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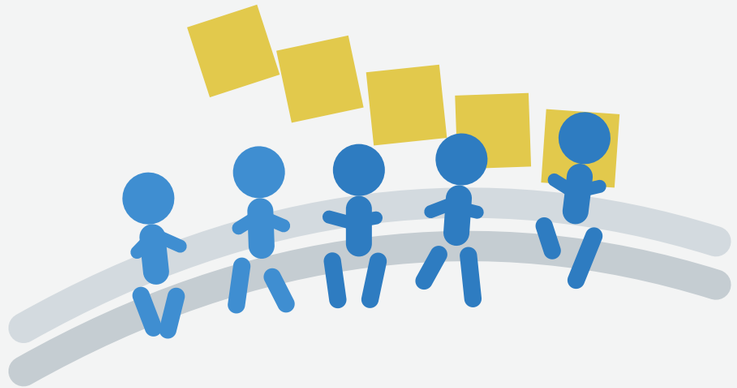

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Inclusive Physical Culture

Health, Physical Activity, and Education

ORIGINAL ARTICLE

The effect of an adapted inclusive physical education program on motor skills and academic engagement of children aged 9–10 years

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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: Inclusive physical education is associated with supporting the motor, social, and emotional development of children with diverse educational needs. In mainstream school settings, students with delayed psychological and intellectual development often experience difficulties in performing motor tasks and maintaining activity during lessons, which necessitates targeted pedagogical adaptation. Despite the use of various inclusive and adapted approaches, their relative effectiveness in improving functional motor skills and academic engagement among schoolchildren with special needs remains of practical interest. The aim of this study was to evaluate the effect of an adapted inclusive physical education program on motor skills and academic engagement of children aged 9–10 years.

Material and Methods: The study was conducted during the second semester of the 2023–2024 academic year and involved 32 fourth-grade students, three of whom had delayed psychological and intellectual development. Data were collected under natural educational conditions during physical education classes organized in an inclusive format. The assessment of essential motor skills was carried out using standardized tests evaluating coordination, balance, movement accuracy, speed, and manipulative skills. In addition, a remote questionnaire was administered to assess students' interest and activity levels during the lessons. Statistical analysis included the calculation of mean values and the use of Student's *t*-test to examine differences and changes in the measured indicators.

Results: Students with delayed psychological and intellectual development demonstrated improvements in essential motor skills following the application of the adapted methodology. Specifically, balance maintenance time increased on average from 18.1 ± 3.01 s to 21.9 ± 1.01 s, walking accuracy along a line improved from 16.53 ± 2.21 cm to 18.2 ± 2.04 cm, and the number of step-up repetitions decreased from 62.4 ± 4.25 to 56.8 ± 2.25, reflecting enhanced movement control. The speed of object transfer also improved (from 1.3 ± 1.69 s to 1.9 ± 1.04 s). Statistically significant changes were observed for several indicators ($p < 0.05$). In addition, an increase in academic engagement was noted, as reflected by a higher proportion of positive evaluations of distance-based lessons and a greater interest in physical education compared with baseline.

Conclusions: The results of the study indicate that an adapted inclusive approach to physical education lessons promotes the development of essential motor skills in students with delayed psychological and intellectual development and enhances their academic engagement. The observed positive changes in motor performance and the increased interest in physical education confirm the effectiveness of structured exercises, step-by-step instructions, and individualized pedagogical support. The organization of inclusive lessons with the involvement of a teaching assistant creates favorable conditions for the successful inclusion of children with special educational needs in the educational process and contributes to the formation of more stable motivation for physical activity.

Keywords: inclusive physical education, adapted physical activity, intellectual disabilities, motor skills, pedagogical support, academic engagement

Introduction

Physical education classes play a central role in the development of motor, cognitive, and social competencies of schoolchildren, forming a foundation for their physical well-being and participation in active life. Within the context of contemporary education, ensuring equal access to physical education for students with special educational needs has become increasingly important, as their participation in physical activity is often limited by a combination of pedagogical, organizational, and interpersonal factors. The challenge of adapting lesson content, teaching methods, and environmental conditions represents a multifaceted task that requires careful consideration of children's individual capabilities, the complexity of inclusive interaction, and the influence of the educational context on the success of their physical and social development.

The theoretical foundations of inclusive physical education are shaped by integrative research that synthesizes evidence on pedagogical,

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organizational, and social mechanisms determining the participation of students with disabilities. A key contribution is the review by Fröberg [1], which systematizes conceptual approaches to understanding the integration of students in physical education lessons and emphasizes the importance of coherence in lesson structure, environmental accessibility, and the quality of interpersonal interactions. These positions are consistent with the findings of two systematic reviews [2, 3], which demonstrate that teachers' attitudes, pedagogical flexibility, and organizational conditions constitute the fundamental basis for successful inclusion. This theoretical framework is further complemented by the meta-analysis by Pocock et al. [4], which illustrates the influence of structural and social factors on the forms and dynamics of participation of students with disabilities. The early integrative review by Qi and Ha [5] remains relevant for the conceptualization of inclusive practices, as the authors emphasize the need to view physical education as a system in which pedagogical, organizational, and interpersonal components jointly determine the accessibility and quality of the educational process. Taken together, these foundational works form a conceptual basis defining the mechanisms of inclusion in physical education.

Other studies in the field of inclusive physical education focus on students' subjective experiences and the specifics of their interaction with the educational environment. Research by Haegele and Sutherland [6] and Haegele et al. [7] shows that the engagement of students with various impairments is largely determined by spatial accessibility, clarity of instructions, and the nature of interpersonal support. The authors emphasize that these factors together create a sense of safety and predictability during lessons. An important contribution to understanding the conditions for successful inclusion is provided by studies examining teachers' professional competence [8, 9]. These studies indicate that teachers' readiness to adapt lesson content influences the quality of the educational experience of students with disabilities. Mastery of flexible and varied instructional methods is also associated with key characteristics of the educational process. In addition, the use of professional communities, including digital platforms, complements pedagogical practice and affects the organization of teaching. Further insight is offered by the study of Liu et al. [10], which systematizes evidence on barriers to and facilitators of student participation, focusing on social acceptability, organizational flexibility, and the structural accessibility of physical education lessons. These studies demonstrate that, in recent years, scholarly attention has increasingly focused on a detailed analysis of the factors that determine students' actual experiences of participation and the effectiveness of pedagogical practices within inclusive educational environments.

Applied research demonstrates a wide range of practical solutions aimed at enhancing the engagement and development of students with disabilities within physical education settings. Intervention programs [11, 12] show that structured adapted physical activity contributes to increased motivation, improved psychological well-being, and the development of motor skills. The results of these studies confirm the effectiveness of targeted pedagogical interventions. Practice-oriented approaches further complement these findings [13, 14] by proposing strategies for adapting motor tasks, organizing socially supportive environments, and translating international recommendations into school practice. Another line of research emphasizes the importance of teacher preparation [15], indicating that participation in adapted programs enhances teachers' self-efficacy and readiness to implement inclusive teaching methods. Together, these applied sources demonstrate that the integration of evidence-based interventions, methodological strategies, and professional development for teachers creates a foundation for improving the quality of participation of students with disabilities in physical education.

The analysis of research findings indicates that the quality of inclusive physical education is determined by a combination of pedagogical attitudes, organizational conditions, and students' subjective experiences. This is supported by both foundational reviews and applied studies. Authors emphasize that the effectiveness of inclusive practices is shaped through the flexible adaptation of content, the creation of a supportive environment, and the use of appropriate pedagogical strategies, which together allow for consideration of the diverse needs of children with disabilities. It is also highlighted that the practical implementation of these principles remains a multifaceted task, influenced by variability in educational contexts, the level of teacher preparation, and the structural characteristics of the school environment. At the same time, there remains a need for a more integrated understanding of how pedagogical approaches, organizational decisions, and individual student characteristics jointly shape the success of inclusion in physical education. This provides a rationale for formulating the research objective aimed at analyzing key factors of inclusion and their interrelationships within contemporary educational practice.

The aim of this study was to evaluate the effect of an adapted inclusive physical education program on motor skills and academic engagement of children aged 9–10 years.

Materials and Methods

Participants

The study involved 32 fourth-grade students aged 9–10 years. Among the participants, 29 were typically developing schoolchildren and 3 students had special educational needs associated with delayed psychological and intellectual development. All children were enrolled in the same mainstream school and attended physical education classes organized in an inclusive learning format. Students with special educational needs completed the tasks with the support of a teaching assistant, who provided the necessary pedagogical assistance.

Ethical Considerations

The study was conducted in accordance with generally accepted ethical standards of pedagogical research. Participation of the students was based on informed consent obtained from parents or legal guardians. The school administration was informed about the purpose of the study and granted permission for its implementation. No personal data were recorded, ensuring the confidentiality of all participants. Students with special educational needs performed the tasks within safe workload limits under the supervision of a teaching assistant, who took into account the individual characteristics of each child. The study protocol was approved by the University Research Ethics Committee of H. S. Skovoroda Kharkiv National Pedagogical University, confirming compliance with requirements for risk minimization and the protection of participants' rights.

Study Design

The study was conducted with primary school students under real educational conditions and included an observational (baseline) stage and an intervention (formative) stage. The baseline stage was carried out during the second semester of the 2023–2024 academic year, from January to May 2024, at the Berestovenky Branch of Krasnohrad Lyceum No. 4 of the Krasnohrad City Council, Kharkiv Region (Ukraine). At this stage, two main objectives were addressed. First, attitudes of students and their parents toward distance physical education lessons, as well as the level of children's activity during such classes, were examined using a remote questionnaire. Second, baseline testing of essential motor skill development was conducted for all study participants.

Parents of students with special educational needs completed an online questionnaire using a Google Form. The questionnaire included items addressing children's attitudes toward the subject of physical education, their level of participation in lessons, and parents' perceptions of the clarity and accessibility of distance learning tasks. A separate section assessed the perceived interest of distance physical education lessons using a five-category scale: "interesting," "rather interesting," "not always interesting," "uninteresting," and "boring." A similar online questionnaire was completed by the students; in the case of children with delayed psychological and intellectual development, parents assisted them in formulating and entering their responses.

In parallel with the questionnaire survey, students' motor and coordination skills were assessed. The assessment was conducted under standard physical education class conditions, with uniform instructions provided to all participants in the study.

Movement accuracy was evaluated using a ball-throwing test aimed at a vertical target with a diameter of 30 cm. Each student performed throws from a distance of 3 m. The deviation of the hits from the center of the target was recorded, allowing for the assessment of visuomotor coordination and the accuracy of goal-directed movements.

Balance was assessed using the Romberg test. Participants alternately stood on the right and left leg with their eyes open. The duration of maintaining a stable position without additional support or trunk displacement was recorded. This test characterized static balance and postural control ability.

Movement coordination during locomotion was determined using a 2 m line-walking test. The student performed the task at a comfortable pace, attempting to maintain the prescribed trajectory. The magnitude of deviation from the line was measured, reflecting the level of movement coordination and spatial control.

Speed–strength characteristics of the lower limbs were assessed using a step-up test performed over 10 s. The total number of step-ups completed within the allotted time was recorded. This test allowed for the evaluation of strength endurance and the execution tempo of cyclic movements.

Fine motor skills and the serial organization of movements were assessed using two consecutive tasks. In the first task, the student transferred 20 pencils from the right hand to the left hand and then placed them on a table. Each subsequent pencil could be taken only after completion of the previous action. The total task completion time was recorded, reflecting the accuracy, rhythm, and sequential organization of motor actions.

In the second task, the student tossed a ball upward, clapped their hands, and then caught the ball. The number of successful tosses with a clap completed within a fixed time interval was recorded. This task characterized complex movement coordination, action synchronization, and the speed of motor response.

The formative stage lasted five months and involved the implementation of an inclusive physical education teaching approach with the

mandatory participation of a teaching assistant. The assistant supported students with special educational needs by helping them understand instructions, selecting appropriate and feasible exercise variations, providing support during balance and coordination tasks, and encouraging participation in joint activities with classmates. The lesson content largely followed the requirements of the standard curriculum. At the same time, the classes included ball games as well as coordination and balance exercises. For some students, simplified or step-by-step versions of motor tasks were used.

Upon completion of the formative stage, repeated testing of the same motor and coordination indicators as those assessed at the baseline stage was conducted. A follow-up survey of students and parents was again administered remotely via a Google Form using the same scales for evaluating interest and activity during lessons. This approach ensured data comparability and made it possible to track changes in the level of essential motor skill development and in attitudes toward physical education lessons as a result of the pedagogical intervention.

Statistical Analysis

Statistical data processing was performed using Microsoft Excel 2019. For all quantitative variables, mean values and standard deviations were calculated ($\bar{X} \pm SD$). Comparisons between typically developing students and children with delayed psychological and intellectual development were conducted using Student's *t*-test for independent samples. Within-group changes among students with special educational needs were analyzed using the paired Student's *t*-test. Statistical significance was set at $p < 0.05$. Questionnaire data were analyzed using percentage distribution of responses.

Results

To determine the baseline level of students' interest in distance physical education lessons, a questionnaire survey was conducted among two groups of schoolchildren. The assessment was carried out using a six-point scale reflecting the degree of subjective attractiveness of the lessons. The distribution of responses is presented in Figure 1.

The analysis of response distribution revealed differences between the two study groups. Among students without developmental impairments, the most frequent rating was category 3, indicating a moderate level of interest in distance physical education classes. Categories 2 and 1 were also reported, but less frequently, suggesting reduced or selective interest. A small number of students rated the lessons as completely uninteresting, reflecting heterogeneity in motivational perception.

Among students with delayed psychological and intellectual development, category 3 was also the dominant rating, with its proportion being noticeably higher than that observed among typically developing peers. This indicates that the distance learning format was perceived by these students primarily as moderately interesting but not consistently motivating. In addition, lower ratings were reported more frequently in this group,

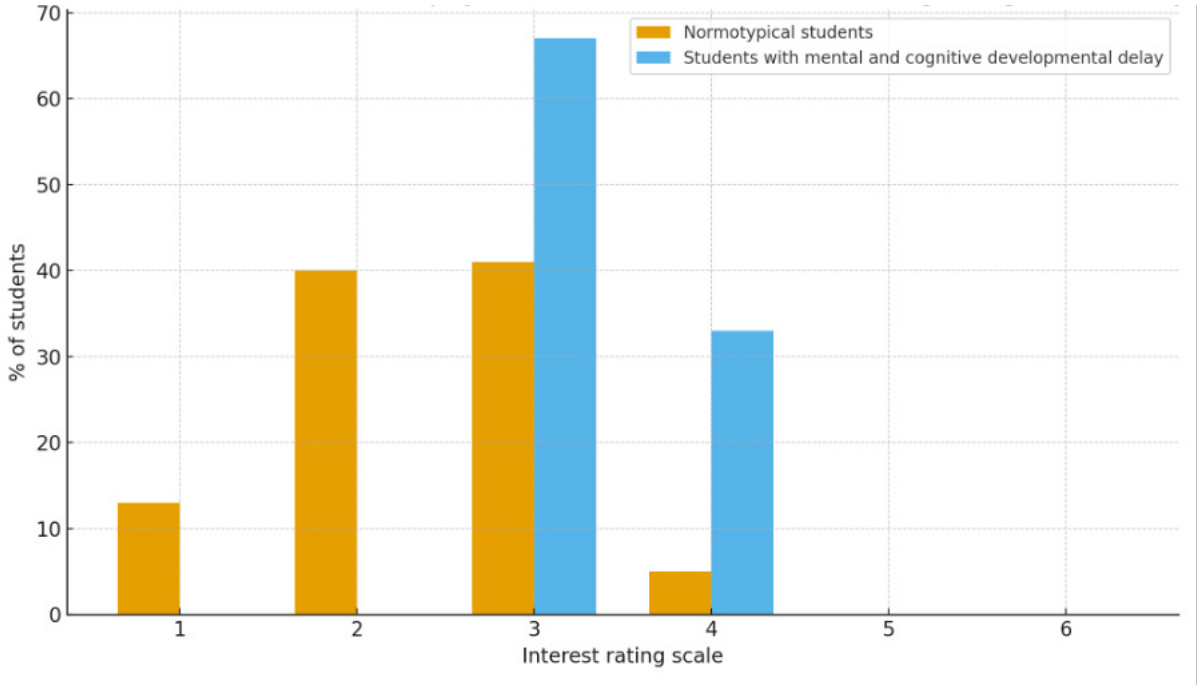

Figure 1. Students' interest in distance physical education lessons at the beginning of the study. (1 – interesting lessons; 2 – rather interesting lessons; 3 – sometimes interesting lessons; 4 – uninteresting lessons; 5 – boring lessons).

suggesting difficulties in maintaining sustained attention and motivation during distance-based activities.

Overall, the data presented in Figure 1 indicate that distance physical education lessons were perceived by both groups as moderately attractive. However, students with special educational needs experienced greater challenges in sustaining interest. These findings support the need to adapt the content and instructional methods of distance physical education lessons in order to enhance their motivational value and accessibility.

To clarify the relationships between indicators of interest and activity during distance physical education lessons, a correlation analysis was conducted. Table 1 presents the correlation coefficients between students' level of interest in the lessons, their activity during classes, and the frequency of camera use.

The results indicate strong positive associations between students' interest in distance lessons and their activity levels, as well as between activity and camera engagement, suggesting that higher interest is linked to greater participation and visibility during online classes.

The data presented in Table 1 indicate that students' interest in distance physical education lessons is positively associated with their learning activity. The correlation coefficient of 0.75 reflects a strong relationship between these parameters, suggesting that increased interest is accompanied by higher levels of engagement in the learning process. Camera engagement also demonstrated a moderate association with the level of interest and a strong association with students' activity. The coefficients of 0.56 and 0.85, respectively, indicate that students tend to be more active and attentive when they remain connected to the communicative space of the lesson. These findings highlight the importance of maintaining motivational components and social interactivity within distance learning formats.

To assess the level of essential motor skill development in primary school students, a comparative analysis of physical and coordination indicators was conducted between students in the main group and those with special educational needs. The results of this analysis are presented in Table 2.

As shown in Table 2, statistically significant differences were observed between the two groups across all examined indicators. Students with special educational needs demonstrated higher performance in tasks related to strength and movement speed. Pronounced differences were identified in the step-up test and the pencil transfer task, where the values of group n^2 were higher. This is confirmed by t values of 7.91 and 9.40 and significance levels of $p < 0.01$.

In coordination and balance tasks, participants from group n^1 showed more stable performance, which is reflected in higher mean values combined with lower standard deviations. These differences were also statistically significant. The p values of < 0.05 and < 0.01 confirm substantial contrasts in the development of coordination skills between students from the two samples.

Thus, the data demonstrate differences in the characteristics of motor preparedness between students in the main group and those with special educational needs. These differences should be taken into account when organizing inclusive physical education lessons.

To provide a more detailed analysis of changes in essential motor skill development among students

Table 1. Interest and activity of students during distance physical education lessons (% of students)

Indicator	Interest in distance lessons, points	Activity during lessons, points
Interest in distance lessons, points	–	–
Activity during lessons, points	0.75	–
Camera engagement	0.56	0.85

Table 2. Comparison of essential motor skill indicators of fourth-grade students participating in the study ($n^1 = 29$; $n^2 = 3$) ($\bar{X} \pm SD$)

Indicator	Ball throw to a vertical target, cm	Static balance maintenance, s	Line walking (2 m), cm	Step-ups in 10 s, repetitions	Transfer of 20 pencils, s	Ball toss with clap, repetitions
$n^1 = 29$	37.5 ± 2.31	24.6 ± 2.01	20.3 ± 2.61	42.4 ± 3.25	15.6 ± 1.25	45.6 ± 2.65
$n^2 = 3$	42.5 ± 2.01	18.1 ± 3.01	16.53 ± 2.21	62.4 ± 4.25	9.4 ± 1.05	65.6 ± 3.65
t	4.03	3.65	2.76	7.91	9.40	9.23
p	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01

Note. $n^1 = 29$ indicates the number of students in the main group. $n^2 = 3$ indicates the number of students with special educational needs.

with delayed psychological and intellectual development, their performance indicators at the beginning and at the end of the study were compared. The measurements included assessments of movement accuracy, balance, coordination, execution speed, and the ability to perform serial motor actions. The results are presented in Table 3.

The analysis of the data presented in Table 3 showed that changes in the performance of students with delayed psychological and intellectual development were heterogeneous. Statistically significant improvements were observed in static balance maintenance, line walking over a distance of two meters, step-ups performed over ten seconds, and ball tosses with a clap. These findings are confirmed by significance levels of $p < 0.05$. Improvements in these tests indicate positive dynamics in the development of coordination, strength, and stability of motor actions.

At the same time, the indicators for the ball throw to a vertical target and the pencil transfer tasks did not demonstrate statistically significant changes. The p values greater than 0.05 suggest that, over the study period, improvements in these skills did not reach statistical significance. This may reflect individual characteristics of fine motor skill development and movement accuracy in children within this category.

Overall, the presented data indicate that participation in adapted physical education classes is associated with improvements in certain components of motor preparedness among students. At the same time, the development of movement accuracy and elements of fine motor skills appears to require a longer or more specialized intervention program.

To examine changes in students' attitudes toward distance physical education lessons, a comparative analysis of lesson ratings was conducted among children with delayed psychological and intellectual development and their peers. Comparing data collected at the beginning and at the end of the study makes it possible to identify the direction of changes in the emotional perception of lessons and in students' levels of engagement. A graphical representation of the results is presented in Figure 2.

As shown in Figure 2, by the end of the

Table 3. Indicators of essential motor skill development in fourth-grade students with delayed psychological and intellectual development participating in the study (n = 3) ($\bar{x} \pm SD$)

Indicator	Ball throw to a vertical target, cm	Static balance maintenance, s	Line walking (2 m), cm	Step-ups in 10 s, repetitions	Transfer of 20 pencils, s	Ball toss with clap, repetitions
Beginning of the study	42.5 ± 2.01	18.1 ± 3.01	16.53 ± 2.21	62.4 ± 4.25	9.4 ± 1.05	65.6 ± 3.65
End of the study	40.5 ± 1.51	21.9 ± 1.01	18.2 ± 2.04	56.8 ± 2.25	9.9 ± 1.15	57.4 ± 1.42
p	> 0.05	< 0.05	< 0.05	< 0.05	> 0.05	< 0.05

Note. Mean values are presented with standard deviations ($\bar{x} \pm SD$).

