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Impact of war in Ukraine and post-pandemic COVID-19 period on the psychophysiological state of Ukrainian schoolchildren aged 12-13

Repercusiones de la guerra en Ucrania y del período posterior a la pandemia COVID-19 en el estado psicofisiológico de los escolares ucranianos de 12-13 años de edad

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Abstract. The article presents a comprehensive analysis of the psychophysical state of schoolchildren, taking into account the challenges posed by the post-pandemic COVID-19 period and the military actions in Ukraine. The study covers the impact of these events on the psychological well-being, physical health, social adaptation and educational achievements of schoolchildren. Using an interdisciplinary approach, the article analyses data collected through surveys, interviews, and physical health indicators, as well as psychological tests, to identify key trends and impacts. *Materials and methods.* The pedagogical experiment involved 103 schoolchildren aged 12-13 from general secondary education institutions of the Chernivtsi region in the period of the academic year 2023-2024 during various sports, health, recreational, and charity events. *Results.* The obtained results highlighted the problematic areas related to schoolchildren's psychophysical state caused by the aftermath of the COVID-19 pandemic and military conflict in Ukraine. The difference in physical development between the sexes, which is statistically significant ($p < 0.05$), indicates a critical need to develop individually adapted programmes to promote physical activity among students. The analysis of psychological well-being using the SDQ questionnaire showed a high risk of psycho-emotional problems in 51.3 % of boys and 37.4 % of girls aged 12-13 years, which requires the development of targeted psychological and pedagogical measures. *Conclusions*. The conducted research indicated existing gaps in the system of modern physical education and the critical need to integrate methods and approaches aimed at improving the schoolchildren's psychophysical state against the backdrop of general social unrest.
Key words: psychophysical state, schoolchildren, military conflict, COVID-19, post-pandemic period.

Resumen. El artículo presenta un análisis exhaustivo del estado psicofísico de los escolares, teniendo en cuenta los retos planteados por el periodo posterior a la pandemia COVID-19 y las acciones militares en Ucrania. El estudio abarca el impacto de estos acontecimientos en el bienestar psicológico, la salud física, la adaptación social y los logros educativos de los escolares. Utilizando un enfoque interdiscipli-nario, el artículo analiza datos recogidos mediante encuestas, entrevistas e indicadores de salud física, así como pruebas psicológicas, para identificar tendencias e impactos clave. *Material y métodos.* En el experimento pedagógico participaron 103 escolares de 12-13 años de instituciones de educación secundaria general de la región de Chernivtsi en el período del curso académico 2023-2024 durante diversos eventos deportivos, sanitarios, recreativos y benéficos. *Resultados.* Los resultados obtenidos pusieron de manifiesto las áreas problemáticas relacionadas con el estado psicofísico de los escolares causadas por las secuelas de la pandemia COVID-19 y el conflicto militar en Ucrania. La diferencia en el desarrollo físico entre los sexos, que es estadísticamente significativa ($p < 0,05$), indica una necesidad crítica de desarrollar programas adaptados individualmente para promover la actividad física entre los estudiantes. El análisis del bienestar psicológico mediante el cuestionario SDQ mostró un alto riesgo de problemas psicoemocionales en el 51,3 % de los chicos y el 37,4 % de las chicas de 12-13 años, lo que requiere el desarrollo de medidas psicológicas y pedagógicas específicas. *Conclusiones.* La investigación realizada puso de manifiesto las lagunas existentes en el sistema de educación física moderno y la necesidad crítica de integrar métodos y enfoques destinados a mejorar el estado psicofísico de los escolares en el contexto del malestar social general.
Palabras clave: estado psicofísico, escolares, conflicto militar, COVID-19, periodo pospandémico.

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Introduction

The UN General Assembly resolution calls for the inclusion of sport and physical activity in COVID-19 recovery plans and national sustainable development strategies, as sport and physical culture improve health, enhance the education of children and youth, including people with disabilities, promote physical and mental health and prevent disease (Lacoste et al., 2020; Pomytkina, & Ichanska, 2021; Intelangelo et al., 2022; Caputo et al., 2022; Poblete-Valderrama et al., 2023).

