed that the direct contribution of PA intensity to resilience was not significant. However, PA intensity positively contributed to resilience through a more pronounced perception of oneself as being regularly physically active. In other words, more intensive PA enhanced self-perception of being regularly physically active, which contributed to higher resilience. This finding aligns with previously shown link between increased PA and strengthened resilience (Li & Guo, 2023; San Román-Mata et al., 2020; Seçer & Yildizhan, 2020) but also contributes to elucidating the possible mechanisms underlying this relationship, suggesting that the self-perception of PA could mediate the relation between PA and resilience. Moreover, the study's findings indicated the importance of self-perception in one's overall well-being and the potential effect of exercise on self-perception, which is particularly emphasised within the hierarchical framework of physical self-perception (Fox, 1997, 2000). This model assumes that specific self-perceptions (perceived strength, sports competence, attractive body, and physical condition) contribute to developing a higher-level construct, namely physical self-worth, as the immediate precursor of global self-esteem. Self-esteem, furthermore, is shown to be a significant determinant of well-being (Pyszczynski et al., 2004) and a significant factor in developing resilience (Sharma & Bali, 2013; Kim & Yoo, 2019). Therefore, our results propose that PA, by increasing the perception of oneself as a regularly physically active individual (lower-level construct), may contribute to the enhancement of self-esteem (global construct) and, consequently, through the increase in self-esteem, lead to the development of higher levels of resilience. However, this explanation also underscores a weakness of this study, namely the exclusion of self-esteem. Encompassing self-esteem might have clarified the entire path from PA to resilience via self-perception and self-esteem.

In addition to the assumption that individuals' perception of themselves as being regularly physically active leads to enhanced self-esteem and thus results in higher resilience, it is also relevant to consider the importance of the role of individuals' beliefs, which might be reflected in self-perception. Specifically, those individuals who place importance on seeing themselves as physically active may also be the ones who believe in the beneficial impact of PA on their well-being. This is well explained within the motivational theory of growth mindset (Dweck, 2000; Yeager & Dweck, 2016). According to this theoretical framework, a growth mindset characterizes individuals with the belief that their personal growth

is determined by their own actions. This assumption is consistent with the studies that demonstrated the significant role of the belief in the benefits of PA in attaining the positive effects of PA on physical (Baceviciene et al., 2019; Crum & Langer, 2007) and psychological well-being (Glavaš et al., 2023; Lang et al., 2018).

While the benefits of physical activity for resilience development (San Román-Mata et al., 2020), as well as for overall physical (Katzmarzyk, 2010) and mental health (Tyson, 2010), are well-documented, this study prompts reflection that simply increasing the level of PA without considering cognitive factors (e.g., self-perception of PA) may not fully realise the benefits of PA.

The practical implications of this research are evident in the significance of emphasizing the need to enhance individuals' knowledge and awareness regarding their perception and attitudes towards their own PA, that can have a vital role in maximising the benefits of PA.

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SLEEP QUALITY AND ACADEMIC ACHIEVEMENTS OF STUDENT'S

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ABSTRACT

Modern lifestyles, social commitments, and technological advances, along with academic pressures, often deprive students of adequate rest, impacting their ability to function optimally. Consequently, many struggle with irregular sleep patterns, sleep deprivation, and poor sleep quality. These disturbances, stemming from academic stress, lifestyle choices, or underlying disorders, adversely affect academic performance, mental health, and overall well-being. This study aims to explore the link between sleep and academic success among university students.

Involving both genders, the study utilized the Pittsburgh Sleep Quality Index (PSQI) to evaluate sleep quality across seven components. Data on gender, age, year of study, and grade point average were collected online anonymously. 50 undergraduate physiotherapy students (12 male, 38 female) participated, reporting an average sleep duration of 6 hours and a grade point average of 4.23. Higher grades correlated positively with more sleep hours. Common sleep disturbances included nocturnal awakenings (62%), bathroom visits (38%), and general discomfort (20%), with fewer citing breathing issues, coughing, or pain. 80% rated their sleep quality as very good or good, while 20% deemed it poor.

Understanding the nexus between sleep quality and academic achievement necessitates a multifaceted approach, considering factors like sleep duration, efficiency, hygiene, and individual variances. The findings underscore sleep quality as a pivotal factor influencing students' academic success.

Keywords: academic achievement, physiotherapy student, sleeping, sleep quality, students

INTRODUCTION

Sleep is an inseparable part of human health and life and is central to learning and exercise as well as physical and mental health (Dewald et al., 2010). In today's fast-paced society, students often have to strike a delicate balance between academic demands, social obligations and technological distractions, leaving little time for adequate rest (Watson et al., 2015.). As a result, a significant proportion of students struggle with sleep disorders and poor sleep quality, posing a major challenge to their academic

success and overall well-being. Studies have shown that inadequate sleep, increased frequency of short sleep, sleeping in late and waking up early impair learning ability, academic performance and neurological functioning (Owens, 2017.)

Understanding the complex relationship between sleep quality and students' academic performance is critical to developing effective strategies to promote their educational success and holistic development (Jalali, 2020).

Sleep quality is typically defined in terms of total sleep duration, latency to fall asleep, sleep efficiency, degree of fragmentation, or sometimes sleep-disrupting events (Krystal et al., 2008)

Adults should regularly sleep 7 or more hours per night to promote optimal health. Regular sleep of less than 7 hours per night is associated with negative health outcomes (Park et al., 2020)

To address this pressing issue, this study examines the relationship between sleep quality and academic performance in undergraduate physical therapy students. While modern lifestyles and academic pressures contribute to irregular sleep patterns and sleep disturbances, the specific impact of these factors on students' academic performance is an area that has yet to be explored in depth. By examining this relationship, this study aims to shed light on the key role of sleep hygiene in shaping students' educational trajectories and provide targeted interventions to promote optimal academic outcomes. Our hypothesis is that sleep quality is closely associated with academic performance.

METHODS AND PARTICIPANTS

This cross-sectional study includes 50 undergraduate and graduate physiotherapy students, both sexes. The research was conducted at the Faculty of Health Studies in Rijeka and data were collected from March to April 2024, as part of research. The survey was conducted online using Google forms. Participation is voluntary and anonymous. Gender, age, year of study and grade point average (GPA) were also recorded.

To assess sleep quality, the Pittsburgh Sleep Quality Index (PSQI) was used, which measures 7 components of sleep quality using 19 items: subjective sleep quality, sleep latency, sleep duration, usual sleep efficiency, sleep disturbances, use of sleep medication and disturbances in daily routines. Only self-rated questions are included in the scoring. Each item is scored from 0 to 3, where a score of "0" indicates no difficulty, while a score of "3" indicates severe difficulty. The total scores of the seven components are referred to as the global PSQI score, which ranges from 0 to 21. A global PSQI score over 5 indicates poor sleep (Buyse et al., 1989.).

RESULTS

38 female (76%) and 12 male (24%) students took part in the research. Most of the participants were in their first year of study (64%). A smaller percentage consisted of 2nd year (22%), 3rd year (8%) and 4th year (6%) students. Participants with a grade point average (GPA) of 3.0 – 3.5 had the poorest sleep quality with an average of 6.8, while participants with a GPA of 4.5 or higher had the best sleep quality with an average of 3.4. The global PSQI score was 4.86, which indicated good sleep quality. Female students had a slightly better score than male students, but no statistically significant difference was found (Table 1).

Table 1. Results of sleep duration in relation to gender, GPA and degree

	N	%
male	38	76
female	12	24
Grade point average	PSQI score	
3,0 – 3,5	6.8	
3,5 – 4,0	4.5	
4,0 – 4,5	5.1	
4,5 – 5,0	3.4	
Gender	PSQI score	
Male	5	
Female	4.86	
ACADEMIC YEAR	PSQI	Average PSQI score
1st year undergraduate	4.86	4,86
2 nd year undergraduate	5	
3 rd year undergraduate	5	
1 st year of graduated study	6	

50% of respondents had a PSQI score above 5, which is considered an indicator of significant sleep disturbance. According to the results, undergraduate students have the worst sleep quality, and 64% of respondents have sleep problems, while only 6% of graduate respondents have sleep problems. The most common disturbances during sleep were attributed to waking up at night (38%), going to the toilet (38%) and poor sleep due to bad dreams (20%). Disorders such as breathing problems, feeling too hot or too cold and pain sensations were less common. In addition, the subjective perception of sleep was distributed among the participants in such a way that 80% of them rated it as good or very good, while 20% categorized it as poor. The daytime dysfunction variable asked participants if they had problems staying awake during daily activities such as attending lectures or driving. Most participants reported that they had problems staying awake less than once a week or not at all. However, a significant number reported having the problem 1 or 2 times a week, while others reported having it 3 or more times a week. Table 2 provides insights into the sleep disturbances experienced by participants, categorized by their significance and distribution across different academic years.

Table 2. Sleep disturbances of participants

	N	%
Significant sleep disturbance	25	50
Insignificant sleep disturbance	25	50
Disturbances according to year of study		
1st year undergraduate	32	64
2 nd year undergraduate	11	22
3 rd year undergraduate	4	8
1 st year of graduated study	3	6
Sleep disturbances trough out the night		
Waking up		38
Need to use the restroom		38
Bad dreams		20
Subjective perception of sleep		
Very good		64
Good		22
Poor		8
Very poor		6
Experiencing of daily disfunction		
Never in the past month		26
Less often than once a week		40
One or two times a week		10
Three or more times a week		24

DISCUSSION

The participation of fifty bachelor's and master's students from the Faculty of Health Studies in Rijeka offers insight into the intricate interplay between academic achievement and sleep quality. The findings underscore a notable association between the number of hours slept and students' grade point averages, revealing an average sleep duration of 6 hours, which falls short of the recommended 7 to 9 hours for optimal health and cognitive function (Hirshkowitz et al., 2015).

The pivotal role of sleep quality in academic success is evident in our study's results. Analysis confirmed our hypothesis, revealing a distinct link between sleep quality and academic performance. Notably, students with higher grade point averages demonstrated superior sleep quality compared to those with lower grades. Consistent with prior research, a sleep quality score exceeding 4 is indicative of satisfactory sleep (Park et al., 2020).

Signs of poor sleep quality include not feeling rested even if you have had enough sleep, waking up repeatedly during the night and experiencing symptoms of sleep disturbance (such as snoring or gasping for air). Improving sleep quality can be achieved through better sleep habits or by diagnosing and treating a sleep disorder you may have (Watson et al., 2015.)

The most important finding is that students with a GPA between 3.0 and 3.5 have the poorest sleep quality, while those with a GPA between 4.5 and 5.0 have the best sleep quality. This underscores the importance of continued research and promotion of healthy sleep habits among university students, especially those whose academic performance may be compromised due to inadequate sleep or poor sleep quality.

In addition, the gender difference in sleep quality among students is not significant, although the results suggest that female students slept slightly better than male students. This finding suggests that strategies to improve sleep quality should be targeted at all students regardless of gender in order to achieve optimal results (Duarte, 2014.)

Those affected often had sleep disturbances, which were mostly related to waking up at night, going to the toilet and general problems falling asleep. Nevertheless, a large proportion of students rated their dream as positive despite these difficulties. These results emphasise the importance of treating sleep-related problems in students, as they have a direct impact on both academic performance and general well-being.

It is crucial to emphasise that half of the students had poor sleep quality according to the overall Pittsburgh Sleep Quality Index (PSQI) score, while the other half had good sleep quality. This suggests that students need to be continually supported and educated on the importance of healthy sleep habits and stress management in order to reduce the incidence of poor sleep quality and potentially improve their academic success.

CONCLUSION

Understanding the complex interplay between sleep quality and academic performance requires a multidimensional approach that takes into account factors as diverse as sleep duration, sleep efficiency, sleep hygiene and individual differences. According to the results, the quality of sleep is one of the elements that influence the academic success of students. Students' sleep quality and academic performance can be improved through more studies and interventions aimed at treating common sleep disorders and promoting better sleep hygiene.

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THE INFLUENCE OF PHYSICAL ACTIVITY ON THE STUDENTS' EMOTIONAL STATES

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ABSTRACT

This work aimed to explore how different levels of physical activity affect the emotional reactions of the students at the University of Zagreb and whether there is a gender difference in emotional states given the amount of exercise performed. 121 students of the University of Zagreb participated in this study. An anonymous questionnaire was applied relating to recreational exercise and involvement in sports as a measure of physical exercise. Different positive and negative emotional states were tested through the Panas questionnaire. The results of the study indicate that physical activity has a positive impact on the emotional states of students. Regular exercise increases the sense of positive emotional states. A gender difference was observed in both the amount of exercise and emotional states, with female students being less physically active and showing more negative emotional states in comparison to their male colleagues.

Keywords: *exercise, emotional states, students*

INTRODUCTION

In this day and age, there is an increasing emphasis placed on the importance of physical activity for the general health and well-being of the individual (Wang and Li, 2022). In addition to the beneficial effects of exercise on physical health, research is increasingly aiming to test the impact of physical activity on the emotional states of the individual (Al-Wardat et al. 2024; Han, 2024). Emotional health, defined as the ability to deal with daily challenges and adjust to changes, is crucial for the overall well-being of the individual. Studies suggest that physical exercise plays a significant role in regulating emotional states and improving overall emotional well-being (Han, 2024; Rodríguez-Romo, 2023). Mandoles et al. (2018) point out that the short-term effects of physical activity include immediate improvement in mood, reducing feelings of stress and anxiety, and increasing positive emotions such as happiness and satisfaction. On the other hand, long-term effects include structural changes and function of the brain that occur over time due to regular physical activity, resulting in long-term improvement of one's emotional well-being. Most students experience various emotional challenges at times. However, if these conditions last for a long time, they become an obstacle to daily functioning. Given the high prevalence of mental health issues among the student population and the potential benefits that physical activity can have for emotional health, understanding this complex relationship is increasingly becoming the focus of research. This paper explores how different levels of physical activity affect the emotional reactions of students of the University of Zagreb, including analyzing positive and negative emotional states. Also, the goal is to examine whether there is a gender difference in emotional states and how this difference varies with the amount of exercise.