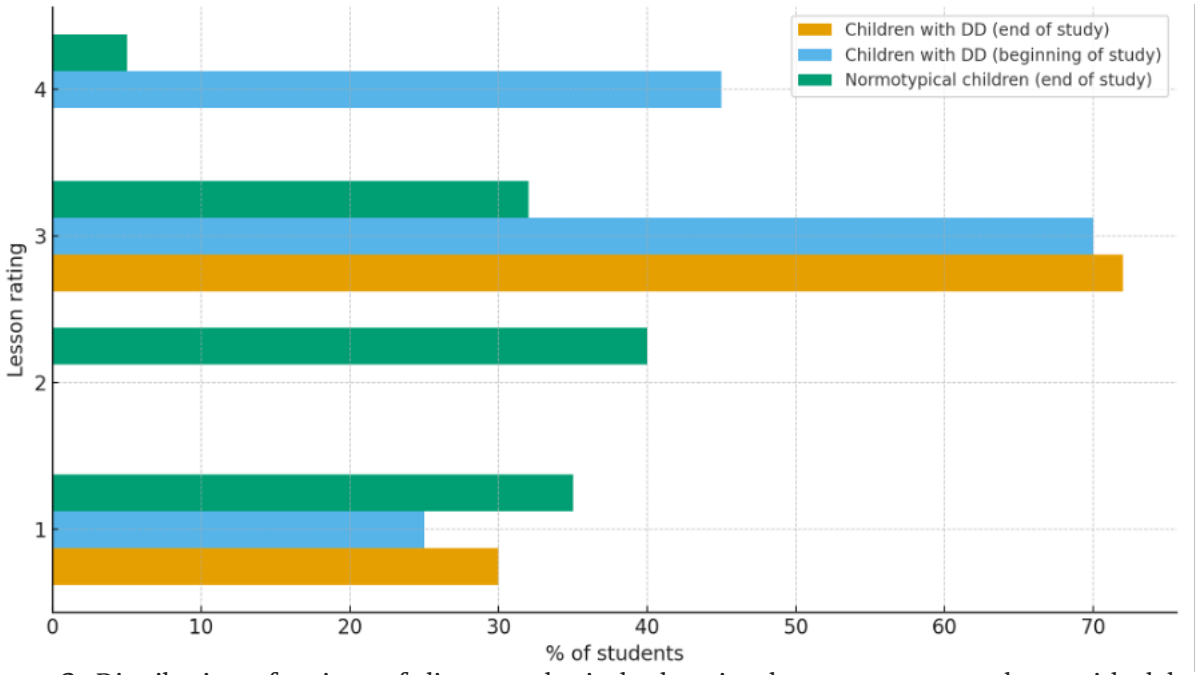

Figure 2. Distribution of ratings of distance physical education lessons among students with delayed psychological and intellectual development and typically developing schoolchildren at the beginning and at the end of the study

study, students with delayed psychological and intellectual development more frequently rated physical education lessons as more interesting and comfortable. The proportion of students in this group who assigned a rating of 3 increased compared with the beginning of the study, indicating an improvement in their emotional perception of the lessons. At the same time, the number of low ratings, particularly at levels 1 and 2, decreased.

Typically developing students also demonstrated positive levels of satisfaction with the lessons. The majority of them rated the lessons at levels 2 and 3, which confirms a stable interest in distance learning formats. At the same time, the distribution of ratings in both groups became more balanced by the end of the study. This indicates a stabilization of emotional attitudes toward the lessons and an improvement in the overall quality of learning perception.

The obtained results suggest that structured planning of distance physical education lessons, combined with adaptation of instructional content, contributes to increased student interest and the creation of a more positive emotional climate in physical education learning.

Discussion

The aim of the present study was to evaluate the effect of an adapted inclusive physical education program on motor skills and academic engagement of children aged 9–10 years. The obtained results demonstrate positive changes in the development of selected essential motor skills among students with special educational needs and reflect shifts in their attitudes toward physical education lessons.

Data analysis showed that, following the implementation of an inclusive approach involving a teaching assistant, students with delayed psychological and intellectual development exhibited improvements in balance, coordination, serial motor skills, and selected components of motor activity ($p < 0.05$). At the same time, the proportion of negative evaluations of distance physical education lessons decreased, while the share of ratings indicating a more positive perception of the lessons increased. Typically developing students also demonstrated stable positive motivation and satisfaction with the lessons, which supports the appropriateness and effectiveness of the implemented pedagogical strategies.

The presented findings allow the inclusive model of organizing physical education lessons to be regarded as an effective approach that promotes increased engagement of students with special educational needs and the development of their motor skills within a shared learning environment.

The obtained results are consistent with previous studies demonstrating the effectiveness of adapted methodologies and pedagogical support in enhancing motor and coordination skills among children with special educational needs. The improvements observed in students with delayed psychological and intellectual development correspond to the conclusions reported by Pocock et al. [4] and Wilhelmsen [3], who noted that structured adaptation of exercises contributes to greater coordination stability and the development of basic motor skills. Similar effects were confirmed in a randomized controlled study by Sun et al. [16], which concluded that an adapted physical activity program led to improvements in physical fitness among adolescents with intellectual disabilities.

Changes in interest ratings are consistent with the findings of Haegele and Sutherland [6] and Liu et al. [10]. These authors reported results highlighting the importance of task accessibility, clarity of instructions, and interpersonal support in shaping positive attitudes toward physical activity. The significance of organizational conditions and pedagogical support is confirmed both by the data reported by Fröberg [1] and Rekaa et al. [2], as well as by more recent findings from Bertills and Björk [17]. According to these authors, teachers' involvement in adapting lesson structure represents a decisive factor for the successful inclusion of students with disabilities. Additional evidence supporting the role of inclusive methodological approaches is provided by the study of Paquibot et al. [18], which demonstrates that targeted pedagogical strategies increase engagement and improve the emotional perception of lessons among children with special educational needs.

The improvements in motor and coordination skills observed in students with delayed psychological and intellectual development are consistent with findings from recent studies confirming the effectiveness of adapted physical activity programs. Specifically, Shen et al. [19] and Claire [20] demonstrated that structured adapted programs contribute to motor development and improved functional fitness in children and adolescents with intellectual disabilities. Similar conclusions were reported by Astuti et al. [21], who emphasized the role of adapted games and step-by-step exercises in the formation of basic motor skills.

The contribution of the pedagogical environment is further supported by the findings of Ben Rakaa, Lourenço et al. [22] and Paquibot et al. [18]. According to these authors, the use of adapted strategies, individualized instructions, and flexible teaching methods increases the engagement of students with intellectual disabilities in physical education lessons. A broader systemic perspective is reflected in the studies by Burhaein et al. [23] and Fierro-Saldaña and Treviño-Villarreal [24], which emphasize that the success of inclusive education is determined not only by the content of adapted exercises but also by the coherence of organizational conditions and supportive pedagogical practices.

Taken together, these findings confirm that the positive dynamics identified in the present study represent an expected outcome of targeted lesson adaptation and structured pedagogical support.

The positive changes in motor and motivational indicators observed among students with delayed psychological and intellectual development may be explained by the influence of key components of the inclusive methodology, including exercise adaptation, structured organization of motor activities, and individualized pedagogical support. The effectiveness of step-by-step organized physical activity is supported by the findings of Shen et al. [19] and Claire [20], as well as by the results of Lima et al. [25], which indicate a relationship between the level of physical activity and the development of motor competence. The importance of early motor skill formation for subsequent physical development is emphasized in the systematic review by García-Hermoso et al. [26]. The increase in motivation and emotional well-being reported by Ben Rakaa and Lourenço et al. [22] is consistent with the pedagogical conclusions of Kot [27] regarding the role of adaptation and supportive guidance in enhancing student engagement. Taken together, these data confirm that the combination of structured motor activity and targeted pedagogical support constitutes a key mechanism underlying the effectiveness of inclusive physical education lessons.

The obtained results indicate the need for purposeful adaptation of the structure of physical education lessons. Step-by-step presentation of motor tasks facilitates clearer understanding and acquisition of exercises by students with delayed psychological and intellectual development. Individualized pedagogical support also influences the formation and development of their motor skills. The effectiveness of such approaches is supported by the studies of Shen et al. [19] and Claire [20], which reported that adapted programs contributed to motor development and greater stability in exercise performance. These conclusions are complemented by the findings of Lima et al. [25], who demonstrated a stable relationship between the level of organized physical activity and the development of motor competence in childhood. The results of the systematic review by García-Hermoso et al. [26] also highlight the importance of early motor skill development for children's subsequent physical development. The increase in motivation and engagement identified in the present study is consistent with the findings of Ben Rakaa et al. [11], which emphasize the significance of an emotionally safe educational environment and child-accessible forms of physical activity.

From a practical perspective, strengthening pedagogical support is of particular importance, including the active role of a teaching assistant and the use of varied instructional methods, as supported by the recommendations of Yun and Beamer [13] and the findings of Sit et al. [14]. In addition, the study by Alhumaid et al. [15] demonstrated that the effectiveness of inclusive lessons is directly related to teachers' professional self-efficacy and their readiness to adapt lesson content and organizational approaches. Improvements in motor development were also reported in the studies of Karakaş et al. [12], which highlighted the value of using specially selected exercises aligned with children's individual capabilities.

At the organizational level, the effectiveness of inclusive education depends on the coherence of teachers' actions, the availability of resources, and institutional support, as emphasized in the systemic analysis by Fierro-Saldaña and Treviño-Villarreal [24]. This perspective is further supported by the pedagogical conclusions of Kot [27]. Overall, the present findings indicate that sustained student progress is achievable through the integration of individualized instructional approaches, structured lesson organization, and coordinated institutional support for inclusive practice.

Study Limitations

Despite the positive findings, this study has several limitations that should be considered when interpreting the results. First, the small number of students with delayed psychological and intellectual development limits the generalizability of the findings and does not allow for more advanced statistical analyses. In addition, the study was conducted within a single school setting, which reduces the transferability of the results to other educational contexts with different organizational conditions and inclusive education practices. The predominant use of quantitative methods to assess motor preparedness also limits the ability to fully capture students' subjective experiences and the quality of pedagogical interactions.

Future research would benefit from expanding the sample to include different categories of students with special educational needs and from conducting interschool comparative studies. The application of mixed-method approaches that combine motor skill testing, observation, and qualitative interviews is also recommended. Such approaches would allow for a deeper understanding of the mechanisms through which inclusive methodologies influence motivation and participation among children with special educational needs. An important direction for further research is the analysis of the effectiveness of specific components of pedagogical support, including the role of the teaching assistant, the structuring of exercises, and the adaptation of the learning environment. This would help to identify optimal conditions for organizing inclusive physical education lessons.

Conclusions

The present study demonstrated that the application of an inclusive physical education teaching methodology incorporating adapted motor tasks, structured lesson organization, and individualized pedagogical support contributes to the improvement of essential motor skills and increased motivation among students with delayed psychological and intellectual development. The observed positive dynamics in coordination and motor indicators confirm the effectiveness of accessible, step-by-step exercises and targeted assistance provided by the teacher and the teaching assistant. Changes in students' interest ratings highlight the importance of an emotionally safe and predictable educational environment, which enhances engagement and readiness to actively participate in physical activity.

The study findings emphasize the importance of integrating adaptive pedagogical strategies into the daily practice of physical education lessons as a condition for the successful inclusion of children with special educational needs. The implementation of such approaches may be considered an effective pathway to improving accessibility, effectiveness, and the social significance of inclusive education in primary schools.

Conflict of interests

The authors declare that there is no conflict of interests.t.

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REVIEW ARTICLE

Inclusive physical culture for university students with disabilities: 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 Inclusive physical culture in higher education is essential for ensuring equal access, participation, and well-being among students with disabilities. Despite increasing international initiatives to promote inclusion, universities still face pedagogical, infrastructural, and organizational barriers that limit full engagement in physical activity. This study aimed to examine the theoretical foundations, recent developments, and practical strategies that support inclusive physical culture for university students with disabilities.

Material and Methods A systematic review was conducted following PRISMA guidelines. Peer-reviewed articles indexed in Web of Science, Scopus, and MedLine between 2010 and 2025 were analyzed. The reviewed literature was grouped into three categories: theoretical, contemporary, and applied studies. Descriptive statistics, thematic content analysis, and bibliometric mapping were used to identify major concepts, program models, and implementation trends.

Results The review showed growing academic interest in inclusive physical activity in higher education, with a clear movement toward integrated approaches that combine adaptive instruction, accessible environments, and psychosocial support. Teacher competence, peer mentoring, and structured adapted physical activity programs were consistently associated with improved motivation, participation, and social inclusion of students with disabilities.

Conclusions Inclusive physical culture serves as both an educational and rehabilitative framework that promotes autonomy, competence, and belonging among students with disabilities. Strengthening teacher preparation, improving infrastructure accessibility, and expanding inclusive program design can further enhance equitable participation and health outcomes in university settings.

Keywords: inclusive physical education, adaptive physical activity, university students with disabilities, accessibility, social inclusion, higher education, rehabilitation

Introduction

Inclusive physical culture is an essential element of modern higher education, integrating the principles of equality, accessibility, and personal development into physical education. In the university setting, inclusive practices allow students with disabilities to participate fully in physical activities, supporting not only their physical health but also their social integration and psychological well-being. This issue involves pedagogical, social, and environmental factors that shape the effectiveness of inclusion. As universities continue to adopt inclusive initiatives, the creation of effective physical culture models becomes critical for promoting diversity, active participation, and comprehensive student development.

Foundational research defines inclusive physical culture as a pedagogical and social process shaped by instructional adaptation, environmental conditions, and interpersonal relationships. Block and Obrusnikova's state-of-the-field review identified key determinants such as teacher competence, curriculum adaptation, peer interaction, and contextual support, emphasizing that effective inclusion depends on systematic instructional design rather than isolated accommodations [1].

At the experiential level, Goodwin and Watkinson highlighted students' perspectives, revealing ongoing tension between enabling and limiting aspects of physical education. They identified belonging, perceived competence, and meaningful participation as core indicators of genuine inclusion. Their qualitative findings underscored the importance of classroom climate and teacher behavior as primary factors influencing engagement and psychosocial outcomes [2].

Conceptually, the WHO's International Classification of Functioning, Disability and Health (ICF) provides a comprehensive framework linking these educational determinants to human functioning. It interprets disability as the interaction among body functions, activities, participation, and environmental factors, guiding universities to address structural, policy, and attitudinal barriers alongside individual abilities when developing inclusive physical culture [3].

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Recent studies in higher education show that campus-based adapted physical activity (APA) programs can significantly increase leisure-time physical activity and enhance self-determination among students with disabilities. In the evaluation of "Fitness Access McGill," Liska et al. reported moderate to large pre–post improvements in total physical activity and in autonomy, competence, and relatedness, emphasizing the effectiveness of need-supportive program design and supervised, individualized exercise on university campuses [4].

Large-scale cross-sectional research highlights the extent of inactivity within this population. In a national Spanish sample of 1,103 university students with disabilities, Úbeda-Colomer et al. found that most participants did not meet WHO recommendations for vigorous or moderate activity. Lower adherence was especially evident among women, older students, those with multiple or acquired disabilities, and individuals with obesity, identifying key groups for targeted interventions [5].

Analyses of perceived barriers reveal a consistent multilevel pattern: intrapersonal factors such as fatigue, pain, and low motivation are most common, followed by organizational barriers like limited adapted programs and cost, and interpersonal or environmental obstacles including inactive peers and restricted accessibility. These results support the need for integrated approaches that combine behavioral support with structural and environmental improvements within universities [6].

Implementation success in higher education also depends on faculty attitudes and readiness. A 2025 survey reported generally positive attitudes among university teachers toward inclusion and academic accommodations, with differences by gender and academic field. The authors identified professional training and adequate resources as key factors in turning inclusive intentions into consistent practice – conditions essential for advancing inclusive physical culture in universities [7].

Applied research shows that inclusive physical culture can be effectively implemented through peer support, environmental assessment, and structured behavior-change strategies. In a 10-week campus program, Todd et al. demonstrated that peer-mentored physical activity for autistic college students is both feasible and effective in promoting self-determined participation. The program enhanced autonomy, competence, and relatedness through individualized activities and near-peer coaching, an approach that universities can expand through structured student-mentor initiatives within recreation services [8].

At the infrastructural level, AIMFREE-based evaluations of university recreation centers identified specific, modifiable barriers related to facilities, equipment, programs, and staff practices. Administrators and staff emphasized that policy adjustments and targeted training can drive improvement, including better equipment spacing, signage, reservation systems, and inclusive service protocols. These findings support practical campus plans that connect facility management, programming, and disability services [9].

Beyond the campus environment, randomized trials involving wheelchair users have shown that multi-component, home-based exercise interventions combining remote coaching, individualized goals, and accessible equipment support long-term engagement over 12 months. Universities can adapt these elements for hybrid or home programs through tele-coaching, equipment loan schemes, and partner-supported routines, extending inclusive physical culture to students who face mobility, scheduling, or transportation barriers [10].

Analysis of research findings shows that inclusive physical culture for university students with disabilities is a dynamic field where theoretical models, institutional strategies, and practical interventions intersect. Scholars emphasize that successful inclusion depends on the coordinated interaction of pedagogical design, accessible infrastructure, and psychosocial support systems. Although the evidence base and inclusive policies continue to expand, many universities still encounter difficulties in translating conceptual frameworks into sustainable practice, particularly in achieving equal participation and maintaining long-term engagement in physical activity. The integration of theoretical and applied perspectives remains essential for strengthening inclusivity in higher education and for guiding evidence-based policy development.

The aim of this study is to examine the theoretical foundations, current developments, and practical applications of inclusive physical culture for university students with disabilities.

Materials and Methods

Information Sources and Search Strategy

The literature search covered the period from 2010 to 2025 and was limited to peer-reviewed, English-language, full-text articles. The databases Web of Science, Scopus, and MedLine were selected for their comprehensive coverage of education, rehabilitation, and sport sciences. Controlled keywords and Boolean operators ensured conceptual and contextual relevance, including "inclusive physical education," "adaptive physical activity," "university students with disabilities," "higher education inclusion," "accessibility," and "teacher attitudes."

The inclusion criteria were as follows: (1) studies focusing on inclusive physical education or physical culture among students with disabilities in higher

education; (2) research employing quantitative, qualitative, or mixed methods; and (3) articles presenting clear methodological grounding and relevant outcomes. The exclusion criteria were: (1) publications unrelated to higher education or from non-academic sources and (2) studies lacking methodological transparency or empirical data.

After the initial search, 214 records were identified, and 34 duplicates were removed. The remaining 180 records were screened by title and abstract. Following full-text evaluation of 68 articles, 15 studies met all inclusion criteria.

Study Design and Framework

This study employed a systematic review design in accordance with the PRISMA 2020 guidelines to ensure methodological rigor, transparency, and replicability. The review process included three main phases: identification, screening and eligibility, and synthesis. Eligible publications were classified into three analytical categories:

1. Fundamental sources referring to theoretical frameworks of inclusive physical education and disability studies;
2. Contemporary sources consisting of empirical research, including surveys and intervention studies;
3. Applied sources focusing on program implementation, evaluation, and policy analysis.

A thematic synthesis was conducted to identify recurring constructs such as teacher competence, accessibility, peer interaction, and self-determination.

The selection process is presented in Figure 1 (PRISMA Flow Diagram).

Data Extraction and Coding

Data extraction and coding were carried out independently by two reviewers using predefined templates to ensure accuracy, transparency, and consistency. The extracted information was verified through cross-checking and consensus discussions. Each study was summarized in a structured analytical table with the following columns: Authors (Year) – bibliographic details; Participants (Country) – sample type and geographical context; Data Source – study design or data collection method (survey, interview, intervention, review); Outcome Measure – indicators related to inclusion and physical activity; Findings Q1–Q3 – summarized evidence corresponding to attitudes toward inclusion, positive experiences, and barriers; Themes; Summary. All entries were verified for completeness and accuracy against full-text sources. Only English-language publications were included.