It is well known that the COVID-19 pandemic has affected the children's motor skills around the world (Guo et al., 2024; Gonzalez et al., 2024). In particular, in Poland and Portugal, quarantine restrictions have affected motor skills, having a significant impact on various aspects of the development of motor skills (Pombo et al., 2021; Wójtowicz-Szefler, Grzankowska & Deja, 2023). Other studies highlight the urgent need to improve physical education to mitigate the negative effects of COVID-19, which decreased children's physical activity (Pajek, 2022; Carcamo-Oyarzun, Salvo-Garrido, & Estevan, 2023).

Nowadays, the protection of people is the main security issue in modern society. The main issue is social security in a broad sense, i.e. the security of individuals, specific population groups and society as a whole. Children, a particularly vulnerable demographic group, are the most susceptible to poverty or social exclusion. They are the main target and object of systemic discrimination, which is particularly intensified during armed conflicts. Nowadays, there is a stable decrease of physical and motor activity (Yarmak et al., 2019; Marconnot et al., 2021; Médor et al., 2022)

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among schoolchildren (Giakoni, Paredes Bettancourt & Duclos-Bastías, 2021; Lermandat al., 2023). And as a result of military conflict on the territory of Ukraine, there is already a threatening trend towards a deterioration in the physical and mental health of schoolchildren (Galan, 2023).

Healthy children are the potential of any country. Therefore, this is one of the most important tasks facing the state (Galanet al., 2017; Popovych et al., 2022). The study focuses on the specific challenges faced by schoolchildren in the current context in Ukraine. The impact of COVID-19, the consequences of martial law and forced migration are exacerbating many social, political and psychological problems among schoolchildren (Lacoste, et al., 2021; Intelangelo et al., 2022; Bürgin et al., 2022; Galan et al., 2023; Karpenko & Klympush, 2023; Galan et al., 2024). Children and schoolchildren are particularly vulnerable, experiencing stress related to their stay in the military conflict zone, frequent air raids (air raids), the need to adapt to new living conditions, including moving and studying in a new environment, which negatively affects their mental, emotional and physical development. These factors necessitate a comprehensive analysis of the psychophysical state of schoolchildren (Moya-Mata et al., 2023).

This problem requires the study and development of effective programmes, strategies and methods to overcome its consequences both in Ukraine and in other European countries where displaced and refugee children from different regions of Ukraine are living. Such a study requires an in-depth analysis of the psychological, social and pedagogical aspects of this problem in order to develop programmes and interventions aimed at supporting children's mental and physical health, their adaptation to new conditions and promoting normal personality development. This approach is based on modern research in the fields of pedagogy, psychology and social work and takes into account the specific needs and context of each individual group of displaced and refugee children (Galan et al., 2023).

As part of this study, we conducted a comprehensive analysis of the psychophysical state of schoolchildren, taking into account the consequences of the post-pandemic COVID-19 period and the impact of the military conflict in Ukraine. Our goal is to analyse and identify how these significant social upheavals affect the mental and physical health of schoolchildren, including refugee children who have been internally displaced by the military conflict in Ukraine, and to propose steps to create a holistic strategy to support their well-being and optimal development in this context and test its effectiveness (Chen et al., 2015; Chen & Knöll, 2022).

Material & methods

Participants

The study presents a comprehensive analysis of the psychophysical state of schoolchildren in the context of the post-pandemic period of COVID-19 and military conflict, which aims to develop strategies, programmes, and models to improve the physical and psycho-emotional state of schoolchildren, including (displaced children and children with special educational needs).

The pedagogical experiment involved 103 schoolchildren aged 12-13 from general secondary education institutions of the Chernivtsi region during the 2023-2024 academic year during various sports, health, recreational, and charity events. The specifics of our study determined the choice of the age under study because middle and high school age is a critical period for psychological and physical development, during which students are most vulnerable to external stressors, such as the effects of the pandemic, military conflicts and other social factors.

Due to the fact that the suggested age groups are susceptible to various socio-emotional factors, the participants were divided into the main and preparatory medical groups, reporting no significant complaints related to health during the pedagogical experiment.

