

Assessment of inclusive and safe physical education under war conditions for posture prevention in 11–12-year-old schoolchildren

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Abstract

Background and Study Aim

The prevention of postural disorders in schoolchildren is a component of maintaining health and functional development. Increased static, sensory, and informational loads during growth contribute to the formation of stable musculoskeletal deviations that affect health and quality of life. Despite the use of various exercise-based approaches, their effectiveness under constrained and safety-limited conditions remains of practical interest. The aim of the study was to evaluate the impact of specially selected exercises on posture indicators and physical fitness in 11–12-year-old schoolchildren under war conditions.

Material and Methods

Thirty-two 5th grade students aged 11–12 years (20 boys and 12 girls) participated in the study. A four-month pedagogical experiment was conducted in Kharkiv, Ukraine, under mixed learning conditions in a war-affected environment with safety-related restrictions and limited space. The physical education program was supplemented with specially selected strength and flexibility exercises implemented as part of an inclusive safe physical activity protocol and performed for 5–7 minutes three times per week. The exercises were adapted for confined spaces, absence of equipment, and different levels of physical and psycho-emotional readiness. Physical fitness was assessed using flexibility, strength, and balance tests. Posture deviations were evaluated using Mashkov's rhombus method. A questionnaire survey was conducted among students and their parents to assess physical activity patterns and parental involvement. Statistical analysis included descriptive statistics, correlation analysis, and Student's t-test.

Results

The survey results indicated low levels of extracurricular physical activity, with 23 out of 32 students demonstrating minimal activity and predominantly sedentary behavior. Moderate correlations were identified between posture deviations and flexibility and strength indicators ($r = -0.54$ to -0.62), while balance indicators showed no significant relationships. After the intervention, flexibility and strength indicators improved in both boys and girls. The number of students without posture deviations increased from 19 to 22.

Conclusions

The integration of short strength and flexibility exercise complexes into physical education lessons within an inclusive safe physical activity protocol represents a feasible approach to organizing physical activity under conditions of limited space, safety restrictions, and increased psycho-emotional stress. In this context, inclusion is achieved through the adaptation of exercises to different levels of physical and psycho-emotional readiness, as well as by maintaining continuity of participation in unstable and potentially hazardous environments. Such exercise formats can be implemented in constrained educational settings as a means of maintaining functional capacity and supporting engagement in physical activity.

Keywords:

postural disorders, schoolchildren, physical fitness, inclusive physical education, war conditions, corrective exercises

Introduction

The organization of physical education in school settings is influenced by external environmental and social conditions that shape students' daily activity patterns. Under prolonged exposure to war-related conditions, including safety restrictions, limited mobility, and disruptions to routine, schoolchildren

experience reduced opportunities for regular physical activity. These factors contribute to increased static load, prolonged sedentary behavior, and decreased engagement in structured exercise, which are associated with functional changes in the musculoskeletal system and the development of postural deviations during critical periods of growth.

The level of physical activity in school-aged children is determined by environmental conditions and behavioral patterns. Under conditions of restricted mobility and limited access to structured

physical education, children demonstrate increased sedentary behavior and reduced engagement in physical activity, which is associated with adverse health indicators and functional changes in the musculoskeletal system [1, 2]. Evidence from recent studies conducted during periods of widespread restrictions indicates a consistent decrease in physical activity levels among children and adolescents, accompanied by changes in movement behavior and daily routines [3, 4, 5, 6, 7, 8, 9]. These conditions contribute to increased static load and are associated with the development of postural deviations.

Exposure to armed conflict is associated with substantial changes in children's living conditions, daily routines, and access to health-supporting environments. War-related factors, including displacement, infrastructure disruption, and restricted mobility, are linked to adverse effects on physical and psychosocial development in children [10, 11, 12]. Armed conflict also leads to disruptions in safe spaces, limited access to structured activities, and reduced opportunities for movement and social interaction due to safety concerns and environmental instability [13, 14]. These constraints contribute to reduced physical activity and alterations in daily movement behavior.

Changes in movement behavior among children are characterized by a decrease in physical activity and an increase in sedentary time. Systematic evidence indicates that a substantial proportion of daily time in youth is spent in low-energy activities, while levels of moderate-to-vigorous physical activity remain insufficient [15, 16]. These trends reflect a shift toward less active daily routines and altered movement behavior.

Sedentary behavior is associated with functional changes in the musculoskeletal system and contributes to the development of postural deviations in children. Prolonged sitting and low levels of physical activity are linked to musculoskeletal discomfort, including neck and lower back pain in adolescents [17, 18]. These findings support the relationship between reduced physical activity and disturbances in posture.