Quality Assessment

The methodological quality of the included studies was evaluated according to the PRISMA 2020 framework, emphasizing transparency, methodological rigor, and completeness of reporting. Two independent reviewers assessed each study using a 10-item checklist covering reporting clarity, methodological soundness, and analytical validity. Each item was rated on a three-point scale (0 = not addressed, 1 = partially addressed,

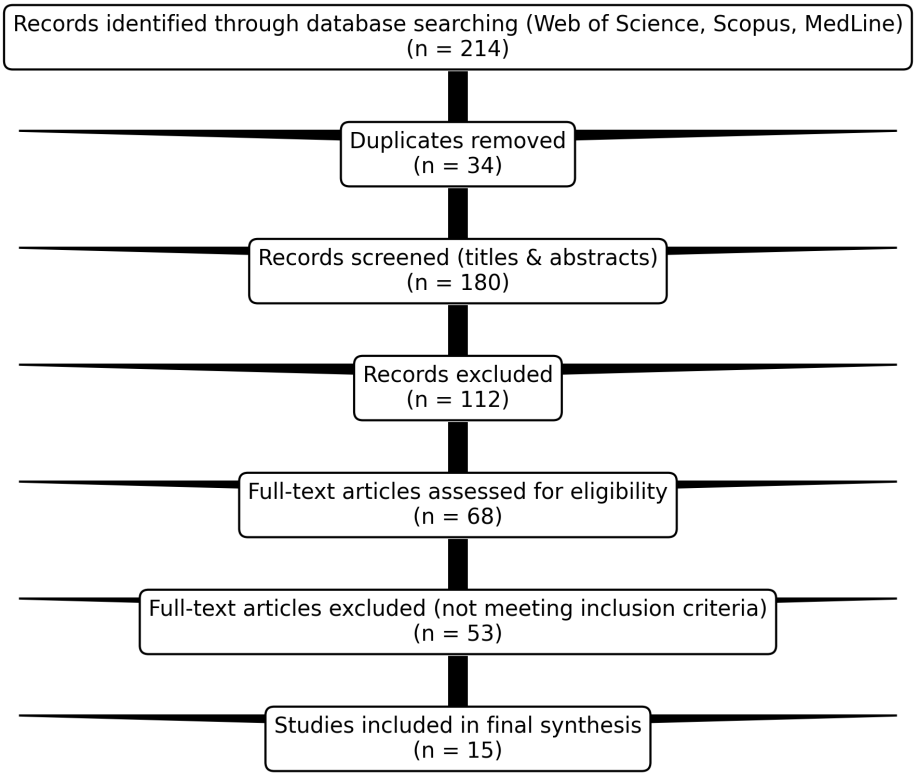

Figure 1. PRISMA Flow Diagram

Table 1. Summary of Studies Included in the Systematic Review (n = 15)

Authors	Year	Participants (country)	Data source	Outcome measure	Findings Q1 — Attitude to inclusion	Findings Q2 — Positive experiences	Findings Q3 — Negative experiences	Themes	Summary
[2]	2000	Not specified (students with physical disabilities)	Qualitative interviews/ phenomenology	Lived experience of inclusion/ participation in PE	Teacher behaviors perceived as supportive or exclusionary; attitudes inferred from student reports	Belonging, perceived competence, meaningful participation when teachers adapt tasks and peers are supportive	Social stigma, low expectations, and environmental barriers limiting participation	['Teacher attitudes/ competence', 'Wheelchair/ exercise RCTs/ behavior change', 'Students' perspectives/ qualitative experience']	Phenomenological study detailing how students with physical disabilities experience PE; highlights belonging, competence, and teacher behavior as participation levers.
[1]	2007	Various (narrative review, 1995–2005 literature)	Narrative literature review	Synthesis of determinants of inclusion in PE	Teacher competence and positive attitudes are central to effective inclusion	Adaptive instruction and peer interaction linked to improved participation	Lack of training/ resources and inflexible curricula hinder inclusion	['Teacher attitudes/ competence', 'Campus APA programs/ interventions']	State-of-the-field review (1995–2005) synthesizing determinants of inclusion in PE: teacher competence, curricular adaptations, peer interaction, and contextual supports.
[3]	2001	N/A (conceptual framework)	ICF framework document	Conceptualization of functioning/ participation and environmental factors	Not directly assessed	Not directly assessed	Not directly assessed	['Accessibility/ facilities (AIMFREE)', 'Campus APA programs/ interventions', 'Frameworks/ conceptual']	Introduces the ICF framework conceptualizing disability as interaction between functioning and environment; foundational for inclusive program design.
[5]	2019	Spain (university students with disabilities)	Crosssectional survey	PA guideline adherence and subgroup differences	Not directly assessed	Not directly assessed	Low PA adherence prevalent; disparities by sex, age, disability, and weight status	['Physical activity levels/ surveillance']	Public Health study showing most university students with disabilities do not meet PA guidelines, with disparities by sex, age, disability, and weight status.
[6]	2019	Spain (university students with disabilities)	Crosssectional survey	Selfreported barriers to physical activity	Not directly assessed	Not directly assessed	Predominant intrapersonal and organizational barriers; accessibility constraints	['Barriers/ facilitators (ecological)']	Disability and Health Journal analysis identifying multilevel PA barriers among university students with disabilities (intrapersonal, organizational, interpersonal, community).

Table 1. Continued

Authors	Year	Participants (country)	Data source	Outcome measure	Findings Q1 — Attitude to inclusion	Findings Q2 — Positive experiences	Findings Q3 — Negative experiences	Themes	Summary
[4]	2024	Canada (university students/staff with disability or chronic condition)	Program evaluation (pre–post)	Leisuretime PA; autonomy, competence, relatedness	Not directly assessed; program framed with supportive, inclusive approach	Improved motivation and engagement within a needsupportive campus APA program	Not directly assessed	['Campus APA programs/ interventions']	Mixed-method evaluation of a campus adapted physical activity program (Fitness Access McGill) reporting gains in leisure-time PA and self-determination needs.
[8]	2019	Not specified (autistic college students)	Campus intervention (peermentored PA)	Feasibility; engagement indicators	Not directly assessed	Enhanced confidence, routine formation, and peer support	Not directly assessed	['Campus APA programs/ interventions']	Autism in Adulthood paper describing a 10-week peer-mentored PA program for autistic college students; demonstrates feasibility and engagement benefits.
[10]	2013	USA (adults who use wheelchairs)	Randomized controlled trial	Exercise adoption and adherence over 12 months	Not directly assessed	Structured, tailored supports facilitated longterm participation	Not directly assessed	['Campus APA programs/ interventions', 'Wheelchair/ exercise RCTs/ behavior change']	RCT among wheelchair users testing multi-component, home-based exercise behavior interventions with sustained adoption over 12 months.
[11]	2017	Not specified (college students with/without disabilities)	Comparative survey	Physical activity indicators	Not directly assessed	Not directly assessed	Lower PA on several indicators among students with disabilities	['Physical activity levels/ surveillance', 'Campus APA programs/ interventions']	Comparative study analyzing physical activity levels among college students with ADHD/LD vs. peers without disabilities.
[12]	2011	Canada (fitness/ recreation facilities)	Facility accessibility audit (AIMFREE)	Accessibility scores across domains	Not directly assessed	Improvements possible through targeted environmental changes	Many 'accessible' facilities failed across multiple domains	['Accessibility/ facilities (AIMFREE)', 'Campus APA programs/ interventions']	Facility audit using modified AIMFREE showing many 'accessible' fitness/recreation centers fall short on multiple domains; informs campus recreation improvements.
[13]	2004	USA (fitness/ recreation environments)	Measurement development/ validation (AIMFREE)	Reliability and validity of accessibility instrument	Not directly assessed	Standardized tools enable systematic improvements in access	Not directly assessed	['Accessibility/ facilities (AIMFREE)']	Development and psychometric validation of AIMFREE instruments for assessing fitness and recreation environment accessibility.

Table 1. Continued

Authors	Year	Participants (country)	Data source	Outcome measure	Findings Q1 — Attitude to inclusion	Findings Q2 — Positive experiences	Findings Q3 — Negative experiences	Themes	Summary
[14]	2022	Not specified (physical education teachers)	Teacher attitude survey	Attitude scale scores by demographic variables	Generally positive attitudes with demographic differences	Not directly assessed	Barriers implied via resource and training needs	['Teacher attitudes/ competence', 'Physical activity levels/ surveillance']	Frontiers in Psychology survey of PE teachers' attitudes toward inclusion, noting generally moderate positivity with gender-related differences.
[15]	2024	Various (scoping review)	Scoping review	Mapping of teachers' perceptions and practices	Positive intentions constrained by implementation challenges	Targeted training associated with improved practices	Policy–practice gaps; limited resources and workload pressures	['Teacher attitudes/ competence']	Scoping review on teachers' perceptions and practices related to inclusion in PE; maps persistent implementation challenges and training needs.
[16]	2019	Various (systematic review)	Systematic review	Synthesis of teacher attitudes and student experiences	Attitudes moderate inclusion quality alongside resources and context	Supportive climate and resources linked to better participation	Insufficient support and negative peer dynamics reduce inclusion	['Teacher attitudes/ competence', 'Students' perspectives/ qualitative experience']	Systematic review combining teacher attitudes and student experiences of inclusion in PE; identifies attitudes, resources, and context as key moderators.
[17]	2023	Not specified (college students with intellectual disabilities)	Qualitative interviews/ focus groups	Narratives of PA engagement and social integration	Not directly assessed	Supportive relationships and accessible contexts enable sustained engagement	Environmental and social barriers hinder consistent participation	['Barriers/ facilitators (ecological)', 'Students' perspectives/ qualitative experience']	Qualitative study of college students with intellectual disabilities detailing lived PA engagement experiences and ecological barriers/ facilitators.

2 = fully addressed), with a maximum score of 20 points. Studies scoring 16–20 were classified as high quality, 12–15 as moderate quality, and below 12 as low quality. Discrepancies between reviewers were resolved through discussion, and consensus forms were archived to ensure transparency. All scoring sheets and methodological documentation are available as supplementary materials upon request.

Data Analysis and Synthesis

A qualitative thematic synthesis was applied to integrate findings from studies with diverse designs. The studies were grouped according to conceptual constructs such as teacher attitudes, accessibility, and psychosocial engagement, as well as participant characteristics, study design, and contextual outcomes related to inclusion and motivation. A comparative descriptive approach guided the synthesis, highlighting areas of convergence and divergence across findings. Consistent trends were interpreted as indicators of stable theoretical constructs, whereas discrepancies were viewed as reflections of contextual or methodological differences.

The interpretation was structured around three analytical questions: (1) What are the dominant attitudes toward inclusion? (2) What positive experiences of inclusion are reported? (3) What barriers or negative experiences limit participation? The synthesized findings connected micro-level experiences of students and teachers with macro-level determinants such as institutional policies and accessibility frameworks. The dataset ensured transparency and reproducibility throughout the analysis. All selection decisions were recorded, and any disagreements between reviewers were resolved through discussion and consensus.

Results

A total of 15 studies met all inclusion criteria and were included in the final synthesis. These publications represent diverse methodological approaches and geographical contexts, reflecting theoretical, empirical, and applied perspectives on inclusive physical culture in higher education. The analyzed studies addressed key dimensions such as teacher attitudes, accessibility, psychosocial engagement, and institutional practices. Table 1 summarizes the core characteristics and findings of the included studies, highlighting the main analytical constructs (Q1–Q3) related to attitudes toward inclusion, positive experiences, and barriers to participation.

The temporal and thematic distribution of the analyzed studies provides additional insight into the development of research on inclusive physical culture in higher education. Table 2 presents the number of publications grouped by five-year periods, illustrating the steady growth of scholarly attention from early conceptual works in the 2000s to a marked increase after 2016. Table 3 summarizes the thematic structure of the dataset, showing how research emphasis has evolved from theoretical and teacher-centered perspectives toward applied interventions, campus-based programs, and accessibility studies.

Table 2. Counts by Time Period

Period	Count
2000–2005	3
2006–2010	1
2011–2015	2
2016–2020	5
2021–2025	4

Table 3. Theme Counts

Theme	Count
Campus APA programs/interventions	7
Teacher attitudes/competence	5
Students' perspectives/qualitative experience	3
Accessibility/facilities (AIMFREE)	3
Physical activity levels/surveillance	3
Wheelchair/exercise RCTs/behavior change	2
Barriers/facilitators (ecological)	2
Frameworks/conceptual	1

The dataset included 15 publications from 2000 to 2024, covering a wide range of methodological approaches and participant groups relevant to inclusive physical culture in higher education. The materials comprised qualitative studies, cross-sectional surveys, campus intervention evaluations, facility audits, one randomized controlled trial, several scoping and systematic reviews, and one conceptual framework. The analyzed populations included university students with disabilities (Spain and other multi-context qualitative samples), autistic college students (campus intervention), adults who use wheelchairs (behavior-change trial adaptable to university contexts), physical education teachers (attitude surveys), and fitness or recreation facilities (accessibility audits).

The thematic synthesis integrated results from different study types and data sources to identify patterns related to attitudes, positive experiences, and barriers in inclusive physical culture. Attitudes toward inclusion were primarily examined in teacher-focused studies [14, 15, 16] and inferred from student reports on teacher behavior [2] as well as narrative syntheses addressing pedagogical determinants [1]. Positive experiences were reported in qualitative and intervention-based studies emphasizing peer support, autonomy, and

belonging [2, 4, 8, 17], while negative experiences reflected multi-level barriers, including limited accessibility, low program diversity, and persistent stigma [5, 6, 11, 12].

Across research designs, qualitative studies consistently highlighted belonging and supportive relationships as indicators of meaningful inclusion, whereas surveys and surveillance data revealed uneven adherence to physical activity guidelines and variability in teacher attitudes. Intervention programs demonstrated feasibility and psychosocial benefits of personalized, need-supportive approaches, while facility audits using AIMFREE identified correctable accessibility issues. Reviews and frameworks contributed an ecological understanding of inclusion, linking pedagogical, organizational, and environmental determinants [1, 3, 16].

The Social Ecological Model (SEM) was applied to illustrate the multilevel factors influencing inclusion in physical culture and physical activity among university students with disabilities (Table 4, Figure 2). The model integrates individual, interpersonal, organizational, community, and societal dimensions, showing how each level contributes to enabling or constraining participation.

Table 4. Factors Influencing Inclusion in Physical Culture and Physical Activity among University Students with Disabilities

SEM Level	Examples of Positive (+) Factors	Examples of Negative (−) Factors
Individual	Motivation, confidence, self-efficacy, perceived competence, autonomy, engagement	Low physical activity adherence, health limitations
Interpersonal	Teacher support, peer mentoring, social belonging, friendships	Negative peer dynamics, low teacher expectations
Organizational	Adapted programs, inclusive curriculum, facility accessibility, campus APA programs	Lack of training and resources, inflexible curricula, limited staff
Community	Local recreation facilities, inclusive clubs, community events	Accessibility gaps, inadequate infrastructure
Societal	Policy support, public awareness, cultural acceptance	Policy–practice gaps, social stigma, lack of governmental coordination

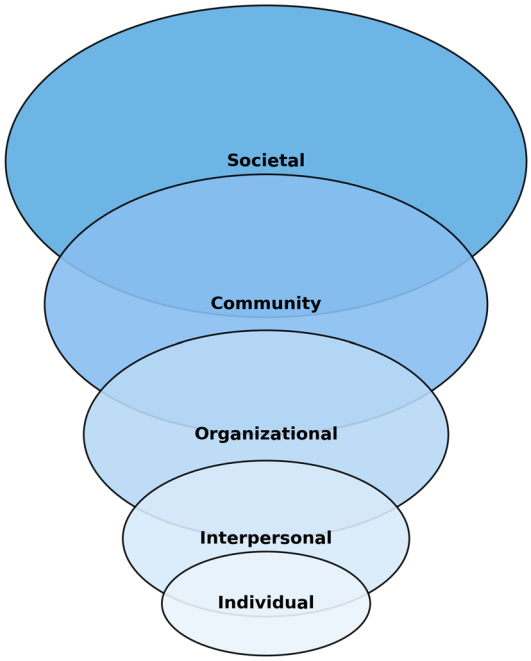

Figure 2. Levels of Factors Influencing Inclusion in Physical Culture, Sport, and Physical Activity within the Social Ecological Model (SEM)

Figure 2 illustrates the interconnected levels of the Social Ecological Model, each represented by an oval denoting a distinct yet interdependent layer of influence on inclusion.

At the Individual level, inclusion is supported by motivation, confidence, self-efficacy, and perceived competence, while barriers involve low adherence to physical activity and health limitations.

At the Interpersonal level, teacher support, peer mentoring, and social belonging encourage participation, whereas negative peer dynamics and low teacher expectations hinder it.

At the Organizational level, adapted programs, inclusive curricula, accessible facilities, and campus-based APA programs promote inclusion, while limited training, inflexible curricula, and staff shortages remain obstacles.

At the Community level, access to recreation facilities, inclusive clubs, and community events fosters engagement, although inadequate infrastructure and accessibility gaps restrict participation.

At the Societal level, supportive policies, public awareness, and cultural acceptance strengthen inclusion, whereas policy–practice gaps, stigma, and weak intersectoral coordination continue to impede progress.

Taken together, these findings show that inclusive physical culture relies on the dynamic interaction of individual motivation, supportive social relationships, institutional capacity, community resources, and societal commitment to

equality. The results further indicate that successful inclusion in university physical culture depends on teacher readiness, supportive environments, and accessible infrastructure. Positive outcomes occur when these elements align, while exclusion and inactivity persist where institutional capacity and accessibility are insufficient. These findings provide an empirical foundation for the subsequent discussion of pedagogical, environmental, and psychosocial mechanisms shaping inclusion in higher education.

Discussion

The main aim of this study was to synthesize and interpret theoretical, empirical, and applied evidence on inclusive physical culture for university students with disabilities, identifying factors that support or limit meaningful participation in higher education. Analysis of fifteen publications revealed three key dimensions of inclusion: teacher competence and attitudes, environmental accessibility, and psychosocial engagement through supportive programs. The findings show that effective inclusion depends on the integration of pedagogical responsiveness, infrastructural readiness, and a sense of social belonging, which together promote both participation in physical activity and psychological well-being. Although progress has been made through peer-mentored and adaptive activity programs, barriers remain, including limited accessibility, institutional resistance, and uneven teacher preparation. Within the wider context of inclusive education and rehabilitation, the results suggest that physical culture functions not only as a means of developing physical skills but also as a pathway to empowerment, health promotion, and social integration.

The synthesis of theoretical and empirical evidence offers a multidimensional view of inclusive physical culture in higher education. Foundational models such as the International Classification of Functioning, Disability and Health (ICF) [3] describe disability as an interaction between individual functioning and environmental conditions, a principle consistently supported by contemporary inclusion research. This perspective is reflected in Block and Obrusnikova's [1] comprehensive review, which identified teacher competence, curricular flexibility, and social context as essential for equitable participation. Consistent with these theoretical foundations, recent empirical studies have expanded the focus from individual adaptation to systemic and ecological inclusion, where institutional policies, facility accessibility, and interpersonal climate determine opportunities for engagement in physical activity.

A consistent theme across the reviewed literature is the decisive role of teacher attitudes and professional readiness. Studies involving physical education teachers [14, 15] show that successful inclusion is closely linked to instructors' confidence, prior training, and institutional support. However, positive attitudes alone do not ensure effective practice; without sufficient pedagogical preparation or structural backing, implementation gaps remain [16]. This pattern aligns with theoretical models of inclusive pedagogy [1], which view teacher competence as both a cognitive and relational construct involving empathy, differentiation, and adaptive instruction. The variation observed in teacher attitudes and competence indicates that inclusion is realized through practice rather than declaration, depending on professional culture, administrative commitment, and available resources.

In contrast to teacher-centered factors, student-centered and environmental perspectives reveal complementary dimensions of inclusion. Goodwin and Watkinson [2] and Chen et al. [17] show that for students with disabilities, the sense of inclusion depends less on formal accommodations and more on social belonging, recognition, and emotional security. Likewise, Liska et al. [4] and Todd et al. [8] demonstrate that campus-based adapted physical activity programs grounded in self-determination theory enhance motivation, confidence, and sustained engagement. These findings indicate that a supportive psychological environment, characterized by relatedness and encouragement, can mitigate material constraints and transform physical culture into a means of empowerment. However, large-scale surveys [5, 11] reveal that despite local successes, participation inequalities remain significant, with many university students with disabilities failing to meet physical activity recommendations. This imbalance points to persistent structural and systemic barriers, including inaccessible infrastructure [12] and limited institutional coordination, which continue to restrict full participation.

From a broader theoretical perspective, these findings support an ecological model of inclusion that connects micro-level pedagogical interactions with macro-level institutional structures. The positive effects of tailored, peer-mentored, and need-supportive interventions [4, 8] illustrate how enabling environments, supportive social networks, and adaptive teaching can bring the ICF's concept of functional participation into practice. In contrast, persistent environmental constraints [12, 13] highlight the partial implementation of accessibility standards, showing that formal compliance does not necessarily ensure meaningful inclusion. The gap between institutional policies and students' lived experiences therefore remains a defining challenge in contemporary higher education.

The pedagogical implications of these findings are noteworthy. Teacher education programs should

include structured training in adaptive methods, disability awareness, and inclusive design. Evidence from both empirical and theoretical studies shows that developing competence in these areas strengthens teacher self-efficacy and positively affects student motivation and participation. From a social perspective, inclusive physical culture extends beyond physical activity as a health outcome; it functions as a process of identity development, empowerment, and community integration. As demonstrated in qualitative and intervention research [2, 8, 17], inclusive participation shapes students' perceptions of their abilities, reduces stigma, and fosters mutual understanding among peers.

In summary, the convergence of theoretical and empirical evidence indicates that inclusive physical culture is most effective when grounded in an interactionist and ecological framework that integrates teacher competence, accessible infrastructure, and psychosocial empowerment. Variations among studies, particularly between structured institutional programs and low-resource contexts, reflect contextual differences rather than conceptual inconsistency. These findings emphasize the need for collaboration among educators, health professionals, and administrators to close the ongoing gap between the principles of inclusion and their implementation in higher education.

The present synthesis shows that inclusive physical culture for university students with disabilities is a multidimensional construct that integrates pedagogical, environmental, and psychosocial domains. The reviewed studies confirm that the quality of inclusion depends on the interaction between teacher competence, accessible institutional settings, and student motivation and belonging. Theoretical frameworks such as the ecological and interactionist perspectives [1, 3] offer a consistent basis for understanding these relationships, while current evidence highlights the need for systemic integration across educational and rehabilitative contexts. In practical terms, the findings indicate that inclusive physical culture supports not only physical development but also emotional well-being, autonomy, and social cohesion within academic environments. The study examines the relationship between theoretical approaches and practical implementation, highlighting how inclusive environments support participation and well-being of university students with disabilities.

Building upon this conceptual framework, the empirical evidence from recent studies further illustrates how inclusive educational models, physical activity interventions, and teacher training initiatives contribute to these multidimensional outcomes across different institutional and cultural contexts.

Building on this conceptual framework, recent empirical evidence demonstrates how inclusive educational models, physical activity interventions, and teacher training initiatives contribute to multidimensional outcomes across institutional and cultural contexts. Systematic reviews indicate that participation in physical activity promotes inclusion and social interaction among people with disabilities across a variety of settings [18, 19, 20].

The findings of this review confirm that inclusive physical culture in higher education supports both physical and psychosocial development among students with disabilities. Experimental implementations of inclusive elective physical education courses produced significant improvements in physical fitness, social adaptation, and motivation, confirming the effectiveness of adapted curricula [21, 22]. Similar results were reported in community-based and blended learning programs, which emphasized the importance of individualized instruction and accessible educational technologies for sustaining participation in physical activity [23].

At the same time, studies from the United States revealed ongoing disparities in access to physical activity opportunities for university students with disabilities, despite the recognized health and social benefits of participation [24, 25]. These results highlight the need for strong institutional commitment and targeted policy initiatives to ensure equal opportunities for engagement in physical culture and sport.

