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PHYSICAL PREPAREDNESS OF PAWERLIFTERS WITH MUSCULOSKELETAL LESION AS A FACTOR OF EFFICIENCY OF TRAINING PROGRAM

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Abstracts

Topicality. Considering the possibility of negative influence on the health of athletes with disabilities, the mechanical transfer of approaches to the training of healthy powerlifters into the practice of adaptive sports, there is a need to develop and substantiate programs for the training of athletes with disabilities. ***The purpose*** of the study is to substantiate the effectiveness of the training program on the basis of analysis of indicators of physical preparedness of powerlifters with musculoskeletal lesion at the stage of initial training. ***Method and Methodology.*** To solve this goal the analysis and generalization of scientific and methodical literature, pedagogical testing, pedagogical experiment, methods of mathematical statistics was used. ***Results.*** On the basis of the analysis of scientific and methodological literature and best practices in sport practice a program of training of powerlifters with musculoskeletal lesion was developed at the stage of initial training. As a result of the experimental implementation of the program in the practice of sport, the degree of influence of powerlifting exercises on the physical preparedness of powerlifters was detected. Significant differences were found ($p < 0.01$) in tests for manual muscle testing, running at 30 m, cooper's 12- minute test, shoulder flexibility test, throwing a ball at the target in sitting position before and after the experiment in powerlifters at the initial training stage. ***Conclusions.*** A statistically significant increase in the indicators of physical preparedness can indicate the possibility of reducing the impact of lost functions on the lives of athletes with disabilities through the use of powerlifting. The scientific results obtained during the experimental verification allow us to conclude about the positive impact of powerlifting exercises on the physical preparedness of athletes with musculoskeletal lesion.

Key words: powerlifting, the stage of initial training, musculoskeletal lesion, physical qualities, rehabilitation.

Марія Розторгуй. Фізична підготовленість пауерліфтерів з інвалідністю як чинник ефективності програми підготовки. ***Актуальність.*** Ураховуючи можливість негативного впливу на здоров'я спортсменів з інвалідністю механічного перенесення підходів до підготовки здорових пауерліфтерів у практику адаптивного спорту, постає необхідність розробки й обґрунтування програм підготовки спортсменів з інвалідністю. ***Мета дослідження*** – обґрунтування ефективності програми підготовки на основі аналізу показників фізичної підготовленості пауерліфтерів із пошкодженнями опорно-рухового апарату на етапі початкової підготовки. ***Метод та методологія проведення роботи.*** Для досягнення поставленої мети використано аналіз й узагальнення науково-методичної літератури; педагогічне тестування; педагогічний експеримент; методи математичної статистики. ***Результати роботи.*** На основі аналізу науково-методичної літератури та передового досвіду практики спорту розроблено програму підготовки пауерліфтерів із пошкодженнями опорно-рухового апарату на етапі початкової підготовки. У результаті експериментального впровадження програми в практику спорту виявлено ступінь впливу занять пауерліфтингом на фізичну підготовленість пауерліфтерів із пошкодженнями опорно-рухового апарату. Виявлено достовірні відмінності ($p<0,01$) у показниках за тестами «біг на 30 м», «12-хвилинний тест Купера на ручному велотренажері», «викрут із гімнастичною палицею з положення "гімнастична палиця хватом двох рук зверху вперед-униз"», «метання м'яча з положення сидячи в ціль» та мануально-м'язового тестування за всіма тестовими позиціями до початку й після експерименту в пауерліфтерів на етапі початкової підготовки. ***Висновки.*** Статистично достовірний приріст показників фізичної підготовленості може свідчити про можливості зменшення впливу втрачених функцій на життя спортсменів з

інвалідністю за допомогою занять пауерліфтингом і про ефективність програми підготовки пауерліфтерів на етапі початкової підготовки. Наукові результати, отримані в ході експериментальної перевірки, дають підставу для висновку про позитивний вплив занять із пауерліфтингу на фізичну підготовленість спортсменів із пошкодженнями опорно-рухового апарату на етапі початкової підготовки.

Ключові слова: пауерліфтинг, етап початкової підготовки, пошкодження опорно-рухового апарату, фізичні якості, реабілітація.

