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SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

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CONTENT

Peculiarities of adaptive changes of qualified athletes to middle mountain conditions

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Abstract

Purpose: to study the peculiarities of adaptive changes in high-class athletes to the effect of significant physical loads in middle mountain conditions.

Material & Methods: determination of the level of urea and the concentration of hemoglobin in the blood was carried out using a biochemical analyzer "Diaglobal" (Germany) using ready-made kits of reagents from the same company.

Results: the article discusses the ways to improve the efficiency of training process management in athletics (race walking) and modern pentathlon, based on the use of biochemical control over the development of adaptation in various climatic conditions of the body of highly qualified athletes under the influence of training and control-competitive activities.

Conclusions: the reaction to the load of the blood system on the hemoglobin in the second microcycle of modern pentathletes showed an unwillingness to perform these loads, due to the fact that most athletes perform training loads at this height for the first time, while in athletes engaged in race walking in the second microcycle adaptive polycythemia was developing. This ensures the formation of sustainable adaptation, which allows you to perform the planned program of training loads. A blood test of race walking athletes showed that the concentration of urea, which was determined before exercise at rest, gradually increased within normal limits, and characterized the tolerability of training loads.

Анотація

Людмила Станкевич, Юлія Хмельницька, Наталія Вдовенко, Галина Россоха, Валентина Єфанова. Особливості адаптаційних змін кваліфікованих спортсменів до умов середньогір'я. Мета: дослідити особливості адаптаційних змін спортсменів високого класу на дію значних фізичних навантажень в умовах середньогір'я. **Матеріал і методи:** визначення рівня сечовини та концентрації гемоглобіну в крові проводились за допомогою біохімічного аналізатора «Diaglobal» (Німеччина) з використанням готових наборів реактивів цієї ж фірми. **Результати:** у статті розглянуто напрями підвищення ефективності управління тренувальним процесом в легкій атлетиці (спортивна ходьба) та сучасному п'ятиборстві, що засновані на використанні біохімічного контролю за розвитком адаптації в різних кліматичних умовах організму спортсменів високої кваліфікації під впливом тренувальної і контрольно-змагальної діяльності. **Висновки:** реакція на навантаження системи крові за показником гемоглобіну у другому мікроциклі спортсменів сучасного п'ятиборства свідчила про неготовність виконувати дані навантаження, що пов'язано з тим, що більшість спортсменів вперше проводять тренувальні навантаження на такій висоті, тоді як у спортсменів спортивної ходьби в другому мікроциклі розвивалась адаптаційна поліцитемія. Це забезпечує формування стійкої адаптації, що в свою чергу дозволяє виконувати заплановану програму тренувальних навантажень. Дослідження крові спортсменів спортивної ходьби засвідчило, що концентрація сечовини, яку визначали до навантаження в стані спокою, поступово збільшувалася в межах норми, і характеризувала переносимість тренувальних навантажень.

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Introduction

The issues of building sports training belong to the category of the most difficult problems in the conditions of modern sports. Despite the fact that at present the main provisions of the organization of the training process have been studied and sufficiently substantiated, a number of issues remain unexplored (Platonov, 2015; Mujika et al., 2019). These include the planning of training loads in special climatic and geographical conditions (mountains).

The growth of sports results and competition in the world sports arena put forward new, increased requirements for optimizing the process of sports training and competitive activity based on an objective assessment of different aspects of preparedness and functional capabilities of the athl etes body (Suslov et al., 2001; Platonov, 2015). The current situation requires specialists to develop priority areas that allow them to unlock the reserves for achieving high sports results (Maydanyuk et al., 2017; Zemtsova et al., 2020). Particularly acute is the problem associated with the use of modern approaches that allow to increase physical performance and recovery processes, to monitor the condition of the athlete and their level of preparedness (Płoszczyca et al., 2018; Kropta et al., 2020).

Achieving significant sports results, in turn, requires great efforts of the physical and mental strength of athletes (Saunders et al., 2009; Platonov, 2015). In order to increase the efficiency of the adaptation process to intense training and competitive loads, additional activities are often used, one of which is training in mountainous areas (Wilber, 2001; Billaut et al., 2012; Chapman et al., 2016; Flaherty et al., 2016).

The level of functional capabilities of the body cannot be obtained only by increasing the volume and intensity of physical activity, even with the improvement of training methods. A constant increase in the volume of loads can negatively affect the functional state and health of athletes, the growth of sports results and lead to a state of overtraining (Terrados, 1992; Platonov, 2015; Stankevich et al., 2018).

Therefore, it is necessary to look for additional opportunities to create a foundation for the formation of a greater influence on the functioning of various body systems in order to increase the effectiveness of training and competitive activities. Pedagogical and medical-biological studies show the effectiveness of the mid-mountain factor in the system of means for improving the functional and metabolic capabilities of the body of representatives of different sports (Suslov & Gippenreyter, 2001; Rusko et al., 2004; Platonov, 2015). Experimental materials obtained as a result of studies in the mountains, as well as under conditions of artificial hypoxia, have demonstrated their effectiveness in terms of the effect on the body of athletes of various specializations.

Thus, the effectiveness of mountain training, as a means of increasing the functional capabilities of athletes and sports results, in all sports related to the manifestation of endurance athletes, has now been completely proven (Suslov & Gippenreyter, 2001; Wilhite et al., 2013; Chapman et al., 2016). However, interest in the conditions of middle and high mountains is constantly growing due to the expansion of the number of competitions held in mountain conditions (Rusko et al., 2004; Maydanyuk et al., 2017). Therefore, the study of the mechanisms of adaptation to physical loads in the mountains requires an extremely special attitude to planning the intensity of exercise, the total amount of training work and control of recovery processes.

Especially important in mid-mountain training is the correct ratio between the volume and intensity of training work aimed at increasing the aerobic potential of athletes. Significant volumes of high-intensity work can shift work to the zone of anaerobic metabolism, lead to excessive fatigue and a significant overstrain of functional systems and a decrease in the volume of training effects. Low intensity does not provide sufficient incentives to increase the level of adaptation and, moreover, may adversely affect the manifestation of special endurance, sports technique and other important components of preparedness (Suslov & Gippenreyter, 2001; Platonov, 2015).

In order to effectively manage the training process under such conditions, it is necessary to select indicators that adequately reflect the rational intensity of training and the speed of recovery processes after heavy loads, the effectiveness of the functioning of various physiological systems both in the body as a whole and at the cellular and subcellular levels of athletes preparation in mountainous conditions.

Communication with scientific plans, topics. The study was carried out within the framework of scientific topics: “Control and correction of the metabolism of qualified athletes during intense physical loads” (state registration number 0120U103004) and “The influence of endogenous and exogenous factors on the course of adaptive reactions of the body to physical loads of varying intensity” (state registration number 012U108187).

Purpose of the study is to investigate the features of adaptive changes in high-class athletes to the effect of significant physical loads to the middle mountain conditions

Material and Methods of the research

Participants

The studies involved athletes specializing in race walking 10 people (m) and athletes of modern pentathlon 11 people (m), aged 19-25 years, experience in sports 6-15 years, qualifications of the Master of Sports, Honored Master of Sports.

Methods

Biochemical methods were used to study the features of adaptive changes in high-class athletes to the effect of significant physical exertion to the conditions of middle mountains, namely, to determine the content of hemoglobin and the level of urea in the blood of athletes. The studies were carried out both at rest and in dynamics after physical exertion and during the recovery period. Studies of the content of hemoglobin and urea were carried out using a biochemical analyzer “Diaglobal” (Germany) using standard sets of reagents from the same company.

Procedure

Athletes were at a specially preparatory stage of the preparatory period of the annual training cycle. The duration of the training camp in the mountains of Erzurum (Turkey) 1900 m (race walking) and Velingrad (Bulgaria) sports complex “Belmeken” 2000 m (modern pentathlon) was 21 days (3 microcycles). The studies were carried out during three microcycles.

The study was conducted in accordance with the basic bioethical norms of the Declaration of Helsinki of the World Medical Association on the ethical principles of scientific and medical research, as amended (2000, as amended in 2008), the Universal Declaration on Bioethics and Human Rights (1997), the Council of Europe Convention on Human Rights and Biomedicine (1997). Written consent to participate in the

study was obtained from each athlete.

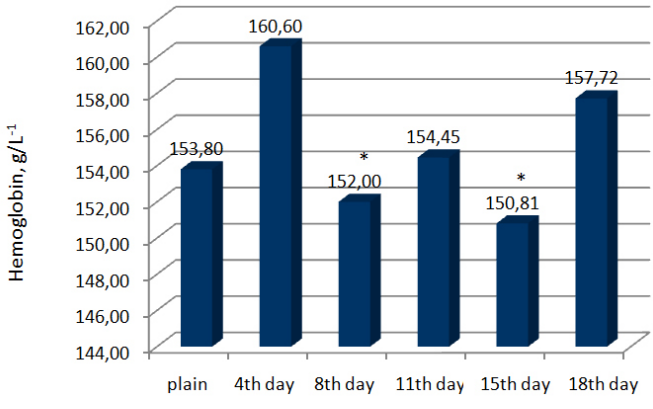
Statistical analysis

Processing of the study results was carried out by methods of mathematical statistics using standard computer programs. Descriptive statistics was used to generalize the quantitative characteristics of the studied components of the preparedness of athletes. On the basis of the initial statistical population, variation series were formed and their parameters were determined, characterizing the totality of information. At the same time, the following numerical characteristics of the sample were calculated: arithmetic mean ($\bar{X}$), standard deviation (S), coefficient of variation (V). The method of averages also included the determination of the error of representativeness, dispersion, and reliability of the results. The subtraction of the statistical significance of discrepancies was assessed by the nonparametric Wilcoxon test.

Results of the research

So, in studies of athletes training for endurance in the middle mountains at an altitude of 2000 m above sea level, after performing the loads of the first and second microcycles, where the volume of loads for race walking athletes was 4-5 hours, and for modern athletes - 5-6 hours per day in the mode of high and moderate intensity, the dynamics of hemoglobin concentration was different.

Studies have shown that on the 4th day of stay in the mountains, modern pentathlon athletes have significant polycythemia compared to the plains (Fig. 1). Along with this, on the 8th and 15th days (Figure 1) of staying in the mountains, athletes have a decrease in hemoglobin concentration by 1,4%, and only on the 18th day adaptive polycythemia develops. This reaction during the transition period indicates the inhibition of hematopoietic functions and increased blood-destroying function and hemolysis with impaired erythrocytes, which indicates the breakdown of erythrocytes. The reason for the decrease in the function of hematopoiesis and the destruction of blood cells is probably uncompensated fatigue, which leads to severe acidosis and impaired neurohumoral regulation of the blood system. And only on the 18th day of stay in the mountains, pentathlon athletes develop adaptive polycythemia, which leads to the formation of fairly stable structural and functional changes in the athlete's body.



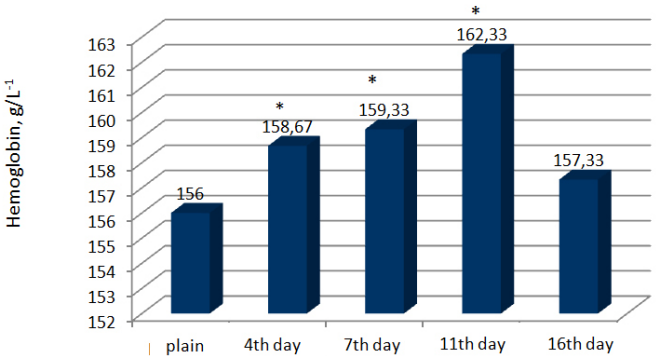
** - p<0,05 in relation to the plain*

Figure 1. Dynamics of blood hemoglobin concentration at an altitude of 2000 m above sea level in modern pentathlon athletes during two microcycles of the preparatory period, (n=11)

In the group of athletes training for endurance (race walking), the hemoglobin concentration gradually increased during the second microcycle (Figure 2). This reaction to the load is characterized by the mobilization of blood from the depot and redistribution in the blood system, which provides an expansion of adaptive capabilities, an increase in the power of this system and resistance to the load.

When adapting to physical loads in such conditions, the metabolism in the body of athletes changes, which leads to the appearance in various tissues and biological fluids of individual metabolites (metabolic products), reflecting functional and metabolic changes that can serve as a control over the functional state of the athlete, and be used for correction of training loads and recovery.