Psychological well-being and social inclusion are integral aspects of inclusive education. Physical activity–based learning models have been shown to enhance emotional balance and self-esteem among students with disabilities [26, 27]. Additional research indicates that teachers' readiness for inclusive practice depends largely on access to specialized training and professional support, including digital tools for inclusive education [28, 29]. These findings correspond with international evidence showing that teachers' attitudes and competence are decisive factors in achieving effective inclusion in physical education [19].

Cross-cultural research demonstrates that the effectiveness of inclusive approaches varies with local socio-economic conditions. Studies from Romania and other countries suggest that social and economic vulnerability exacerbates barriers to inclusion, whereas digital and extracurricular programs can help to mitigate them [30, 31]. Moreover, studies on peer interaction in inclusive physical education settings reveal generally positive attitudes of able-bodied students toward peers with disabilities, particularly among girls, emphasizing the importance of early socialization in inclusive environments [32].

Overall, the reviewed literature supports the view that inclusive physical culture should be

understood as an interdisciplinary and multi-level construct encompassing pedagogical, psychological, and institutional dimensions. Its success depends on coordinated efforts combining teacher competence, accessible infrastructure, and continuous social engagement of students with disabilities [18, 21, 23, 24, 28].

Ensuring continued progress in inclusion requires systematic evaluation of teacher training, accessibility policies, and institutional practices. Evidence from different research approaches contributes to the refinement of inclusion models that emphasize contextual adaptation, participation, and equity.

Limitations and Future Directions

This synthesis of literature on inclusive physical culture for university students with disabilities has several methodological and contextual limitations. First, it relied on secondary data from previously published studies, most of which used cross-sectional, descriptive, or qualitative designs. As a result, causal relationships and long-term effects of inclusive practices cannot be determined. Second, the geographical distribution of research is uneven, with most studies conducted in high-income regions (Europe and North America) and limited representation from developing or transitional countries, where infrastructural and policy conditions may differ substantially. Third, the conceptual diversity of "inclusion" across disciplines complicates synthesis, as terminologies and operational definitions often reflect educational, rehabilitative, or policy frameworks rather than a unified theoretical model. In addition, variation in instruments used to assess physical activity, accessibility, and psychosocial outcomes restricts comparability and generalization. Finally, the absence of quantitative meta-analytical data limits the ability to assess the magnitude of effects across studies.

Future research should focus on methodological improvement and diversification. Large-scale, longitudinal, and experimental designs are needed to examine the long-term impacts of inclusive physical culture programs on physical, psychological, and academic outcomes. Cross-cultural research would enhance current understanding by showing how sociocultural norms, economic conditions, and policy systems influence inclusion. Standardized evaluation tools are also needed to measure constructs such as teacher competence, environmental accessibility, and student engagement, enabling consistent comparison across studies. Interdisciplinary collaboration among education, rehabilitation, psychology, and health promotion specialists can help develop comprehensive intervention models. Innovation through digital technologies, including virtual adaptive physical education platforms and wearable devices for monitoring participation, may expand access and personalization. Partnerships between universities, disability organizations, and policymakers should work toward embedding inclusive practices into campus culture as a core component rather than a supplementary initiative.

Addressing these methodological, theoretical, and practical limitations will strengthen the evidence base and improve the translation of inclusive physical culture principles into sustainable educational and rehabilitative practice. Continued research in diverse contexts will ensure that inclusion in higher education evolves as a dynamic and equitable process that promotes health, empowerment, and social participation for all students.

Conclusions

This study synthesized theoretical foundations and empirical evidence to examine the structure, determinants, and outcomes of inclusive physical culture for university students with disabilities. The findings indicate that effective inclusion in higher education depends on the interaction of pedagogical competence, accessible environments, and psychosocial engagement, each contributing to the creation of equitable and empowering activity settings. The integration of ecological and self-determination perspectives shows that inclusion in physical culture is not merely a pedagogical responsibility but a transformative process that fosters autonomy, confidence, and social belonging among students with diverse abilities.

Theoretically, the study reinforces the ecological and interactionist interpretation of inclusion as a multi-level construct shaped by personal, social, and institutional factors. Practically, it highlights the importance of teacher training, peer-supported adaptive programs, and ongoing accessibility evaluation to ensure sustained participation. Socially, inclusive physical culture serves as a mechanism for rehabilitation and community development, promoting health equity, educational justice, and social cohesion.

In essence, inclusive physical culture represents a key element of modern higher education, linking physical activity with human development, empathy, and collective well-being. By embedding inclusive practices within educational and institutional systems, universities can move beyond accommodation toward genuine participation, ensuring that every student experiences physical culture as a source of empowerment and shared growth.

Conflict of interests

The authors declare that there is no conflict of interests.

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REVIEW ARTICLE

Inclusive physical activity for war affected adolescents: 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: Armed conflict disrupts education, social interaction, and opportunities for physical development, adversely affecting adolescents' physical and psychosocial functioning. In post-conflict and trauma-affected contexts, inclusive physical activity is discussed as an approach that integrates rehabilitation, educational adaptation, and social participation. The aim of this study was to examine the conceptual foundations, research approaches, and reported outcomes of inclusive physical activity programs for adolescents affected by armed conflict.

Material and Methods: A systematic review was conducted in accordance with PRISMA guidelines using the Web of Science, Scopus, and MedLine (via PubMed) databases. Publications from 2013 to 2025 were considered. The initial search identified 647 records, of which 22 peer-reviewed studies met the inclusion criteria and were included in the final synthesis. Data extraction and coding were performed independently by two reviewers following a structured protocol. Each study was classified into one of three analytical categories: fundamental (n = 6), contemporary (n = 9), or applied (n = 7). Quantitative characteristics, including publication year, study design, and thematic focus, were summarized using descriptive analysis. Qualitative synthesis was conducted using a thematic approach focusing on inclusion mechanisms, psychosocial outcomes, and contextual barriers. This mixed analytical strategy enabled integration of numerical patterns and thematic findings.

Results: Among the 22 included studies, research most frequently focused on rehabilitation-related outcomes (45%), followed by psychological dimensions such as emotional regulation and motivation (32%), educational aspects (18%), and sport-related contexts (5%). Observational designs were predominant (59%), while qualitative approaches accounted for 18%, cross-sectional and survey-based studies for 9% each, and mixed-methods designs for 5%. Reported outcomes were clustered around physical functioning, emotional regulation, and participation. Across studies, frequently identified mechanisms included adaptive pedagogical strategies, structured activity formats, peer interaction, and self-regulation practices. Rehabilitation-focused interventions reported changes in functional capacity, mobility, and stress-related responses. Education-oriented interventions addressed motivation and elements of teacher practice, while community-based and outreach initiatives examined social belonging, resilience-related processes, and continuity of participation.

Conclusions: Inclusive physical activity can be described as a framework that addresses physical, psychological, and social dimensions of adolescent recovery. The synthesized evidence indicates associations with educational inclusion and resilience-related processes. It also shows links to social participation in post-conflict contexts. In this way, inclusive physical activity is situated within broader processes of social reintegration.

Keywords: inclusive physical activity, adaptive physical education, adolescents, war trauma, rehabilitation, social inclusion, resilience.

Introduction

Inclusive physical activity is considered within the context of post-conflict recovery and social reintegration among adolescents affected by war. Many young people experience displacement, psychological stress, or physical limitations associated with armed conflict. Recovery in such contexts involves interconnected processes of psychological adjustment, social adaptation, and physical rehabilitation. Inclusive physical activity is examined in published research as an approach that supports functional abilities and motor skills within these processes. It is also associated with psychosocial well-being and forms of community participation during recovery.

Foundational scholarship describes inclusive physical activity for conflict-affected adolescents within integrative models that link motor rehabilitation, psychosocial adaptation, and social

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participation. These approaches are commonly based on a biopsychosocial perspective combined with ecological and trauma-informed principles. Within this framework, physical activity is viewed as a means of functional recovery and as a structured setting that supports safety, agency, and peer interaction [1]. Conceptual models often propose a staged progression from protected, low-intensity engagement to community-based activities. This progression is guided by individualized goals and environmental adaptations intended to reduce activity limitations and participation barriers [2]. Recent theoretical reviews also describe the integration of inclusive physical activity into public health and education systems. In this context, adaptive exercise is aligned with mental health support and school reintegration, alongside outcomes related to motor function, self-efficacy, and social participation [3].

Other studies describe three developments related to inclusive physical activity for adolescents affected by armed conflict. First, contemporary frameworks extend inclusion beyond impairment-focused adaptation and incorporate trauma- and resilience-informed approaches. These approaches integrate psychosocial elements, including peer support, self-efficacy–related strategies, and gradual engagement in group activities within physical education and community settings [4, 5]. Second, cross-sector models that connect schools, primary healthcare, and local sport or rehabilitation services are examined in relation to activity continuity during displacement and return. These models describe the use of scalable procedures, digital tools, and family involvement to address participation discontinuity [4, 6]. Third, recent evidence highlights the role of implementation conditions. Factors such as teacher preparation, safe-space organization, and flexible assessment practices are associated with sustained participation and reduced avoidance among adolescents experiencing displacement-related stress [7]. Overall, the reviewed studies indicate that inclusion practices are more consistent when adaptive exercise progression is combined with psychosocial components and coordinated service structures.

Applied studies describe how inclusive physical activity is implemented in practice with conflict-affected adolescents. Program designs commonly include adaptable session structures, low entry thresholds, and gradual load progression. These elements are adjusted to changes in physical capacity and stress levels. Community- and school-based programs describe the use of structured peer support, consistent routines, and targeted teacher or coach preparation. These components are associated with session attendance and perceived safety during participation [8]. Intervention studies also report the feasibility of multi-component protocols. Such protocols combine aerobic and strength exercises with self-regulation techniques, including breathing, grounding, and brief reflective tasks. Reported outcomes include changes in functional capacity, self-efficacy, and willingness to engage in group activity [9]. Program-level analyses highlight the role of continuity of support through referral links between schools, rehabilitation services, and local sports organizations. Simple monitoring tools, such as session records and brief well-being measures, are used to guide progression and address participation disruption during displacement or return [10]. Overall, these studies identify operational factors related to staff preparation, peer involvement, and the integration of psychosocial elements within physical activity programs.

Armed conflict disrupts public health systems and affects psychosocial and physical development, particularly among children and adolescents. Post-war recovery therefore involves strategies that link rehabilitation, education, and social reintegration through inclusive physical and psychosocial approaches. Recent research addresses resilience, trauma recovery, and health reconstruction in post-conflict settings. Kelmendi [11] describes resilience as a multidimensional process shaped by interactions between individual psychological adaptation and supporting social systems in youth and communities exposed to prolonged violence. Murphy [12] provides meta-analytic evidence of long-term psychological and social consequences of conflict-related violence and discusses the need for integrated interventions that connect mental health, education, and physical rehabilitation. Health sciences research extends this perspective to systemic recovery challenges. Muvaffak [13] reports that damage to health infrastructure during and after armed conflict disrupts continuity of care and limits access to rehabilitation services, as observed in post-conflict Syria. Wild [14] synthesizes evidence on coordination between humanitarian and emergency response systems and describes integrated models that combine medical care, psychosocial support, and community-based rehabilitation for survivors of explosive violence.

Together, the reviewed studies present a shared perspective that post-conflict recovery involves the restoration of physical functioning alongside social participation. In this context, inclusive physical activity is discussed as an approach that links rehabilitation with educational processes and supports participation among adolescents affected by war. Inclusive physical activity is therefore considered not only as structured exercise but also as a component of broader recovery processes that involve health, community engagement, and social reintegration.

Analysis of the literature indicates that inclusive physical activity grounded in biopsychosocial and trauma-informed principles is described

as addressing both rehabilitation-related and psychosocial dimensions. Studies report that the combination of adaptive physical education, psychosocial support, and opportunities for community participation is associated with the restoration of functional skills and renewed engagement in physical activity. At the same time, the literature points to ongoing challenges in conflict-affected settings, including infrastructure constraints, limited professional training, and issues related to program sustainability. These factors indicate the need for further research focused on context-sensitive and evidence-based models of inclusive physical activity.

The aim of this study was to examine the conceptual foundations, research approaches, and reported outcomes of inclusive physical activity programs for adolescents affected by armed conflict.

Materials and Methods

Information Sources and Search Strategy

Inclusive physical activity is considered within the context of post-conflict recovery and social reintegration among adolescents affected by war. Many young people experience displacement, psychological stress, or physical limitations related to armed conflict. Recovery in such contexts involves interconnected processes of psychological adjustment, social adaptation, and physical rehabilitation. Inclusive physical activity is described as an approach that supports functional abilities and motor skills within these processes. It is also associated with psychosocial well-being and forms of community participation during recovery.

The search covered publications from 2013 to 2025 and was conducted in accordance with the PRISMA guidelines. Predefined keyword combinations related to inclusive physical activity, adolescence, conflict, and psychosocial outcomes were applied using Boolean operators.

Eligible studies were peer-reviewed journal articles available in full text and published in English. Inclusion criteria comprised empirical studies, theoretical analyses, and systematic reviews involving adolescents aged 10–19 and reporting physical, psychosocial, or educational outcomes related to inclusion. Non-peer-reviewed materials, studies outside the scope of physical education or rehabilitation, and research focused exclusively on adult populations were excluded.

The initial search yielded 647 records (Web of Science, n = 198; Scopus, n = 445; PubMed, n = 4). After duplicate removal, 503 unique records were screened, of which 341 were excluded based on topical or population-related criteria. Full-text assessment was conducted for 162 articles, resulting in 22 studies included in the final synthesis. Study selection and screening were performed independently by two reviewers. The included studies were categorized as fundamental (n = 6), contemporary (n = 9), or applied (n = 7), in line with the analytical framework of the review. Figure 1 summarizes the study selection process.

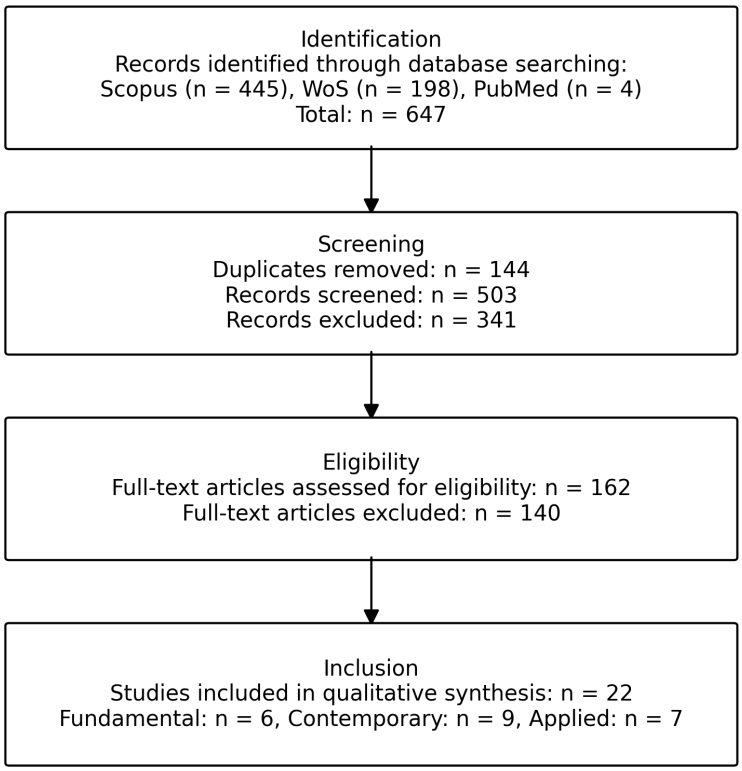

Figure 1. PRISMA Flow Diagram

Data Extraction and Coding

Data extraction was conducted for the 22 included studies using a standardized protocol applied independently by two reviewers with expertise in inclusive physical education and rehabilitation. For each study, bibliographic and methodological characteristics were recorded, including publication year, country, study design, target population, intervention type, and reported outcomes. Outcomes were grouped into physical, psychological, and social domains, and contextual information related to setting and professional preparation was also documented.

Data coding followed the analytical framework of the review, with each study assigned to one of three categories and variables coded numerically or thematically as appropriate. Coding reliability was confirmed through independent comparison and consensus, with high inter-rater agreement (Cohen's $\kappa = 0.87$). The finalized dataset was verified for completeness and internal consistency prior to quality assessment and synthesis.

Quality Assessment

The methodological quality and potential risk of bias of the 22 included studies were evaluated using a structured appraisal procedure adapted to different study designs. Each study was independently assessed by two reviewers who also participated in data extraction. The appraisal addressed key aspects of study quality, including sampling adequacy, clarity of intervention description, data collection procedures, outcome measurement, and coherence between evidence and conclusions.

A three-level classification system was used to summarize study quality. Studies meeting at least 80% of the applicable criteria were classified as high quality, those meeting 60–79% as moderate quality, and those below 60% as low quality. Disagreements between reviewers were resolved through discussion and consensus. Inter-rater agreement was high (Cohen's $\kappa = 0.87$). Based on this assessment, 15 studies (68%) were classified as high quality, 6 studies (27%) as moderate quality, and 1 study (5%) as low quality.

Data Analysis and Synthesis

The analysis combined quantitative and qualitative procedures to synthesize evidence on inclusive physical activity for adolescents affected by armed conflict. This mixed approach allowed descriptive summarization of study characteristics alongside structured integration of conceptual and contextual findings.

Descriptive analysis was used to examine the distribution of key study attributes across the 22 included publications, including publication year, study design, participant characteristics, and intervention type. Frequency distributions and temporal patterns were calculated to summarize research trends in inclusive physical activity and rehabilitation within conflict related contexts (Figures 2 and 3).

Qualitative synthesis was conducted using an inductive thematic approach. Full text data and extracted variables related to inclusion mechanisms,

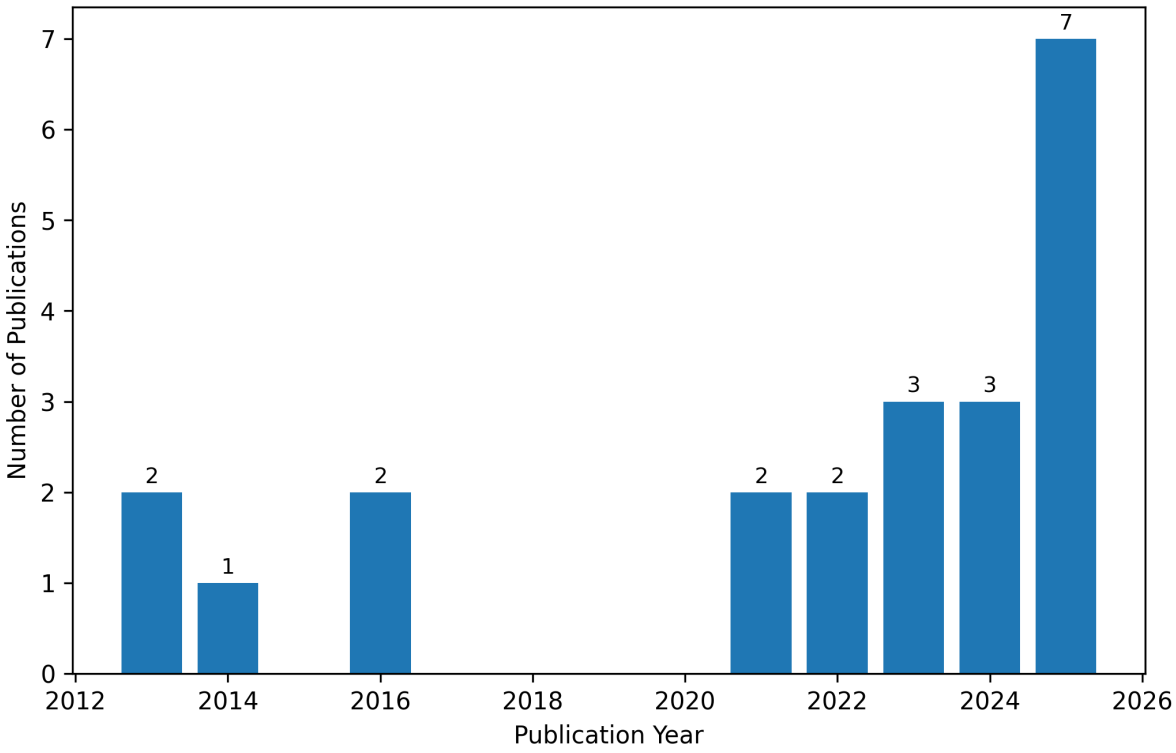

Figure 2. Temporal Distribution of Publications (2013–2025)

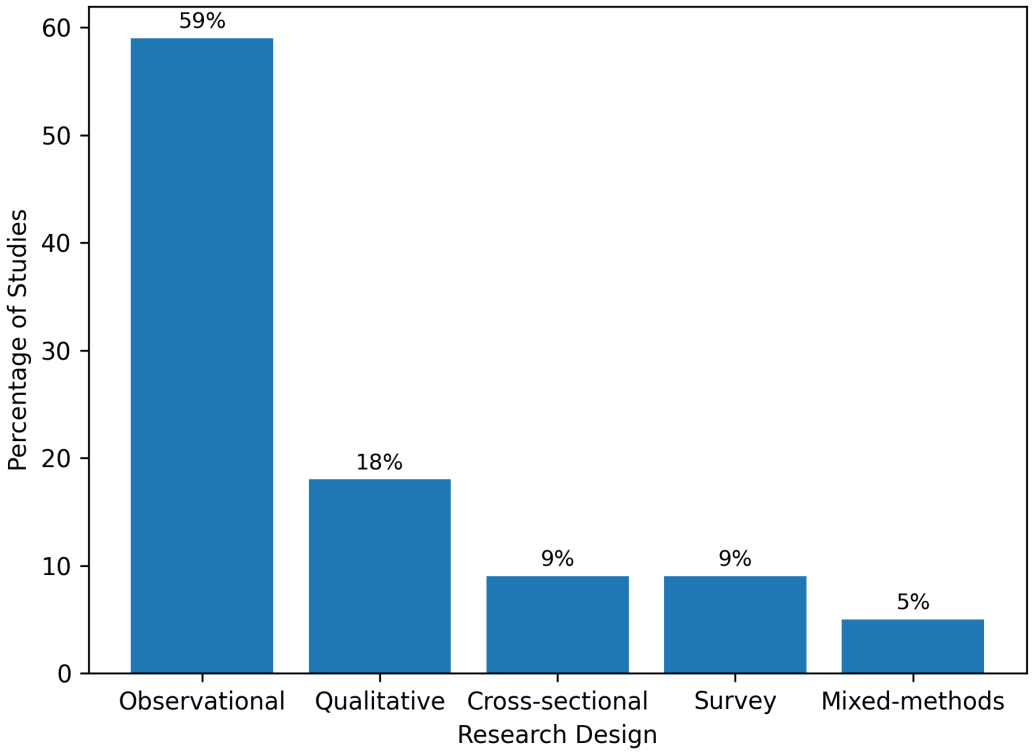

Figure 3. Distribution of Studies by Research Design

psychosocial outcomes, pedagogical strategies, and participation barriers were coded iteratively. Identified themes were organized into three analytical categories, fundamental, contemporary, and applied, to capture recurring patterns and conceptual relationships across studies.

