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CONTENTS

REVIEW ARTICLE

Modern methods and means of physical culture in the rehabilitation of various population groups: a systematic review

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim: The influence of physical culture on the health improvement of various population groups requires analysis and the search for promising research directions. At the same time, the methods and means of physical culture used in rehabilitation are diverse and need systematization and clarification. The aim of the study is to review contemporary methods and means of physical culture applied in the rehabilitation of various population groups. Additionally, the study aims to identify trends and promising research directions

Material and Methods: The study involved searching for articles within the Web of Science (WoS) database for the period from 2014 to 2024. The initial search using the keyword "physical culture" and its variations yielded 1198 documents. A refined search with the keyword "rehabilitation" and its variations resulted in 70 articles. The data were exported in Plain text format. For preliminary processing of the extracted references, the PyCharm CE development environment and custom Python scripts were used. Descriptive statistics and content analysis methods were applied for data analysis.

Results: The most cited articles and eight key research themes in the field of physical rehabilitation were identified. The main results indicate that contemporary rehabilitation technologies and methods of adaptive physical rehabilitation significantly improve the physical and psychological health of various population groups. The importance of pedagogical, psychological, and social aspects in the training of rehabilitation specialists was also highlighted.

Conclusions: Modern methods and means of physical culture in rehabilitation prove their effectiveness in improving physical and mental health, promoting social integration, and enhancing the quality of life for various population groups. The study emphasizes the need for continuous innovation and comprehensive training of specialists who integrate physical and psychological rehabilitation strategies.

Keywords: health, pedagogical, rehabilitation, adaptive

Introduction

Effective physical rehabilitation for various population groups requires a systematic and interdisciplinary approach. Analyzing contemporary research in the fields of physical culture and rehabilitation allows us to identify the most effective methods and develop standardized approaches capable of providing quality assistance to the population. In this context, knowledge and understanding of the current state and future prospects of physical rehabilitation are crucial, as they help find ways to improve the quality of life and health of the population. Several research directions stand out in particular.

Modern rehabilitation technologies play a key role in restoring health and functional abilities of various population groups. The application of therapeutic physical culture in the rehabilitation of children has demonstrated significant improvements in motor activity [1, 2, 3]. The comprehensive use of this approach, including massage, physiotherapy, and mud therapy, has shown effectiveness in children's rehabilitation [4, 5, 6]. In these approaches, static exercises have been beneficial in preventing dysfunctions in children [7]. In turn, rehabilitation programs using Callanetics have contributed to the improvement of the cardiovascular system in students with scoliosis [8]. Another study confirmed the effectiveness of rehabilitation programs for security and defense sector employees injured in the line of duty [9]. Additionally, the development of high-tech devices and programs for rehabilitation is considered a promising direction, emphasizing the importance of an interdisciplinary approach [10, 11].

Adaptive physical rehabilitation involves the use of physical culture methods to improve the health conditions of individuals with various limitations. Research shows that adaptive physical

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culture can foster a conscious attitude towards one's abilities and help overcome psychological barriers [12, 13]. Involving children with disabilities in physical activity programs can reach 81.4% with sustained government regulation [13]. Another study demonstrated that physical exercises for people with hearing impairments contribute to their social adaptation and comprehensive development [14]. Study by Kornev et al. [15] notes that increasing physical activity in children with intellectual disabilities improves their physical fitness and motivation. Study by Kopzhanov et al. [16] emphasizes the importance of professional training for specialists in adaptive physical culture and sports. The authors note that such an approach expands opportunities for people with disabilities, providing them with more chances to participate in various physical activities and sports.

It is well known that physical exercises have a significant impact on the health and quality of life of various population groups. Research by Razmakhova et al. [17] identified gender differences in the quality of life of students exempted from physical education for medical reasons. The authors emphasize the need for preventive measures and lifestyle changes. Another study [18] notes the dependence of public health on political systems, highlighting the importance of government control for the successful functioning of the social healthcare system. Golovina et al. [19] showed that monitoring the attitudes of elderly women towards physical training revealed the positive impact of physical exercises on overall health and the reduction of cardiovascular risk factors. In another study [20], methodological approaches to preparing youth for organizing leisure and recreational activities through health fitness and tourism increased the motivation levels and overall readiness of future specialists in physical culture and sports. Esaulenko et al. [21] identified the main health problems of medical university students and proposed novel approaches to organizing medical care, emphasizing the need for innovative forms and the development of a unified health management model for students.

Studies reveal various aspects of pedagogical training for specialists in physical rehabilitation. Zaitseva et al. [22] developed a methodological system for using fitness technologies in physical education for students. The system includes motivational-target, content-organizational, technological, and control components. Another study confirmed positive changes in the level of physical activity and professional motivation of students [23]. Additionally, the effectiveness of socio-pedagogical experimental learning, which demonstrated positive social and educational effects, was confirmed in another study [24]. Zhamardiy et al. [25] developed methods for forming leadership competencies in future physical education teachers, showing positive changes in students' leadership skills. These and other studies [26, 27] also emphasize the importance of pedagogical training in various aspects of physical culture and sports, including the optimization of individual student work and the use of educational computer programs for diagnosing the functional state of the body.

Despite the considerable progress achieved in rehabilitation through the methods and means of physical culture, unresolved issues remain. These aspects highlight the importance of continuing the systematic study and application of physical culture methods and means to ensure quality rehabilitation for various population groups.

The aim of the study is to review contemporary methods and means of physical culture applied in the rehabilitation of various population groups. Additionally, the study aims to identify trends and promising research directions.

Materials and Methods

Data Sources

For this study, a search for scientific articles was conducted within the Web of Science (WoS) database for the last 10 years, from 2014 to 2024. The search was performed using the keywords: "physical culture" OR "Physical culture" OR "Physical Culture" OR "physical Culture". The initial search phase yielded 1198 documents. Subsequently, a refined search was conducted using the keywords: "Rehabilitation" OR "rehabilitation" OR "Rehab*" OR "rehab*". This refinement reduced the number of results to 70 articles. The data from WoS were exported in Plain text format, specifying the main source elements, using the option: Export —> Plain text file —> Record Content: —> Custom selection (9) Edit. The resulting list was saved with the main source elements indicated.

Data Processing

For preliminary processing of the extracted references, the PyCharm Community Edition (CE) development environment and custom Python scripts were used. This process included the following stages:

1. Importing data from the exported text file into the Python environment for further processing.
2. Using Python scripts for data cleaning, removing duplicates, and extracting key information (e.g., article titles, publication years, keywords, and abstracts).
3. Conducting an analysis of the obtained data to determine key directions and themes represented in the selected articles.
4. Systematizing the analysis results into tables for further use in the study.

Statistical Analysis

Methods of descriptive statistics were used for the synthesis and interpretation of data in the review article. The focus was on the quantitative and qualitative analysis of the selected articles, including counting the frequency of key themes and assessing their significance. Content analysis was applied to identify the main directions and trends in the research. All analyses were conducted using data processing and analysis software, such as Python and its libraries.

Results

Table 1 contains a quantitative analysis of the frequency of various keywords in the studied scientific articles, found in in the Web of Science database from 2014 to 2024. These keywords were selected to identify the main themes and directions in the field of physical culture and rehabilitation. Table 2 provides the most cited articles on the topics of physical culture and rehabilitation. Table 3 presents the main themes presented in the articles studied.

Table 1. Descriptive Statistics: Frequency of Mention of Key Themes

Keyword	Count
physical	48
culture	14
rehabilitation	14
students	12
children	10
education	9
training	9
health	8
sports	6
activity	5

Table 3 demonstrates that the studies cover a wide range of issues related to the application of physical culture methods and means in rehabilitation.

Discussion

The aim of the study was to review contemporary methods and means of physical culture applied in the rehabilitation of various population groups. The analysis of the frequency of key themes mentioned in studies over the past ten years showed that the most frequently occurring terms were “physical culture,” “rehabilitation,” “students,” “children,” “education,” “training,” “health,” “sports,” and “activity.” These results align with the existing literature, which emphasizes the importance of physical culture and rehabilitation in various contexts. The most cited articles also confirm the significance of these themes, highlighting the importance of innovations and methodologies in improving rehabilitation processes.

The review identified key themes highlighted in physical rehabilitation studies. These themes represent the main directions and trends in the field of rehabilitation and underscore the importance of innovative methods and approaches for improving the health and quality of life of various population groups.

Application of Modern Rehabilitation Technologies

Modern rehabilitation technologies, such as hydrokinetic therapy and CrossFit, indicate improvements in the physical condition of various population groups [1, 2]. Authors emphasize the significance of innovations in rehabilitation processes. It is also asserted that such approaches contribute to better treatment outcomes and overall functional capacity of the population [1, 2]. Other studies note that the implementation and application of these technologies are becoming important directions in the field of physical rehabilitation [4, 5, 9, 10, 37]. In these contexts, the need for further research and the development of new methodologies is evident.

Use of Adaptive Physical Rehabilitation

Adaptive physical rehabilitation remains one of the most in-demand approaches for meeting

Table 3. Key Research Topics in the Field of Physical Rehabilitation

Serial Number	Paper Title (ID)	Insight
1	1, 2, 4, 5, 9, 10, 11, 37	Application of modern rehabilitation technologies
2	12, 13, 14, 15, 16, 38, 39, 40	Use of adaptive physical rehabilitation
3	17, 18, 19, 20, 21, 41, 42, 43, 44	Impact of physical exercises on health and quality of life
4	22, 23, 24, 25, 26, 27, 45, 46, 47, 48, 49, 50	Pedagogical aspects of training specialists in physical rehabilitation
5	1, 2, 4, 5, 9, 10, 11, 51, 52, 53, 54	Rehabilitation of specific population groups
6	12, 14, 19, 55	Psychological aspects of physical rehabilitation
7	10, 11, 24, 56, 57, 58, 59, 60	Innovative methods and technologies in rehabilitation
8	13, 14, 16, 61, 62, 63, 64	Social aspects of physical activity

Table 2. Most Cited Article Characteristics

Source	Citation Count	Study Participants or Target Population	Study Design	Main Result or Issue	Author(s) Stated Conclusion
[28]	24	Population of all Northern countries	Review	"In the case of progressive hypothermia in the human body, a number of negative reactions occur, leading to a drop in temperature, depletion of physical reserves of the heart, liver, muscles, breathing and heartbeat, reduce the tone of vessels and reduce the blood flow rate."	"Physical rehabilitation after the action of the cold should be carried out very actively. Its success is associated with the complexity and perseverance of the use of therapeutic physical culture, massage, and various physiotherapy."
[29]	21	43 men (age range 45 to 60) who experienced "a small focal myocardial infarction in the posterior or anterolateral walls of the left ventricle 5-6 days ago without signs of heart failure."	Experimental	Experimental participants "managed to significantly increase the body's resistance to physical exertion and hypoxia, as well as significantly increase the functional activity of their cardiovascular system" compared to control participants.	"The effectiveness of the author's scheme of therapeutic physical culture was significantly higher than the results of applying the traditional scheme in terms of rehabilitation of this patient population."
[4]	20	Lower limb injured children in need of rehabilitation with Down's syndrome	Review	"The therapeutic physical culture allows restoring movements in the lower limb, reduces swelling of the injured leg, prevents the development of traumatic flat feet, deformities of the foot and the curving of the fingers, restores the functions of the damaged limb and the movement skill. Massage promotes acceleration of regeneration processes at the site of fracture and elimination of stiffness. To restore the functions of the lower limb, the combination of massage with mud therapy, apparatus physiotherapy and mechanotherapy has a good effect. Also, to achieve full recovery of lost function of ankle joints, an increase in motor activity in the form of soccer can be used."	"The success of rehabilitation with this pathology is possible when using complex therapeutic physical training, therapeutic massage, physiotherapy."

Table 2 (Continued)

Source	Citation Count	Study Participants or Target Population	Study Design	Main Result or Issue	Author(s) Stated Conclusion
[30]	20	Boys (age range 12 to 13) with either high or low self-reported high or low physical capital	Qualitative	"…this paper explores the relational and performative aspects of gender in the interview space, mediating how boys with multiple body capitals and masculinities shape their narratives in different ways during an interview with a male researcher."	"Overall, influenced by relational and performative aspects of gender, adolescent boys in our study performed what they understood as an 'appropriate' version of gender with a male interviewer. To extend methodological data about the influence of the interviewer's gender with children and youth, future research should investigate how boys and girls perform gender during gender congruent and gender incongruent interview settings."
[31]	17	Physical culture teachers in higher education	Qualitative	"…the system of RBL (Resource-Based Learning) of future teachers of physical culture was developed, which contains the following subsystems: motivational, conceptual-targeting, structural-content, process-technological, diagnostic-effective."	"Theoretical and practical results obtained during research form the basis for further examination of the problem in the aspects of improving the existing system, identifying the specific ways of organizing effective cooperation with Ukrainian and foreign libraries, with international higher education institutions providing training for future teachers of physical culture, exploring the directions of development in RBL within higher education institutions and creating the new-generation universities with the means of applying innovative technologies."
[32]	17	573 adults (55% females) enrolled being prepared as future teachers	Experimental	"The main factors contributing to the positive attitude of students to the fitness technology classes are: control of the department of physical education, responsibility for the level of physical fitness, responsibility and discipline…" and "The most attractive factor for the pursuit of fitness technology in the after-school hours is the accessibility and comfort of sports facilities…"	"Therefore, students' physical improvement needs are a mental state characterized by an attraction to practising fitness to develop their physical qualities and promote health. The vital need to meet such needs leads to a student's motive for action."

Table 2 (Continued)

Source	Citation Count	Study Participants or Target Population	Study Design	Main Result or Issue	Author(s) Stated Conclusion
[33]	16	Youth who sustained a lower jaw fracture	Review	"Regular physical education should be of great importance in the development of rehabilitation options for a fracture of the lower jaw. It provides a good healing effect, especially when combined with several physiotherapeutic and psychotherapeutic effects."	"The continuing need to accelerate and increase the efficiency of the rehabilitation process after a fracture of the mandible requires further extensive research in this direction."
[34]	13	Canadian adult prison population	Self-reflective case study	"Firstly, that qualitative researchers of sport and physical culture continue to offer self-reflexive accounts of undertaking projects in total institutional (or total institution-like) sport settings. The recent work of Parker (2016) and Allain (2014) represents notable exemplars of such an approach. Secondly, that discussions continue within sports studies about methodological challenges and frustrations, as well as creative methodological and theoretical approaches to overcoming or working around these barriers."	"This paper fills a unique void in the literature on sport research in total institutions, offering a critical and reflexive methodological examination of the barriers to qualitative research at such sites." Sites refers to federal prisons.
[35]	13	32 (50% female) cardiac rehabilitation patients with diabetes within the initial 3 months of their program	Qualitative	"Attention to CR goals was not always the primary consideration for study participants. Instead, a central concern was to restore social dignity within other fields of activity, including family, friendships, and employment. Thus, study participants evolved improvised tactical approaches that combined both physical and social rehabilitation. These improvised tactics were socially embedded and blended new cultural capital with existing (often gendered) cultural capital and included: concealment, mobilizing cooperation, re-positioning, and push-back."	"Our findings suggest that success in CR requires certain baseline levels of capital – including embodied, often gendered, cultural capital – and that efforts to follow CR recommendations may alter social positioning."
[36]	11	Healthcare professionals	Review	"…Western mind–body exercise methods enjoyed celebrated success during the first half of the 20th century, were hailed by medical and allied health practitioners and practiced by millions from society's elite to deprived minorities."	"Rediscovering the Western mind–body exercise movement is hoped to facilitate official healthcare establishment recognition of this kind of training as an integral entity."

the individual needs of various population groups with disabilities. Current research highlights the importance of government programs and sustainable regulation for involving children with disabilities in physical activity [13]. The significance of professional training for specialists in this field is also noted, as it expands opportunities and improves the quality of life for people with disabilities [16]. Many studies in the field of adaptive rehabilitation demonstrate new approaches that promote social adaptation and improve the physical condition of the population [12, 14, 15]. The results of these and other studies [38, 39, 40] indicate the need for continued efforts to find more effective approaches to addressing the challenges of adaptive physical rehabilitation.

Impact of Physical Exercises on Health and Quality of Life

Physical exercises hold a special and important place in the physical rehabilitation of people of different ages. Physical exercises significantly impact the improvement of health and quality of life for various population groups. Research highlights the importance of preventive measures to eliminate gender differences in the quality of life of students [17], government control over healthcare for the successful functioning of society [18], and reducing cardiovascular disease risks in elderly women through physical activity [19]. The necessity of new methodological approaches in preparing students for health-related activities [20] and improving the organization of medical care for medical university students [21] is also noted. Other studies [41, 42, 43, 44] confirm the validity of such approaches regarding the impact of physical exercises on the health and quality of life of various population groups. These aspects emphasize the importance of a comprehensive approach to physical activity and population health, contributing to the further improvement of quality of life.