Table 1.
Characteristics of study participants

	N = 103	%
Gender		
Girls	64	62.1
Boys	39	37.9
Age		
12	56	54.4
13	47	45.6
Place of school attendance		
Village	36	34.9
Small town up to 20.000 residents	18	17.5
Major city over 200.000 residents	49	47.6

Procedure

This article analyses the schoolchildren's psychophysical state in Ukraine, emphasising the unique challenges caused by the post-COVID-19 pandemic period and the military conflict that significantly influences children's health and motivation to engage in physical activities. The present research aims to showcase the impact of the pandemic and war conditions on schoolchildren's psycho-physical state, health well-being, adaptation skills, and educational endeavours. We applied the interdisciplinary approach to data analysis, which was done using various empirical methods, such as surveys, interviews and psychological tests, which ensures taping into key trends that shape students' perceptions and attitudes.

Furthermore, we have applied to ethical principles at all the stages of the research. We have been granted the approval from the Ethics Committee at the Yuriy Fedkovych Chernivtsi National University. We have obtained the written approval from the parents and guardians of the children who took part in the research. A special attention was given to the anonymity and confidentiality of the participants. The

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results of the study participants' data were encrypted to ensure anonymity. Personal data was stored separately from test results. During the study, students who may have experienced stress or other psychological problems were supported by a qualified psychologist.

Methods

The following standardised tests were used to assess the physical condition of schoolchildren aged 12-13 years (n=103): 30-metre run to assess speed, 4 x 9-metre shuttle race to assess agility, push-ups to assess upper body muscle strength, 1 minute sit-ups to assess muscle endurance, long jump from a standing position to assess explosive leg strength, 1000 metres running to determine aerobic endurance, Flamingo Balance Test to assess balance, Jump rope to determine coordination and rhythm, Burpee test for a comprehensive assessment of physical fitness and Sit and reach to assess flexibility. These tests were selected based on their widespread use and proven reliability in assessing the physical condition of children and adolescents (Ruiz et al., 2010; Cvejić, Pejovic & Ostojić, 2013; Wouters, Evenhuis & Hilgenkamp, 2017; Galan et al., 2017). The 30-metre run and the 4 x 9-metre shuttle run are standard tests used in many international studies to assess speed and agility (Morina, Miftari & Badau, 2021; Taskin, 2022; Tsoukos & Bogdanis, 2023). These tests are included in the physical education curriculum in Ukrainian schools, which is recommended by the Ministry of Education and Science of Ukraine. Through the use of these tests, our study provides a detailed and reliable assessment of schoolchildren's physical condition, taking into account all key aspects of their physical fitness (Ministry of Education and Science of Ukraine, 2022).

In the next part of our research, we used several tools to assess the psycho-physiological state of schoolchildren in the post-pandemic period of COVID-19 and the consequences of the war in Ukraine.

Psychological Questionnaire 'Strengths and Difficulties Questionnaire' (SDQ) aimed at schoolchildren aged 2-17 years, which allowed assessment of participants' emotional well-being, behavioural issues and adaptation skills (Español-Martín et al., 2021). We conducted a comprehensive analysis of schoolchildren's psychophysical state, emphasising the influence of post-pandemic conditions and military escalation in Ukraine on participants' well-being. We measured vegetative coefficient using the Luscher test based on the measurements of the boys and girls aged 12-13 years during a pedagogical experiment (Galan et al., 2023). Table 2 shows the measurement of the vegetative coefficient.

We measures the vegetative coefficient as follows: 1, 2 - exhaustion, setting for inactivity. Chronic overwork. 3 - setting to optimise energy expenditure. Moderate need for recovery and rest. 4, 5 - mobilisation, setting on active action. Optimal mobilisation of physical and mental resources. 6, 7 - excessive excitement, fussiness. The level of arousal is excessively high.

Table 2.
Assessment of the vegetative coefficient

Standard points	1	2	3	4	5	6	7
The range of values of the vegetative coefficient, c.u.	0.2	0.3-0.4	0.5-0.8	0.9-1.2	1.3-1.9	2.0-3.1	3.2

Data analysis

The statistical information obtained during the study was processed using the computer packages Statistica 13.0 and Excel 2021 (Microsoft, USA) and the GraphPad Prism 10 software. We chose statistical criteria depending on the scale of measurements and the number of samples. Since the group was heterogeneous in most of the studied indicators, we used the median (Me). We used the interquartile range to show the distribution of the data, indicating the first quartile (25 % percentile) and the third quartile (75 % percentile). In the comparative analysis of physical condition indicators, we used the non-parametric Wilcoxon test for dependent samples.