All analytical procedures were performed independently by two researchers and subsequently cross checked to ensure consistency. Quantitative and qualitative findings were integrated through narrative synthesis to examine relationships between numerical distributions and thematic patterns.

Study Design

This study was designed as a systematic review. The review process consisted of sequential stages including literature identification, screening, eligibility assessment, and final inclusion of studies. Eligible publications were classified by study design type, geographical context, participant characteristics, intervention setting, and thematic focus to support structured synthesis. Study designs were recorded as observational, qualitative, cross-sectional, survey-based, or mixed-methods. Participant information included age range and sample size where reported, with adolescents defined as individuals aged 10–19 years. Study settings were categorized as educational, rehabilitation or clinical, community or outreach, or unspecified. Each included study was additionally assigned to one thematic category reflecting its primary focus, namely rehabilitation, psychology, education, or sport. Quality appraisal results were used to describe the methodological profile of the included evidence but were not used to exclude studies.

Results

Detailed characteristics of the included studies, including publication year, study design, sample characteristics, and reported outcomes, are summarized in Table 1.

The main findings can be grouped into five thematic areas.

- *Rehabilitation-focused.* Rehabilitation-oriented studies describe two interconnected pathways: gradual recovery of physical function and psychosocial stabilization. Programs combining structured activity with predictable routines, brief self-regulation elements, and peer support are associated with reduced stress-related responses and improved engagement. These approaches appear to support re-entry into group activity after displacement or trauma and are linked to lower dropout rates and more stable participation [2, 15, 16].
- *Education-focused.* School-based evidence highlights the role of inclusive pedagogy, including task differentiation, flexible assessment, and planned peer interaction. Teacher preparedness in trauma-informed practices and adaptive progression is consistently linked to motivation and attendance. Qualitative findings indicate higher self-efficacy and participation when educators co-design activities with students and integrate simple regulation strategies, alongside reported

Table 1. Characteristics of Included Studies.

No	Country/ Region	Study Design	Participants (Age, N)	Setting/ Context	Aim/ Objectives	Type of Inclusion / Intervention	Analytical Group	Duration	Measured Outcomes	Main Results	Thematic Category	Quality Rating	Notes
[1]	Not specified	Observational	Adolescents (age not specified; N not specified)	School-based	To review psychosocial and mental health interventions for conflict-affected youth	Post-conflict psychosocial rehabilitation	Rehabilitation-focused	Not specified	Health, mental health	Limited evidence on intervention effectiveness reported	Rehabilitation	Moderate	Reviews psychosocial and mental health interventions
[2]	Not specified	Observational	Adolescents (age not specified; N not specified)	School-based / health services	To examine service delivery models for pediatric concussion and mild traumatic brain injury	Rehabilitation-oriented health services	Rehabilitation-focused	Not specified	Health, rehabilitation	Limited evaluation of service delivery models reported	Rehabilitation	Moderate	Addresses rehabilitation and inclusion in adaptive care models
[8]	Not specified	Observational	Adolescents (age not specified; N not specified)	Rehabilitation / clinical	To explore factors influencing inclusive physical activity	Rehabilitation / therapy program	Rehabilitation-focused	12 weeks	Motivation, participation, rehabilitation	Engagement described as multifaceted beyond enjoyment	Rehabilitation	Moderate	Examines complexity of participation in rehabilitation contexts
[15]	Not specified	Cross-sectional	Adolescents (8–13 yrs; N not specified)	School-based	To identify determinants of sport dropout	Post-conflict / reintegration-oriented activity	Rehabilitation-focused	1 year	Participation, stress	High dropout associated with psychosocial factors	Psychology	Moderate	Focus on resilience, stress, and motivation
[16]	Not specified	Observational	Adolescents (age not specified; n = 4)	Rehabilitation / clinical	To assess the effects of ATCS on behavioural, clinical, and patient-related outcomes	Post-conflict / rehabilitation-oriented intervention	Rehabilitation-focused	6 months	Health, performance, stress	Reported outcomes varied across conditions	Education	Moderate	Focus on inclusive education and professional practice

Table 1. Continued

No	Country/ Region	Study Design	Participants (Age, N)	Setting/ Context	Aim/ Objectives	Type of Inclusion / Intervention	Analytical Group	Duration	Measured Outcomes	Main Results	Thematic Category	Quality Rating	Notes
[17]	UK	Qualitative	Children and adolescents (2–17 yrs; N not specified)	School-based	To examine parents' perceptions of electronic device use for physical activity	Technology-supported physical activity	Rehabilitation-focused	1 year	Health, motivation	Positive perceptions of device-supported physical activity reported	Education	Moderate	Addresses digital tools for physical activity in educational contexts
[18]	Not specified	Observational	Children and adolescents (5–18 yrs; n = 6812)	School-based	To assess the effects of summer holiday programs on mental health and social-emotional outcomes	Program-based psychosocial support	Rehabilitation-focused	1 year	Health, stress	Improvements in mental health and social-emotional outcomes reported	Education	Moderate	Examines non-academic outcomes of structured activity programs
[19]	Not specified	Observational	Adolescents (10–17 yrs; N not specified)	Community / outreach	To map evidence on peer support interventions for youth prevention programs	Peer support–based psychosocial intervention	Rehabilitation-focused	1 year	Health	Evidence and contextual use of peer support interventions summarized	Rehabilitation	Moderate	Reviews peer support approaches in community settings
[20]	Not specified	Mixed-methods	Adolescents (9–16 yrs; N not specified)	Rehabilitation / clinical	To synthesize evidence on effects and experiences of leisure-time physical activity	Training / exercise intervention	Exercise-focused	Not specified	Health	Effects on positive mental health varied by activity type and outcome	Psychology	Moderate	Examines leisure-time physical activity and mental health outcomes
[21]	Not specified	Observational	Adolescents (age not specified; N not specified)	Rehabilitation / clinical	To review clinical practice guidelines for treating child and adolescent obesity	Training / exercise intervention	Exercise-focused	Not specified	Health	Variability and gaps identified across obesity treatment guidelines	Psychology	Moderate	Reviews guideline-based approaches relevant to clinical rehabilitation

Table 1. Continued

No	Country/ Region	Study Design	Participants (Age, N)	Setting/ Context	Aim/ Objectives	Type of Inclusion / Intervention	Analytical Group	Duration	Measured Outcomes	Main Results	Thematic Category	Quality Rating	Notes
[22]	Not specified	Qualitative	Children and adolescents (<18 yrs; N not specified)	School-based / post-conflict	To review quantitative research on psychosocial adjustment and mental health among conflict-associated children	Post-conflict psychosocial rehabilitation	Rehabilitation-focused	1 year	Health	Studies varied in quality according to SAQOR criteria	Psychology	Moderate	Reviews mental health outcomes among conflict-affected youth
[23]	USA	Qualitative	Adolescents (age not specified; n = 65)	Not specified	To describe experiences of children in military families affected by parental PTSD	Psychosocial support in post-conflict contexts	Rehabilitation-focused	Not specified	Stress	Family stress and psychosocial impacts described across thematic categories	Rehabilitation	Moderate	Examines family-related psychosocial effects relevant to rehabilitation
[24]	Not specified	Observational	Adolescents (age not specified; N not specified)	School-based / clinical	To assess the effects of psychological therapies on PTSD-related outcomes after trauma	Trauma-focused psychological intervention	Rehabilitation-focused	1 year	Health, stress	Some evidence reported for PTSD symptom reduction	Rehabilitation	Moderate	Reviews psychological therapies relevant to post-trauma rehabilitation
[25]	Not specified	Observational	Adolescents (age not specified; N not specified)	Not specified	To examine the effects of exercise across health-related outcomes	Rehabilitation-oriented exercise intervention	Rehabilitation-focused	Not specified	Health	Inconsistent findings reported across existing evidence	Psychology	Moderate	Addresses evidence synthesis and outcome variability
[26]	Not specified	Observational	Adolescents (age not specified; N not specified)	Not specified	To describe participation in social and physical leisure activities and related determinants	Rehabilitation-oriented participation support	Rehabilitation-focused	Not specified	Health, participation	Participation patterns and determinants summarized	Rehabilitation	Moderate	Examines leisure participation and inclusion factors

Table 1. Continued

No	Country/ Region	Study Design	Participants (Age, N)	Setting/ Context	Aim/ Objectives	Type of Inclusion / Intervention	Analytical Group	Duration	Measured Outcomes	Main Results	Thematic Category	Quality Rating	Notes
[27]	Not specified	Observational	Adolescents and young adults (age not specified; n = 4519)	Rehabilitation / clinical	To examine associations between age, physical activity patterns, pubertal timing, BMI, and ACL injury risk	Injury risk assessment in rehabilitation contexts	Rehabilitation-focused	18 months	Rehabilitation	Higher ACL injury risk associated with age, vigorous activity, overweight/ obesity, and advanced pubertal stage	Rehabilitation	Moderate	Examines injury risk factors relevant to rehabilitation practice
[28]	Not specified	Observational	Youth (13–17 yrs; N not specified)	Not specified	To examine associations between family functioning domains and youth physical activity	Family-context–related physical activity	Rehabilitation-focused	Not specified	Health	Small associations reported between physical activity and family cohesion, communication, and conflict	Sport	Moderate	Examines family context factors related to youth physical activity
[29]	Not specified	Qualitative	Adolescents (10–19 yrs; N not specified)	School-based	To explore factors influencing inclusive physical activity	Post-conflict / inclusion-oriented physical activity	Rehabilitation-focused	1 year	Not specified	Factors related to inclusion in physical activity described	Psychology	Moderate	Examines psychosocial factors influencing inclusion
[30]	Not specified	Survey	Adolescents (age not specified; n = 89)	Rehabilitation centers (educational context)	To examine mental health dimensions among incarcerated youth in rehabilitation settings	Rehabilitation / therapy program	Rehabilitation-focused	Not specified	Health, rehabilitation, stress	Mental health vulnerabilities reported among incarcerated youth	Rehabilitation	Moderate	Focuses on mental health and inclusion in rehabilitation contexts

Table 1. Continued

No	Country/ Region	Study Design	Participants (Age, N)	Setting/ Context	Aim/ Objectives	Type of Inclusion / Intervention	Analytical Group	Duration	Measured Outcomes	Main Results	Thematic Category	Quality Rating	Notes
[31]	USA	Cross-sectional	Adolescents (12–17 yrs; N not specified)	School-based	To examine associations between social network use, messaging apps, addictive behaviors, and sleep problems	Psychosocial and digital behavior–related factors	Rehabilitation-focused	1 year	Health	Associations reported between social network use and sleep-related problems	Education	Moderate	Examines digital behavior and well-being in educational contexts
[32]	Canada	Observational	Adolescents (age not specified; N not specified)	Rehabilitation / clinical	To review the effects of mental health treatments delivered in youth-friendly and integrated youth service clinics	Mental health–oriented rehabilitation services	Rehabilitation-focused	1 year	Health	Study protocol describing planned synthesis and dissemination	Psychology	Moderate	Protocol focusing on mental health services for adolescents
[33]	Not specified	Survey	Adolescents (age not specified; n = 14)	School-based	To examine associations between sport-related concussion and violence-related behaviors	Rehabilitation-oriented school support	Rehabilitation-focused	12 months	Not specified	Associations reported between concussion history and behavioral outcomes	Rehabilitation	Moderate	Addresses psychosocial and behavioral aspects in school contexts

changes in motivation and stress indicators [16, 17, 18].

- *Community-focused.* Community and outreach programs address participation continuity beyond school settings. Logistical supports, caregiver involvement, and informal peer networks are described as factors associated with sustained engagement. Although only one study met explicit community-based criteria, it reported contextual and health-related changes linked to accessible programming and local resource coordination, while also noting challenges related to staffing and safe space availability [19].
- *Exercise/training-focused.* Studies emphasizing exercise prescription report higher adherence when programs use low-entry thresholds, brief work intervals, and feedback on progress. Motivation is commonly linked to perceived competence and peer encouragement. Reported outcomes include changes in health, physical performance, and affect, particularly when exercise intensity is adjusted and alternative tasks are available during periods of symptom fluctuation [20, 21].
- *Cross-cutting themes.* Across categories, three recurring themes emerge: inclusivity through task and environmental adaptation; psychosocial well-being, including stress regulation and safety cues; and equity in access for displaced or trauma-affected adolescents. The synthesis suggests that inclusive physical activity functions as a coordinated approach that links physical progression with predictable structure and relational support across educational, rehabilitation, and, where available, community contexts.

The methodological quality of the 22 studies included in the synthesis was classified as moderate. All studies met baseline requirements for validity and reporting transparency, although methodological approaches varied and longitudinal designs were limited. Most investigations reported clearly defined objectives, appropriate sampling strategies, and coherent analytical procedures. Mixed-methods designs were frequently used, allowing the documentation of both measurable outcomes, such as functional recovery, activity participation, and psychological adaptation, and qualitative aspects of inclusion. Several studies also employed multi-site or multi-country designs, contributing to contextual diversity within the dataset.

Discussion

The aim of this study was to examine theoretical, methodological, and applied aspects of inclusive physical activity programs for adolescents affected by armed conflict, with attention to physical rehabilitation, social participation, and psychological adaptation. The synthesized findings indicate that inclusive physical activity is associated with changes in motor function, stress regulation, and motivation among conflict-affected adolescents. Rehabilitation-oriented interventions were linked to functional and emotional outcomes. Education-based programs addressed participation and aspects of teacher preparedness. Community-focused initiatives were reported less frequently but described continuity of participation and peer-related support within local contexts.

These findings align with the view of inclusive physical activity as a multidimensional system that integrates rehabilitative, psychosocial, and educational components. In post-conflict contexts, inclusive physical activity is discussed not only as structured exercise but also as a context for restoring safety, self-efficacy, and social participation among adolescents. The convergence of evidence across different study designs supports theoretical models that conceptualize physical inclusion as part of broader recovery processes. Previous research similarly emphasizes that post-conflict recovery depends on the coordinated integration of physical rehabilitation, psychosocial support, and institutional collaboration across education and health sectors [11, 12, 13, 14]. From this perspective, inclusive physical activity contributes to recovery by linking functional health restoration with social reintegration and resilience-related processes.

Evidence highlights the interrelated nature of psychological recovery, physical activity, and social reintegration among adolescents affected by conflict and adversity. Across contexts, studies converge on the view that resilience and inclusion are not achieved through isolated interventions but require coordinated strategies linking mental health support, family involvement, and accessible opportunities for physical activity. Within this framework, the reviewed literature can be grouped into several thematic areas.

Psychosocial Rehabilitation and Trauma Recovery. Studies consistently emphasize the role of psychosocial interventions in supporting adolescents exposed to violence, displacement, or family-related trauma [22, 23, 24]. Recovery-oriented programs commonly combine mental health support with community and family engagement. Evidence indicates that adolescents affected by war-related stress benefit from approaches that integrate psychological care with structured physical or social activity. Such models are associated with improved emotional regulation, self-efficacy, and social participation, which are frequently described as components of post-conflict resilience.

Physical Activity, Health, and Cognitive Function. Research examining physical activity and health outcomes reports associations with psychological well-being, cognitive functioning, and general

health among children and adolescents [25, 26, 27]. Structured exercise and recreational programs are described as beneficial across diverse groups, including youth with chronic conditions. When safety measures and task adaptations are applied, participation in physical activity is also discussed as a protective factor, supporting both rehabilitative and preventive health processes.

Family, Social, and Environmental Factors. Several studies address the relationship between family functioning, social support, and adolescent health-related behaviors [28, 29, 30]. Supportive family communication and stable social networks are associated with better emotional adjustment and higher levels of physical activity. In contrast, family instability and social disruption are linked to behavioral and mental health challenges, particularly in post-conflict settings. These findings support the inclusion of family-oriented components within inclusive education and rehabilitation frameworks.

Digital Health, Prevention, and Systemic Approaches. Recent literature explores the use of digital tools and preventive systems to support adolescent well-being [16, 31, 32, 33]. Technology-assisted interventions are described as expanding access to support and facilitating engagement. At the same time, excessive digital use is associated with sleep-related and behavioral difficulties, indicating the need for balanced implementation. The reviewed studies suggest that digital solutions are most effective when combined with in-person inclusion practices and appropriate guidance.

Taken together, the evidence indicates that adolescent recovery and inclusion are shaped by the interaction of psychosocial, physical, family, and contextual factors. In post-conflict settings, the findings support integrated approaches that link health, education, and community systems through inclusive and context-sensitive physical activity.

The synthesis of theoretical and empirical evidence presents a multifaceted view of inclusive physical activity as a component of rehabilitation, psychosocial recovery, and educational reintegration among adolescents affected by armed conflict. Within this framework, three analytical perspectives can be distinguished: rehabilitation-focused, education-focused, and community-focused.

*Rehabilitation-focusedperspective.*Biopsychosocial rehabilitation theories [1] and adaptive activity models [2] propose that structured physical activity supports post-traumatic adaptation by linking physical reactivation with emotional regulation. The present synthesis is consistent with these assumptions. Empirical studies report that inclusive rehabilitation programs combining gradual motor progression with stress-regulation components are associated with reduced anxiety and increased participation [15, 20, 22, 24, 25]. Differences across studies relate mainly to outcome emphasis, with some focusing on physiological indicators and others on subjective well-being and social re-engagement [26, 27]. Across designs, rehabilitation-oriented inclusion is linked to improvements in physical function and perceived safety in group settings, aligning with theoretical models of adaptive physical culture [3, 23, 30].

Education-focused perspective. Inclusive pedagogy frameworks position schools as central environments for psychosocial reconstruction. Recent evidence highlights the role of teacher competence, empathy, and adaptive instructional design in supporting participation of trauma-affected students in physical education [17, 18, 22, 24, 32]. In line with theoretical perspectives on inclusive education [34], engagement appears higher when educators combine structured routines with flexibility and integrate socioemotional elements into lessons [28, 29]. At the same time, variation in teacher preparation contributes to uneven outcomes across settings. Some schools implement differentiated tasks and peer support effectively, while others face constraints related to limited training and resources [23, 30]. These findings point to the relevance of sustained professional development and institutional support for inclusive practice [26, 33].

Although community-based programs are less frequently examined, available studies indicate that local activity networks contribute to sustained engagement beyond school or clinical settings [6, 19]. Youth centers, outreach sports clubs, and rehabilitation camps emphasize peer support and psychosocial safety rather than performance outcomes [22, 23]. Qualitative findings suggest that continuity of participation, even at low intensity, is associated with resilience, belonging, and emotional stability [30, 32]. Compared with institutional models, community approaches offer flexibility but face challenges related to supervision and funding stability [31, 33]. The evidence therefore supports intersectoral collaboration linking schools, health services, and community organizations to maintain inclusion across transitions [14, 16].

Taken together, these three perspectives indicate that inclusive physical activity operates most effectively when rehabilitation, education, and community contexts are interconnected. The findings suggest that recovery and inclusion among conflict-affected adolescents depend on coordinated approaches that align physical rehabilitation with pedagogical support and sustained opportunities for participation across settings.

Studies examining structured exercise interventions report higher adherence and motivation when programs include choice, feedback, and individualized progression [20, 21, 25, 26]. Physical performance gains are generally modest but consistent, whereas psychosocial outcomes,

including self-image, confidence, and perceived competence, are more pronounced [27, 28]. This overlap between exercise and rehabilitation domains suggests that the therapeutic value of physical activity is linked less to performance outcomes and more to social connectedness and agency, which corresponds to socio-constructivist models of inclusion [4, 32, 33].

Across analytical dimensions, three interconnected theoretical principles can be identified. First, embodied inclusion highlights the role of movement experiences in restoring agency and perceptions of safety following trauma. Second, educational contextualization situates inclusion within predictable and relationally secure environments rather than isolated interventions. Third, multilevel coordination among educational, rehabilitative, and community systems is associated with equity in access and sustained participation. Together, these principles align with conceptual models that describe inclusive physical culture as an integrated framework combining rehabilitation, pedagogy, and social integration [2, 3].

At the same time, variability in program duration, cultural context, and assessment approaches indicates that inclusive physical activity remains an evolving field. While research from Western and North American contexts often emphasizes individualized adaptive models, studies conducted in Eastern European and post-conflict settings more frequently focus on psychosocial recovery and collective resilience. This divergence underscores the importance of developing culturally responsive and methodologically comparable approaches for evaluating inclusive physical activity across contexts.

The synthesis indicates that inclusive physical activity functions as a multidimensional context for physical rehabilitation, psychosocial adaptation, and educational reintegration among adolescents affected by war. Evidence from rehabilitation-, education-, community-, and training-focused studies suggests that inclusive practice extends beyond physical exercise to include emotional regulation, social participation, and the restoration of agency through movement. The convergence of theoretical perspectives [1, 2] and empirical findings [15, 18] supports the view that structured and supportive movement contexts contribute to recovery processes that involve both bodily and psychosocial dimensions.