Adaptation of physical education to constrained environments involves the use of short, structured, and accessible exercise formats that can be integrated into limited space and time. Brief, time-efficient physical activity interventions implemented within the educational process can improve physical fitness indicators without requiring specialized equipment or extensive facilities [19, 20]. These approaches provide a basis for organizing safe and accessible physical activity under conditions of environmental and safety limitations.

An inclusive approach in physical education is defined by providing opportunities for all children to participate in physical activity regardless of individual or environmental conditions. Inclusion

is achieved through the adaptation of content, methods, and learning environments to ensure active engagement of all participants [21, 22, 23, 24]. Participation in shared activities also supports social integration and engagement in structured environments under conditions of environmental constraints [25].

The use of short exercise complexes represents a practical approach to maintaining physical activity under constrained conditions. Brief and structured exercise formats can improve physical fitness indicators, while integration of short activity bouts into the educational process contributes to increased overall activity levels without requiring additional resources [26, 27]. These findings support the application of short exercise programs in environments with limited space and time.

Analysis of research findings has shown that reduced physical activity, increased sedentary behavior, and environmental constraints are associated with functional changes in the musculoskeletal system and alterations in children's movement patterns. Researchers emphasize that under conditions of limited space, safety restrictions, and disrupted routines, the organization of physical activity requires adaptation through accessible and time-efficient approaches that ensure participation of all children. At the same time, the combined influence of safety-related limitations and the need for inclusive participation creates conditions in which practical solutions for maintaining physical activity remain a subject of ongoing consideration. These circumstances define the relevance of examining structured exercise approaches adapted to constrained environments.

The aim of the study was to evaluate the impact of specially selected exercises on posture indicators and physical fitness in 11–12-year-old schoolchildren under war conditions.

Materials and Methods

Participants

Thirty-two 5th grade students aged 11–12 years participated in the study, including 20 boys and 12 girls. All participants attended regular physical education lessons during the second semester of the 2023–2024 academic year. The study was conducted in Kharkiv, Ukraine, a region exposed to ongoing war-related conditions, where educational activities were organized with consideration of safety requirements, including interruptions due to air raid alerts and limited use of space. Participation in the study was voluntary. The program was designed to be applicable to students with varying levels of physical fitness and psycho-emotional readiness under conditions of environmental stress.

Ethical Considerations

The study was conducted in accordance with

ethical standards for research involving minors and was approved by the Ethics Committee of the university. Participation was voluntary, and informed consent was obtained from the parents or legal guardians of all participants prior to inclusion in the study. The procedures were designed to ensure the safety and well-being of children, taking into account both physical and psycho-emotional conditions in a war-affected environment. All activities were integrated into regular educational practice and did not involve additional risk. Confidentiality of participants' data was maintained, and all results were used exclusively for research purposes.

The pedagogical experiment lasted four months from January to May 2024. Physical education lessons were conducted according to the standard curriculum using a mixed format combining classroom and distance learning. Due to safety-related constraints, including limited space and the need for rapid response to emergency signals, the content of lessons was adapted to ensure feasibility under restricted conditions. During air raid alerts, classes were relocated to basement spaces equipped on the basis of previously constructed bomb shelters, allowing the continuation of physical activity in a protected environment.

The physical education program was supplemented with specially selected posture-corrective exercises, including strength and flexibility components, implemented as part of an inclusive safe physical activity protocol. The exercises were performed during the main part of each lesson for 5–7 minutes three times per week. The selected exercises were designed for implementation in confined spaces without specialized equipment, with consideration of safety

and accessibility for all students. The structure of the exercise program is presented in Table 1.

Program characteristics:

- duration: 5–7 minutes per session
- frequency: 3 times per week
- environment: limited space, no equipment
- approach: inclusive safe physical activity protocol
- adaptation: suitable for different levels of physical and psycho-emotional readiness

A questionnaire survey was conducted among students and their parents. Students were surveyed to assess awareness of posture, daily habits related to body alignment, and understanding of preventive measures. Parents were surveyed to evaluate their involvement in their children's physical development and monitoring of physical activity. The questionnaire included items on knowledge of correct posture, frequency of physical activity, time spent in sedentary behavior, participation in extracurricular activities, and the use of posture-related exercises. Responses were recorded using structured answer options to allow quantitative analysis.

Physical fitness indicators were evaluated using standard tests, including forward trunk flexion from standing and sitting positions, the Romberg test on the left and right leg with open eyes, hanging on a horizontal bar with straight arms, push-ups from a bench support position, and trunk lifting from a prone position.

Posture deviations were assessed using Mashkov's rhombus method [28], which is based on the geometric analysis of anatomical landmarks, including the spinous processes of the C7 and L5 vertebrae and the inferior angles of the scapulae, forming a rhombus to evaluate trunk asymmetry and spinal deviations.