Pedagogical Aspects of Training Specialists in Physical Rehabilitation

The training of specialists in physical rehabilitation requires the application of person-centered, active, and axiological approaches that promote professional development and motivation among students [22]. Current research emphasizes the need to modernize the content and forms of teacher training and to implement experimental methodologies for developing leadership competencies [24]. Additionally, the use of information and communication technologies to enhance educational processes is highlighted [27]. Special attention is given to intensifying the educational and corrective process for schoolchildren with special needs [26]. Authors report that such an approach helps achieve corrective and speech therapy goals. In another study [23], it is noted that the level of physical activity among students depends on their motivation and readiness for continuous professional development, underlining the importance of motivation in the learning process. Another study [25] points out that developing leadership skills is also a crucial aspect of training future physical education teachers. Numerous studies [45, 46, 47, 48, 49, 50] confirm the role and significance of pedagogy in training specialists in the field of physical rehabilitation.

Rehabilitation of Various Population Groups

The rehabilitation of specific population groups includes specialized programs that improve physical condition and quality of life. Current research highlights the importance of a comprehensive approach, incorporating therapeutic physical culture, massage, physiotherapy, and pharmacological agents for various groups, including the general population [1], stroke patients [2], and office workers [9]. It is emphasized that inclusive tourism [10] and interdisciplinary educational programs also play a key role in enhancing rehabilitation processes and ensuring the quality training of specialists [11]. Another study [4] notes that a rehabilitation program for children with Down syndrome and lower limb injuries contributed to functional recovery and health normalization. In a study by Kalmykov et al. [5], a program for patients with chronic gastritis is presented, showing effectiveness in functional recovery and health normalization. The authors of these and other studies [51, 52, 53, 54] largely support and welcome approaches that consider the age-specific characteristics of the participants.

Psychological Aspects of Physical Rehabilitation

The psychological aspects of physical rehabilitation are an important element in the system of recovery and improving the quality of life for the population. Research emphasizes that adaptive physical culture helps people with disabilities overcome psychological barriers and develop a conscious attitude towards their capabilities [12]. Additionally, physical activity plays a crucial role in the social adaptation of people with hearing impairments and in improving the cognitive abilities of elderly women, contributing to their overall well-being [14, 19]. These aspects and the results of other studies [52, 55] demonstrate the necessity of integrating psychological approaches into physical rehabilitation programs to achieve the best outcomes.

Innovative Methods and Technologies in Rehabilitation

Innovative methods and technologies are becoming increasingly important in the field of rehabilitation. They enable the discovery of new approaches to improving the quality of life for various population groups. Inclusive tourism

and high-tech training programs for specialists expand opportunities for rehabilitation and social integration of people with disabilities [10, 11]. The introduction of new pedagogical methodologies and technologies into the educational process also plays a key role in enhancing the physical and mental health of students [24, 65]. The authors of these and other studies [56, 57, 58, 59, 60] highlight the need for further development and implementation of innovative solutions in rehabilitation programs.

Social Aspects of Physical Activity

The social aspects of physical activity play a crucial role in improving the quality of life and social integration of various population groups. Government regulation and support for physical activity programs for children with disabilities are essential factors that ensure high involvement and successful implementation of these programs [13]. Regular participation in physical activity helps improve physical condition and develop social skills and promote social adaptation, especially in people with hearing impairments [14]. The importance of professional training for specialists in adaptive physical culture is also indisputable. In study [16], it is noted that such an approach expands opportunities for people with disabilities, enhancing their quality of life and promoting successful social integration. These and other studies [61, 62, 66, 67, 68, 69, 70] emphasize the significance of regular physical exercises and the qualified training of specialists to achieve sustainable results in improving the health and quality of life of various social groups.

Limitations of the Evidence Included in the Review

The limitations of the evidence in this study are related to the use of data solely from the Web of Science database. This may limit the representativeness of the sample, as not all relevant studies may be included in this database. Additionally, only articles published in English were included in the review. This may also limit the comprehensiveness of the analysis, considering the possible existence of significant studies in other languages.

Implications of the Results for Practice, Policy, and Future Research

The results of this study have important implications for practice, policy, and future research in the field of physical culture and rehabilitation. The identified key themes and methods can be used to develop and improve physical education and rehabilitation programs. This approach will contribute to increased motivation for physical activity and improved health among various population groups. Future research can focus on an in-depth study of the identified themes, utilizing data from other databases and sources, as well as investigating the long-term effects of applying different rehabilitation methods and technologies.

Conclusions

The conducted review highlights several key directions in the field of physical rehabilitation. Modern technologies and adaptive methods have proven effective in improving the physical and psychological condition of various population groups, including children, the elderly, and people with disabilities. Physical activity enhances health and quality of life and promotes social integration and adaptation.

Pedagogical training of specialists in physical rehabilitation also plays an important role. The implementation of innovative methods and technologies is necessary to increase the effectiveness of rehabilitation programs. Training specialists should consider both physical and psychological aspects of rehabilitation, ensuring a comprehensive approach to health recovery.

Future research should focus on further exploring and developing these directions. This will improve the quality and accessibility of rehabilitation services and develop new methods and approaches for successful rehabilitation and social integration.

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REVIEW ARTICLE

Physical culture and recreation: a systematic review

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim In recent years, there has been a growing interest in physical culture and recreation due to their significant impact on population health and quality of life. This work aims to systematically review research in the field of physical culture and recreation to identify current trends, issues, and prospects.

Material and Methods The search for publications was conducted in the Web of Science database using the keywords "Physical Culture" and "Recreational." As a result, 1192 publications were found, of which 69 were selected for detailed analysis after excluding irrelevant ones. Data extraction and classification into five categories were performed using Python.

Results The analysis revealed that the main research directions include the impact of physical activity on health; the organization and management of sports events; educational aspects of physical culture; social and psychological aspects of recreational activities; and innovative approaches in the field of physical culture. The results showed that physical culture in the context of recreation significantly impacts health and quality of life, playing an important role in the social and cultural context. Modern trends in the development of physical recreation were identified, as well as the significant influence of physical activity and socio-demographic factors on the population's quality of life.

Conclusions The systematic analysis showed that research in the field of physical culture and recreation is crucial for the development of a healthy lifestyle and social integration. The results highlight the need for further research and the implementation of innovative practices to improve the population's quality of life and health.

Keywords: health, quality of life, lifestyle, physical activity, educational, sports

Introduction

In recent years, there has been a growing interest in physical culture and recreation due to their significant impact on population health and quality of life. This necessitates a systematic analysis of current research to identify key trends and directions. Despite a considerable amount of research, there is still a lack of systematized data, complicating the understanding of general trends and the identification of relevant issues. In this context, research on the interrelationship between physical culture and recreation is primarily focused on the following areas.

The Impact of Physical Culture and Sports on Various Aspects of Society

Research shows that participation in sports and recreational activities positively affects physical and mental health, social integration, and quality of life [1, 2]. Authors note that physical activity contributes to improved physical condition and reduces the risk of chronic diseases. The validity of this approach is confirmed by other studies [3, 4]. It has been found that sports events and physical education play an important role in shaping social identity and cultural values, especially among young people.

Historical and Contemporary Aspects of Physical Culture

Historical studies serve as a guide for planning or adjusting the modern environment and organizing societal life. These studies emphasize the significance of physical culture in various social and cultural contexts. For example, the Alpine Club of Canada played a crucial role in the development of mountain tourism and conservation activities in the 20th century [5]. This approach serves as a valuable guide for contemporary clubs' activities. In the Soviet Union, sports events and mass celebrations contributed to forming the image of the «new woman» and maintaining social and political values [6]. This approach remains relevant today.

The Role of Education and Physical Activity in Improving Health

Educational programs aimed at increasing physical activity significantly impact the health and well-being of various age groups. Research shows that students participating in physical recreation programs exhibit higher quality of life and health satisfaction [7, 8]. Additionally, physical education in schools and universities contributes to the development of self-regulation skills and improved physical fitness [9, 10]. All these factors together help maintain an appropriate level of health and physical activity.

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Modern Trends in the Development of Physical Recreation

Contemporary research emphasizes the importance of developing infrastructure and programs to support physical recreation. This approach focuses on improving the existing organization of recreational activities, as reflected in various studies [11, 12]. Authors argue that comprehensive physical training programs for tourists enhance the organization and conduct of hiking trips, thereby increasing the time allocated for leisure and recreational activities. Other studies highlight the significant role of innovative approaches to physical activity, which promote broader participation across different population groups [13]. Overall, these and other studies contribute to understanding modern trends in the development of physical recreation and the utilization of physical culture methods and tools.

The Impact of Physical Activity and Socio-Demographic Factors on Quality of Life

Physical activity positively impacts the quality of life of various age groups, particularly among students and young people. Research shows that female students who lead physically active lifestyles exhibit higher quality of life and health satisfaction [2, 14]. Additionally, the impact of physical activity depends on social and demographic factors such as age, gender, and social status [9, 15]. This underscores the necessity for an individualized approach to organizing recreational programs [16, 17, 18]. The combination of various factors considered in these studies helps in understanding ways to address issues and improve quality of life.

Despite numerous studies, there is still a significant lack of systematized data on issues related to physical culture and recreation. The inconsistency in methodologies and various approaches to studying this topic complicates the comprehensive understanding of current trends and the identification of key issues. This work aims to systematically review research in the field of physical culture and recreation to identify current trends, issues, and prospects.

Materials and Methods

In this study, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol was used for the systematic review of publications on physical culture and recreation. The selection and analysis process of the publications included the following stages:

Search and Selection of Publications

The document search was conducted in the Web of Science (WoS) database for the period from 2014 to 2024 using the keywords «Physical Culture» and «Recreational.» The search resulted in 1192 publications. After applying inclusion and exclusion criteria, 69 publications were selected for further analysis.

Inclusion and Exclusion Criteria

The following inclusion criteria were used for the selection of publications:

- Articles published in peer-reviewed scientific journals.
- Articles containing research on physical culture and recreation.
- Articles published in English.

The exclusion criteria included:

- Duplicate articles.
- Articles not relevant to the research topic.
- Conference papers and dissertations.

Categorization of Publications

The selected publications were categorized as follows:

1. The impact of physical culture and sports on various aspects of society.
2. Historical and contemporary aspects of physical culture.
3. The role of education and physical activity in improving health.
4. Modern trends in the development of physical recreation.
5. The impact of physical activity and socio-demographic factors on quality of life.

Data Analysis

The publications were analyzed in terms of their methodology, results, and conclusions. Special attention was given to identifying current trends, issues, and prospects in the field of physical culture and recreation. Data extraction and classification into five categories were performed using Python.

Results

As a result of the systematic analysis, 47 publications were selected, representing a significant contribution to the field of physical culture and recreation. These publications were classified into relevant categories, allowing for the identification of key trends and the following research directions.

A quantitative analysis of the frequency of various keywords in the studied scientific articles, published in the period from 2014 to 2024 in the Web of Science database, is presented in Table 1. These keywords were selected to identify the main themes and directions in the field of physical culture and rehabilitation.

The Impact of Physical Culture and Sports on Various Aspects of Society

Recent studies emphasize the importance of physical culture and sports in various aspects of social life and health. Many studies examine the role of martial arts in physical culture and their connection with sports and physical education

[19, 20]. Authors note that the analysis of business development in the field of physical culture and sports has shown an increase in the monetization of sports activities. Other educational studies have revealed that focusing on the development of physical culture in young individuals enhances the effectiveness of professional training [21].

Table 1. Descriptive Statistics: Frequency of Mention of Key Themes

Keyword	Count
physical	29
culture	15
students	13
health	12
recreation	11
sports	8
education	6
activity	6
development	4
activities	4

It is also noted that students' health levels are declining despite the recognition of the importance of physical activity [22]. In this context, an important aspect is the training of physical education teachers, which requires the implementation of innovative pedagogical approaches [23, 24]. Authors show that students view sports as a way to fill their free time, although the academic workload limits their level of activity. Proper nutrition plays a significant role in this context. The analysis of students' dietary habits revealed the need for dietary adjustments to improve their health [25, 26].

Strategic vectors for the development of sports and recreational activities highlight the importance of balanced management and the attraction of private capital. Since 2020, during COVID-19, effective forms of sports activity in universities and the role of physical culture have also been subjects of research [27, 28]. Authors note that issues in physical education require the improvement of pedagogical competencies and curricula. Another study indicates that visits from foreign sports delegations have contributed to improving the international reputation of countries [29]. These studies underscore the significance of physical culture and sports for health, education, and socio-economic development.

Historical and Contemporary Aspects of Physical Culture

Studying the historical and contemporary aspects of physical culture allows for an understanding of its importance for health and social integration in various contexts. Various studies [30] have analyzed the concepts of culture, health, and physical culture. This approach helps to evaluate health as one of the core values of physical culture. Other studies [31] have established a link between the political system and public health practices. Authors have shown that the successful functioning of society is possible when the state maintains control against neoliberal ideologies.

Other studies [32] have revealed a minimal need for individual wellness activities among young people, justifying the importance of a flexible daily schedule. For the elderly, integral support through specialized clubs has been recommended [33]. The necessity of creating conditions for regular physical activity for students was demonstrated in the study by Castro Jimenez et al. [34], which highlighted a decline in agility and flexibility metrics.

Students' expectations regarding future work in the field of physical education were discussed in the study by Alfonso Gonzalez-Rivas et al. [35]. The authors identified prospects in recreational dance and sports tourism. Another study [36] examined the role of wellness hikes and orienteering in improving the physical condition of younger schoolchildren. Research by Skurikhina et al. [37] showed that fitness yoga is an effective means for strengthening the psychophysical state of female students.

Separately, studies on the ideas of past educators about the formation of health culture should be highlighted. Iermakova [38] summarized the ideas affirming the importance of physical education for the development of a healthy personality. The importance of physical education for developing a healthy personality was emphasized in studies examining the ideas of past educators [35, 36]. The influence of physical culture on the planning of garden cities between 1898 and 1903 revealed a biopower strategy for regulating the lives of the working class [39]. Additionally, the formation of physical culture among working-class youth in the 1920s was discussed in another study [40]. The authors demonstrated the role of physical activity in improving health and social integration. An analysis of the activities of the first hygienic gymnasiums founded in the 1860s revealed their role in supporting bodily culture [41]. The results showed that ideological and cultural connections among gymnasium users promoted the spread of self-control and recreation based on physical exercises.

These studies emphasize the importance of a comprehensive approach to physical culture, encompassing both historical and contemporary aspects. Understanding this context allows for the more effective implementation of physical education and wellness programs, contributing to the improvement of health and quality of life for various population groups.

The Role of Education and Physical Activity in Improving Health

Studying the educational and wellness aspects of physical culture reveals the significance of physical

activity for various population groups and suggests effective health improvement strategies. Various studies have analyzed the definitions of culture, health, and physical culture [30]. Authors identified a high valuation of health as a key value among students. Another study highlighted the relationship between the political system and public health, demonstrating the importance of state control in ensuring the welfare of society [31].

Some studies highlight the insufficient need for individual wellness activities among female students and the importance of a flexible daily schedule for improving their health [32]. Other researchers [38] emphasize the necessity of creating conditions for regular physical activity for students, noting the decline in agility and flexibility metrics after entering university. The study by Skurikhina et al. [37] explored students' expectations regarding future work in the field of physical education, identifying promising areas such as recreational dance and sports tourism. Another study demonstrated the potential of fitness yoga to strengthen the psychophysical state of female students, showing positive results from this approach [40].

The implementation of wellness hikes and orienteering has proven effective in improving the physical condition of younger schoolchildren [39]. Equally important is the focus on programs for other age groups. For example, the development of physical culture programs for the elderly highlighted the need for integrated support through specialized clubs [33, 34].

These studies underscore the necessity of a comprehensive approach to physical culture and healthcare, ensuring the improvement of health and quality of life for various population groups.

Modern Trends in the Development of Physical Recreation

Research shows that outdoor physical recreation is influenced by socio-economic factors, urban environments, and sports infrastructure. A study on modern trends in physical recreation identified key factors that facilitate and limit the use of physical culture and sports during leisure time [42]. Additionally, an analysis of sociological studies highlights the influence of consumer culture on sports events, which are perceived as rituals and parareligious phenomena [43]. The relationship between physical recreation and academic performance was confirmed in the study where a systematic approach to educational activities contributed to the social development of the community [44].

Another study [45] found that adaptive motor recreation for children with mild intellectual disabilities shows positive results in improving their physical condition. The authors argue that unfavorable economic and environmental conditions increase the need for specialized rehabilitation technologies for this category of children.

