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Original scientific article

Modern Psychological Technologies for Correcting Conflict Situations in Limited Coalitions (Based on Volleyball Material)

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Abstract

The purpose of the work – to determine the peculiarities of the response of sportswomen to conflict situations in the conditions of a limited coalition of the volleyball team in order to optimize the process of sports training.

Materials and methods. Participants: 30 amateur volleyball players (women), who participated in park and beach volleyball competitions in the 2022-2023 season under the auspices of the Zaporizhzhia Regional Volleyball Federation. Age range: 18-27.

Methods: Analysis and systematization of data from scientific and methodical literature and the electronic resource of global information network "Internet"; pedagogical observations; psychological testing according to the method of K. Thomas "Determining the style of behavior in a conflict situation"; pedagogical experiment of controlling orientation; methods of mathematical statistics.

Results. The analysis of the experimental indicators allows us to state that the volleyball players of the main group significantly improved the "cooperation" (+6.67%) and "compromise" (+6.67%) indicators, while the "avoidance" indicator significantly decreased (-13.33%). Based on this, we note that the technology for correcting conflict situations in limited coalitions of the volleyball team is quite effective (indicators of volleyball players of the main group). Among the volleyball players of the control group, an increase in indicators according to the "compromise" criteria (+6.67%) and a decrease according to the "avoidance" criterion (-6.66%) were recorded.

Conclusion. Modern technologies of psychological training in volleyball, which relate to issues of correction of conflict situations in limited coalitions, are a prerequisite for increasing the effectiveness of the competitive activity of volleyball players. The main ways of applying these technologies in the training process in volleyball are the psychological diagnosis of female athletes taking in to account their personal qualifications, social roles in the limited coalition of the volleyball team; targeted application in competitive micro- or mesocycles of training to increase the effectiveness of training and competitive activities in limited coalitions.

Keywords: volleyball, training, psychological technologies, correction, limited coalition.

Introduction

Team sports games (including volleyball) are one of the most popular and spectacular sports. Scientists note that purely pedagogical approaches and technologies to improve the system of long-term training of athletes and increase the efficiency of competitive activities are practically exhausted (Oliinyk, et al., 2021; Doroshenko, I. Oliinyk, Melnyk et al., 2022). In this context, there is a problematic situation, which is due to the need for further improvement of long-term training and increasing the effectiveness of the training process of volleyball players, on the one hand, with almost complete exhaustion of the potential physiological resources of the body based on traditional technologies of long-term training of volleyball players, on the other hand. This state of affairs increases the importance of other factors that directly affect the effectiveness of sports training of volleyball players. In particular, this concerns the integration of modern psychological technologies for the correction of conflict situations into the training process of volleyball players, which

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can significantly increase the efficiency and effectiveness of the competitive activity of individual athletes and the team as a whole.

General scientific issues related to modern conflictology are thoroughly explained in scientific studies (Bevz, Petrenko, Husiev et al., 2020) – innovative communication technologies for the resolution of conflict situations in the social aspect; (Kazmirenko, Dukhnevych, Osadko et al., 2013) – principles of cognitive psychology of communication; (Danylova, Zhovtianska, Kukharuk et al., 2023) – psychological support for predicting social processes; (Petrenko, 2018) – specifics of communicative and technological settlement of social conflicts, etc.

From the point of view of modern psychological science, a volleyball team is a sports team that has the characteristics of a limited coalition (Chorna, Hornostai, Yaremchuk et al., 2021). This concerns the formation of formal and informal structures of relations in the sports team, which are determined by the peculiarities of the educational, training and competitive activities of volleyball players and socio-psychological factors – the coach's leadership style, the personal qualities of the members of the sports team, their social status in society and their role in the team, etc. (Oliinyk & Doroshenko, 2018; 2020). Also significant are the issues of formation of factors for a person to acquire social status in a limited coalition in the processes of leisure, recreation and health and other types of social activity (Lapshova, 2021); consideration of problematic issues of the formation of emotional stability of the individual as a psychological phenomenon (Andrusyk, 2022), which is especially significant for team sports games; psychological analysis of the personality in situations of external and internal uncertainty, which are characteristic of sports activities (Zaretska, 2023) and psychological features of the relationship between vitality and anxiety of the personality, which also has a significant impact on the success of the competitive activity of the volleyball team (Mushcherova, 2022). In addition, to solve this problem, it is important to take into account the gender characteristics of the manifestation of leadership (Khomenko-Semenova, Istratov, & Oksamytna, 2022) and the identification of a gender (female) personality in a limited coalition of a sports team (Korokhod, Tatianchykov, & Samara, 2023).

From the point of view of improving sports training in volleyball, studies (Doroshenko, Oliinyk, Melnyk et al., 2022) aimed at developing effective technologies for forming the psychological climate in limited coalitions (sports teams) are significant. Pertinent to this scientific issue are studies on the development of team cohesion and sustainable cooperation skills using specialized sports education models (Kao, 2019), issues of effective extrapolation of team improvisation into team adaptation (Abrantes, Passos, Cunha et al., 2018) and the development of integrative approaches to the induction of cognitive conflicts in pedagogical models of teaching volleyball tactics (Mastrogiannis, Antoniou, Sotiriou et al., 2017).

This state of affairs of the mentioned problem allows scientists to focus on the importance of social aspects in resolving conflict issues in limited coalitions (for example, women's volleyball teams). In particular, this concerns the issues of promoting social integration through sports for young people (Block & Gibbs, 2017; Haudenhuyse, 2017), the development of personal and social responsibility in limited coalitions of a volleyball team based on the application of mixed (hybrid) technologies (Muñoz-Llerena, Hernández-Hernández, García-de-Alcaraz et al., 2021). As a result, there is an improvement in cultural diversity, emotional well-being, and interpersonal relationships of volleyball players, which leads to the optimization of the psychological climate in limited coalitions (Lavega-Burgués, Bortoleto, Pic et al., 2021). In turn, this contributes to the optimization of sports training by positively influencing the skills of perception of game activity in volleyball during specialized training (Lin, Chang, Hung et al., 2022).

The above review of scientific research allows us to state that the issue of the formation of modern psychological technologies for the correction of conflict situations in limited coalitions of volleyball teams is covered in sufficient detail and thoroughly. However, there remain a number of finally unresolved problematic issues related to the search for ways of applying the most effective technologies for the correction of conflict situations in the practice of sports training in volleyball and the possibilities of their practical implementation; formation of managed conflict situations in limited coalitions of volleyball teams to optimize the psychological climate and sports training. These questions are not finally resolved and are the basis for conducting our research.

Hypothesis. The study of modern psychological technologies for the correction of conflict situations in limited coalitions of volleyball teams and the possibilities of their practical implementation in the sports training of volleyball players will allow to optimize sports training and increase the effectiveness of competitive activities.

The purpose of the work: to determine the peculiarities of the response of sportswomen to conflict situations in the conditions of a limited coalition of the volleyball team in order to optimize the process of sports training.

Materials and methods

Participants

Thirty amateur volleyball players (women), who participated in park and beach volleyball competitions in the 2022-2023 season under the auspices of the Zaporizhzhia Regional Volleyball Federation. Age range: 18-27. The main group – 15 volleyball players of the national team of the Zaporizhzhia State Medical and Pharmaceutical University; control group – 15 volleyball players from other teams.

Methods of research

Analysis and systematization of data from scientific and methodical literature and the electronic resource of global information network "Internet"; pedagogical observations; psychological testing according to the method of K. Thomas "Determining the style of behavior in a conflict situation"; pedagogical experiment of controlling orientation; methods of mathematical statistics.

Organization of research

The research was conducted during the competitive periods of the annual macrocycle of training amateur volleyball

players for the regional level competitions in park and beach volleyball of the 2022-2023 season (August-September 2022 and April-May 2023). The research was carried out taking in to account the criteria (Declaration of Helsinki of the World Medical Association "Ethical principles of medical research with the participation of a person as an object of research").

Interpretation of results

Rivalry (competition): the desire to achieve the satisfaction of one's own interests, regardless of the interests of others, active actions and willful efforts, orientation to one's own ideals and abilities, authoritarianism in decision-making.

Cooperation: active participation in conflict resolution, defending both one's own interests and the interests of partners, joint discussion of problems and needs.

Compromise: the ability of representatives of both parties involved in the conflict to give up their interests. Striving for a solution that satisfies both parties.

Avoidance: lack of desire for cooperation, passivity in defending one's rights due to one's own unimportance of solving the problem or a state of impasse, transfer of responsibility for solving the problem to others.

Adaptation: the ability to act together with a partner for his interests, the desire for harmony in the relationship, the comfort of both parties.