Table 1. Structure of short exercise complexes for posture correction under constrained conditions

No.	Exercise	Purpose	Duration / Repetitions	Sets	Load Level	Notes (safety / conditions)
1	Wall posture alignment	Postural control	20–30 s hold	2	Low	Back, head, and pelvis aligned with wall
2	Forward trunk flexion (standing)	Spine flexibility	8–10 reps	1–2	Low	Slow execution, no jerks
3	Forward trunk flexion (sitting)	Hamstring flexibility	8–10 reps	1–2	Low	Controlled movement
4	Scapular retraction (standing)	Upper back strength	10–12 reps	2	Low–moderate	Arms back, shoulder blades together
5	Isometric plank (modified)	Core stability	15–20 s hold	2	Moderate	Knees on floor if needed
6	Trunk extension (prone)	Back muscle strength	8–10 reps	1–2	Moderate	Hands behind head or along body
7	Balance (single-leg stance)	Coordination, stability	15–20 s each leg	2	Low	Performed near wall for safety
8	Seated posture correction hold	Postural endurance	20–30 s hold	1–2	Low	Neutral spine position

Statistical Analysis

Descriptive statistics were calculated for all variables, with results presented as mean values and standard deviations ($\bar{x} \pm SD$). Correlation analysis was used to determine relationships between physical fitness indicators and posture deviations. Student's t-test was applied to evaluate differences between baseline and post-experiment measurements. Statistical significance was set at $p < 0.05$.

Results

The survey results showed that only 12% of parents paid maximum attention to the physical development of their children. Another 36% periodically monitored physical education activities, while 52% showed occasional interest in their children's physical development. Approximately 18% of students attended sports clubs, while 11% participated in extracurricular activities with low physical load. The remaining 71% demonstrated minimal physical activity and preferred sedentary leisure activities.

The distribution of parental involvement and

students' physical activity levels is presented in Figure 1.

Initial posture assessment showed that 19 out of 32 students (59%) had normal posture according to Mashkov's rhombus indicators. The relationships between posture deviations and physical fitness indicators are visualized in Figure 2. The heatmap represents correlation coefficients between posture deviation and each physical fitness indicator. As shown in Figure 2, moderate negative correlations were observed between posture deviations and flexibility indicators ($r = -0.54; -0.62$), as well as upper body strength indicators ($r = -0.58; -0.62$). No significant relationships were found between posture deviations and balance indicators ($r = 0.14; -0.06$). Changes in physical fitness indicators in boys at different stages of the pedagogical experiment are presented in Table 2. As shown in Table 2, flexibility indicators demonstrated an increase from -0.85 ± 4.07 cm to -0.15 ± 3.93 cm in the forward bend from standing position and from -1.85 ± 5.04 cm to -0.25 ± 4.05 cm in the forward bend from sitting position ($p < 0.05$). Balance indicators showed minimal changes and were not statistically significant ($p > 0.05$).

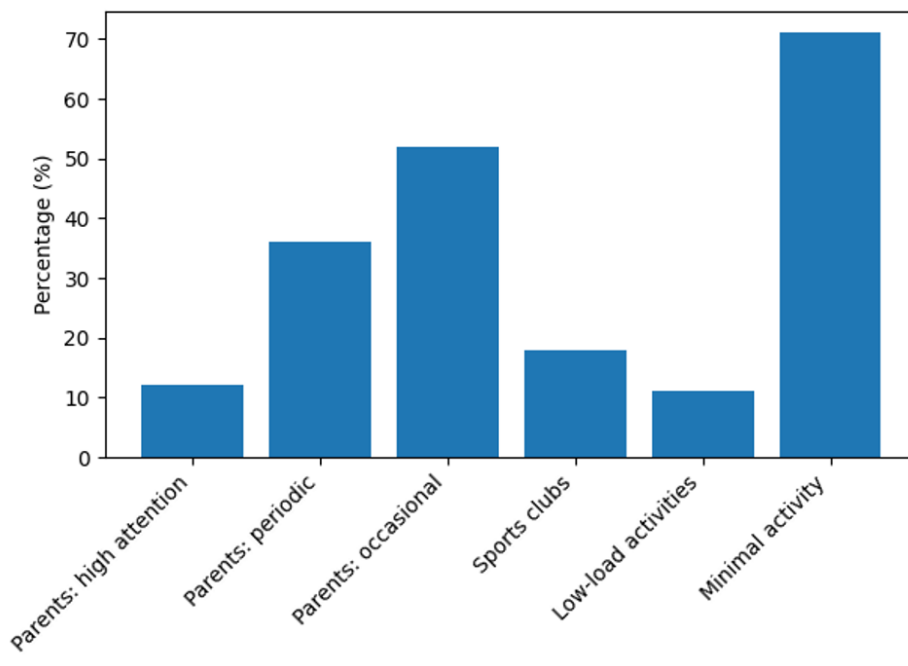


Figure 1. Distribution of parental involvement in children's physical development and students' physical activity levels.