WORK METHODS

Sample: A commemorative sample of 121 students of the University of Zagreb (45.45% M and 54.55% F) studying in various fields of science.

Sample variables: In addition to using demographic variables (gender, age, year of study), we used variables that describe physical activity within the last month (walking, recreational exercise, and cycling) and variables examining active sports playing (playing sports throughout childhood until college, the number of years the examinees have been actively involved in sports, in case they are still active in sports - how many training sessions they have per week). Various positive and negative emotional states were examined through the validated Panas (Positive and Negative Affect Schedule) questionnaire, which is used to measure positive and negative affects, that is, a person's feelings and emotional states (Watson et al. 1988). The questionnaire consists of two separate parts - one part measures positive (10 variables), while the other measures negative affects (10 variables).

Data processing: Data was processed by a statistical SAS (Statistical Analysis System) package. In addition to descriptive indicators, gender differences (Fisher's exact test) were made for each variable, as well as a canonical correlation analysis between sets of physical activity variables and sets of variables of different emotional states within the student population. MANOVA analysis was used to investigate interactions between multiple variables within the same model.

RESULTS

The analysis of the descriptive indicators has shown that the sample consists of 121 students (45.45% M and 54.55% F) between the ages of 19-24 / 19 = 23.14%; 20 = 44.54%; 21 = 14.05%; 22 = 4.13%, 23 = 9.09%; 24 = 6.96%). Most students sampled are part of an undergraduate study 88.43% (1st year = 48.76%; 2nd = 38.02%; 3rd = 1.65%) and graduate study 11.57% (1st = 0.83; 2nd = 10.74 %).

The results in variables related to physical activity within the last month were observed through walking, free time recreational exercise and cycling, showing that 44.63% of students walked every day for at least 30 minutes at a time without interruption. There is a moderate, statistically significant difference by gender (Fisher's exact test, $P = 0.0788$), showcasing that female students were significantly less active. As for free time recreational exercise lasting at least 45 minutes, 31.40% of the examinees participated three or more times a week. The analysis did not show a statistically significant gender difference, with a slight emphasis on the fact that a greater number of female students exercised less per week than their male colleagues. Also, a higher number of female students didn't go cycling at all within the last month compared to male students (38.84% vs 28.93%). They equally cycled 1-2 times per week (55.56% M vs 44.44% F), while a higher number of male students cycled 3 or more times a week (5.79% vs 3.31%). Gender differences did not show a statistically significant difference (Fisher's exact test, $P = 0.5434$).

The analysis of sports inclusion of students from childhood up until entering college shows that fewer female students were involved in sports (23.14% vs 9.92%). After enrollment, an equal number of students stopped actively participating in sports (49.15% M and 50.85% F). There is a statistically significant gender difference (Fisher's exact test, $P = 0.0280$), which shows that a larger number of male students remain active in sports during college (11.57%) compared to female students (6.61%). For those who are still actively participating in sports, the gender difference shows that female students have fewer training sessions per week than their male colleagues. A higher number of male students (9.92% M and 2.48% F) have more than five training sessions per week.

The analysis of descriptive indicators and gender differences related to emotional states is presented in Table 1.

Table 1. PANAS descriptive indicators

Variables	1	2	3	4	5		1	2	3	4	5	P=
ACTIVE	2.48	20.66	34.71	25.62	16.53	% M	0	9.09	10.74	15.70	9.92	.0252
						% F	2.48	11.57	23.97	9.92	6.61	
GUILTY	28.10	32.23	29.75	4.96	4.96	% M	17.36	16.53	9.09	1.65	0.83	.0426
						% F	10.74	15.70	20.66	3.31	4.13	
ATTENTIVE	10.74	27.27	33.06	25.62	3.31	% M	4.96	13.22	13.22	12.40	1.65	0.9467
						% F	5.79	14.05	19.83	13.22	1.65	
NERVOUS	18.18	20.66	24.79	26.45	9.92	% M	14.05	9.09	10.74	8.26	3.31	.0143
						% F	4.13	11.57	14.05	18.18	6.61	
EXCITED	7.44	16.53	44.63	26.45	4.96	% M	4.13	8.26	20.66	9.92	2.48	0.8336
						% F	3.31	8.26	23.97	16.53	2.48	
STRONG	12.40	23.97	33.88	19.83	9.92	% M	4.13	7.44	15.70	11.57	6.61	0.1343
						% F	8.26	16.53	18.18	8.26	3.31	
HOSTILE	52.07	23.14	14.88	6.61	3.31	%M	25.62	13.22	2.48	2.48	1.65	.0642
						% F	26.45	9.92	12.40	4.13	1.65	
PROUD	10.74	28.93	36.36	15.70	8.26	% M	5.79	8.26	19.01	8.26	4.13	.2134
						% F	4.96	20.66	17.36	7.44	4.13	
AGGRAVATED	11.57	28.10	23.97	20.66	15.70	% M	8.26	14.88	8.26	9.09	4.96	.1188
						% F	3.31	13.22	15.70	11.57	11.57	
IRRITATED	19.01	35.54	26.45	12.40	6.61	% M	14.88	16.53	8.26	4.13	1.65	.0045
						% F	4.13	19.01	18.18	8.26	4.96	
ASHAMED	55.37	31.40	10.74	1.65	0.83	% M	30.58	11.57	2.48	0.83	0	0.0746
						% F	24.79	19.83	8.26	0.83	0.83	
INSPIRED	12.40	30.58	31.40	19.01	6.61	% M	4.96	12.40	14.88	9.09	4.13	0.8286
						% F	7.44	18.18	16.53	9.92	2.48	
AMAZED	15.70	37.19	30.58	12.40	3.31	% M	3.31	17.36	15.70	7.44	1.65	0.1556
						% F	12.40	19.83	14.88	4.96	2.48	
FRIGHTENED	50.41	33.88	9.92	4.13	1.65	%M	28.10	12.40	4.13	0.83	0	0.1459
						% F	22.31	21.49	5.79	3.31	1.65	
UNHAPPY	35.83	39.17	12.50	8.33	4.17	%M	18.33	20.00	3.33	2.50	0.83	0.2588
						% F	17.50	19.17	9.17	5.83	3.33	
DETERMINED	9.92	19.83	38.02	23.97	8.26	% M	4.13	8.26	15.70	11.57	5.79	0.5676
						% F	5.79	11.57	22.31	12.40	2.48	
SCARED	55.37	23.97	14.88	4.13	1.65	% M	29.75	8.26	7.44	0	0	.0476
						% F	25.62	15.70	7.44	4.13	1.65	
AWAKE	8.26	23.97	36.36	21.49	9.92	% M	2.48	9.92	16.53	12.40	4.13	0.6129
						% F	5.79	14.05	19.83	9.09	5.79	
INTERESTED	5.79	19.01	40.50	26.45	8.26	% M	2.48	5.79	22.31	9.92	4.96	0.2260
						% F	3.31	13.22	18.18	16.53	3.31	
UPSET	23.14	28.93	24.79	16.53	6.61	% M	14.88	13.22	13.22	2.48	1.65	.0070
						% F	8.26	15.70	11.57	14.05	4.96	

Tab. 1 shows the proportions of the results of positive and negative emotions within the examined sample. Regarding positive emotions, results show that students are moderately interested (40.50%), determined (38.02%), and active 34.71%. Regarding negative emotions, students mostly feel quite or extremely nervous, aggravated, irritated, upset, frightened, unhappy, and hostile. The results show a statistically significant gender difference, with female students indicating significantly more negative emotional states in comparison to their male colleagues (upset $p=.0070$; irritated $p=.0450$; scared $p=.0476$; and nervous $p=.0143$).

Table 2. Results of the canonical correlation analysis, which investigates the relationship between physical activity variables and the emotional state of the examinees.

				Eigenvalues of $\text{Inv}(\mathbf{E})^* \mathbf{H} = \text{CanRs} / (1 - \text{CanRs})$				Test of H_0 : The canonical correlations in the current row and all that follow are zero					
	Canonical Correlation	Adjusted Canonical Correlation	Approximate Standard Error	Squared Canonical Correlation	Eigenvalue	Difference	Proportion	Cumulative	Likelihood Ratio	Approximate F Value	Num DF	Den DF	Pr > F
1	0.635871	0.575823	0.054377	0.404332	0.6788	0.4689	0.5886	0.5886	0.38189341	1.87	60	555.18	0.0002
2	0.416520	0.289257	0.075450	0.173489	0.2099	0.0974	0.1820	0.7706	0.64111742	1.11	45	477.27	0.2972
3	0.317996	0.136015	0.082056	0.101122	0.1125	0.0265	0.0975	0.8681	0.77569132	0.88	32	396.19	0.6540
4	0.281473	.	0.084055	0.079227	0.0860	0.0429	0.0746	0.9428	0.86295458	0.78	21	310.67	0.7451
5	0.203324	.	0.087513	0.041341	0.0431	0.0202	0.0374	0.9802	0.93720643	0.60	12	218	0.8421
6	0.149593	.	0.089244	0.022378	0.0229		0.0198	1.0000	0.97762184	0.50	5	110	0.7730

In Table 2, the first canonical correlation has a statistically significant p-value (0.0002), which indicates that there is a significant connection between physical activity (walking, recreational exercise, cycling, involvement in sports) and emotional states (such as nervousness, irritability, fear, etc.). The second canonical correlation also shows a statistical significance ($p = 0.2972$). Although not as significant as the first one, it still suggests some association between the variables. Other canonical correlations are not statistically significant. The results suggest that students who regularly exercise or play sports have less pronounced negative emotional reactions such as nervousness or fear. On the other hand, it can be assumed that students who are less physically active have a greater tendency towards negative emotional states.

Tab. 3. Results of multivariate analysis of variance (MANOVA)

Multivariate Statistics and F Approximations					
S=6 M=1.5 N=51.5					
Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.38189341	1.87	60	555.18	0.0002
Pillai's Trace	0.82188753	1.75	60	660	0.0007
Hotelling-Lawley Trace	1.15324635	1.99	60	363.21	<.0001
Roy's Greatest Root	0.67878628	7.47	10	110	<.0001

NOTE: F Statistic for Roy's Greatest Root is an upper bound.

In the result of the multivariate analysis of variance (MANOVA) (Tab. 3), there is a statistically significant difference between the examinees based on the combination of physical activity variables and emotional states. This indicates that there is a connection between the level of physical activity and the emotional states of the examinees.

DISCUSSION

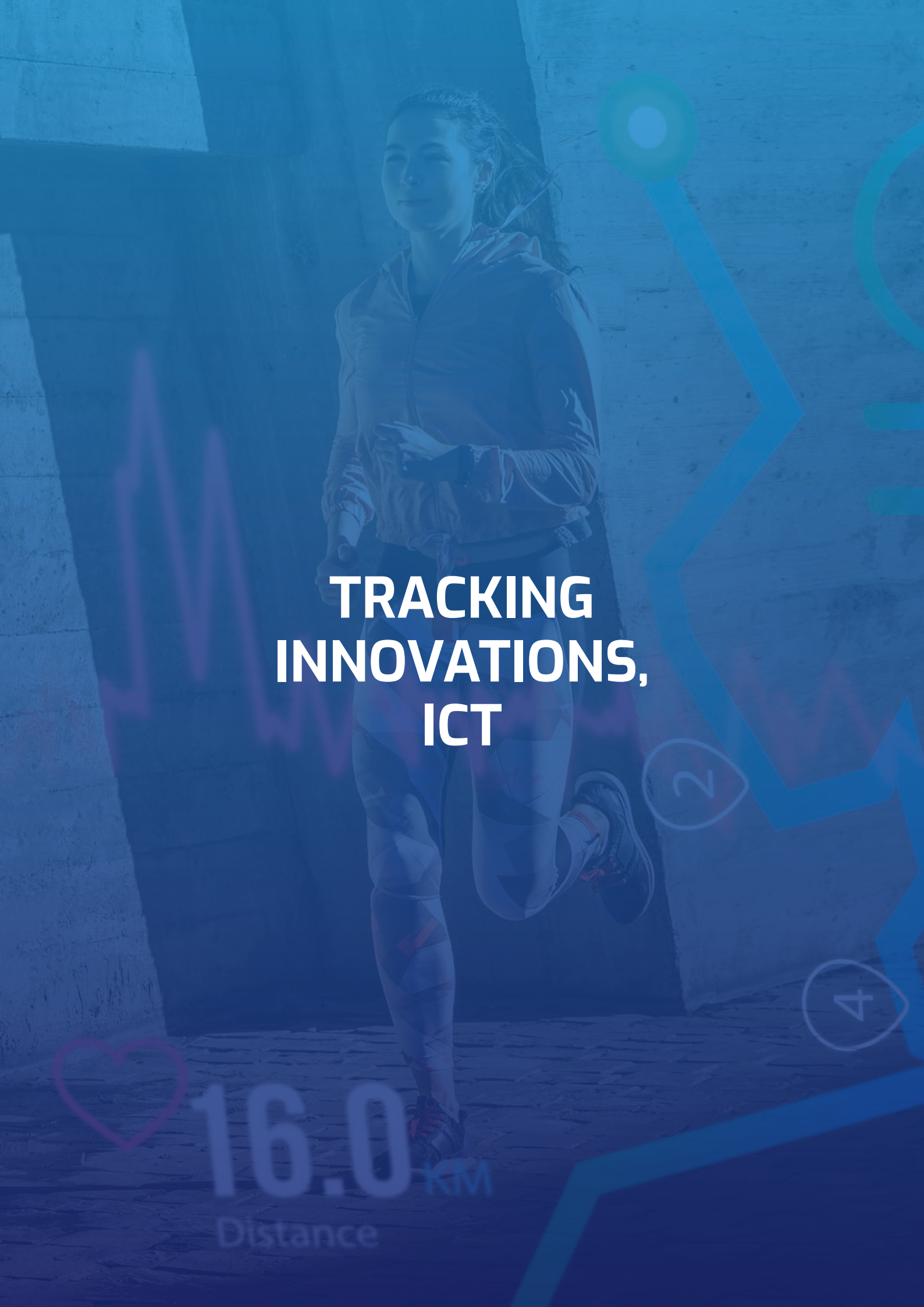
The results of the conducted research show that there is a significant connection between physical activity and the emotional states of students. Students who regularly exercise or play sports have less pronounced negative emotional reactions, such as nervousness, irritability, or fear. On the other hand, less physically active students have a greater tendency towards negative emotional states. Similar results were obtained by Yang et al. (2024) and Maher et al. (2021) whose results show that students with higher levels of physical activity showcase less negative emotional reactions, such as sadness or anxiety, and show more positive emotional reactions, such as happiness and satisfaction. Gender differences in this research indicate that female students express more negative emotional states while also being less physically active. Other studies confirm the gender difference regarding the impact of physical activity on emotional states, with male students showing a greater positive impact of physical activity on their emotional state compared to female students (Jiang et al. 2021). The positive effects of physical activity on emotional states may differ between genders for several reasons. Firstly, men and women have different biology, including hormonal balance (Teo et al. 2023). They also have different patterns of socialization that affect their perception of physical activity and its impact on their emotional states (Espada et al. 2023). Based on this and other research, there is an emphasis on the necessity of promoting physical activity among students as a means of improving their emotional health and well-being.