The dynamics of urea content in the blood carries very important information about the direction of metabolic processes occurring in the body during muscle activity. The need for such control in sports is obvious, since it ensures compliance with all the rules for building a rational training process, and also justifies the use of nutritional factors and pharmacological agents. Such timely control also prevents the development of negative consequences of exposure to inadequate physical loads for the body, which takes place in modern sports.



** - p<0,05 in relation to the plain*

Figure 2. Dynamics of blood hemoglobin concentration at an altitude of 1900 m in athletes trained for endurance (race walking) during two microcycles of the preparatory period, (n=10)

The studied indicator of urea in the blood indicates the state of balance of anabolism and catabolism of proteins, and therefore, at rest, it may indicate the tolerance of physical exertion, and immediately after them, the contribution of proteins to the energy supply of muscle activity.

The data obtained indicate that in the first days of stay in the mountains, the concentration of blood urea (Figure 3) in athletes of the modern pentathlon was 6,14 and 6,98 mmol l^{-1}, which indicates a non-recovery caused by preloads on the plain. And only from 8 to 15 days, the level of urea in the blood of athletes, which determined before the load at rest, gradually increased, which indicated a slight under-recovery, those. The incompleteness of the recovery processes of previous workouts, such a growth dynamics of this indicator leads to supercompensation, which ensures an increase in the content of glycogen and protein in skeletal muscles, resulting in an increase in the functionality of the body.

A study of the blood of race walking athletes testified (Figure 4) that the concentration of urea, determined before the load at rest, gradually increased within the normal range, and characterized the tolerance of training loads.

A characteristic feature of the dynamics of the results obtained is that the recovery period after the end of muscu-

lar work is always associated with the intense activity of the body, which is characterized not only by ensuring a decrease in work shifts, but also by filling the body's energy resources and restoring working capacity.

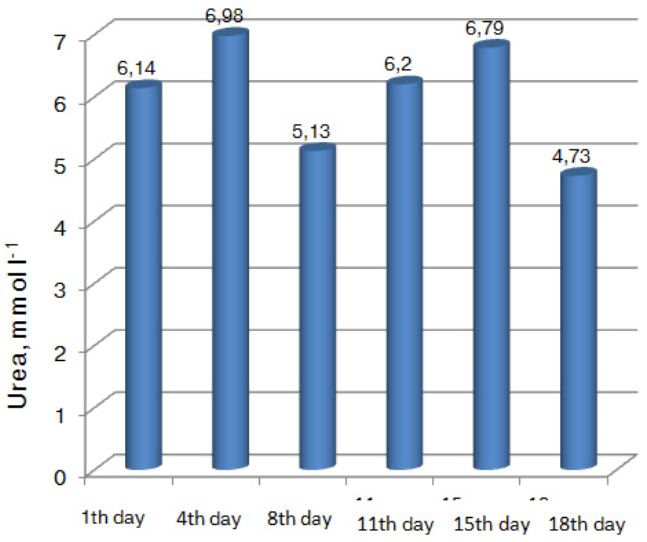
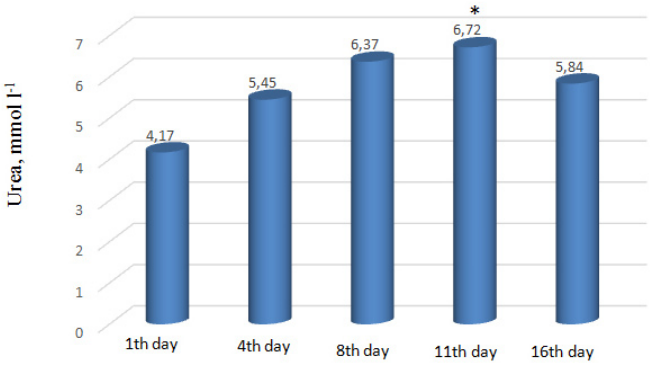


Figure 3. Dynamics of blood urea content in modern pentathlon athletes at an altitude of 2000 m in the preparatory period, (n=11)



** – p < 0,05 compared to the beginning of the mesocycle*

Figure 4. Content of blood urea in athletes trained for endurance (race walking) at an altitude of 2000 m in the preparatory period, (n=10)

Thus, the reaction of the body to the load is defined as three successive phases: load, recovery and supercompensation. Strengthening the process of formation of urea during physical work and an increase in its content in the blood occurs in the later stages of physical work. In the early stages, an increase in the concentration of this substance does not occur. Obviously, this is due to the fact that in the early stages of recovery after a long-term high-intensity muscle load, as well as at the beginning of prolonged muscle work, the urea content does not increase. Therefore, in the practice of biochemical control, this indicator is the most informative in the morning of the next physical activity after the previous day.

Discussion

Human adaptation to high-altitude hypoxia is a complex integral reaction involving various body systems. The most pronounced are changes in the cardiovascular system, hematopoietic apparatus, external respiration, gas exchange and metabolism, which leads to high-altitude hypoxia of sports specialists (Wagner, 2000; Chapman, 2013; Pugliese et al., 2014; Platonov, 2015). It is clear that an integrated and coordinated restructuring of functions at the subcellular, cellular, organ, and system levels is possible only through a restructuring of the functions of systems that regulate integral physiological responses. From this it becomes obvious that adaptation is impossible without an adequate restructuring of the functions of the nervous and endocrine systems, which provide fine regulation of the physiological functions of various systems.

Thus, the restructuring of the athlete's body in mountain conditions is expressed in an increase in pulmonary ventilation, cardiac output, an increase in hemoglobin content, an increase in the number of erythrocytes, an increase in 2,3-diphosphoglycerate in erythrocytes, an increase in the amount of myoglobin in muscles, an increase in the size and number of mitochondria, increased activity of oxidative enzymes (Suslov & Gippenreyter, 2001; Stellingwerff et al., 2019; Płoszczyca et al., 2021).

Features of adaptation of the organism of athletes to mountain conditions require a special approach, which is associated both with individual adaptation and taking into account high-altitude hypoxia of different heights.

So the first reaction to hypoxic conditions leads to the occurrence of hypoxemia (a decrease in the partial pressure (content) of oxygen in the blood) and thereby sharply disrupts the body's homeostasis, causing a number of interrelated processes (Suslov & Gippenreyter, 2001; Płoszczyca et al., 2018). The occurrence of such a state of the body of athletes leads to the activation of a functional system that ensures the transport of oxygen from the environment to the body and its distribution within the body, this is hyperventilation of the lungs, an increase in cardiac output, dilation of the vessels of the brain and heart, narrowing of the vessels of the abdominal organs and muscles.

At the same time, one of the first hemodynamic reactions is an increase in heart rate, an increase in pulmonary blood pressure as a result of spasm of the pulmonary arterioles, which ensures regional redistribution of blood and a decrease in arterial hypoxemia, but after a few days, cardiac output returns to a plain level, which is a consequence of an increase in the ability of muscles to utilize oxygen from the blood, which is expressed in an increase in the arteriovenous oxygen difference.

The period from the 4th to the 16th day of stay in the mountains is associated with the formation of sufficiently pronounced and stable structural and functional changes in the body of athletes. In particular, adaptive polycythemia develops and there is an increase in the oxygen capacity of the blood; a pronounced increase in the respiratory surface of the lungs is detected, the power of the adrenergic regulation of the heart increases, the concentration of myoglobin increases, and the throughput of the coronary bed increases.

And from the 16th day of stay in the mountains, a stable adaptation is formed, a concrete manifestation of which is an increase in the power and at the same time the efficiency of the functioning of the apparatus of external respiration and blood circulation, the growth of the respiratory surface of the lungs and the power of the respiratory muscles, the coefficient of oxygen utilization from the inhaled air. There is also an increase in the mass of the heart and the capacity of the coronary bed, an increase in the concentration of myoglobin

and the number of mitochondria in the myocardium, and an increase in the power of the energy supply system.

Myogenic shifts in the morphological nature of the blood depend on the duration, intensity and nature of the work, but they are largely determined by the state of the blood depots, hematopoiesis and blood destruction. So at the beginning of muscle activity and during short work, blood is mobilized from the depot, while the qualitative composition does not change significantly. With a longer physical load, more significant changes occur in the hematopoietic and blood-destroying organs, which is reflected in the composition of blood cells.

Training loads are longer, several hours of moderate intensity lead to an increase in the number of erythrocytes due to more complete mobilization, however, the total content of hemoglobin and its presence in the erythrocyte decreases due to young forms less saturated with hemoglobin. The number of reticulocytes increases due to the strengthening of hematopoietic functions. The composition of red blood cells is rejuvenated, the activity of cellular enzymes increases. This reaction is explained not only by the mobilization of blood from the depot, but also by the strengthening of hematopoietic functions - which has been proven by many authors (Suslov & Gippenreyter, 2001; Płoszczyca et al., 2018; Płoszczyca et al., 2021).

Conclusions

Intense physical activity, as well as special conditions, which are mountains, lead to the destruction of blood erythrocytes and, consequently, to a decrease in hemoglobin concentration, therefore, this indicator can be considered as a factor indicating exercise tolerance, which provides the potential for the passage of oxidative stress in the body. Recovery reactions, that is, the processes of aerobic metabolism. Thus, the reaction to the load of the blood system in terms of hemoglobin in the second microcycle of modern pentathlon athletes indicates the unwillingness to perform these loads, which is due to the fact that most athletes conduct training loads at such a height for the first time. Recovery after this reaction takes longer and requires additional correction of training loads. Sports walking athletes developed adaptive polycythemia in the second microcycle, this reaction provides an increase in the oxygen capacity of the blood, an increase in the respiratory surface of the lungs, an increase in the power of heart regulation, an increase in the conductivity of the coronary bed and an increase in the concentration of myoglobin. This response to this indicator ensures the formation of sustainable adaptation, which allows you to carry out the planned program of training loads.

The value of the urea clearance itself varies depending on the volume and intensity of the work done: as a rule, it increases in the post-work period. Tiring muscular work delays the increase in the intensity of renal excretion of urea. So, during long-term work (5-hour training), at the beginning of the recovery period (during the first six hours), its active accumulation in the blood continues, which leads to the highest concentration. Inhibition of the functioning of the adrenal cortex, accompanied by changes in water-salt metabolism, causes retention of urea in the blood.

It should be noted that the strength component in training has a significant impact on the body's response to urea in the direction of increasing its concentration to the load. In the supercompensation phase, along with various biological processes, the content of glycogen and protein in skeletal muscles increases, as a result of which the functional capabilities of the body increase. This is the most important process of transition of urgent adaptation to long-term one. The severity and duration of the supercompensation phase depend on the magnitude of the preload. At the same time, if significant loads are used during the period of incompleteness of anabolism processes, then, on the contrary, the opposite state may turn out - overwork, overtraining. Since urea is an integral indicator of the course of recovery processes, the assessment of the dynamics of its concentration in the blood has found wide use in the practice of sports training.

In further studies, it is planned to monitor the studies of metabolism in the body of track and field athletes and athletes from other sports at various volumes and intensity of loads in certain climatic and geographical conditions.

Author Contributions
Lyudmyla Stankevych: data collection, input, data analysis, manuscript preparation, statistics; Yuliia Khmelnytska: data interpretation, manuscript preparation, statistics; Nataliia Vdovenko: design, interpretation of data; Halyna Rossokha: design, research planning; Valentyna Yefanova: data interpretation, literature search analysis.

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Conflicts of Interest
The authors declare no conflict of interest.

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Cybersports education in Ukraine: current state and development prospects

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Abstract

Purpose: based on the study of scientific literature on Internet sources, to analyze the current state of cybersports education in Ukraine and determine the prospects for its development.

Material & Methods: the material of the study is the scientific literature and Internet sources, which highlight the current state of cybersport and cybersport education in Ukraine. Research methods: analysis, generalization and systematization of data; historical, logical, problem-search, prognostic.

Results: cybersport is a promising sports and economic area, which is based on the use of computer games. At the same time, cybersport is a new socio-cultural phenomenon that requires reflection by philosophers, culturologists, psychologists and art historians. The advantage of cybersport is the possibility of organizing competitions remotely, which allows you to involve a larger number of spectators. The latter fact makes cybersport attractive enough for potential sponsors and advertisers. The development of cybersports requires the involvement of professional cybersports players with appropriately developed cognitive abilities and psychological qualities, as well as other specialists who ensure the constant and uninterrupted organization, holding and coverage of sports competitions at the proper level (coaches, psychologists, managers, public relations specialists, commentators, analysts, marketers, directors, etc.). In the universities of Europe, America, Asia, educational programs aimed at obtaining education in the field of cybersports are quite diverse and presented in sufficient quantity. Unlike foreign institutions of higher education, domestic universities practically do not offer educational programs that meet the needs of the cybersports market. Therefore, cybersports education in Ukraine is a promising educational area that meets the modern needs of the labor market and the needs of potential employers.