Results

In the study, amateur volleyball players were tested according to the method of K. Thomas "Determining the style of behavior in a conflict situation".

In the process of research, volleyball players of the main group were offered a technology for correcting conflict situations in a limited sports team coalition based on the use of specially developed psychological and pedagogical tasks, exercises, and situational role-playing games.

These tasks involved the creation of psychological and pedagogical conditions that contribute to the correction of conflict situations in a limited sports team coalition using methods of active socio-psychological training: discussion, training, situational role-playing and creative games.

In the structure of the technology for the correction of conflict situations in the limited coalition of the volleyball team, the sequence of the formation of psychological skills, which consists of three phases, is taken into account:

- the orientation phase, which contributes to the performance of the informational and motivational function;
- the assimilation phase, in which the pedagogical function of obtaining the necessary knowledge and applying it in conditions of uncertainty is performed;
- the phase of practical mastery, which is aimed at bringing the acquired knowledge, abilities and skills to automatism and their practical implementation in the conditions of a limited coalition of the sports team.

Volleyball players of the control group trained according to traditional schemes of sports training, without using the specified special psychological means

The results are shown in Table 1.

Table 1. Comparative analysis of the results of psychological testing of amateur volleyball players, n = 30

N	Levels of formation of motivation for successful resolution of conflict situations	To the experiment		After the experiment	
		number, n	number, %	number, n	number, %
	main group				
1	rivalry	6	40.00	7	46.66
2	adaptation	3	20.00	2	13.33
3	cooperation	2	13.33	3	20.00
4	avoidance	2	13.33	0	0.00
5	compromise	2	13.33	3	20.00
	control group				
1	rivalry	5	33.33	5	33.33
2	adaptation	3	20.00	4	26.66
3	cooperation	3	20.00	2	15.4
4	avoidance	2	13.33	1	6.66
5	compromise	2	13.33	3	20.00

Figure 1 and 2 shows the changes in the ways of responding to conflict situations of amateur volleyball players during the competitive periods of the annual training macrocycle.

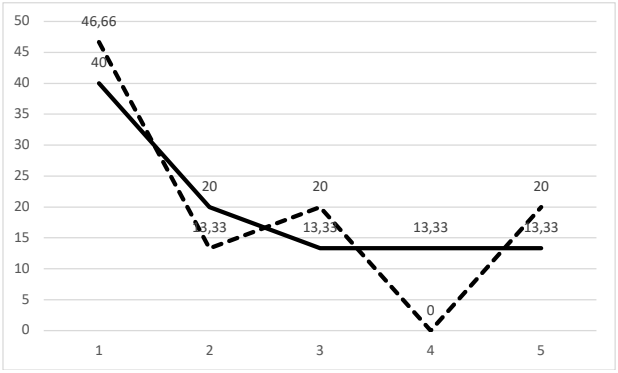

Fig. 1. Comparative analysis of the results of psychological testing of amateur volleyball players (main group), n = 15
notes: – number 1 (to the experiment); --- number 2 (after the experiment)

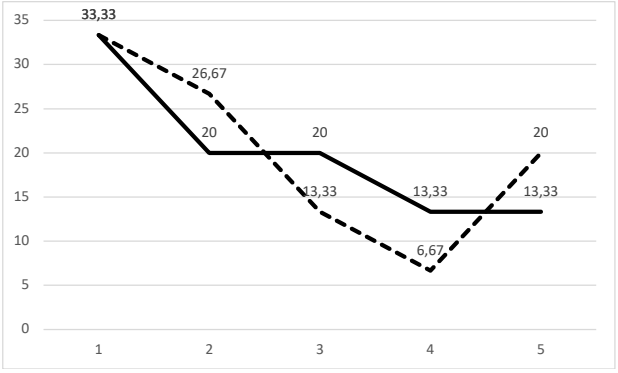

Fig. 2. Comparative analysis of the results of psychological testing of amateur volleyball players (control group), n = 15
notes: – number 1 (to the experiment); --- number 2 (after the experiment)

The analysis of the experimental indicators, which are shown in Figures 1 and 2, allows us to state that the volleyball players of the main group significantly improved the "cooperation" (+6.67%) and "compromise" (+6.67%) indicators, while the "avoidance" indicator significantly decreased (-13.33%). Based on this, we note that the technology for correcting conflict situations in limited coalitions of the volleyball team is quite effective (indicators of volleyball players of the main group). Among the volleyball players of the control group, an increase in indicators according to the "compromise" criteria (+6.67%) and a decrease according to the "avoidance" criterion (-6.66%) were recorded.

Discussion

The problem of the formation of modern psychological technologies for the correction of conflict situations in limited coalitions (based on the material of volleyball teams) is not a completely new topic in scientific research (Oliinyk, & Doroshenko, 2020; Mastrogiannis, Antoniou, Sotiriou et al., 2017; Muñoz-Llerena, Hernández-Hernández, García-de-Alcaraz et al., 2021).

In our study, for the first time, the possibilities of improving the effectiveness of competitive activity in volleyball based on the application of technologies for the correction of conflict situations in limited coalitions are shown (Oliinyk & Doroshenko, 2018) taking in to account the social roles of volleyball players in a sports team (Abrantes, Passos, Cunha et al., 2018) to form an optimal psychological climate (Doroshenko, I. Oliinyk, Melnyk et al., 2022).

In addition, in the process of conducting the research, the data of the general theory of sports and the system of training athletes in volleyball were supplemented with regard to the optimization of the training process and the improvement of the efficiency of competitive activity based on the application of psychological factors for the correction of conflict situations in the volleyball team (Oliinyk, Doroshenko, & Melnyk, 2021).

Multidisciplinary factors are also significant - improvement of cultural diversity, emotional well-being, interpersonal relationships and the ability to make optimal decisions in the conditions of fast-moving variable situations of competitive activity in volleyball (Lavega-Burgués, Bortoleto, Pic et al., 2021); formation and development of the cohesion of the volleyball team and the skills of stable cooperation of players in competitive activities with the help of models of sports education and theoretical training (Kao, 2019).

Prospects for further research in this direction are quite diverse: firstly, they relate to the issues of detailing the technology for correcting conflict situations in limited coalitions of volleyball teams, taking into account the gender and qualification differences of players; secondly, it is a matter of applying the mentioned technologies in various structural formations of the macrocycle of training - microcycles and mesocycles; thirdly, it is a question of diagnosing the mental states of volleyball players as a prerequisite for the correction of conflict situations in limited coalitions of volleyball teams.

Conclusions

Modern technologies of psychological training in volleyball, which relate to issues of correction of conflict situations in limited coalitions, are a prerequisite for increasing the effectiveness of the competitive activity of volleyball players.

The analysis of the experimental indicators allows us to state that the volleyball players of the main group significantly improved the "cooperation" (+6.67%) and "compromise" (+6.67%) indicators, while the "avoidance" indicator significantly decreased (-13.33%), which indicates the effectiveness of the presented technology.

The main ways of applying these technologies in the training process in volleyball are the psychological diagnosis of female athletes taking in to account their personal qualifications, social roles in the limited coalition of the volleyball team; targeted application in competitive micro- or mesocycles of training to increase the effectiveness of training and competitive activities in limited coalitions.

Conflict of interest

The authors state no conflict of interest.

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Сучасні психологічні технології корекції конфліктних ситуацій в обмежених коаліціях (на матеріалі волейболу)

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 6 с., 1 табл., 1 рис., 30 джерел.

Мета роботи – визначити особливості реагування спортсменок на конфліктні ситуації в умовах обмеженої згуртованості волейбольної команди з метою оптимізації процесу спортивної підготовки.

Матеріал і методи. Учасники: 30 волейболістів-любителів (жінок), які брали участь у змаганнях з паркового та пляжного волейболу сезону 2022-2023 під егідою Запорізької обласної федерації волейболу. Віковий діапазон: 18-27. Методи. Аналіз та систематизація даних науково-методичної літератури та електронного ресурсу глобальної інформаційної мережі «Інтернет»; педагогічні спостереження; психологічне тестування за методикою К. Томаса «Визначення стилю поведінки в конфліктній ситуації»; педагогічний експеримент контролюючої спрямованості; методи математичної статистики.

Результати. Аналіз експериментальних показників дозволяє стверджувати, що у волейболісток основної групи суттєво покращилися показники «співпраця» (+6,67%) та «компроміс» (+6,67%), а показник «уникнення» значно знизився (- 13,33%). Виходячи з цього, зазначимо, що технологія корекції конфліктних ситуацій в обмежених складах волейбольної команди є досить ефективною (показники волейболістів основної групи). Серед волейболісток контрольної групи зафіксовано зростання показників за критерієм «компроміс» (+6,67%) та зниження за критерієм «уникнення» (-6,66%).