Results

Numerous scientific studies indicate that the psychophysical state of schoolchildren during and after the post-pandemic COVID-19 period has undergone significant changes (Orap, Akimova, & Kalba, 2021; Galan et al., 2023; Carcamo-Oyarzun, Salvo-Garrido & Estevan, 2023). Researchers note that this can be observed, among other things, through increased levels of anxiety, depression and other psycho-emotional disorders among children and adolescents. It has also been found that these challenges have a long-term impact on the physical health and academic performance of schoolchildren. However, the complex impact, especially in the context of the hostilities in Ukraine, remains under-researched in the scientific literature. Air raid alerts are sounded almost daily in Ukraine, which puts considerable psychological pressure on the population. We conducted our study in the Chernivtsi region among schoolchildren aged 12-13. It is worth noting that more than 500 cases of air rage were recorded from February 2022 to June 2024 in this region. Such frequency of alarms significantly increases the level of anxiety, stress and constant irritability among children, which negatively affects their psychophysiological state (Air-Alarms, 2024).

The article analyses schoolchildren's well-being affected by the consequences of COVID-19 and military conflict in Ukraine. We focus on the influence on children's social adaptation skills. Our mission is to provide evidence for existing problems with mental health faced by Ukrainian schoolchildren. We also strive to provide effective strategies for dealing with such challenges.

The study involved middle school students who were classified as primary and preparatory medical groups for health reasons.

Following the purpose of the research, the study examined various components of the psychophysical state of

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schoolchildren, including physical condition, psychological state and psychophysical interaction.

The physical condition of schoolchildren aged 12-13 is an important indicator of their overall health and development, as this age is characterised by intensive growth and physical changes. Regular assessment and analysis of physical activity, endurance and coordination can help identify potential health risks and set the foundation for a healthy lifestyle for the future.

During the assessment stage, 10 physiological tests were used to measure schoolchildren's physical state. These tests were integrated into the school curriculum in Ukrainian secondary educational institutions (Ministry of Education and Science of Ukraine, 2022). Table 3 represents the general level of 12-13 year olds' physical development between boys and girls.

Table 3.
Average physical condition indicators of schoolchildren aged 12-13 (n=103)

Indicators under study	$\bar{x}$	S	Me	25 %	75 %	V, %
Boys (n = 39)						
Run 30 m, s	6.1	1.2	5.8	5.9	6.8	19.7
Shuttle race 4x9 m, s	11.9	1.23	12.0	11.6	13.1	10.3
Push-ups, times	14.2	5.14	14.0	9.1	19.3	36.2
Sit-ups, 1 min, times	17.5	5.14	17.0	12.4	22.6	29.4
Long jump from a standing position, cm	152.1	16.21	152.0	135.9	168.3	10.7
Running 1000 m, min. s.	5.21	1.2	5.20	4.51	6.41	23.0
Flamingo Balance Test, number of errors per 1 minute.	11.5	9.14	11.0	10.9	12.6	79.5
Jump rope, 1 min, times	26.4	18.7	26.0	24.5	32.1	70.8
Burpee test in 10 seconds, times	6.4	5.11	6.0	5.9	7.2	79.8
Sit and reach, cm	3.1	6.17	3.0	2.4	3.4	199.0
Girls (n = 64)						
Run 30 m, s	6.9	1.1	6.0	6.1	7.6	15.9
Shuttle race 4x9 m, s	12.9	1.21	12.5	12.0	13.7	9.3
Push-ups, times	7.5	4.12	7.0	4.7	10.2	54.9
Sit-ups, 1 min, times	11.5	4.18	11.0	8.6	14.3	36.3
Long jump from a standing position, cm	137.5	14.4	135.0	127.7	147.2	10.4
Running 1000 m, min. s.	6.12	1.5	6.10	5.11	7.13	24.5
Flamingo Balance Test, number of errors per 1 minute.	11.7	8.14	11.0	6.2	17.1	69.5
Jump rope, 1 min, times	52.6	14.2	52.0	43.0	62.1	27.0
Burpee test in 10 seconds, times	6.1	4.12	6.0	3.3	8.8	67.5
Sit and reach, cm	10.9	4.5	10.0	7.8	13.9	41.2