Conclusions: cybersports education in Ukraine is a promising educational area that meets the modern needs of the labor market and the needs of potential employers. At the same time, it requires determining the real needs of the domestic cybersports market in order to develop and implement relevant educational programs aimed at training specialists in this industry. The information obtained will allow developing and offering new educational programs that will allow Ukrainian cybersports to take its rightful place on the world stage.

Анотація

Наталія Циганoвська, В'ячеслав Гончар, Вадим Данилян, Світлана П'ятисоцька. Кіберспортивна освіта в Україні: сучасний стан та перспективи розвитку. Мета: на підставі вивчення наукової літератури на інтернет-джерел проаналізувати сучасний стан кіберспортивної освіти в Україні та визначити перспективи її розвитку. **Матеріал і методи:** матеріалом дослідження є наукова література та інтернет-джерела, в яких висвітлюється актуальний стан кіберспорту та кіберспортивної освіти в Україні. Методи дослідження: аналіз, узагальнення та систематизація даних; історичний, логічний, проблемно-пошуковий, прогностичний. **Результати:** Кіберспорт являє собою перспективну спортивну та економічну галузь, в основі якої лежить використання комп'ютерних ігор. Водночас кіберспорт представляє собою новий соціокультурний феномен, що потребує осмислення філософів, культурологів, психологів та мистецтвознавців. Перевагою кіберспорту є можливість організації змагань у дистанційному режимі, що

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Key words:
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Ключові слова:
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дозволяє задіяти більшу кількість глядачів. Останній факт робить кіберспорт досить привабливим для потенційних спонсорів та рекламодавців. Розвиток кіберспорту потребує залучення професійних кіберспортсменів із відповідно розвиненими когнітивними здібностями та психологічними якостями, а також інших фахівців, що забезпечують постійну та безперебійну організацію, проведення та висвітлення спортивних е-змагань на належному рівні (тренерів, психологів, менеджерів, фахівців із коучингу, брендингу, зв'язків із громадськістю, коментаторів, аналітиків, маркетологів, режисерів-постановників тощо). В університетах Європи, Америки, Азії освітні програми, спрямовані на отримання освіти в галузі кіберспорту досить різноманітні та представлені у достатній кількості. На відміну від закордонних закладів вищої освіти, вітчизняні ЗВО практично не пропонують освітніх програм, які відповідають потребам ринку кіберспорту. Тому кіберспортивна освіта в Україні є перспективним освітнім напрямом, що відповідатиме сучасним потребам ринку праці та запитам потенційних роботодавців. **Висновки:** Кіберспортивна освіта в Україні є перспективним освітнім напрямом, що відповідатиме сучасним потребам ринку праці та запитам потенційних роботодавців. Водночас вона потребує визначення реальних потреб ринку вітчизняного кіберспорту задля розробки та впровадження актуальних освітніх програм, спрямованих на підготовку фахівців зазначеної галузі. Отримана інформація дозволить розробити та запропонувати нові освітні програми, які дозволять українському кіберспорту посісти належне місце на світовій арені.

Introduction

Global digitalization is significantly changing the world, putting forward new requirements for many sectors of the economy, production, culture and education, changing established ideas even about traditional areas. E-commerce, e-banking, administrative e-services have recently been supplemented by various scientific, artistic, cultural, and entertainment events in digital format (remote scientific conferences and internships, industrial presentations in online format and virtual excursion tours, etc.).

At present, it is digitalization that is the main driver of changes in society and, therefore, in sports, Riatti and Thiel (2021) argue. The Ukrainian society is gradually joining the global trend in the development of sports and cybersports, which has already received global recognition in the world. Objectively, the number of people professionally involved in cybersport as athletes and/or organizers of cybersports competitions and tournaments is growing (Briskin et al., 2015).

From 2018 to 2019, the total number of cybersports jobs grew by 87%, from 5869 to 11027 jobs respectively. The total number of potential vacancies in cybersports in 2021 was more than 12,000 (Jenny et al., 2021). As T. Savchuk (2022) notes: "... cybersport is not just shooting games, but a fundamental element of modern digital culture. Today, cybersport can even be studied at the university, and there are more and more jobs in this area" (Lysenko & Morozova, 2020). Dynamic development of the cybersport market in Ukraine (Horova et al., 2016; Tsaranenko, 2018; Chaika, 2018; Lytvin & Vakulka, 2021) increases the demand for professional athletes/players, administrators, managers and other professionals involved in organizing cybersports competitions. A team of Ukrainian scientists based on the results of their own exploratory research (Shynkaruk et al., 2020, p. 115) also testifies not only to the growing popularity of cybersports, its globalization as a sport, but also to the trend towards increased demand from employers and the interest of higher education in training personnel for the cybersports industry.

The professionalization of the industry is inextricably linked with the possibility of obtaining professional education. It should be noted that non-formal education in the field of e-sports is actively developing today. Thus, cybersports organizations and federations create private schools and academies that allow them to develop their own gaming skills, as well as learn how to create games and hold competitions.

Higher education institutions are just beginning to recognize the potential value of cybersports education as the cybersports industry continues to grow. There are full-fledged educational programs in this area only in three domestic universities (Kharkiv State Academy of Physical Education, Petro Mohyla Black Sea National University and the National University of Physical Education and Sports of Ukraine), which is certainly not enough, and requires a detailed study of the current state of the cybersports market, to analyze its needs, existing educational programs and determine possible directions for the development of domestic cybersport education.

Purpose of the study: based on the study of scientific literature on Internet sources, to analyze the current state of development of cybersports education in Ukraine and determine the prospects for its development.

Material and Methods of the research

The research material is specialized scientific literature and Internet sources, which highlight the current state of cybersports and cybersports education in Ukraine. Research methods: analysis, generalization and systematization of data; historical, logical, problem-search, prognostic.

Results of the research

Cybersports is "a kind of sport that is a training and competitive activity in a virtual space based on computer and / or video games, which is characterized by the constant rules of sports competitions, interpersonal relationships between players, where a player or team interacts with a competitive environment in real time, mediated sports equipment, at a certain distance and the impossibility of breaking away from the competitive environment during the competition" (Shinkaruk & Anokhin, 2021, p. 50).

A relatively small number of scientific works of domestic and foreign experts are devoted to the study of the phenomenon of cybersports and especially cybersports education, which is explained by the relative youth of cybersports, on the one hand, and the ambiguous perception by a part of society, on the other. An analysis of recent publications shows that the features and possibilities of cybersports as a cultural, economic, educational and sports phenomenon are of interest to many modern domestic and foreign scientists. Thus, cybersports as a modern cultural and social phenomenon is described by Riatti and Thiel (2021), Ganaga et al. (2021), Savchuk (2022), Shinkaruk et al. (2020); the essence and features of the development of the cybersports industry in the world are systematized by Reitman et al. (2019), Wagner (2015), Tsaranenko (2018), Shinkaruk et al. (2019); in Ukraine - by Lytvyn and Vakulka (2021); trends in the development of

the cybersports market in Ukraine were determined by Gorovoy, et al. (2016), Zozulev and Chaika (2019); the definition of the concept of "cybersport" was provided by Shinkaruk and Anokhin (2021); the history of the development of cybersport and the prospects for its further development are considered by Bulgakov (2019); periodization of cybersports development was proposed by Briskin et al. (2021); the subjects of the cybersports market and the relationship between them are analyzed by Chaika and Zozulev (2019); signs of cybersports as a sports discipline are systematized by Lysenko and Morozova (2019); the problems of training cybersports specialists are analyzed by Jenny et al. (2021), Alekseeva and Alekseenko (2019).

According to the periodization proposed by Briskin et al. (2021, p. 13), it is expedient to divide the process of cybersports development into three stages: 1) 1972-1988 (1972 - the first mention in information sources of organized video game competitions; competitions were organized exclusively by game developers with the aim of advertising their own products, the sports result was determined by means of objective metric calculations; there was no mechanism for making a profit in monetary terms); 2) 1988-2011 (the appearance of games that support the Internet connection; organization of competitions for sponsorship and with the help of distance technologies; emergence of professional structures specializing in holding competitions; the latter acquire entertainment and coverage through popular internet platforms); 3) from 2011 to the present (thanks to the appearance in 2011 of the Twitch TV video streaming platform, a mechanism is being created for the sale of online tickets and licensed products, ad monetization processes are improving, which entails a rapid increase in sponsorship funding, prize funds, and athletes' salaries professional players, active development and improvement of cybersports education, development of special software).

According to S. Hunter, at the present stage of development of cybersports, its subjects are: cybersports players themselves, competition organizers, fans, game developers, bookmakers, sponsors, clubs/associations, media and streaming platforms or TV channels (Chaika & Zozulov, 2019, p. 320). Together, they form an integral system, subject to market laws. Based on their interests, each of them has its own role and responsibilities. The key players in the cybersports market are the players (Chaika & Zozulov, 2019, p. 322).

The ecosystem of the cyber industry, according to Russian scientists Lytvyn and Vakulka (2021), consists of the following structural elements: game developers - people who create a product; video games - the actual product (for example, Dota 2, Overwatch, League of Legends, Counter-Strike, etc.) that meets the criteria of an cybersports discipline; cybersports organizations; direct participants in cybersports competitions teams and/or individual players; tournament operators and other intermediaries directly providing the holding of events, their advertising and media coverage; broadcast streaming platforms (Twitch, YouTube, etc.); National and international federations and professional cybersports associations whose activities are aimed at promoting cybersports, attracting investments, developing a professional cybersports infrastructure; fans (Lytvin & Vakulka, 2021, p. 169).

Professional cybersport athletes, according to Imas et al. (2021), must be stress-resistant, creative, have well-developed reactions and motor skills, analytical thinking, the ability to make quick decisions in non-standard situations, be able to work in a team (in the case of team competitions) (Imas et al., 2021, p. 77), also, "like any kind of sport, cybersport and a cybersport athletes needs social, scientific and psychological support and, obviously, the support of a cyberpsychologist" (Imas et al., 2021, p. 77). All this requires the creation of full-fledged, systematized educational programs aimed at the thorough training of various specialists for cybersports: athletes, coaches, administrators / managers, psychologists, streamers / hosts / commentators of cybersports competitions, public relations specialists, etc. the latter, according to E. Imas, today are very few in Ukraine (Imas et al., 2021, p. 77).

In Western countries, secondary or higher education in the field of cybersports is already becoming commonplace. In order to train specialists in the field of the cybersports industry, there are more than 50 educational institutions in the United States alone where there is such a specialization. The countries of Europe and Asia are not far behind. According to Jenny et al. (2021) there are more than 80 bachelor's and master's cybersports programs in the world in 2021, offered by 62 different institutions of higher education around the world, mainly located in North America and Europe. The vast majority of these programs (77,5%) are focused on the cybersports business (e.g., management, marketing). In addition to full-fledged educational programs in the field of cybersports, there are many universities that offer separate courses in cybersports, which also do not offer academic programs in cybersports. Thus, cybersport disciplines were added to the main school curriculum at The Games Vidaregaande Skule (Norway) and Arlandagymnasiet (Sweden). You can enroll in a one-year course in cybersports and game design (Informatics Academy, Singapore) or study in a three-year game skills development program (Lanxiang Vocational School, China). In addition, there is an opportunity to get a bachelor's degree in cybersports (Staffordshire University, UK).

Academic programs in cybersports have the following direction (according to Jenny et al. (2021): cybersports business/management/administration (22%), theoretical aspects of the functioning of cybersports/history of cybersports (13%), production of cybersports services/cybersports media communications/public relations (12%). Among others: cybersports coaching, event management, cybersports marketing, coaching, cybersports job management. The main focus is on the gaming preparation of cybersport athletes/players for their future careers. The cybersports training program includes: development of cognitive skills and digital intelligence, teamwork, communication and adaptability.

In Ukraine, opportunities for education in the field of cybersports are much less. In particular, since 2018, the specialization "Computer sports (cybersport)" has been launched at the Kharkiv State Academy of Physical Culture as part of the educational program "Coaching in the chosen sport" for the first (bachelor's) and second master's levels of higher education. Since 2019, you can get a master's degree in the educational program "Cybersport" at the National University of Physical Education and Sports of Ukraine (NUUPES).