CONCLUSION

To better understand the complex connections between physical activity and emotional states, further research is necessary. Future research should explore the impact of biological and social factors on this relationship and develop practical guidelines and strategies for promoting physical activity and emotional well-being among college students. This work represents a step forward in understanding the relationship between physical exercise and emotional well-being, with potential implications for improving the mental health of young adults.

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A woman in athletic wear is running on a cobblestone path. The image is overlaid with a blue tint and various digital graphics. A pink heart rate line is on the left. A blue line with a green circle at the top and numbers 2 and 4 in circles is on the right. At the bottom left, there is a pink heart icon, the text '16.0 KM' in large blue font, and 'Distance' in smaller blue font below it.

TRACKING INNOVATIONS, ICT

16.0 KM
Distance

DIGITAL DYNAMICS OF STUDENT SPORTS: IMPACT OF ICT ON SOCIAL AND EMOTIONAL ASPECTS

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ABSTRACT

This research paper is based on the investigation of the impact of information and communication technology (ICT) on the social and emotional aspects of student sports. Student sports are a key part of the overall student experience, providing not only physical benefits but also opportunities for social interaction and emotional well-being. By conducting detailed analyzes of student participation in sports activities, the use of online platforms dedicated to sports, and the level of communication with other student-athletes through digital means, various aspects of student sports in the context of the digital age are explored. In addition, the emotional impacts of using digital tools in a student sport environment are explored, including exercise motivation, self-confidence, and pre-competition anxiety. Through the analysis of empirical data collected through survey surveillance conducted on the population of participants in student sports competitions, the connection between the use of ICT and social and emotional factors specific to student sports is determined. The research results provide a deeper understanding of how digital technology is shaping and transforming the student sports landscape. The importance of integrating ICT into the student sports environment is emphasized in order to improve the sports experience, encourage mutual cooperation and support, and promote healthy emotional development among student athletes. This analysis provides a basis for further research and development of strategies that will maximize the potential of ICT in promoting a quality and inclusive student sports experience.

Keywords: social network, kinesiology, ICT, social and emotional aspects

INTRODUCTION

The digital revolution of recent decades has dramatically impacted various aspects of our lives, including student sports activities. The introduction of information and communication technology (ICT) into student sports has created numerous new opportunities but has also posed challenges in terms of the social and psychological aspects of sports participation. In response to this paradigm, researchers are increasingly focused on studying the impact of the digital age on student sports and how it affects the social and psychological aspects of participants.

A key factor in this context is the change in communication and interaction among student athletes. According to research (Boyle & Haynes, 2014; Clavio, 2013; Lewis, 2017; Abeza & Sanderson, 2022), social media and digital tools have become integral parts of the sports community among students. Virtual spaces enable athletes to connect, share their sporting achievements and challenges, and provide support to each other, all through online platforms. However, such interaction also raises questions of privacy, authenticity, and self-presentation (Ruihley & Hardin, 2014), affecting emotional bonding and social dynamics within the sports community. Moreover, the digital age has significantly changed the psychological aspects of student sports. Research (Kioumourtzoglou et al., 2022; Masters, 2022) suggests that

the presence of digital technologies can influence sports motivation, self-confidence, and stress among student athletes. From social media competition to managing sports achievements through tracking apps, digital tools shape the perception of sporting success and athlete identity. In this research paper, we will delve deeper into the social and psychological aspects of student sports in the digital age, focusing on the impact of digital technologies on athlete interaction, sports motivation, and the emotional experience of sports participation. Through an analysis of existing literature and our own research, we aim to understand how the digital age influences the sports community among students and shapes the psychological profile of student athletes. This study includes an analysis of a survey conducted by Rastovski & Tomić (2023), and specifically investigates the relationships between students' perceptions, expectations, and their use of information and communication technology (ICT) in sports engagement.

METHODS

The statistical analysis was carried out using the statistical program package STATISTICA, in accordance with the methods used in the research. Descriptive statistics were made. Correlations between variables were analyzed to explore associations, with correlation coefficients indicating the strength and direction of the relationship. The significance level for statistical tests was set at $P < 0.05$ to determine statistical significance. To calculate the correlation between the variables, we used the Pearson correlation coefficient. This coefficient measures the linear relationship between two continuous variables. For each pair of variables from the table, we calculated the Pearson correlation coefficient using statistical software. For example, for the variables "State of Student Sports" and "Correlation with Socialization," we calculated a Pearson correlation coefficient based on the scores given for "State of Student Sports" and the associated correlations with socialization. After we calculated the coefficients for all pairs of variables, we recorded the results in a table in order to have an overview of all correlations between variables.

RESULTS

Question	Average Rating	Standard Deviation	Minimum	Maximum
State of Student Sports	3.40	0.21	3.17	3.97
Legislative Framework for Student Sports	3.20	0.22	2.98	3.68
University Supports Sports Engagement	3.17	0.18	3.02	3.85
Sports Extend Career	3.23	0.25	2.91	3.98
Sports Contribute to Socialization	3.97	0.15	3.70	4.25
ICT Role in Sports Promotion	3.50	0.19	3.28	3.75
Webinars	3.45	0.23	3.18	3.88
Computer Games	3.28	0.20	3.05	3.95
Online Courses	3.15	0.24	2.87	3.72
Video Tutorials	3.38	0.22	3.11	3.80
Podcasts	3.55	0.18	3.32	3.97
Social Media	3.67	0.16	3.45	4.12
Educational Apps	3.25	0.21	3.02	3.78

Table 1. Descriptive Statistics for ICT Tools and Students' Attitudes

Question	Average Rating	Correlation with Socialization (p)	Correlation with Emotional Aspects (p)
State of Student Sports	3.40	0.29	0.17
Legislative Framework for Student Sports	3.20	0.15	0.08
University Supports Sports Engagement	3.17	0.41	0.25
Sports Extend Career	3.23	0.12	0.07
Sports Contribute to Socialization	3.97	1.00	0.54
ICT Role in Sports Promotion	3.50	0.28	0.19

Table 2. Statistically significant relationships ($p < 0.05$)

The results of the correlation analysis show that there is a slight connection between some variables and socialization in student sports, although these connections are not strong enough to be considered statistically significant at the $p < 0.05$ level. For the variable "Legislative Framework for Student Sports" we have a correlation of 0.15 with socialization, which suggests some sort of positive association. This may mean that there is some relationship between the perception of the legislative framework for student sports and socialization in that context, but this relationship is not strong enough to be considered statistically significant. Similarly, for the variable "Sports Extend Career" we have a correlation of 0.12 with socialization. Although this indicates some sort of positive association, the association is weak and not statistically significant at the $p < 0.05$ level. These results suggest that although there is some connection between the perception of the legislative framework and expectations about career extension through sports and socialization in student sports, this connection is not strong enough to be considered statistically significant. For the variable "Legislative Framework for Student Sports", the correlation with the emotional aspect is 0.08, while for the variable "Sports Extend Career" the correlation is 0.07. These results show a slight positive association between these variables and the emotional aspects of student sports. However, these relationships are not strong enough to be considered statistically significant at the $p < 0.05$ level. This suggests that although there is some relationship between the perception of the legislative framework for student sports and the expectations of career extension through sports and emotional aspects, these relationships are not strong enough to be considered statistically relevant.

DISCUSSION

In our discussion, we will additionally highlight the importance of the connection between issues related to the legislative framework for student sports and the expectation that playing sports prolongs a career with social and emotional aspects. Although the correlations between these variables are not statistically significant (0.15 for socialization and 0.08 for emotional aspects), their presence suggests a certain (marginal) connection between perceptions of student sports in terms of the legislative framework and expectations regarding career extension through sports with social and emotional experiences. Perhaps students perceive sports activities as a safer and more supportive environment, which could contribute to their emotional well-being. For example, the positive correlation between the perception of the legislative framework for student sports and socialization indicates that students who have confidence in the set laws and rules are likely to perceive sports activities as an opportunity to build social bonds and interact. This is consistent with the idea that clear and supportive legal frameworks can foster a sense of belonging and togetherness within the sports community, further confirming the research proposed by Behzadnia et al. (2018).

In addition to the above analyses, we should also note the correlation of 0.07 between the questions "Sports Extend Career" and "Correlation with Emotional Aspects". Although this correlation is not statistically significant, it suggests that there is a relationship between the perception that playing sports prolongs one's career and the emotional aspects of sports activity among students. This may indicate that students who believe that sports activities can positively influence their career also perceive positive emotional experiences related to these activities. Additionally, this correlation may imply that students who tend to associate their careers with sports activities may experience greater emotional well-being or satisfaction while participating in sports. Although this relationship is not strong enough (0.07), it indicates the need for further research in order to better understand how the perception of sports activity as a career extension can affect the emotional well-being of students. These findings further encourage thinking about the importance of legal regulation in sports contexts and emphasize the need for further research on how the legislative framework can affect the social and emotional aspects of sports practice. Integrating these elements into further research and practice efforts can provide a foundation for the development of policies and programs that support positive sports participation experiences among college students. Also, correlations that are perhaps less obvious at first glance should be highlighted, such as the one between "Sports Extend Career" and "Correlation with Socialization" (0.12). Although not strong, this association suggests that students who believe that playing sports can be career-enhancing may also tend to engage more in social activities within the sports environment. Further analysis points to the central role of social factors in shaping participation in sport, aligning with the socio-ecological model proposed by Teare & Taks (2024). This model emphasizes the influence of interpersonal relationships, community networks, and social norms on individuals' sporting behavior, emphasizing the interconnectedness of social and environmental factors. In researching the adoption of ICT in sport promotion, our findings confirm the framework proposed by Kim & Jeon (2018), who emphasize the importance of usefulness and ease of use in determining individuals' attitudes towards technology adoption. Recognizing the practical benefits offered by digital platforms in enhancing sporting experiences and fostering social connections, students are more inclined to embrace ICT as a valuable tool for promoting sport. Building on the work of Hayes (2022), who investigated the impact of digital platforms on the psychological well-being of athletes, our findings also show enhanced motivation and confidence through the use of digital tools. In summary, our research highlights the interrelationship between social, psychological, and technological factors in shaping student sports. By contextualizing our findings within the broader discourse of sport sociology, organizational behavior, and technology adoption, we provide valuable insights into the complex dynamics in sport and pave the way for future research in this area.

CONCLUSION

The digitalization of student sports has brought forth a multitude of opportunities and challenges, impacting various aspects of sports participation, particularly in terms of social and emotional dimensions. Through our research, we have explored the intricate interplay between information and communication technology (ICT), legislative frameworks, and the social and emotional aspects of student sports. Our findings underscore the importance of recognizing the subtle yet significant connections between the legislative framework for student sports and students' expectations regarding career extension through sports with their social and emotional experiences. Although the correlations observed were not statistically significant, they suggest a marginal association between perceptions of the legislative framework and expectations regarding career extension through sports with social and emotional aspects. This implies that students who perceive sports activities within a supportive legal framework may also experience enhanced emotional well-being and social interaction. Additionally, the correlation between the perception that sports extend one's career and emotional aspects of sports activity further highlights the nuanced relationship between sports participation and emotional well-being among students. While this correlation was not strong, it indicates the need for further investigation into how perceptions of sports as career-enhancing activities may influence students' emotional experiences.

Furthermore, our research reinforces the central role of social factors in shaping sports participation and the importance of integrating ICT into sports promotion efforts. By recognizing the practical benefits offered by digital platforms in enhancing sporting experiences and fostering social connections, students are more inclined to embrace ICT as a valuable tool for promoting sports engagement. In conclusion, our study contributes to a deeper understanding of the complex dynamics of student sports in the digital age. By shedding light on the relationships between legislative frameworks, ICT adoption, and social and emotional aspects of sports participation, we provide valuable insights for policymakers, educators, and practitioners to develop strategies that support positive sports experiences and promote the holistic well-being of college students. This research sets the stage for future investigations aimed at maximizing the potential of ICT in promoting inclusive and enriching student sports environments.

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PREFERRED COMMUNICATION CHANNELS FOR INFORMING STUDENTS ABOUT ACTIVITIES AT THE FACULTY

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ABSTRACT

The challenges of informing students and the way higher education institutions communicate with them every day are getting bigger and more important. Today's availability of a large amount of information brings positive effects through easy access to information, but on the other hand, it makes it difficult to decide which information has a higher priority, that is, which information is relevant at a certain moment.