Висновок. Сучасні технології психологічної підготовки у волейболі, які стосуються питань корекції конфліктних ситуацій в обмежених коаліціях, є передумовою підвищення ефективності змагальної діяльності волейболістів. Основними напрямами застосування цих технологій у навчально-тренувальному процесі у волейболі є психологічна діагностика спортсменок з урахуванням їх особистісних якостей, соціальних ролей у обмеженому складі волейбольної команди; цілеспрямоване застосування в змагальних мікро- або мезоциклах підготовки для підвищення ефективності тренувальної та змагальної діяльності в обмежених коаліціях.

Ключові слова: волейбол, навчання, психологічні технології, корекція, обмежена коаліція.

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Research of Reliability and Informativeness of Indicators of Muscular Fitness of Karate Boys Aged 8 Years

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

The aim of the research is to develop a program for testing the strength fitness of boys aged 8 years at the level of orange belt (10, 9 kyu) with the use of informative tests that are available for application in conditions of general education school.

Materials and methods. The study involved 20 boys aged 8 years. Informed consent for children's participation in the experiment was obtained from their parents. The following research methods were applied to solve the set tasks: analysis of scientific and methodical literature, pedagogical testing of strength abilities, and methods of mathematical statistics for processing research results.

Results. The analysis of correlation dependence between test tasks that characterize the display of different types of force generally shows a large and numerous interrelation of the average and high level of significance between all tests ($\rho xy = 0.508 - 0.879$ at $p<0.05$; $p<0.01$. Processing of retest data showed the stability of the battery of tests and sufficient retest reliability for most test scores (rtt ranged from 0.818 to 0.984, $p<0.001$).

Conclusions. The selected battery of tests is accessible, informative, and reliable. It will allow us to solve the following pedagogical tasks more effectively: to control the efficiency and effectiveness of physical training as an element of the pedagogical process of formation of motor skills and development of physical qualities, to maintain and strengthen health, to maintain a productive level of general working capacity, and to increase body resistance to action of unfavorable factors of the present.

Keywords: kyokushinkai karate, strength abilities, reliability of tests, informativeness of tests, boys.

Introduction

Muscle strength is one of the main components of physical training in martial arts. Well-developed upper and lower limb muscle strength is the key to effectively performing high physical and technical-tactical requirements in Kyokushinkai karate (Marchenko & Satdyiev, 2021; Hontarenko, Marchenko & Korol, 2022). It can also have a preventive effect on athletes involved in combat sports to prevent injuries (Pocecco, Ruedl, Stankovic et al., 2013; Follmer, Dellagrana, de Lima et al., 2017; Lystad, Augustovičova, Harris et al., 2020).

Marchenko & Handymov (2021), Kim, Won, & Shin (2021), and Hontarenko, Marchenko, & Korol (2022) note that regular strength training can contribute to an increase in physical activity, improve physical fitness and individual health only when it is part of a general physical education or sports program

Marchenko & Satdyiev (2021), Marchenko & Handymov (2021), for the development of strength in 10-year-old boys and girls engaged in Kyokushinkai karate, proposed the use of special outdoor games and game exercises as an effective means in the educational and training process for the complex improvement of strength abilities. According to Ropret & Jevtić (2019), Perreault & Gonzalez (2021), and Siswantoyo, Sudarko, Arga et al. (2023), the concept of martial arts training programs for children should be conducted in a playful way, cause pleasant sensations, and avoid specialization stages. Ropret & Jevtić (2019), Styriak, Billman, & Augustovicova (2020), and Ce & Ag (2023) believe that training children at the professional level negatively affects their growth, physical, and mental development, and increases the risk of injury.

In martial arts, achieving this goal is closely related to understanding the system of planning and management of the sports and training process (Chernozub, Danylchenko, Imas et al., 2019; Marchenko, Khudolii, Ivashchenko et al., 2023). In martial arts, coaches need to pay special attention to the components of profiling (conducting a fight with different dosages of contact, formal complexes with or without weapons, solo compositions to music) and testing individual progress in a particular type of martial arts.

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Evaluation of training effects at certain stages requires regular observation and coaching control, which are important in the process of training a young athlete. With the help of test results, physical education teachers and coaches have the opportunity to adjust training and competitive loads, which will allow them to correctly direct the training process (Pochettia, Ponczosznika, Filártigaa et al., 2018; He, Pan, & Du, 2019; Marchenko & Verdysh, 2021).

There is a need for comprehensive control of special strength indicators of schoolchildren's engaged in karate. Checking a complex of tests for informativeness and reliability will allow us to obtain the information necessary for a more exact assessment of the state of children's power fitness.

The aim of the research is to develop a program for testing the strength fitness of 8-year-old boys at the level of orange belt (10, 9 kyu) with the use of informative tests that are available for application in the conditions of general education schools.

Materials and methods

Participants in the study

The study involved 20 boys aged 8 years. The children and their parents were informed about the features of the study and agreed to participate in the experiment.

Design of the research

The following research methods were applied to solve the set tasks: analysis of scientific and methodical literature, pedagogical testing of power abilities, and methods of mathematical statistics for processing research results.

The procedure for testing strength abilities

The level of power fitness was determined using a battery of simple tests that do not require complicated additional equipment and are widely used in physical training. The selected tests cover all the main muscle groups, correspond to the purpose and tasks of the research. At the beginning of the experiment, the pupils were familiarized with the tests and the testing procedure. Health risk screening was conducted. Informed consent was obtained from the parents. Protocol forms were prepared, which included basic information about strength training. An appropriate warm-up was developed. When planning the study of strength training, parameters such as age, gender were taken into account, and testing conditions were created in accordance with the methodology. Standard EUROFIT protocols were used (Eurofit, 1993; Sergienko, 2010; Đurić S, Sember V, Starc G, Sorić M, Kovač M, Jurak, 2021).

Testing was conducted during a week during classes in the Kyokushinkai Karate Section. Children were given one to three attempts to complete the tests. The best result was taken for analysis.

Control exercises were conducted in the school gym. Before the examination, a set of exercises (10-15 min) was performed, which included running, jumping, general developmental exercises, and outdoor games. It was aimed at preparing children for the test tasks.

To check the selected set of tests for reliability and informativeness, a month later, a retest procedure was conducted under the same conditions (Hopkins, 2002; Anastasi & Urbina, 2007; Sergienko, 2010).

The complex chosen for experimental observations included the following tests:

Test 1 – push-ups;
Test 2 – hanging push-ups;
Test 3 – bent arm hang;
Test 4 – standing long jump;
Test 5 – sit-ups in 30s from the supine position;
Test 6 – handgrips of the right hand;
Test 7 – handgrips of the left hand;
Test 8 – throwing a stuffed ball (1 kg) from behind the head with both hands from a sitting position;
Test 9 – vertical jump.

Statistical analysis

IBM SPSS STATISTICS 26 was used in the study. The following parameters were calculated: arithmetic mean (X), standard squared deviation characterizing the variability of the mean (σ), standard error of the mean (m), median (Md), mode (Mo), skewness (AS), standard deviation of skewness, kurtosis (Ek), standard error of kurtosis, minimum, maximum. The hypothesis of normality of the data distribution was determined using the Kolmogorov-Smirnov (Dn) and the Shapiro-Wilk (W) tests.

We analyzed the correlation between test tasks that characterize the manifestation of the different types of strength using Spearman's rank correlation coefficient ρ. To determine the reliability of the test results, we calculated the reliability coefficient (rn) for correlating the paired samples.

Results

The results presented in Table 1 demonstrate the average level of the strength fitness of boys aged 8 years. The obtained values of the test results were compared with the norms of physical fitness assessment of primary school pupils of Ukraine (Sergienko, 2010) and certification norms in Kyokushinkai karate for fulfillment of qualification requirements of orange belt levels 10 and 9 kyu (Goncharenko, 2007; Goncharenko, 2021). According to the majority of the obtained values, children have high, above average, and average levels of development of strength abilities. In this sample, there were no indicators below the average.