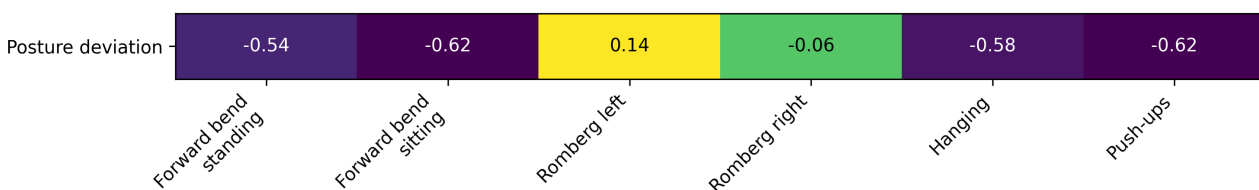


Figure 2. Heatmap of correlation coefficients between posture deviation and physical fitness indicators (n = 32).

Table 2. Results of physical tests in boys at different stages of the pedagogical experiment (n = 20) ($\bar{x} \pm SD$)

Stage	Forward bend standing (cm)	Forward bend sitting (cm)	Romberg left (s)	Romberg right (s)	Hanging (s)	Push-ups (reps)	Trunk lifting prone (s)
Initial	-0.85 ± 4.07	-1.85 ± 5.04	32.85 ± 2.63	33.00 ± 2.85	36.00 ± 4.92	9.25 ± 2.00	15.10 ± 1.79
Final	-0.15 ± 3.93	-0.25 ± 4.05	33.00 ± 2.24	33.55 ± 2.65	38.40 ± 3.61	14.10 ± 1.58	32.35 ± 2.80
t	2.24	2.59	0.19	0.62	7.76	8.31	22.65
p	<0.05	<0.05	>0.05	>0.05	<0.01	<0.01	<0.01
Δ (Final-Initial)	+0.70	+1.60	+0.15	+0.55	+2.40	+4.85	+17.25
Change (%)	-	-	+0.46%	+1.67%	+6.67%	+52.43%	+114.24%

Note: Percentage change was not calculated for flexibility indicators due to negative baseline values.

Table 3. Results of physical tests in girls at different stages of the pedagogical experiment (n = 12) ($\bar{x} \pm SD$)

Stage	Forward bend standing (cm)	Forward bend sitting (cm)	Romberg left (s)	Romberg right (s)	Hanging (s)	Push-ups (reps)	Trunk lifting prone (s)
Initial	2.67 ± 4.09	2.67 ± 4.96	32.50 ± 2.29	32.58 ± 2.33	19.67 ± 5.06	6.33 ± 1.03	16.83 ± 1.67
Final	5.92 ± 3.12	6.33 ± 2.95	35.25 ± 3.61	34.50 ± 1.80	24.17 ± 4.32	6.92 ± 1.11	21.25 ± 2.89
t	2.095	2.04	2.13	2.16	2.24	1.27	4.38
p	<0.05	<0.05	<0.05	<0.05	<0.05	>0.05	<0.05
Δ (Final-Initial)	+3.25	+3.66	+2.75	+1.92	+4.50	+0.59	+4.42
Change (%)	+121.72%	+137.08%	+8.46%	+5.89%	+22.87%	+9.32%	+26.26%

Strength indicators demonstrated more pronounced increases, including hanging on straight arms, push-ups, and trunk lifting ($p < 0.01$). Additional columns present absolute (Δ) and relative (%) changes to provide a more detailed description of the observed dynamics.

Changes in physical fitness indicators in girls at different stages of the pedagogical experiment are presented in Table 3. As shown in Table 3, increases were observed in flexibility indicators ($p < 0.05$), as well as in most strength and balance indicators ($p < 0.05$), except for push-ups, where changes were not statistically significant ($p > 0.05$). Additional rows present absolute (Δ) and relative (%) changes to provide a more detailed description of the observed dynamics.

After completion of the experiment, the proportion of students without posture deviations increased from 59% to 69% according to Mashkov's rhombus indicators.