This paper tries to analyze the preferred methods of communication among the different participants in the communication process, starting with the vertical ones in the student-teacher or student-faculty, teacher-faculty relationship, and on the other hand, it will try to analyze the horizontal communication methods in the student-student, teacher relationship – teacher. It can be assumed that the method of communication depends on the type of information itself, its content, as well as the time it takes for it to reach the end recipient. It is here that the differences between one-way and two-way communication are emphasized, since the content of certain messages does not require any feedback from the recipient, or the sender asks for confirmation that the recipient has received the message, or to express his opinion, attitude, or some other reaction. The methods of communication must be adapted to the age group that the higher education institution addresses, which in this case are students, so it is expected that the preferred method of communication will be different digital channels such as websites, social networks, or communication platforms such as Viber or Whatsapp.

Key words: communication methods, student communication, digital tools, academic society

INTRODUCTION

Communication between students and faculty is a vital for the academic community. Quality communication facilitates understanding, fosters collaboration, and ensures successful education. However, different students prefer different communication methods, and the same applies to the faculty. From classic methods such as personal meetings to modern digital tools, there are a variety of options that facilitate communication between these two important parties. Here are a few quotes illustrating different ways in which students communicate with the faculty: Communication is an effort between two or more elements, based on signs, codes and languages, to provide a shared commonality. (Stokoe;1972). With diverse communication methods available, students could adapt their approach according to their preferences and needs. It is important for the faculty to recognize and support various communication methods to ensure open and productive interaction with students. Digital technologies have played a pivotal role in the social changes that have occurred since the 1990s, shaping what is known as the Information and Knowledge Society (Castels; 2002). In the dynamic environment of the contemporary

academy, effective communication plays a key role in fostering engagement and participation among students. Universities and faculty organize many activities ranging from seminars and workshops to social events and extracurricular programs. However, ensuring that students are well informed about these activities is a significant challenge. Given the proliferation of communication channels, it becomes critical to identify and use preferred platforms through which to reach students. This article explores different communication channels and their effectiveness in informing students about faculty activities.

TEORETICAL PART

The Internet has created new communication alternatives and challenges in public relations. (Moore and Carlson; 2013). In accordance with that some results suggest that face to face communications is diminishing at the expense of digital communications such as SMS and social media (Fisher and Gonzales; 2014). In 2021, 90% of young adults were engaging regularly with social media, such as Facebook, Instagram, YouTube, and Twitter (Dix et al.; 2022); (Fergie, Hunt & Hilton; 2016).

Before delving into specific communication channels, it's essential to underscore the importance of effective communication in the academic setting. Clear and timely communication enhances student engagement, fosters a sense of belonging, and promotes overall student success. When students are well-informed about upcoming activities, they are more likely to participate actively, contribute to the academic community, and derive maximum benefit from their educational experience. communication is an essential component of the learning process in both face to face and online classroom contexts (Kaufmann and Vallade; 2020).

It is also relevant to acknowledge that retaining students is becoming increasingly important for Higher Education Institutions, and such, ideas from relationship marketing should be of great interest to university, where the creation of value should be regarded as an ongoing process over the lifetime of the relationship (Helgesen, 2008)

To determine the most effective communication channels, it's crucial to understand student preferences and habits regarding information consumption. Today's students are digital natives, accustomed to accessing information through various online platforms and mobile devices. However, preferences may vary depending on factors such as age, field of study, and individual communication habits. Surveys, focus groups, and feedback mechanisms can provide valuable insights into how students prefer to receive information about faculty activities.

PREFERRED COMMUNICATION CHANNELS

Email

Email remains a main communication channel in academia, allowing faculty members to disseminate information to a wide audience quickly. Many students check their university email regularly, making it an effective platform for announcing upcoming events, deadlines, and opportunities. However, given the volume of emails that students receive, it is essential to craft concise, attention-grabbing messages to ensure that important information is not overlooked.

Social Media

Social media platforms such as Facebook, Twitter, and Instagram have become integral tools for communication and community-building in higher education. Faculty departments and student organizations often maintain active social media presences to share updates, promote events, and connect with students. Leveraging social media allows faculty members to reach students where they already spend a significant amount of their online time, fostering interaction and dialogue.

Faculty Websites

Faculty websites serve as repositories of information about academic programs, faculty members, and departmental activities. By maintaining up-to-date event calendars and news sections, faculty websites can serve as valuable resources for students seeking information about upcoming activities. Additionally, faculty members can include links to relevant websites and resources in their course materials, ensuring that students have easy access to information about extracurricular opportunities.

In-Person Announcements

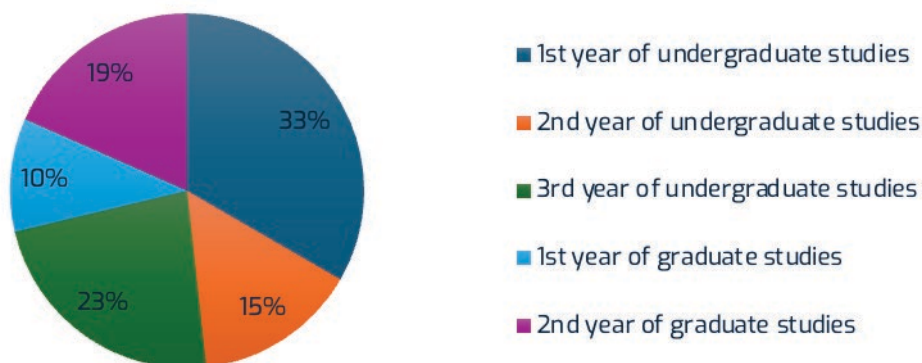
Despite the prevalence of digital communication channels, in-person announcements remain a valuable means of reaching students. Faculty members can promote upcoming activities during lectures, seminars, and departmental meetings, ensuring that students receive information directly from authoritative sources. In-person announcements allow for immediate engagement and clarification of any questions or concerns students may have.

RESEARCH GOAL AND METHODS

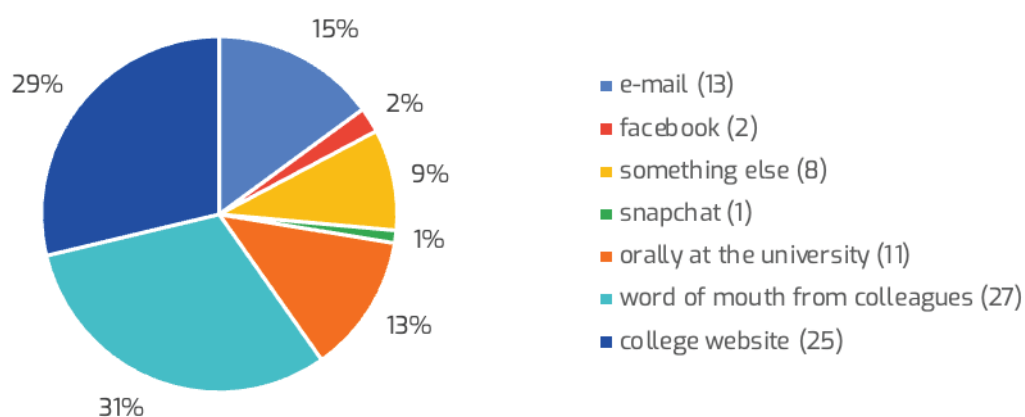
The aim of the research was to determine which communication channels students prefer when it comes to their communication with the faculty and how satisfied they are with the current communication channels.

The research was conducted on students of all study years of the Faculty of Kinesiology Osijek through an anonymous online questionnaire, which included a series of optional answers. The research sample included 87 students out of a total of 427 students, which is slightly more than 20% of the total number of students, and we can consider that the sample is representative. In addition to the questionnaire, data from Google Analytics was also used for the website of the Faculty of Kinesiology in Osijek to determine the structure and habits of website visitors.

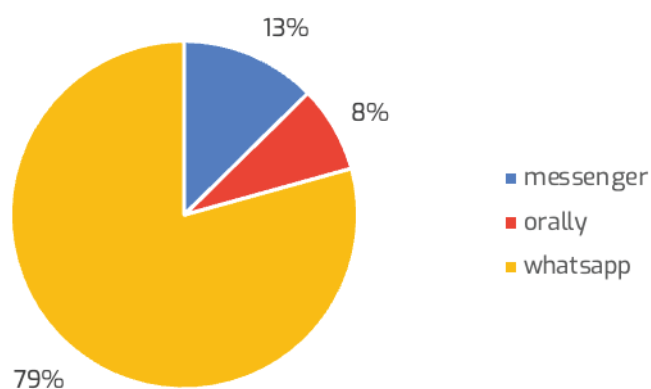
RESULTS



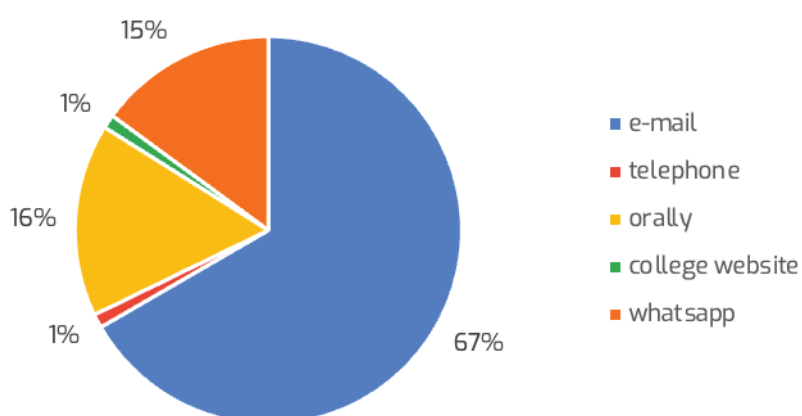
Graph 1: Number of students



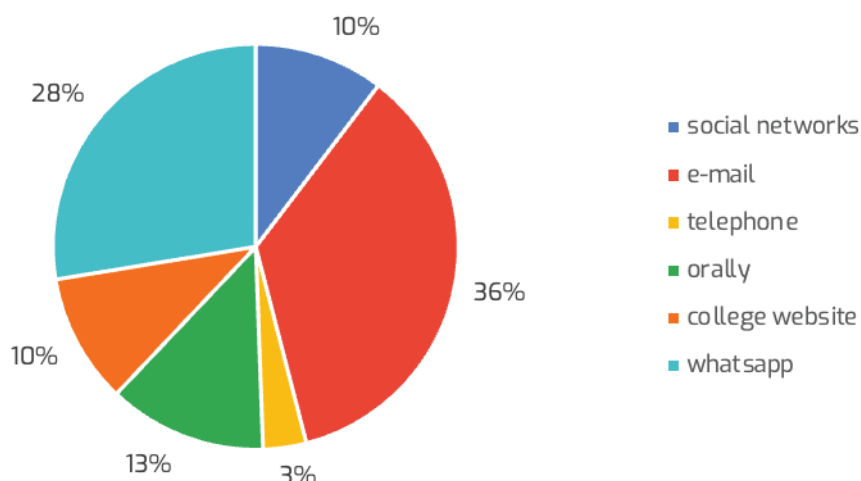
Graph 2: *How do you most often get information about classes?*



Graph 3: *How do you most often communicate with colleagues about subjects related to teaching?*



Graph 4: *What do you consider the most adequate way to communicate with professors?*



Graph 5: Which method of communication do you consider the most adequate for communicating about student sports activities?

DISCUSSION

The results of the research show that students prefer digital channels, which was to be expected. However, it is important to note that when asked about the method of information about classes, the largest number (31%) of them stated that they get the most information orally from colleagues at the faculty, while it is immediately followed by information via the faculty's website (28.7%). The response about the content that students search for most on the faculty's website is significant, namely the schedule with a percentage of 98.9%. The research also showed that students mostly communicate with each other about classes via the WhatsApp application (79.3%), which suggests that it is their preferred method of communication compared to Viber or SMS.

A large number of students (32.2%) believe that the best way to communicate about activities at the faculty is e-mail, as well as the faculty's website, from which it can be concluded that students still use e-mail as a means of communication and browse the faculty's website regardless of the fact that the website is a one-way communication method where I don't know how the recipient understood our message.

When it comes to communication with professors, students here also want to maintain a more serious and official level of communication, therefore 66.7% of them believe that e-mail is the most appropriate way of communicating with professors. Students of the Faculty of Kinesiology Osijek follow student sports activities, but it is significant that part of the communication is still emphasized through channels close to them, such as WhatsApp, and again e-mail as a generally important means of communication on all issues.

CONCLUSION

Effective communication is essential for informing students about activities at the faculty and fostering engagement within the academic community. By understanding student preferences and utilizing a combination of communication channels, faculty members can ensure that important information reaches on time to the target audience. Whether through email, online platforms, social media, or person announcements, faculty members play a vital role in connecting students with opportunities for academic enrichment, personal growth, and community involvement. By prioritizing clear, concise, and inclusive communication, faculty members can empower students to take full advantage of all that the academic experience has to offer.

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PREVALENCE AND CONSEQUENCES OF CYBERBULLYING AMONG STUDENTS: THE NEED FOR PREVENTIVE STRATEGIES AND EDUCATION

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ABSTRACT

Aligned with the rapid expansion of social networks among young people, this research investigates the prevalence of cyberbullying or internet violence, the characteristics of both abusers and victims, and the consequences of digital peer violence. Utilizing a survey approach among the student population, the data were analyzed using statistical methods to gain insight into the forms of violence on social networks. The results indicate a high percentage of young people exposed to cyberbullying and identify specific profiles of abusers and forms of violence. Through this study, we conclude the importance of developing preventive strategies and education to reduce the incidence of cyberbullying among young people, contributing to a better understanding of the dynamics of this problem.

In conclusion, it is necessary to develop and implement preventive strategies and educational programs aimed at reducing cyberbullying among young people. Education about digital security and responsible use of the Internet is key to combating this problem. The paper indicates a significant prevalence of cyberbullying among students and emphasizes the need for preventive strategies and education. The results of the research contribute to a better understanding of the dynamics of cyberbullying and open perspectives for further interventions and promoting the safety of young people in the digital space.