Boys aged 8 years engaged in Kyokushinkai karate showed high results in dynamic strength and strength endurance. This may be due to the fact that the training program in Kyokushinkai karate at the orange belt level (10th and 9th kyu) involves active physical training with an emphasis on the development of trunk and upper limb muscle strength. Active strength gains in boys of this age may also be associated with age-related changes and occur to some extent independently of physical activity. At the same time, in the test aimed at detecting the strength of the abdominal muscles, the children showed an average result that corresponds to a good grade. It was found that the strength of the muscles of the lower extremities in boys is somewhat less developed. Tests in jumping exercises were performed using a satisfactory grade. In connection with the discrepancy of work of the lower and upper parts of

Table 1. Results of the calculation of descriptive statistics

Statistics		Push-ups, times	Hanging push-ups, times	Bent arm hang, s	Standing long jump, cm	Sit-ups in 30s from the supine position, times	Handgrips of the right hand, kg	Handgrips of the left hand, kg	Throwing a stuffed ball (1 kg) from behind the head with both hands from a sitting position, cm	Vertical jump, cm
N	Validated	20	20	20	20	20	20	20	20	20
	Skipped	0	0	0	0	0	0	0	0	0
Mean		22.5	2.95	14.495	129.5	14.45	11.8	11.2	302.8	25.7
Standard error of the mean		1.004	0.266	1.27	2.28	0.515	0.421	0.451	10.19	0.657
Median		21.5	3.0	14.3	132.5	14.0	12.0	12.0	317.5	26.0
Mode		18a	2	12.40a	134	13	12	13	322	25a
Standard deviation		4.49	1.191	5.674	10.195	2.305	1.881	2.016	45.603	2.94
Skewness		0.936	0.105	-0.387	-0.933	0.472	-0.154	-0.689	-0.271	-0.183
Standard deviation of skewness		0.512	0.512	0.512	0.512	0.512	0.512	0.512	0.512	0.512
Kurtosis		0.550	-0.839	-0.254	0.679	0.503	-10.17	-0.579	-10.243	-0.458
Standard error of the kurtosis		0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992
Minimum		17	1	2.5	105	10	9	7	229	20
Maximum		34	5	23.60	145	20	15	14	365	31

a. There are several modal values. The lowest value is shown

a body, it is desirable to include more exercises for muscles of the legs, as in karate they play an important role in training and performance of a kicking technique of the legs and different types of movements of karate athlete on the tatami.

The hypothesis of normality of the data distribution was determined using the Kolmogorov-Smirnov test. In almost all tests, the hypothesis of normality of data distribution is accepted. Due to the fact that the hypothesis of normality of distribution was not confirmed in the test "Handgrips of the left hand" ($p < 0.05$), we used the nonparametric Shapiro-Wilk test (Table 2). The value obtained from the Shapiro-Wilk test ($p > 0.05$) allows us to continue further calculations.

According to Hopkins (2002), the value of the correlation coefficient was considered trivial ($r < 0.1$), small ($0.1 \le r < 0.3$), moderate ($0.3 \le r < 0.5$), large ($0.5) \le r < 0.7$), numerous ($0.7 \le r < 0.9$), almost perfect ($r \ge 0.9$), and perfect ($r = 1$). The significance level was set at $p < 0.05$ (Table 3).

Table 2. Normality of data distribution according to the Kolmogorov-Smirnov and the Shapiro-Wilk tests (N=20)

Indicators under study	the Shapiro-Wilk test			
	Statistics	p	Statistics	p
Push-ups, times	0.161	0.184	0.914	0.075
Hanging push-ups, times	0.187	0.064	0.923	0.112
Bent arm hang, s	0.106	0.200*	0.968	0.716
Standing long jump, cm	0.147	0.200*	0.936	0.202
Sit-ups in 30s from the supine position, times	0.177	0.099	0.953	0.412
Handgrips of the right hand, kg	0.192	0.051	0.915	0.081
Handgrips of the left hand, kg	0.204	0.028	0.905	0.051
Throwing a stuffed ball (1 kg) from behind the head with both hands from a sitting position, cm	0.172	0.122	0.928	0.141
Vertical jump, cm	0.106	0.200*	0.982	0.959

Table 3. Interpretation of the closeness of the correlation coefficient (according to Hopkins, 2002)

Correlation coefficient	Characterization of the closeness of the correlation
0.0-0.1	very small, insignificant, practically zero
0.1-0.3	small, low, and insignificant
0.3-0.5	moderate, medium
0.5-0.7	large, high, main
0.7-0.9	very large, very high, huge
0.9-1	near, practically or almost: perfect, infinite

Since the sample size was n<30 and the variables in Handgrips of the left hand,test were not normally distributed (the Kolmogorov-Smirnov test), we decided to choose Spearman's rank correlation coefficient ρ to calculate the correlation between the test tasks.

The analysis of correlation dependence between test tasks (Table 4), characterizing the manifestation of different types of force, generally shows a large and numerous interrelation of medium and high level of significance almost between all tests (ρxy = 0,508 - 0,879 at p<0,05; p<0,01).

The results of the test "Sit-ups in 30s", which characterizes the manifestation of dynamic strength, do not show a huge correlation with all selected tests.

Statistically significant direct correlations were observed. All identified correlations had significant closeness according to Hopkins scale (2002).

The results of the test "Push-ups" have a very high correlation of high statistical significance with the tests "Hanging push-ups", ρxy = 0.795 at p<0.001, "Bent arm hang",

Table 4. Correlation dependence between the test tasks

		Correlationsb								
		Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Test 6**	**Test 7**	**Test 8**	**Test 9**
Test 1	Correlation coefficient	1								
	Signif. (two-sided)									
Test 2	Correlation coefficient	0.795**	1							
	Signif. (two-sided)	0.000								
Test 3	Correlation coefficient	0.795**	0.692**	1						
	Signif. (two-sided)	0.000	0.001							
Test 4	Correlation coefficient	0.715**	0.676**	0.524*	1					
	Signif. (two-sided)	0.000	0.001	0.018						
Test 5	Correlation coefficient	0.525*	0.531*	0.605**	0.376	1				
	Signif. (two-sided)	0.017	0.016	0.005	0.103					
Test 6	Correlation coefficient	0.840**	0.656**	0.710**	0.651**	0.508*	1			
	Signif. (two-sided)	0.000	0.002	0.000	0.002	0.022				
Test 7	Correlation coefficient	0.652**	0.572**	0.633**	0.460*	0.630**	0.746**	1		
	Signif. (two-sided)	0.002	0.008	0.003	0.041	0.003	0.000			
Test 8	Correlation coefficient	0.833**	0.773**	0.592**	0.746**	0.528*	0.842**	0.675**	1	
	Signif. (two-sided)	0.000	0.000	0.006	0.000	0.017	0.000	0.001		
Test 9	Correlation coefficient	0.754**	0.879**	0.649**	0.712**	0.442	0.715**	0.657**	0.798**	1
	Signif. (two-sided)	0.000	0.000	0.002	0.000	0.051	0.000	0.002	0.000	

**. The correlation is significant at 0.01 level (two-sided).

*. The correlation is significant at 0.05 level (two-sided).

b. Reference value N=20

ρxy = 0.795 at p<0.001, "Standing long jump", ρxy = 0.715 at p<0.001, "Handgrips of the right hand", ρxy = 0.840 at p<0.001, "Throwing a stuffed ball", ρxy = 0.833 at p<0.001 and "Vertical jump", ρxy = 0.754 at p<0.001.

The test "Hanging push-ups" demonstrates a reliable very high degree of correlation of high degree of significance with the results of tests "Throwing a stuffed ball", ρxy = 0,773 at p<0,001 and "Vertical jump", ρxy = 0,879 at p<0,001.

The mathematical processing of the data also revealed a very high correlation at a high level of significance of p<0.001 between the results of the two tests: "Bent arm hang" and "Handgrips of the right hand", ρxy = 0.710.

In addition, a very large correlation of high degree of significance was observed between indicators of the test "Standing long jump" with tests "Throwing of a stuffed ball", ρxy = 0,746 at p<0,001 and "Vertical jump", ρxy = 0,712 at p<0,001.

The results of correlation analysis demonstrate a very large positive interrelation of high degree of significance between indicators of the test "Handgrips of the right hand" with indicators of tests "Handgrips of the left hand", ρxy = 0,746 at p<0,001, "Throwing of a stuffed ball", ρxy = 0,842 at p<0,001, "Vertical jump", ρxy = 0,715 at p<0,001.

A very large positive correlation between indicators of the test "Throwing a stuffed ball" with "Vertical jump" with a value ρxy = 0,798 at p<0,001 was revealed.

As a result of correlation analysis peculiarities of interrelation between indicators of the test "Push-ups" with results of tests: "Sit-ups in 30s from the supine position" and "Handgrips of the left hand". There is a large positive correlation between them. In "Sit-ups in 30s from the supine position" ρxy = 0,525 at a low degree of significance p<0,017 and in "Handgrips of the left hand" ρxy = 0,652 at an average force of statistical significance p<0,002.