Theoretical and practical training of future coaches in the educational program "Computer Sports" at the I (bachelor's) level of higher education at the Kharkiv State Academy of Physical Culture includes: computer game theory, cybersports ergonomics, management and marketing trends, mastering basic gaming, information technology in sports, the theory and methodology of sports training, as well as practical physical training, pedagogical skills, sports psychology, scientific research methods, anatomy, physiology, statistical research methods in sports, etc. Upon graduation, graduates

receive the qualification "Cybersports (e-sports) coach".

The Petr Mohyla Black Sea National University involved experienced cybersport athletes in teaching under the new educational program "Cybersports" at the first (bachelor's) level of higher education, and included the practice of playing in a team in the practical training program from the second year. The compulsory subjects included gaming theory, sports law, biomechanics of body organization in cybersports.

You can get a master's degree in the Cybersports educational program at the National University of Physical Education and Sports of Ukraine (NUUPES). Future master's study innovative technologies in cybersports, cybersports infrastructure, computer gaming theory, professional gaming, strategic management, modern management and marketing trends in the work of the cybersports club and cyber arena; psychological support of sports activities, a system of training and competition in cybersports, leadership and an education team in cybersports, psychoregulation in sports activities of gamers, event management in cybersports, etc. Not only theoretical teachers are involved in the training, but also practitioners in the field of cybersports. After graduating from the master's program, specialists will have the opportunity to work in various qualifications - trainers, PR journalists, commentators, psychologists, managers.

Promising areas of esports education in Ukraine, which create prerequisites not only for the career of an cybersports athlete/player, but also allow them to further realize themselves in many other areas, are: 1) management, administration, management of an cybersports team/club; 2) coaching and mentoring; 3) PR and marketing of cybersports events; 4) organization of cybersport tournaments, championships, competitions and other events; 5) commenting on cybersports measures and their analytics; 6) development of games and other products for the cybersports industry; 7) game design; 8) cybersports journalism; 9) branding.

The training program for specialists in the field of cybersports must necessarily include disciplines, both general disciplines that allow to form a certain level of culture and general awareness of a specialist, and professional educational components designed to develop professional competencies in the field of cybersports (in particular, games, gaming, information technology in sports, modern digital technologies, theory and methodology of cyber training, etc.). Taking into account the significant number of international tournaments and competitions, the skills of free communication in English will be useful for future cybersports specialists, which will be a significant advantage for the graduate during employment. An important competence is also the ability to maintain physical and mental health, which can be realized through systematic physical activity and the study of the theory and practice of stress management (necessarily with elements of practical training to relieve and minimize stress through various means). The qualification of a journalist or PR-specialist in the field of cybersports, of course, requires perfect command of the literary Ukrainian language, skills in working with text, copywriting, promotion of sites/web pages in social networks, communication and conflict management.

Discussion

Thus, cybersports is one of the modern sports, which is a form of competitive activity, which is based on the use of computer games that require the development of specific cognitive abilities and psychological qualities in cybersport athletes. Cybersports is not just a sports competition, but a completely new socio-cultural phenomenon that requires reflection from specialists in various fields, primarily philosophers, culturologists, psychologists, and art historians.

The launch of the webcasting platform in 2011 allowed for a rapid increase in viewership and, as a result, made cybersports competitions commercially attractive. The latter requires not only the proper professional level of cybersports players, but also the appropriate level of organization, coverage and entertainment of the competition itself.

The professionalization of cybersports has led to the need to train a number of specialists who can competently ensure the planning, organization and conduct of cybersports at the proper level (coaches, psychologists, managers, coaching, branding, public relations specialists, commentators, analysts, marketers, directors etc.). In the universities of Europe, America, Asia, educational programs aimed at obtaining education in the field of cybersports are quite diverse and presented in sufficient quantity. Unlike foreign institutions of higher education, domestic universities practically do not offer educational programs that meet the needs of the cybersports s market. The exceptions are two programs on the bachelor's level of higher education (Kharkiv State Academy of Physical Education, Petro Mohyla Black Sea National University) and a master's program (National University of Physical Education and Sports of Ukraine), as they cannot fully meet the needs of the Ukrainian cybersports market in professional personnel.

Conclusions

Cybersports education in Ukraine is a promising educational area that meets the modern needs of the labor market and the needs of potential employers. At the same time, it requires determining the real needs of the domestic cybersports market in order to develop and implement relevant educational programs aimed at training specialists in this industry. The information obtained will allow us to develop and offer new educational programs that will allow Ukrainian cybersport to take its rightful place on the world stage.

Prospects for further research in this area are related to the need to carefully study the structure of the cybersports market and the requests of employers in order to determine specific qualifications and specializations that will be in demand in the field of cybersports, as well as content components for future educational programs. The information obtained will allow us to develop and offer new educational programs that will allow Ukrainian cybersport to take its rightful place on the world stage.

Author Contributions

Natalia Tsyganovska: research planning, data collection, analysis and interpretation. Vyacheslav Gonchar: search and analysis of literature, data entry. Vadym Danilyan: search and analysis of literature, data entry, manuscript preparation. Svitlana Pyatysotska: research planning, analysis and interpretation of data, preparation of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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Control of physical and technical readiness of football players at the stage of specialized basic training

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Abstract

Purpose: to determine at the beginning of the preparatory period the initial level of physical and technical preparedness of football players born in 2006 of different youth teams in Kharkiv.

Material & Methods: the study was conducted in August 2021. The contingent of the examined - athletes in the amount of 56 football players of the Children's and Youth Football Club (FC) "Arsenal" in Kharkiv and the Youth Sports School No. 7 in Kharkiv, whose average age was 14,6 years. Technical and physical indicators were determined that characterize the level of readiness of football players for the beginning of the competitive season. The following methods were used in the study: analysis of scientific and methodological literature, pedagogical testing, methods of mathematical statistics.

Results: the work established statistically significant differences between technical indicators: in the test, running 30 m (with the ball) ($p<0,05$; $t=2,18$), throw-in ($p<0,05$; 2,88); in terms of physical preparedness, statistically significant changes were found in the tests "Illinois" ($p<0,05$; $t=2,72$), shuttle run 7x30 m ($p<0,05$; $t=2,48$), at the same time, the players of the FC "Arsenal" overcome the distance faster ($p<0,05$; $t_1=2,10$; $t_2=2,05$; $t_3=2,06$; $t_7=2,15$) on the first, second, third and seventh segments than the players of the Youth Sports School No. 7. In the endurance test of the shuttle run 5x30 m, the players of the FC "Arsenal" run faster ($p<0,05$; $t=2,12$) than the players of the Youth Sports School No. 7, while in the first and third segments the players of the Youth Sports School No. 7 are slower ($p<0,05$; $t_1=2,75$; $t_3=2,05$) overcome the distance than the players of the FC "Arsenal".

Conclusions: analysis of special literature shows that the modern scientific and methodological base in the analysis of technical and physical preparedness in football has not been sufficiently studied in order to ensure the effective preparation of young men for the highest sports achievements. As a result of the study, statistically significant differences were established in the indicators of physical and technical readiness between the football players of the FC "Arsenal" and the Youth Sports School No. 7 in Kharkiv. It was determined that football players born in 2006 have a low level of functional performance.

Анотація

Сергій Лебедєв, Сергій Журид, Святослав Коваль, Віктор Шаленко. Контроль фізичної та технічної підготовленості футболістів на етапі спеціалізованої базової підготовки. Мета: визначити на початку підготовчого періоду вихідний рівень фізичної та технічної підготовленості футболістів 2006 р.н. різних дитячо-юнацьких команд м. Харкова. **Матеріал і методи:** дослідження проводилося в серпні 2021 року. Контингент обстежуваних - спортсмени у кількості 56 футболістів ДЮФК (дитячо-юнацький футбольний клуб) «Арсенал» м. Харкова та ДЮСШ (дитячо-юнацька спортивна школа) № 7 м. Харкова, вік яких становив у середньому 14,6 років. Були визначені технічні та фізичні показники, які характеризують рівень підготовленості футболістів до початку змагального

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сезону. У дослідженні були використані такі методи: аналіз науково-методичної літератури, педагогічне тестування, методи математичної статистики. **Результати:** у роботі встановлені статистично достовірні відмінності між технічними показниками: в тесті біг 30 м (з м'ячем) ($p<0,05$; $t=2,18$), вкидання м'яча з-за бічної лінії ($p<0,05$; 2,88); у показниках з фізичної підготовленості статистично достовірні зміни були виявлені у тестах «Іллінойс» ($p<0,05$; $t=2,72$), човниковий біг 7х30 м ($p<0,05$; $t=2,48$), при цьому гравці ДЮФК «Арсенал» долають відстань швидше ($p<0,05$; $t_1=2,10$; $t_2=2,05$; $t_3=2,06$; $t_7=2,15$) на першому, другому, третьому та сьомому відрізках ніж гравці ДЮСШ № 7. У тесті на витривалість човниковий біг 5х30 м гравці ДЮФК «Арсенал» швидше ($p<0,05$; $t=2,12$) пробігають, ніж гравці ДЮСШ № 7, при цьому на першому та третьому відрізках гравці ДЮСШ № 7 повільніше ($p<0,05$; $t_1=2,75$; $t_3=2,05$) долають відстань, ніж футболісти ДЮФК «Арсенал». **Висновки:** аналіз спеціальної літератури свідчить, що сучасна науково-методична база в аналізі технічної та фізичної підготовленості у футболі є недостатньо вивченою для того, щоб забезпечити ефективну підготовку юнаків до вищих спортивних досягнень. У результаті дослідження встановлено статистично достовірні відмінності у показниках з фізичної та технічної підготовленості між ДЮФК «Арсенал» та ДЮСШ № 7 м. Харкова. Визначено, що футболісти 2006 року народження мають низький рівень функціональної працездатності.

Introduction

An analysis of recent publications suggests that the quality of scientific research in football has increased significantly in recent years. This is due to the expansion of opportunities for communication between specialists both in person and online within the framework of various scientific conferences, meetings, and practical seminars. Many leading experts addressed the issues of pedagogical control and continue to study its diversity and peculiarities of conducting and correctness in use (Stula, 1995; Bangsbo et al., 2012; Platonov, 2017; Bromley et al., 2021).

Young et al. (2011) note in their work that in order to increase the effectiveness of the training process, it is necessary to study the organized control over the ongoing changes in the state of the athlete's body. Paul et al. (2016) argue that control provides for a mandatory determination of the effectiveness of training work, makes it possible to justify the selection of appropriate training tools based on the information received about the nature of the work performed and adaptive changes in the athlete's body under the influence of increased training loads.

Leading experts Godik et al. (2010), Seluianov et al. (2012), Guba et al. (2015) believe that the essence of control is to compare the results of an activity with its goal (task) in order to assess the preparedness of an athlete and, in the process of further training work, make changes either to the goals or subsequent elements of the activity.

Control over the training process of football players should be of an integral nature, that is, taking into account all the factors influencing the sports result. In a broad sense of control, it should cover the pedagogical, biomedical and psychological aspects of the training process (Buchheit et al., 2010; Sporis et al., 2010; Platonov, 2017; Solomonko et al., 2021).

The essence of control is the assessment of the state of the athlete's body, the technique of motor actions, training loads and sports results. The full implementation of the listed volume of control actions requires the use of numerous research methods, special equipment and the involvement of a wide range of specialists (Rampinini et al., 2007; Godik et al., 2010; Guba et al., 2010; Rumpf et al., 2016; Hicheur et al., 2017).

Pedagogical testing tools are used to study the level of manifestation of technical and physical preparedness parameters (Ivanchenko, 2008; Buchheit et al., 2012; Guba et al., 2014; Hicheur et al., 2019). One of the most effective means of assessing training activity is pedagogical tests, which allow you to determine the dynamics of the development of technical and physical qualities of a football player. (Lberto et al., 2013; Perevoznik, 2014; Paul et al., 2016; Lebedev, 2017).

Purpose of the study is to determine at the beginning of the preparatory period the initial level of physical and technical readiness of football players born in 2006 of various youth teams in Kharkiv.

Material and Methods of the research

Participants

The study involved 56 football players (boys) born in 2006, who were involved in football sections. The subjects were divided into 2 groups of 28 people in each: the first group was the FC "Arsenal", the second group was the Youth Sports School No. 7, who trained according to the traditional methodology developed by the Football Federation of Ukraine (Nicolaenko et al., 1995). The total number of hours per year was 960 (GPP 20%, SPP 40%, auxiliary 40%).

All participants gave consent to participate in the study.

At the time of the study, all participants were healthy and had permission from a doctor to practice football.

During the observation process, the initial level of preparedness of football players born in 2006 after a long rest in July 2021 (31 days) was determined.