Keywords: cyberbullying, social networks, students, prevalence, consequences, prevention, education

1. INTRODUCTION

Abuse is a form of violence, most often directed towards an individual, which threatens their well-being. This form of violence includes repeated actions that harm the individual either verbally or physically (and others), and can lead to psychological and/or physical consequences (or others) on the abused individual (Olweus, 1994). With the development of the Internet, a new form of abuse has emerged where the abuser can hide behind the screen and intentionally and repeatedly harm someone, and we call this form of abuse cyberbullying, which is increasingly common, especially among today's adolescents and young people (Hinduja and Patchin, 2012). With cyberbullying, the abuser aims to hurt, upset, or in any way damage an individual who cannot protect themselves from such actions (Sakellariou et al., 2012; Milković-Nikčević and Jerković, 2016). Cyberbullying includes: (a) inciting group hatred; (b) invasion of privacy; (c) harassment; (d) stalking; (e) insulting; (f) negligent access to harmful content; (g) sending threatening and cruel messages; (h) creating pages that contain stories, drawings, pictures, and jokes at the expense of peers; (i) dissemination of violent and offensive comments. There are two forms of cyberbullying, namely direct attacks and attacks through intermediaries. An attack through an intermediary is when the abuser attacks the victim through a third person who is usually not even aware of it, making

it the most dangerous type of violence over the Internet because it often involves adults, among whom there are many people with bad intentions (Sakellariou et al., 2012; Milković–Nikčević and Jerković, 2016).

According to international and domestic literature sources, peer violence on the Internet has numerous negative consequences on the social and private life of the victim of peer violence. The consequences of any violence are always severe and inevitable, and so are the consequences of cyberbullying, which, according to numerous authors, can be even more serious than the consequences of classic forms of violence (Willard, 2007). There are numerous reasons for the serious consequences, and Willard (2007) states the following: the audience is usually much wider than the audience on the playground and around the school or in the classroom, the written word spreads quickly to users throughout the world, and the spoken word is easily forgotten. Additionally, the possibility of avoiding violence is very small because online violence can happen anytime and anywhere. Cyberbullying is associated with multiple inappropriate emotional, psychological, and behavioral outcomes (Patchin and Hinduja, 2006). The effects of cyberbullying vary depending on the individual, but mostly include low self-esteem, anxiety, feelings of sadness, fear, shame, depression, anger, absenteeism, reduced academic achievement, school violence, and even suicide (Beran and Li, 2005; Willard, 2006; Hinduja and Patchin, 2009).

It should be emphasized that education is a key factor in the prevention of cyberbullying. It is very important to be able to realistically assess the situation and see the advantages and risks of using the Internet. The rate of abused children experienced a sharp increase, as indicated by the results obtained from a sample of 30 thousand children in an American study. While in 2016, 10.3% of children reported that they used to stay at home because of cyberbullying, in 2023 this percentage grew to as much as 54% (Patchin, 2023). Attention to the prevention of violent behavior should be directed towards the reduction of risk factors and the increase of protective factors, but unfortunately, despite this knowledge about prevention, there are still not enough effective preventive programs in Croatia. The task of schools is also to involve parents in activities, i.e., educate them about the risks of the Internet. In schools, a pedagogue who can talk and influence students is especially important. They can make the victim aware, as well as the abuser, and explain to them the consequences that their behavior or actions leave on others. Schools should also provide education for school employees in the form of preventive programs aimed at combating electronic violence. Since peer violence on the Internet is increasingly present in our society, it is extremely important to approach it seriously and direct all goals and efforts towards the education of teachers, professional associates, parents, and ultimately students in order to successfully prevent this extensive problem (Tokunaga, 2010). The aim of this paper is to provide an overview of cyberbullying and peer violence and show its frequency.

1.1. INTERNET ABUSE OR CYBERBULLYING

Internet bullying, also known as cyberbullying, involves the use of electronic means, such as social networks, email, or messages, to intentionally hurt, intimidate, or humiliate a person. This form of abuse often entails spreading false information, threats, insults, or revealing personal information with the aim of causing emotional and psychological harm to the victim (Kowalski et al., 2012). Peer violence refers to aggressive behavior carried out by members of the same or similar generation. This may include physical violence, verbal abuse, isolation, or spreading rumors. Peer violence can occur in the school environment, social groups, or through digital media, which has a serious impact on the victim and wider society (Feinberg and Robey, 2009). Harassment, or stalking, entails systematic and intrusive observation, monitoring, or contacting a person without their consent. In the context of the online space, harassment can include monitoring online activity, sending threatening messages, or posting personal information to intentionally invade the victim's privacy and cause discomfort (Willard, 2006). Media abuse includes the unethical use of media to achieve information manipulation or influence public opinion. This may include misrepresentation of events, sensationalism, dissemination of fake news, or manipulation of images and video materials. This type of abuse significantly impacts the perception of reality and can potentially harm individuals or groups that are the subject of media manipulation (Boban and Vrbat, 2016).

Violence among children and young people in institutional care has specific characteristics, and children placed in child care are at an increased risk of violence (Kamenov and Majdak, 2009). Stigmatized children may be at a greater risk of participating in violent behavior, especially among those who experience such violence. Victims of both sexes are children with low self-esteem and neurotic behavior (Sekol, 2011). Experts believe that the possibility of hiding behind fake profiles and nicknames can increase the feeling of power among perpetrators of violence and reduce the fear of the risk of being caught (Toshack and Colmar, 2012).

Technology is evolving every day, and progress also affects the incidence of peer violence on the Internet. Peer violence on the Internet is a global problem today (Bilić et al., 2012). Some studies indicate that one out of five children is a victim of peer violence on the Internet, as well as a bully (Chisholm and Day, 2013, according to Bilić et al., 2012). As many as 20-40% of the children who participated in the research experienced and/or committed peer violence via the Internet (Đuraković et al., 2014, according to Bilić et al., 2012). Juvonen and Gross (2008, according to Bilić et al., 2012), for example, state that as many as 72% of young people between the ages of 12 and 17 have encountered violence on the Internet. Research conducted by the Polyclinic for the Protection of Children in the City of Zagreb and the Brave Phone (2004, according to Buljan Flander and Handabaka, 2015) showed that as many as seven percent of the respondents had once misused someone's name and published someone's private information. Five percent of respondents posted someone else's photos or video clip, while seven percent impersonated themselves. A survey conducted by UNICEF in 2010 showed that as many as 23.8% of children between the ages of 10 and 15 think it's fun to send anonymous harassing messages. According to the same survey, 57.9% of them believe that it is much easier to get away with abusing someone online because no one knows your true identity. Similar results were reached by other experts (Vandebosch, 2003; Kowalski et al., 2008 according to Heirman, Walrave, 2008). However, despite the seemingly original protection and the possibility of hiding behind fake profiles, every connection to the Internet remains recorded, and therefore every perpetrator of violent acts on the Internet can be detected through their IP address.

For the prevention of this form of violence, it is important to involve all people from the environment, including family, friends, teachers, and students in schools. The aforementioned findings point to the occurrence of electronic violence among children and young people, but also to the specificity of this form of violence, given the differences in computer literacy, where children are often more computer-literate than their parents, which adds to the risk when using modern technologies at a young age. Therefore, it is important to include parents in addition to preventive programs for children and youth in educational institutions. Violence on the Internet is punishable by law, whether it is an insult, slander, threat, disclosure of personal or family circumstances. Any type of sexual harassment over the Internet is also punishable by law.

2. METHODOLOGY: COMPARATIVE ANALYSIS OF CONDUCTED RESEARCH

As part of this research, a comparison was made of two different approaches in collecting data on internet abuse, peer violence, harassment, and media abuse among students.

Participants: The first study used a random sample of Applied Mathematics and Informatics students (N = 30), 20 of whom were women and 10 men, aged 19 to 25. The second study used the snowball methodology and included (N = 37, 12 men and 25 women), aged 19-26.

Instruments: In the first study, an online questionnaire was used with 32 questions of different answer types, which the participants had to solve individually. This questionnaire consisted of questions that explored experiences and attitudes on the mentioned topics. In the second study, a questionnaire was developed with 37 questions, distributed in several sections that explored the participants' awareness, experiences, and behavior on the Internet and social networks. This questionnaire was available on social networks, and the participants were asked to answer honestly and anonymously.

Procedure: The first survey was conducted online, where the participants received a link to access the questionnaire and solved it individually, taking approximately 5 minutes. The second study was conducted through social networks, where participants were asked to answer questions honestly and anonymously.

Both studies use online questionnaires to collect data on experiences with cyberbullying, peer violence, and media abuse. The first survey focuses on students, while the second survey includes the general population. The instruments differ in the number of questions and structure, but both surveys cover similar topics. Both studies emphasize the anonymity of the participants. This comparative analysis of research provides insight into different methods of data collection on the problems of cyberbullying and media abuse among the student population. While the first research uses a convenience sample and an online questionnaire, the second research relies on the snowball method and social networks. These results emphasize the importance of a variety of approaches in researching such topics and point to the need for further research and promotion of awareness of these problems among young people.

2.1. COMPARATIVE ANALYSIS OF THE OBTAINED RESULTS:

In both conducted studies, participants were questioned about their information and experience with cyberbullying, peer violence, harassment, and media abuse.

Awareness and Identification: Both studies show a high level of awareness among participants about the concepts of cyberbullying, peer violence, and online harassment. In the first survey, 90% of respondents were familiar with these terms, while all participants in the second survey stated that they were familiar with them.

Attitudes and perceptions: The snowball survey reveals that most participants consider cyberbullying, peer violence, and harassment to be significant problems among young people today. These participants point out the rapid spread and strong impact of these forms of online violence, and the fact that abusers often hide behind anonymity and avoid punishment. While the first survey does not mention the perception of importance, the second survey states that 29 out of 37 participants (78%) believe that online bullying and harassment are significant issues among students.

Participants' experience: In the first survey, 12 participants (40%) admitted that they had been victims of cyberbullying, peer violence, harassment, or media abuse. Similarly, in the other study, as many as 12 participants (32.4%) stated that they had once been victims of one of these forms of violence.

Use of social networks: While the first survey does not mention the frequency of use of online platforms, the second survey says that 35 out of 37 participants use social networks, media, and online platforms on a daily basis. According to another survey, the majority of participants (94.6%) use social networks, media, and online platforms daily. This indicates a high presence of young people on digital platforms, further emphasizing the importance of combating cyberbullying and media abuse. In addition to a more in-depth examination of cyberbullying and peer violence, the second study provides additional insights into the experiences and attitudes of the participants.

Experience with cyberbullying and peer violence: Although the majority of participants in the first survey (56.7%) did not experience cyberbullying, peer violence, harassment, or media abuse, the second survey shows that as many as 31 out of 37 participants witnessed or were victims of internet/online bullying. However, only 7 participants reported being victims of online bullying or harassment.

Frequency of experiencing violence: In the first survey, the frequency of experiencing violence was not explicitly mentioned. In the other study, the results show a varied presence of online violence among the participants. As many as 56.7% of the participants did not report experiencing cyberbullying, peer violence, harassment, or media abuse. However, 83.8% of participants had witnessed or been a victim of online bullying, while 35.1% of participants reported witnessing online bullying by their peers.

Reaction to online violence: In the first survey, reactions to online violence were not mentioned. In the other study, results show that victims of online violence mostly responded by ignoring the abuser, suppressing their emotions, or seeking support from friends and family. Only one victim reported the abuser. Also, the majority of participants who witnessed online bullying by their peers ignored the incident, while 54.1% of participants reported abusive comments on social media.

Perception of the role of Internet platforms: In the first survey, the perception of the role of Internet platforms was not mentioned. In another survey, the majority of participants (70.3%) believe that online platforms are not doing enough to combat online violence. The participants criticized the insufficient sensitivity of the security system to reports and demanded more rigorous sanctions for violators.

Seeking support: In the first survey, there was no mention of seeking support. In another study, only 18.9% of participants sought support for online bullying or peer violence, most often turning to family, friends, or acquaintances. 32.4% of participants believe that support or counseling helped them to some extent, while 56.8% of participants do not want to express their opinion about the experience of seeking help.

Personal behavior on the Internet: In the first survey, personal behavior on the Internet was not mentioned. In another survey, the majority of participants (75.7%) tend to make their online interactions respectful, while 75.7% of participants have never regretted their online posts. Participants outlined a number of good practices for maintaining fair online interactions, including using inclusive language, avoiding hate speech, and fact-checking before sharing information.

Emotional Impact: The most common emotional responses to cyberbullying or peer violence were anxiety and stress, with as many as 23.3% of respondents developing low self-esteem. These results indicate serious emotional consequences of such forms of violence.

Behavior and Reactions to Violence: Most participants (86.5%) witnessed or were victims of online bullying or harassment, but only a small number reported or reacted to violence. These findings suggest the need for improved reporting and support mechanisms for victims.

Prevention and Support: Although most participants believe that social platforms do not do enough to prevent cyberbullying, only a small number of them (13.5%) were aware of their college's policy and resources related to this issue. Additionally, only 4 participants received training on prevention and response to cyberbullying.

Although the methodologies and samples are different, both studies provide similar insights into the problems of cyberbullying, peer violence, harassment, and media abuse among young people. The first survey focuses on students, while the second survey includes the general population. The second research includes an analysis of the participants' perception of the impact and consequences of online violence. The sample size in the second survey is slightly larger ($N = 37$) compared to the first survey ($N = 30$). The high level of awareness and experience with these terms suggests the need for further research and development of preventive strategies to ensure a safer online environment for young people. The second study analyzed various aspects of online violence, including the reaction of victims and witnesses, the perception of the role of online platforms, and seeking support. The first study focused on students, while the second study included the general population. Additionally, the sample size in the second study is slightly larger ($N = 37$). The research indicates the prevalence of cyberbullying and peer violence among young people and underscores the importance of timely and adequate support for victims. Both surveys show a high level of information about cyberbullying, peer violence, and online harassment. A significant number of participants in both studies are exposed to online violence. Another study provides additional insights into participants' perceptions of the impact and consequences of online violence. It is necessary to improve awareness and education about these issues, as well as implement effective reporting and support mechanisms to create a safer online environment for young people.