Analyzing the average physical condition indicators of 12-13-year-old students, significant differences were found between boys and girls. Boys demonstrate better results in most exercises, such as the 30-meter run, where the average time is 6.1 seconds with a variability of 19.7 %, compared to 6.9 seconds for girls with a lower variability of 15.9 %. Flexibility exercises, such as sit and reach, show a high level of variability among boys (199 %), whereas for girls, this indicator is 41.2 %. In standing long jumps, girls have an average distance of 137.5 cm, which is lower compared to 152.1 cm for boys. These data can serve as a basis for developing age- and gender-specific standards for school physical education programs.

Comparing the average results presented in Table 1 with the standards of the physical education curriculum for physical education for 7th-grade students, it should be noted that girls and boys aged 12-13 years are dominated by average, sufficient and low levels (Fig. 1). As part of the study of the physical condition of schoolchildren aged 12-13, an analysis of different types of physical exercises was carried out, which reflect the general fitness of children. The results indicate a significant difference in physical fitness between boys and girls, with statistically significant differences ($p < 0.05$) in some activities.

The study results necessitate immediate measures to increase physical activity implemented in schools to enhance agility and quick reaction skills among students, particularly girls. The findings indicate the need to develop endurance, strength, and motor skills in 12-to-13-year-old students. Among boys, low performance was noted in the burpee test at 35.9 % (n = 14), long jump at 30.8 % (n = 12), and jump rope at 30.7 % (n = 12). Among girls, low performance was demonstrated in the 1000-meter run at 53.1 % (n = 34), the burpee test at 42.2 % (n = 27), and the Flamingo Balance Test at 37.5 % (n = 24).

We observe the following results when analyzing the low and average physical condition indicators of 12-to-13-year-old students based on motor competence levels. For boys: sit-ups in 1 min at 79.5 % (n = 31), long jump at 79.5 % (n = 31), and sit and reach at 76.9 % (n = 30). For girls: long jump at 81.3 % (n = 52), 1000-meter run at 81.2 % (n = 52), and shuttle run 4 x 9 m at 79.6 % (n = 51).

The obtained results demonstrate the necessity of integrating educational and training programs aimed at developing fundamental motor skills and physical fitness in schoolchildren.

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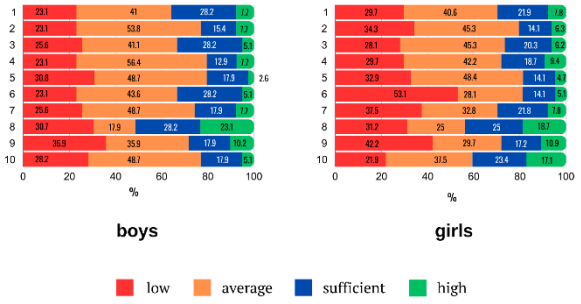

Figure. 1. Percentage ratio of indicators of physical condition of schoolchildren aged 12-13 years by the level of physical activity competence: 1 - run 30 m; 2 - shuttle run 4 x 9 m; 3 - push-ups; 4 - sit-ups in 1 min; 5 - long jump; 6 - run 1000 m; 7 - Flamingo Balance Test; 8 - jump rope; 9 - burpee test; 10 - sit and reach.