From a theoretical standpoint, these findings position inclusive physical culture as an integrated pedagogical and therapeutic framework that combines motor learning, psychosocial development, and participation within educational and community environments. Empirical evidence indicates that schools, rehabilitation services, and community organizations can apply inclusive physical activity as a coordinated approach when supported by appropriate teacher preparation, accessibility measures, and psychosocial support structures. Across contexts, inclusive physical activity is thus described as a flexible framework that links physical development with social engagement and psychological adaptation, rather than as a narrowly defined form of adaptive exercise.

Overall, this review integrates theoretical and empirical evidence on inclusive physical activity for adolescents affected by armed conflict and related post-conflict contexts. The findings support the interpretation of inclusive physical activity as a multidimensional practice that links physical rehabilitation with psychosocial adaptation and educational participation. Across rehabilitation, educational, and exercise-oriented studies, inclusive activity is described as a context in which movement, social interaction, and structured support interact to facilitate recovery processes. Within this framework, inclusive physical activity is positioned not as an isolated intervention but as a component of coordinated rehabilitation and inclusion pathways for conflict-affected youth.

Limitations and Future Research Directions

Several limitations should be considered when interpreting the findings of this review. The synthesis was based on 22 peer-reviewed studies, many of which employed cross-sectional or short-term observational designs, limiting causal inference and assessment of long-term effects. Most studies were conducted in diverse international and post-conflict contexts rather than within a single national setting. Conceptual heterogeneity, inconsistent definitions of inclusion, and variability in outcome measures constrained comparability across studies. In addition, the focus on English-language publications and the exclusion of gray literature may have resulted in the omission of regionally relevant evidence.

Future research should address these limitations by applying longitudinal and mixed-methods designs to examine sustained effects on physical rehabilitation, psychosocial adaptation, and educational integration. The development of standardized and culturally responsive indicators that integrate physical and psychosocial outcomes would enhance comparability and practical relevance. Further theoretical refinement of trauma-informed and socio-ecological frameworks is also needed to better reflect the complex and context-dependent experiences of adolescents affected by armed conflict.

Conclusions

Inclusive physical activity represents a multidimensional framework that unites rehabilitation, education, and psychosocial

development in the recovery of adolescents affected by war. Its conceptual foundation lies at the intersection of rehabilitation science, pedagogy, and social integration, where movement becomes both a means of restoring agency and a medium of social cohesion.

The reviewed evidence supports a theoretical understanding of inclusive physical culture as a trauma-informed and context-sensitive approach that integrates physical development with emotional stability and community belonging. Implementing such frameworks within national education and health systems promotes a culture of equity, dignity, and sustainable well-being.

In the broader post-war context, inclusive physical activity should be regarded as a strategic element of rebuilding human potential. By aligning educational, social, and health policies, it can contribute to the formation of resilient communities and to the renewal of social and civic life through movement.

Conflict of interests

The authors declare that there is no conflict of interests.

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ORIGINAL ARTICLE

Recreational preferences and motivational factors among adults in the Precarpathian region

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Abstract

Background and Study Aim: Recreational activity among adults is an important factor in maintaining physical fitness, emotional balance, and social interaction. It contributes to the restoration of bodily resources, reduction of stress levels, and enhancement of subjective well-being. Although the Recreation Experience Preference (REP) scale is widely used to assess recreational motives and experiences, its application in regional and age-specific contexts remains a subject of practical interest. The aim of this study was to conduct a preliminary exploratory assessment of the internal consistency and item-level coherence of a short-form adapted REP scale in an adult sample from the Precarpathian region.

Material and Methods: The study was conducted among adults from the Precarpathian region who participated in recreational and wellness programs. The sample included 186 individuals (84 men and 102 women) aged 25 to 60 years. An adapted Ukrainian version of the Recreation Experience Preference (REP) scale comprising 10 items was used to assess recreational preferences. Responses were rated on a five-point scale ranging from 1 ("not important at all") to 5 ("very important"). Data were collected using an online questionnaire (Google Forms); participation was voluntary and anonymous. Statistical analysis included calculation of means and standard deviations. The reliability of the scale was evaluated using Cronbach's alpha coefficient, and internal coherence at the item level was examined using Spearman's correlations between individual items and the total score.

Results: The analysis revealed that the adapted REP scale demonstrated high internal consistency ($\alpha = 0.89$) and coherent item–total associations (Spearman $\rho = 0.302–0.911$), indicating satisfactory internal homogeneity at an exploratory level. Due to the small sample size ($n = 19$), no conclusions regarding factorial structure can be drawn. The highest mean values were recorded for items related to psychological recovery and a sense of inner balance. Women rated emotional and social aspects of recreational activity as more significant, whereas men emphasized achievement and development motives. Descriptive differences across gender and age groups were observed; however, given the small sample size ($n = 19$), these findings should be interpreted cautiously and cannot be considered conclusive.

Conclusions: The obtained results demonstrate high internal consistency and coherent item-level associations of the adapted REP short form in this exploratory pilot sample. The observed pattern of item responses reflects the diversity of motivational and emotional aspects associated with personal development, recovery, and social interaction; however, no structural factor interpretation can be inferred from the present data. The instrument may be considered for exploratory use in pedagogical and health-promotion contexts, pending further large-scale psychometric validation.

Keywords: Recreation Experience Preference, motivation, adults, leisure activity, Precarpathian region

Introduction

Recreational activity among adults is one of the key factors influencing the maintenance of physical fitness, psychological balance, and life satisfaction. The experience gained through various forms of recreational activity reflects a combination of personal motives, emotional responses, and social conditions that determine individual preferences. These preferences affect the nature of participation in recreational events, the level of engagement, as well as processes of adaptation, stress reduction, and interaction within the social environment.

In this context, the study by Shevchenko [1] represents a fundamental approach to the analysis of recreational activity, in which the behavior of recreation participants is examined through the conceptual model of the experience economy and the well-being economy. The author emphasizes that emotional experiences and subjective

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perceptions serve as central elements of analysis, while the behavioral approach allows the integration of ecological, psychological, and socio-economic aspects of recreational behavior.

Contemporary research continues to develop these theoretical foundations. For example, the study by Arvidsen et al. [2] demonstrated that recreational activity in urban forests is closely related to individual motivational and value-based differences among visitors, thereby expanding the understanding of the spatial dimension of recreational behavior. Hughes and Paveglio [3] highlighted that personal, social, and environmental benefits of recreation determine the intention to re-engage in such activities, and that measurement scales make it possible to quantitatively assess the structure of this experience. Another study [4] showed that the state of "flow" and subjective well-being are key factors contributing to repeated participation in recreational activities.

Taken together, these publications emphasize that modern research on recreational experience integrates behavioral, emotional, and social aspects. This approach provides a comprehensive methodological basis for analyzing motivational factors and psychological well-being among the adult population.

Studies on the motivational and social aspects of recreational activity highlight the diversity of factors influencing participation and satisfaction. In this context, research shows that the combination of intrinsic motives, resource availability, and interpersonal conditions determines the degree of involvement in leisure activities [5, 6, 7, 8]. The authors emphasize that social isolation, as well as temporal or financial constraints, act as barriers to participation.

The findings of Gaffar et al. [9] confirm the role of social, demographic, and educational differences in shaping recreational behavior and preferences. Other studies expand the scope of investigation by including psychological, cultural, and technological factors that influence motivation and the sustainability of recreational practices [10, 11, 12, 13, 14].

Taken together, these results reflect the multilevel nature of recreational behavior, where individual motives interact with social and environmental conditions of participation.

Many studies are based on the use of scales designed to assess the subjective and emotional aspects of participation in recreational activities. The study by Dzaki et al. [15] demonstrates that the perception of the natural environment, local atmosphere, and gastronomic impressions contributes to the formation of a positive recreational experience. Another study [16] explores the phenomenon of the "egocentric leisure experience," in which autonomy and self-realization determine satisfaction with the activity, aligning closely with the concept of the REP scale.

Publications by Lee et al. [17] and Jeong et al. [18] examine modern forms of digital and virtual leisure. The authors conclude that users' emotional engagement and sensory experiences are comparable to those of traditional recreation. These studies reflect a shift in research focus from external conditions of participation toward the study of internal experience, personal preferences, and the psychological effects of recreational activity.

In the development of concepts regarding the structure and mechanisms of recreational behavior, particular attention has been given to studies employing the Recreation Experience Preference (REP) scale as a tool for identifying motivational and emotional aspects of participation in leisure activities.

The study by Kurar et al. [19] analyzes the preferences and expectations of the local population. The authors identified leading motives such as pleasant pastime, psychological relaxation, and family interaction, along with constraints related to lack of time and financial difficulties. In another study, the authors used the REP scale to determine the motivation for participation in active forms of recreation among rural and urban residents [20]. They identified four key categories: social interaction, physical health, relaxation, and contact with nature.

Various studies have applied the REP scale in analyzing the motivation of divers and trekking participants, where the main determinants of participation include the pursuit of adventure, physical and psychological restoration, and social involvement [21, 22]. Research by Talib et al. [23, 24] demonstrates the use of the REP model for evaluating tourist experiences in the natural areas of Sabah. The authors confirmed that the key sources of positive impressions are associated with the aesthetic perception of the landscape and the emotional intensity of interaction with the natural environment.

Taken together, these publications confirm the stability and universality of the REP scale as a tool for analyzing recreational experience in diverse contexts – from local tourism to active outdoor recreation. They emphasize the importance of emotional, social, and cognitive factors in shaping satisfaction and preferences, making the REP model suitable for a comprehensive investigation of recreational behavior.

The analysis of previous studies has shown that recreational activity among adults is closely associated with motivational, emotional, and social aspects that determine the nature of participation and the level of satisfaction. The authors emphasize that individual preferences and experiences of recreation participants reflect a complex interaction of personal attitudes, social environment, and contextual conditions.

At the same time, there remains a need for further investigation of the characteristics of recreational experience within a regional context, where specific cultural and socio-economic factors may significantly influence the structure of motivation and the perception of leisure. In this regard, the aim of this study was to conduct a preliminary exploratory assessment of the internal consistency and item-level coherence of a short-form adapted REP scale in an adult sample from the Precarpathian region.

Materials and Methods

Participants

The adult group consisted of respondents aged 25 years and older (n = 21) who participated in a recreational program conducted at a mountain camp located in Mykulychyn (Ivano-Frankivsk region, Ukraine). The gender distribution was 14 women (67%) and 7 men (33%), with a mean age of 33.6 years. The study was carried out in accordance with the principles of voluntary participation, anonymity, and informed consent, following ethical standards for research focused on recreational and wellness activities.

Given the small sample size (n = 19), the study should be interpreted as an exploratory pilot reliability study rather than a full psychometric validation, and the findings must be considered preliminary.

Study Design

To assess participants' recreational motivations, a 10-item short form was developed based on the original Recreation Experience Preference (REP) scales created by Driver and colleagues at the U.S. Forest Service [25, 26]. The original REP inventory included a comprehensive pool of more than 300 statements across multiple experiential domains, such as escape, social interaction, nature appreciation, achievement, risk taking, introspection, and physical fitness. For the present study, ten items were selected to represent the most frequently reported motivational domains identified in previous REP-based research [26]. This short version ensured adequate conceptual coverage while maintaining brevity and suitability for adult respondents. The selected items reflect key motivational constructs including escape/restoration, social relationships, nature contact, adventure, introspection, and physical challenge, which have been widely recognized in prior adaptations of the REP scales [25, 26, 27, 28].

An adapted Ukrainian version of the Recreation Experience Preference (REP) scale, including 10 statements reflecting various aspects of recreational activity, was used to assess motivational and recreational preferences. Respondents were asked:

"How important are the following motives for you when participating in recreational activities?"

List of items:

- Q1 – to feel calm and find solitude;
- Q2 – to be with friends or family;
- Q3 – to learn new outdoor skills;
- Q4 – to enjoy natural scenery;
- Q5 – to escape from everyday routine;
- Q6 – to challenge myself physically;
- Q7 – to feel close to nature;
- Q8 – to experience excitement and adventure;
- Q9 – to reflect on my own thoughts;
- Q10 – to improve physical fitness.

Responses were rated on a five-point scale:

1 – not important at all, 2 – slightly important, 3 – neutral, 4 – rather important, 5 – very important.

Participants interpreted the questionnaire statements independently; however, before completion, program facilitators provided brief instructions explaining the purpose of the study and the structure of the scale. The questionnaire was completed individually in electronic format (via Google Form), ensuring convenience, anonymity, and data integrity.

Prior to the study, all participants were informed about the purpose of the survey, the voluntary nature of participation, and the confidentiality of their responses. Participants completed the questionnaire consciously, understanding that there were no "right" or "wrong" answers – their personal opinions and individual experiences were of primary importance. No additional clarifications were required, as respondents demonstrated a high level of understanding of the questionnaire statements.

Statistical Analysis

Data analysis was performed using Microsoft Excel. The raw data were pre-cleaned and prepared for processing with consideration of respondents' age groups.

The main stages of analysis included:

- calculation of descriptive statistics (mean, standard deviation, minimum, maximum, skewness, and kurtosis coefficients);
- assessment of response distribution across the scale;
- analysis of priorities within the scale based on mean values and ranking;
- evaluation of scale reliability using Cronbach's alpha coefficient;
- examination of item-level internal coherence using Spearman's correlations between individual items and the total score.

Results were considered statistically significant at $p < 0.05$.

Results

Table 1 presents the individual data of adult participants (n = 19), including age, gender,

anthropometric indicators (height, body mass), and responses to the Recreation Experience Preference (REP) scale items (Q1–Q10). Each item represents a specific motive for participation in recreational activities, rated on a five-point scale from 1 ("not important at all") to 5 ("very important").

The analysis of the presented data showed that most respondents gave high ratings for items related to psychological restoration, appreciation of nature, and physical activity. The highest values (5 points) were most frequently observed for items Q4, Q5, Q9, and Q10, indicating the high importance of motives such as enjoying nature, escaping from daily routine, reflecting on one's own thoughts, and improving physical fitness.

The mean scores across the scale indicate a predominance of positive recreational attitudes among the adult sample. At the same time, some participants reported lower ratings for items related to social interactions (Q2) and physical challenges (Q6), which may reflect individual differences in motivational structure.

he distributions of responses for the Recreation Experience Preference (REP) scale items (Q1–Q10) were tested using the Shapiro-Wilk test. As shown in Table 2, normality was not confirmed for most

Table 1. Individual data of adult participants according to the Recreation Experience Preference (REP) scale items

Participant ID	Age	Gender	Height	Weight	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
M001	44	male	176	82	5	5	5	5	5	5	5	5	5	5
M002	57	female	165	59	4	2	2	4	4	2	3	2	4	2
M003	40	male	178	78	5	4	4	5	5	4	5	4	5	5
M004	60	male	173	90	4	3	5	4	5	4	5	5	4	5
M005	25	male	187	90	5	5	5	5	5	5	5	5	5	5
M006	29	male	175	90	3	1	5	4	4	4	5	4	4	5
M007	26	male	180	89	1	5	3	4	4	1	3	1	5	3
M008	25	male	186	86	1	4	3	1	1	2	1	1	1	4
M009	27	male	173	75	5	4	4	4	4	4	4	4	4	4
M010	31	male	182	91	3	4	4	4	3	4	4	3	4	3
M011	28	male	164	80	5	5	5	5	5	5	5	5	5	5
M012	25	male	180	90	3	5	2	2	4	2	1	5	2	4
M013	25	male	172	62	4	2	5	5	5	5	5	5	5	5
M014	26	male	179	76	5	5	5	5	4	5	4	5	5	5
M015	28	male	178	60	5	4	4	4	4	4	3	4	4	4
M016	37	female	163	59	5	2	5	5	5	5	5	5	5	5
M017	51	male	185	88	5	5	3	5	5	4	5	4	4	4
M018	58	female	160	54	4	4	3	5	4	3	5	4	4	4
M019	44	female	172	62	5	5	4	5	5	4	4	4	5	4

Table 2. Testing the normality of response distributions for the REP scale items using the Shapiro-Wilk test

Question	W-statistic	p-value	Interpretation
Q1	0.7386	0.0002	Not normal
Q2	0.8019	0.0012	Not normal
Q3	0.8296	0.0032	Not normal
Q4	0.6772	0.0	Not normal
Q5	0.6959	0.0	Not normal
Q6	0.8249	0.0027	Not normal
Q7	0.7386	0.0002	Not normal
Q8	0.7574	0.0003	Not normal
Q9	0.694	0.0	Not normal
Q10	0.7874	0.0008	Not normal

items, indicating statistically significant deviations from the normal distribution.

To assess the internal consistency of the scale, Cronbach's alpha coefficient was calculated, yielding a value of $\alpha = 0.9044$. This result indicates a high level of internal consistency among the items, confirming the reliability and stability of the scale within the given sample.

Since the preliminary analysis using the Shapiro-Wilk test revealed deviations from normality, the application of parametric methods was limited. Therefore, Spearman's correlation coefficient (ρ) was calculated between each individual item (Q1–Q10) and the total score to assess the construct validity of the scale.

As shown in Table 3, most items demonstrated high correlation coefficients, confirming the internal consistency of the scale and its conceptual integrity. This approach makes it possible to determine the extent to which each item reflects the overall construct of recreational experience measurement.

Table 3. Spearman's correlation coefficients between REP scale items (Q1–Q10) and the total score (Total Score)

Question	Spearman_r	Interpretation
Q1	0.7861	Strong
Q2	0.302	Weak
Q3	0.7705	Strong
Q4	0.8393	Strong
Q5	0.784	Strong
Q6	0.911	Strong
Q7	0.7022	Good
Q8	0.7608	Strong
Q9	0.7723	Strong
Q10	0.7811	Strong

Most of the scale items (Q1, Q3–Q6, Q8–Q10) showed high correlation values with the total score, indicating strong consistency of their content with the overall structure of the scale. Item Q7 showed a correlation at the boundary between strong and good, while item Q2 ($\rho = 0.302$) demonstrated a weak relationship, suggesting its possible conceptual specificity and lower connection with other items.

Participants completed the survey in a mountain camp setting, which may have contributed to a high level of awareness in their responses and stability in motivational attitudes. The relatively low correlation of item Q2 is not considered a reason for its exclusion, as it may reflect an independent aspect of recreational experience, such as the value of communication with close ones.

The distribution of responses for the REP scale items is presented in Table 4. The indicators include mean values, standard deviations, as well as skewness and kurtosis parameters, which make it possible to assess the nature of distribution for each item of the scale.

The highest mean values were observed for items Q4 (4.26), Q5 (4.26), Q9 (4.21), and Q10 (4.26), indicating the strong importance of aspects related to aesthetic perception of nature, physical condition, inner reflection, and psychological restoration. Items Q5 and Q4 were characterized by pronounced negative skewness (−2.12 and −1.99) and high positive kurtosis (5.96 and 4.05), which indicates a concentration of responses in the upper range of the scale and a high degree of homogeneity in the perception of these aspects. Most items showed skewness values between −0.6 and −1.4, suggesting a predominance of high ratings. Standard deviations ranged from 0.87 to 1.31, reflecting moderate variability within the overall tendency toward high scores. The lowest mean value was recorded for item Q6 (3.79), although it also demonstrated a positive tendency and moderate negative skewness (−0.96). Overall, the obtained data indicate the predominance of positive evaluations for most recreational activity motives, particularly those related to nature, self-awareness, and physical recovery. This confirms the adequacy and sensitivity of the REP scale for assessing recreational preferences among adult participants.

The analysis of mean value rankings for the REP scale items is presented in Table 5. The data make it possible to determine which motives of recreational

Table 4. Descriptive statistics for the REP scale items (Q1–Q10)

Question	mean	std	min	25 %	50 %	75 %	max	Skewness	Kurtosis
Q1	4.05	1.31	1.0	3.5	5.0	5.0	5.0	-1.43	1.29
Q2	3.89	1.29	1.0	3.5	4.0	5.0	5.0	-1.01	-0.13
Q3	4.0	1.05	2.0	3.0	4.0	5.0	5.0	-0.64	-0.81
Q4	4.26	1.1	1.0	4.0	5.0	5.0	5.0	-1.99	4.05
Q5	4.26	0.99	1.0	4.0	4.0	5.0	5.0	-2.12	5.96
Q6	3.79	1.23	1.0	3.5	4.0	5.0	5.0	-0.96	-0.01
Q7	4.05	1.31	1.0	3.5	5.0	5.0	5.0	-1.43	1.29
Q8	3.95	1.31	1.0	4.0	4.0	5.0	5.0	-1.38	1.05
Q9	4.21	1.08	1.0	4.0	4.0	5.0	5.0	-1.93	3.93
Q10	4.26	0.87	2.0	4.0	4.0	5.0	5.0	-1.14	0.99

activity were the most significant for the adult participant group.

Table 5. Priorities according to the REP scale items (Q1–Q10)

Question	Mean	Rank
Q4	4.26	1
Q5	4.26	2
Q10	4.26	3
Q9	4.21	4
Q1	4.05	5
Q7	4.05	6
Q3	4.0	7
Q8	3.95	8
Q2	3.89	9
Q6	3.79	10

The highest mean values were obtained for items Q4 (4.26), Q5 (4.26), Q10 (4.26), and Q9 (4.21), reflecting participants' desire to enjoy natural scenery, escape from daily routine, improve physical fitness, and reflect on their own thoughts. These results indicate that the most significant motives for respondents are aesthetic enjoyment, psychological relaxation, physical recovery, and inner reflection. Mean values in the range of 4.0–4.05 were recorded for items Q1 and Q7, which are associated with motives of solitude and closeness to nature, suggesting a tendency toward personal space and natural balance. The lowest ratings were noted for items Q2 (3.89) and Q6 (3.79), reflecting motives related to communication with close ones and physical self-challenge, although these also maintain a positive orientation. Overall, the distribution of priorities demonstrates that participants perceive recreational activity primarily as a means of inner recovery, self-reflection, and balance, with moderate emphasis on physical challenges and external interactions.

Discussion

The aim of this study was to conduct a preliminary exploratory assessment of the internal consistency and item-level coherence of the adapted Recreation Experience Preference (REP) short form among adults in the Precarpathian region. The obtained results confirmed high internal consistency of the scale ($\alpha = 0.9044$) and demonstrated coherent item–total associations (Spearman $\rho = 0.302–0.911$), indicating satisfactory internal homogeneity at an exploratory level. Due to the small sample size ($n = 19$), no conclusions regarding factorial structure or structural validity can be drawn.