3. DISCUSSION ON RESEARCH ON CYBERBULLYING AMONG THE STUDENT POPULATION:

In light of the increasing digitization of society, cyberbullying is becoming a significant problem among young people, including university students. This discussion compares the results of two studies on cyberbullying and peer violence among college students. The first study focused on awareness of cyberbullying and the expected frequency of experience, while the second study extended the analysis to the role of online platforms, reactions to online violence, seeking support, and personal behavior online.

Both surveys showed a high level of awareness among students about the concept of cyberbullying. Although in the first study, 90% of participants had already heard of this term, the second study shows that all participants had a high level of awareness. This suggests that awareness of cyberbullying is widespread among students, which is important for recognizing and preventing this problem.

Although the results differed between the two studies, both confirmed that cyberbullying remains a significant problem among college students. In the first study, every fifth participant reported experiencing cyberbullying, while the second study showed that 86.5% of participants witnessed or were victims of cyberbullying. This underscores the importance of continued research and awareness of cyberbullying to understand its prevalence and impact.

The second study investigated violence in general, including cyberbullying, providing a broader insight into the issue of violence among students. Although cyberbullying is singled out as a specific form of violence, it is important to include peer violence in the discussion, as these two phenomena are often linked and can have similar negative consequences for victims. The first study did not explicitly focus on peer violence, while the second study investigated general violence, including cyberbullying. The results show that peer bullying is still present among students, with potentially higher prevalence than cyberbullying.

Both studies faced limitations such as a small sample size, gender disparity, and the use of questionnaires with unclear questions. These limitations highlight the need for a more careful approach in future research, including a larger and more representative sample and clearer formulation of questionnaires.

Research on cyberbullying among the student population provides important insights into the prevalence and impact of this problem. The high level of awareness about cyberbullying among students indicates the need for further research and interventions to protect the student community from cyberbullying and other forms of violence. Additionally, it emphasizes the importance of including peer violence in the cyberbullying discussion to provide a more complete picture of youth violence.

Despite methodological differences, both studies indicate the seriousness of the problem of cyberbullying and peer violence among students. Additional research and interventions are needed to combat these forms of violence and ensure a safe environment for all students.

Future research can focus on analyzing different forms of online violence and their specific characteristics. It would be useful to investigate the influence of different factors on the risk of experiencing online violence. The results of these studies can be used to develop preventive programs and education about online violence.

4. CONCLUSION:

Both conducted research on cyberbullying among the student population provide important insights and emphasize the complexity of the cyberbullying problem. Although the research had different approaches and focuses, their results contribute to a deeper understanding of cyberbullying among students.

The first research highlighted a high level of awareness among students about the concept of cyberbullying, as well as significant experience with this form of violence. The other research investigated violence in general, including cyberbullying, providing a broader context to the problem.

Despite the differences in results, both studies show that cyberbullying remains a current and serious problem among students. Therefore, it is necessary to continuously raise awareness about cyberbullying and implement interventions to protect the student community.

Furthermore, the limitations of both studies highlight the need for a more careful approach in future research. This includes larger and more representative samples, more clearly worded questionnaires, and the inclusion of peer violence in cyberbullying research to provide a more complete picture of youth violence.

Ultimately, the common conclusion of both studies is the need for a comprehensive approach in solving the problem of cyberbullying among students. This includes ongoing research, education, victim support, and the development of preventive measures to ensure a safe and supportive environment for all students.

In addition, future research could focus on the analysis of different forms of online violence and their specific characteristics, and investigate the influence of different factors on the risk of experiencing online violence. The results of these studies can be used to develop preventive programs and education about online violence.

This conclusion is based on the results of two studies on cyberbullying and peer violence among students. It is important to note that the research results are limited by the methodology and the sample. For a more complete understanding of the problem of cyberbullying and peer violence, additional research is needed.

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SOCIETY BEHIND THE MEDIA MASK: MENTAL HEALTH AND SOCIAL NETWORKS

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ABSTRACT

Social networks have become an indispensable part of life, providing a sense of connection and support in everyday life. Social interactions play a key role in shaping an individual's identity, influencing emotional well-being and mental health. On the other hand, social networks are increasingly used to create and promote new trends. Constantly exposed to idealized images and perfect life stories, young people often feel the pressure to compare themselves with others and achieve the same standards. This can lead to feelings of low self-esteem, anxiety and depression. Therefore, it is so important to make young people aware of accepting themselves and others as individuals in creating their own life values. Attention should also be paid to how these unrealistic trends affect the mental health of young people, and strategies should be developed to support young people and strengthen their resistance to these negative influences. Through the qualitative method of interviewing pupils, professors and students, their experiences, attitudes and perceptions regarding the use of social networks and the consequences of their influence on mental health were investigated. The research results provide a deeper insight into the dynamics of the interaction between media platforms, social networks and mental health of young people. The research encourages reflection on the need to adapt media culture in order to protect the mental health of young people in the age of technologies.

Keywords: academic community, social networks, mental health

INTRODUCTION

In today's digital age, social networks have become not only a means of communication, but also a platform for identity formation, expression and information. They have transformed the way we communicate and perceive ourselves and others. Although they have brought many positive changes to modern society, social networks also have complex effects on the mental health of young people. While providing a sense of connection and support, social media also becomes an environment where trends are promoted based on idealized images, perfect stories, and constant success. Social networks allow users to create and present an idealized version of themselves, which often leads to the creation of so-called "media mask" or idealized "I". However, behind this presented image are hidden greater consequences for the mental health of young people. For young people, constantly exposed to these pressures, it can result in low self-esteem, anxiety and depression. Jerončić Tomić et al. (2020) talk about the tendency of people to compare themselves with each other as a means of determining personal growth and progress in life. Often, comparing real life with someone's ideal representation leads to the creation of the concept of life's injustice. In addition to dissatisfaction with achieved material and spiritual well-being, there is often also dissatisfaction with physical appearance. Research by Bair et al. (2012) showed that subjects who watched television and Internet content that emphasized the importance of physical appearance showed a greater tendency to symptoms of eating disorders, while subjects who used magazines did not show this result. Bi (2024) says that the very perception of media content can influence adolescent eating

disorders. The negative influence of social networks was also confirmed in the research of Park, Sun and McLaughlin (2017), which points out that certain social networks tend to promote extremely thin looks. While Braghieri (2022) states in his research that the results show the bad influence of the social network on students and even lower academic success. Various studies have confirmed the negative impact on mental health, which often leaves lasting consequences on the body itself.

This paper investigates the awareness of professors, students and high school students about the connection between social networks and the mental health of young people, with an emphasis on their experiences, attitudes and perceptions. Through the qualitative method of interviews with respondents, the goal is to gain a deeper insight into the extent to which respondents are aware of the influence of social networks on the mental health of young people and to identify support strategies that could help strengthen their resistance to negative influences.

Also, this work calls for reflection on the need to adapt media culture in order to protect the mental health of young people in the age of technology. Through the analysis of research results, we hope to contribute to a better understanding of the complex connections between media platforms, social networks and mental health of young people.

METHODS

For the purposes of this research, we applied a qualitative methodology, which included interviews with five professors of different scientific fields and five students of Teacher Studies from the Faculty of Educational Sciences in Osijek, as well as five high school students aged 16. The aim of the interview was to investigate the views of respondents on the use of social networks and their perception of the influence these networks have on young people today. In the paper itself, the names and personal data of the respondents were not mentioned, which is why we respected the ethics of the research.

The interviews were structured and focused on different aspects of social media use, including time spent on them, types of activities performed, feelings associated with use, and perceived impact on youth mental health. After collecting data through interviews, we analyzed the obtained results and classified them into frequency categories, and obtained the results using the *Statistica* program. This procedure enabled us to systematically process and interpret the data, and to better understand the attitudes and perceptions of the participants about social networks and their influence on young people.

The interview consisted of the following questions:

1. How much time do you spend a day on social networks?
2. What positive aspects do you see in the use of social networks in your life?
3. How do you perceive the impact of social networks on your mental health?
4. How do you deal with the pressure that comes from social media, such as feeling compared to others or perfectionism?
5. Do you think that unrealistic standards of beauty, success and happiness are created on social networks?
6. How does it affect you and your environment?
7. Do you think that young people today are more dissatisfied with their own appearance due to the imposed new ideals of beauty?
8. To what extent do you think it is important for young people today to be part of a society that follows the imposition of new ideals.
9. What strategies or resources do you find useful in supporting young people dealing with the negative impacts of social media on their mental health?

RESULTS

Respondents emphasize the importance of social networks in facilitating communication, accessing information and discovering new ideas, recipes and advice. They also use social networks as a platform for entertainment and expression of creative and educational content, and enable insight into different cultures and ways of thinking. In addition, some see the potential of social networks in business and sensitive situations, such as product promotion or rapid information exchange in crisis situations. Although many see social networks as a source of entertainment and information, some point out their negative impact on their own mental health. Feelings of fatigue, unproductiveness and burden from excessive use are the consequences that the respondents shared with us. There is an awareness of the addiction they can cause, as well as the unrealistic standards they can set. However, some users find that they have a minimal impact on their health, while others claim that they encourage personal development. Respondents who stated that they spend two or more hours on social networks mostly point out that they are aware of the harmful effects of social networks on their mental health, which can be seen in Table 1. Of course, access to social networks varies depending on personal boundaries and awareness of their potential negative consequences. Our research shows that there is a significant number of respondents who believe that social networks have a negative impact on their mental health, with as many as seven respondents sharing this perception. Of that number, four are students, while one is a high school student (Table 1). All the respondents emphasized the awareness of the unreality of the published content on social networks and they emphasized that this does not cause the majority of them to feel less valuable. Also, all respondents agreed that social networks often create unrealistic images of a perfect life and that they believe that young people often feel dissatisfied with their own appearance due to the imposition of new ideals of beauty. This research shows that the majority of respondents consider that being part of such a society is important, since it contributes to the feeling of belonging to a certain social group.

Analyzing the results, it was determined that high school students attach less importance to belonging to such a society compared to students and professors, which was expected. When it comes to strategies for providing support to young people, respondents emphasized the importance of educating young people, implementing school programs that guide and support students, promoting hobbies as a healthy alternative and limiting time spent on social networks as a preventive measure. These conclusions indicate the need for further research and implementation of preventive programs that would support the mental health of young people in the age of social media.

Table 1. Correlation between time spent on social networks and self-estimated impact on mental health

<i>Are you:</i>	<i>How much time do you spend a day on social networks?</i>	<i>How do you perceive the impact of social networks on your mental health?</i>
student	more than 3 hours	I think they are currently having a negative impact on my mental health as I am only mildly dependent on them.
student	1-2 hours	I am not affected by social networks because I am aware enough of everything that happens on the Internet.
student	2-3 hours	When I spend too much time on social media, I feel tired, unproductive and dull.
professor	less than 1 hour	social networks are harmful to mental health
professor	more than 3 hours	To a large extent, the burden is due to checking the content too often, so to some extent it creates addiction

professor	less than 1 hour	It doesn't affect me
professor	less than 1 hour	Positively
high school students	2-3 hours	I do not mind
high school students	more than 3 hours	Bad
high school students	2-3 hours	It doesn't affect my mental health much, but it encourages me to be better at the things I like to do.
high school students	more than 3 hours	Very bad. I spend too much time on them and am not doing anything productive because of it, so I feel bad
high school students	more than 3 hours	Good
professor	less than 1 hour	Social networks have a minimal impact on my health.
student	2-3 hours	I think they are harming my mental health because they are showing unrealistic content
student	1-2 hours	Not very well because everything is shown perfectly on social networks. This sometimes causes frustration for me that I don't have something that someone else has with more time, money, etc., but I try to be realistic about it.

DISCUSSION

We can conclude that all respondents are aware of the dangers of social networks on the health of young people and suggest a higher level of education on this issue. "It is estimated that in the total population of Internet users, there are 5-10% of those who can be called Internet addicts. Considering the atmosphere in which the Internet is developing in Croatia, dependence on the Internet is still not a significant problem in our country. However, taught by the experiences of others, we should act preventively" (Miliša, 2010).

In order to provide adequate support to young people who face the negative effects of social networks on their mental health, it is important to implement strategies such as media literacy education, psychological support, and pedagogical workshops. Schools could introduce programs that include discussions about the negative impacts of social networks and the importance of occasional abstinence from them. Also, the support of parents, professors and psychologists is crucial in providing support to young people, which Grubić (2023) and Debelić et al. (2023) point out. "One in seven children and young people aged 10-18 have mental health problems, but they mostly remain unrecognized and untreated due to fear of stigmatization, discrimination, social exclusion, peer pressure and other difficulties," states Botića (2023). In addition, it is important to promote activities outside of social networks, such as hobbies, sports and being in nature. Additionally, open dialogue about the realities of the digital world should be encouraged and resources such as videos that promote a healthy lifestyle outside of social media should be provided. Ultimately, cooperation between educational institutions, parents, experts and civil societies is key to providing comprehensive support to young people. Tolić (2009) emphasizes the importance of developing media competences in preventing media manipulation and states the reasons for its introduction into the education system.