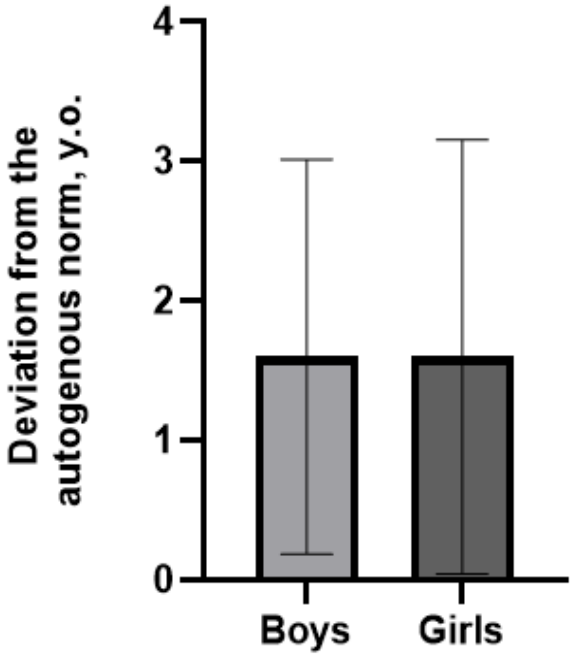

Figure. 2. Results of the vegetative coefficient index in boys and girls of 12-13 years old during the pedagogical experiment ($p<0.05$)

In the context of the above-mentioned conditions, it is important to consider that physical activity and regular training not only contribute to physical fitness, but also have a positive impact on psychological well-being, in particular by reducing stress and improving overall mood. Therefore, integrating physical activity into children's daily routines should be a priority for parents, educational institutions and the public at large.

In order to achieve significant improvements in physical fitness and overall well-being of schoolchildren, it is recommended to develop individually adapted physical activity programmes that take into account the age, individual fitness level and interests of children. Such programmes should be flexible and able to adapt to changing environmental conditions to ensure their effectiveness and attractiveness to students.

Given the complex impact of the post-pandemic period and the hostilities in Ukraine on the physical and psychological state of schoolchildren, it is important to emphasise the need for a systematic approach to addressing these issues. Nowadays, psychological support for children is important for the young generation of schoolchildren, especially against the backdrop of the pandemic effects and detrimental consequences of the war conflicts, which bring additional stress and depression in modern-day children making them unwilling to participate in various sports and physical activities.

Using the Luscher test, we were able to determine the vegetative coefficient in schoolchildren aged 12-13 years, which characterises the relative dominance of the sympathetic or parasympathetic autonomic nervous system, the results of the study are presented in Fig. 2.

The analysis of individual indicators among the boys of the study participants revealed a significant range of vegetative coefficient, which ranged from 0.5 to 2.5 units, while among girls the indicators ranged from 0.4 to 2.7 units. These results indicate a significant variability in the state of vegetative activity, which may indicate both vegetative exhaustion and increased excitability and hyperactivity of the nervous system. In schoolchildren aged 12-13 years, 35.9 % (n = 21) of boys and 45.3 % (n = 29) of girls had a low vegetative coefficient, which may indicate a passive reaction to difficulties, and a lack of readiness for balanced actions in stressful situations. This category of schoolchildren requires a set of diverse recovery measures.

In the context of the post-pandemic period of COVID-19 and the military actions in Ukraine, the high vegetative coefficient in schoolchildren often reflects excessive excitability, impulsivity, and low emotional regulation, which leads to chaotic behaviour and panic attacks in difficult situations.

In the context of frequent air raids, students are forced to interrupt classes to rush to the shelter, and learning is moving to an online format, which creates additional stress and complicates the educational process.

The next stage of the study was to evaluate the results of the Psychological Questionnaire 'Strengths and Difficulties Questionnaire' (SDQ) among schoolchildren aged 12-13. It was found that among boys, 17.9 % (n = 7) of participants had a normal level of well-being, a slightly increased risk of developing psychological well-being problems was found in 30.8 % (n = 12), while 51.3 % (n = 20) of the subjects had a high risk. Among girls, 14.2 % (n = 9) of participants were found to be at normal risk, 48.4 % (n = 31) were at somewhat increased risk, and 37.4 % (n = 22) were at high risk. The data obtained indicate the need to develop and implement targeted psychological and pedagogical interventions to optimise the level of psychological well-being among schoolchildren. Among boys, 51.3 % of those surveyed were found to be at risk, while among girls this figure was 37.4 %. This indicates the need for urgent psychological and pedagogical interventions to maintain and improve psychological well-being among schoolchildren (Fig. 3).