Equally important are studies focusing on the adult population. The study [46] showed that adults aged 50-60 choose recreational swimming to improve their health and physical fitness. Such activities help strengthen the cardiovascular and nervous systems. Another study [47] found that organizing mass sports events at industrial enterprises also proved effective in improving workers' health and productivity.

Thus, the development of outdoor physical recreation requires a comprehensive approach that includes socio-economic, sociocultural, and motivational aspects.

The Impact of Physical Activity and Socio-Demographic Factors on Quality of Life

Modern research in the field of physical activity and health highlights the importance of various factors influencing the quality of life and physical activity of different population groups. Physical activity among students has a significant impact on their overall quality of life and health satisfaction, particularly among female students in physical education faculties and participants in physical recreation [2]. Higher levels of quality of life and health satisfaction are also associated with age, marital status, and professional activity [4].

Studies show that female students who lead physically active lifestyles demonstrate higher results in physical, psychological, and environmental aspects compared to less active ones [1, 8, 11, 12]. Additionally, physical activity among students can be influenced by various social and demographic factors, such as motivation, the need for praise, and the availability of free time [7, 14].

Research also emphasizes the importance of structured physical activity programs and their impact on the quality of life of different age groups. For example, physical activity and recreation programs aimed at adolescents and children contribute to improving their physical fitness and overall health [3, 9]. An important aspect is the influence of the social and cultural environment on physical activity. For instance, studies on Chinese migrant communities show that their participation in recreational activities depends on multiple factors, including cultural capital [16].

Similarly, studies on the role of sports clubs emphasize the importance of social integration and the preservation of traditions in the formation of physical culture [3, 5]. Several studies analyze the legal regulation of adaptive physical culture, especially in the context of providing services to children with disabilities [15, 18]. Physical activity is a multifaceted phenomenon requiring a comprehensive approach to improve the quality of

life and health of various population groups [6, 10, 17, 18].

These results underscore the significance of physical culture and recreation in various aspects of societal life. They demonstrate the diversity of research in this field, covering both historical and contemporary aspects, and highlight the need for further studies to address identified issues and strengthen positive trends.

Discussion

The aim of this study was to systematically analyze publications on issues of physical culture and recreation to identify current trends, problems, and prospects in this field. The analysis showed that physical culture and sports significantly impact health and quality of life, playing an important role in the social and cultural context. Modern trends in the development of physical recreation were identified, as well as the significant influence of physical activity and socio-demographic factors on the quality of life of the population.

The Impact of Physical Culture and Sports on Various Aspects of Society

The results of our systematic analysis confirm the significant impact of physical culture and sports on various aspects of society. Sports activities contribute to the improvement of physical and mental health, social integration, and stress reduction [48, 49]. Comparisons with previous studies [50, 51] show that these trends persist and strengthen in the context of the modern social and economic environment [7, 15, 18]. However, despite the obvious advantages, there is a lack of systematic data on the impact of physical activity on social mobility and economic development, which requires further research. Additionally, most existing studies focus on short-term effects, while long-term consequences are insufficiently studied.

Physical culture and sports also play an important role in shaping cultural identity and social cohesion. Research shows that participation in sports events strengthens social bonds and improves communication skills, which is particularly important for youth and vulnerable populations [1, 9, 52]. However, despite these positive aspects, significant disparities exist in the accessibility of sports activities for different socio-economic groups. The lack of infrastructure and financial support in some regions limits opportunities for physical activity, which requires attention from policymakers and public organizations. More targeted programs are needed to address these barriers and ensure equal access to sports resources.

The impact of physical activity on stress reduction and mental health improvement is confirmed by numerous studies [49, 53, 54]. Regular sports activities promote the production of endorphins, which help cope with depression and anxiety. This is especially important in the context of modern challenges, such as the COVID-19 pandemic, when the level of stress in society has significantly increased [4, 13]. However, despite substantial evidence of the positive impact of physical activity on mental health, existing programs often do not consider the individual needs and preferences of people.

It is important to develop more personalized approaches to physical activity that consider the diversity and unique circumstances of each individual to maximize the benefits for mental health. These aspects also highlight the importance of physical culture as a means of improving quality of life and social well-being. However, further research is needed to gain a deeper understanding of the impact of physical activity on social mobility and economic development to develop effective strategies that enhance life in various social contexts.

Historical and Contemporary Aspects of Physical Culture

Our analysis of the historical and contemporary aspects of physical culture shows that its significance remains highly relevant. Historical data confirm that physical culture has played an important role in shaping societal norms and values, a trend also observed in modern conditions [1, 9, 13]. Physical culture has contributed to the development of social identity and the strengthening of the moral foundations of society [55, 56, 57]. However, despite numerous studies, there is a limitation in evidence due to the lack of research examining long-term social and cultural changes brought about by physical culture.

Contemporary research confirms that physical culture continues to play an important role in society, promoting a healthy lifestyle and social integration. The impact of physical culture on the health and well-being of the population is well documented; however, more attention needs to be given to various aspects such as accessibility and equality in participation [1, 4, 58, 59]. Modern studies often focus on short-term effects and do not consider cultural and historical contexts, requiring a more comprehensive approach.

Physical culture also plays an important role in education, contributing to the comprehensive development of individuals. It helps develop the physical and social skills necessary for successful integration into society [14, 16, 60]. However, the modern education system does not always provide equal opportunities for all students, requiring improvements in infrastructure and programs to ensure the accessibility of physical culture for all population groups. More research is needed to identify best practices and develop effective

programs that take into account cultural and social differences.

The analysis of historical and contemporary aspects of physical culture highlights its significance in shaping societal norms and values. The impact of physical culture on social and cultural changes remains relevant today. To further understand this, it is necessary to conduct research that covers the long-term social and cultural changes brought about by physical culture, in order to better integrate this data into modern physical culture and recreation development programs.

The Role of Education and Physical Activity in Health Improvement

Education and physical activity are key factors in improving health. The results of our review confirm that integrating physical activity into educational programs promotes healthy habits in young people, consistent with the findings of many studies [1, 4, 14, 61, 62]. Participation in physical education and sports activities in schools and universities positively impacts students' physical and mental health, improving their physical fitness and reducing stress levels. However, despite significant achievements in this area, there is a lack of systematic data on the long-term effects of such programs.

A limitation of our analysis is the insufficient number of longitudinal studies examining the long-term effects of integrating physical activity into educational programs. Many studies focus on short-term outcomes, making it difficult to assess their impact on health over a lifetime. More research is needed to study the sustainability of healthy habits formed within educational programs and their influence on adult life.

The importance of physical activity in educational institutions also lies in the formation of social capital and the improvement of students' cognitive abilities. Active students demonstrate better academic performance and a higher level of social integration [9, 13, 63, 64, 65]. However, existing programs often do not consider the individual differences and needs of students, requiring a more personalized approach.

Despite the positive aspects, many educational institutions face challenges in implementing effective physical activity programs. Lack of resources, limited infrastructure, and insufficient teacher training hinder the proper execution of these programs [1, 16, 66]. To address these issues, it is necessary to improve educational policies and attract additional resources.

Overall, education and physical activity are key factors in forming healthy habits and improving health. Integrating physical activity into educational programs promotes a healthy lifestyle among young people, as confirmed by the results of our analysis. However, further research is needed to study the long-term effects of such programs and to optimize them for achieving maximum health benefits.

Modern Trends in the Development of Physical Recreation

Contemporary research shows a growing popularity of physical recreation. Socio-economic conditions and the availability of infrastructure play a significant role in this process [3, 16, 17]. The development of urban environments, the creation of parks, and sports facilities contribute to increased public engagement in outdoor physical activities. Comparisons with previous data indicate that motivational aspects remain critical factors, as support from family and the community stimulates participation in recreational physical culture.

However, despite the positive trends, there is a lack of research examining the impact of digital technologies on physical activity. The use of mobile applications and fitness trackers can contribute to increased physical activity, but more data is needed to assess their effectiveness and long-term impact. Existing data indicate that technologies can both stimulate and distract from sports activities, requiring a more in-depth evaluation.

A limitation of our analysis is the lack of data on the long-term effects and sustainability of motivational factors. Many studies focus on short-term outcomes without considering the impact of social and economic changes on physical recreation. Additional research is needed to study the persistence of interest in physical activity across different age groups and conditions.

Moreover, it is important to consider regional differences in the availability of recreational services and infrastructure [5, 10, 67]. In some regions, access to sports facilities and programs is limited, necessitating the development of more inclusive strategies. Improving accessibility and diversifying physical recreation programs can increase engagement and enhance the population's quality of life.

Overall, contemporary research demonstrates a growing popularity of physical recreation, highlighting the importance of socio-economic conditions and infrastructure availability. Motivational aspects continue to play a key role in engaging people in physical activity. To gain a deeper understanding, it is necessary to study the impact of digital technologies on physical activity and develop new approaches that encourage increased participation in physical recreation.

The Impact of Physical Activity and Socio-Demographic Factors on Quality of Life

Physical activity has a significant impact on quality of life, as confirmed by numerous studies. Many results highlight the importance of socio-demographic factors such as age, gender, marital status, and income level [5, 10, 11, 68]. Age and

gender significantly influence the level of physical activity, with men generally being more active than women, and younger individuals being more active than older adults. Marital status also plays a crucial role: having a partner or children can either stimulate or limit physical activity depending on the circumstances.

Overall, the categories of research highlighted in the review are detailed in Table 2, ranked by the number of publications. This allows for the identification of the most extensively studied areas within physical culture and recreation, providing insight into prevalent research trends and priorities in the field.

In our opinion, attention should also be paid to the most cited publications (Table 3). The data in Table 3 indicate the most sought-after research topics in the context of the interrelationship between physical culture and recreation.

Nevertheless, there are limitations in our analysis related to the lack of studies examining the impact of physical activity on quality of life in different cultural contexts. Most research focuses on Western countries, while data from developing countries and cultural communities remain limited. This restricts our understanding of how social and cultural factors may influence the relationship between physical activity and quality of life.

Additionally, it is essential to consider the impact of socio-economic factors such as income level and education. People with higher income and education levels generally have better access to resources for physical activity, positively affecting their quality of life [6, 8, 12]. However, low-income groups often experience a lack of accessible programs and infrastructure for physical activity, necessitating the development of targeted policies to improve the situation.

It is also important to note that the impact of physical activity on quality of life can vary depending on the level of activity and type of exercise. For example, intensive aerobic exercises may have a more significant impact on physical health, while lighter forms of activity, such as walking, may be more accessible and sustainable for a broader audience. Further research is needed to better understand which forms of physical activity are most effective for improving quality of life in different demographic groups.

Overall, physical activity has a significant impact on quality of life, with socio-demographic factors playing an important role. Our analysis highlights the importance of age, gender, marital status, and income level in this context. To gain a more comprehensive understanding, it is necessary to conduct research that considers cultural differences and their influence on quality of life in various demographic groups. This will enable the development of more effective physical activity and recreation programs.

Limitations of Evidence and Review Processes

Table 2. Categorized Research in Physical Culture and Recreation

No	Topic		Summary	Cited Sources
1	The impact of physical culture and sports on various aspects of society.	Professional and Applied Physical Training	Explores the training programs and their effects on students and professionals in pedagogical fields.	[1, 20, 21]
		Psychological and Social Aspects of Sports	Focuses on the psychological and social dimensions of sports participation, including motivation and well-being.	[7, 14, 25, 31, 39, 41]
		Adaptive and Special Physical Culture	Addresses adaptive physical culture for individuals with special needs, including legal and social aspects.	[15, 17, 27, 37]
2	Historical and contemporary aspects of physical culture.	Historical Development of Physical Culture	Examines the evolution of physical culture from historical and contemporary perspectives, highlighting key milestones and developments.	[5, 19, 36, 38, 40, 42]
3	The role of education and physical activity in improving health.	Educational and Physical Activities in Health Improvement	Discusses the integration of educational programs and physical activities to enhance health and well-being, with a focus on youth and students.	[3, 8, 12, 24, 30, 32, 35]
4	Modern trends in the development of physical recreation.	Trends in Physical Recreation	Analyzes current trends in physical recreation, including new forms of outdoor activities and their benefits.	[9, 18, 26, 29, 33, 34, 43]
5	The impact of physical activity and socio-demographic factors on quality of life.	Socio-Demographic Factors in Physical Culture	Studies the influence of socio-demographic factors on participation and attitudes towards physical culture.	[2, 4, 22, 28]

Table 3. Most Cited Research in Physical Culture and Recreation

Source	Citation Count	Category	Summary
[37]	29	Adaptive and Special Physical Culture	Substantiates the use of fitness yoga for improving psycho-physical and psycho-social health of special health groups' girl students.
[11]	13	Quality of Life and Physical Activity	Analyzes the influence of students' physical fitness on the quality and organization of sports and health tourism trips.
[38]	8	Historical Development of Physical Culture	Reveals the historical development of health culture formation in educational thought from the Renaissance to the neo-classical period.
[41]	6	Historical Development of Physical Culture	Examines the role of hygienic gyms in the social and cultural differentiation among the bourgeoisie in the 19th century.
[69]	5	Psychological and Social Aspects of Sports	Discusses the place of martial arts in physical culture, highlighting their relationship to sport, physical education, and recreation.
[43]	5	Psychological and Social Aspects of Sports	Analyzes sociological perspectives on free time, tourism, and recreation, highlighting contemporary critical theory and postmodern culture.
[27]	5	Quality of Life and Physical Activity	Assesses the impact of educational engagement in physical activity on students' activity levels during and after COVID-19 lockdowns.

Our review identified several limitations. First, there is a shortage of longitudinal studies, making it difficult to assess the long-term effects of physical activity. Second, most research focuses on developed countries, limiting our understanding of global trends. Additionally, the review process was constrained by data availability and variability in methodologies.

Implications of the Results for Practice, Policy, and Future Research

The results of our analysis have important implications for practice and policy. It is necessary to develop and implement programs aimed at integrating physical activity into educational and workplace settings, as well as improving infrastructure for physical recreation. Future research should focus on longitudinal studies and cross-cultural comparisons to gain a more comprehensive understanding of the impact of physical activity on health and quality of life in various contexts.

Conclusions

The systematic analysis of publications shows that physical culture and recreation play an important role in improving health, social integration, and quality of life. Despite a significant amount of research, several issues require further investigation, such as the long-term effects of physical activity and educational programs, and the impact of modern technologies on recreational activities. Further studies are needed to understand the cultural and socio-economic factors affecting participation in physical culture and recreation. Future research should aim to develop effective strategies that enhance access to physical activity and recreation for different demographic groups and examine the impact of these factors on a global level.

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ORIGINAL ARTICLE

Assessment of stress and health conditions among students in the context of the war in Ukraine

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Abstract

Background and Study Aim: In the context of a military conflict, students' health is subjected to significant stress and psychological challenges. Monitoring the health condition of this vulnerable group can provide important data for developing effective support measures. The aim of this study is to assess the level of stress and health condition of students in Ukraine during the war and to compare these indicators with those of students from neighbouring countries, Poland and Romania.

Material and Methods: The study used the Perceived Stress Scale (PSS-10) questionnaire to assess stress levels among students. A total of 443 students participated: 36 from Poland, 215 from Romania, and 179 from Ukraine. Factor analysis (PCA) was employed to test the validity and reliability of the PSS-10 questionnaire structure, with the number of factors determined using the Kaiser criterion. Reliability was assessed using Cronbach's alpha coefficient. The Python library in the PyCharm CE environment was used as the analysis tool. The Mann-Whitney test was applied for group comparisons. Correlation analysis was conducted between the overall PSS-10 score and measures of positive and negative affect. A logistic regression model was used to identify predictors of stress.

Results: The results of the factor analysis showed that both factors significantly and reliably measure different aspects of stress. Cronbach's alpha values for Factor 1 (0.87) indicate high reliability, while for Factor 2 (0.79), they indicate good reliability. A correlation of 0.89 for Factor 1 indicates a very strong positive relationship between this factor and the overall level of stress. A correlation of 0.69 for Factor 2 indicates a strong positive relationship, though not as strong as Factor 1 (p=0.0000). The results confirm that the overall PSS-10 scores are closely related to both positive and negative emotional states, with a more pronounced impact on negative emotions. The highest number of students with a stress level of 2 is observed among students from Ukraine (32.65%) and Romania (35.60%), while in Poland this figure is 4.99%.

Conclusions: The study showed that the military conflict in Ukraine significantly affects the psycho-emotional state of students, causing high levels of stress, anxiety, and depression. Younger students and women were found to be particularly vulnerable. These results underscore the need to develop targeted support programs to improve the mental health of students in the context of the war.