Methods

The following methods were used in the study: analysis of scientific and methodological literature, pedagogical testing, methods of mathematical statistics.

Theoretical (analysis, comparison, generalization, systematization, theoretical modeling) were carried out in order to generalize the experience of scientists involved in the study of the problem of gender approach in education and upbringing, modern approaches to the development and improvement of the system of physical education.

Pedagogical testing: the assessment of technical indicators was accompanied by the following tests: PA (passing accuracy), 30 m run (with the ball), throw-in, hitting the ball for accuracy (rotational kick); assessment of physical indicators was carried out using such tests: manifestations of speed-strength qualities - standing long jump, jump up; speed qualities - running 30 m from a place; to improve the effectiveness of testing and given the small sample, we included 2 variants of the test for speed endurance: shuttle run 7x30 m, shuttle run 5x30 m, in addition, the "Illinois" test was used, which made it possible to determine the indicators of dexterity, the essence of the test was that the athlete needs to quickly turn around at different angles and change the direction of movement while running (Figure 1).

Registration of test results was carried out using the innovative technology of the SmartSpeed PRO testing system, which made it possible to obtain reliable results during the

study.

The SmartSpeed PRO system is a timing system with limitless training simulation possibilities and unique research capabilities, SMARTSPEED PRO allows you to fully explore and improve the performance of athletes (Figure 2).

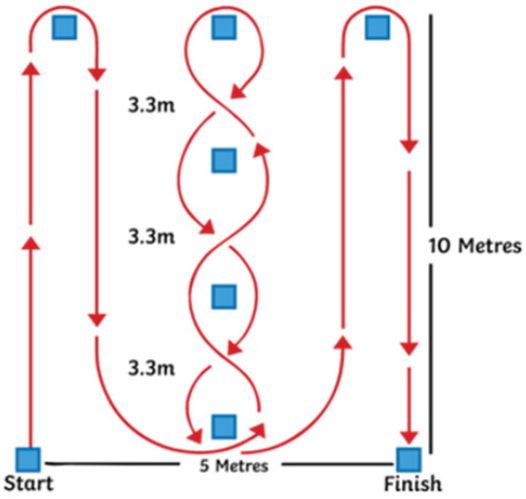

Figure 1. Test "Illinois" (Hicheur et al., 2017)

On the field, 6 lines of wireless gates were installed, which automatically controlled the time of the distance run with a tablet computer.

Figure 2. Temporary registration desk (Sporis et al., 2010)

Procedure

Data for the study of physical and technical readiness were determined from pedagogical testing conducted in the conditions of direct training of football players.

Testing of participants was carried out at the beginning of the preliminary period by specialists of the UAF (Ukrainian Football Association) on the natural surface of the football field. The obtained data were entered on a computer with their subsequent analysis using the methods of mathematical statistics.

Statistical analysis

The processing of the research results by the methods of mathematical statistics are used in accordance with the well-known recommendations using the computer program "EXCEL" (Antomonov, 2006; Ivanchenko, 2008).

The following indicators were calculated:

- $\bar{X}$ – arithmetic mean;
- m – representativeness error of the arithmetic mean;
- t - reliability of the difference between the average values (according to Student's criterion), determined by the formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{m_1^2 + m_2^2}}$$

The significance of differences between different indicators of the studied groups was considered significant at a five percent significance level ($p<0,05$), which was recognized as quite reliable in biological studies. (Antomonov, 2006; Togobitckaia et al., 2009).

Connection of work with scientific programs, plans, themes. The work is carried out in accordance with the Initiative theme of research work in the field of physical culture and sports of the Kharkiv State Academy of Physical Culture for 2019-2023 on the topic "Improvement of the educational and training process in sports games", state registration number 0116U101644.

Results of the research

To determine the level of preparedness of football players born in 2006, an ascertaining experiment was conducted, in which 56 boys from two football schools in Kharkiv took part.

The analysis of the indicators of technical readiness between the FC "Arsenal" and the Youth Sports School No. 7 indicates that the studied indicators are statistically different ($p<0,05$) (Table 1).

Thus, the players of FC "Arsenal" faster ($p<0,05$; $t=2,18$) perform the 30 m run test (with the ball) compared to the players of the Youth Sports School No. 7, throw-in ($p<0,05$; 2,88) (Table 1). In other technical indicators, the changes were not significant and unreliable. There are no significant differences in the PA test (passing accuracy) and hitting the ball for accuracy (rotational kick) ($p<0,05$).

The conducted analysis of physical preparedness revealed that the indicators of football players of FC "Arsenal" and Youth Sports School No. 7 also have differences. Thus, the players of FC "Arsenal" perform the Illinois test faster ($p<0,05$; $t=2,72$) compared to the players of the Youth Sports School No. 7, shuttle run 7x30 ($p<0,05$; $t=2,48$) (Table 1).

Therefore, the results shown in Table 2 indicate that the players of FC "Arsenal" in the first, second, third and seventh segments overcome the distance faster ($p<0,05$; $t_1=2,10$; $t_2=2,05$; $t_3=2,06$; $t_7=2,15$) than the football players of the Youth Sports School No. 7.

In the test for endurance shuttle run 5x30 m, the players of FC "Arsenal" show much better results ($p<0,05$; $t=2,12$) than the players of the Youth Sports School No. 7 (Table 1).

According to the data of Table 3, the endurance indicators in the 5x30 m shuttle run test, the players of FC "Arsenal" in the first and third segments cover the distance faster ($p<0,05$; $t_1=2,75$; $t_3=2,05$) than the players of the Youth Sports School No. 7 (Table 3).

It was found that in the jump test, the players of FC "Arsenal" had higher indicators ($p<0,05$; $t=2,06$) compared to the players of the Youth Sports School No. 7 (Table 1). In the test of standing long jump and 30 m run from a place, the differences between the studied groups are insignificant and do not have significant differences between them.

The functional readiness of football players was determined using the Rufier functional test. It was determined that,

Table 1

Comparative analysis of technical and physical indicators of preparedness of young football players born in 2006

№ i/o	Tests	FC "Arsenal", Kharkiv (n=28) $\bar{X}_{1\pm}m_1$	Youth Sports School No. 7 Kharkiv (n=28) $\bar{X}_{2\pm}m_2$	t	p
	Technical indicators				
1	PA (passing accuracy), s	14,68±2,03	16,72±2,13	0,69	>0,05
2	Run 30 m (with ball), s	4,95±0,23	5,31±0,32	2,18	**<0,05**
3	Throw-in, m	21,9±0,47	20,1±0,41	2,88	**<0,05**
4	Hitting the ball for accuracy (rotational kick), number of hits	4,3±0,81	3,4±0,75	0,81	>0,05
	Physical indicators				
1	Illinois, s	16,38±0,54	18,33±0,47	2,72	**<0,05**
2	Shuttle run 7x30 m	44,48±2,44	52,54±2,14	2,48	**<0,05**
3	Shuttle run 5x30 m	31,58±1,67	36,24±1,31	2,12	**<0,05**
4	Standing long jump, m	2,03±0,15	2,12±0,17	0,39	>0,05
5	Running 30 m from a place, s	4,61±0,20	4,67±0,27	0,17	>0,05
6	Jump up	49,5±1,3	44,8±1,88	2,06	**<0,05**

Table 2

Results of the run of 30 m segments by football players during the control standard of the shuttle run 7x30 m

Indicators		FC "Arsenal", Kharkiv (n=28) $\bar{X}_{1\pm}m_1$	Youth Sports School No. 7 Kharkiv (n=28) $\bar{X}_{2\pm}m_2$	t	P
Test "shuttle run 7x30 m"	t1 30, m	5,52±0,31	6,55±0,38	2,10	**<0,05**
	t2 30, m	6,05±0,35	7,27±0,48	2,05	**<0,05**
	t3 30, m	6,48±0,34	7,61±0,43	2,06	**<0,05**
	t4 30, m	6,56±0,35	7,52±0,44	1,70	>0,05
	t5 30, m	6,67±0,36	7,62±0,45	1,65	>0,05
	t6 30, m	6,71±0,37	7,74±0,42	1,84	>0,05
	t7 30, m	6,79±0,34	7,97±0,43	2,15	**<0,05**

Table 3

Results of the run of 30 m segments by football players during the control standard of the shuttle run 5x30 m

Indicators		FC "Arsenal", Kharkiv (n=28) $\bar{X}_{1\pm}m_1$	Youth Sports School No. 7 Kharkiv (n=28) $\bar{X}_{2\pm}m_2$	t	p
Test "shuttle run 5x30 m"	t1 30, m	5,51±0,24	6,68±0,35	2,75	**<0,05**
	t2 30, m	6,36±0,38	7,16±0,43	1,39	>0,05
	t3 30, m	6,40±0,35	7,51±0,41	2,05	**<0,05**
	t4 30, m	6,56±0,33	7,53±0,44	1,76	>0,05
	t5 30, m	6,67±0,36	7,58±0,43	1,62	>0,05

Table 4

Results of functional testing according to the functional test of Rufier

Indicators	FC "Arsenal", Kharkiv (n=28)	Youth Sports School No. 7 Kharkiv (n=28)	t	p
Rufier test	14,46±3,10	15,78±2,85	0,31	>0,05

according to the results of Table 4, the performance indicators of the players of FC "Arsenal" and Youth Sports School No. 7 constitute a low level of performance in accordance with the standard indicators (Nikolaenko, 1995; Guba et al., 2015). This indicates that the level of functional readiness in both teams is at the same level, and all the players were in the same conditions.

Discussion

The analysis of special literature shows that the modern scientific and methodological base in the analysis of technical and physical preparedness in football has not been studied enough to ensure the effective preparation of boys for the highest sports achievements. Therefore, it is necessary to determine the initial level of functional, technical and physical indicators before the introduction of experimental methods and various implementations into the training and competitive processes of football players. In this regard, it is necessary to take into account what qualities you need to pay attention to in order to achieve a high sports result.

Summarizing the above, we emphasize that a long rest affected the level of the functional state of the players of both groups, resulting in a low level of functional readiness. At the same time, significant differences in technical and physical preparedness were revealed in the studied groups, which proves that the children of FC "Arsenal" maintained their sports shape on their own during the holidays, and the players of the Youth Sports School 7 paid less attention to this, as a result of which they received such differences.

The results of our study confirm the existing opinion that the problem of controlling the technical and physical preparedness of young athletes does not lose its relevance (Guba et al., 2010; Lebedev et al., 2017). Supplemented and refined the data of scientific studies on the technical (Guba et al., 2016) and physical (Perevoznik, 2014; Guba et al., 2015; Platonov, 2017) preparedness of football players.

The conducted study confirmed the results of the authors (Iordanskaia, 2011; Buchheit et al., 2012; Guba et al., 2014; Perevoznik, 2014; Lebedev et al., 2017) on the need to study changes in the technical and physical preparedness indicators of football players, and deepens the data of scientists on this issue.

Conclusions

Our research allowed:

1. To determine the differences between the studied groups in technical indicators: in the Illinois test ($p<0,05$; $t=2,72$), 30 m run (with a ball) ($p<0,05$; $t=2,18$), throw-in ($p<0,05$; $t=2,88$).

2. It has been established that statistically significant changes in physical preparedness indicators were detected in endurance tests of the shuttle run 7x30 m ($p<0,05$; $t=2,48$), while the players of FC "Arsenal" in the first, second, third and seventh segments reliably overcome the distance faster than the players of the Youth Sports School No. 7 ($p<0,05$; $t_1=2,10$; $t_2=2,05$; $t_3=2,06$; $t_7=2,15$). In the endurance test of the shuttle run 5x30 m, the players of FC "Arsenal" run faster ($p<0,05$; $t=2,12$) than the players of the Youth Sports School No. 7, while in the first and third segments the players of the Youth Sports School No. 7 are slower ($p<0,05$; $t_1=2,75$; $t_3=2,05$) overcome the distance than the players of FC "Arsenal".

3. In other indicators of technical readiness PA (passing accuracy), hitting the ball for accuracy and physical readiness standing long jump, 30 m run from a place between the studied groups, the differences were insignificant and unreliable.

4. It was found that the players of the studied groups have a low level of functional performance. This is due to the fact that the players were on a long rest (vacation) before the start of the preparatory period.

In further studies, it is planned to introduce an experimental methodology, taking into account the differences in the functional state, technical and physical preparedness of football players.

Author Contributions
Serhii Lebedev: data collection, input, statistics; Serhii Lebedev, Serhii Zhurid: interpretation of data, preparation of the manuscript, analysis, search of literature; Svyatoslav Koval: design, research planning; Serhii Zhurid, Svyatoslav Koval, Victor Shalenko: fundraising.