A large positive correlation with varying degrees of significance was also observed in the tests presented below. Thus, the test "Hanging push-ups" correlates with a high degree of significance p<0.001 with the tests "Bent arm hang", ρxy = 0.692 and "Standing long jump", ρxy = 0.676. At the level of average significance p<0.01, the results of this test correlate with the indicators of the tests "Handgrips of the right hand", ρxy = 0.656 and "Handgrips of the left hand", ρxy = 0.572. At a low statistical significance level of p<0.05, a correlation was observed with the results of the test "Sit-ups in 30s", ρxy = 0.531.

In the test "Bent arm hang" indicators have a big positive correlation with "Standing long jump", ρxy = 0,524, "Sit-ups in 30s", ρxy = 0, 605, "Handgrips of the left hand", ρxy = 0.633, "Throwing a stuffed ball", ρxy = 0.592 and "Vertical jump", ρxy = 0.649 at the level of average degree of significance (p<0.01).

The results of the test "Standing long jump" show a high correlation with the data obtained in the test "Handgrips of the right hand", ρxy = 0,651 at the average level of significance (p<0,002).

The correlation coefficients between test tasks "Sit-ups in 30s" and "Handgrips of the right hand", "Handgrips of the left hand", "Throwing of a stuffed ball" are in the range from 0,508 to 0.630, which characterizes a rather high level of correlation dependence at the average level of significance (p<0,05).

A high correlation dependence was obtained in comparison of the test "Handgrips of the left hand" with the test "Throwing of a stuffed ball", ρxy = 0,675 at a high level of significance (p<0,001) and at an average level of significance with the test "Vertical jump" ρxy = 0,657 (p<0,002).

There was a level of correlation of average strength between a test "Standing long jump" with "Sit-ups in 30s", ρxy = 0,376 and "Handgrips of the left hand", ρxy = 0,460; a test "Sit-ups in 30s" with "Vertical jump", ρxy = 0,442. The

connection between variables is statistically insignificant (>0.05) at detection of a correlation of "Standing long jump" with "Sit-ups in 30s", and "Sit-ups in 30s" with "Vertical jump". In this case, the correlation is recognized as statistically unreliable and not subject to meaningful interpretation.

A low degree of significance (p<0.041) was found between "Standing long jump" with "Handgrips of the left hand".

The data of correlation analysis give the possibility to carry out more perfect control over a condition of power fitness of boys aged 8 years engaged in Kyokushinkai karate.

To determine the level of reliability of the selected tests, we conducted additional testing within a month. In our opinion, this is a sufficient period for primary school children. The data processing showed the stability of the test battery and sufficient retest reliability for most test indicators (rtt ranges from 0.818 to 0.984). According to the reliability scale (Sergienko, 2010), poor reliability was found in the test "Sit-ups in 30s" (rtt = 0.761). However, from a practical point of view, there is evidence that values around 0.7 are considered good (Table 5).

Table 5. Correlations between paired samples

	Content	N	Reliability coefficient r_{tt}
Pair 1	Test 1 & retest 1	20	0.984
Pair 2	Test 2 & retest 2	20	0.818
Pair 3	Test 3 & retest 3	20	0.967
Pair 4	Test 4 & retest 4	20	0.919
Pair 5	Test 5 & retest 5	20	0.761
Pair 6	Test 6 & retest 6	20	0.931
Pair 7	Test 7 & retest 7	20	0.936
Pair 8	Test 8 & retest 8	20	0.995
Pair 9	Test 9 & retest 9	20	0.877

N = 20, p < 0,001

The analysis of the obtained correlations of paired samples indicates excellent reliability of "Push-ups" (rtt = 0.984), "Bent arm hang" (rtt = 0.967), "Throwing a stuffed ball" (rtt = 0.995).

During the repeated testing procedure, good reliability was obtained in the tests "Standing long jump" (rtt = 0.919), "Handgrips of the right hand" (rtt = 0.931), "Handgrips of the left hand" (rtt = 0.936).

The tests "Vertical jump" and "Hanging push-ups" showed acceptable reliability over time with rtt = 0.877 and rtt = 0.818, respectively.

Discussion

In the research, it was assumed that the offered complex of tests comprehensively characterizes the level of development of force in boys aged 8 years who train in a sports section of Kyokushinkai karate. The results of the correlation analysis between test tasks demonstrate their high reliability.

The obtained correlation coefficients between the results of two measurements (test-retest) indicate high reliability and stability of the test results. In the selected contingent of schoolchildren, there were parallel changes in different manifestations of power abilities.

The analysis of scientific papers has revealed that muscle strength is one of the main components of physical training for the successful fulfillment of high physical, technical, and tactical requirements in martial arts. Scientists have reported the emergence of "physical activity deficiency syndrome" with the negative consequences for the health of children and adolescents in many countries.

Experts note the need to revise the criteria for assessing motor abilities and make adjustments in accordance with current conditions (coronavirus, war in Ukraine, distance learning, migration). They point to the lack of monitoring studies and systematic approaches to assess the physical fitness of schoolchildren involved in sports clubs. This hinders the development of updated assessment criteria that would contribute to the individualization of the educational process.

The need to develop strength in martial arts students has been confirmed (Ma & Qu, 2017; Marchenko & Satdyiev, 2021; Hontarenko, Marchenko & Korol, 2022). Sufficient development of different muscle groups contributes to the successful performance of technical actions in Kyokushinkai karate (Hontarenko, Marchenko & Korol, 2022; Marchenko, Ivashchenko, Jagiello et al., 2022; Marchenko, Khudolii, Ivashchenko et al., 2023). The authors include preparatory exercises for the development of strength abilities in their training programs (Marchenko & Taranenko, 2020; Litvin & Marchenko, 2021; Marchenko, Khudolii, Ivashchenko et al. 2023, etc.).

Our results agree with Radenković & Stanković (2012), Liqin Yin, Changfa Tang & Xia Tao (2018), and Shaw, Schwartzel, Millard et al. (2020), who found that the correlation coefficients between the long jump and other upper limb strength tests were low. However, the long jump was also challenged by Radenković & Stanković (2012), Liqin Yin, Changfa Tang, & Xia Tao (2018), as the test results were sensitive to factors such as skill training.

Knowledge about the importance of control at the initial stage of schoolchildren's sports training and the consideration of such important characteristics as reliability and informativeness has been expanded (Liqin Yin, Changfa Tang & Xia Tao, 2018; Pochettia, Ponczosznika, Filártigaa, et al., 2018; Marchenko & Verdysh, 2021). The results obtained in this way will further contribute to the effective selection and use of various tests, the development of effective control programs, and the consideration of its results in the further planning of sports activities (Chernozub, Danylchenko, Imas et al., 2019; Kim, Won & Shin, 2021; Marchenko, Khudolii, Ivashchenko et al., 2023). The study also contributes timely detection of shortcomings during training at different stages of sports improvement.

Conclusions

The average indicators obtained after the first test correspond to the norms of development of children's strength abilities in this age category as defined by scientists in scientific literature. Children have high, above average, and average levels of development of power abilities. In the given sample, there were no indicators that had a level below an average.

Statistically significant direct correlations were observed. All the revealed connections had a noticeable closeness. The

data of correlation analysis allow to perform more perfect control over a condition of power fitness, covering control of different muscle groups in Kyokushinkai karate, promote the improvement of a training process and increase quality of planning of means of development of different types of force.

The informativeness of all chosen tests indicates the high efficiency of the use of this technique for the measurement of both general and special strength fitness of karate boys aged 8 years.

According to the results of the retest, there is a high reliability of the offered chosen test battery for checking the power possibilities of boys. Tests characterize different sides of the manifestation of power abilities and are directed on an estimation of the muscular force of the whole body.

The chosen battery of tests will allow us to solve the following pedagogical tasks more effectively: to control the efficiency and effectiveness of physical training as a pedagogical process of formation of motor skills and development of physical qualities, to maintain and strengthen health, to maintain a productive level of general working capacity, and to increase body resistance to the action of unfavorable factors of the present.

The next research area could be the development of norms of strength fitness for primary school pupils attending the sports section of Kyokushinkai karate for health improvement.

Conflict of interest

The authors declare no conflict of interest.

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Дослідження надійності та інформативності показників м'язової підготовленості хлопців каратистів 8 років

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 5 табл., 31 джерело.

Мета дослідження – розробити програму тестування силової підготовленості хлопців 8 років на рівні помаранчевого поясу (10, 9 кю) з використанням інформативних тестів, які доступні для застосування в умовах загальноосвітньої школи.

Матеріали і методи. У дослідженні взяли участь 20 хлопців 8 років. Від батьків було отримано поінформовану згоду на участь дітей в експерименті. Для вирішення поставлених завдань були застосовані такі методи дослідження: аналіз науково-методичної літератури, педагогічне тестування силових здібностей та методи математичної статистики обробки результатів дослідження.