Discussion

The study examines the organization of inclusive physical activity under conditions of environmental constraints, where participation must be maintained despite limitations related to safety, space, and psycho-emotional stress. Within this framework, the aim was to assess the impact of specially

selected exercises on posture indicators and physical fitness in 11–12-year-old schoolchildren under war conditions, while also considering the feasibility of their implementation in constrained and unstable environments. The results obtained are consistent with existing evidence indicating a decline in physical activity and an increase in sedentary behavior among school-aged children in constrained settings. Previous studies demonstrate that limited mobility and environmental restrictions are associated with reduced engagement in physical activity and increased time spent in low-energy behaviors [1,2]. These tendencies are also observed at the global level, where insufficient physical activity among children has been consistently reported across countries [29]. Comparable trends have been identified during periods of external restrictions, with children showing decreased participation in organized physical activity and a shift toward sedentary routines [3, 4, 5, 6]. The present findings, where 23 out of 32 students demonstrated minimal physical activity, align with these patterns and indicate similar behavioral changes under restricted living conditions. In this context, reduced activity levels should also be considered in relation to psycho-emotional factors, including stress and anxiety, which affect children's readiness to engage in physical activity. This underscores the

importance of an inclusive approach that considers both physical and psycho-emotional variability, as well as safety constraints, ensuring the possibility of participation even in unstable and restrictive environmental conditions.

The observed associations between posture deviations and indicators of flexibility and strength are consistent with studies linking sedentary behavior to functional changes in the musculoskeletal system. In the present study, moderate correlations were identified between posture deviations and flexibility and strength indicators ($r = -0.54$ to -0.62), indicating the contribution of these components to postural alignment. Evidence indicates that prolonged sitting and reduced physical activity are associated with musculoskeletal discomfort and postural disturbances in children and adolescents [17, 18]. The absence of significant relationships between posture and balance indicators in the present study may reflect the limited sensitivity of balance tests under short-term intervention conditions or the predominant role of strength and flexibility in posture maintenance.

The findings should also be considered in the context of war-related environmental constraints. Research demonstrates that armed conflict affects children's daily routines, access to safe environments, and opportunities for physical activity, leading to changes in both physical and psychosocial development [10, 11, 12, 13, 14]. Similar effects of environmental disruption have been observed in studies of school closures, where reduced access to structured environments leads to decreased physical activity and changes in daily routines [30]. Under such conditions, physical activity is not only limited by external restrictions but also influenced by safety concerns, unstable environments, and reduced access to structured educational settings. The results of the present study reflect these constraints through low baseline activity levels and reduced participation in organized physical activity.

In the context of the ongoing war in Ukraine, particular importance is assigned to studies conducted within the country and focused on school-aged children, as they reflect actual environmental, educational, and psychosocial constraints. Ukrainian research has consistently reported increased levels of stress and anxiety, along with disruptions in social and behavioral functioning among children under wartime conditions [31, 32, 33, 34]. At the same time, studies highlight the need for health-preserving and trauma-informed approaches, including the incorporation of structured physical activity into children's daily routines [35, 36]. Evidence further suggests that physical education interventions can support the maintenance of the general functional state of children under war conditions [37]. In this context, the present study complements and extends

existing Ukrainian research by providing empirical data on the relationship between physical fitness and posture, and by demonstrating the feasibility of implementing short, structured exercise programs in constrained and unsafe environments. These findings are also consistent with recent systematic analyses indicating the limited representation of physical activity-focused studies in wartime research and the need for integrated approaches combining physical and psychosocial components [22, 38].

At the same time, the observed improvements in flexibility and strength indicators after the intervention correspond with evidence supporting the effectiveness of short, structured exercise formats. Previous studies indicate that time-efficient physical activity interventions and short bouts of exercise integrated into educational settings can improve physical fitness in children and adolescents [19, 26, 27]. The present findings extend this evidence by demonstrating that similar approaches remain applicable under conditions of limited space, safety restrictions, and disrupted educational routines. This study can be considered as a continuation and development of previous research by Pozdnyakov [39], which demonstrated the effectiveness of short-term strength and flexibility exercises for improving posture indicators in middle school students. However, the present study expands this approach by implementing it under war-related constraints, including limited space, safety restrictions, and disrupted educational conditions. In contrast to the previous work conducted under mixed learning conditions, this study integrates an inclusive safe physical activity protocol and evaluates not only posture outcomes but also the relationship between physical fitness indicators and posture deviations. This provides additional evidence on the applicability of short exercise formats as a tool for maintaining both posture and overall functional state of children in crisis environments. In this study, the proportion of students without posture deviations increased from 59% to 69%, corresponding to an increase from 19 to 22 students. Although the absolute change was limited to three students, this shift reflects a positive trend against a relatively low baseline level and indicates the sensitivity of posture indicators to short-term structured interventions under constrained conditions.