Keywords: Perceived Stress Scale, Poland, Romania, anxiety, depression

Introduction

War and armed conflicts have a significant impact on the mental and physical health of the population, especially vulnerable groups such as students. In the context of military conflict, students are subjected to increased levels of stress, which can lead to serious psychological and physiological consequences. Monitoring the health status and stress levels among students during wartime is critically important for developing effective support measures and improving the quality of life for this vulnerable group.

Numerous studies have shown that students in conflict zones experience higher levels of stress and psychological problems compared to their peers in peaceful regions. Analyzing data from

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various studies allows for a better understanding of the impact of war on students' mental health and helps identify effective support strategies. Studies conducted in the context of the war in Ukraine show a significant impact of the conflict on the physical and psycho-emotional state of students. Adamczak et al. [1] found that Ukrainian students exhibit higher levels of physical activity compared to Polish students, despite significant motivational barriers. Halchenko et al. [2] and Kokun et al. [3] noted a decrease in resilience levels among adult participants and higher resilience among youth, which depended on their place of residence and subjective assessment of safety. Kurapov et al. [4] and Ogorenko [5] reported a deterioration in the psycho-emotional state of most respondents, including depression, exhaustion, loneliness, and nervousness, with the use of maladaptive strategies significantly increasing the risk of anxiety.

Pavlova et al. [6] found that 98% of students were exposed to the war, with 27% exhibiting symptoms of Post-Traumatic Stress Disorder (PTSD). Rogowska et al. [7] confirmed positive correlations between war exposure, nightmares, fear of war, insomnia, and PTSD symptoms, especially among women. Pinchuk et al. [8] reported that 66% of students tested positive for PTSD symptoms, 45% for moderate to severe anxiety symptoms, and 47% for moderate to severe depression symptoms. Limone et al. [9] noted a high prevalence of anxiety and stress among students, with predictors including young age, female gender, and isolation.

These results underscore the importance of developing support measures to improve the mental health of students in the context of military conflict. They also highlight the need for specialized interventions to reduce stress and anxiety levels among young people, particularly among women.

Studies among students of various specialties and countries have shown high levels of perceived stress, anxiety, and depression [10, 11, 12, 13, 14]. Cognitive empathy contributes to reducing stress levels, while law students experience greater stress compared to medical and psychology students [15, 16]. Among students, 84.7% reported moderately high levels of perceived stress, and those who stayed at their universities experienced significantly higher stress related to COVID-19 [17, 18]. Short-term group workshops based on Acceptance and Commitment Therapy (ACT) have proven effective in reducing symptoms of stress, depression, and anxiety among students [19, 20]. Emotional, academic, and physical problems are significantly associated with perceived stress, depression, and anxiety, with women and first-year students being more susceptible to high levels of stress [21, 22, 23].

These studies have shown that students experience high levels of perceived stress, anxiety, and depression. At the same time, each country has its distinctive characteristics in how university students perceive stress.

For example, in the USA, medical students experienced significantly higher stress after the suspension of classes and during the COVID-19 pandemic, especially among women and those with a mental health diagnosis [24, 25]. Financial difficulties and racism exacerbated stress and burnout, while volunteer activities reduced the likelihood of burnout [25]. Other causes of perceived stress include factors such as "anxiety" and "irritability" [26], and the satisfaction of basic needs [23, 26, 27].

Studies among students in Colombia have shown that stress, anxiety, and depression are widespread within this group [28]. The average stress level among medical students was 18.83 ± 5.19 points, with higher stress levels observed in younger students, men, and those living in rural areas [28].

Studies among students in EU countries have revealed high levels of perceived stress and significant differences depending on gender, discipline, and study load. In Austria, women experience almost twice as much stress as men [29]. In Spain, students in health science faculties, especially women and third-year occupational therapy students, exhibit high levels of stress, anxiety, and depression [30]. High levels of stress and emotional exhaustion have also been noted among students in Serbia [31], Finland [32], the Czech Republic [33], Italy [34], and Spain [35]. Numerous studies in Turkey have reported a significant increase in levels of stress and anxiety [36, 37, 38].

Studies among students in Asian countries have shown high levels of perceived stress, depression, and other mental health problems. In Bangladesh, women were 3.6 times more likely to experience stress than men [39]. In Sri Lanka, students' stress was associated with the academic environment and career choice [40]. Other studies also highlight the characteristics of perceived stress in Vietnam [41], Hong Kong [42], Jordan [43], Thailand [44], India [45, 46], Saudi Arabia [47, 48], and Malaysia [49, 50].

Numerous studies among students in China have shown that stress, anxiety, and depression are common problems [51, 52, 53]. High levels of perceived stress were associated with borderline personality disorder, attachment anxiety, and depression [54, 55]. The main predictors of anxiety and depression included musculoskeletal pain [56], watching movies [57], and residential area [58]. Overall, students in Asian countries are subject to stress depending on many factors specific to their regions.

Studies have shown that students in Poland experience high levels of stress and mental disorders [59, 60, 61]. Female gender, urban residence, and initial level of education are significant predictors of high levels of stress and depression [8, 59].

Polish dental students exhibited high levels of stress, especially women, who more often turned to religion and emotional support, while men used psychoactive substances and humor to cope with stress [62, 63].

A healthy lifestyle and positive mental attitude served as protective factors against stress among medical students [64, 65]. Positive correlations between active coping strategies and quality of life were observed among Polish students, particularly in psychological and physical domains [66, 67]. Students who had experienced COVID-19 exhibited higher levels of anxiety and stress, depending on the duration of the illness and the severity of residual symptoms [65, 66]. Polish students from rural areas showed higher levels of depression and suicidal thoughts, whereas senior students were more prone to stress [67].

Assessment of anxiety, stress, and health conditions among students in Romanian universities has been explored in various studies. In particular, perceived stress among students has been thoroughly studied, allowing the identification of key factors affecting their mental health. Balgiu et al. [68] confirmed the adequate properties of the PSS-14 questionnaire for assessing perceived stress, making it a useful tool for studying stress among dental students. The study by Butnaru et al. [69] showed that the economic crisis caused anxiety and reduced students' well-being; however, their fear ranged from moderate to low and did not significantly impact their overall well-being.

In another study [70], the authors found a negative correlation between depression, anxiety, and insomnia with overall satisfaction with e-learning. Palos [71] discovered that students with high levels of basic self-esteem reported low levels of burnout. Puiu et al. [72] identified communication problems and stress specific to online education that students experience. Simionescu et al. [73] determined the main stressors and coping strategies, showing that working students were more vulnerable to stress compared to non-working students both before and during the pandemic.

Other studies [74, 75, 76, 77] revealed the interconnection between health anxiety, symptoms of depression, anxiety, and stress, as well as coping mechanisms. The results showed that when controlling for the variable of health anxiety, a high level of anxiety and stress symptoms, along with a low level of depression symptoms, can predict the level of anxiety. These studies highlight the importance of understanding the mental health of students in Romanian universities and allow for the development of more effective support measures to improve their overall well-being.

Despite numerous studies dedicated to the use of the PSS-10 questionnaire among university students, unresolved issues remain that require new solutions. Special attention should be paid to the necessity of comparing results across countries such as Poland, Romania, and Ukraine, due to the unique circumstances caused by the war in Ukraine. This will allow for a deeper understanding of the impact of military actions on the stress levels and mental health of students, and help develop more effective support measures for this vulnerable group.

The aim of this study is to assess the level of stress and health conditions of students in Ukraine during the war and compare these indicators with those of students from neighbouring countries, Poland and Romania.

Materials and Methods

Participants

The study utilized the Perceived Stress Scale (PSS-10) questionnaire to assess stress levels among students. A total of 443 students participated: 36 from Poland, 215 from Romania, and 179 from Ukraine. The survey was conducted online, and participation was voluntary. All participants were informed about the objectives of the study and consented to participate by checking the appropriate box in the online form. The study was approved by the university's ethics committee, and all data were anonymized to protect participants' confidentiality.

Study Design

To assess quality of life was used The PSS-10 questionnaire, adapted into three languages: Ukrainian, Polish, and Romanian. Data collection was conducted online using a survey platform. The processing of questionnaires included checking the data for accuracy. Exclusion criteria included incomplete data and incorrect responses, which were removed from the final analysis.

Distribution of Questions Related to Positive and Negative Affect Indicators

To calculate the correlation, the responses to the questions were grouped into categories, and the average values for each category were computed. Questions related to feelings of confidence, control, and the perception that things are going well were categorized under positive affect. Questions related to nervousness, stress, and the inability to cope were categorized under negative affect.

Questions Related to Positive Affect: 4, 5, 6, 7:

4. Question about confidence;
5. Question about things going well;
6. Question about controlling irritations;
7. Question about everything being under control.

Questions Related to Negative Affect: 1, 2, 3, 4, 5, 6:

1. Question about being upset;
2. Question about inability to control important things;
3. Question about nervousness and stress;

4. Question about inability to cope;
5. Question about anger;
6. Question about difficulties.

Questions 4, 5, and 6 appear in both categories due to their mixed affect content.

Statistical Analysis

To test the validity and reliability of the PSS-10 questionnaire structure, factor analysis (PCA) was used, with the number of factors determined by the Kaiser criterion. Reliability was assessed using Cronbach's alpha coefficient. The Python library in the PyCharm CE environment was used as the analysis tool. The Grubbs' test was applied to check for the presence of outliers or anomalous values in the questionnaire data. The Mann-Whitney test was used for group comparisons. Correlation analysis was conducted between the overall PSS-10 score and indicators of positive and negative affect. A logistic regression model was employed to identify predictors of stress. Means, standard deviations, and percentages were determined. The significance level was set at 0.05.

Results

The Shapiro-Wilk test for normality distribution of the questionnaire data showed that the data do not follow a normal distribution. Therefore, factor analysis was used to test the reliability of the questionnaire with the following criteria: sample size n=443 students, and absence of outliers or anomalous values. The sample size is sufficient for conducting factor analysis (substantial size). The Grubbs' test was applied to check for the presence of outliers or anomalous values. The test indicated that no outliers were detected in any columns of the data.

The results of the factor analysis showed factor loadings for two factors (Table 1).

The results of the factor analysis are presented in Table 2.

The data in Table 1 show that for Factor 1 (Experiences and Stresses), the questions with higher loadings are: 1, 2, 3, 6, 9, 10. For Factor 2 (Managing Personal Problems and Control over Life Circumstances), the questions with higher loadings are: 4, 5, 7, 8. The results of the factor analysis (Table 1) show that each factor explains a certain percentage of the total variance in the data. The percentage of variance explained by each factor indicates its contribution to explaining the overall variability in the questionnaire data. Factor 1 explains 64.11% of the total variance. Factor 1, which is associated with experiences and stresses, is the primary factor influencing the respondents' answers. A significant portion of the variation in

Table 1. 10 item loadings in the factor

No	Item	Factor 1	Factor 2
1	In the last month, how often have you been upset because of something that happened unexpectedly?	0.712	-0.273
2	In the last month, how often have you felt that you were unable to control the important things in your life?	0.694	-0.176
3	In the last month, how often have you felt nervous and stressed?	0.754	-0.27
4	In the last month, how often have you felt confident about your ability to handle your personal problems?	0.347	0.577
5	In the last month, how often have you felt that things were going your way?	0.462	0.569
6	In the last month, how often have you found that you could not cope with all the things that you had to do?	0.545	-0.273
7	In the last month, how often have you been able to control irritations in your life?	0.369	0.451
8	In the last month, how often have you felt that you were on top of things?	0.567	0.595
9	In the last month, how often have you been angered because of things that happened that were outside of your control?	0.678	-0.228
10	In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0.74	-0.194

Table 2. Factor Analysis Results for PSS-10 Questionnaire

Measure	Factor 1	Factor 2
Cronbach's Alpha	0.87	0.79
Mean (SD); Range	1.77 (0.92); 0.0 – 4.0	1.53 (0.88); 0.0 – 4.0
Pearson's Correlation with PSS-10 Total Score	0.89 (p-value = 0.0000)	0.69 (p-value = 0.0000)
Percentage of Variance Explained by the Factor	64.11%	35.89%

the questionnaire responses is explained by this factor.

Factor 2 explains 35.89% of the total variance. Factor 2, which is related to managing personal problems and control over life circumstances, is also significant but contributes less to the total variance compared to Factor 1. This indicates that while both factors are important, Factor 1 has a more substantial impact on the overall stress levels and experiences of the students surveyed.

The data in Table 2 show that the Cronbach's alpha values (or coefficient of internal consistency) for Factor 1 (0.87) indicate high reliability (Table 2). The Cronbach's alpha values for Factor 2 (0.79) indicate good reliability (Table 2). A correlation of 0.89 for Factor 1 indicates a very strong positive relationship between this factor and the overall level of stress. A correlation of 0.69 for Factor 2 indicates a strong positive relationship, but not as strong as for Factor 1. The p-values (p=0.0000) indicate the statistical significance of the correlations.

Overall, Factor 1 (Experiences and Stresses) shows high reliability and a strong correlation with the overall PSS-10 score, indicating that this factor is a crucial component of the overall stress level. Factor 2 (Managing Personal Problems and Control over Life Circumstances) is also reliable and significantly correlated with the overall PSS-10 score, but its influence on the overall stress level is less pronounced compared to Factor 1. Both factors significantly and reliably measure different aspects of stress, confirming the validity of the PSS-10 questionnaire structure.

The correlation analysis between the overall PSS-10 score and the indicators of positive and negative affect yielded the following results (Table 3). The correlation between the overall PSS-10 score and positive affect was 0.6932, with a p-value of 0.0000. This indicates a significant positive relationship between these measures. This means that as the overall PSS-10 score, which reflects the level of stress, increases, the level of positive affect also increases. The correlation between the overall PSS-10 score and negative affect was even more significant, with a value of 0.8868 and a p-value of 0.0000. This indicates a very strong positive relationship between stress levels and negative affect. This demonstrates that as stress increases, the level of negative affect also rises. These results confirm that overall PSS-10 scores are closely related to both positive and negative emotional states, with a more pronounced impact on negative emotions.

The survey results are presented in Table 4.

The main trends show that, on average, men in all countries are taller and heavier than women (Table 4). The average age of students varies across countries, with the greatest variations in Ukraine. Polish female students are older than Romanian and Ukrainian female students. Romanian male students have the lowest average overall score. The significance level in all cases is 0.05, indicating sufficient statistical significance of the differences in the data.

Stress level indicators among students are presented in Table 5.

The results show the distribution of stress levels among students from Poland, Romania, and Ukraine (Table 5). On average, men from all countries show a higher percentage of stress levels than women. The highest number of students with stress level 2 is observed among students from Ukraine (32.65%) and Romania (35.60%), while in Poland, this figure is 4.99%. Among Romanian male students, the highest stress level 1 is observed (73 cases), which constitutes 46.50% of the total number of Romanian students. At the same time, among Ukrainian female students, the highest stress level 2 is observed (96 cases), which constitutes 32.65% of the total number of Ukrainian students. The overall data confirm that stress level 2 is the most common among all categories of students. This indicates a high level of stress among students in general.

Table 3. The results of the correlation analysis between PSS-10 Scores, Positive and Negative affect

Questions Related to Affect (Question Numbers)	Correlation	p-value
Positive Affect (4, 5, 7, 8)	0.6932	0.0
Negative Affect (1, 2, 3, 6, 9, 10)	0.8868	0.0

Table 4. Characteristics of Students from Poland, Romania, and Ukraine by Gender, Age, Height, Weight, and Overall Score.

University	Gender	Age	Age	Height	Height	Weight	Weight	Total	Total	Total_ Gender	Significance_ Level
		mean	std	mean	std	mean	std	mean	std		
Poland	female	21.86	2.21	166.29	5.24	60.36	8.37	19.36	9.22	216	0.05
	male	20.36	1.79	178.73	8.53	75.45	14.39	17.41	6.65	225	0.05
Romania	female	20.4	5.41	165.24	6.23	59.16	8.85	19.21	7.52	216	0.05
	male	19.73	4.33	179.66	6.45	77.44	17.74	14.0	7.06	225	0.05
Ukraine	female	18.92	4.34	165.91	6.24	56.83	10.37	18.46	6.88	216	0.05
	male	21.22	7.55	178.61	7.42	73.11	11.19	16.46	6.49	225	0.05

Table 5. Distribution of Stress Levels among Students from Poland, Romania, and Ukraine by Gender, Including Total Numbers and Percentages.