The highest values were observed for items related to psychological restoration and inner balance, reflecting participants' focus on emotional renewal and stress relief. Gender differences were evident in the prioritization of emotional and social aspects among women and achievement-related motives among men. These findings suggest that the adapted REP scale may capture individual differences in recreational preferences at an exploratory level and may be considered for preliminary pedagogical and health-promotion applications pending further validation.

The results of this study demonstrated high internal consistency of the adapted REP scale ($\alpha = 0.90$) and coherent item–total associations, indicating satisfactory internal homogeneity at an exploratory level. Due to the limited sample size, no conclusions regarding factorial structure can be drawn. These findings are consistent with the meta-analysis by Manfredo et al. [26], in which these dimensions were identified as the fundamental components of the structure of recreational experience. Similar results were obtained in the studies by Kurar [19] and Kurar and Kavacik [27], where the leading motives for participation included psychological relaxation, family cohesion, and personal development, confirming the universality of the REP scale factors across different social and cultural contexts.

High mean values for items related to the aesthetic perception of nature (Q4) and escape from everyday routine (Q5) are consistent with the findings of Talib [23, 24] and Gaffar et al. [9], which also emphasized the importance of the natural environment and outdoor recreation as sources of psychological restoration. Similar conclusions were reported by Ayyıldız Durhan et al. [29], where intrinsic motivations associated with overcoming difficulties and relieving stress were identified as key determinants of a positive recreational experience.

Several items demonstrated pronounced negative skewness (e.g., Q5 = –2.12; Q4 = –1.99) and elevated kurtosis (Q5 = 5.96), indicating ceiling effects and restricted variability, which may limit discrimination capacity and inflate internal consistency estimates. Descriptive differences in motivational priorities across gender and age groups were observed in the present sample; however, given the limited sample size ($n = 19$), these observations should be interpreted cautiously and cannot be considered conclusive. Similar patterns have been discussed in previous research [5]. The weak correlation of item Q2 ("to be with friends or family") with the overall scale may reflect a tendency typical of the adult population toward more individualized leisure practices, which was also observed in the study by Hwang et al. [16].

Thus, the results of the present exploratory study

are broadly consistent with theoretical assumptions of the REP model reported in previous research; however, given the pilot nature of the study and the limited sample size (n = 19), no conclusions regarding structural stability or broad applicability can be drawn. The obtained results highlight the importance of recreational activity as an educational resource that promotes mental health and the development of sustainable self-regulation strategies. The high ratings for items related to nature contemplation (Q4) and escape from everyday routine (Q5) confirm that participation in outdoor leisure activities serves as a means of emotional release and restoration of inner balance. These findings are consistent with the results of Gaffar et al. [9] and Johansson et al. [13], which emphasize the role of nature and sensory experience in enhancing mental well-being.

From a pedagogical perspective, such forms of activity can be regarded as tools of non-formal education aimed at developing mindfulness, reflective ability, and stress resilience. Numerous studies have shown that participation in recreational programs contributes to the restoration of vitality, enhancement of self-esteem, and strengthening of a positive perception of aging [11, 29, 30, 31, 32]. This confirms the pedagogical potential of recreational practices as effective means for fostering intrinsic motivation and personal growth.

The psychological interpretation of the identified trends indicates the predominance of introspective and aesthetic motives among adult participants, such as the desire for self-reflection (Q9) and improvement of physical condition (Q10). Similar observations were reported by Hwang et al. [16], who emphasized the importance of autonomy and self-determination as key sources of psychological satisfaction derived from leisure activities. Thus, the results of this study confirm that participation in recreational activities not only contributes to physical recovery but also performs a compensatory function by reducing the effects of chronic stress and improving overall psycho-emotional well-being.

In the pedagogical context, these findings emphasize the need to integrate recreational programs into the system of adult education and social work, particularly under conditions of elevated stress and professional burnout. The adapted REP short form may be considered as a preliminary tool for exploratory assessment and tentative individualization of psychological and pedagogical support programs, pending further comprehensive psychometric validation.

The analysis of the study results revealed pronounced differences in recreational activity priorities depending on gender and age. Women more frequently preferred leisure activities associated with emotional relaxation, communication, and aesthetic appreciation of nature (high values for items Q4 and Q5), whereas men showed a stronger tendency toward physically active and goal-oriented forms of recreation, including self-development and maintaining physical fitness (Q10). These observations are consistent with the findings of Cho and Kim [5] and Dinç et al. [7], which showed that men tend to associate leisure activity with achievement and competitiveness, while women emphasize social interaction and emotional support.

Age-related differences were also observed in the structure of preferences. Older participants more frequently rated contemplative and nature-oriented motives (Q4, Q9) as highly significant, which may be associated with a re-evaluation of life priorities and a desire for inner harmony. Similar tendencies were reported in the studies of Talib [24] and Kim et al. [11], where recreational activity was viewed as a means of maintaining psychological balance and fostering a positive perception of aging among middle-aged and older women.

Social role and family status also influence the choice of recreational behavior forms. According to the findings of Ab Dulhamid et al. [20], family obligations and the division of time between work and rest reduce participation in active forms of leisure but enhance motivation for shared recreational activities aimed at restoring emotional connections. In our study, a similar trend was reflected in the relatively low correlation of item Q2 (“to be with friends or family”) with the total scale score, which may indicate the individualized nature of recreation among adults in a stable life phase who seek personal space.

Taken together, the obtained results confirm that gender and age differences in recreational preferences are determined not only by biological and psychological factors but also by social role, activity level, and life stage. These differences should be taken into account when designing recreational and educational programs aimed at fostering balanced behavior in the domains of health and leisure.

The recreational preferences of the study participants demonstrate a close connection with the cultural and natural characteristics of the Precarpathian region, confirming the influence of territorial identity and living environment on the formation of motivation for rest and recovery. The Precarpathian region is characterized by remarkable natural diversity, including mountainous landscapes, clean air, and a well-developed network of ecological trails and tourist routes, which fosters a stable orientation toward active forms of recreation and interaction with nature. The high ratings for items Q4 (“to enjoy natural scenery”) and Q5 (“to escape from everyday routine”) reflect the importance of the natural component in the

structure of recreational experience, consistent with the observations made in the studies of Talib [24] and Gaffar et al. [9], where the natural environment was identified as a key source of positive emotions and satisfaction.

The cultural specificity of the region also has a noticeable impact on the choice of leisure activity forms. Residents of the Precarpathian region tend to favor family-oriented and traditional forms of social interaction, which strengthen the socio-emotional component of recreational experience. This corresponds to the findings of Ab Dulhamid et al. [20] and Ayyıldız Durhan et al. [29], which emphasize that local communities develop their own models of interaction between recreation, culture, and everyday life. In the context of the Precarpathian region, such practices include joint hiking, participation in ethnocultural festivals, recreation in natural settings, and family-oriented forms of active leisure.

Accessibility of recreational resources remains an important factor. A moderate level of urbanization, a developed transportation network, and preserved natural areas provide opportunities for balanced physical and emotional activity. However, limited infrastructure in rural areas creates disparities in the frequency and form of participation, which calls for a pedagogical approach to fostering recreational culture and promoting the conscious use of natural resources.

Thus, the results of the study confirm that recreational activity in the Precarpathian region represents not only an expression of individual preferences but also a reflection of regional identity. Cultural traditions, natural surroundings, and lifestyle create a unique pedagogical context in which the REP model can be used as both a diagnostic and developmental tool for assessing and promoting population health.

Despite the exploratory findings obtained, the study has several important limitations. The primary limitation is the small sample size (n = 19), which restricts statistical power and prevents structural validation procedures such as exploratory or confirmatory factor analysis. Consequently, the findings represent preliminary reliability evidence and cannot be generalized beyond this regional pilot sample. The use of a self-report questionnaire may introduce subjective bias, and the cross-sectional design does not allow examination of temporal stability. Additionally, ceiling effects observed in several items may have influenced internal consistency estimates. Future studies should include larger and more diverse samples to enable full psychometric validation, including structural analysis and broader assessment of measurement properties. Further large-scale validation is required before the instrument can be considered suitable for broader pedagogical or applied use.

Practical implications

Given the exploratory pilot nature of the present study and the limited sample size (n = 19), the adapted 10-item REP short form may be considered as a preliminary research instrument for further investigation of recreational preferences in adult populations. The current findings provide initial reliability evidence at the item level; however, broader pedagogical, diagnostic, or program-design applications require comprehensive large-scale psychometric validation, including structural analysis and testing in diverse samples. Until such validation is conducted, the use of the instrument should remain exploratory and research-oriented rather than applied in formal program development contexts.

Conclusions

The conducted study demonstrated high internal consistency (Cronbach's $\alpha = 0.9044$) and coherent item–total associations (Spearman $\rho = 0.302–0.911$) of the adapted 10-item REP short form in this exploratory pilot sample. Given the small sample size (n = 19) and the absence of structural validation procedures, the findings should be interpreted cautiously and regarded as preliminary reliability evidence rather than full psychometric validation. The descriptive results suggest that participants placed high importance on motives related to aesthetic appreciation of nature, self-reflection, psychological relaxation, and maintenance of physical condition; however, these observations are sample-specific and not generalizable beyond the present exploratory context. The findings may inform future large-scale validation studies and further investigation of recreational preferences in broader adult populations.

Conflict of interests

The authors declare that there is no conflict of interests.

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ORIGINAL ARTICLE

Assessment of the effects of low-intensity external resistance exercises on strength indicators of students aged 12–13 under conditions of wartime stress

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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: Under conditions of wartime stress, the daily routine and patterns of physical activity of students undergo significant changes, creating prerequisites for a decline in physical functioning. Limited access to habitual forms of movement, prolonged stays in shelters, and disruption of the stable educational process form an environment in which the maintenance of strength qualities becomes challenging. Although various forms of physical activity are used to compensate for these adverse effects, their relative effectiveness in maintaining and developing strength in adolescents remains of practical interest. The aim of the study was to analyze changes in strength indicators of students aged 12–13 resulting from low-intensity external resistance exercises under conditions of wartime stress.

Material and Methods: The study involved students aged 12–13 who were assigned to an experimental group and a control group. The duration of the intervention was eight weeks, with a training frequency of three sessions per week. The program for the experimental group included low-intensity external resistance exercises performed under conditions of restricted physical activity caused by the wartime stress environment. Strength indicators were assessed before and after the intervention using standardized tests, including push-ups, squats, trunk raises, plank hold, and standing long jump. Statistical data processing was carried out using comparative analysis methods within and between groups.

Results: Following the eight-week intervention, students in the experimental group demonstrated improvements in strength indicators. In boys, the number of push-ups increased from 20.5 ± 7.5 to 23.0 ± 7.25, plank holding time increased from 98.5 ± 24.25 to 104.37 ± 25.62, and standing long jump performance improved from 155.0 ± 21.25 to 157.62 ± 21.03. In girls, the improvements were moderate: the number of push-ups increased from 16.0 ± 1.2 to 17.2 ± 1.84, plank holding time increased from 80.4 ± 12.48 to 82.4 ± 14.88, and standing long jump distance increased from 131.4 ± 2.32 to 132.6 ± 3.12. Statistically significant improvements ($p < 0.05$) were observed mainly in tests reflecting strength endurance and static strength, whereas no substantial changes were identified in the control group.

Conclusions: The results obtained demonstrated that low-intensity external resistance exercises can contribute to the maintenance and moderate improvement of strength indicators in students aged 12–13 under conditions of restricted physical activity caused by the wartime stress environment. The most pronounced changes were observed in tests for strength endurance and static strength, with the dynamics of improvement differing in magnitude and nature between boys and girls. The findings highlight the practical value of dosed strength training as an accessible means of maintaining physical fitness in students under external restrictions.

Keywords: adolescents, physical fitness, strength endurance, adaptive loads, stress environment, functional status

Introduction

The living conditions of students during wartime stress are accompanied by changes in their usual activity patterns and limitations in performing daily physical tasks. Constant external stressors, reduced overall mobility, and irregular physical practice create a set of factors that can affect the physical condition of adolescents. The interaction of these factors creates prerequisites for variability in the physical fitness indicators of students.

The results of studies examining the living conditions of children in Ukraine during wartime indicate significant changes in the structure of their daily activities and the characteristics of physical load. The combination of stress factors, disruption of habitual routines, and restrictions on performing physical actions has been shown to affect the overall condition of the child population and to create altered conditions for bodily functioning [1, 2]. According to reports from international

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organizations, a substantial proportion of children are forced to spend prolonged periods in shelters, experience irregular physical activity, and adapt to a modified structure of the school day [3]. Regional studies report a decline in physical activity levels among adolescents and changes in physical condition indicators in students aged 12–13 [4, 5]. These findings are associated with restrictions in motor routines, a reduction in the volume of active movements, and the impact of prolonged stress exposure. Hozak et al. emphasize the effect of reduced opportunities for organized and leisure-time physical activity [6], which, according to the authors, creates new conditions for maintaining the functional state of children and adolescents. Another study presents pedagogical approaches aimed at compensating for motor and educational losses in younger age groups [7].

Baj-Korpak et al. indicate that the physical fitness of children and adolescents reflects characteristics of their functional state and changes under the influence of various environmental factors [8]. In this context, the level of physical fitness in childhood demonstrates a certain degree of stability during the transition to later developmental stages and is associated with indicators of somatic health [9]. A systematic review by França et al. reports that strength-oriented exercises should be considered as one of the means for maintaining and modifying physical fitness parameters in youth [10]. Conceptual syntheses also highlight the role of resistance-based loads in the development and stabilization of muscular characteristics in adolescents, particularly under conditions of restricted physical activity [11].

Applied research examining the effects of strength programs on the physical condition of children and adolescents demonstrates a consistent trend toward the use of external resistance exercises as a means of targeted influence on indicators of muscular functionality. Systematic reviews indicate that regular strength-oriented training contributes to changes in physical fitness parameters in students, including strength development and improvements in performance in motor tests [12, 13]. The findings of Moreno-Torres et al. confirm that structured programs delivered under professional supervision can lead to changes in strength levels and related characteristics in children and adolescents, provided that principles of safety and appropriate load dosage are observed [14]. Other studies emphasize the physiological foundations of strength exercise application at a young age and describe practical approaches to their implementation in educational settings [15, 16]. In applied school-based interventions, a combination of strength and endurance components is used, which is considered one option for organizing adolescents' physical activity and may result in changes in a range of physical and cognitive parameters [17].

An analysis of research findings indicates that strength exercises and programs involving external resistance can influence physical fitness indicators in children and adolescents, including parameters related to muscular functionality. Authors of various studies emphasize that the effectiveness of such interventions depends on the conditions under which exercises are performed, characteristics of the movement environment, and age-specific features of the participants. It is also highlighted that changes in physical activity caused by external restrictions introduce additional factors that may affect the strength characteristics of students. At the same time, there remains a need to investigate how different forms of external resistance exercises manifest under conditions of uneven physical load and altered activity patterns. This gap complicates the clarification of the specific effects of low-intensity strength interventions on physical condition indicators in students and determines the necessity for further analytical research on this issue.

The aim of the study was to analyze changes in strength indicators of students aged 12–13 resulting from low-intensity external resistance exercises under conditions of wartime stress.

Materials and Methods

Participants

The study involved 32 students aged 12–13 attending a general secondary school in Kharkiv, Ukraine. The total sample consisted of 16 boys and 16 girls. All participants were generally healthy, had no medical contraindications to physical exercise, and attended physical education classes as part of the school curriculum.

The sample was formed on the basis of voluntary participation of students who met the age criteria and regularly attended school. According to the study design, participants were assigned to two groups: an experimental group (n = 16) and a control group (n = 16). Each group included 8 boys and 8 girls, ensuring comparability between groups in terms of sex distribution.

The participants had not undergone specialized sports training and had a similar level of motor experience, which allowed the experimental and control groups to be considered relatively homogeneous in terms of basic physical characteristics at the baseline stage of the study.

The study was conducted in accordance with the principles of the Declaration of Helsinki and the current regulatory requirements for conducting research involving minors. Prior to the start of the study, written informed consent was obtained from the parents or legal guardians of the students, as well as verbal consent from the participants themselves for voluntary participation. All children

were informed in advance about the expected nature of the exercises and testing procedures. In addition, participation in the study did not involve any interventions exceeding age-appropriate levels of physical activity.

The study did not include the use of potentially injurious loads, in line with the principles of risk minimization for minors. Personal data of the participants were not collected or recorded in an identifiable form; the results are presented in an aggregated manner that precludes the identification of individual students. The conduct of the study also complied with the requirements of the educational institution where the activities were carried out.

Study Design

The study was conducted at the extracurricular education institution of the "Olymp" sports club in Kharkiv and lasted eight weeks. Training sessions were held three times per week with a fixed duration of 45 minutes. All training sessions were conducted indoors, ensuring stable and safe conditions for exercise during the period of external stress.

Baseline and post-intervention assessments of the participants were performed under identical conditions, at the same time of day, with a stable indoor temperature and unchanged sports facility equipment. Attendance was recorded throughout the entire study period, allowing for monitoring of participation regularity and ensuring the accuracy of the analysis of changes in the measured indicators.

Equipment

To implement low-intensity external resistance exercises, a set of simple training aids was used, including light-weight dumbbells, resistance bands, and TRX suspension straps. All equipment was selected with consideration of the age-specific characteristics of students aged 12–13 and allowed for controlled additional loading without exceeding acceptable levels of exertion.

Light-weight dumbbells (0.5–1 kg) were used to create minimal external resistance when performing exercises aimed at activating the muscles of the upper limbs and shoulder girdle. Their use allowed for variation of the load without increasing movement intensity.

Resistance bands provided elastic resistance that varied depending on the degree of band elongation. They were used to perform exercises targeting the muscles of the back, shoulder girdle, and lower limbs and enabled regulation of load magnitude by modifying the range of motion.

TRX suspension straps were applied in exercises using body weight as resistance. Changes in body inclination angle and support point positioning allowed adjustment of the level of external resistance while maintaining low exercise intensity. The use of suspension straps enabled the performance of stabilization and supportive exercises with a controlled level of load.

The combination of the equipment used made it possible to create conditions for performing exercises with low-intensity, dosed external resistance without the need for heavy or specialized training machines.

Exercise Program

The training program was designed for eight weeks and included three sessions per week, each lasting 45 minutes. Each session had a fixed structure consisting of a warm-up, a main part, and a final block of recovery exercises. The content of the sessions was adapted to the age-specific characteristics of students aged 12–13 and involved the use of low-intensity external resistance exercises.

Session Structure

1. *Warm-up (8–10 minutes).* The warm-up included simple general conditioning exercises aimed at preparing the musculoskeletal system, activating major muscle groups, and increasing joint mobility.
2. *Main part (30 minutes).* The main part consisted of a set of exercises performed using light-weight dumbbells, resistance bands, and TRX suspension straps. The exercises were selected to provide dosed loading of the major muscle groups without exceeding low-intensity thresholds.
3. *Cool-down (5 minutes).* The final part included relaxation exercises, breathing exercises, and stretching, facilitating a gradual reduction of muscle tension.

Exercise Selection and Objectives

Low-Intensity Dumbbell Exercises

Dumbbell curls. The exercise was performed in a standing position with the dumbbells held alongside the body. Elbow flexion was executed through the activation of the arm muscles without trunk swinging. The elbows remained fixed relative to the torso, and the range of motion was controlled.

*Dumbbell triceps extensions***.** The starting position involved a slight forward inclination of the torso. The upper arm was kept close to the body, and the movement was performed through elbow extension. The trunk remained stabilized, and the movement was slow and controlled.

*Squats with light-weight dumbbells***.** The dumbbells were held alongside the body. Squats were performed to a comfortable depth while maintaining a neutral spine position. The knees followed the line of the feet, and postural stability was preserved throughout the movement.

*Objective***.** The objective of these exercises was to provide light external resistance to activate the muscles of the upper and lower limbs while maintaining a safe load level appropriate for students aged 12–13.

Resistance Band Exercises

*Resistance band row to the chest***.** The resistance band was fixed at chest level. The participant performed a pulling movement by flexing the arms and retracting the shoulder blades. The trunk remained stationary, and the movement was executed at a controlled speed.

*Lateral arm raises with a resistance band***.** The starting position involved slightly flexed arms with the resistance band held in front of the body. The arms were abducted to shoulder level with a controlled trajectory. The movement was smooth and performed without elbow hyperextension.

*Backward leg extension with a resistance band***.** The resistance band was fixed at the level of the lower leg or foot. The participant maintained an upright trunk position and slowly extended the leg backward while preserving stability of the supporting leg. The range of motion was controlled, and the pelvis remained in a neutral position.

Objective. The objective of these exercises was to develop the muscles of the back, shoulder girdle, and gluteal region using elastic resistance, allowing movements to be performed within an accessible range of motion and at a safe level of exertion.

TRX Suspension Exercises

*TRX horizontal row***.** The participant held the handles with the body inclined backward at an angle not exceeding 35°. The pulling movement was performed through elbow flexion and scapular retraction. The shoulder girdle was stabilized, and the movement was controlled.

*Supported semi-squat with TRX***.** The participant held the suspension straps and performed a squat to an approximate knee flexion angle of 60–70°. Body weight was evenly distributed, and the knees did not move beyond the line of the toes. The TRX system was used as a stabilization aid.

*TRX plank (modified version)***.** The elbows were positioned under the shoulder joints, and the body was maintained in a straight line. The legs were placed in the TRX straps in a position that minimized the lever arm. The exercise was discontinued at the first signs of technique deterioration.

*Objective***.** The objective of these exercises was to strengthen the core, back, and lower limb muscles through bodyweight-based exercises with adjustable body inclination angles.

The selection of exercises was based on the principles of age appropriateness, the possibility of safely adjusting resistance levels, and the need to maintain motor activity under conditions of external stress exposure. The exercises ensured the involvement of major muscle groups while not requiring high effort and avoiding excessive physical load (Table 1).