The application of an inclusive approach in the study involves the organization of physical activity to ensure participation of all students regardless of environmental constraints. In the present study, inclusion is considered within the context of war-related conditions, where children experience elevated levels of stress and anxiety that influence their physical and psycho-emotional readiness for participation. Within this framework,

inclusion is defined not only by accessibility for participants with varying levels of physical and psycho-emotional readiness, but also by the need to ensure safety, adaptability to limited space, and continuity of physical activity in unstable and potentially hazardous environments. Inclusion in physical education is therefore characterized by the adaptation of content and conditions to maintain engagement of all participants [21]. Participation in shared structured activities also supports behavioral engagement and social integration in constrained environments [25]. In the present study, the use of an inclusive safe physical activity protocol enabled the implementation of exercises adapted to different levels of physical and psycho-emotional readiness.

The novelty of this study lies in the combined consideration of physical activity, inclusion, and safety within the context of prolonged war conditions. In contrast to studies conducted under general or pandemic-related restrictions, the present research examines the organization of physical activity in environments characterized by ongoing safety threats, limited space, and unstable educational conditions. The results indicate that short exercise complexes can be implemented as a structured component of physical education under such conditions, ensuring both accessibility and feasibility.

Simple exercise complexes in this context function not only as a means of posture correction but also as a tool for maintaining the basic functional state of children. Under conditions of limited mobility and environmental instability, such exercises support the preservation of movement activity and the maintenance of physical fitness parameters within the constraints of available space and time. This extends the role of physical education as a component of adaptation and stabilization in crisis environments.

Limitations and Future Directions

The study has several limitations related to sample size and the specific context of implementation. The number of participants was limited, which may affect the generalizability of the findings. The study was conducted within a single educational setting under specific war-related conditions, which may not fully

represent other regions or contexts. The duration of the intervention was limited to four months, which does not allow assessment of long-term effects. In addition, the use of standard physical fitness tests and a single method for posture assessment may limit the depth of analysis of posture-related changes.

Future research should include larger and more diverse samples, as well as longer observation periods to evaluate the stability of observed changes. Further studies may also incorporate additional objective methods for assessing posture and functional state, and examine the influence of psycho-emotional factors on participation in physical activity under constrained conditions. The development and validation of structured protocols adapted to different environmental and safety conditions also require further investigation.

Conclusions

The organization of physical activity for schoolchildren under conditions of environmental constraints requires the adaptation of both content and delivery formats in accordance with safety requirements and unstable learning environments. The use of short, structured exercise complexes allows the continuation of physical activity within limited space and during interruptions caused by external factors. In this context, the inclusive approach is associated not only with accessibility for students with different levels of physical fitness, but also with consideration of psycho-emotional states influenced by stress and anxiety under war conditions. The adaptation of exercises, variability of load, and simplicity of implementation facilitate the involvement of all students while maintaining safety and continuity of participation. Under such conditions, physical activity functions as a component of maintaining functional capacity and supporting consistent engagement in structured movement activity.

Conflict of interests

The authors declare that there is no conflict of interests.