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Conflicts of Interest
The authors declare no conflict of interest.

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Improvement of the physical preparedness of athletes in breaking at the age of 13-15 years using the functional simulator “alpha-gravity”

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Abstract

Purpose: to experimentally substantiate the improvement of the physical preparedness of breakdancers at the age of 13-15 years using the functional simulator «Alpha Gravity».

Material & Methods: theoretical analysis and generalization of scientific and methodological literature, pedagogical observation, pedagogical testing, pedagogical experiment, methods of mathematical statistics. The study involved 22 breakdancers aged 13-15 years, from the reserve of the national team of Ukraine. Two groups were formed from the study participants: the control group (CG) - 11 athletes and the main group (MG) – 11 athletes, in the educational process of which the means of the functional simulator «Alpha Gravity» were included.

Results: a positive effect of the application of a set of exercises using the «Alpha Gravity» functional simulator in the training process of breakdancers aged 13-15 years was revealed. The greatest increase in indicators of physical fitness of the athletes of the main group was found in the tests: T1 «Bend forward from a sitting position, legs together (cm)»; T2 «Push-ups» (number of times min^{-1})”; T5 «Holding the torso in the prone position, (s)»; T6 «Plank, (s)». In other tests, there is also a positive trend in the growth of indicators.

Conclusions: statistically significant positive changes in the level of physical preparedness of breakdancers at the age of 13-15 years of the main group (MG, n=11) were established under the influence of the developed training methodology using the means of the functional simulator «Alpha Gravity».

Анотація

Сергій Гуменюк, Володимир Коновалов, Владислав Замазій. Вдосконалення фізичної підготовленості спортсменів з брейкінгу віком 13-15 років засобами функціонального тренажеру «альфа-гравіті». Мета: експериментально обґрунтувати вдосконалення фізичної підготовленості спортсменів з брейкінгу віком 13-15 років засобами функціонального тренажеру «Альфа-гравіті». **Матеріал і методи:** теоретичний аналіз і узагальнення науково-методичної літератури, педагогічне спостереження, педагогічне тестування, педагогічний експеримент, методи математичної статистики. У дослідженні взяли участь 22 спортсмена з брейкінгу віком 13-15 років, зі складу резерву збірної команди України. З учасників дослідження було сформовано дві групи: контрольну групу (КГ) - 11 спортсменів та основну групу (ОГ) - 11 спортсменів, до навчально-тренувального процесу якої було включено засоби функціонального тренажеру «Альфа-гравіті». **Результати:** виявлено позитивний вплив застосування у навчально-тренувальному процесі спортсменів з брейкінгу віком 13-15 років комплексу вправ з використанням функціонального тренажеру «Альфа-гравіті». Найбільший приріст показників фізичної підготовленості спортсменів основної групи виявлено у тестах: Т1 «Нахил вперед з положення сидячи ноги разом, (см)»; Т2 «Згинання та розгинання рук в упорі лежачи (к-ть разів·$хв^{-1}$)»; Т5 «Утримання тулубу в положенні лежачи на животі, (с)»; Т6 «Планка, (с)». В інших тестах також простежується позитивна динаміка зростання показників. Висновки: встановлено статистично значущі позитивні зміни

Key words:
fbreaking
physical preparedness
functional trainer
alpha gravity

Ключові слова:
брейкінг
фізична підготовленість
функціональний тренажер
альфа-гравіті

рівня фізичної підготовленості спортсменів з брейкінгу віком 13-15 років основної групи (ОГ, n=11) під впливом розробленої методики тренувань з використанням засобів функціонального тренажеру «Альфа-гравіті».

Introduction

Today, experts in the field of physical culture and sports state the growth of the attractiveness of practicing technical and aesthetic sports. Usually, the group of "technical and aesthetic" sports includes sports acrobatics, artistic gymnastics, artistic swimming, aesthetic gymnastics, rhythmic gymnastics, and figure skating. These sports are characterized by the presence of a technical and artistic component in the performance of competitive programs, as well as a peculiar approach to assessing the performance skills of athletes, depending on the aesthetics, complexity, accuracy of the performed motor actions (Platonov, 2004; Hrytsyshyn (Dzhala) & Zanevs'kyy, 2007; Medvedyeva, 2008; Bernads'ka, 2013; Kaluzhna, 2015).

Classes in dance types of physical activity have a positive effect on the motivation for classes, as well as indicators of physical condition and personality traits, provide ample opportunities for the realization of creative potential (Shynkaruk, 2003; Rovnyy & Romanenko, 2016; Humenyuk, 2018; Kyzim et. al., 2018; Kolnohuzenko, 2018).

Today, traditionally, dance sports include sports aerobics, cheerleading, sports (ballroom) dancing, acrobatic rock and roll and, more recently, breaking.

Breaking was the first of the dance sports, according to the decision of the International Olympic Committee, was included in the program of the Olympic Games, which will be held in Paris (France) in 2024.

As in any other sport, the basis of successful competitive activity in breaking is the proper level of physical preparedness of athletes (Shkrebtiy, 2005; Sergienko, 2010; Baranov, 2012; Yeshpanova, 2017). But breaking experts note that today there is no scientific and methodological literature covering the issues of training athletes in breaking. Due to the fact that the national team of Ukraine in breaking, which is currently undergoing the stage of formation, will take part in the Olympic Games in Paris, there is a manifested scientific and applied problem, on the one hand, in the absence of a sufficient amount of scientific and methodological materials on the training of breakdancers, on the other hand, it is necessary to develop a structured system for the practical training of breakdancers, which will ensure a corresponding increase in sportsmanship and the achievement of high sports results in a short time.

Connection of research with scientific programs, plans, topics. The study was carried out in accordance with the initiative topic of the scientific research of the Department of Gymnastics, Dance Sports and Choreography of the KhSAPC: "Theoretical and methodological foundations for the development of backbone components of physical culture (sport, fitness and recreation) for 2020-2025 state registration number 0120U01215".

Purpose of the study: to experimentally substantiate the improvement of the physical preparedness of breakdancers at the age of 13-15 years using the functional simulator «Alpha Gravity».

Research task: to characterize the construction of the training process and increase the physical preparedness of athletes using the functional simulator «Alpha Gravity».

Material and Methods of the research

Participants

The study involved 11 breakdancers aged 13-15 years in the control group (CG) and 11 breakdancers aged 13-15 years in the main group (MG). All participants and their parents were informed of the nature of the study and gave informed consent to participate and process the data.

Methods

In the course of the study, a set of research methods was used to solve the set purpose: theoretical analysis of scientific and methodological literature, pedagogical observation, pedagogical testing, pedagogical experiment, methods of mathematical statistics.

Procedure

To assess the level of physical fitness of athletes in breaking, 8 tests were selected: "Push-ups", "Lifting the body from a supine position", "Holding the torso in the prone position" to assess the strength abilities of athletes; the "Plank" test was chosen to assess static strength; to assess flexibility – tests "Split (right, left, split)" and the test "Bend forward from a sitting position, legs together"; to assess the speed-strength abilities – the test "Standing long jump"; "Romberg" test was used to assess coordination abilities (ability to maintain balance).

In the training process of the athletes of the main group (MG, n=11), a set of exercises was included using the means of the functional simulator " Alpha Gravity".

"Alpha Gravity" is a functional simulator, which is a suspension system in which athletes are horizontally suspended using special attachments for arms and legs (Alabin. & Skripko, 1974). Training sessions with the inclusion in the training process of the means of the functional simulator " Alpha Gravity" were held 3 times a week. The duration of the complex is 20-25 minutes. The complex developed by us included the following exercises:

Exercise 1. Hanging face up (basic position), arms and legs are fixed in slings (unloading the pelvis). The duration of the exercise is 20 s.

Exercise 2. Pull-ups with a wide grip (legs suspended in slings). Number of repetitions – 12.

Exercise 3. Bringing the pelvis up with the touch of the heels. Number of repetitions – 8.

Exercise 4. Bringing the pelvis and pulling up with a wide grip while fixing the knees and elbows in the central zone (navel area) for 5-8 seconds. Number of repetitions – 8.

Exercise 5. From the basic position twist to the right, then pull up face down (exit to the "second floor"), after reaching the end point, the body is bent and unbent (10 times) face down. Repeat on the other side. Number of repetitions – 1.

Exercise 6. From the basic position, turn the shoulder girdle back to form an arc in the spine and perform oscillatory movements to unload the pelvic region.

Exercise 7. Access to the "high level" with a change in support on the knees and ankles.

The athletes of the control group (CG, n=11) had the training process according to the traditional method of training athletes in breaking.

Statistical analysis

Statistical analysis of the results obtained was carried out using descriptive statistics indicators using licensed Excel spreadsheet packages and a set of built-in functions.

Results of the research

Indicators of the level of physical preparedness of breakdancers 13-15 years old of the main and control groups at the initial and final stages of the study are presented in Tables 1-2.

As a result of the analysis of statistical indicators of the level of physical preparedness of athletes from the MG and CG, carried out at the beginning of the study, the unreliability of the differences in the results obtained in 7 tests (from tp=0,1 до tp=1,68 at tgr=2,2). Thus, we state the acceptable difference in the initial level of physical fitness of athletes of both groups. In the test "Splits (right/left/splits), (cm)" at the beginning of our study, the performance of athletes from the main group (n=11) significantly exceeded the performance of athletes from the control group (n=11).

As a result of the analysis of the data obtained at the final stages of the study, we note that the greatest increase in the physical preparedness indicators of the MG athletes was found in the tests: T1 "Bend forward from a sitting position, legs together (cm)"; test T2 «Push-ups (number of times min^{-1})»; test T5 «Holding the torso in the prone position, (s)»; test T6 «Plank, (s)». In our opinion, this may indicate that with the help of the «Alpha Gravity» functional simulator, muscles, ligaments and tendons in the back and waist are strengthened, and in breaking these areas bear the main load when performing basic elements and their variations. It is also important to note that the indicators of the T1 test "Bend forward from a sitting position, legs together, (cm)" indicate that the «Alpha Gravity» simulator significantly contributes not only to increasing the level of strength indicators, but also has a positive effect on the level of flexibility, which, in turn, contributes to the implementation of breaking elements with greater amplitude and dynamics, as well as a high rate of flexibility reduces the risk of injury and reduces the recovery time after training and competitive loads. In other tests, there is also a positive trend in the growth of indicators. In the T4 test "Romberg test" and the T7 test "Splits", positive changes did not reach statistically significant values, which may be the result of the fact that the complex developed by us did not include specialized exercises aimed at improving flexibility and vestibular stability.