Результати. Аналіз кореляційної залежності між тестовими завданнями, які характеризують прояв різних видів сили, в цілому показує великий та дуже великий взаємозв'язок середнього та високого рівня значимості між усіма тестами (ρxy = 0,508 – 0,879 при p<0,05; p<0,01. Обробка даних повторного тестування показала стабільність батареї тестів і достатню ретестову надійність за більшістю показників тестів (rtt знаходиться в межах від 0,818 до 0,984, p<0,001).

Висновки. Обрана батарея тестів є доступною, інформативною та надійною. Яка дозволить більш ефективно вирішувати наступні педагогічні задачі: контролювати ефективність та результативність фізичної підготовки, як елементу педагогічного процесу формування рухових навичок та розвитку фізичних якостей, підтримувати та зміцнювати здоров'я, зберігати продуктивний рівень загальної працездатності, підвищувати стійкість організму до дії несприятливих факторів сьогодення.

Ключові слова: кіокушинкай карате, силові здібності, надійність тестів, інформативність тестів, хлопці

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Postural Control Development of Students with Disabilities in the Process of Inclusive Physical Education

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Abstract

Background. An important aspect of ensuring the effectiveness of inclusive physical education of students with disabilities in higher education is taking into account the increase in certain violations in the state of health of students caused by the long war of the Russian Federation against Ukraine. As a result, a powerful factor of disability, a violation of postural control, is considered one of the main problems in inclusive PE of students with disabilities.

The study purpose was to reveal the effectiveness of inclusive PE classes on the development of postural control of students with disabilities in the process of implementing the developed program.

Materials and methods. To solve the tasks, a complex of scientific intelligence methods was used at the empirical and theoretical level: literature analysis, observation, testing, experiment, and methods of mathematical statistics. 30 first-year students with disabilities took part in the experiment. The organization of the study provided for the determination of the state of the studied parameters as a consequence of the action of the developed program aimed at correcting the postural control of students with disabilities.

Results. According to the results of the test control of maintaining balance and orientation in space, the development of postural control of students with disabilities after the end of the experimental study was established. The results of the study established an improvement in the quality of the balance function, as a correlator of translational control, in students of the studied sample after the end of the experimental study within 20%.

Conclusions. Considering the fact that postural control is ensured by the functional activity of the somatosensory, vestibular, visual and neuromuscular systems, scientifically based use of the tools of the developed inclusive PE program became a factor in improving the studied parameters of postural control of students with disabilities.

The established statistically reliable positive dynamics of the set of postural control indicators proved that the implementation of the developed innovations in the PE of students with disabilities provides a targeted impact on the normalization of balance functions. The obtained results of the conducted pedagogical experiment prove the effectiveness of the author's development of pedagogical actions regarding the correlation of postural control of students with disabilities in the process of inclusive physical education.

Keywords: inclusive, physical education, students with disabilities, postural control, program, effectiveness.

Introduction

The military aggression of the Russian Federation against Ukraine became a powerful factor in increasing the number of students with disabilities in higher education institutions. The undeniable role of the higher school as a social institution that forms not only a competent specialist, but also ensures the health of students with disabilities (Goodwin & Watkinson, 2020).

Currently, in Ukrainian society, special attention is paid to the process of gradually changing the attitude towards persons with disabilities. Overcoming obstacles to the integration of the above-mentioned social group is due to the European integration initiatives of Ukraine as a strong, independent and democratic country, which provides opportunities for them to acquire quality educational knowledge. This becomes especially important in connection with the long-term hostilities on the territory of our country.

In higher education, as a system of pedagogical activities aimed at strengthening health, harmonious development of forms, functions and physical capabilities, formation of vital motor skills and abilities, high-quality inclusive PE acquires special relevance (Simões, Lorenzini, Gavioli, Caminha, De Souza Júnior, & De Melo, 2018).

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Today, much attention is paid to current trends in the development of inclusive PE in Ukraine, as they are in an active state of activity development. The scientific pursuit of quality assurance in inclusive PE is the subject of numerous studies (Page, Anderson, & Charteris, 2021; Barber, 2018; Haegele, Giese Wilson, & Oldörp, 2020).

As indicated (Nanayakkara, 2022; Ruscitti, Thomas, & Bentley, 2017), a prominent feature of inclusive PE is its dynamism, as there is a constant adaptation of this process to the individual characteristics of students with disabilities (Lidor, & Hutzler, 2019).

An important aspect of ensuring the effectiveness of physical education for students with disabilities in higher education is taking into account the increase in certain disorders in their health (Keles, ten Braak, & Munthe, 2022; Goodwin, & Watkinson, 2000). Amputations of limbs and craniocerebral injuries caused by the long war of the Russian Federation against Ukraine occupy a special place among them. As a result of the indicated factors of disability, the violation of postural control is considered (Matiychuk, Nikitenko, & Maslova, 2023; Matiychuk, & Vlasyuk, 2023) to be one of the main problems in the PE process of students with disabilities.

The relevance of the chosen direction of research is due to the fact that psychological disorders, a state of tension or accumulated traumatization due to the impact of long-term terrorist attacks in Russia, according to certain theories, "is expressed in the curves of the spine" (Gurgel, Dourado, Moreira, Serafini, Menegotto, Reppold, & Soldera, 2012). At the same time, according to information (Bansal, Katzman, & Giangregorio, 2014), postural control, as the ability to hold the body in space, achieving both stability and orientation, ensures the achievement of balance in any situation. The significance of the study is determined by the fact that the coordination of the vertical position of the body while standing is an indicator of the functional state of the human body, and the level of its health (Hicheur, Vieilledent, & Berthoz, 2005).

We emphasize the importance of the development of postural control, given that it is a key component of the safe performance of vital functions in everyday activities, a factor in minimizing secondary complications for the preservation of motor function, and an external indicator of the state of health and quality of life (Voronova, Lazareva, Kovelska, & Kobinskyi, 2021). It is important to note that the normalization of postural antigravity mechanisms ensures motor development and prevention of contractures and deformations due to injuries (Halmágyi, & Curthoys, 2021).

The purpose of the article is to reveal the effectiveness of inclusive PE classes on the development of postural control of students with disabilities in the process of implementing the developed program.

Material and methods

Study participants

The research was conducted in the Department of PE of the National University «Lviv Polytechnic» and Department of physical education, sports and health 2Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies of Lviv during the one-year course of PE. 30 first-year students with disabilities (an equal number of girls and boys) took part in the experiment. The study was conducted following the Helsinki Declaration of the World Medical Association (WMA-2013) WMA, Ethical Principles of Medical Research Involving Human Subjects.

Methods

A complex of adequate methods of scientific intelligence was used to solve the tasks. Research at the theoretical level provided for the formation of an inclusive PE program for students with disabilities based on information from literary sources. For this, general scientific methods were used, including analysis, systematization, and generalization.

During the research at the empirical level, a complex of pedagogical methods was used: observation, testing, experiment, which included ascertaining and formative stages. At the final stage, the methods of mathematical statistics were applied to process and analyze the results of the experimental research and determine their reliability.

Because body balance control is considered part of postural control, the basic Romberg test (Blak, Wall, Rockette, & Kitch, 1983) was used to investigate and assess vertical stability. The testing consisted of two equal time (30 s) periods of recording parameters of the test performance with eyes open and eyes closed.

Romberg's test is performed standing, arms extended forward, fingers slightly apart. The student first performs the test task with his eyes open, and then his stability is assessed in the absence of visual control.

The tests "Walking to the goal" and "Walking in a straight line with closed eyes" (Magill & Anderson, 2017) were used to determine the level of development of the ability to navigate in space.

The procedure of the "Walking to the goal" test assumes that the student from the starting line during an arbitrary time estimates the distance to the center of the circle, which he must walk to the center of the circle at an arbitrary pace. At the end of the test, mark the projection of the body's center of gravity between the feet. Measure the distance from the marked projection of the center of gravity of the body to the center of the circle.

The test "Walking in a straight line with closed eyes" involves the following: a student from the starting line at an arbitrary pace blindfolded must reach a distance of 15 meters to the center of the circle. At the end of the test, mark the projection of the body's center of gravity between the feet. The result is the distance Deviation to the right or left from the marked projection of the center of gravity of the body – to the center of the circle.

"Stabilan 01-2" stability analyzer was used to register and analyze the statodynamic stability of the body of the participants of the research sample. This is how to evaluate the individual resistance of the body to the movement of the general center of mass in the sagittal and frontal planes and, in general, determine the effectiveness of maintaining balance.

Study organization

Consent was obtained from each participant of the studied sample, in accordance with established international re-

quirements. Permission was obtained from a medical worker to conduct the study, as well as data on the physical condition based on the medical history and medical examination of students with disabilities who were planned to be involved in the experiment. The ability to move independently, to perform self-care in everyday activities, which was confirmed by a primary care physician based on medical history and medical examination, was significant in the selection of participants of the experiment. Students with disabilities who had cognitive impairments were not included in the study.

