ORIGINAL ARTICLE

CONTENTS

Adaptive football in physical and sports rehabilitation of individuals with amputations: Impact on health-related quality of life, health status, and cognitive domain

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ABSTRACT

Aim: To investigate the impact of adaptive football training sessions on the indicators of health-related quality of life, health status, and the cognitive domain of individuals with amputations.

Materials and Methods: The research included 32 male service members and law enforcement officers who had suffered limb amputations as a result of blast and shrapnel injuries sustained during the war in Ukraine (2022-2025). Twenty-six participants had lower-limb amputations, and six had upper-limb amputations. Indicators of health-related quality of life and health status were assessed via the "SF-36 Health Survey". Cognitive domain status was evaluated using the indicators of "Attention Distribution and Span" and "Attention Concentration and Sustainability".

Results: It was found that adaptive football training sessions contributed to a statistically significant improvement in the physical and mental components of health among individuals with amputations. The greatest positive changes were observed in social functioning (12.28 %), vitality (9.99 %), and physical functioning (9.77 %) indicators. A statistically significant improvement was also observed in cognitive indicators: attention distribution and span (15.03 %) and attention concentration and sustainability (3.26 %). At the same time, changes in pain intensity did not reach statistical significance.

Conclusions: Adaptive football is an effective means of physical and sports rehabilitation for individuals with amputations, providing a comprehensive positive impact on indicators of health status, health-related quality of life, and cognitive domain. Regular training sessions help increase physical activity, improve psychological and emotional well-being, promote social adaptation, confirming the value of incorporating adaptive football into rehabilitation programs for people with amputations.

KEYWORDS: adaptive sports, amputee football, health, individuals with amputations, physical and sports rehabilitation, quality of life

Wiad Lek. 2026;79(9):2065-2071. doi: 10.36740/WLek/237516 DOI

INTRODUCTION

The full-scale war in Ukraine has been accompanied by a significant increase in the number of people who have suffered severe injuries resulting in limb amputations. According to estimates by international organizations, during the first two years of the Russian-Ukrainian war alone, more than 100,000 people lost an upper or lower limb [1]. Such a high number of amputations significantly highlights the challenge not only of the medical recovery of those affected but also of ensuring their long-term physical, psychological, and social rehabilitation.

Limb amputation is a complex biopsychosocial problem, the consequences of which are not limited to the loss of a specific anatomical structure but encompass a wide range of functional, psychological, and social changes [2]. People with amputations experience reduced motor activity, impaired movement biomechanics, limited functional capabilities, changes in their usual lifestyles, and the need to adapt to new living conditions [3]. In addition to physical limitations, a significant proportion of these individuals experience psycho-emotional difficulties, the most common of which include post-traumatic stress disorder, anxiety

and depression, low self-esteem, social isolation, and a reduced quality of life [4]. Common somatic consequences include phantom pain, postural abnormalities, muscle imbalances, and functional limitations caused by changes in movement patterns [5].

Under these conditions, comprehensive rehabilitation for individuals after amputation becomes particularly important; it must combine medical, physical, psychological, and social components of recovery. One of the promising areas of modern rehabilitation practice is the use of adaptive physical education and adaptive sports, which contribute to the restoration of the body's functional capabilities, increased levels of physical activity, the development of motivation for an active lifestyle, and successful social integration.

The analysis of current scientific sources indicates that rehabilitation for individuals following amputation is comprehensive in nature and must encompass the physical, psychological, and social components of recovery [6]. Researchers emphasize that, alongside medical interventions, psychological support is a key factor in successful rehabilitation; this support aims to overcome the consequences of a traumatic event, adapt to changes in physical condition, and foster readiness for active participation in social life [7]. It has been established that the effectiveness of psychological adaptation is largely determined by the level of motivation for physical activity, social interaction, and professional self-fulfillment among individuals with amputations [8].

After the acute postoperative period ends, the main goals of rehabilitation are preparation for prosthetics, restoration of functional independence, improvement of physical performance, and ensuring the individual's social integration [9]. In this regard, significant attention should be paid to developing strength, endurance, coordination, and balance, which help compensate for existing functional limitations and increase independence in daily activities [10].

