

Assessing the effects of targeted soccer exercises on the physical fitness of 15-16-year-old schoolchildren

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Abstract

Background and Study Aim Soccer activities are a good means of physical activity for high school students. However, the living conditions of teenagers in war zones necessitate organizing education in an online format. Overall, this affects the physical fitness of adolescents. The purpose of the study was to evaluate the impact of soccer exercises on the physical fitness indicators of high school students under the conditions of online learning.

Material and Methods The study involved 21 high school students (15-16 years old, n=16 boys; n=5 girls). To assess physical fitness indicators, standardized tests were used, including the Bondarevsky test and the Yarotsky test.

Results A significant improvement in coordination abilities was observed in boys: according to the Bondarevsky test ($t=2.16, p<0.05$) and the Yarotsky test ($t=2.18, p<0.05$). There were also statistically significant changes in the level of endurance: in the “running around the perimeter of a 15 x 15 m square” test ($t=2.08, p<0.05$) and when performing the “Burpee” test ($t=2.45, p<0.01$). The abilities of girls almost did not change, which may be related to their low interest in football.

Conclusions The introduction of specific football exercises in remote physical education lessons can contribute to the improvement of the physical fitness of high school students, especially boys. Results confirm and expand existing knowledge about the positive impact of participation in football activities on the physical and social well-being of students. It emphasizes the importance of implementing sports programs in the educational process, especially in situations where traditional forms of physical education are limited.

Keywords: endurance, coordination abilities, online education, football, speed-power abilities, war, Ukraine.

Introduction

In the context of distance learning, students are forced to spend more time on the computer, which can lead to a decrease in physical activity and negatively affect their overall health. In such a situation, soccer activities can become not only a way of positive distraction from studies but also a means of overcoming social isolation. Moreover, the dangerous living conditions in war zones further contribute to the decrease in teenagers' physical activity. Under these conditions, teaching students soccer promotes joint activity, the development of communication skills, and the ability to work in a team, even when conducting classes online. This is especially important for the social adaptation of teenagers in the conditions of military conflict.

The impact of military conflicts and the specifics of educational organization have been examined in various studies [1, 2, 3, 4, 5]. Authors highlight the importance of safety measures during classes and the possibilities for maintaining physical activity at home. Maintaining and developing physical fitness

through specific soccer exercises during remote learning can prepare students for a more active life and physical demands after online education. Youth show great interest in adhering to broader social norms, including in the field of sports. This strengthens the popularity of soccer as one of the most acceptable types of sports [6].

The biological maturity of young footballers significantly impacts their functional potential. Accumulated workload greatly affects aerobic endurance. In this context, height and weight significantly influence speed and vertical jump outcomes [7]. Research findings indicate that the performance of an intermittent progressive multistage test correlates with neuromuscular and speed abilities. However, the anaerobic speed reserve seems to remain relatively independent of these qualities [8]. To assess other physical qualities (linear speed, change of direction speed, aerobic endurance, and muscular strength), various tests are often used: 10-meter sprint, agility test, multistage fitness test, and maximal strength tests [9].

These results provide representative profiles of the performance capabilities of school-age athletes. This allows teachers to effectively assess the

potential of each player and use this information for further development [10]. For success in football at the regional level, physical parameters such as running speed, dynamic balance, and participation in specialized training centers are of particular importance [11].

In light of modern challenges associated with distance learning, studying the impact of specific soccer exercises on the physical fitness of 15-16-year-old students becomes especially relevant. This topic requires consideration of the specifics of online education, as physical activity and overall health of students may fall victim to increased time spent in front of a computer. Thus, exploring the impact of soccer activities on the physical form and health of teenagers in the context of distance learning represents an important research direction. Such an approach can provide valuable practical recommendations for educational institutions and coaching staffs.

The aim of the study was to evaluate the impact of soccer exercises on the physical fitness indicators of high school students in the context of online learning.

Materials and Methods

Participants

The study involved 21 high school students (15-

16 years old, n= 16 boys; n= 5 girls), who were in good health and belonged to the main group. All participants lived in a war zone (Kharkiv, Ukraine). Parental consent was obtained for their children's participation in the experiment.