Category	Gender	Stress Level 1	Stress Level 2	Stress Level 3	Total	% Total	% Female	% Male
Poland	female	4	6	4	14	3.17%	28.57%	42.86%
	male	7	13	2	22	4.99%	31.82%	59.09%
Romania	female	12	37	9	58	13.15%	20.69%	63.79%
	male	73	81	3	157	35.60%	46.50%	51.59%
Ukraine	female	33	96	15	144	32.65%	22.92%	66.67%
	male	10	33	3	46	10.43%	21.74%	71.74%
Total		139	266	36	441			

Table 6. Confusion Matrix for Stress Level Classification Model

Actual \ Predicted	Pred 1	Pred 2	Pred 3	Total
True 1	40	5	0	45
True 2	2	71	0	73
True 3	0	2	13	15
Total	42	78	13	133

Table 7. Classification Report for Stress Level Prediction Model

Class	Precision	Recall	F1-Score	Support
1	0.9524	0.8889	0.9195	45
2	0.9103	0.9726	0.9404	73
3	1.0000	0.8667	0.9286	15
Accuracy	0.9323	0.9323	0.9323	133
Macro Avg	0.9542	0.9094	0.9295	133
Weighted Avg	0.9346	0.9323	0.9320	133

Confirmation of Stress Level Classification Results Using Logistic Regression Model

The study employed a logistic regression model to classify participants' stress levels based on their responses to the PSS-10 questionnaire. This approach allowed for the assessment of how accurately the model could classify stress levels (low, moderate, high) and confirm the distribution of participants across these stress levels. The results are confirmed by the stress level prediction model (Table 6, 7). The model demonstrated high classification accuracy with an overall accuracy of 93.23%. Classification metrics analysis showed that the model achieved high precision for all stress levels (0.9524 for level 1, 0.9103 for level 2, and 1.0 for level 3) and high recall (0.8889 for level 1, 0.9726 for level 2, and 0.8667 for level 3). These results confirm that the model effectively classifies participant responses, matching the initial distribution of stress levels among participants. Thus, the model can be a reliable tool for stress management research.

The logistic regression model demonstrated high accuracy in classifying stress levels among students, confirming the distribution identified in the survey data (Table 7). The performance metrics indicate that the model is reliable and effective in predicting stress levels based on PSS-10 responses. This validation reinforces the initial findings about the distribution of stress levels among students from Poland, Romania, and Ukraine, highlighting the importance of targeted interventions to address stress and mental health issues, especially in regions facing significant challenges like conflict zones.

Discussion

The aim of this study was to assess the level of stress and health conditions among students in Ukraine during the war and compare these indicators with the results of students from Poland and Romania. The results revealed significant differences in stress levels among students from these three countries. On average, men demonstrated higher levels of stress compared to women. Ukrainian and Romanian students more frequently experienced high levels of stress compared to Polish students. The most common level of stress among all categories of students was moderate, indicating a significant impact of stress on the student population overall.

Our results confirm that students in Ukraine experience significant levels of stress and

psychological difficulties in the context of the military conflict. As studies have shown, Ukrainian students exhibit higher levels of physical activity, which can serve as a coping strategy under stress [16]. At the same time, they face serious psycho-emotional problems, including depression, anxiety, and insomnia [44]. These findings correlate with results from studies conducted in various countries, where students also show high levels of perceived stress and anxiety [18, 19, 78].

Compared to Polish and Romanian students, Ukrainian students showed higher levels of stress related to personal health and lack of social support [67]. In Poland, first-year dental students exhibit high levels of stress; however, this is related to academic workload and professional demands rather than external factors such as war [61]. In Romania, the stress level is also high, but the causes and nature differ somewhat from those of Ukrainian students.

The assessment of anxiety, stress, and health conditions among Romanian university students has been covered in various studies. Specifically, Balgiu et al. [68] confirmed the adequacy of the PSS-14 questionnaire for assessing perceived stress, making it a useful tool for studying stress among dental students. Ionescu et al. [70] found a negative correlation between depression, anxiety, and insomnia with overall satisfaction with e-learning. Palos [71] discovered that students with high levels of basic self-esteem reported low levels of burnout.

While Romanian students face economic and academic stressors, Ukrainian students experience significant stress related to the war, leading to higher levels of anxiety and depression. Polish students, although experiencing stress, are less likely to face extreme situations like their Ukrainian counterparts. This may explain the lower stress levels in Poland. These differences highlight the necessity of considering specific contexts and circumstances when developing support programs and interventions for students in different countries.

Research shows that cognitive empathy and emotional support play a key role in reducing stress levels among students [16]. This underscores the importance of implementing programs aimed at developing psychological flexibility and social support, as has been demonstrated in other countries [19, 20].

Studies conducted in the context of the war in Ukraine confirm the significant impact of the conflict on the physical and psycho-emotional state of students. Ukrainian students exhibit higher levels of physical activity compared to Polish students, despite significant motivational barriers [1]. The decrease in resilience among adults and higher resilience among youth depend on residence and subjective assessment of safety [2, 3]. The deterioration in psycho-emotional state is supported by data [4, 5, 75, 79]. A high percentage of students have been exposed to the war, leading to nightmares, fear of war, and insomnia, especially among women [6, 7]. The high prevalence of anxiety and stress among students, particularly among young people and women, necessitates special intervention programs [8, 9]. Other causes of anxiety and stress among students include temporal, financial, and social stress factors and related symptoms [76]; resilience in the context of positive psychology [80]; and personal factors [77].

Our study also found a high level of physical activity among Ukrainian students, which may indicate an effort to maintain physical fitness as a coping mechanism for stress. Ukrainian youth are compelled to increase their resilience to stress, highlighting the importance of the social environment and a sense of security for psychological well-being. Our results show high levels of depression and anxiety among students, particularly among women. These findings underscore the significant impact of the war on the mental health of Ukrainian students and the need to develop support programs to reduce stress levels and improve their psycho-emotional state.

Nevertheless, despite the positive outcomes of short-term interventions, attention must be given to long-term strategies for supporting students in the context of military conflict. Implementing such measures could include developing programs for stress management and emergency adaptation, which would help students better cope with psychological burdens and improve their overall health.

Thus, our results highlight the need for further research and the development of targeted support programs for students living in war conditions. These measures could significantly enhance their mental and physical health, as well as their academic performance.

Conclusions

The conducted study confirmed the significant impact of the military conflict in Ukraine on the physical and psycho-emotional state of students. Ukrainian students demonstrate high levels of physical activity, which may indicate an effort to use physical activity as a coping mechanism for stress. The level of resilience highlights the importance of the social environment and a sense of security. The high levels of anxiety and stress symptoms, especially among women and younger students, underscore the need for the development and implementation of psychological support and intervention programs to improve the psycho-emotional state of this group.

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REVIEW ARTICLE

Recreational and rehabilitation aspects of psychological health and well-being of students: a systematic review

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Abstract

Background and Study Aim: Given the increasing attention to the psychological health and well-being of students, it is important to consider the impact of recreational and rehabilitation aspects. The purpose of this study is to analyze documents from the Web of Science (WoS) database from 2014 to 2024, focusing on the recreational and rehabilitation aspects of students' psychological health and well-being.

Material and Methods: A systematic search was conducted in the Web of Science (WoS) database using keywords related to psychological health, well-being, recreation, and rehabilitation of students. A total of 318 documents (articles) were retrieved. The extracted documents were processed using the PYCharm Community Edition (CE) development environment and special codes in the Python programming language. The K-means method was used for clustering the articles based on the presence of keywords. A total of 294 documents (out of 318) were identified that met the criteria of this study. Cluster analysis was used to group the retrieved articles by topic. Content analysis was applied to identify the main directions and trends in the research.

Results: The review identified a significant number of studies dedicated to various aspects of students' psychological health and well-being. These aspects include the impact of physical activity, social support, mindfulness programs, and nutrition. Key factors contributing to the improvement of students' psychological state, as well as the main barriers and problems they face, were identified. The study results showed that physical activity and psychological strategies play a key role in improving students' mental health. Significant differences were found in the levels of stress and well-being depending on participation in recreational and rehabilitation activities.

Conclusions: Recreational and rehabilitation activities play an important role in maintaining and improving the psychological health and well-being of students. Students face a complex set of barriers that negatively impact their mental and physical health. These barriers include high levels of stress, lack of physical activity, sleep disturbances, financial difficulties, and social isolation. The war in Ukraine adds another level of stress and trauma, requiring special attention.

Keywords: psychological health, student well-being, physical activity, sport

Introduction

The mental health and well-being of students are crucial aspects that influence their academic performance and overall quality of life. Contemporary research identifies numerous factors that contribute to the improvement of students' psychological state, including recreational and rehabilitation activities. Physical activity, mindfulness programs, social support, and healthy nutrition play a key role in maintaining psychological health. A distinct area of study examines the impact of the war in Ukraine on the psychological well-being of students and the role of recreational and rehabilitation interventions in mitigating the negative effects of stress on their health. In recent years, there has been an increase in research focused on these factors and their impact on students.

Research shows that mindfulness training significantly reduces levels of stress, anxiety, and depression among medical students. It also improves their mood, self-confidence, and empathy [1, 2, 3]. Social support and the use of social networks play a significant role in the psychological well-being of students. The use of social networks for social and informational purposes increases life satisfaction and social capital, whereas use for entertainment purposes is associated with higher levels of loneliness and dependency [4, 5, 6]. Physical activity helps mitigate the negative effects of stress and prevents dependency on social networks [7, 8].

Unhealthy eating habits among students are

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associated with increased anxiety, depression, and stress. The consumption of fruits and vegetables positively impacts students' psychological well-being [3, 9, 10]. Studies have shown that following dietary recommendations, such as the DASH diet, reduces levels of depression and aggression [11]. Conversely, strict calorie control can lead to weight gain and mental health problems [12]. Besides nutrition, social connections and participation in sports teams play an important role. Social ties and group structure in sports teams are linked to students' psychological health and social identification. Participation in team sports and a high density of social connections contribute to strengthening social identity and psychological well-being [13, 14, 15].

Self-care practices, such as mindfulness, seeking social support, and maintaining sleep hygiene, contribute to the improvement of students' psychological well-being [16, 17, 18]. These findings emphasize the importance of a comprehensive approach to supporting students' psychological health, which includes mindfulness, healthy eating, social connections, and self-care.

Thus, various strategies and factors such as mindfulness, the use of social networks, nutrition, participation in sports teams, and self-care practices significantly impact the psychological health and well-being of students.

Research on the impact of the COVID-19 pandemic on students' psychological health and well-being has shown a significant deterioration in mental health due to restrictions, isolation, and lifestyle changes. Maintaining social connections with peers helped students preserve their identity and improve psychological well-being [19, 20, 21]. Green spaces and parks contributed to reducing emotional stress among students, and regular visits helped improve their psychological state [21, 22, 23]. Other studies identified economic difficulties and financial anxiety caused by the pandemic, which negatively affected the psychological well-being of hospitality industry workers [24, 25]. Research indicated that students who led an active lifestyle and avoided smoking had better mental health indicators [26, 27]. However, increased screen time and lack of physical activity were associated with heightened anxiety and depression [28, 29].

Additionally, restricted access to public spaces significantly worsened the quality of life and psychological well-being of students [22, 23, 30]. Many students reported increased levels of anxiety and depression, especially among medical students who faced changes in their curricula and practices [31, 32, 33]. Cognitive and emotional strategies, such as mindfulness, physical activity, and improved sleep, have shown a positive impact on students' mental state [23, 30, 34]. Studies have also identified a significant correlation between behavior changes, such as increased alcohol consumption, and the deterioration of students' psychological health [35, 36].

These findings underscore the importance of a comprehensive approach to supporting students' mental health, which includes social connections, physical activity, and mindfulness strategies.

Engaging in physical activity and sports has proven essential for maintaining students' psychological health. Participation in physical exercises and sports classes contributed to improved self-esteem and reduced stress levels [37, 38, 39]. Mindful eating and regular physical exercise also contributed to lower anxiety levels and better overall health [40, 41, 42]. Physical activity has a significant positive impact on mental health, reducing anxiety and depression levels [7, 43]. The effectiveness of exercise programs such as WeActive and WeMindful has also been confirmed, as they improve participants' physical activity levels and psychological well-being [44, 45]. However, exercise dependence can negatively affect psychophysiological health, highlighting the importance of a balanced approach to physical activity [45]. Sports activities have shown significant improvements in depression and anxiety indicators among students, emphasizing the importance of physical activity for mental health [43, 47, 48]. Similarly, regular participation in Pilates and other forms of physical activity contributed to reduced anxiety levels and improved overall well-being [49, 50].

Psychological issues among students remain a significant concern, especially under conditions of high academic workload and stress. Research indicates that students in dentistry and medicine experience high levels of stress and anxiety [29]. Meanwhile, cognitive strategies such as rational self-affirmations can aid in improving mental health [51]. The motivational climate in sports and academics also plays a crucial role in students' mental health. Social-emotional intelligence skills contribute to students' academic and life success, enhancing their relationships and overall well-being [52]. A supportive environment in sports and academics, along with healthy habits, helps reduce burnout and improve mental health [53, 54].

Thus, the key factors in maintaining students' mental health are physical activity, healthy nutrition, stress management, and a supportive academic and sports environment.

War has a significant impact on the mental and physical health of young people, necessitating the development of effective protection and support strategies. The study by Kokun et al. [55] aimed to identify personal resources that contribute to resilience against military stress among Ukrainian students. A total of 498 students participated in the online survey. The results indicated that

emotional stability and resilience are most strongly associated with fewer symptoms of post-traumatic stress disorder (PTSD) and physical complaints, highlighting the importance of these resources for stress resistance. Lass-Hennemann et al. [56] found that global crises, such as climate change, the COVID-19 pandemic, and war, negatively affect the mental health of schoolchildren in Germany, increasing levels of depression and anxiety and decreasing quality of life.

Lazurenko et al. [57] discovered that during wartime, young people are prone to using defense mechanisms such as repression and projection, indicating the need for psychological support programs to improve time perception and motivation. Mytsyk et al. [58] emphasize the importance of social and psychological adaptation programs for adolescents forcibly displaced by war, suggesting the use of gamification to enhance adaptation. Osokina et al. [59] compared the psychological state of adolescents in combat zones and peaceful regions of Ukraine, finding significantly higher risks of post-traumatic stress disorder (PTSD), anxiety, and depression among adolescents in war zones. Pavlova et al. [60] investigated individual and contextual predictors of subjective well-being in Ukrainian youth, highlighting the importance of optimism, hope, and resilience. Rybinska et al. [61] stress the necessity of restoring the physical and mental health of Ukrainian youth, which is a crucial factor for the future of the nation in the context of war.

Despite numerous studies indicating the positive impact of physical activity, healthy nutrition, and social-emotional skills on students' mental health, the issue of deteriorating well-being remains pertinent. The COVID-19 pandemic exacerbated the situation, revealing a significant increase in anxiety and depression among students due to restrictions and lifestyle changes. Research shows that while regular physical activity and healthy habits improve mental health, many students still experience serious psychological problems due to insufficient activity, increased screen time, and stresses related to academic workload and social interactions. Additionally, the war in Ukraine has had a devastating impact on the physical and mental health of young people, necessitating the development of effective protection and support strategies. Thus, despite extensive data on ways to improve well-being, there is an evident need to identify current trends and challenges in supporting students' mental health amidst global crises and conflicts.

The purpose of this study is to analyze documents from the Web of Science (WoS) database from 2014 to 2024, focusing on the recreational and rehabilitation aspects of students' psychological health and well-being.

Materials and Methods

Data Sources

For this study, a search for scientific articles was conducted in the authoritative database Web of Science (WoS) over the last 10 years, from 2014 to 2024. The search was carried out using the keywords: «psychological health» OR «psychological well-being» OR «psychological assessment» (Topic). As a result of the first stage, 26,594 documents (articles) were identified. Subsequently, an additional search was conducted using the keywords: «students» NOT «schoolchildren» NOT «children» NOT «adolescents». This search revealed 2,956 articles in the database. Another refining search was performed using the keywords: «recreation» OR «leisure» OR «tourism» OR «sport» OR «physical activity» OR «physical exercises» OR «physical rehabilitation». A total of 318 documents were identified and retrieved.

Data from the Web of Science (WoS) were exported in Plain text file format with the main elements of the sources indicated, using the option: Export → Plain text file → Record Content → Custom selection (9) Edit. The resulting list was saved with the main elements of the sources indicated.

Inclusion (Exclusion) Criteria

Information about the articles was extracted based on the following conditions: the language of publication was English, and an abstract was available. Conference materials and articles marked as «RETRACTED» were excluded from the search.

Data Processing

The extracted documents were processed using the PYCharm Community Edition (CE) development environment and special codes in the Python programming language. This process included the following steps:

1. Data Import: The data from the exported text file were imported into the Python environment for data cleaning. This involved removing duplicates, extracting key information, and transforming it into a more convenient form for analysis, such as CSV tables.
2. Data Analysis: The cleaned data were analyzed to determine the key directions and themes represented in the selected articles.

Clustering

The K-means method was used for clustering the articles based on the presence of keywords. The most frequently occurring keywords in the articles were extracted and represented as binary features (0 or 1), indicating the presence or absence of each keyword in the article's text. A total of 294 documents (out of 318) met the criteria for this study.