Adaptive sports play a significant role in modern rehabilitation programs, and their effectiveness has been confirmed by numerous scientific studies [11]. It has been established that regular participation in adaptive sports positively affects the body's functional state, promotes the development of strength, endurance, and coordination, and improves balance and spatial orientation [12]. In addition, participation in sports activities helps improve physical health, expand social contacts, and foster a positive attitude toward one's own capabilities.

In recent years, team adaptive sports – which combine physical exertion with the need for constant interaction among participants – have attracted particular interest from researchers. It has been proven that participation in such activities helps reduce anxiety and depressive symptoms, boost self-esteem, increase self-confidence, and enhance motivation for further rehabilitation [13]. At the same time, the team-based training format creates favorable conditions for rebuilding social connections, developing communication skills, and successfully integrating people with amputations into society [14].

Among adaptive team sports, adaptive football (amputee football) is a promising tool for physical and sports rehabilitation. The nature of the game involves performing complex coordination tasks, moving quickly across the field, constantly monitoring the game situation, and making quick decisions. In this regard, adaptive football training sessions have the potential to influence not only participants' physical condition but also their cognitive domains, including attention, information-processing speed, spatial perception, and executive control [15, 16]. At the same time, the analysis of the scientific literature indicates that most studies focus on specific aspects of rehabilitation for individuals with amputations or on the impact of adaptive sports on physical fitness and psycho-emotional well-being. In contrast, the issue of a comprehensive assessment of the impact of adaptive football training sessions on indicators of health status, health-related quality of life, and cognitive domain in people with amputations has not been sufficiently addressed. This issue is particularly relevant in the current context of a growing number of people who have undergone amputations as a result of the Russian-Ukrainian war and who require effective means of long-term recovery and social adaptation. This highlights the need to study the impact of adaptive football training sessions on indicators of health-related quality of life, health status, and cognitive domain among individuals with amputations.

AIM

The aim is to investigate the impact of adaptive football training sessions on the indicators of health-related quality of life, health status, and the cognitive domain of individuals with amputations.

MATERIALS AND METHODS

PARTICIPANTS

The research, conducted between 2025 and 2026, included 32 service members and law enforcement officers who had suffered limb amputations as a result of blast and shrapnel injuries sustained during the war in Ukraine (2022-2025). All participants were male. Twen-

ty-six participants had lower-limb amputations, and six had upper-limb amputations. All research participants underwent rehabilitation at rehabilitation facilities in Kyiv. Inclusion criteria: the research included individuals with amputations who voluntarily expressed a desire to play amputee football to accelerate the restoration of physiological functions, improve their psychological well-being, and facilitate social adaptation. In addition, a mandatory condition for inclusion in the study group was approval from rehabilitation specialists and physicians, as well as the participants' clearance to participate in amputee football. The participants' age, education, occupation, and marital status were not taken into account. The volume of other motor activity types and the types of treatments participants received during rehabilitation were also not monitored. Exclusion criteria included a participant's desire to stop playing amputee football or a doctor's prohibition on continuing participation due to a deterioration in the participant's health.

The duration of the experiment was 6 months. The initial phase began in September 2025, and the final phase concluded in February 2026. Amputee football training sessions were held three times a week under the guidance of coaches and under the supervision of physical education and sports rehabilitation specialists at Dragomanov Ukrainian State University (Kyiv, Ukraine). Data processing and evaluation of the research results were carried out at the Department of Fitness and Adaptive Sports of Dragomanov Ukrainian State University.

MATERIALS AND METHODS

To achieve the set aim, a set of general scientific theoretical research methods was used. The analysis, systematization, generalization, and interpretation of scientific publications on the rehabilitation of people with amputations, adaptive physical education, and adaptive sports were conducted. The information base for the research consisted of scientific articles found in the international scientometric databases Scopus, Web of Science, and PubMed. The research process involved the bibliographic method, content analysis of scientific sources, comparative analysis, and the generalization of research results.