Мария Розторгуй. **Физическая подготовленность пауэрлифтеров-инвалидов как фактор эффективности программы подготовки.** ***Актуальность.*** Учитывая возможность негативного влияния на здоровье спортсменов-инвалидов механического переноса подходов к подготовке здоровых пауэрлифтеров в практику адаптивного спорта возникает необходимость разработки и обоснования программ подготовки для спортсменов-инвалидов. ***Цель*** исследования – обоснование эффективности программы подготовки на основе анализа показателей физической подготовленности пауэрлифтеров с поражениями опорно-двигательного аппарата на этапе начальной подготовки. ***Метод и методология проведения работы.*** Для решения поставленной цели использован анализ и обобщение научно-методической литературы; педагогическое тестирование; педагоги- ческий эксперимент; методы математической статистики. ***Результаты работы.*** На основе анализа научно-мето- дической литературы и передового опыта практики спорта разработана программа подготовки пауэрлифтеров с поражениями опорно-двигательного аппарата на этапе начальной подготовки. В результате экспериментального внедрения программы в практику спорта выявлена степень влияния занятий пауэрлифтингом на физическую подготовленность пауэрлифтеров. Наблюдаются достоверные различия ($p < 0,01$) в показателях по тестам «бег на 30 м», «12-минутный тест Купера на ручном велотренажере», «прокручивание гимнастической палки назад из положения «гимнастическая палка хватом двух рук сверху», «метание мяча из положения сидя в цель» и мануально-мышечное тестирование по всем тестовым позициям до начала и после эксперимента у пауэрлифтеров на этапе начальной подготовки. ***Выводы.*** Статистически достоверный прирост показателей физической подготов- ленности может свидетельствовать о возможности уменьшения влияния утраченных функций на жизнь спорт- сменов с инвалидностью с помощью занятий пауэрлифтингом и об эффективности программы подготовки пауэр- лифтеров на этапе начальной подготовки. Научные результаты, полученные в ходе экспериментальной проверки, позволяют сделать вывод о положительном влиянии занятий пауэрлифтингом на физическую подготовленность спортсменов с поражениями опорно-двигательного аппарата на этапе начальной подготовки.

Ключевые слова: пауэрлифтинг, этап начальной подготовки, поражения опорно-двигательного аппарата, физические качества, реабилитация.

Introduction. Adaptive sport is socially significant phenomenon that helps to overcome the lack of confidence in own abilities, defeat disability, achieve the highest possible sport result and demonstrate human capabilities to create conditions for social adaptation and integration of people with disabilities [1; 3; 4; 9; 12]. At the present stage of development, adaptive sport is directed towards achieving the highest result that promotes the formation of such social values as victory, record, prestige, spectacle, empathy. Sense of self-realization, personal growth and personal contribution to the development of society are formed on the basis of the demonstration of such a sport result, which has a great social significance [6; 7; 9].

Despite the positive aspects of the goal-oriented focus of adaptive sport, the desire to set records and to win medals causes numerous problems in adaptive sport, which are inherent to the Olympic sport [5; 6; 7; 11]. One of the most acute problems is the mechanical transfer of the methodological provisions for the training of athletes in the Olympic sport into the system of training athletes in adaptive sport, without taking into account the specifics of motor activity and the functional capabilities of athletes with disabilities [8; 10; 13]. Excessive intensity of training and competitive activities hinders the full realization of recreational and rehabilitative functions of adaptive sport.

This problem is particularly acute in the early stages of multiple years of preparation, which causes the forcing of preparation process and the occurrence of numerous sports injuries and associated diseases in persons with disabilities, which substantiates the need to find ways to adapt approaches to preparation and existing training programs for athletes with disabilities [2]. The solution to this problem in the practice of adaptive sports occurs within the framework of preparation of groups of initial training, which corresponds to the second stage of multiple years of preparation of athletes in adaptive sports. Thus, there is an important scientific and practical task of improving the structure and content of training programmes for athletes with disabilities in sport at the initial stage of training.

The goal of research is to substantiate the efficiency of the training programme, analyzing indicators of physical preparation of powerlifters with musculoskeletal lesion at the initial stage of training..

Material and methods of research. Participants: 28 athletes from the initial stage training group (first year of study) participated in the examination, including 6 athletes with cerebral palsy, 6 sportsmen with spinal injury and spinal cord injury, 8 athletes with amputations and 8 athletes with other musculoskeletal lesion. The average age of the subjects was 24.50 ± 8.31 years. All subjects had not engaged in sports sections before the experiment. Due to impossibility of forming equivalent control and experimental groups because of the large number of diseases and their courses, the experiment was of an absolute nature and provided for comparison of powerlifters' indicators before and after the experiment.