Ethical Aspect of the Research

The study received approval from the University's Ethical Committee and was conducted in accordance with the Principles of the Declaration of Helsinki. Detailed information about the study was provided to the parents of the children involved, and their written consent was obtained.

Study Organization

The study lasted two months, from April 3 to May 30, 2023. Classes were conducted remotely according to a pre-arranged training program using specific soccer exercises (short-distance ball control, rolling the ball between the legs, ball balancing, tossing the ball from foot to hand, dribbling through an imitated obstacle of bottles, ball juggling in a net). Exercises were applied in each lesson for no less than 15 minutes.

A battery of tests was used (Fig. 1):

1. Endurance test: running around the perimeter of a 15 x 15 m square; Burpees (fig. 1a);
2. Coordination abilities test static balance: by Bondarevsky's test (fig. 1b); Yarotsky's test (fig. 1c);

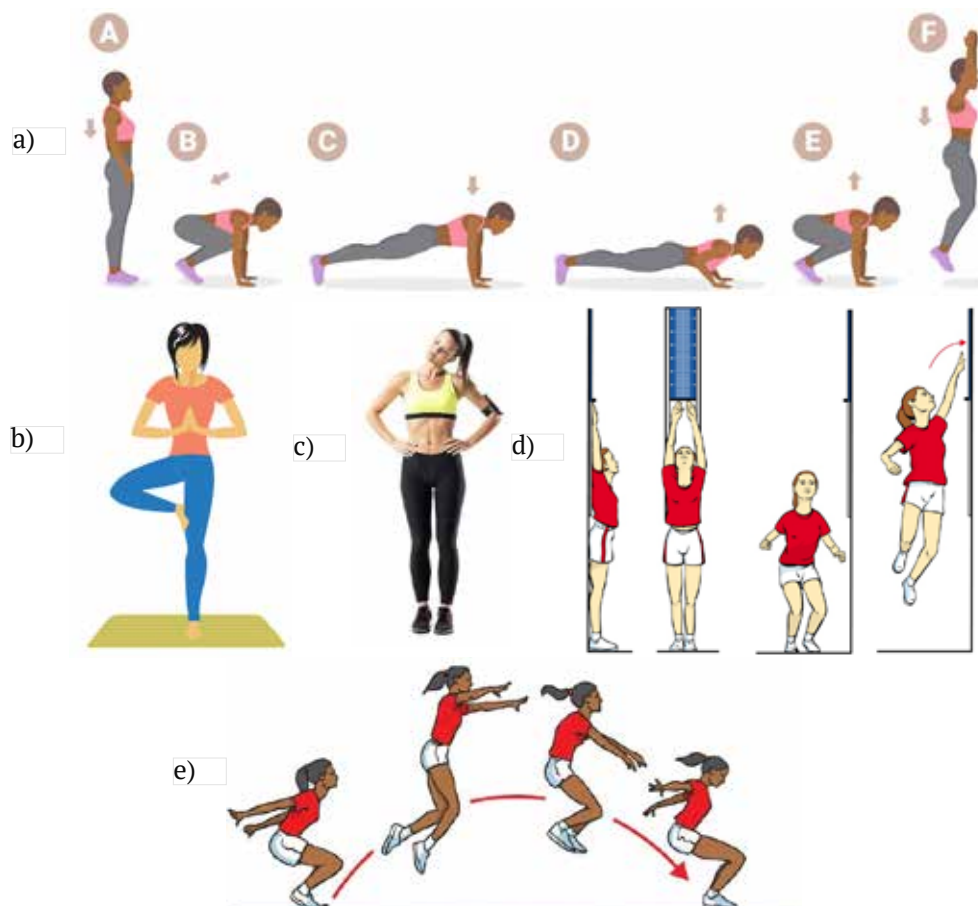


Figure 1. Battery of Tests (image: Sportshall; VectorStock)

3. Speed-strength abilities test: vertical jump from a standstill (fig 1d); Standing Long Jump Test (Broad Jump), cm (fig 1e).

Recommendations for the physical fitness of students were taken into account [12, 13, 14, 15]. The conditions for conducting the tests took into account the military situation in Ukraine and the proximity of the city of Kharkiv to the line of military contact. Therefore, the testing site was located near a bomb shelter (in case of an air raid alarm).