The research also involved empirical methods and mathematical statistics. Dynamics in health-related quality of life, health status, and cognitive domain indicators were assessed using the "SF-36 Health Survey" sociopsychological questionnaire, the "Number Searching" test, and the Bourdon-Anfimov cancellation test.

According to the method for assessing health-related quality of life and health status indicators, participants in the rehabilitation program were required to answer 36 questions on the "SF-36 Health Survey" questionnaire. The assessment was conducted by comparing the results obtained before and after the course of training sessions using adaptive football. The method does not specify normative or critical values. For each item, several response options are provided and scored proportionally on a scale from 0 to 100 points. A score of 0 points indicates the poorest health-related quality of life, while 100 points indicates the highest health-related quality of life. The results are presented across 8 scales, grouped into two categories that define physical and mental health components. The Physical Health (PH) component includes the following indicators: Physical Functioning (PF); Role-Physical Functioning (RP); Bodily Pain (BP); and General Health (GH). The Mental Health (MH) component includes the following indicators: Vitality (VT); Social Functioning (SF); Role-Emotional (RE); and Mental Health (MH) [17].

To assess the cognitive functioning of the research participants, the indicators "Attention Distribution and Span" and "Attention Concentration and Sustainability" were measured.

The "Attention Distribution and Span" indicator was assessed using the "Number Searching" test [18]. According to the test instructions, participants had to find and cross out on the answer sheet, as quickly as possible, the numbers missing from the main test sheet. The level of development of this aspect of attention was assessed using the number of correctly identified and crossed-out numbers on a 9-point scale. Depending on the result obtained, the following levels were identified: high – 8-9 points, sufficient – 6-7 points, satisfactory – 3-5 points, low – 1-2 points.

To determine the "Attention Concentration and Sustainability" indicator, the Bourdon-Anfimov cancellation test [19] was used. Scores were expressed as a percentage of the maximum possible result. Based on the obtained values, attention concentration and sustainability levels were interpreted as follows: low – less than 80 %, below average – 80-84 %, average – 85-89 %, above average – 90-94 %, and high – 95 % and above.

METHODS OF MATHEMATICAL STATISTICS

The statistical method was used to process the data obtained. The reliability of the difference was determined using the Student's t-test. The results were presented as Mean ± m, where Mean is the arithmetic mean, m is the standard error. The reliability of the difference was set at $p<0.05$. All statistical analyses were performed using STATISTICA 13.3.1 software package (2018), adapted for medical and biological research.

Table 1. Dynamics in health-related quality of life, health status, and cognitive domain indicators among individuals with amputations (n = 32)

Indicators	Research phases	Mean±m	t	p
Physical health, points				
Physical Functioning – PF	Initial phase	50.25±1.41	2.49	p≤0.05
	Final phase	55.16±1.38		
Role-Physical Functioning – RP	Initial phase	54.05±1.33	2.29	p≤0.05
	Final phase	58.15±1.20		
Bodily pain – BP	Initial phase	71.41±2.08	1.01	p≥0.05
	Final phase	74.30±1.95		
General Health – GH	Initial phase	64.69±1.05	2.35	p≤0.05
	Final phase	68.28±1.11		
Overall physical health component	Initial phase	60.10±1.38	2.33	p≤0.05
	Final phase	63.97±0.92		
Mental Health, points				
Vitality – VT	Initial phase	66.80±1.23	4.58	p≤0.001
	Final phase	73.47±0.78		
Social Functioning – SF	Initial phase	73.06±1.60	4.61	p≤0.01
	Final phase	82.03±1.11		
Role-Emotional – RE	Initial phase	72.05±1.30	2.97	p≤0.05
	Final phase	77.21±1.15		
Mental Health – MH	Initial phase	71.25±1.13	3.80	p≤0.01
	Final phase	75.94±0.50		
Overall mental health component	Initial phase	70.79±0.62	7.81	p≤0.001
	Final phase	77.16±0.53		
Cognitive domain indicators				
Attention Distribution and Span, points	Initial phase	5.92±0.24	2.79	p≤0.01
	Final phase	6.81±0.21		
Attention Concentration and Sustainability, %	Initial phase	87.68±0.82	2.56	p≤0.05
	Final phase	90.54±0.76		

Legend: Mean – arithmetic mean; m – error of arithmetic mean; n – number of female students; t – Student's test value; p – reliability value
Source: compiled by the authors of this study

COMPLIANCE WITH ETHICAL STANDARDS

The participants were informed of the research aim and voluntarily agreed to participate. The research results were reviewed and approved by the Academic Integrity Committee of the Dragomanov Ukrainian State University (Minutes No. 5 dated April 20, 2026).