CONCLUSION

Prnjak (2019) emphasizes the importance of the social community in creating a personal opinion about satisfaction with one's own body. This is also confirmed by the author Trifiro (2018), who states in his work that there is a connection between the use of social networks and dissatisfaction with one's own body, which leaves the biggest mark on young people, adolescents, who are just forming an opinion about themselves. On the other hand, he also mentions the positive influence of social networks on young people in the form of stimulation of the feeling of belonging to the social community. Some studies have shown that adolescents themselves consider social networks a threat to their mental health (O'reilly et al., 2018). Galant (2020) highlights the awareness of the negative effects of social networks on young people and gives examples of applications that contribute to the creation of a positive technological environment. He attributes a key role in educating young people aware of their infection to parents, monitoring the available content that is offered to young people, the importance of critical thinking about available content and responsible and limited time spent on social networks for the purpose of preventing addiction to social networks and developing self-discipline. He states that it is important to develop the ability to distinguish between real and unreal Internet content so that young people develop resistance to the influence of fake content on their own perception of themselves and others. This research confirmed the importance of timely education of young people about the good and bad sides of the world on social networks, and through the family, school and social community implements programs aimed at developing critical thinking skills and resistance to the influence of imposed ideals. Encouraging awareness of one's own value and the integrity of a human being. In addition to these points, it's essential to underscore the importance of collaboration among various stakeholders in addressing the complex challenges posed by social media on young people's mental health. By fostering partnerships between academia, government agencies, non-profit organizations, and industry leaders, we can develop holistic approaches to promoting positive online experiences and safeguarding the well-being of the next generation in an increasingly digital world. Together, we can empower young people to navigate the digital landscape with resilience, critical thinking, and a strong sense of self-worth.

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COACHES' SELF-ASSESSMENT OF VOICE STATUS

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ABSTRACT

In voice care research, sport coaches are classified as vocal professionals due to the prolonged daily use of their voice. The term vocal professionals addresses intensive use of voice, implying often the more intensive straining of vocal cords than in the average population. Coaches commonly use their voices in non-acoustically treated open and/or closed spaces, which makes them more susceptible to voice disorders. The aim of this study is to examine awareness of voice (mis)use among coaches. An online survey was conducted employing standardized self-reporting instrument Voice Handicap Index (VHI) along with questions about voice care in general: familiarity with voice care exercises, proper pronunciation, and the need for their inclusion in formal education. The study included sixty Croatian coaches (male: 38; female: 22; age: 33 ± 9.4 years; work experience: 7.9 ± 7.3 years). VHI responses indicate that 4 (6.7%) and 3 (5%) participants showed mild and moderate voice impairment, respectively. 73.33% of participants declared that they are not worried about their voice status and 81.67% reported they do not have any voice problems. These findings align with their 8 years of work experience and are similar to the findings for other vocal professionals (i.e. teachers) showing that voice problems increase later in the career. However, the reported symptoms linked to excessive voice use indicate a lack of awareness among participants regarding their voice care. In addition, 75% of participants are not familiar with voice-care and proper pronunciation exercises, while 73% of participants agree that vocal exercises should be included in formal education. The results of the present study provide insights into coaches' common knowledge and awareness about their vocal health. Integration of some vocal training into formal education would proactively ensure voice safety concerns and reduce the potential risk of long-term voice misuse.

Keywords: coaches, voice care exercises, subjective assessment of voice and pronunciation, risk factors, Voice Handicap Index (VHI)

INTRODUCTION

Vocal professionals are individuals who use their voice for the purpose of performing professional activities through which they earn a living (Przysiechny & Przysiechny, 2015). Coaches are in this category due to the daily vocal demands they face, as they use their voice to provide instructions, motivate, and communicate with individuals they train. Multiple studies have indicated that sports and fitness instructors are at a higher risk of encountering voice problems compared to the general population (Heidel & Torgerson, 1993; Komura et al., 1992; Long et al., 1998; Newman & Kersner, 1998; Rumbach, 2013). Consequently, voice difficulties can negatively impact their work performance, efficiency, and psychosocial well-being (Rumbach, 2013). The primary objective of this study is to investigate the prevalence of voice problems among Croatian coaches, a population in which no such study was previously conducted, using a questionnaire that includes VHI assessment, as well as to investigate the impact of associated

risk factors. The necessity for this type of study in Croatia is emphasized by the absence of any national health program focused on raising awareness of vocal risks among coaches. Additionally, to gain a comprehensive understanding of the situation, this study also aims to assess coaches' knowledge regarding vocal prevention and care in context of life quality.

METHODS

60 Croatian coaches participated in this study (male: 38; female: 22; age: 33 ± 9.4 years, 22 – 60-year-old; work experience: 7.9 ± 7.3 years). The participants were contacted through social media and email. An anonymous online survey included standardized self-reporting instrument Voice Handicap Index (VHI) along with questions about voice care in general: familiarity with voice care exercises and the need for their inclusion in formal education. The VHI is a psychometric instrument which evaluates the impact of voice handicap on functional, physical and emotional domains and can be applied for both clinical and research purposes (Slavych et al., 2013). It has been translated into numerous languages, including Croatian (Bonetti et Bonetti, 2013), and is the most widely used instrument for assessing voice-related quality of life (Zraick et al., 2008).

RESULTS

Table 1. presents the values of subscales and total scores that may indicate a normal voice or mildly/moderately/severely impaired voice.

Table 1. Interpretation of the results of the VHI questionnaire according to Jacobson et al. (1997)

Scale	Mild	Moderate	Severe
Functional	>10	>12	>18
Physical	>15	>18	>22
Emotional	>8	>18	>20
Total	>33	>44	>61

Table 2. Results of the VHI questionnaire among Croatian coaches

	VHI			VHI (F)			VHI (P)			VHI (E)		
	Mi	Mo	S	Mi	Mo	S	Mi	Mo	S	Mi	Mo	S
Coaches	4	3	0	4	5	2	0	2	2	5	0	1

VHI= Voice Handicap Indeks, F= Functional, P = Physical, E= Emotional, Mi= Mild, Mo= Moderate, S = Severe

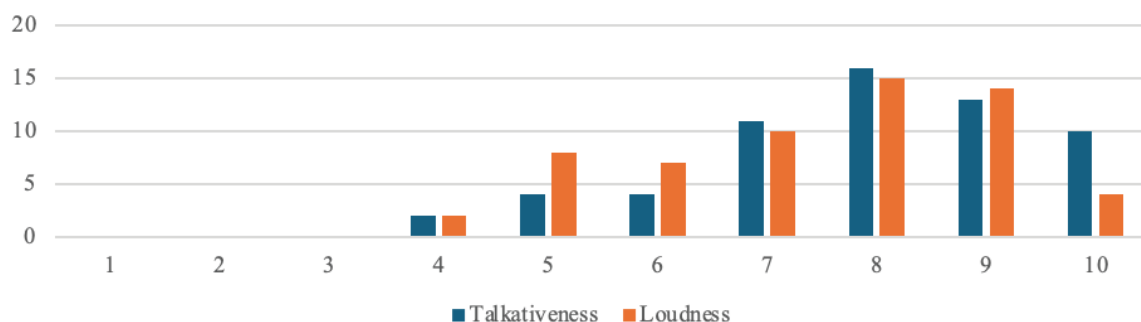
Table 2. presents the results of the VHI questionnaire among coaches, which indicate that 4 (6.7%) and 3 (5%) participants showed mild and moderate voice impairment, respectively. Results on the functional scale show higher difficulties associated with potential voice disorders. Even though the total VHI does not show severe voice impairment, the results of each individual scale show severe functional (2), physical (2) and emotional (1) impairment.

Table 3. Descriptive statistics of the VHI questionnaire among Croatian coaches

Variable	Descriptive Statistics				
	Valid N	Mean	Minimum	Maximum	Std.Dev.
SUM (F)	60	5.88	0	22	5.13
SUM (P)	60	5.95	0	24	6.03
SUM (E)	60	2.38	0	21	4.42
	Valid N	Sum	Minimum	Maximum	Std.Dev.
VHI (F+P+E)	60	14.22	2.38	5.95	2.04

The average VHI score of all participants is 14.22, with no differences between group (13.61) and individual (14.22) coaches, male (14.22) and female (14.22) trainers, or smokers (12.76) and non-smokers (14.22).

Figure 1. Talkativeness and loudness among coaches



Participants describe themselves as talkative or loud individuals, indicating a continuous use of their voice both within and outside their professional environment. This suggests a significant vocal demand, leaving little time for vocal rest.

The results indicate that only 15 participants (25%) are familiar with voice and pronunciation exercises, and among them, only 2 (3.3%) engage in some form of exercises. As examples of exercises they perform, they mentioned stretching, breathing exercises, counting in whisper, relaxation, prolonged vowel pronunciation, and speaking with hands behind the ears.

DISCUSSION

The VD prevalence reported here is inferior to those reported in the studies of Heidel and Torgerson (1993), and Rumbach (2013). One potential explanation could be that the populations in these earlier studies consisted of a significantly higher proportion of female coaches (age: 20 – 40, work experience: 1 – 12 years (Heidel and Torgerson (1993), age: 38.32 ± 10.88 years, work experience: 12.71 ± 8.91 years (Rumbach (2013))), which is a risk factor (Fontan et al., 2013), if we take into consideration that female teachers report voice problems more frequently, without difference between men and women in terms of the average amount of hours taught per day or the years spent teaching particular courses (Smith et al., 1998). The reported loudness could be associated with workplace factors such as loud music during training or multiple sources of noise that need to be outvoiced, the explanation has psychoacoustic grounding. It is called Lombard effect, wherein speakers adjust the intensity and pitch of their voice to

overcome background noise during communication. Therefore, the noisy working conditions heighten the likelihood of vocal strain for sports and fitness instructors. Interestingly, the more experienced coaches tend to shout less frequently, and it was therefore found that the elderly population's VHI was lower than that of the younger coaches (Fontan et al., 2017), which does not align with the studies from other vocal professionals (e.g., teachers), which indicate that voice issues become more prevalent as one advances in their job. This shows the importance of proactive vocal education from an early age and makes less experienced coaches, such as in this study, an important population for future studies. The limitation of this study is that a subjective, self-assessment questionnaire was used among a population lacking vocal awareness (Gauvin et al., 2013), especially taken into consideration that, in many cases, practitioners are not aware that they are in the process of damaging their vocal folds until they experience moments of dysphonia (Maslach, 2001), prompting the question of what the results would be if objective assessment was used, thus providing opportunities for future studies. Fitness instructors often encounter various vocal fold injuries due to strain, with nearly half requiring surgical intervention and one in four cases recurring following surgery; providing education on vocal health, implementing strategies to optimize voice usage in fitness settings, and aiding in the early detection of warning signs for vocal injuries could significantly benefit instructors (Estes et al., 2020). Integration of some vocal training into formal education would proactively ensure vocal safety concerns and reduce the potential risk of long-term voice misuse, which aligns with the findings of similar studies on this topic (Aiken & Rumbach, 2018; Fontan et al., 2013; Gauvin et al., 2021).

CONCLUSION

The findings from this study indicate that symptoms related to excessive voice use suggest a lack of awareness about voice care. Additionally, most participants are unfamiliar with voice-care exercises, though many agree they should be included in formal education. Voice-care exercises are implemented in the courses of Culture of Public Speaking at the Faculty of Kinesiology, University of Zagreb. However, research has shown that in-person training sessions would need to be conducted repeatedly to ensure that coaches could retain the practical skills being taught, and it was proposed that quarterly access would be an appropriate frequency for these training sessions, with a multimodal approach (such as face-to-face didactic teaching, text-based education, video-based instruction, and app-based education and instruction) selected specifically for the type of content being delivered (Aiken & Rumbach, 2018). These findings underscore the need for greater education on vocal health among coaches to prevent long-term voice issues.

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STUDENTS IN IMPLEMENTATION OF THE ORGANIZATION OF REGIONAL COMPETITIONS (SIORC) - AN EXAMPLE OF GOOD PRACTICE

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ABSTRACT

The safety and well-being of children and young people in sport is a key concern that requires the co-operation of sports coaches, teachers, educators and medical staff. The SIORC project aims to create a sustainable and effective approach to injury prevention and care. The project aims to provide safe health care to children and young people participating in school sports competitions in the city of Rijeka and Primorje-Gorski Kotar County. Through the project, students are trained in basic life support and the use of an automatic external defibrillator, immobilization and hemostasis. Students also gain professional experience through training and sports fields, which is necessary for their further development.

In the school year 2022/2023., a total of 5,500 children and young people from primary and secondary schools took part in school sports competitions. In addition to them, around 50 team leaders, commissioners, referees and medical staff were also present. Over 400 competitions were held in 14 different sports. Medical staff (students) participated in the competitions with more than 1000 volunteer hours.

Children and young athletes are particularly exposed to the risk of sports injuries. Therefore, it is important to promote a safe and stimulating environment for children and young people to participate in sports and physical activities. This is the first time in County that this type of medical service has been applied in school sports competitions in cooperation between the faculty and the local community.

By promoting education, training and collaboration, the SIORC project aims to improve the safety and well-being of young athletes and create a sustainable and effective approach to the prevention and treatment of sports injuries. By improving students' skills and knowledge, SIORC aims to create a safe and stimulating environment for sport and physical activity for children and young people.

Keywords: education, prevention, school sports, SIORC, students

INTRODUCTION

Injuries include superficial wounds, open wounds, open and closed fractures, dislocations, tears, sprains and strains, injuries to nerves, the spinal cord, blood vessels, muscles, tendons and internal organs as well as crush injuries and traumatic amputations. In 2020, accidents caused more than a third (33.7%) of all deaths in the EU among people aged 15 to 19 and between a quarter and a third of all deaths among people aged 20 to 24 and 25 and 29 years (Accidents and injuries statistics, 2024).

One of three main priorities of Directorate General for youth, sport, education and culture (DG EAC), a department surrounded by the European Commission (EC) field of sport is promotion of participation in sport and health. Subtask of that priority is creation and promotion of adequate opportunities for sport (European Education Area, 2024).

Collage students of Faculty of Health Study University of Rijeka from Croatia found an opportunity to improve sports competitions by providing medical assistance on the field in SIORC project. Support in the implementation of the project was provided by the secretaries of the association of school sports clubs of the Primorje-Gorski County and the city of Rijeka. Student volunteers, professors and many educators participate in project. Many students, even after completing their studies, do not have enough self-confidence, knowledge and independence in work, which they can significantly develop through this project. Every year, new generations are included in the project and complete basic life support course. The implementation of the project also shifts a lot of responsibility and care from coaches and sports managers.