The data processing was carried out in the following order:

1. Each article's text was represented as a vector of binary features, where each keyword had a value

of 1 if it was present in the text and 0 if it was absent.
2. A feature matrix was created for each article, representing the presence of keywords.
3. The K-means method was applied to the feature matrix to group the articles into five clusters based on the similarity of their thematic content.
4. For each cluster, the total citations were calculated, and the five most cited articles were identified.

Statistical Analysis

Descriptive statistics methods were used for data synthesis and interpretation. The primary focus was on the quantitative and qualitative analysis of the selected articles, including the frequency count of keywords (topics) and their significance assessment. Cluster analysis was employed to group the retrieved articles by topic. Content analysis was applied to identify the main directions and trends in the research. Python software and its libraries were used for data processing and analysis, including pandas for data manipulation, matplotlib and seaborn for data visualization, and scikit-learn for performing cluster analysis.

Results

Figure 1 shows the most frequently occurring keywords in the extracted documents, including titles, abstracts, and keywords. These keywords were used for cluster analysis. Based on the clustering, the articles were divided into the following thematic groups, with the number of citations per cluster indicated (Figure 2):

- Cluster 0: Students and Mental Health;
- Cluster 1: Physical Activity and Health;
- Cluster 2: Psychological Aspects of Well-being;
- Cluster 3: Recreational / Rehabilitation Strategies and Stress;
- Cluster 4: Educational and Social Factors.

Figure 2 summarizes the key findings of the most cited articles, distributed across the five main clusters.

The table 1 presents brief results of the studies. Table 1 includes articles distributed across five different clusters based on the number of citations. Cluster 4 contains articles with a total of 479 citations, Cluster 0 with 401 citations, Cluster 3 with 323 citations, Cluster 1 with 289 citations, and Cluster 2 with 210 citations. The clusters are ranked by the total number of citations, highlighting the most significant and discussed studies in each thematic group.

Characteristics of Studies - Cluster 0 (Students and Mental Health):

1. Mindfulness Training and Psychological Well-being of Students: Includes studies examining

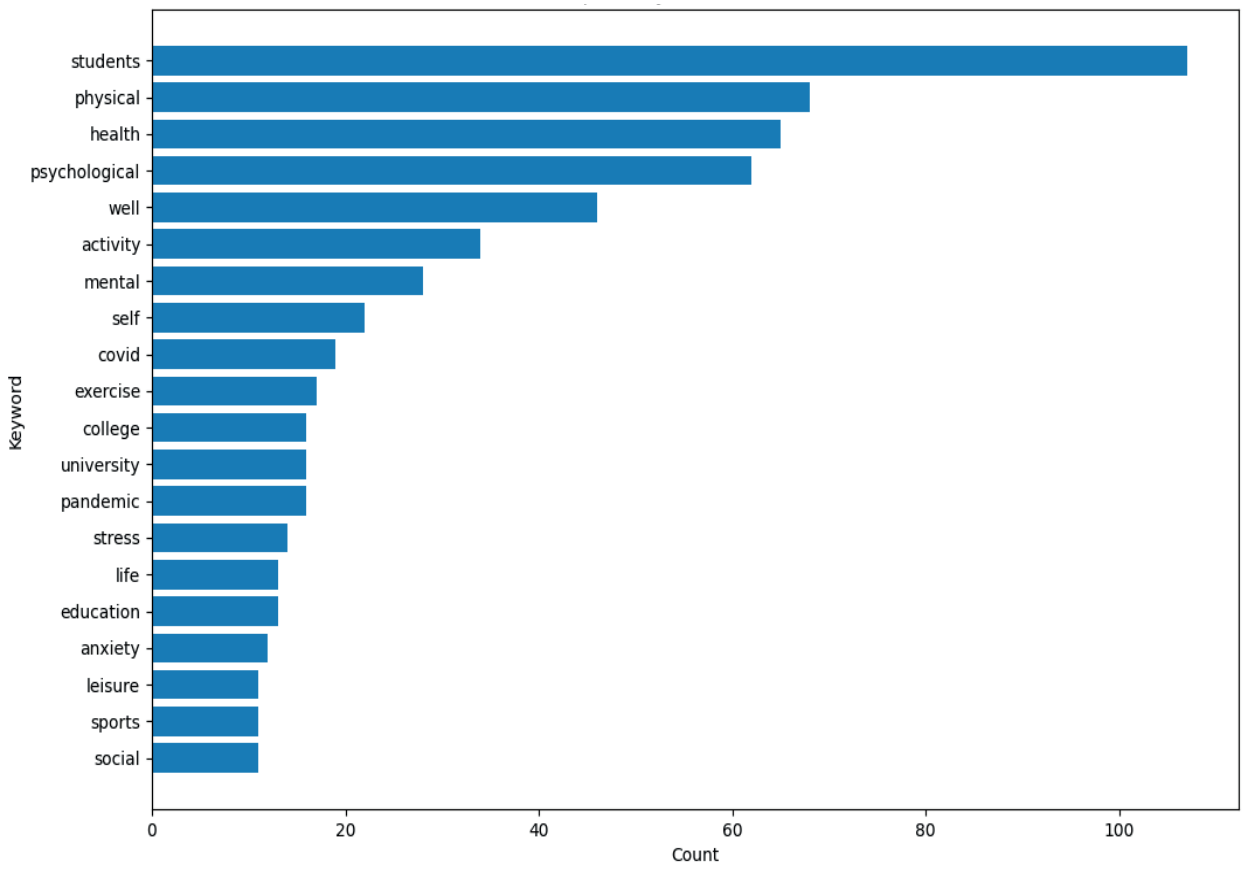

Figure 1. Frequency of Keywords in the Extracted Articles.

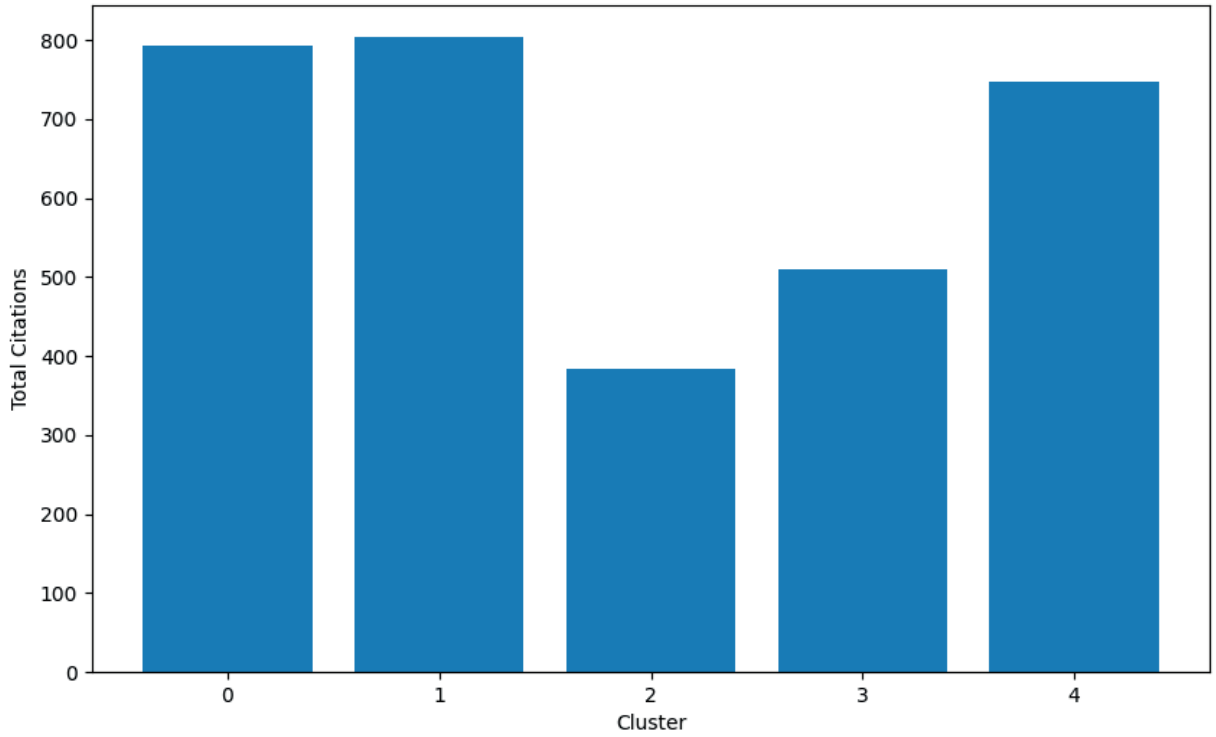

Figure 2. Distribution of Citations by Clusters.

Table 1. Information on the Most Cited Articles by Cluster

Source	Citations	Cluster Number	Results
[1]	188	0	Mindfulness training, analyzed in 19 studies (n=1815), reduces stress, anxiety, and depression, and improves mood, well-being, and empathy. These training programs can be easily integrated into medical curricula to enhance the psychological well-being of students.
[4]	84	0	In a sample of 142 students, the use of social networks for social and informational purposes increased perceived social capital and life satisfaction, whereas use for entertainment purposes increased loneliness. While no direct relationship between social network use and acculturation stress was identified, social capital was found to reduce stress, whereas loneliness increased it.
[2]	74	0	In a study of 364 students, it was found that social needs and the need for recognition contribute to Instagram dependency, whereas informational and entertainment needs do not affect it. Instagram dependency negatively impacts academic performance and increases levels of shyness and loneliness.
[9]	28	0	In a study of 1055 students, unhealthy eating was found to be associated with increased levels of anxiety, depression, and stress. Educational programs aimed at reducing the consumption of unhealthy food can improve students' psychological health.
[3]	27	0	In a study involving 1270 students, it was found that the number of positive emotions increases linearly with the number of daily servings of fruits and vegetables. This confirms that regular consumption of fruits and vegetables is associated with improved psychological well-being in students.
[19]	124	1	In a study involving 234 student-athletes, it was found that those who maintained social connections with their teammates were less likely to experience a decline in sports identity and reported better mental health. Teammate support and maintaining connections contributed to better psychological well-being and reduced symptoms of depression.
[20]	117	1	In a survey conducted among 501 students, it was found that 35.33% experienced anxiety and 72.93% experienced depression. Physical activity reduced the likelihood of anxiety, while the inability to see friends and partners worsened psychological well-being.

Table 1. Continued

Source	Citations	Cluster Numbe	Results
[21]	61	1	In a study involving 1280 students from four major universities in the United States, it was found that restricting access to parks and green spaces increased emotional distress. Students who continued to visit parks reported improvements in their mental and physical health.
[22]	44	1	In a study involving 132 students aged 19 to 26, it was found that restrictions on access to public places led to a deterioration in their physical and psychological condition, as well as overall quality of life. Students noted that the lack of direct social interactions could not be fully compensated by remote communication.
[33]	43	1	In a study involving 1910 students from over 80 universities, it was found that cognitive strategies helped them cope with the effects of the pandemic and isolation, maintaining a positive perception of the new learning situation. Students noted the insufficient preparedness of the teaching staff for online education but rated their own digital competencies and ability for interactive online communication highly.
[40]	127	2	A systematic review of 24 studies found that intuitive eating is associated with fewer eating disorders, a more positive body image, and better emotional well-being. However, since all studies were conducted using cross-sectional designs, no conclusions can be drawn about the direction of the relationship between intuitive eating and psychosocial correlates. Prospective studies are needed to confirm these findings.
[41]	26	2	In a study using the conceptual mapping methodology, a taxonomic list of self-care strategies proposed by medical students was created, encompassing 10 clusters of activities such as nutrition, hygiene, physical activity, and spiritual care. This list can serve as a basis for enhancing programs and counseling students on self-care practices.
[38]	24	2	In a survey of 661 students, it was found that planning and prioritization skills positively influence physical activity, while constraints such as lack of time and financial resources have a negative impact. The findings of the study can contribute to the development of university programs aimed at promoting student health through physical activity.
[37]	17	2	The main findings of the study include the levels of moderate to vigorous physical activity (MVPA) among students during physical education classes, their motivation, psychological well-being, and physical fitness.
[42]	16	2	Most students were mentally healthy, and those with better mental health were less likely to engage in unhealthy behaviors. The study's findings highlight the importance of supporting mental health to prevent unhealthy behaviors among students.
[62]	155	3	The COVID-19 pandemic and misleading media reports about the «Chinese virus» negatively affected the mental health of Chinese tourists. Some world leaders perpetuated this sensationalism, increasing anxiety and stress among travelers from China. This underscores the importance of responsible media coverage to prevent psychological issues during crisis periods.
[7]	63	3	In a study conducted among German students, it was found that physical activity reduces the impact of daily stress on the development of Facebook Addiction Disorder (FAD) over the course of a year. These results highlight the importance of physical activity in preventing internet addictions in stressful situations.
[63]	35	3	The study assessed the factor structure, internal consistency, reliability, gender invariance, and discriminant validity of the French version of the Mental Health Continuum-Short Form (MHC-SF). A survey of 1485 French-speaking post-secondary students in Quebec confirmed the reliability and validity of the MHC-SF for assessing mental health among young adults in Canada.
[64]	33	3	The psychometric properties of the Brazilian-Portuguese translation of the Body Appreciation Scale-2 (BAS-2) were studied. The instrument demonstrated good internal consistency and construct validity, making it useful for assessing body satisfaction in the Brazilian context.

Table 1. Continued

Source	Citations	Cluster Number	Results
[65]	27	3	The study examined the impact of perceived stress and specialization on the relationship between perfectionism and burnout among student athletes. The results showed that perfectionists with high levels of stress and narrow specialization are more prone to burnout. This highlights the need to consider personal characteristics and stress in developing burnout prevention strategies for athletes.
[66]	138	4	Two studies demonstrated that the satisfaction of the need for novelty predicts life satisfaction (study 1, n=399) and intrinsic motivation in physical education classes (study 2, n=1035), independently of other psychological needs. These findings provide preliminary evidence that the need for novelty may be a unique addition to the existing needs in self-determination theory.
[26]	120	4	A longitudinal study showed that better baseline and one-year mental health predicted a lower body mass index, higher frequency of physical and mental activities, smoking cessation, a non-vegetarian diet, and a more regular social rhythm. The sample included German (n=2991) and Chinese (n=12405) students. These results confirm the importance of a healthy lifestyle in improving psychological well-being and reducing mental health issues.
[67]	112	4	A systematic review and meta-analysis demonstrated that mindfulness-based programs (MBPs), including Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT), significantly reduced symptoms of stress, depression, and anxiety, and improved quality of life and well-being in non-clinical samples (n=4,733). These findings suggest that MBPs can be effective approaches for enhancing psychological health within the public healthcare system.
[28]	64	4	In a 15-month study involving 1140 students from universities in Dhaka, Bangladesh, the prevalence of depression increased by 22.5% and anxiety by 27.1%. Students who were dissatisfied with university culture, as well as those with high screen time and low physical activity, were more prone to depression and anxiety.
[68]	45	4	In a sample of 380 students, a study assessed fanaticism, identification with the university basketball team, sense of belonging, and meaning in life. The results showed that the sense of belonging mediates the relationship between team identification and meaning in life, as well as between fanaticism and meaning in life. These findings highlight the significance of social connections formed through sports fanaticism and their impact on well-being.

Note: Cluster 0 - Students and Mental Health; Cluster 1 - Physical Activity and Health; Cluster 2 - Psychological Aspects of Well-being; Cluster 3 - Recreational/Rehabilitation Strategies and Stress; Cluster 4 - Educational and Social Factors.

the impact of mindfulness training on the psychological well-being, learning, and clinical performance of medical students. [1, 18].

2. Social Media Use and Its Impact on Psychological Well-being: Studies focused on the influence of social media use, such as Instagram, on perceived social capital, psychological well-being, and social media dependency. [2, 4, 5, 69].
3. Nutrition, Self-care, and Mental Health: Includes studies exploring the relationship between eating behavior, stress, anxiety, depression, insomnia, and self-care practices and their impact on student well-being. [3, 9, 16].
4. Physical Activity, Sports, and Social Aspects: Studies examining differences between types of sports, the impact of physical activity on psychological well-being, social identification, and networks in sports teams. [6, 13, 14, 15].
5. Stigma, Self-help, and Psychometric Studies: Reviews and studies related to overcoming stigma and self-stigma, development of cynicism among medical students, as well as the psychometric properties of various psychological scales and their application. [5, 6, 17, 69, 70].

Characteristics of Studies - Cluster 1 (Physical Activity and Health):

1. Psychological Well-being of Students During the COVID-19 Pandemic: Includes studies focusing on the impact of the pandemic on students' psychological well-being, including web surveys and cross-sectional studies in universities in Italy and Poland, as well as among medical students worldwide. [20, 22, 31].
2. Use of Green Spaces and Public Areas During the Pandemic: Studies regarding the use of parks and green spaces by students during the pandemic and their effects on emotional well-being. [21, 71].