Tests

The following test trials were used to assess the strength indicators of the students:

1. *Push-ups* — maximum number of correctly performed repetitions.
2. *Bodyweight squats* — number of repetitions performed using standardized technique.
3. *Trunk raises (sit-ups) in 30 seconds* — number of correctly executed repetitions.
4. *Forearm plank hold* — duration of maintaining the position.

Table 1. Detailed list of exercises

No.	Type of exercise	Equipment	Primary muscle groups	Intensity characteristics
1	Standing arm curls	Dumbbells (0.5–1 kg)	Biceps brachii	Low load, 12–15 repetitions
2	Backward arm extensions	Dumbbells	Triceps brachii	Low load, 12–15 repetitions
3	Resistance band row to the chest	Resistance band	Latissimus dorsi, rhomboids	Light elastic resistance
4	Lateral arm raises	Resistance band	Deltoid muscles	Light resistance, slow execution
5	Backward leg extension	Resistance band	Gluteal muscles	Low load, controlled range of motion
6	Inclined horizontal row	TRX suspension straps	Back muscles, shoulder girdle	Bodyweight resistance, angle ⩽ 35°
7	Supported semi-squat	TRX suspension straps	Quadriceps, gluteal muscles	Low load, 10–12 repetitions
8	TRX-supported plank (modified)	TRX suspension straps	Core muscles	Hold for 10–20 s
9	Squat with light-weight dumbbells	Dumbbells	Lower limb muscles	Low load, controlled tempo
10	Forearm flexion with resistance band	Resistance band	Forearm muscles	Light resistance

5. *Standing long jump* — best result from two attempts.

Methods for Assessing Strength Indicators. Strength indicators were assessed twice – before the start of the training cycle and after its completion – using a standardized testing protocol. Prior to each testing session, participants received a brief explanation of the task and a demonstration of the starting position. All tests were performed individually, with monitoring of correct technique and a fixed sequence of test execution.

Manual measurement tools were used to record the results: a stopwatch for measuring the duration of static holds, a measuring tape for assessing standing long jump distance, and recording sheets for counting repetitions. Each attempt was documented in an individual recording form, and the final outcome was defined as the maximum value achieved (time, number of repetitions, or jump distance).

Testing conditions remained unchanged at both assessment points. All tests were conducted at the same time of day, under stable indoor temperature conditions, and using identical sports facility equipment. All measurements were performed by the same specialist, ensuring consistency in technical requirements and reducing variability associated with inter-rater differences.

Training Load Characteristics. The training load was classified as low-intensity strength activity and was regulated through the volume and duration of exercise performance. For dynamic exercises, 10–15 repetitions per set were used, allowing activation of major muscle groups without inducing pronounced fatigue. Static exercises were performed with position holds lasting 10–20 seconds, and execution was terminated at the first signs of technique deterioration.

Rest intervals of 45–60 seconds were maintained between sets to ensure adequate recovery. All exercises were performed at a moderate tempo, with controlled ranges of motion and adherence to proper technique. The training load did not include maximal or submaximal efforts and remained within levels considered safe for students aged 12–13. This regimen corresponded to the principle of dosed and adaptive physical activity under conditions of external stress.

Load Progression. Load progression was achieved through gradual modifications of exercise volume and execution complexity, while the magnitude of external resistance remained unchanged and corresponded to a low-intensity level (Table 2). During the first two weeks, emphasis was placed on mastering proper technique and performing an optimal workload with minimal movement variability. In weeks 3–4, the number of repetitions and the duration of static holds were increased, providing a moderate increase in overall load without altering the nature of resistance.

During weeks 5–6, the number of sets was increased for selected exercises, and minor adjustments to starting positions were introduced, allowing task complexity to increase without raising intensity. In the final weeks (7–8), progression was achieved through improvements in movement quality, moderate increases in execution tempo, and optimization of motor effort while maintaining the required range of motion. This approach ensured a gradual increase in training stimulus and was consistent with the age-related capabilities of students.

Statistical Analysis

Statistical analysis was conducted to evaluate changes in the strength indicators of students at the beginning and at the end of the eight-week training cycle. For each test, mean values and standard deviations were calculated to describe the dynamics of physical fitness indicators. The normality of data distribution was assessed using the Shapiro–

Table 2. Weekly load progression scheme

Week	Type of progression	Main focus
1	Technique acquisition, minimal resistance	Coordination, correct range of motion
2	Technique stabilization, full workload execution	10–12 repetitions, 1–2 sets
3	Increase in number of repetitions	12–15 repetitions, 2 sets
4	Slight increase in static hold duration	+5 s for plank and TRX supports
5	Increase in total session volume	3 sets for simple exercises
6	Increased exercise complexity (not intensity)	TRX angle modification by 5–10°
7	Increased execution speed with maintained technical control	Moderate dynamics
8	Final load stabilization	Repetition of weeks 6–7 conditions

Principle: progression through volume, technique, and holding time, rather than through increased external load.

Wilk test. As measurements were obtained from the same participants at two time points, paired Student's *t*-tests were applied to compare baseline and post-intervention data. The level of statistical significance was set at $p < 0.05$, in accordance with commonly accepted criteria in studies of physical development in students. Statistical data processing was performed using standard Excel software.

Results

The analysis of strength test data obtained from boys in the experimental group at the beginning and at the end of the eight-week training period made it possible to determine the dynamics of performance indicators for each test. A comparison of mean values demonstrated varying magnitudes of change, as presented in Table 3.

An analysis of the data presented in Table 3 showed that most strength indicators in the experimental group demonstrated positive dynamics. Statistically significant differences ($p < 0.05$) were identified in Tests 1, 2, 4, and 5, indicating improvements in parameters associated with strength endurance and static strength. In Test 3, the slight increase in the mean value did not reach the level of statistical significance ($p = 0.115405$), which may indicate lower sensitivity of this indicator to the applied training loads or a more stable baseline level of preparedness among the participants. Overall, the results demonstrate a tendency toward improved strength characteristics in boys of the experimental group following participation in the eight-week low-intensity external resistance exercise program.

In boys of the control group, strength indicators remained stable throughout the study period (Table 4). Minor increases in mean values did not reach statistical significance in any of the tests ($p > 0.05$), which corresponds to the expected natural variability of indicators in the absence of targeted training intervention.

For girls in the experimental group, changes in strength indicators over the eight-week period were also assessed. Mean values, standard deviations, and the statistical significance of differences are presented in Table 5.

Table 3. Dynamics of strength fitness indicators in boys of the experimental group

Test	January 2024 (Mean ± SD)	May 2024 (Mean ± SD)	*p*
Test 1	20.5 ± 7.5	23.0 ± 7.25	0.000614
Test 2	56.12 ± 15.34	59.75 ± 13.81	0.003117
Test 3	21.12 ± 1.65	21.62 ± 1.71	0.115405
Test 4	98.5 ± 24.25	104.37 ± 25.62	0.00052
Test 5	155.0 ± 21.25	157.62 ± 21.03	0.02852

Table 4. Dynamics of strength fitness indicators in boys of the control group

Test	January 2024 (Mean ± SD)	May 2024 (Mean ± SD)	*p*
Test 1	20.1 ± 7.4	20.4 ± 7.5	0.284
Test 2	55.8 ± 15.1	56.2 ± 14.9	0.412
Test 3	21.0 ± 1.7	21.1 ± 1.7	0.365
Test 4	97.9 ± 24.1	98.3 ± 23.8	0.298
Test 5	154.2 ± 21.0	154.6 ± 21.2	0.340

Table 5. Dynamics of strength fitness indicators in girls of the experimental group

Test	January 2024 (Mean ± SD)	May 2024 (Mean ± SD)	*p*
Test 1	16.0 ± 1.2	17.2 ± 1.84	0.011153
Test 2	54.0 ± 11.6	56.8 ± 11.76	0.003689
Test 3	14.2 ± 11.12	14.6 ± 11.76	0.139829
Test 4	80.4 ± 12.48	82.4 ± 14.88	0.033567
Test 5	131.4 ± 2.32	132.6 ± 3.12	0.140738

An analysis of the data presented in Table 5 showed that girls in the experimental group demonstrated moderately expressed positive dynamics in most of the assessed strength tests. Statistically significant differences ($p < 0.05$) were recorded in Tests 1, 2, and 4, reflecting improvements in indicators associated with strength endurance of the upper shoulder girdle muscles and static strength. In Tests 3 and 5, the increases in mean values were minimal and did not reach statistical significance ($p > 0.05$). This may indicate a more stable nature of these indicators or lower sensitivity of the applied methodology to changes in this group of participants. Overall, the results demonstrate a tendency toward improved strength characteristics in girls of the experimental group following the implementation of the low-intensity external resistance exercise program.

In girls of the control group, the observed changes were also minimal, and differences in mean values did not reach statistical significance ($p > 0.05$). This reflects the absence of targeted training intervention and the stability of strength characteristics under conditions of usual physical activity (Table 6).

To provide a clear visualization of changes in strength indicators in boys from the experimental and control groups, a comparative diagram was constructed illustrating the dynamics of values across all five tests (Figure 1).

The diagram illustrates differences in the dynamics of strength indicators between the groups. Boys in the experimental group demonstrated a pronounced increase in mean values in most tests following the eight-week exercise program. In the control group, changes remained minimal and did not exceed the range of natural variability. The most notable differences in favor of the experimental group were observed in Tests 1, 2, 4, and 5, which is consistent with the data presented in the tables and the results of the statistical analysis.

A similar comparative diagram was constructed for girls, allowing assessment of differences in the dynamics of strength fitness between the experimental and control groups (Figure 2).

In girls of the experimental group, a moderate increase in strength indicators was observed in Tests 1, 2, and 4, whereas values in the control group remained virtually unchanged. The observed

Table 6. Dynamics of strength fitness indicators in girls of the control group

Test	January 2024 (Mean ± SD)	May 2024 (Mean ± SD)	*p*
Test 1	15.9 ± 1.3	16.1 ± 1.4	0.240
Test 2	53.8 ± 11.4	54.2 ± 11.5	0.334
Test 3	14.1 ± 11.0	14.2 ± 11.2	0.402
Test 4	80.0 ± 12.3	80.3 ± 12.5	0.276
Test 5	131.0 ± 2.2	131.2 ± 2.3	0.310

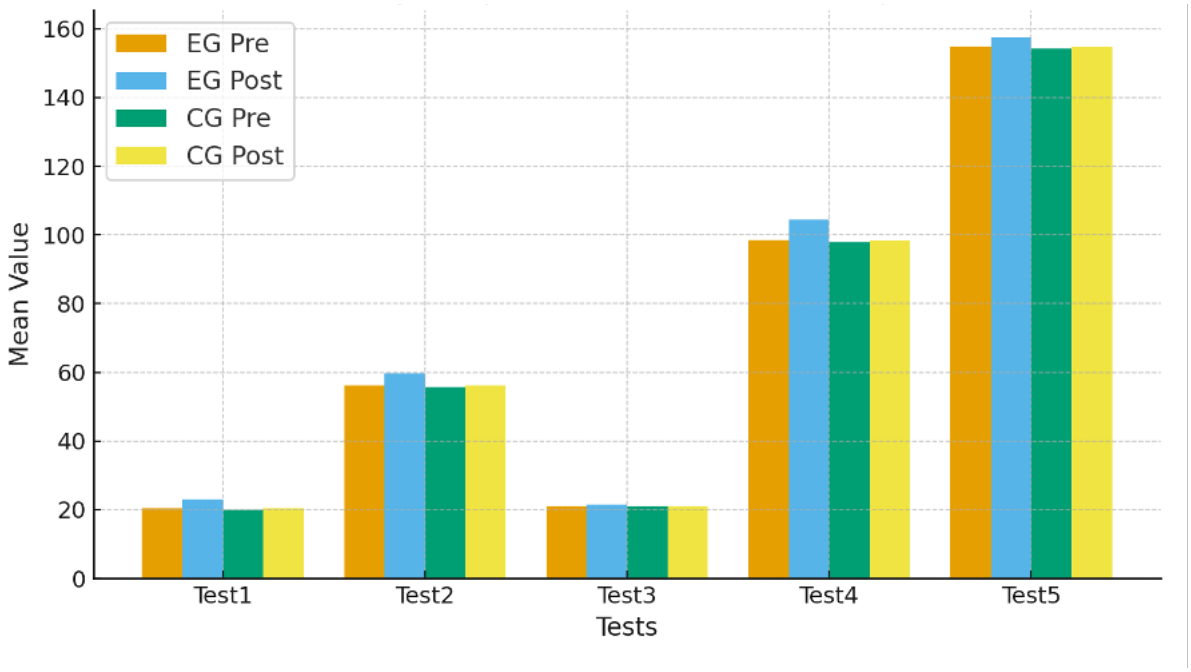

Figure 1. Comparison of strength indicators in boys from the experimental and control groups (Pre–Post).

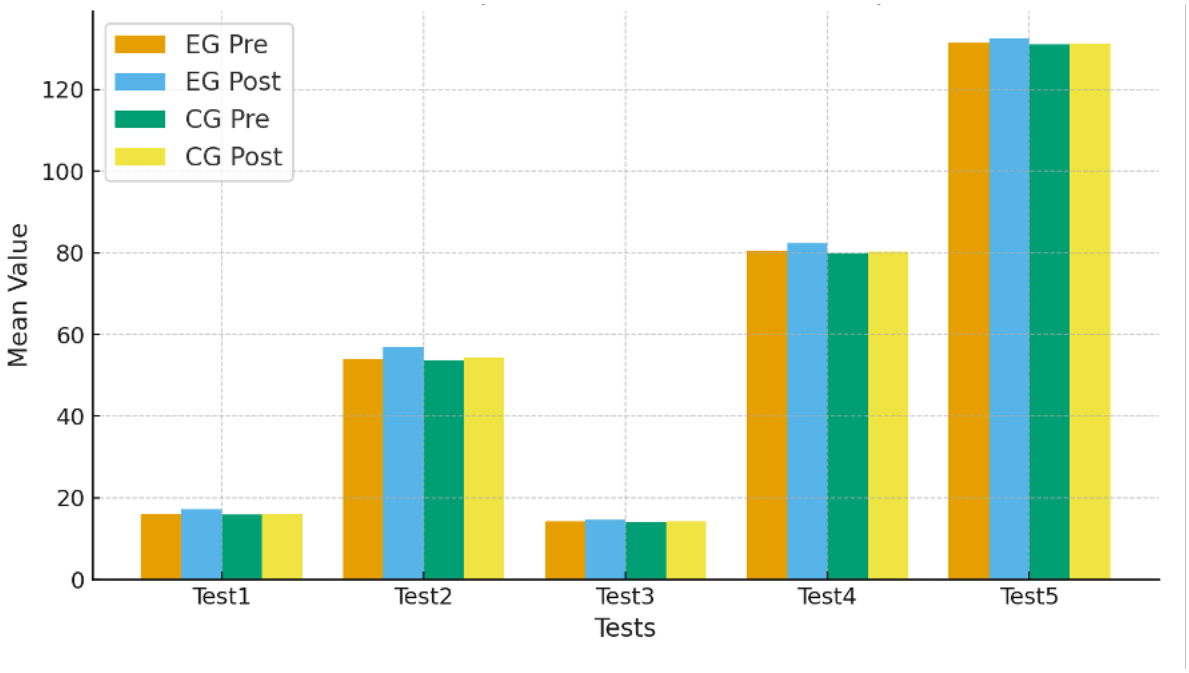

Figure 2. Comparison of strength indicators in girls from the experimental and control groups (Pre–Post).

positive dynamics in the experimental group are consistent with the results presented in Table 2 and confirm differences in the trajectory of changes compared with the control group, in which no significant shifts were detected.

Discussion

The aim of the study was to analyze changes in strength indicators in students aged 12–13 resulting from low-intensity external resistance exercises under conditions of wartime stress. The obtained data made it possible to characterize the dynamics of strength fitness in boys and girls of the experimental group and to compare these changes with those observed in the control group, which did not participate in a targeted training program.

The results of the comparative analysis showed that participants in the experimental group exhibited a moderate improvement in strength characteristics across several tests, whereas changes in the control group remained minimal and did not reach statistical significance. The most pronounced differences were observed in tests associated with strength endurance and static strength, which is consistent with the orientation of the applied low-intensity exercise program. At the same time, some indicators demonstrated limited changes, highlighting the heterogeneous nature of participants' responses to training stimuli under conditions of altered The obtained results indicate that low-intensity external resistance exercises are capable of producing moderate positive changes in the strength fitness of early adolescent students even under conditions of restricted motor activity. This pattern of changes is consistent with findings from systematic reviews reporting that dosed resistance loads lead to improvements in strength endurance and static strength in children and adolescents when principles of gradual progression and technical control are observed [10, 13, 18]. Other studies confirm that even low levels of external resistance can elicit adaptive muscular responses and contribute to functional improvements during adolescence [11, 19, 20]. Synthesized analytical evidence emphasizes that low-intensity resistance activity can support the development of basic muscular qualities in adolescents when overall motor activity is limited [21, 22]. At the same time, the observed heterogeneity of changes across individual tests is consistent with conclusions indicating that the response of different muscle groups to training stimuli depends on exercise specificity, baseline fitness level, and the context in which physical activity is performed [14].

Comparison of the obtained data with findings from studies conducted under conditions of restricted motor activity or exposure to stress factors reveals similar trends. Research examining the impact of the wartime situation on the lifestyle and physical condition of children in Ukraine highlights a reduction in overall mobility, irregular physical activity patterns, and a decrease in time allocated to strength- and endurance-oriented exercises [1, 4]. These conclusions are consistent with broader investigations addressing the consequences of armed conflicts [23, 24]. The results demonstrate that a stressful environment and disruption of habitual daily routines exert a substantial influence on the functional state of children, including levels of motor activity and capacity for physical adaptation. Under

such conditions, even small doses of structured physical activity may assume a compensatory role, which corresponds to the observed improvements in selected strength indicators among students in the experimental group.

Additional evidence reported by Sennersten et al. regarding the effects of stressful environments on children's physical development supports the notion that adaptive responses of the organism may be delayed and may vary across different components of physical fitness [2]. This is partially reflected in the present study, where increases in strength indicators were heterogeneous and differed across tests and participant subgroups. The observed tendency is consistent with conclusions from studies emphasizing the importance of minimal organized physical activity for maintaining functional stability in children exposed to external stressors [5, 25].

The obtained data indicate that the dynamics of strength indicators in boys and girls were uneven, which is consistent with well-established age- and sex-related characteristics of muscular system development in early adolescence. Boys demonstrated more pronounced changes in tests associated with upper limb strength endurance and static strength. This finding is consistent with studies reporting higher sensitivity of the shoulder girdle muscles to resistance loads in boys aged 12–14 years [12, 13, 26]. In contrast, girls were characterized by moderate positive changes, which may be related to lower levels of relative strength, differences in habitual motor activity, and specific features of muscle effort mobilization described in research on adolescent development [15].

The observed difference in responses to the training intervention is also consistent with the findings reported by Moran et al. [27]. The authors emphasize that gains in muscular strength in boys at this age stage may be more pronounced due to accelerated neuromuscular adaptation and the increasing influence of hormonal factors. Girls, in contrast, are traditionally reported to demonstrate a more favorable response to stabilization-oriented exercises and tasks requiring trunk control, which is explained by earlier development of motor coordination and postural skills [10, 28]. These patterns are partially reflected in the present findings, where changes in strength indicators in girls were more uniform but less pronounced than those observed in boys.

The practical significance of the obtained results lies in the fact that low-intensity external resistance exercises can be considered an accessible and relatively safe tool for maintaining strength fitness in students under conditions of restricted motor activity and exposure to chronic stressors. It should be noted that wartime conditions are characterized by irregularity of the educational process, reduced levels of daily physical activity, and periodic stays of children in shelters. In this context, such exercises make it possible to organize a minimally necessary level of motor load without exacerbating external constraints. The mechanisms underlying the positive effects may be related to the fact that small doses of resistance activity provide sufficient stimulation of muscle groups without inducing excessive fatigue, which is particularly important under conditions of increased psychophysiological strain.

Comparison of the results with data from studies conducted among children living in unstable environments indicates that even moderate and structured physical loads can play a compensatory role. Such forms of motor activity allow maintenance of a basic level of physical work capacity and help prevent further declines in strength indicators. This approach is particularly relevant in situations where opportunities for full-scale physical activity are limited and the functional state of children is characterized by high sensitivity to external factors. Thus, the systematic inclusion of low-intensity exercises may be considered a means of maintaining the physical condition of students in a stressful environment, providing minimal but regular training stimulation.

Limitations of the Study

The study has several limitations. First, the sample size was relatively small and included students from a single educational institution, which limits the generalizability of the findings. Second, conducting the study under conditions of wartime stress involved factors that could not be fully controlled (air raid alerts, changes in class schedules, and time spent in shelters), which may have affected training regularity and participants' physical and psychological states. Third, the use of low-intensity exercises and standard bodyweight-based tests limited the depth of analysis of specific strength characteristics. In addition, the relatively short observation period does not allow assessment of the long-term effects of the proposed program.

Future research may focus on examining the long-term effects of low-intensity external resistance exercises and evaluating the sustainability of the observed changes over extended time periods. Expanding the sample to include different age groups and educational institutions would be of interest, as well as analyzing the effects of training programs with varying orientations and levels of variability on students's strength indicators. An important direction for further research may involve assessing the combined influence of training interventions and external environmental factors, including patterns of motor activity under stressful conditions. Additional studies employing instrumental measurement methods would allow for a more precise characterization of adaptive mechanisms in children and adolescents.

Conclusions

The obtained data demonstrated that low-intensity external resistance exercises contribute to a moderate improvement in strength indicators in students aged 12–13 under conditions of restricted motor activity and exposure to a wartime stress environment. Participants in the experimental group exhibited positive changes across several tests, whereas indicators in the control group remained stable. These findings confirm that regular, dosed physical loads can serve as an effective means of maintaining physical fitness in children in situations where opportunities for full-scale physical activity are limited. The results highlight the appropriateness of implementing such programs in educational practice and underscore the need for further investigation of their potential under altered external conditions.

Conflict of interests

The authors declare that there is no conflict of interests.

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