References

1. World Health Organization. *WHO Guidelines on physical activity and sedentary behaviour* [Internet]. 2020 [updated 2023 Jun; cited 2023 Sep 28]. Available from: <https://www.who.int/publications/item/9789240015128>
2. Tremblay MS, LeBlanc AG, Kho ME, Saunders TJ, Larouche R, Colley RC, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, 2011;8(1): 98. <https://doi.org/10.1186/1479-5868-8-98>
3. Rossi L, Behme N, Breuer C. Physical Activity of Children and Adolescents during the COVID-19 Pandemic—A Scoping Review. *International Journal of Environmental Research and Public Health*, 2021;18(21): 11440. <https://doi.org/10.3390/ijerph182111440>
4. Do B, Kirkland C, Besenyi GM, Smock C, Lanza K. Youth physical activity and the COVID-19 pandemic: A systematic review. *Preventive Medicine Reports*, 2022;29: 101959. <https://doi.org/10.1016/j.pmedr.2022.101959>
5. Ramirez A, Rapp AB, Santarossa S. Effects of the COVID-19 Pandemic on Physical Activity in Children: A Systematic Review. *International Journal of Medical Students*, 2024;12(3): 311–333. <https://doi.org/10.5195/ijms.2024.1716>
6. Yelizarova O, Hozak S, Stankevych T, Polka N, Koblianska A, Parats A, et al. The COVID-19 pandemic and children: Impact on physical activity. In: *International and Life Course Aspects of COVID-19*, Elsevier; 2024. p. 465–474. <https://doi.org/10.1016/B978-0-323-95648-2.00053-8>
7. Moore SA, Faulkner G, Rhodes RE, Brussoni M, Chulak-Bozzer T, Ferguson LJ, et al. Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: a national survey. *International Journal of Behavioral Nutrition and Physical Activity*, 2020;17(1): 85. <https://doi.org/10.1186/s12966-020-00987-8>
8. Dunton GF, Do B, Wang SD. Early effects of the COVID-19 pandemic on physical activity and sedentary behavior in children living in the U.S. *BMC Public Health*, 2020;20(1): 1351. <https://doi.org/10.1186/s12889-020-09429-3>
9. Stockwell S, Trott M, Tully M, Shin J, Barnett Y, Butler L, et al. Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: a systematic review. *BMJ Open Sport & Exercise Medicine*, 2021;7(1): e000960. <https://doi.org/10.1136/bmjsem-2020-000960>
10. Kadir A, Shenoda S, Goldhagen J. Effects of armed conflict on child health and development: A systematic review. Das JK (ed.) *PLOS ONE*, 2019;14(1): e0210071. <https://doi.org/10.1371/journal.pone.0210071>
11. Bendavid E, Boerma T, Akseer N, Langer A, Malembaka EB, Okiro EA, et al. The effects of armed conflict on the health of women and children. *The Lancet*, 2021;397(10273): 522–532. [https://doi.org/10.1016/S0140-6736\(21\)00131-8](https://doi.org/10.1016/S0140-6736(21)00131-8)
12. Jawad M, Hone T, Vamos EP, Cetorelli V, Millett C. Implications of armed conflict for maternal and child health: A regression analysis of data from 181 countries for 2000–2019. Bhutta ZA (ed.) *PLOS Medicine*, 2021;18(9): e1003810. <https://doi.org/10.1371/journal.pmed.1003810>
13. Ferrara P, Zona M, Giardino I, Scaltrito F, Pettoello-Mantovani C, Cammisa I. The silent wounds of war: Psycho-physical impacts and international legal implications for children in conflict zones. *Global Pediatrics*, 2025;14: 100287. <https://doi.org/10.1016/j.gped.2025.100287>
14. Umphrey L, Patel A, Alayyan A, Haq HA, Suchdev PS, Schonfeld DJ, et al. The Effects of Armed Conflict on Children and Adolescents: Policy Statement. *Pediatrics*, 2026;157(3): e2025075748. <https://doi.org/10.1542/peds.2025-075748>
15. Tassitano RM, Weaver RG, Tenório MCM, Brazendale K, Beets MW. Physical activity and sedentary time of youth in structured settings: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 2020;17(1): 160. <https://doi.org/10.1186/s12966-020-01054-y>
16. Saudi L, Lameky VY. A Systematic Review of Physical Activity, Sedentary Behavior, and Screen Time in Youth Aged 7–18. *Journal of Pubnursing Sciences*, 2025;3(01): 30–41. <https://doi.org/10.69606/jps.v3i01.218>
17. Da Costa L, Lemes IR, Tebar WR, Oliveira CB, Guerra PH, Soidán JLG, et al. Sedentary behavior is associated with musculoskeletal pain in adolescents: A cross sectional study. *Brazilian Journal of Physical Therapy*, 2022;26(5): 100452. <https://doi.org/10.1016/j.bjpt.2022.100452>
18. Baradaran Mahdavi S, Mazaheri-Tehrani S, Riahi R, Vahdatpour B, Kelishadi R. Sedentary behavior and neck pain in children and adolescents; a systematic review and meta-analysis. *Health Promotion Perspectives*, 2022;12(3): 240–248. <https://doi.org/10.34172/hpp.2022.31>
19. Lubans DR, Smith JJ, Eather N, Leahy AA, Morgan PJ, Lonsdale C, et al. Time-efficient intervention to improve older adolescents' cardiorespiratory fitness: findings from the 'Burn 2 Learn' cluster randomised controlled trial. *British Journal of Sports Medicine*, 2021;55(13): 751–758. <https://doi.org/10.1136/bjsports-2020-103277>
20. Watson A, Timperio A, Brown H, Best K, Hesketh KD. Effect of classroom-based physical activity interventions on academic and physical activity outcomes: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 2017;14(1): 114. <https://doi.org/10.1186/s12966-017-0569-9>
21. Block ME, Obrusnikova I. Inclusion in Physical Education: A Review of the Literature from 1995–2005. *Adapted Physical Activity Quarterly*, 2007;24(2): 103–124. <https://doi.org/10.1123/apaq.24.2.103>
22. Lesko O, Potop V, Soia M, Sultanova I. Inclusive physical activity for war affected adolescents: a systematic review. *Pedagogy of Health*. 2026;5(1):27–42. <https://doi.org/10.15561/health.2026.0103>