The dynamics of physical preparedness characteristics of athletes of the main group (MG, n=11) is presented in Table 3

The increase in the indicators of physical preparedness of breakdancers at the age of 13-15 years of the main group (MG) in the performance of the battery of tests is:

- test T1 «Bend forward from a sitting position, legs together, (cm)» - increase 147,8% (t_p = 2,44; p < 0,05);
- test T2 «Push-ups (number of times min^{-1})» - increase 35% (t_p=3,11; p < 0,05);
- test T3 «Lifting the body from a supine position (number of times min^{-1})» - increase 16,7% (t_p = 2,28; p < 0,05);
- test T4 «Romberg test (on the right/left), (s)» - increase 35% (t_p = 1,04; p > 0,05) / increase 62,9% (t_p = 2,25; p < 0,05);
- test T5 «Holding the torso in the prone position, (s)» - increase 100% (t_p = 4,64; p < 0,001);
- test T6 «Plank, (s)» - increase 140,8 % (t_p = 2,79; p < 0,05);
- test T7 «Split (right/left/split) (cm)» - increase 33,2% (t_p=1,18; p > 0,05)/increase 35,5% (t_p = 1,10; p > 0,05) /

Table 1

Indicators of the level of physical preparedness of breakdancers at the age of 13-15 at the beginning of the study (n=22)

Test №	Tests	Maingroup (*n*=11) $\bar{X}\pm m$	Controlgroup (*n*=11) $\bar{X}\pm m$	t_p	P
T1	«Bend forward from a sitting position, legs together, (cm)»	4,18±2,31	2,18±1,42	0,74	p>0,05
T2	«Push-ups (number of times min^{-1})»	40,81±3,58	40,27±3,5	0,1	p>0,05
T3	«Lifting the body from a supine position (number of times min^{-1})»	44,18±2,33	38,45±2,83	1,56	p>0,05
T4	«Romberg test (on the right/left), (s)»	6,0±1,01 4,54±0,72	5,0±0,63 4,36±0,72	0,83 0,18	p>0,05 p>0,05
T5	«Holding the torso in the prone position, (s)»	127,27±10,23	113,45±11,77	0,88	p>0,05
T6	«Plank (s)»	159,54±28,57	119,72±14,27	1,24	p>0,05
T7	«Split (right/left/split) (cm)»	15,36±3,53 14,91±3,83 16,77±3,93	28,63±3,12 28,27±2,93 24,72±2,6	2,82 2,77 1,68	p<0,05 p<0,05 p>0,05
T8	«Standing long jump (cm)»	175,90±6,3	168,90±3,03	1,0	p>0,05

Table 2

Indicators of the level of physical preparedness of breakdancers at the age of 13-15 years at the final stages of the study (n=22)

Test №	Tests	Maingroup (*n*=11)	Controlgroup (*n*=11)	tp	p
		$\bar{X}$±m			
T1	«Bend forward from a sitting position, legs together, (cm)»	10,36±1,05	2,36±1,36	4,67	p<0,001
T2	«Push-ups (number of times min^{-1}) »	55,18±2,92	41,09±3,44	3,12	p<0,01
T3	«Lifting the body from a supine position (number of times min^{-1}) »	51,54±2,23	38,27±3,02	3,54	p<0,01
T4	«Romberg test (on the right/left), (s)»	8,1±1,75 7,4±1,09	4,9±0,5 4,81±0,8	1,75 1,92	p>0,05 p>0,05
T5	«Holding the torso in the prone position, (s)»	254,63±25,41	120,36±11,72	4,79	p<0,001
T6	«Plank (s)»	384,3±75,11	124,09±13,64	3,41	p<0,01
T7	«Split (right/left/split) (cm)»	10,27±2,5 9,63±2,87 13,54±3,75	27,09±4,0 28,18±2,91 24,63±2,64	3,56 4,54 2,42	p<0,01 p<0,01 p<0,05
T8	«Standing long jump (cm)»	190,54±8,63	167,18±4,34	2,42	p<0,05

Table 3

Dynamics of indicators of physical preparedness of breakdancers of the main group (n =11)

Test №	Tests	$\bar{X}$±m		t_p	P
		at the beginning of the study	at the end of the study		
T1	«Bend forward from a sitting position, legs together, (cm)»	4,18±2,31	10,36±1,05	2,44	p<0,05
T2	«Push-ups (number of times min^{-1})»	40,81±3,58	55,18±2,92	3,11	p<0,05
T3	«Lifting the body from a supine position (number of times min^{-1})»	44,18±2,33	51,54±2,23	2,28	p<0,05
T4	«Romberg test (on the right/left), (s)»	6,0±1,01 4,54±0,72	8,1±1,75 7,4±1,09	1,04 2,2	p>0,05 p<0,05
T5	«Holding the torso in the prone position, (s)»	127,27±10,23	254,63±25,41	4,64	p<0,001
T6	«Plank (s)»	159,54±28,57	384,3±75,11	2,79	p<0,05
T7	«Split (right/left/split) (cm)»	15,36±3.53 14,91±3,83 16,77±3,93	10,27±2,5 9,63±2,87 13,54±3,75	1,18 1,10 0,59	p>0,05 p>0,05 p>0,05
T8	«Standing long jump (cm)»	175,90±6,3	190,54±8,63	1,37	p>0,05

Table 4

Dynamics of indicators of physical preparedness of breakdancers of the control group (n=11)

Test №	Tests	$\bar{X}\pm m$		t_p	P
		at the beginning of the study	at the end of the study		
T1	«Bend forward from a sitting position, legs together, (cm)»	2,18±1,42	2,36±1,36	0,09	p>0,05
T2	«Push-ups (number of times min^{-1})»	40,27±3,5	41,09±3,44	0,16	p>0,05
T3	«Lifting the body from a supine position (number of times min^{-1})»	38,45±2,83	38,27±3,02	0,04	p>0,05
T4	«Romberg test (on the right/left), (s)»	5,0±0,63 4,36±0,72	4,9±0,5 4,81±0,8	0,12 0,42	p>0,05 p>0,05
T5	«Holding the torso in the prone position, (s)»	113,45±11,77	120,36±11,72	0,41	p>0,05
T6	«Plank (s)»	119,72±14,27	124,09±13,64	0,22	p>0,05
T7	«Split (right/left/split) (cm)»	28,63±3,12 28,27±2,93 24,72±2,6	27,09±4,0 28,18±2,91 24,63±2,64	0,30 0.02 0,02	p>0,05 p>0,05 p>0,05
T8	«Standing long jump (cm)»	168,90±3,03	167,18±4,34	0,32	p>0,05

increase 19,3% (t_p = 0,59; p > 0,05);

- test T8 «Standing long jump (cm)» - increase 8,3% (t_p = 1,37; p > 0,05).

As a result of the analysis of indicators in the performance of a battery of tests to assess the level of physical preparedness of breakdancers at the age of 13-15 years at the initial and final stages of the study, we state a trend of positive growth in strength indicators (dynamic and static strength), which indicates the effectiveness and significant effect of the application functional simulator "Alpha-gravity" in the educational process of athletes of the main group (MG).

To compare the results of athletes in both study groups, we also determined the dynamics of the physical preparedness indicators of breakdancers of the control group. The results are presented in Table 4.

Based on the indicators of the control group at the initial and final stages of the study, we state that in the control group there were positive changes in most tests (except for the T8 test «Standing long jump (cm), test T3 "Lifting the body from a supine position (number of times/min)" and test T4 "Romberg test (on the right), (s)", where there is a minimal decrease in performance). The decrease in indicators is insignificant, which may indicate that training according to the traditional method of the training process of athletes in breaking does not give the training effect that is observed in the main group with the integration of the means of the "Alfa Gravity" functional simulator into the training process.

The dynamics of the indicators of the main and control groups in the performance of the battery of tests for assessing the physical preparedness of athletes aged 13-15 years of the main and control groups is shown in the Figure 1.

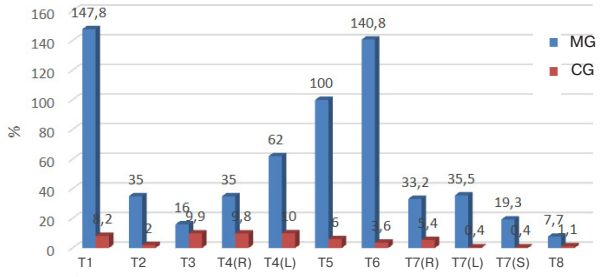

Figure 1. Changes in the indicators of physical preparedness of breakdancers in the main (MG) and control groups (CG)

T1 - Bend forward from a sitting position, legs together (cm);
T2 - Push-ups (number of times min^{-1});

T3 - Lifting the body from a supine position (number of times min^{-1});
T4 - Romberg test (on the right) (s);
T4 - Romberg test (on the left) (s);
T5 - Holding the torso in the prone position (s);
T6 - Plank (s);
T7 - Right split (cm);
T7- Left split (cm);
T7 - Split (cm);
T8- Standing long jump (cm).

In the T1 test "Bend forward from a sitting position, legs together, (cm)", the increase in the indicators of the main group is 147,8%, and in the control group only 8,2%; in the T2 test "Push-ups, (number of times min^{-1})" indicators in the main group increased by 35%, in the control group by 2%; in the test "T6 Plank, (s)" in the main group of growth 140,8%, in the control – 3,6%; in the T5 test "Holding the torso in the prone position (s)" in the main group - 100%, in the control group - 6%; in the T7 test "Splits (right /left/splits) (cm)" in the main 33,2%, 35,5%, 19,3%, in the control 5,4%, 0,4%, 0,4%.

Discussion

An analysis of the special literature shows that specialists using the "Alpha Gravity" simulator in their professional activities, among its advantages, note that muscles and ligaments become stronger, stretch and relax under the weight of the body, joints are strengthened and their mobility increases, the spine is stretched, vertebrae fall into place, innervation and blood circulation are restored, psycho-emotional blocks are removed. (Rovnyy & Romanenko, 2016).

Conclusions

1. Based on these characteristics of the functional simulator "Alpha Gravity" and its use in the educational and training process of the main group, it made it possible to combine the advantages of strength training, stretching, Pilates, yoga, which had a positive effect on the level of physical preparedness of breakdancers aged 15 years. Evidence of the effectiveness of the developed methodology is statistically significant changes in the level of physical fitness in athletes of the main group.
2. Using the obtained indicators, the developed set of exercises, which gave a positive result, we can integrate into the general training course for breakdancers, and continue to improve the existing developments and develop new exercises that will improve sportsmanship.

Author Contributions
Sergey Humenyuk: data collection, input, statistics; Vladimir Konovalov: data interpretation, manuscript preparation, literature search analysis.; Vladislav Zamaziy: design, research planning, fundraising.

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Conflicts of Interest
The authors declare no conflict of interest.

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Substantiation of the professiographic model of sports dances

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Abstract

Purpose: analysis of the activity of dance sport athletes using professiographic techniques to optimize the training and growth of sportsmanship.

Material & Methods: the method of developing a professiogram was used according to the accepted methodology, methods for assessing the severity and intensity of work were used.

Results: the severity and intensity of sports activities in dancing were assessed. The main professional requirements are identified, which include: the need to maintain a pose in dance, high technicality in performing elements, mandatory artistry, a sense of rhythm and performing movements in accordance with music, high noise immunity, high physical preparedness with an advantage in coordination, strength qualities and endurance, high functionality of cardiorespiratory systems.

Conclusions: the analysis of sports activities in sports dances made it possible to substantiate and develop a professional model of this sport. It has been established that sports dances belong to the 3rd category of labor in terms of severity and the 4th category in terms of intensity in accordance with the official physiological and hygienic criteria. The main professional requirements that determine the success of professional activity are highlighted. A set of methods necessary for the study and assessment of the state of the most important organs and systems that ensure the implementation of sports tasks is substantiated. These methods can be used in monitoring the functional state of athletes to develop a forecast for the growth of sportsmanship.

Анотація

Ольга Подрігало, Го Сяохун, Леонід Подрігало, Олександр Подаваленко, Олександр Галашко. Обґрунтування професіографічної моделі спортивних танців. Мета: аналіз діяльності спортсменів-танцюристів з використанням професійних методик для оптимізації підготовки та зростання спортивної майстерності. **Матеріал і методи:** використано метод розробки професіограми згідно з прийнятою методологією, використано методики оцінки тяжкості та напруженості праці. **Результати:** оцінено тяжкість та напруженість спортивної діяльності в танцях. Виділено основні професійні вимоги, до яких віднесені: необхідність підтримки пози в танці, висока технічність виконання елементів, обов'язковість артистизму, почуття ритму та виконання рухів відповідно до музики, висока завадостійкість, висока фізична підготовленість з перевагою координаційних, силових якостей та витривалості, високі функціональні можливості системи. **Висновки:** проведений аналіз спортивної діяльності у спортивних танцях дозволив обґрунтувати та розробити професіографічну модель даного виду спорту. Встановлено, що спортивні танці відносяться до 3 категорії праці за тяжкістю та 4 категорії за напруженістю у відповідності з офіційними фізіолого-гігієнічними критеріями. Виділено основні професійні вимоги, що визначають успішність професійної діяльності. Обґрунтовано комплекс методик, необхідних для дослідження та оцінки стану найважливіших органів та систем, що забезпечують виконання спортивних завдань. Ці методики можуть бути використані в моніторингу функціонального стану спортсменів для розробки прогнозу зростання спортивної майстерності.

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Introduction

The total time spent on sports activities allows us to consider it professional, and athletes to be singled out in a separate professional group. The current situation makes it possible to apply professiographic approaches to the analysis of sports. Sports professiography is a complex area of sports science, which is actively developing at the present time (Shemanaev, 2013; Podrigalo et al., 2014; Podrigalo et al., 2015; Bogatirev, 2016).

A comprehensive assessment of sports activities, the study of the main factors influencing the functional state of athletes, make it possible to draw up a professional description of a sport. It is the basis for the regulation of activities, the implementation of the necessary measures to optimize the training and growth of sportsmanship (Podrigalo & Podrihalo, 2019).

The basis of professiography is the determination of the requirements of the profession for the employee, his capabilities and abilities. Based on this analysis, a special professiogram is compiled (Garber & Kosacha, 1992). This is the main document that characterizes the relationship between the employee and his profession. The professiogram contains a comprehensive, systematized description of the socio-economic, psychological, industrial, technical, medical, sanitary and hygienic and other objective characteristics of a particular profession. These characteristics reveal the specifics of production activities and the requirements for the employee. The professiogram informs a person about the objective content of labor activity, psychophysiological and physical qualities that are required of him.