Importance of project is that it is the first and only such project in Croatia and beyond. In addition to quality, the project also saved a lot of financial resources because the students work for volunteer hours, which later bring them many benefits. Medical student volunteers from Japan had a similar opportunity, which is to be included in the medical team with doctors and other medical staff at the triathlon. Before the competition, they received first aid training and learned how to take care of triathlon-specific injuries and illnesses (Hamai, et al., 2023).

PARTICIPANTS (MATERIALS) AND METHODS

Quantitative research method was used in the study. 18 students from the first and 18 students from the second year of undergraduate studies in physiotherapy and 6 students from the third year of undergraduate studies in nursing participated in the research. 15 coaches, professors and teachers who took children to competitions were also questioned.

The quantitative part included the satisfaction of coaches and sports leaders with the implementation of the project and the satisfaction of students with participation in the project was examined through several questions (in attachment) on a Likert scale. Respondents marked the statement with 1 representing „I strongly disagree“ and 4 representing „I strongly agree“.

The creation and implementation of the questionnaire was approved by the ethics committee of the Faculty of Health Studies in Rijeka. Before filling out the questionnaire, the respondents signed an informed consent to participate in the research.

Course of basic life support is held twice a year for students of the second year of undergraduate physiotherapy studies and once for first-year physiotherapy undergraduate students and third year undergraduate nursing students.

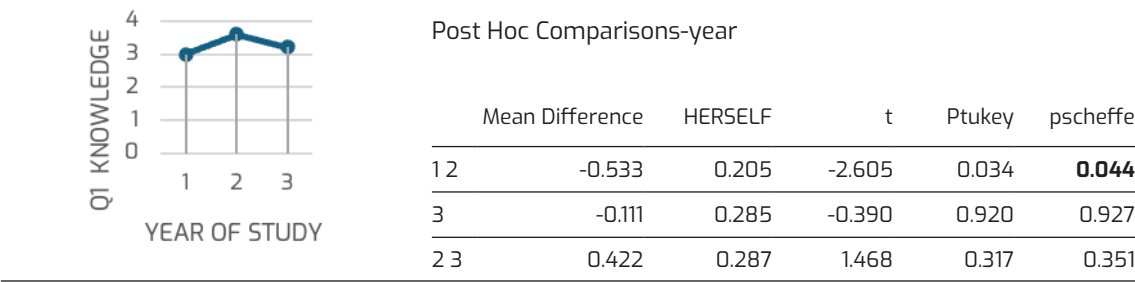
Descriptive statistics are processed in the program JASP-0.17.3.0.msi.

RESULTS

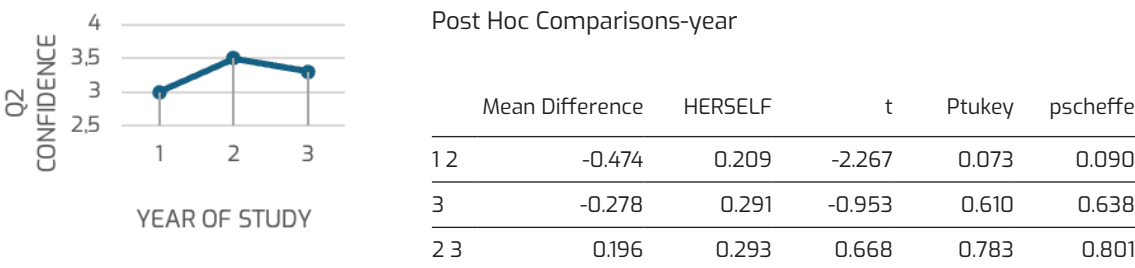
Table 1. The median of all students' answers to the 4 questions

	Q1 knowledge	Q2 self-confidence	Q3 education	Q4 body act
Median	3.000	3.000	3.000	3.000
Minimum	1.000	2.000	2.000	1.000
Maximum	4.000	4.000	4.000	4.000
25th percentile	3.000	3.000	3.000	3.000
75th percentile	4.000	4.000	4.000	4.000

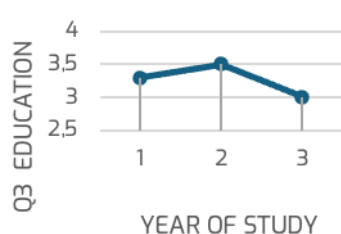
Values are shown as median
On all four questions, the median is 3.
For question number one, the minimum value is 1, while the maximum value is 4.
For question number two, the minimum value is 2, while the maximum value is 4.
For question number three, the minimum value is 2, while the maximum value is 4.
For question number four, the minimum value is 1, while the maximum value is 4.



Graph 1. Comparison of median answers to the 1st question between 1st, 2nd and 3rd year students



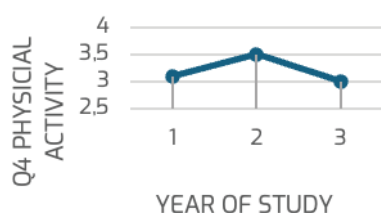
Graph 2. Comparison of median answers to the 2nd question between 1st, 2nd and 3rd year students



Post Hoc Comparisons-year

	Mean Difference	HERSELF	t	Ptukey	pscheffe
1 2	-0.196	0.207	-0.947	0.614	0.642
3	0.333	0.289	1.155	0.487	0.519
2 3	0.529	0.291	1.822	0.176	0.204

Graph 3. Comparison of median answers to the 3rd question between 1st, 2nd and 3rd year students



Post Hoc Comparisons-year

	Mean Difference	HERSELF	t	Ptukey	pscheffe
1 2	-0.474	0.209	-2.267	0.073	0.090
3	-0.278	0.291	-0.953	0.610	0.638
2 3	0.196	0.293	0.668	0.783	0.801

Graph 4. Comparison of median answers to the 4th question between 1st, 2nd and 3rd year students

Table 2. The median of all teachers' answers to the 3 questions asked

Descriptive Statistics			
	Q1-medical help	Q2-satisfaction	Q3-competencies
Median	4.000	4.000	4.000
Minimum	4.000	1.000	1.000
Maximum	4.000	4.000	4.000
25th percentile	4.000	3.500	3.000
75th percentile	4.000	4.000	4.000

Values are shown as median
 On all three questions, the median is 4.
 For question number one, both the minimum and maximum values are 4.
 For question number two, the minimum value is 1, while the maximum value is 4.
 For question number three, the minimum value is 1, while the maximum value is 4.

Table 3. Response frequencies to the 1st question (medical help)

Q1 - medical help	Frequency	Percent	Valid Percent	Cumulative Percent
4	15	100.000	100.000	100.000
Total	15	100.000		

Values are shown as percentages
 All respondents (100%) circled the answer 4 (I completely agree)

Table 4. Response frequencies to the 2nd question (satisfaction)

Q2- satisfaction	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	6.667	6.667	6.667
3	3	20.000	20.000	26.667
4	11	73.333	73.333	100.000
Total	15	100.000		

Values are shown as percentages

1 respondent (6.67%) circled the answer 1 (I completely disagree)

3 respondents (20%) circled the answer 3 (I mostly agree)

11 respondents (73.33%) circled the answer 4 (I completely agree)

Table 5. Response frequencies to the 3rd question (competencies)

Q3- competencies	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	6.667	6.667	6.667
3	5	33.333	33.333	40.000
4	9	60.000	60.000	100.000
Total	15	100.000		

Values are shown as percentages

1 respondent (6.67%) circled the answer 1 (I completely disagree)

5 respondents (33.33%) circled the answer 3 (I mostly agree)

9 respondents (60%) circled the answer 4 (I completely agree)

DISCUSSION

Most studies in the Republic of Croatia are designed in such a way that most students lack practice after graduation and have almost no impression of how much responsibility independent work carries. Those who are themselves aware of the issue of independence try to avoid this responsibility while they have the opportunity. Physiotherapy and nursing are professions that offer a wide range of jobs and almost every student can find an area of interest. Students who want to work in sports in the future through the SIORC project provide them with a realistic experience of the profession in sports through overcoming simpler challenges. Knowledge and practice are crucial for the development of independence and self-confidence, and through the project all these items are developed.

A total of 42 students from the Faculty of Health Studies in Rijeka participated in the study. Descriptive statistical analysis concluded that students answered all questions with median 3, which says that they mostly agree with all the claims made. From this it is concluded that through the project they mostly learned something new and established existing knowledge and that the project helps them during their education. The median concludes that participation mainly positively affects their self-confidence and another very important item is that it encourages them to physical activity (Table 1).

With more detailed data processing, there is a significant difference ($p = 0.044$) between second-year physiotherapy students and first-year physiotherapy students, while the difference between third-year nursing students and first and second years of physiotherapy is not significant in the claim that through the project they acquired new knowledge and established existing ones. The average score of first-year physiotherapy students is 3 and third-year nursing students are 3.2, while second-year physiotherapy

students responded with an average score of 3.6. These data are expected because second-year physiotherapy students have been participating for 2 years while the others have only been involved for almost a year. As they go through more courses, they realize how much knowledge they have gathered through the project and how they are coping better in new situations on the ground (Graph 1.).

Participation in the project has a positive impact on the self-confidence of students of all surveyed majors. The difference is in the grades of senior year students compared to first-year students. Students of senior years could compare the level of self-confidence with previous experiences in exercises and practices, while first-year students do not have previous experiences in a similar field or enough knowledge and skills that can give them initial self-confidence (Graph 2.).

Whether participating in the project during their education helps them, students of different years responded differently. Namely, the highest grade point average is 3.5, almost expected, in second-year physiotherapy students, while third-year nursing students gave an average score of 3, and first-year physiotherapy students 3.3. The difference is clearly visible because nursing students by participating in the project generally do not encounter situations specific to their profession and courses within the program, and first-year physiotherapy students have just started in the profession (Graph 3.).

When asked if the project encouraged them to engage in physical activity again the highest score of 3.5 was given by second-year physiotherapy students. First-year physiotherapy students rated this issue with an average score of 3.1 and nursing students a score of 3.0. The difference in average grades is not particularly significant, but it is explained by the number of hours spent on sports fields, which in the second year is much higher than in other students (Graph 4.).

Professors and teachers have much more tasks than just teaching students, which makes it even more difficult for them to have the already great responsibility they have. When they come to competitions, their focus should be on improving the quality of play and not on repairing injuries caused on the field, so it is very important to have an educated team or individuals who will care and help in these situations.

A questionnaire was conducted among 15 teachers, teachers and other employees in charge of taking students to sports competitions.

The result of descriptive statistical analysis median when asked if they thought medical assistance was needed in competitions was 4.0. (Table 2.) Children in the game and on the field give the maximum of themselves and the desire with which they come to the field is extremely high, so the possibility of injury increases, which justifies the assessment of the teacher for the necessary medical team.

Satisfaction with the implementation of the project teachers responded with a median 4, but not everyone is completely satisfied with the performance. Most of them are satisfied with the implementation of the project very likely because nothing like this has been implemented so far and they accept the news and have seen the benefits that the project brings.

When asked if they thought students were competent to provide assistance in sports competitions, teachers responded with a median 4. Many people believe that young people do not have enough knowledge and skills to work independently, while a few of them believe in the opposite because of their desire and will to acquire new knowledge and experience, and most respondents agree that students are competent to provide assistance.

CONCLUSION

This is the first time in our city and county that the medical service at school sports competitions has been organized in this way. This includes physiotherapy and nursing students who supervise sports competitions and do so on a voluntary basis. In discussions with the secretaries of the city and county school sports associations, we identified the lack of medical support at school sports competitions and subsequently launched this project. By promoting education, training and collaboration, the SIORC project aims to improve the safety and wellbeing of young athletes and create a sustainable and effective approach to the prevention and treatment of sports injuries. By improving the skills and knowledge of students, SIORC strives to create a safe and stimulating environment for sport and physical activity for children and young people. In addition to providing medical support, the project also helps to reduce costs, as the communities of the school sports clubs do not have to pay for a professional medical team, which is also not insignificant. In future, the project is to be implemented nationwide in school sports and also in academic sports.

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ATTACHMENT

1. Questions for students

Please rate how much you agree or disagree with each statement by circling your answer. The numbers mean the following:

1	2	3	4
I completely disagree	I mostly disagree	I mostly agree	I completely agree

Please answer each question by circling only one answer.

1	I LEARNED SOMETHING NEW AND CONFIRMED MY EXISTING KNOWLEDGE DURING THE IMPLEMENTATION OF THE PROJECT	1	2	3	4
2	PARTICIPATION IN THE PROJECT HAS A POSITIVE EFFECT ON MY SELF-CONFIDENCE	1	2	3	4
3	PARTICIPATION IN THE PROJECT HELPS ME DURING EDUCATION	1	2	3	4
4	PARTICIPATION IN THE PROJECT ENCOURAGES ME TO PHYSICAL ACTIVITY	1	2	3	4

2. Questions for teachers

Please rate how much you agree or disagree with each statement by circling your answer. The numbers mean the following:

1	2	3	4
I completely disagree	I mostly disagree	I mostly agree	I completely agree

Please answer each question by circling only one answer.

1.	I THINK MEDICAL ASSISTANCE IS NEEDED AT SCHOOL SPORTS COMPETITIONS	1	2	3	4
2.	I AM SATISFIED WITH THE IMPLEMENTATION OF THIS PROGRAM/PROJECT	1	2	3	4
3.	I CONSIDER THAT STUDENTS ARE COMPETENT AND HAVE ENOUGH KNOWLEDGE TO PROVIDE ASSISTANCE AT SCHOOL SPORTS COMPETITIONS	1	2	3	4

DO YOU HAVE SUGGESTIONS TO IMPROVE THIS PROJECT?

If yes, please list them...

[illegible]



4 HEALTHY ACADEMIC SOCIETY

International Scientific
Congress of student' sport,
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POREČ, May 30 - June 1, 2024





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