Organization of research. In order to determine the level of physical strength of powerlifters with damaged musculoskeletal system, determination of indicators of development of the basic physical qualities of these powerlifters by means of tests was carried out (table 1). The selection of tests was taking into account nosological peculiarities, features of athletes' motor activity and technical simplicity in the training process. Testing of physical fitness of athletes with osteo-muscular disorders was conducted before and after the experiment. To avoid the influence of external factors on the indicators of athletes' physical fitness, testing before and after the experiment was held at the same time. Before testing, athletes fulfilled a complex of combined developing exercises.

Table 1

A list of tests for determining physical fitness in powerlifters with osteo-muscular disorders

№ п/п	Name of the test	Physical quality
1.	Manual-muscle testing using dynamometer, kGs	Strength
2.	30-meters race (with a wheelchair / without a wheelchair), sec	Speed
3.	12-minute Cooper's test on a manual exercise bike, m	Stamina
4.	Shift with a broomstick from the position the broomstick with the grip of two hands from the top forward and down, cm	Agile
5.	Ball throwing from the sitting position to the target, the number of hits	Coordinating qualities

The process of defining the strength development level of powerlifters, who have their musculoskeletal system damaged, was based on the results of manual muscle testing, which was carried out using the dynamometer Microfet 2. The choice of test positions was done in accordance with the International Standards for the Classification of Spinal Cord Injury of American Spinal Injury Association [9]. The selection of tests and determination of their optimal number was done taking into account the nosological features and the level of the preserved locomotor capabilities of the athletes. Considering the level of the preserved locomotor capabilities of the athletes, who have taken part in the research, test positions for the assessment of the strength of the deltoid muscle, biceps, triceps, pectoralis and torso extension muscles were chosen.

The process of defining the level of the agility of the athletes, who have their musculoskeletal system damaged, was based on the results of 30-meter race test. Depending on the preserved locomotor capabilities, athletes took the test in a wheelchair or without it from the position of an elongated start. The 30-meter race test was carried out on treadmills of stadiums. Casio stopwatch, with an accuracy of 0.01 seconds, was used to track the results.

The level of endurance development was determined on the basis of the 12-minute Cooper test on the Matrix KRANKcycle Hand Exercise Bike. Wheelchair athletes took this test in their wheelchairs, which were fixed on special platforms. In case of necessity, the athletes were also fixed by means of belts to keep the torso still. In the course of the exercise, the starting position of the athletes included sitting and keeping their hands on the pedals. On the trainer's command athletes began to pedal for 12 minutes.

Examining the flexibility was carried out on the basis of the test of rotation with a broomstick from the starting sitting position on the chair, grabbing broomstick with two hands from top to bottom. Before performing the test, athletes with damaged musculoskeletal system must be fixed to the chair with the use of

special straps. A special marking on the broomstick was used to determine the distance between the thumbs of the left and right hands of the athletes.

Ball throwing at the target was carried out from the sitting position on the chair, holding the ball with two hands in front of you. There were used a 57-gramme tennis ball for throwing and a 1x1 metres target, which was placed on a wall at an altitude of 2 metres from the floor. The distance between the chair and the wall was 6 metres. At the team's coach command, the athlete did a pre-flight behind his head and threw a shot forward trying to hit the target. Athletes had to make five throws.

Statistical analysis. The obtained results were analyzed using the IBM SPSS Statistics 20 software. The criterion of Shapiro-Wilka was used to determine the normality of distribution in indicators of physical training. The Student's criterion was used in cases of a normal distribution in order to determine the authenticity of the differences in the indicators of athletes' physical training before and after the experiment. In the absence of normal distribution, the Wilcoxon criterion was used to estimate the value of statistical differences before and after the experiment.

Research results. The participants were engaged in the training programme with the norm of the weekly training routine that equals 6 hours, which corresponded to the first year of training in the initial training groups of powerlifting. The quantitative characteristics for the participants of the experiment at the initial training stage was 312 hours / year (table 2).

Table 2

General distribution of programme material for powerlifters, who have their musculoskeletal system damaged at the initial stage training

No	Section of program material	Number of hours
1.	Academic training	29
2.	Acquisition of the skills self-mobility and physical self-maintenance	3
3.	Physical training	115
4.	Technical training	88
5.	Mental training	48
6.	Competitive activities	2
7.	Control	4
8.	Recreation measures	22
Total:		312

The structure of the training programme for athletes is described in detail in our previous studies [11]. The theoretical part of the training programme for sportsmen, who have their musculoskeletal system damaged, in the initial training groups provided for the solving the problems of theoretical and mental training. The practical component of the training program for persons, who have their musculoskeletal system damaged, provided the implementation of the tasks of technical training, physical training, control, competitive activities, restoration measures, Acquisition of the skills self-mobility and physical self-maintenance.