Statistical Analysis

Data were processed using the SPSS program (Statistical Package for the Social Sciences), version 26. The following statistical measures and criteria were applied in the analysis:

- Average value (\bar{X}) and standard deviation (SD) for describing the main characteristics of the sample;
- Independent t-test for comparing average values between two groups (boys and girls) at the initial stage of the study, as well as for assessing changes after educational intervention;
- Significance level (p-value) to determine the reliability of differences between the compared groups. A standard significance level of $p < 0.05$ was adopted in the study.

0.05 was adopted in the study. This means that results are considered statistically significant if the probability of a type I error (erroneous rejection of the null hypothesis) is less than 5%.

Results

The study yielded the following results, which are presented in Figure 2. These results reflect the physical fitness indicators of boys and girls aged 15-16 years at the initial stage of the study.

Based on the conducted study, the importance of a comprehensive approach to assessing the physical fitness of school students can be noted. These results emphasize the need to pay attention to strength and endurance indicators, which can further contribute to improving the overall health and physical development of adolescents.

The results of the pedagogical research, reflecting changes in the physical fitness of boys after targeted training interventions, are presented in Figure 3. The study demonstrates the effectiveness of the applied methodologies on the level of physical fitness of the participants.

The analysis of the pedagogical research results indicates a positive impact of the applied training programs on improving the physical