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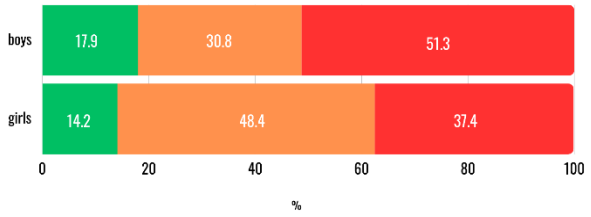

Figure. 3. Results of the psychological well-being questionnaire (SDQ) among schoolchildren aged 12-13 years, %.

These tools provided valuable insights into the psychophysical state of students, allowing us to identify key areas for support and intervention during this critical period. The results of the study emphasise the importance of adapting educational and training programmes to the needs of students in difficult social and emotional conditions.

Thus, the psychophysiological state includes the following components: mental, emotional, neuropsychological and cognitive. Physical inactivity leads to a deterioration in mental state, increased anxiety, reduced spatial perception and impaired decision-making based on non-verbal information. Physical activity as a preventive factor leads to an improvement in the psychophysiological state. In particular, physically active people showed an increase in mental wellbeing, a decrease in anxiety levels, improved decision-making speed, speed perception and the development of non-verbal intelligence.

Our study proved significant negative changes in the psychophysical state of the schoolchildren aged 12-13 in the post-pandemic COVID-19 period and war in Ukraine. In the study, we used the tests that are included in the school physical education curriculum, as recommended by the Ministry of Education and Science of Ukraine, which allowed us to assess the level of physical condition in detail. The results demonstrated a significant level of deterioration in the schoolchildren's physical condition, which necessitates the need for immediate measures to improve the indicators. The obtained data showed a high level of risk of psychological problems among the respondents, indicating the need for targeted psychological and pedagogical interventions to optimise their mental well-being.

Discussion

The results confirmed and supplemented the already known developments in the aspect of the problem under study. The findings are supported by the data of numerous studies (Tulchin-Francis et al, 2021; Hortigüela-Alcalá, González Fernández, Gonzá-lez-Calvo & Hernando Garijo, 2022; Neville et al, 2022; Galan et al, 2024) on the low level of development of basic physical qualities in 12-13 year olds, in particular strength, flexibility, speed and endurance, and on the low level of physical fitness of schoolchildren (Lermanda et al, 2023).

Various studies attest to the significance of the role physical activity in reducing children's stress and anxiety, which leads to the improvement of their mental health and academic performance (Carter et al, 2022; Hu, Li & Yang, 2023). Regular physical exercise and recreational activities integrated into the school curriculum proves to be helpful in organising a supportive healthy environment aimed at reinforcing physical and emotional resilience (Galan et al, 2023). Moreover, practicing mindfulness and relaxation techniques as a part of education curricula gives more guarantees the improvement of children's resilience and emotional regulation (Cordeiro et al, 2021).

Modern researchers are actively studying the features and patterns of children's physical and psycho-emotional state, which are key to the development of their harmonious and holistic potential (Andermo et al, 2020; Klizieneal, 2020; Galan et al, 2024). Although many researchers have investigated the issue of improving the physical and psycho-emotional well-being of middle school children, the issues related to improving the issues related to improving such conditions during COVID-19 remain insufficiently studied in the context of martial law (Hortigüela Alcalá et al, 2022; Gadermann et al, 2022; Galan, 2023).

In the context of our study, the obtained results underscore the necessity of rethinking approaches to the physical education process in Ukrainian schools within the current Ukrainian realities (Galan & Zoriy, 2024). This requires educators and researchers to seek effective mechanisms for integrating more efficient programs to enhance physical activity levels, which consider not only the physical but also the emotional health of students (Di Maglie et al., 2022).

The analysis of the results of our scientific research may serve as a foundation for further studies that would examine in greater detail the impact of various physical activity programs on the psycho-emotional state of students.

To conclude our results, we proposed a scheme of general approaches that might help establish the effectiveness of physical activities for improving psychophysiological state (Fig. 4).