The organization of the study provided for the determination of the state of the studied parameters at the beginning of the experiment and the detection of changes due to the action of the experimental factor. The introduction of a developed program aimed at correcting the postural control of students with disabilities in the process of inclusive PE was considered an experimental factor.

Statistical analysis

Statistics were used to prevent errors and biases in the evaluation of research results, in this case, the results of a pedagogical experiment. The choice of statistical methods was guided by the fact that the proper use of statistical methods is the basis for ensuring reliable conclusions of empirical research and the correct application of research results.

At the initial stage, methods of descriptive statistics were used. Finally, to determine the reliability of the obtained empirical results, the methods of inductive statistics (Bhandari, 2023) were used, which made it possible to draw general conclusions under the given assumptions. All statistical analyses were performed using SPSS Version 21.

Results

The premise of our research is that successful postural control depends on the operation of a complex postural control system that works together to achieve body balance (King, Horak, Mancini, Chesnutt, Sullivan, & Chapman, 2013). This system is formed by the somatosensory, vestibular, visual and neuromuscular systems. Any deviations in the activity of the listed systems cause the loss of postural control (Gandolfi, Valè, Filippetti, Dimitrova, Geroin, Picelli, & Smania, 2018).

The essential role of postural control in ensuring the performance of vital functions in various static and dynamic activities such as sitting, standing, crawling, walking and running, the ability to contract the relevant muscles necessary to maintain posture, and the ability to make small adjustments in response for changes in position. Maintaining postural stability in both dynamic and static conditions involves establishing a balance between destabilizing and stabilizing forces and requires sensory information received from these systems (Voronova, Lazareva, Kovelska, & Kobinskyi, 2021).

All of the above was the basis of the developed inclusive PE program. It was also taken into account that the pathological physiology of a postural control system disorder is multifaceted and consists of the synthesis of certain components (biomechanical, motor, sensory), orientation in space, control of dynamic movements, and cognitive processing.

Therefore, while studying different approaches using PE tools, we tried to combine them into a comprehensive program that would maximally take into account all the affected areas individually for each of the students with disabilities in the studied sample. A significant feature of the program is that it provides for the correction of the physical development of a student with a disability in the educational process through the introduction of the necessary PE equipment, based on individual needs and certain individual functional differences.

Because there is no single approach to solving the problem of regulating postural control in the process of inclusive PE, the basis of the formation of the content of classes is the complexity in the choice of means of influencing the formation of physiological stereotypes. Special attention was paid to the correction of body position regulation mechanisms, focusing on the exceptional importance of the muscle stretching factor in relation to the effect on the central nervous system.

When forming the content of classes in a certain sequence, the goal and task were specified, the forms of classes were defined for the implementation of differentiated content, and the current diagnosis of each state of the studied indicators of each student with disabilities, ensuring systematicity in the implementation of content correction following the results obtained, allowing for flexibility and changes during its implementation.

Considering the above, the normalization of postural control is a rather difficult task. Therefore, they tried to focus on certain individual aspects, which are considered to be an integral part of postural control.

According to scientific data, postural control has two main goals: postural balance, which is based on sensorimotor coordination, and postural orientation, which ensures the maintenance of an appropriate relationship between body parts or with the environment during the performance of a certain task (Gurgel, Dourado, Moreira, Serafini, Menegotto, Reppold, & Soldera, 2012). Based on the above, the scientific intelligence provided for the formation of conclusions about the quality of the introduced innovations based on the results of motion tests and stabiliography, which provided information about the specified parameters (Tabl. 1, 2).

The Romberg test was used as a «background» test in which the proprioceptive, visual, and vestibular analyzers operate in a natural mode (Blak, Wall, Rockette, & Kitch, 1983). Body balance, considered as the ability to maintain the body's center of gravity above the plane of support, which is ensured by the interaction of complex systems (Vovkanych, & Bergtraum, 2013), according to the results of testing, is characterized by the absence of a fundamental gender difference. Therefore, this aspect was not investigated in the control results.

It was established that the role of visual control has a significant place in maintaining balance in students with disabilities: the duration of maintaining balance without visual control is almost half as long, and the range of oscillations is more pronounced than when eyes are open. Therefore, at the end of the study, the place of visual control is somewhat leveled as a compensatory mechanism for maintaining body balance.

According to the results of Romberg's test, changes in the quality of coordination of the vertical position of the body while standing in a complex position were evaluated; the

Table 1. Test control results of students of the studied sample

Statistical parameters	Test tasks and measurement results							
	Romberg's test with eyes open (points)		Romberg's test with eyes closed (points)		Walking to the goal (sm)		Walking in a straight line with closed eyes (sm)	
Period of the experiment	at the beginning	after	at the beginning	after	at the beginning	after	at the beginning	after
M	14.13	18.21	7.17	10.3	44.23	35.12	131.6	106.5
S	3.5	3.09	2.31	2.06	3.15	2.88	14.03	11.08

*The differences in the results at the beginning and end of the year are significant (p<0.05–0.001)

Table 2. Stabiliography results of students of the studied sample

		Statistical parameters (M±S)			
	Period of the experiment	The center of the body amplitude in the frontal plane (mm)	The center of the body amplitude in the sagittal plane (mm)	Area of an ellipse, mm^2	The quality of the equilibrium function, %
with open eyes	at the beginning	3.31±0.53	2.95±0.52	93.2±3.1	53.1±3.5
	after	3.02±0.88	2.61±0.82	89.1±2.9	65.3±4.8
with closed eyes	at the beginning	3.93±0.21	3.99±0.92	173.6±4.5	40.1±2.2
	after	3.57±0.93	3.21±0.54	160.2±3.4	47.4±3.3

*The differences in the results at the beginning and end of the year are significant (p<0.05–0.001)

level of formation of skills of the motor-sensory system for managing body stability and changes in the quality of neuromuscular activity in students of the studied sample. The presence of statistically significant positive changes (up to 30%) after the approval of the developed program was established (at the p<0.05 level), which, in our opinion, is associated with a favorable effect due to its implementation.

Regarding the correction of the ability to navigate in space, the changes in the studied indicators (up to 20%) also confirm the success of the program, however, the proposed tasks were quite difficult to reproduce, especially in the absence of visual control.

According to the results of stabiliography at the beginning of the study, a significant spread in the frontal plane compared to the sagittal plane was observed in the students of the studied sample. Obviously, this is a consequence of the fact that in the presence of disability, in the presence of pathological curves in the spine, it is much more difficult to maintain balance in the sagittal plane. In the end, it was possible to reduce the spread to some extent.

The results of improvement in the quality of balance at the end of the experimental study (within 20%) are a consequence of the improvement in particular of muscle balance in the process of engaging in inclusive PE. The latter is also a factor in the displacement of the body's center of gravity, as a balance stabilizer. However, the effect of the optimal ratio between body weight and height as a functional factor stabilizing the balance function is not excluded.

Discussion

The leading idea of inclusive education is the need to ensure comprehensive personality development and health care of students with disabilities, which contributes to their successful adaptation in the environment of higher education and is the basis for further integration into social life (Mieghem, Verschueren, Petry, & Struyf, 2020). The potential of PE to provide the above has been researched and confirmed (Rouse, 2009; Ruscitti, Thomas, & Bentley, 2017). Therefore, we coordinate our research and emphasize the need to adapt the content, forms, methods and technologies of inclusive PE, as the main factor of health preservation, to the needs of modern times (Mihajlovic, & Meier, 2022).

Our research is based on the information that the rapid increase in the number of students with disabilities since the full-scale invasion of Russia on the territory of Ukraine and the long hostilities, the solution to the scientific and practical problem of overcoming health disorders in the process of obtaining higher education needs improvement, primarily by developing (modernization) of innovative pedagogical and practices (Pocock, & Miyahara, 2018; Grenier, Collins, Wright, & Kearns, 2014).

To date, there is no consensus on the optimal approach to implementing inclusive PE in higher education. In the conditions of active search for effective solutions to such a situation, it seems appropriate to study the possibilities of PE, which are answers to the challenges of the time, based on experimental activity. The science, experience and practice of advanced countries of the EU and the world confirm the need, with the development of new and improved technologies, to constantly create new programs of inclusive PE to improve the physical development of students with disabilities. Our study extends the findings of the research (Ruscitti, Thomas, & Bentley, 2017; Block, & Obrusnikova, 2007; Blavt, 2022) regarding the improvement of inclusive PE programs.