The use of professiographic methods in sports is gradually expanding. Archery and armwrestling professiograms made it possible to identify the main risk factors influencing success, to form a battery of tests to analyze the condition of athletes (Podrigalo et al., 2014; Podrigalo et al., 2015).

Shemanaev (2013) has developed a tourism instructor professiogram. It is proposed to assess the severity and intensity of the activity, highlight the qualities, abilities and skills that ensure the success of the professional activity, and the factors that hinder its effectiveness.

The concepts of professiography were used by Bogatirev (2016) when analyzing the professional and applied training of martial arts athletes. The importance of psychophysiological functions, such as reaction speed, coordination, eye, etc., is emphasized.

Eliseev et al. (2016) note that professional sports are a kind of work activity. Therefore, the psychology of work in this case is the psychology of sports work. Compilation of professiograms also requires taking into account the ratio of reliability and safety of the «man - sport» system.

The development of a professiogram is carried out in two directions - an analysis of the features of a sport and an analysis of the athlete's condition. The influence of a sport is expressed in the professional requirements for an athlete. The most important among them is the level of health, as an integral indicator of sports success and skill. Professionally important qualities are also very important for the growth of sportsmanship. These include psychophysiological features and psychological properties of the individual (Garber & Kosacha, 1992).

Dance sport is relatively young. Competitions for this species appeared only at the end of the last century. Nastase (2012a) emphasizes his intermediateness between sports and art. This sport is classified as the highest form of motor activity, a synthesis of art and sport in general.

Shang and Wang (2019) conducted an analysis of the share of the main components of dancesport. It is noted that the aesthetic and physical components play the main role. Their share was 44,5% and 40,0%, respectively.

The growing popularity of sports dances is due to a number of reasons. First of all, this is a large number of prestigious international competitions. In addition, the growth in popularity is due to the inclusion of sports dances in the program of the Olympic Games. In this regard, their scientific and practical support is an important task of modern sports science. Based on this, **the purpose of this study** was to analyze the activities of dancers using professiographic techniques to optimize the training and growth of sportsmanship.

Material and Methods of the research

Study participants

Given the theoretical and methodological nature of the study, there was no need to involve special participants in its implementation. When developing a professiographic model of sports dances, the available literature data and the practical experience of one of the authors, who works as a trainer in this field, were taken into account.

Study organization

According to current approaches, a professiogram is developed according to a certain methodological scheme (Garber & Kosacha, 1992). Taking into account sports specifics, it has the following form: sport → professionally significant requirements for an athlete → professionally important qualities (PIQ) → the level of requirements for the corresponding sport psychophysiological properties (PPS) → research methods → ranking the level of development of the PPS → norms for assessing PIQ → psychogram → selection and adaptation of an athlete → prediction of his skill and success → types and forms of correction and optimization.

Official criteria for the physiology of labor were used to analyze the severity and intensity of production activities (Zolina & Izmerov, 1983).

Statistical analysis

Substantiation and development of a professional model of a sport does not require statistical processing and analysis.

Results of the research

Considering sports dancing as a professional activity, it is necessary to highlight the following main areas of research:

- assessment of the nature and characteristics of activities to maintain optimal performance, prevent overwork, overtraining and overstrain;
- allocation of functional systems involved in the work, justification for the use of informative and adequate methods for their study and evaluation;
- determination of the main "professional requirements" for an dance sport athletes - for the optimal regulation of his activities, their maximum possible correction.

The use of official criteria of labor physiology (Zolina & Izmerov, 1983) makes it possible to assess the severity and intensity of sports activity. When assessing the severity of work, the magnitude of energy costs, changes in heart rate and a decrease in endurance in relation to the initial level are taken into account. The predominant physical load in sports dancing is performed by the muscles of the lower extremities

and torso. Its power is up to 45 watts. This allows us to classify sports dancing as moderate. The average duration of the performance of sports dancers is 2-3 minutes, and the total movements during training exceed 5 km. Energy costs during dancing reach 450 kcal / hour, the pulse rate can reach 120 beats / min. It also makes it possible to evaluate sports dances as hard work (3rd category of severity).

The analysis of labor intensity in sports dances gives a different assessment depending on the criteria used. Athletes must control not only their own movements, but also the movements of other couples when performing exercises. The number of pairs that are simultaneously on the site can reach ten or more. This allows us to assess this activity as a little stressful (2nd degree). The duration of concentrated observation should be practically constant, the time of active actions should be more than 80% of the total time. Performing dance exercises requires a large amount of main memory due to the demonstration of more than 5 techniques. This confirms the 4th degree of tension - a very intense activity. Intellectual tension should be assessed as 3rd degree, since the performance requires solving complex problems according to the algorithm (demonstration of special techniques).

Thus, the use of official criteria of labor physiology makes it possible to evaluate sports dances as hard (category 3) and very intense (category 4) work.

However, the criteria existing in the physiology of labor do not allow to fully reflect the specifics of sports dances, which necessitates the use of professiographic approaches.

The basic professional requirements in sports dances should include:

- need to maintain a posture in dance,
- high technical performance of elements,
- obligatory artistry,
- sense of rhythm and execution of movements according to the music,
- high noise immunity,
- high physical preparedness with the advantage of coordination, strength and endurance,
- high functionality of the cardiorespiratory system.

Thus, the analysis of activity in sports dances allows us to identify a number of physical, psychophysiological and psychological factors that affect success. They are associated with the functional state of the athlete and with the level of his sportsmanship. Their study requires the selection of appropriate methods that allow us to evaluate these factors and carry out the necessary correction of the condition of athletes or the organization of training.

From the physiological and hygienic positions, the following research methods can be used for the professional characteristics of sports dances:

- timing of training and competitive activity, which allows to determine the general and motor density, to evaluate the main types of activity, allowing to characterize the intensity of work;
- goniometry of the main joints provides information on the range of motion in the main joints;
- anthropometric study of physical development, assessment of the harmony of his physique with the help of appropriate indices;
- assessment of the somatotype using the bioimpedance method, determination of the main components of the athlete's body;
- psychophysiological study of coordination, sense of rhythm, concentration and switching of attention, volume of motor memory, static and dynamic coordination - balance maintenance;
- indicators evaluating the general adaptive potential of an athlete, his functional capabilities, the response of physiological indicators to a standardized load;
- APASM questionnaire test, which allows assessing the dynamics of the mental status (anxiety, performance, activity, self-esteem and mood).

Discussion

The training of elite athletes in almost all sports involves the use of excessive loads that exceed functional capabilities (Omelyanenko, 2014; Borisova, 2016). This necessitates the justification and development of new approaches to training, expansion of adaptive capacity and increase in functional reserves (Joyner and Coyle, 2007). The complexity of competitive activity in dance sport determines the importance of the state of physical health, the level of adaptive mechanisms and features of the implementation of genetically determined functions (Sivitsky, 2012; Demidova, 2019; Podrigalo et al., 2019).

The conducted professiographic analysis of sports dances allowed to substantiate the main directions of scientific research in this sport. The implementation of the selected areas of research provides data for improving the selection and prediction of the growth of sportsmanship, optimizing the training and monitoring the functional state of dancers.

In dance, the body is an instrument, it must be well studied and controlled. Daniela, Mircea (2013) proposed and developed a number of devices for teaching dance technique. With their help, special exercises can be created to improve certain elements of dance movements.

Success in sports dancing is largely determined by the characteristics of information processing, which depend on the development of sensations, perceptions and ideas (N stase, 2012b). The high physiological cost of the functional support of competitive activity in sports dancing among highly qualified athletes is a prerequisite for taking into account adaptive mechanisms in the preparation and prediction of success. (Soponovich et al., 2018).

The assessment of sports dances as hard work determines the need to include in the training of athletes training sessions for the development of special and general endurance, increasing adaptive potential and expanding functionality.

This agrees with the available literature data. Kolokythas, Metsios, Wyon, et al. (2021) analyzed the causes of injuries in dance and aesthetic sports. Overexertion and training loads are highlighted as major risk factors for injury. This proves the importance of matching loads to the functional capabilities of athletes in dance sports. Available research confirms the existence of a relationship between the formation of difficult coordination dance skills and the level of endurance (Williams & Ericsson, 2007; Raczek, 2010; Artemieva, 2014). Nastase (2012c) emphasizes that the basis of a comprehensive methodology for ensuring the performance of a dance couple is a performance analysis.

The definition of sports dancing as a very intense activity requires the inclusion in the training of techniques that develop concentration, short-term memory and other psychophysiological features. The organization of monitoring the functional state of dance sport athletes should include a comprehensive psychophysiological study aimed at studying these qualities.

Techniques in dance sport are based on the implementation of complex coordination skills, taking into

account the characteristics of musical accompaniment. Their provision is carried out due to the psycho-physiological and mental abilities of the athlete (Soponovich et al., 2013; Korobeynikov et al., 2017).

Nastase (2012d) analyzes the role of sensations, perceptions, representations, memory and imagination in dancesport. The stages of learning are divided into the perception and presentation of the dance action to be performed; understanding of the technical execution to be performed; formation of correct technical stereotypes. It is emphasized that these stages are fundamental skills in teaching specific dancesport movements.

Highlighted professional requirements in sports dances require the introduction of corrective measures in the training of dancers. General physical training should be aimed at the predominant development of the strength of the muscles of the lower extremities and torso with simultaneous flexibility training. An important point of monitoring in sports dancing is the control of the somatotype of athletes.

Similar data are given in works devoted to the study of the functional state of dancers. Banio and Malchrowicz-Mosko (2021) note the importance of body features for success in ballroom dancing. This factor is recognized as one of the main ones in the selection in this sport. The authors emphasize the importance of studying and evaluating the characteristics of the somatotype, the proportion of muscle and adipose tissue.

Anthropometric indicators are important for selection in aesthetic sports, including dancing. Liiv et al. (2014) analyzed the characteristics of athletes in Latin American and standard dance sports. It is concluded that the somatotypes of athletes differ in the style of dance. Compared to other aesthetic sports, male and female dancers are less mesomorphic and more ectomorphic. Standard dancers tend to be more ectomorphic with greater height, greater arm span compared to Latin American dancers. Dancers with a more pronounced mesomorphic type had better results in the international ranking and occupied higher places.

As already noted, an important place in the preparation should be occupied by endurance training to expand adaptive capabilities. High working capacity and endurance allow demonstrating ease of dance performance, artistry and positive emotions. An important component of the dancer's success is the sense of rhythm, the execution of movements in accordance with the musical accompaniment. Similar results are reported by Eliakim et al. (2013).

In the work of Donath et al. (2016) highlights the importance of balance research in dance teaching. Stands on one and two legs, with eyes open and closed, were used as balance tests. It is recommended to use for this technique based on virtual reality.

An important place in the preparation should be occupied by measures for psychological preparation, managing one's mental state, and correcting stress. This will significantly increase the noise immunity of athletes, optimize the mental status, and positively influence its main components. The use of the APASM test meets the objectives. This test can be used to monitor the functional state of dance sport athletes.

The proposed set of tests can be used to select and predict the growth of mastery in sports dancing. Similar results were obtained by Zabrocka et al. (2015). The authors identified selection indicators at the initial stage of training. It is concluded that at the initial stage of sports dancing, the greatest influence on special preparedness is exerted by coordination of movements, balance, flexibility, speed-strength qualities, height and weight of the body, the circumference of the pelvis, torso, and chest. The tests and indicators used in the study most fully reflect the specifics of dance sport and can be recommended in the selection process for this sport discipline.

Conclusions

The analysis of sports activities in sports dances made it possible to substantiate and develop a professional model of this sport. It has been established that sports dances belong to the 3rd category of labor in terms of severity and the 4th category in terms of intensity in accordance with the official physiological and hygienic criteria. The main professional requirements that determine the success of professional activity are highlighted. The complex of techniques necessary for the study and assessment of the state of the most important organs and systems that ensure the implementation of sports tasks is substantiated. These methods can be used in monitoring the functional state of athletes to develop a forecast for the growth of sportsmanship.

Author Contributions
Olha Podrihalo: data collection, input, data analysis, manuscript preparation; Guo Xiaohong: interpretation of data, preparation of the manuscript; Leonid Podrigalo: design, interpretation of data; Olexandr Podavalenko: design, research planning; Olexsandr Halashko: analysis, literature search.

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