FRAMEWORK

This study was carried according to the research plan of the Faculty of Physical Education, Sports and Health of the Dragomanov Ukrainian State University in 2023-2027 in accordance with the theme "Monitoring, control and evaluation of learning results in physical culture, the basics of healthy lifestyle" (state registration number 0113U009185).

AI STATEMENT

The author states that no AI tools were used in writing this article.

RESULTS

The results of the study on dynamics in health-related quality of life, health status, and cognitive domain indicators among individuals with amputations before and after a six-month course of adaptive football training sessions are presented in Table 1. The analysis of the SF-36 questionnaire results revealed positive changes in most of the indicators studied. In particular, a statistically significant increase in the overall physical health component indicator was observed, from 60.10 ± 1.38 to 63.97 ± 0.92 points ($p \leq 0.05$), corresponding to a 6.44 % increase.

Statistically significant positive changes were also observed in the physical functioning indicator. Its mean value increased from 50.25 ± 1.41 to 55.16 ± 1.38 points ($p \leq 0.05$), representing a 9.77 % increase. A similar trend was observed for role-physical functioning: the indicator increased from 54.05 ± 1.33 to 58.15 ± 1.20 points ($p \leq 0.05$), representing a 7.59% increase. Positive dynamics were also observed on the general health scale. The indicator rose from 64.69 ± 1.05 to 68.28 ± 1.11 points ($p \leq 0.05$), corresponding to an increase of 5.55 %. At the same time, the pain intensity indicator showed a trend toward improvement but did not reach statistical significance ($p \geq 0.05$).

The most significant changes were observed in the structure of the mental health component. Its composite indicator increased from 70.79 ± 0.62 to 77.16 ± 0.53 points ($p \leq 0.001$), representing an 8.71 % increase. The largest increase among all SF-36 indicators was observed on the social functioning scale. The indicator rose from 73.06 ± 1.60 to 82.03 ± 1.11 points ($p \leq 0.001$), corresponding to a 12.28 % increase. A high positive effect was also observed for the vitality indicator, which increased from 66.80 ± 1.23 to 73.47 ± 0.78 points ($p \leq 0.001$), representing a 9.99% increase. Self-assessed mental health improved significantly from 71.25 ± 1.13 to 75.94 ± 0.50 points ($p \leq 0.001$), representing a 6.58 % increase. The role-emotional functioning indicator, increased from 72.05 ± 1.30 to 77.21 ± 1.15 points ($p \leq 0.01$), corresponding to an increase of 7.16%.

The results of the cognitive domain assessment also showed positive changes. According to the "Number Searching" test, the "Attention Distribution and Span" indicator significantly improved from 5.92 ± 0.24 to 6.81 ± 0.21 points ($p \leq 0.01$). The relative increase was 15.03%, the highest among the cognitive indicators studied. At the same time, the level of development of this aspect of attention changed from satisfactory to sufficient.

According to the results of the Bourdon-Anfimov cancellation test, a statistically significant increase in the "Attention Concentration and Sustainability" indicator was observed, from 87.68 ± 0.82 % to 90.54 ± 0.76 % ($p \leq 0.05$). The relative increase was 3.26 %, accompanied by a shift from an average level of attention development to an above-average level.

Thus, six months of adaptive football training sessions resulted in statistically significant improvements in most physical and mental health indicators, as well as in cognitive aspects of attention, among individuals with amputations. The most significant positive changes were observed in the indicators of attention distribution and span (15.03 %), social functioning (12.28 %), vitality (9.99 %), and physical functioning (9.77 %), indicating the comprehensive impact of adaptive football on various components of the participants' health-related quality of life.