3. Stress and Mental Health of Medical Students and Interns: Includes studies focused on mental stress and changes in the mental health of medical students and interns during the pandemic. [32, 34].
4. Physical Activity, Nutrition, and Mental Health: The impact of the pandemic on changes in physical activity, symptoms of eating disorders, pain, and overall psychological well-being. [23, 30, 72].
5. Coping Strategies and Mental Well-being: Studies on stress coping strategies such as mindfulness and self-compassion and their impact on mental health during the pandemic, as well as specific studies among hospitality and tourism students. [24, 25, 36, 73].

Characteristics of Studies - Cluster 2 (Psychological Aspects of Well-being):

1. Psychosocial Aspects of Intuitive Eating and Self-care: Includes systematic reviews and studies aimed at examining the psychosocial correlates of intuitive eating among women and self-care practices among medical students. [40, 41]
2. Physical Activity and Well-being: Studies focusing on the impact of physical activity on mental well-being, including the effects of exercise programs on the well-being of students and university staff during the COVID-19 pandemic. [38, 39, 48, 74, 75, 76].
3. Effectiveness of Educational Interventions and Exercises: Includes studies on the effectiveness of various exercise programs, such as cluster randomized controlled trials and web interventions aimed at increasing physical activity and well-being. [37, 44, 45].
4. Mental Health and Behavior: Studies aimed at exploring mental health profiles and related behavioral factors among students, including research on dental procedure anxiety and the impact of physical activity on mental health. [42, 47, 48, 77].
5. Various Aspects of Physical Activity: Studies exploring different aspects of physical activity and their impact on well-being, such as the effects of tennis on student well-being and the influence of exercise on sleep and mental health. [43, 48, 49, 50].

Characteristics of Studies - Cluster 3 (Recreational/ Rehabilitation Strategies and Stress):

1. Impact of the COVID-19 Pandemic on Mental Health and Physical Activity: Includes studies aimed at examining the impact of the COVID-19 pandemic on students' mental health and physical activity, including the effect of misleading media information on the mental health of Chinese tourists. [7, 62].
2. Psychometric Assessments and Scale Translations: Includes studies related to the psychometric evaluation of various instruments and their adaptation for different cultural contexts, such as the translation and validation of the Brazilian version of the Body Appreciation Scale-2. [63, 64].
3. Psychological Aspects of Stress and Burnout: Studies focused on the impact of stress, perfectionism, and specialization on burnout among student-athletes and other groups, as well as the relationships between depression and various aspects of leisure. [8, 11, 12, 65, 78, 79].
4. Psychological Effects of Nature and Motivational Factors: Research on the influence of nature on the physiological and psychological state of young people, the role of the motivational climate in sports, and the impact of avatars on user behavior in virtual contexts. [53, 80, 81, 82, 83].
5. Mental Health Issues and Their Impact on Behavior: Includes studies examining mental health problems among students, such as sleep and emotional issues, self-reports of psychological problems among dental students, and the influence of physical exercises on students' psychophysiological health. [29, 45, 51, 54, 84].

Characteristics of Studies - Cluster 4 (Educational and Social Factors):

1. Novelty and Self-Determination: Research aimed at understanding the need for novelty and its role in self-determination theory, as well as the impact of novelty on the psychological health and well-being of students. [66].
2. Lifestyle Choices and Mental Health: Longitudinal studies focusing on lifestyle choices such as physical activity, mindfulness, sleep patterns, and their impact on the mental health of students from different countries. [26, 27, 28, 52, 67, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96].
3. Sociocultural and Emotional Aspects: The influence of the sociocultural environment and emotional factors on students' psychological health, including team identification models and socio-psychological health, interpersonal skills, and success in academic and personal life. [68, 97].

Discussion

The aim of this study is to analyze documents from the Web of Science (WoS) database from 2014 to 2024, focusing on recreational and rehabilitation aspects of students' psychological health and well-being. The analysis of current research shows that improving students' mental health requires a comprehensive approach that includes physical

activity, psychological strategies, recreational and rehabilitation activities, as well as social and educational support. In the context of global crises such as the pandemic and war, it is particularly important to emphasize effective interventions to support students' psychological well-being.

The analysis of studies by clusters has identified the most effective approaches to maintaining and enhancing students' psychological health and well-being. These approaches are primarily based on recreational and rehabilitation activities conducted in various environmental settings.

1. Students and Mental Health

Mental health issues among students have become particularly relevant in recent years, especially in connection with the COVID-19 pandemic and military conflicts. The study by Gruba et al. [98] showed that the pandemic led to an increase in anxiety and depression among students. These findings are consistent with the research by Schmits et al. [99] and Xiao et al. [100], which revealed a rise in psychological stress due to lifestyle changes and increased screen time. The COVID-19 pandemic exacerbated existing mental health issues, as confirmed by Lass-Hennemann et al. [56], who found a significant increase in depression and anxiety among schoolchildren in Germany. Other studies indicate that students facing war experience significant psychological difficulties [55, 57, 59, 60]. The results highlight the critical importance of personal resources such as emotional stability and resilience in protecting students from the negative effects of military stress. This is supported by the research of Kokun et al. [55], which showed that these resources significantly reduce symptoms of post-traumatic stress disorder (PTSD) and physical complaints among students in Ukraine.

In this context, the following conclusions can be drawn:

- Mental health issues among students remain pressing, despite numerous studies and interventions. The COVID-19 pandemic and the war in Ukraine have intensified psychological stress, significantly affecting students. Research shows that emotional stability and resilience play key roles in mitigating the negative effects of stress.
- There is a growing trend of mental health disorders among students during crises, highlighting the increasing need for the development of psychological support programs and resilience-building initiatives.

2. Physical Activity and Health

Physical activity plays a crucial role in maintaining the mental and physical health of students. Studies by Isabella et al. [71] and Tran et al. [73] emphasize the positive impact of physical activity on mental health, including reduced levels of anxiety and depression. Additionally, the study by Mensah et al. [24] demonstrated that engaging in sports and physical exercises can improve overall well-being and the psychological state of students. As noted in the research by Lazurenko et al. [57], students' defense mechanisms and time perspectives change in wartime conditions, necessitating the development of specialized psychological support programs.

In this context, the following conclusions can be drawn:

- Regular physical activity has a significant positive impact on students' mental health, helping to reduce levels of anxiety and depression and improve overall well-being. Engaging in sports and utilizing green spaces contribute to these benefits.
- There is a growing interest in studying various types of physical activity and their effects on mental health. This has led to an increase in programs aimed at promoting physical activity among students.
- Specialized psychological support programs are needed to address changes in students' defense mechanisms and time perspectives in conditions of war, highlighting the importance of tailored interventions for students in crisis situations.

3. Psychological Aspects of Well-being

The psychological aspects of students' well-being include factors such as self-compassion, stress coping strategies, and emotional regulation. Studies by Tran et al. [73] and Mensah et al. [24] demonstrate that using coping strategies and self-compassion helps reduce anxiety and depression levels. These findings are supported by the results of Kokun et al. [55], which show that emotional stability and resilience play key roles in mitigating the negative effects of stress. Data from Mytsyk et al. [58] confirm the importance of social and psychological adaptation, especially for displaced persons. The use of gamification to improve the adaptation of Ukrainian adolescents in German schools appears to be a promising approach that could be extended to other student groups. Pavlova et al. [60] note that personal qualities such as optimism, hope, resilience, and post-traumatic growth play crucial roles in the subjective well-being of youth.

In this context, the following conclusions can be drawn:

- Self-compassion and coping strategies significantly contribute to reducing anxiety and depression among students. Emotional stability and resilience are key in lessening the negative impact of stress.
- Social and psychological adaptation is critical for students, especially for those displaced

by conflicts. Innovative approaches like gamification can enhance adaptation and well-being.
- Personal qualities such as optimism, hope, and resilience are essential for the subjective well-being and mental health of students.

4. Recreational/Rehabilitation Strategies and Stress

Recreational and rehabilitation strategies can significantly reduce stress levels among students. The study by Isabella et al. [71] found that the use of green spaces in cities positively impacts citizens' mental health. This underscores the need for creating conducive environments for physical activity in urban settings, which can enhance students' mental health. Another study [73] also showed that engaging in sports and physical exercises can help students cope with stress and improve their overall well-being. An important direction for future research is examining the long-term consequences of war on students' mental health. The study by Osokina et al. [59] revealed that adolescents from war-torn regions of Ukraine have significantly higher risks of post-traumatic stress disorder (PTSD), anxiety, and depression. This highlights the necessity for developing long-term support and mental health recovery strategies.

In this context, the following conclusions can be drawn:
- Utilization of green spaces and urban environments for physical activity can significantly enhance students' mental health, highlighting the importance of accessible and well-maintained recreational areas.
- Engagement in sports and physical exercises is effective in helping students manage stress and improve overall well-being.
- Long-term impacts of war on students' mental health necessitate the development of comprehensive strategies for long-term support and recovery, addressing the elevated risks of PTSD, anxiety, and depression among students from conflict regions.

5. Educational and Social Factors

Educational and social factors also play a crucial role in students' mental health. The study by Dore et al. [63] emphasizes the importance of social support and a stable environment for improving mental health. Other studies [24, 73] highlight the significance of social-emotional skills for student well-being. The authors demonstrated that stress coping strategies and the use of self-compassion can significantly reduce levels of anxiety and depression. Additionally, the war in Ukraine and the related displacement of students have shown the necessity of adaptive programs to support their psychological well-being [58]. Implementing such programs, like the use of gamification in education, can help improve the social and psychological adaptation of students [58].

In this context, the following conclusions can be drawn:
- Social support and a stable environment are critical for improving students' mental health. Strategies that foster social-emotional skills are essential for student well-being.
- Stress coping strategies and self-compassion are effective in reducing anxiety and depression, emphasizing the need for their inclusion in student support programs.
- Adaptive programs are necessary to support the psychological well-being of displaced students, with innovative approaches like gamification showing promise in enhancing social and psychological adaptation.

Thus, despite the significant amount of research, the issue of students' mental health in the context of global crises and conflicts remains relevant. This underscores the importance of developing qualities that enhance students' resilience to stress. However, students face numerous barriers that negatively affect their mental and physical health. High levels of stress and anxiety due to academic workload and exams often lead to significant psychological problems such as depression and anxiety [21, 40]. The lack of physical activity, exacerbated by the COVID-19 pandemic and remote learning, negatively impacts students' overall well-being [53, 62]. Disrupted sleep patterns, caused by late-night studying and exam preparation, impair cognitive functions and overall health [19]. Financial difficulties, such as paying for tuition and housing, create additional stress, affecting mental health and academic performance [20, 101]. Social isolation and lack of support, brought about by the pandemic and other factors, exacerbate feelings of loneliness and increase the risk of developing depression and anxiety disorders [22]. The war in Ukraine has also had a severe impact on students, causing post-traumatic stress disorder (PTSD), anxiety, and depression, especially among those who have experienced violence or been forced to flee their homes [62].

Limitations of the Review Processes

The review process also has its limitations. Despite the careful selection of keywords and inclusion criteria, there is a possibility of missing some relevant studies. The analysis was limited to publications in English, which may exclude important research published in other languages. The use of only certain databases, such as WoS, may restrict the scope of available information and affect the completeness of the review.

Implications of the Results for Practice, Policy, and Future Research

The findings of this study have significant

implications for practice and policy in the field of student mental health preservation. The necessity of developing and implementing targeted interventions to support students' mental health becomes evident. This is particularly important in light of the consequences of the COVID-19 pandemic and the war in Ukraine, which have significantly impacted students' psychological well-being. Future research should focus on developing effective support programs that consider the specific conditions and needs of students. It is also crucial to continue studying the impact of physical activity and other healthy habits on students' mental and physical health in order to develop comprehensive strategies for improving their well-being.

Conclusions

This study identified key factors influencing students' mental and physical health, such as physical activity, psychological resilience, and social support. The analysis of documents extracted from the WoS database showed that regular physical activity and the use of various strategies contribute to reducing stress levels and improving overall student well-being. In the context of global crises such as the COVID-19 pandemic and the war in Ukraine, comprehensive approaches to supporting mental health, including hybrid intervention models, are of particular importance. Future research should focus on developing and testing new methods aimed at sustainably improving the mental and physical well-being of students, taking into account regional and cultural specificities.

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ORIGINAL ARTICLE

Perspectives towards training approaches to skill achievement in swimming athletes: mixed methods

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Abstract

Background and Study Aim: In recent years, the performance of swimming athletes in South Kalimantan Province has improved at the national level. The number of athletes in junior and student categories has also increased, and their average performance times have shown significant improvement. Therefore, further studies are needed to explore how coaches train swimming skills from the initial training stages to the development of athletes. This study aims to analyze the perspectives of swimming coaches on the training methods or approaches applied to athletes.

Material and Methods: This research employed a mixed-methods approach, combining qualitative and quantitative methods. The sample consisted of ten coaches aged 35-55 years, with an average of 17.8±7.8 years of coaching experience. All participants had at least a B license and were former athletes. The qualitative method involved 30-40 minute interviews, while the quantitative method involved questionnaires covering coach-athlete communication (12 items), coaching style (10 items), and coach-athlete relationship (11 items), using a 1 to 5 scale.

Results: The analysis revealed that training initially focuses on freestyle, backstroke, breaststroke, and butterfly strokes, with attention to technique evaluation. Endurance is the primary physical component, which changes with the athlete's specialization. Coaches determine athlete specialization based on ability, recommending participation in a few events with medal targets and maintaining the same events even with different strokes. During pre-competition and competition stages, coaches tailor specific training programs to the athlete's events. The concept of long-term athlete development (LTAD) is understood by coaches, although not consistently applied. Quantitative analysis showed that more than seven coaches achieved sufficient to excellent category results.

Conclusions: The use of mixed methods in this study provides a comprehensive understanding of coaches' training approaches to developing swimming skills, as evidenced by athlete achievements. The study highlights the importance of applying long-term athlete development (LTAD) principles, as LTAD offers significant benefits to athletes across all sports.

Keywords: coaches, perspective, training approach, swimming

Introduction

Coaches are the most significant factor in athletes' achievements. Competent coaches must master all aspects of sports, including technique, tactics, physical conditioning, mentality, nutritional knowledge, and injury management [1-3]. Coaches are also required to have qualifications in their specific sport, such as tiered licenses and academic degrees in sports science [4]. Additionally, coaches play a crucial role in creating a training environment that enhances skills and prepares athletes for competition [5]. Ideally, a coach should possess all these competencies, with the most important being prior experience as an athlete, providing valuable competition insight [6]. However, having a competent coach does not guarantee that athletes will achieve their goals.

A significant challenge for coaches is ensuring that the training program is effectively communicated to athletes [7]. In swimming, coaches develop programs to enhance athletes' physical and technical components from the preparation stage to the competition stage. The focus shifts to more specific training methods tailored to the race [6, 8]. However, understanding the full extent of swimming skills that athletes must master through predefined

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training designs remains limited.

The training methods applied by coaches significantly impact athletes' progress in both technique and achievement. The success of swimming athletes is closely tied to how coaches set training methods, such as low volume, low intensity, high intensity, and high volume [9]. Swimming is a sport that focuses on time and speed, where efficient technique is crucial for securing first place. However, some coaches fail to monitor stroke rate, split times, and exertion [10]. While coaches are aware of the long-term athlete development (LTAD) model, it is rarely applied in daily practice [11]. The measure of swimming athletes' success is still uncertain, often heavily reliant on the coaches' ambitions. In practice, some coaches set performance targets for athletes during their teenage years. Commonly, coaches focus on mastering techniques before aiming for championship targets as the athletes mature into young adults.

However, coaches need to ensure that techniques are both correct and efficient, not just aiming for the fastest time. Therefore, further studies are needed to explore how coaches train swimming skills from the initial stages of training to the development of athletes. Previous studies have reported that coaches prefer to decompose tasks for swimmers, focusing more on specific swimming styles or race numbers rather than on individual athletes [12]. This study aims to analyze the perspectives of swimming coaches on the training methods and approaches they apply to athletes.

Materials and Methods

Participants

The study population consisted of swimming coaches in South Kalimantan province, selected using purposive sampling. The primary criterion was having trained athletes who have won medals in the National Sports Week (PON), a multi-event championship held every four years in Indonesia, with a rigorous selection process. The sample comprised ten male swimming coaches aged 35-55 years, with an average of 17.8±7.8 years of coaching experience. All participants held a minimum coach license of category 'B' and were former athletes.