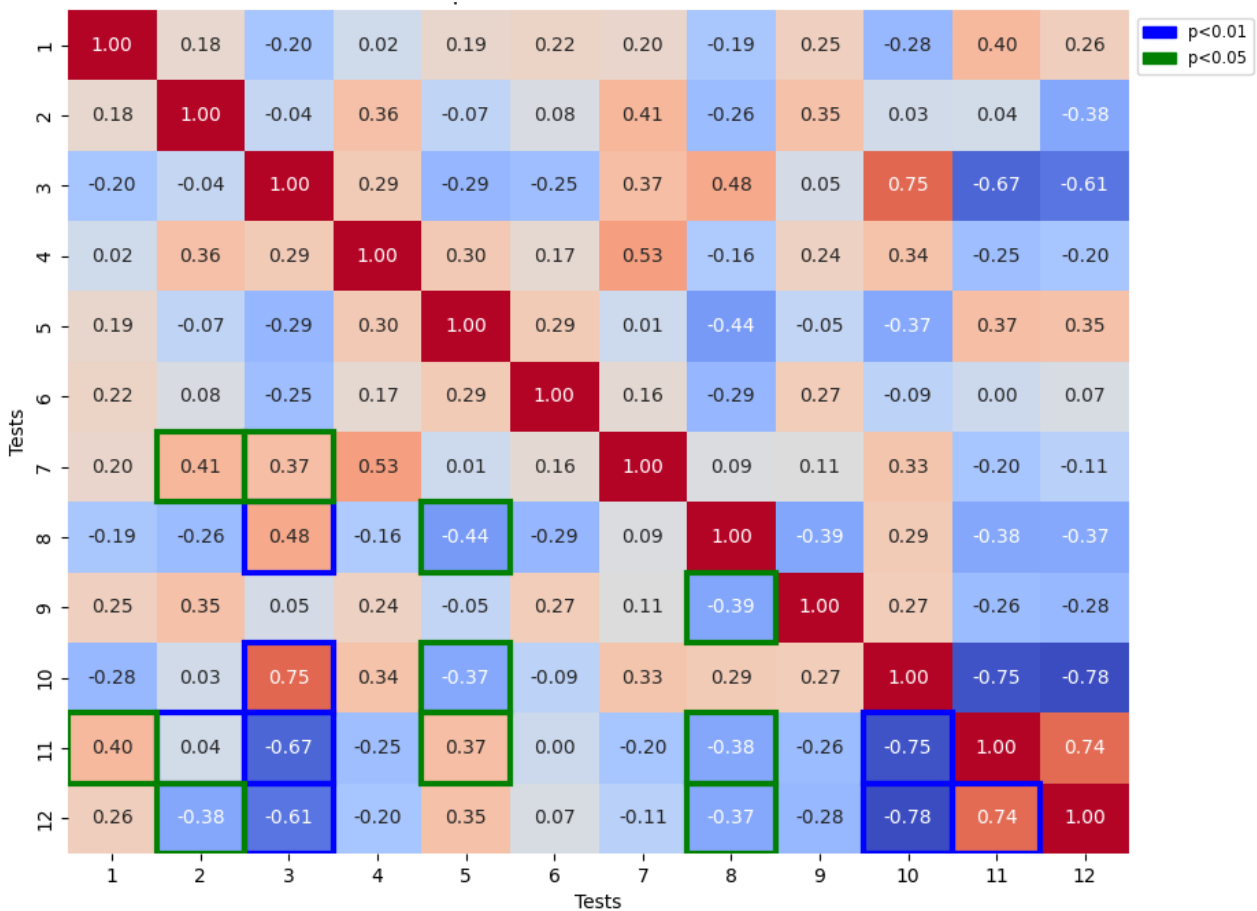


Figure 2. Physical fitness indicators of boys and girls aged 15-16 at the beginning of the study (Mean ± SD). Tests: 1 - 15x15 m square run, sec; 2 – Burpees; 3 - Bondarevsky’s test, sec; 4 - Yarotsky’s test, sec; 5 - Vertical jump from a standstill, cm; 6 - Long jump from a standstill, cm.