DISCUSSION

The results indicate a positive impact of six months of adaptive football training sessions on health-related quality of life, health status, and cognitive domain indicators among individuals with amputations. The most significant changes were observed in the mental components of health, which attests to the considerable rehabilitative potential of amputee football not only as a means of physical recovery but also as a tool for psychosocial adaptation.

Improvements in the overall indicator of physical health component, physical functioning, and role-physical functioning may be linked to the specific nature of amputee football training. Systematic practice of crutch-assisted locomotion, changing direction, accelerating, stopping, kicking the ball, and performing coordination exercises contributes to the development of muscle strength in the upper limbs, shoulder girdle, trunk, and the intact lower limb; improves the functional state of the cardiorespiratory system; and increases the level of motor independence [20]. It is precisely this improvement in the body's functional capabilities that likely underpinned the research participants' improved self-assessment of their health.

At the same time, the absence of statistically significant changes in pain intensity may be explained by the fact that post-amputation pain largely depends on individual characteristics of the injury, the presence of phantom pain, the condition of the residual limb, and the effectiveness of prosthetics. Thus, even amid positive changes in physical condition, the short-term impact of sports activities on pain sensations may be less pronounced.

Significant positive dynamics were observed in the social functioning indicator. This result is to be expected, as amputee football is a team sport in which performance depends largely on interaction among players, mutual support, and a sense of belonging to the team. Participation in training sessions and competitions helps expand social contacts, restore communication skills, and overcome the social isolation that often arises after limb loss [21].

Improvements in levels of vitality, mental health, and role-emotional functioning are likely linked to the comprehensive psychophysiological effects of training sessions. Regular motor activity helps normalize nervous system function, reduce psychological and emotional stress, and enhance subjective well-being. An additional factor is the achievement of athletic goals, increased confidence in one's own abilities, and the development of a positive outlook on life, which is particularly important for individuals who have experienced severe trauma and amputation [22, 23].

Positive changes in the cognitive domain are evidenced by significant improvements in indicators of attention distribution, span, concentration, and sustained attention. These results may be attributed to the high cognitive demands of amputee football. During the game, athletes must simultaneously monitor the ball's position, the movements of teammates and opponents, assess the game situation, and make quick decisions under time pressure. Such conditions stimulate the development of selective attention mechanisms, improve the ability to shift attention, and sustain it on relevant objects for extended periods. In addition, moderate, varied physical exercise positively affects cerebral blood flow, neurometabolic processes, and central nervous system function, which may also contribute to improved cognitive performance [24].

Overall, the research's results confirm that adaptive football has a comprehensive impact on the physical, mental, and cognitive domains of individuals with amputations. Its advantage lies in the combination of physical activity, elements of social interaction, and sustained cognitive engagement, which creates favorable conditions for improving participants' health-related quality of life and facilitating their successful social adaptation.

CONCLUSIONS

It was found that six months of adaptive football training sessions contributed to a statistically significant improvement in the physical and mental components of health among individuals with amputations. Positive dynamics were observed in indicators of physical functioning, role-physical functioning, and self-assessment of general health. The most significant positive changes were observed in the mental component of health, particularly in social functioning, vitality, and mental health indicators. At the same time, changes in the pain intensity indicator showed a positive trend but did not differ significantly.

The results of the cognitive domain assessment also demonstrated a positive impact of adaptive football training sessions, as evidenced by a statistically significant improvement in indicators of attention distribution and span, as well as concentration and sustained attention. The results obtained provide grounds for concluding that adaptive football has a comprehensive effect on the physical, psycho-emotional, and cognitive state of individuals with amputations and confirm the feasibility of using it as an effective means of physical and sports rehabilitation aimed at improving the health-related quality of life and functional capabilities of this group of individuals.

PROSPECTS FOR FURTHER RESEARCH

We see horizons for future research in the development and experimental testing of physical education and sports rehabilitation programs using adaptive football for individuals with amputations.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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RECEIVED: 10.03.2026
ACCEPTED: 27.08.2026

CREATIVE COMMONS 4.0