Figure. 4. Means of improving the psychophysical state of schoolchildren through physical activity in the COVID-19 post-pandemic period and during the aftermath of military conflict in Ukraine

The word cloud above represents the most significant strategies to be taken into account for further improvement of children's physical and mental health. The figure was created following the principle of prioritizing the essential steps that were obtained as a result of our research and

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therefore were highlighted as the key words in the word cloud.

In the current post-pandemic context of COVID-19 and the ongoing military conflicts in Ukraine, there has been a significant deterioration in the psychophysical state of schoolchildren, which is a cause for concern among educators and medical professionals (Opuchlik et al, 2022; Limone, Toto, & Messina, 2023; Wójtowicz-Szefler, Grzankowska, & Deja, 2023; Galan et al, 2024). Decreased physical activity and increased stress levels among schoolchildren have become a clear reflection of these crisis phenomena. However, thanks to the tireless work of scientists (Lacoste, Dancause, Bernard & Gadais, 2021; Mondéjar-Jiménez, Ceballos-Santamaría, Valencia-García & Sánchez-Cubo, 2022; Galan et al, 2023) and interaction with physical education teachers, coaches and other professionals, it is possible to develop and implement innovative means to increase physical activity and improve the psychophysical state of students. The creation of effective mechanisms and tools that meet modern needs and take into account the specifics of crisis conditions are an important task that the scientific community and educational institutions are focused on. Our research compliments and expands existing studies and provides strategic solutions for successful decisions for integration of more effective educational programmes focused on developing children's physical activity, which would comprise both physical and emotional health of children (Castelli, Welk, Brusseau, & McMullen, 2022; Galan, 2023). That could serve as a foundation for the further research aimed at studying the impact of various physical activity programmes and psycho-physiological state of schoolchildren in the conditions of war and post-pandemic COVID-19 period (Hortigüela Alcalá et al., 2022; Gadermann et al., 2022; Mccann et al., 2022; Wójtowicz-Szefler, Grzankowska & Deja, 2023; Nafei, Samadzadeh, Ordooei, & Vaghefi, 2023).

Strength and Limitations

The present study "Comprehensive analysis of the psychophysical state of schoolchildren in the context of the post-pandemic period of COVID-19 and the consequences of military operations in Ukraine" provides a comprehensive analysis of the Ukrainian schoolchildren's psychophysical state affected by the aftermath of the COVID-19 and war conflict in Ukraine. The researched issues pose an extreme relevance which is reflected in the increased interest of many scholars in finding effective ways of helping young generations adapt to these conditions. The strengths of our study are reflected in the novelty of the investigated problems and search for effective methods, as well as assessing schoolchildren's psychophysical state during the post-pandemic period and military conflicts, ensuring a thorough analysis.

Conclusions

Numerous studies have shown that the psychophysical state of schoolchildren in the post-pandemic period of COVID-19 and in the context of military conflict in Ukraine has undergone significant changes, which manifested itself in increased levels of anxiety, depression and other psycho-emotional disorders. Statistically significant differences in physical fitness between boys and girls ($p < 0.05$) highlight the need for an individualised approach to increasing physical activity. In particular, boys performed the worst in 'burpee test' (35.9 %). In girls, the worst performance is demonstrated in the category 'the run 1000 m' (53.1 %), with low results. Such data indicate an overwhelming need for the development and implementation of targeted innovative means and methods that contribute to the improvement of the physical condition of this age group. The revealed indicators of the vegetative coefficient among boys and girls aged 12-13 show a significant variation in autonomic regulation, which indicates the possibility of vegetative imbalance, which can manifest itself both in the form of exhaustion and in the form of increased nervous excitability. A significant number of schoolchildren with low vegetative coefficient indicators - 35.9 % among boys and 45.3 % among girls - indicates the potential vulnerability of this age group to stressful influences and necessitates the development and implementation of comprehensive rehabilitation programmes. The analysis of psychological well-being using the SDQ questionnaire among schoolchildren aged 12-13 revealed a high risk of psycho-emotional problems in 51.3 % of boys and 37.4 % of girls, which highlights the critical need to develop and implement targeted psychological and pedagogical measures. These data indicate the urgency of urgent action to support the psychological well-being of the younger generation in the post-pandemic reality and the ongoing hostilities in Ukraine.

Conflict of interest

Authors state no conflict of interest.

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