Among the wide spectrum of disorders of students with disabilities, limb amputations and brain injuries, which are accompanied by postural control disorders, are now the most common (Voronova, Lazareva, Kovelska, & Kobinskyi, 2021). The consequence of this is disorders of motor and muscle

functions, impaired coordination of movements, pathologies of muscle tone, which are manifested by weakness of a certain group of muscles, deformation of the spine and joints, formation of contractures, etc. (Hallett, DelRosso, Elble, Ferri, Horak, Lehericy, Mancini, Matsuhashi, Matsumoto, Muthuraman, Raethjen, & Shibasaki, 2021). Our study expands the circle of scientific research on the elimination of these violations in the process of inclusive PE (Goodwin, & Watkinson, 2020; Ruscitti, Thomas, & Bentley, 2017). The system of knowledge regarding directions for postural control correction in the process of inclusive PE was supplemented (Matiychuk, Nikitenko, & Maslova, 2023; Matiychuk, & Vlasyuk, 2023).

The conclusions of scientists have confirmed, that the study of postural control is a rather difficult task, since possible disturbances in many sensory systems and other physiological mechanisms of regulation of this parameter, in particular the center of body mass, should be taken into account (Gurgel, Dourado, Moreira, Serafini, Menegotto, Reppold, & Soldera, 2012; Vovkanych, & Bergtraum, 2013).

The results of the conducted study confirm the results of previous studies regarding the need for targeted influence in the process of inclusive PE, taking into account the specific violations of students with disabilities (Lidor, & Hutzler, 2019; Koryahin, Blavt, Bakhmat, Guska, Ludovyk, Prozar, Bodnar, Kravets, & Bezgrebelnaya, 2019). Our research is consistent with the findings of a previous study (Ivashchenko, 2020) that a targeted effect on a certain functional characteristic leads not only to its improvement but also to some others that were not affected due to the «crossover effect».

The results obtained during the pedagogical experiment confirm the conclusions of scientists (Mihajlovic, & Meier, 2022; Justin, & Zhu, 2017; Grenier, Patey, & Grenier-Burtis, 2022) regarding the need to organize inclusive PE based on the effective selection of organizational forms, methods, and technologies and teaching aids, which is based on a differentiated approach taking into account the factor of students' disability, based on individual needs and individual functional differences.

We support scientific approaches (Matiychuk, Nikitenko, & Maslova, 2023; Matiychuk, & Vlasyuk, 2023) that adding stabilometric criteria to postural control in the process of inclusive PE contributes to improving the diagnosis of existing disorders and makes it possible to objectively monitor the state of the investigated balance indicators and spatial orientation of the bodies of students with disabilities, and is a factor in the effectiveness of the applied innovations.

Research that has been conducted (Goodwin, & Watkinson, 2020; Page, Anderson, & Charteris, 2021; Ruscitti, Thomas, & Bentley, 2017) suggests that a professional approach to harnessing the potential of inclusive PE, which is based on changes in understanding and practices of this process to ensure the improvement of the physical condition of students with disabilities, will have a positive impact on the inclusive policy in the field of education.

The practical significance of the research results lies in the possibility of adapting the proposed innovations in the inclusive PE of students with disabilities.

Conclusions

Inclusion in higher education is an urgent need of the hour since the military aggression of the Russian Federation on the territory of Ukraine became a factor in the significant increase in the number of students with disabilities. Society's demands for high-quality graduates of a higher school provide for its highest possible development, to a large extent due to the need to ensure high effectiveness in the education or work of students with disabilities.

The higher school, which ensures the fulfillment of the social order - the preparation of a comprehensively developed harmonious personality, provides for the formation of physically healthy specialists. The latter is intended to be implemented by the modern theory and practice of inclusive PE, which is based on the need to eliminate the segregation of students with disabilities in the environment of higher education, aimed at preventing existing negative trends in their physical development, health to ensure a full, productive life and activities in the process of obtaining a higher education education

The systematization and generalization of the final results at the end of the experiment testify to the benefit of using the developed translational control correction program in the process of inclusive PE. According to the obtained results, the statistically reliable positive dynamics of the complex of studied indicators of EG students proved that the implementation of the intended content of the developed inclusive PE program for students with disabilities ensures effectiveness in the development of postural control: the analysis of the state of the studied parameters before and after the action of the experimental factor by the method of test control and stabilography proved improvement in their values according to the results of the final cut of the results of the indicators of the balance function and orientation in space.

Taking into account the fact that translational control is provided by the functional activity of the somatosensory, vestibular, visual and neuromuscular systems, scientifically based use of the means of use of the developed inclusive PE program became a factor in improving the studied parameters of translational control of students with disabilities. In general, the results of the conducted pedagogical experiment prove the effectiveness of inclusive PE classes on the development of postural control of students with disabilities in the process of implementing the developed program.

Conflicts of interest

No conflicts of interest exist.

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Розвиток постурального контролю студентів з інвалідністю у процесі інклюзивного фізичного виховання

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 5 табл., 31 джерело.

Важливим напрямом забезпечення ефективності інклюзивного фізичного виховання здобувачів вищої освіти з інвалідністю у вищій школі є урахування збільшення певних порушень у стані здоров'я здобувачів вищої освіти, зумовлені тривалою війною рф проти України. Як наслідок, потужного чинника інвалідизації, порушення постурального контролю, вважається одним з головних проблем у інклюзивному фізичному вихованні здобувачів вищої освіти з інвалідністю.

Мета статті – виявити ефективність впливу занять інклюзивного фізичному вихованні на розвиток постурального контролю здобувачів вищої освіти з інвалідністю у процесі реалізації розробленої програми.

Матеріали та методи. Для вирішення поставлених завдань використовували комплекс методів наукової розвідки на емпіричному та теоретичному рівні: аналіз літератури, спостереження, тестування, експеримент, методи математичної статистики. В експерименті взяли участь 30 здобувачів вищої освіти з інвалідністю першого року навчання у закладі вищої освіти. Організація дослідження передбачала визначення стану досліджуваних параметрів як наслідку дії розробленої програми, скерованої на корекцію постурального контролю здобувачів вищої освіти з інвалідністю.

Результати. За результатами тестового контролю утримання рівноваги та орієнтування у просторі установлено розвиток постурального контролю здобувачів вищої освіти з інвалідністю по закінченні експериментального дослідження. Підсумками дослідження установлено покращання якості функції рівноваги, як корелятора поступального контролю, у здобувачів вищої освіти досліджуваної вибірки у межах 20%.

Висновки. Зважаючи, на те, що постуральний контроль забезпечується функціональною діяльністю соматосенсорної, вестибулярної, зорової та нервово-м'язової систем, науково-обґрунтоване використання засобів розробленої програми інклюзивного фізичного виховання стало чинником покращання досліджуваних параметрів постурального контролю здобувачів вищої освіти з інвалідністю.

Установлена статистично достовірна позитивна динаміка комплексу показників постурального контролю засвідчила, що реалізація розроблених новацій у фізичному вихованні здобувачів вищої освіти з інвалідністю забезпечує цілеспрямований вплив на нормалізацію функцій рівноваги. Отримані результати проведеного педагогічного експерименту доводять ефективність авторської розробки педагогічних дій щодо кореляції постурального контролю здобувачів вищої освіти з інвалідністю в процесі інклюзивного фізичного виховання.

Ключові слова: інклюзія, фізичне виховання, здобувач вищої освіти з інвалідністю, постуральний контроль, програма, ефективність.

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Your review will help the editor decide whether to publish the article or not. Giving your overall opinion and general conclusions about the article are essential. Your comments should be courteous and constructive, and should not contain any personal remarks or personal data, including your name.

Providing insight into any deficiencies is important. You need to explain your judgment so that both editors and authors will be able to fully understand the reasoning behind your comments.

Checklist

Please evaluate the following aspects of the article: (If the answer is "No", please make your improvements in the field "Information for authors", if applicable)

- Does the title accurately reflect the content of the text?
- Is the aim of the review clearly stated?
- Does this article make a significant contribution to the development of this problem?
- Is the article sufficiently complete and up-to-date?
- Is the article clearly written (concise, clear and well organised)?
- Is the essence of the article covered in the abstract? Is the abstract informative and concise?
- Are the author's conclusions adequately supported by references?

Please provide specific comments and suggestions, particularly on the layout, title, description, introduction, hypothesis and/or subject of study, materials and methods, statistical processing of materials, results, discussions, conclusions, language and references.

If you see the manifestations of academic dishonesty, discuss your suspicions with the editor, providing as much detail as possible.

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The editor-in-chief decides whether to accept or reject the article. The editor, before making a decision, will weigh all the views and may call for a third opinion or ask the author to revise the document. The editorial system provides users with a notification of the final decision.

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