This study employed mixed methods, combining qualitative and quantitative approaches to provide a comprehensive understanding of the research problem. The mixed method was chosen to explore qualitative insights from the sample, which were then analyzed quantitatively for broader applicability. In the qualitative phase, interviews were conducted with the coaches. Example questions included:

1. What are your stages in training prospective athletes?
2. How do you deliver the material?
3. According to you, what physical component do you practice first?
4. How do you specialize in training?

The coaches' responses to these questions provided insights into their training methods and approaches. In the quantitative phase, coaches were given a questionnaire to complete using a Likert scale. The questionnaire included questions on three dimensions: coach-athlete communication, coaching style, and coach-athlete relationship.

Procedure

The first stage of this study involved analyzing problems in swimming through observation. This included recording athletes' achievements from previous years and conducting unstructured interviews with athletes and coaches. However, the unstructured interviews with coaches were not conducted using the appropriate criteria for the study. In the second stage, after identifying the problem, evidence was gathered from published scientific articles. This stage aimed to prepare interview questions and questionnaire statement items for quantitative analysis. Validation was performed using a focus group discussion (FGD) during the instrument preparation, involving sports coaching lecturers who were experts in swimming and held at least a Doctoral degree. The third stage was data collection, conducted on Sundays when there were no training schedules. During this stage, coaches were interviewed for approximately 30-40 minutes. After the interview, coaches were asked to complete a questionnaire with statement items rated on a scale of 1 to 5 (1 'very poor', 2 'poor', 3 'fair', 4 'good', 5 'very good').

Statistical Analysis

The statistical analysis for this study was conducted using two methods, aligning with the mixed research design. Qualitative analysis of the interviews involved coding responses. For example, in response to the question, "How do you determine specialization in training?" if a coach mentioned anthropometry, it was coded as 1; if they mentioned physical components like endurance, strength, and speed, it was coded as 2; if they mentioned test results based on swimming skills like freestyle, butterfly, backstroke, and breaststroke, it was coded as 3. The purpose of coding was to present the results briefly and clearly. Coaches were also assigned codes; ten coach identities were given alphabetic codes (A, B, C, D, E, F, G, H, I, J). Quantitative analysis of the questionnaire responses used descriptive percentages, analyzed with the help of SPSS version 26 software.

Results

Qualitative Analysis

The qualitative analysis involved explaining the coaches' interview responses. Coaches described

their methods for training prospective athletes, considering whether the athletes had prior swimming experience. Eight coaches (B, C, D, E, F, H, I, J) preferred athletes who showed courage in deep water, provided they had practiced swimming before. Coaches A and G explained that they teach prospective athletes how to float by observing their depth adaptation. This method involved using a circular rubber float around the athlete's body, asking them to dive for 2 or 3 seconds to adjust their breathing.

Furthermore, an analysis was conducted based on the preferred age for starting swimming training. All coaches preferred prospective athletes to begin training at an early age, between 5 and 10 years. According to coaches A, C, D, E, and H, children are easier to coach before they enter elementary school. Other coaches (B, F, G, I, J) mentioned that younger children are easier to motivate. During this stage, coaches take 4 to 6 months before progressing to the next material, which involves learning swimming strokes. Initially, all coaches provide training that involves swimming 25 or 50 meters using a float on the hands, with arms extended straight forward, focusing on footwork.

All coaches involved in this study agreed that the method was effective for training leg paddling strength and that it was easy and effective for freestyle training. When practicing freestyle with a hand float, some coaches (A, B, G, H, I) focused on teaching the correct breathing technique, while others (C, D, E, F, J) emphasized the rotation of the hands. At this stage, coaches did not specify a set time for combining hand movements with breathing. However, interviews with coaches B and F revealed that if an athlete trains at least four times a week, they can practice freestyle without a buoy within a month. All coaches believe that freestyle is an easy and flexible style, meaning it can be learned sooner or later. Freestyle is considered the most basic swimming style that prospective athletes must master. Once the athlete masters freestyle, they are introduced to the next swimming style.

Coaches use similar methods, with all coaches preferring the use of floats to learn the next swimming style. Coaches A, D, H, I, and J believe that using a buoy helps prospective athletes regulate hand, foot, and breath movements. This approach is supported by coaches B, E, and F, who explained that floats help train athletes' balance, while coaches C and G mentioned that floats aid in coordination training. Coaches could not provide a precise timeline for mastering freestyle, breaststroke, backstroke, and butterfly techniques, but they estimated about a year if the athlete starts training at an elementary school age (coaches A, D, G, H). While coaches did not specify the sequence of techniques learned after freestyle, they unanimously agreed that the butterfly stroke is taught last and in more detail. According to coaches F and J, even with a year of routine training, prospective athletes might not fully master the butterfly stroke. The butterfly stroke is taught last because it requires precise technique and a good rhythm of body, arm, and leg movements (coaches A, B, C, F, G, H, I). Besides the simultaneous arm movement, the legs perform a dolphin kick, necessitating more detailed supervision from the coach (coaches D, E, J).

In delivering training materials, coaches exhibit various characteristics. When discussing daily intensity and volume, the trainees are influenced before training begins. However, when teaching techniques, each coach has a unique approach. Coaches D, F, and I provide evaluations when the athlete is stopped, whereas coaches B and C evaluate while the athlete performs the swimming style, often using a shouting tone. In contrast, coaches A, E, G, H, and J provide evaluations both when athletes are stopped and while they are performing a swimming style. Coaches D, F, and I believe that athletes are more receptive to feedback when they stop training, allowing them to focus better during the training session. Meanwhile, coaches B and C feel that athletes can receive immediate feedback during training, enabling them to correct minor errors promptly based on the coach's instructions.

Despite these differences, the interviews revealed two commonalities among all coaches in delivering training material. First, when focusing on strengthening the foot paddle, coaches use a float on the athlete's palm. This method effectively allows for the evaluation and exercise of foot movements. Second, all coaches instruct athletes to practice hand-wheel movements at the edge of the pool before entering the water. This allows coaches to evaluate ineffective hand movements more easily and provide examples of correct hand techniques.

Furthermore, coaches have different opinions regarding the prioritized physical components for swimming athletes. This variation changes when athletes reach the ages of 12 to 15 years and beyond 15 years old, as the physical components are then adjusted according to their specialization. When athletes begin training, endurance is prioritized. According to coaches A, D, F, and J, endurance is the most important basic physical component because it enables athletes to adjust their swimming rhythm more efficiently and effectively. Coaches E, G, and I concur, adding that good endurance helps athletes cope with strenuous training programs, preventing early fatigue. Meanwhile, coaches B and C agree but also assess whether athletes have potential in medium or long-distance events such as 400 meters, 800 meters, or 1500 meters.

After the age of 12 to 15 years, coaches agree that the physical components trained become more varied with combination training methods. Besides endurance, speed becomes the dominant and most

important physical component, as swimming is a sport where achieving the fastest time to the finish is crucial.

This combination is implemented based on targets to be achieved through a systematic training program. Coaches A, D, E, F, G, I, and J explained that they divide the preparation and competition stages into two phases. During the preparation stage, the focus is on building endurance and evaluating swimming techniques. As the pre-competition stage approaches, the training is adjusted according to the specific race events.

The seven coaches (A, D, E, F, G, I, J) recommend race events for athletes and allow them to choose which events to participate in, without imposing their preferences on the athletes. In contrast, coaches B, C, and H plan the training program based on the race events they recommend. For instance, if an athlete decides to compete in the 100 meters freestyle, the training program from the preparation stage to the competition will focus on that event.

There are two clear approaches among the coaches. Coaches A, D, E, F, G, I, and J tend to encourage athletes to participate in multiple events, adjusting to the athlete's capabilities at the time. This could include 50 meters freestyle, 100 meters freestyle, 50 meters breaststroke, 100 meters breaststroke, 50 meters backstroke, 100 meters backstroke, 200 meters medley, and relay events. On the other hand, coaches B, C, and H prefer to limit the number of race events but aim to achieve specific targets, such as the 100 meters freestyle, 100 meters breaststroke, and 100 meters backstroke. These coaches also advise athletes to choose events with the same distance (e.g., 100 meters) even if they involve different strokes.

After athletes turn 15 or enter high school, specialization is determined. Coaches have different principles for this process. Coaches A, E, and G base specialization on the athlete's winning record in races. Coaches D, F, I, and J use anthropometry, such as height and other physical tests, to determine specialization. Coaches B, C, and H consider the opportunities for athletes to win at the provincial level and qualify for national competitions. As a result, athletes typically choose two to three swimming styles with the same distance, such as 50 or 100 meters.

From the analysis of the 10 coaches, athletes tend to prefer freestyle, breaststroke, and backstroke, with very few choosing butterfly. Those who do choose butterfly usually compete in the 50 and 100-meter events. Middle and long-distance events like the 400, 800, and 1500 meters freestyle are also less popular among athletes, with a preference for the 400 and 800 meters.

Once athletes have specialized in a swimming style, their training programs focus on re-evaluating their strokes. This specialized training intensifies during the pre-competition and competition stages. During the preparation stages, such as general and special preparation, coaches emphasize endurance and technique.

The interviews also revealed that coaches are familiar with the concept of long-term athlete development (LTAD), although their understanding is not complete. Coaches A, C, D, E, F, and G believe that applying LTAD to prospective swimming athletes is easier before the age of 10. At this age, coaches can better predict an athlete's potential at 20 years old. Additionally, children under 10 have good flexibility and coordination, making it easier for them to absorb the material provided by the coach.

However, coaches B, H, I, and J expressed concerns about the risk of overtraining when implementing LTAD. They noted that while they set appropriate training targets and programs, some parents push their children to become champions at an early age, complicating the application of LTAD. Despite these challenges, coaches acknowledged that it is not impossible to apply LTAD to swimming.

According to the coaches, athletes who consistently win competitions at the national and international levels by around 25 years old are those who follow their coaches' guidance and maintain good communication. Parental support for the coach's program and the athlete's motivation are crucial. Thus, openness and trust are essential factors, in addition to the competencies of swimming coaches in South Kalimantan.

Quantitative Analysis

This quantitative analysis reports the results of a questionnaire addressing three main factors: coach-athlete communication [13, 14], coaching style [15], and coach-athlete intimacy [16, 17]. Each factor was adapted from previous studies, with statement items modified to suit the sample, i.e., swimming coaches. The results are presented using descriptive percentages.

Coach-athlete communication includes three aspects: creating a positive atmosphere, fostering open dialogue, and providing feedback. These aspects generated 11 statement items. The analysis results for coach-athlete communication factors are presented in Table 1.

Table 1. Coach-Athlete Communication Ratings

No	Interval	Category	Frequency	%
1	59.75 < 60	Very good	1	10
2	56.85 < 59.75	Good	4	40
3	53.95 < 56.85	Fair	4	40
4	51.05 < 53.95	Poor	0	0
5	50 < 51.05	Very Poor	1	10
	Total		10	100

Based on the results in Table 1, coach-athlete communication was rated as "very poor" for one coach, "fair" for four coaches, "good" for four coaches, and "very good" for one coach.

Furthermore, there are two aspects to training style: democratic and authoritarian. These aspects generated 10 statement items. The analysis results for coaching style factors are presented in Table 2.

Table 2. Coaching Style Ratings

No	Interval	Category	Frequency	%
1	49.10 < 50	Very good	1	10
2	47.10 < 49.10	Good	2	20
3	45.10 < 47.10	Fair	4	40
4	43.10 < 45.10	Poor	2	20
5	43 < 43.10	Very Poor	1	10
	Total		10	100

Based on the results in Table 2, it is found that one coach falls into the "very poor" coaching style category, two coaches into the "poor" category, four coaches into the "fair" category, two coaches into the "good" category, and one coach into the "very good" category.

There are three aspects of the coach-athlete relationship: intimacy, commitment, and complementarity. These aspects generated 11 statement items. The analysis results for coach-athlete relationship factors are presented in Table 3.

Table 3. Coach-Athlete Relationship Ratings

No	Interval	Category	Frequency	%
1	54.05 < 55	Very good	1	10
2	51.75 < 54.05	Good	5	40
3	49.45 < 51.75	Fair	2	20
4	47.15 < 49.45	Poor	2	20
5	47 < 47.15	Very Poor	1	10
	Total		10	100

Based on the results in Table 3, the coach-athlete relationship is rated as "very poor" for one coach, "poor" for one coach, "fair" for two coaches, "good" for five coaches, and "very good" for one coach.

Discussion

The initial approach taken by swimming coaches is quite straightforward: ensuring that individuals or prospective athletes are not afraid of water. This is followed by teaching foot paddling movements using various types of buoyancy aids. Footwork not only helps individuals prevent drowning but also makes their movements faster, more dynamic, and balanced [18, 19]. To achieve athletic success, coaches introduce techniques and strokes starting with the easiest: freestyle, backstroke, breaststroke, and finally, butterfly.

For prospective athletes, the primary physical component trained is endurance. For athletes aged 15 and above, who are approaching adulthood, training focuses on a combination of speed and endurance, depending on the race type. This method aligns with previous research studies, which also suggest that freestyle should be the initial stroke introduced and that endurance should be the first physical component to be trained [20, 21].

Factors in the training approach also vary, such as the age at which the athlete first begins training with a swimming coach. The results show that coaches pay more attention to athletes who start training between the ages of 5 and 10. Starting training at this age allows athletes to develop faster movement capabilities by age 17 [22] and enhances flexibility, as well as broadening the shoulder spine [23]. Thus, beginning training at an early age ensures the training program runs appropriately without rushing to achieve targets.

Communication and training style are crucial in this process. Effective communication helps convey training programs, especially as athletes progress to more challenging levels, preventing complaints and maintaining motivation [24]. The quantitative analysis of coach-athlete communication revealed that nine coaches demonstrated sufficient to very good levels of communication.

Training style also significantly impacts performance, as a well-defined and consistent training program enhances athlete skills [8, 25]. The quantitative analysis of coaching style showed that seven coaches demonstrated sufficient to very good levels of training style.

The effectiveness of the training model plays a crucial role in athlete achievement, as it is evidenced by the athletes' performance in competitions [26, 27]. When athletes consistently win in the same events and styles, the training program can be deemed effective. According to the coaches' interview responses, special and specific training methods are applied during the pre-competition and competition stages, highlighting differences in coaching approaches. These differences may be influenced by the coaches' background, experience, and education [28].

The training method must be tailored to the athlete's abilities. Previous research indicates that training methods during the pre-competition and competition stages are often based on the coaches' experience [29, 30]. Evaluating the effectiveness of training methods solely on the number of achievements is insufficient; it must also be supported by analyzing the coach-athlete relationship [2]. This analysis helps predict whether the training method is appropriately suited to the athlete. The quantitative analysis of the coach-athlete relationship revealed that seven coaches

had a sufficient to very good relationship with their athletes.

Furthermore, discussing long-term athlete development (LTAD) is crucial for the process of coaching athletes over the long term. Many sports have adopted the LTAD concept, primarily targeting athletes with potential and talent identified at a young age [31, 32]. In contrast, athletes who lack potential or talent receive less attention and are given separate training [33]. Applying LTAD has numerous benefits, including achieving athlete success more quickly and avoiding early retirement [10, 34]. Additionally, LTAD enhances athlete well-being by improving psychological health, preventing injuries, and avoiding overtraining [35].

Therefore, implementing the LTAD concept is best started by screening prospective athletes at the elementary school level and incorporating swimming into the physical education curriculum [36, 37, 38, 39].

The biggest challenge for coaches, based on interview results, is to apply the right approach through an appropriate training program, an assertive yet democratic coaching style, discipline, and establishing good relationships with both athletes and their parents. Many athletes quit at a mature age due to incompatibility with the training program or the coach's character. However, many athletes succeed at the international level because of effective coaching.

The limitation of this study is the small sample size, which may affect the accuracy of the results. Additionally, the presentation of interview results tends to combine answers from several coaches for better reader understanding. It is hoped that this study provides valuable insights, particularly for coaches or swimming athletes pursuing a bachelor's degree in sports, to focus on the right approach to coaching swimming athletes.

Conclusions

Coaches employ different approaches to developing swimming skills, supported by proven records of athlete achievement. In the initial training stage for prospective athletes, freestyle, backstroke, breaststroke, and butterfly techniques are always considered and evaluated. Endurance is the foundational physical component developed by the coach, though it will be adjusted according to the race characteristics and chosen style. Coaches also follow guidelines indicating that the pre-competition and competition stages are ideal for more specific training tailored to the upcoming races.

The quantitative analysis reinforces the interview evidence, showing that coach-athlete communication, coaching style, and coach-athlete relationships did not yield poor results, with more than seven coaches rated in the sufficient to very good categories. An important finding of this study is the necessity of applying long-term athlete development (LTAD) principles. This can be achieved through seminars or coach competency training, as LTAD provides significant benefits to athletes across all sports.

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