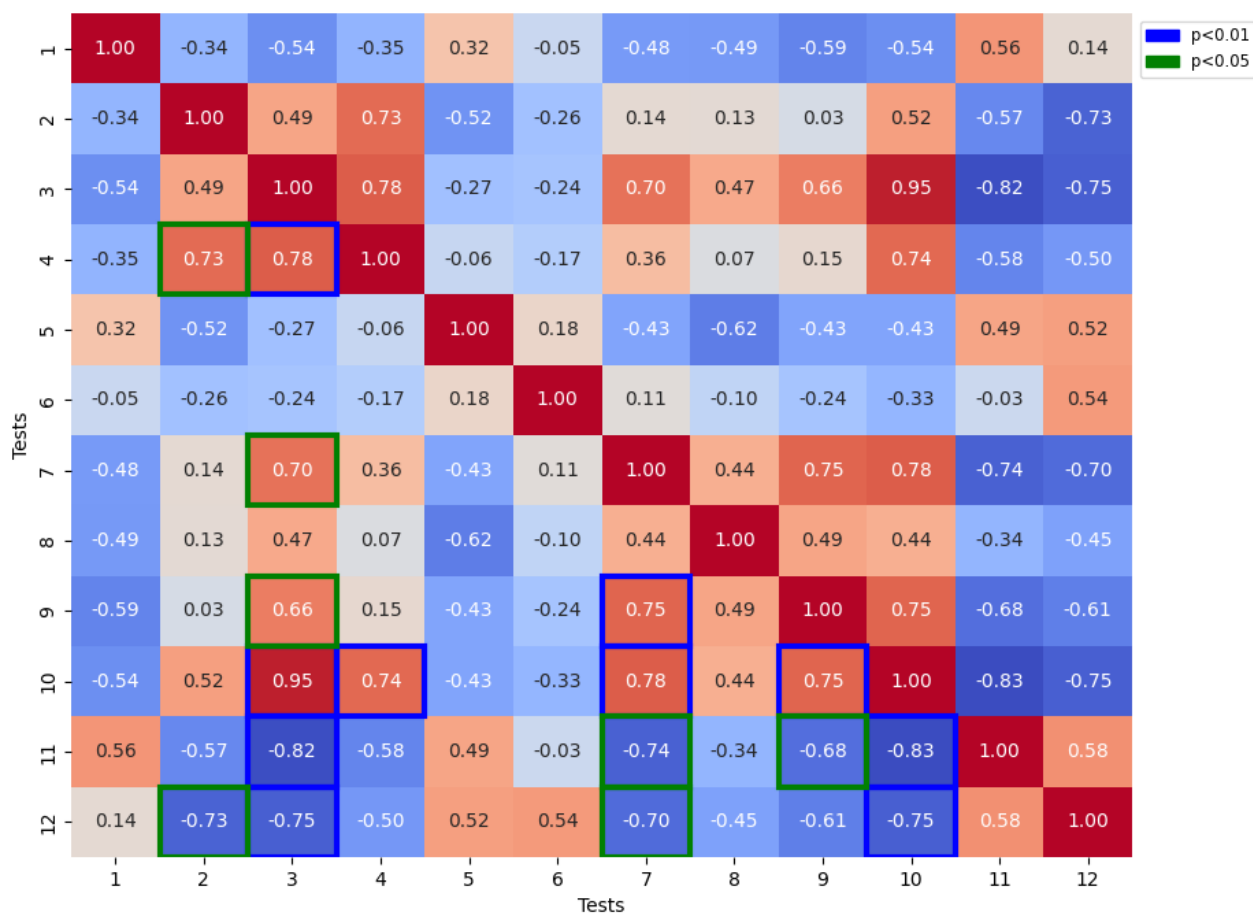


Figure 3. Physical Fitness Indicators of Boys After Pedagogical Research (Mean \pm SD). Tests: 1 - 15x15 m square run, sec; 2 – Burpees; 3 - Bondarevsky's test, sec; 4 - Yarotsky's test, sec; 5 - Vertical jump from a standstill, cm; 6 - Long jump from a standstill, cm.

fitness indicators of boys. This improvement was particularly noticeable in the results of the running test, the Burpee exercise, and the Bondarevsky and Yarotsky tests. However, it should be noted that changes in the indicators of jumping exercises do not show statistically significant improvement.

Changes in physical fitness indicators of girls identified in the study (Figure 3). The study revealed changes in the physical fitness indicators of girls, demonstrating the impact of educational methodologies on the physical abilities of girls.

The study shows that after the implementation of pedagogical methodologies, no statistically significant changes were recorded in the physical fitness of girls. These results may indicate that the training approaches used did not have the expected impact on improving physical indicators in this group. It may be necessary to reconsider the approaches and teaching methodologies to more effectively utilize the needs and abilities of girls. This will allow for noticeable improvements in their physical fitness.

Discussion

The aim of the study was to assess the impact of soccer exercises on the physical fitness indicators

of high school students in the context of online learning. The obtained results demonstrate a significant improvement in the physical fitness of the participants. This is consistent with the findings of previous studies, highlighting the positive impact of sports activities on the overall physical condition and social well-being of adolescents [6, 10, 16].

Soccer training not only improves physical indicators but also develops communication skills and the ability to work in a team. This is critically important for social development in adolescence [6, 13]. These aspects are especially significant in conditions where remote learning limits opportunities for social interaction.

An important aspect of the study was also the confirmation of the role of biological maturity and aerobic endurance in the physical fitness of young footballers [7, 16, 17]. This emphasizes the need to consider individual physiological characteristics when developing training programs.

However, the study also found that the anaerobic speed reserve remains relatively independent of other measured physical qualities. This result is consistent with the data of other authors [8, 17, 18]. It highlights the importance of applying specific

exercises aimed at improving anaerobic abilities in training programs for adolescents.

Furthermore, the use of various tests to assess physical qualities, including linear speed and change of direction speed, allows for a more comprehensive evaluation of students' physical potential and the adaptation of training programs to their individual needs [9, 16].

The results of our study confirm and expand existing knowledge about the positive impact of soccer exercises on physical fitness and social interaction among adolescents, emphasizing the significance of sports activity during remote learning. These findings offer valuable practical recommendations for school teachers aiming to improve the physical and social well-being of students.

Conclusions

Based on the data from the study, it can be concluded that the integration of specific sports exercises into the educational process is important. This approach is particularly crucial when students face restrictions related to the need for remote learning. Soccer, as a sport, offers a unique combination of physical activity and social interaction. This makes it particularly suitable for addressing issues of decreased physical activity and social isolation among teenagers.

In conclusion, this study confirms and expands existing knowledge about the positive impact of participation in soccer activities on the physical and social well-being of students. It also emphasizes the importance of implementing sports programs in the educational process, especially in situations where traditional forms of physical education are limited.

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