23. Krun L, Nesen O. The effect of an adapted inclusive physical education program on motor skills and academic engagement of children aged 9–10 years. *Pedagogy of Health*. 2026;5(1):4–13. <https://doi.org/10.15561/health.2026.0101>
24. Yermakova T, Jagiello M. Inclusive physical culture for university students with disabilities: a systematic review. *Pedagogy of Health*. 2026;5(1):14–26. <https://doi.org/10.15561/health.2026.0102>
25. Yang L, Wu Q. Group Differences in the Psychological Integration Path of the Rural-to-Urban Migrants: A Conditional Process Analysis. *International Journal of Environmental Research and Public Health*, 2021;18(21): 11463. <https://doi.org/10.3390/ijerph182111463>
26. Costigan SA, Eather N, Plotnikoff RC, Taaffe DR, Lubans DR. High-intensity interval training for improving health-related fitness in adolescents: a systematic review and meta-analysis. *British Journal of Sports Medicine*, 2015;49(19): 1253–1261. <https://doi.org/10.1136/bjsports-2014-094490>
27. Norris E, Van Steen T, Direito A, Stamatakis E. Physically active lessons in schools and their impact on physical activity, educational, health and cognition outcomes: a systematic review and meta-analysis. *British Journal of Sports Medicine*, 2020;54(14): 826–838. <https://doi.org/10.1136/bjsports-2018-100502>
28. Zanevskyy I, Bodnarchuk O, Zanevska L. Validity of the Moshkov Test Regarding a Spine Asymmetry in Young Patients. *Biomedical Engineering and Computational Biology*, 2024;15:11795972241272381. <https://doi.org/10.1177/11795972241272381>
29. Aubert S, Barnes JD, Abdeta C, Abi Nader P, Adeniyi AF, Aguilar-Farias N, et al. Global Matrix 3.0 Physical Activity Report Card Grades for Children and Youth: Results and Analysis From 49 Countries. *Journal of Physical Activity and Health*, 2018;15(s2): S251–S273. <https://doi.org/10.1123/jpah.2018-0472>
30. Viner RM, Russell SJ, Croker H, Packer J, Ward J, Stansfield C, et al. School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review. *The Lancet Child & Adolescent Health*, 2020;4(5): 397–404. [https://doi.org/10.1016/S2352-4642\(20\)30095-X](https://doi.org/10.1016/S2352-4642(20)30095-X)
31. Borshch KK. Features of stress manifestation among children in wartime conditions. *Naukovyi visnyk Uzhhorodskoho natsionalnoho universytetu. Seriya: Psykholohiia*, 2023;(1):47–51. (In Ukrainian). <https://doi.org/10.32782/psy-visnyk/2023.1.9>
32. Matviienko O, Vedmedenko N, Khymych M. Features of anxiety manifestation in children of primary school age under wartime conditions. *Osvitno-naukovyi prostir*, 2024;(6(1)):77–86. (In Ukrainian). [https://doi.org/10.31392/ONP.2786-6890.6\(1\).2024.08](https://doi.org/10.31392/ONP.2786-6890.6(1).2024.08)
33. Halushko L I a, Amurova I a V. Application of a complex of thematic psychodrawings as a method of psychocorrection of the personality of primary school-aged children under martial law in Ukraine. *Naukovi zapysky. Seriya: Psykholohiia*, 2023;(2):7–14. (In Ukrainian). <https://doi.org/10.32782/cusu-psy-2023-2-1>
34. Sukhodolia Yu. Final results of an empirical study on the development of social intelligence of primary schoolchildren in families during distance learning. *Psychology Travelogs*, 2023;(3):236–258. (In Ukrainian). <https://doi.org/10.31891/PT-2023-3-22>
35. Andrushchenko N. Application of health-preserving technologies by future preschool teachers in work with children under martial law. *Osvitno-naukovyi prostir*, 2023;(5(2)):18–26. (In Ukrainian). [https://doi.org/10.31392/ONP.2786-6890.5\(2\).2023.02](https://doi.org/10.31392/ONP.2786-6890.5(2).2023.02)
36. Vakulenko SM. Application of a trauma-informed approach in social work with children during war. *Sotsialna robota ta psykholohiia: osvita i nauka*, 2025;(1):17–22. (In Ukrainian). <https://doi.org/10.32782/3041-1351/2025-1-3>
37. Kholodova O, Marchenko O, Osadcha N. Impact of physical education means on the general condition of school-aged children under wartime conditions. *Sportyvna medytsyna, fizychna terapiia ta erhoterapiia*, 2024;(1):151–157. (In Ukrainian). <https://doi.org/10.32652/spmed.2024.1.151-157>
38. Yermakova T, Prusik K. Impact of the war in Ukraine on mental health, psychosocial adaptation, and physical activity of the population: a systematic review of Ukrainian-language publications. *Physical Culture, Recreation and Rehabilitation*. 2026;5(1):41–64. <https://doi.org/10.15561/physcult.2026.0105>
39. Pozdnyakov I. Prevention of postural disorders in middle class students during a mixed form of educational organization. *Physical Culture and Sports. Challenges of Modernity*, 2024;4:7078. (In Ukrainian). <https://zenodo.org/records/14025907>

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