Testing was conducted before and after the experiment in order to determine the degree of influence of the training program at the initial training stage on the physical preparation of powerlifters, who have their musculoskeletal system damaged (Table 3).

Analysis of the results of determining the powerlifters' physical fitness level, as a result of training in initial stage training groups, has shown that there was a significant increase in the indexes for all tests in all test subjects. Indicators for 30-meters race test, 12-minute Cooper's test on a manual exercise bike, shift with a broomstick from the position the broomstick with the grip of two hands from the top forward and down

from the top forward and down, ball throwing from the sitting position to the target and manual muscle testing for all test positions before and after the experiment, differ with the reliability level p <0.01.

Table 3

Physical preparation indices of powerlifters with musculoskeletal lesion before and after the experiment

Tests	Before experiment	After experiment	%	*p*
	$\bar{x} \pm SD$	$\bar{x} \pm SD$		
30-meter race test (with a wheelchair / without a wheelchair), s	14.00±1.41	12.78±1.16	8.70	< 0.01
12-minute Cooper's test on a manual exercise bike, m	3222.29±1281.76	3884.86±1199.57	20.56	< 0.01
Shift with a broomstick from the position the broomstick with the grip of two hands from the top forward and down from the top forward and down, cm	100.75±7.45	86.64±6.24	14.00	< 0.01
Ball throwing from the sitting position to the target, the number of hits	2.54±1.07	3.14±0.89	23.94	< 0.01
Manual-muscle testing				
Shoulder flexion, right arm, kgf	12.00±2.78	13.91±2.39	15.96	< 0.01
Shoulder abduction, right arm, kgf	12.03±2.77	13.99±2.25	16.36	< 0.01
Shoulder extension, right arm, kgf	11.56±2.81	13.63±2.43	17.82	< 0.01
Bending forearm, right arm , kgf	12.31±2.79	14.22±2.52	15.52	< 0.01
Forearm extension, right arm, kgf	10.70±2.87	12.46±2.60	16.42	< 0.01
Horizontal shoulder alignment, right arm kgf	10.41±3.29	12.27±2.92	17.90	< 0.01
Horizontal shoulder abduction, right arm , kgf	9.96±3.11	11.93±2.53	19.80	< 0.01
Shoulder flexion, left arm, kgf	11.33±2.81	13.52±2.45	19.29	< 0.01
Shoulder abduction, left arm, kgf	11.24±2.76	13.42±2.48	19.38	< 0.01
Shoulder extension, left arm, kgf	10.78±2.70	13.15±2.62	22.03	< 0.01
Bending forearm, left arm, kgf	11.74±2.76	13.98±2.57	19.11	< 0.01
Forearm extension, left arm, kgf	10.33±2.58	12.37±2.65	19.79	< 0.01
Horizontal shoulder alignment, left arm, kgf	9.92±2.98	12.00±2.76	20.99	< 0.01
Horizontal shoulder abduction, left arm, kgf	9.39±3.11	11.71±2.53	24.81	< 0.01

* $\bar{x}$ –average value, SD – quadratic deviation, % –percentage increase; p – authenticity.

Discussion. The highest increase in physical fitness indicators as a result of the experiment has been detected by tests of ball throwing from the sitting position to the target and manual muscle testing, indicating that powerlifting exercises have a significant impact on the level of development of coordination qualities and strength. The increase in the indicators of the test of ball throwing from the sitting position to the target, which characterizes the level of development of coordination qualities, was 23.94%, and indicators of the

results of manual muscle testing - from 11.71% to 14.22%.Indicators of the power growth capabilities by the test manual muscle testing of the right and left hands are different. Indicators of the power growth capabilities of the right hand in powerlifters are somewhat higher, which may be explained by a predominantly larger number of right-handed test subjects. At the same time, the growth indices for all tests significantly differ from the initial level of development of physical qualities ($p < 0.01$), which indicates the complex impact of the training programme at the stage of initial training on the physical preparation of powerlifters with damaged musculoskeletal system.

Numerous studies in the field of medicine show that the level of saved motor ability is the most significant factor influencing physical fitness in athletes with disabilities [3; 7; 12]. The key to increasing the physical fitness of athletes with damage to the musculoskeletal system is to restore lost functions, to increase the level of development of physical qualities and to create mechanisms that allow adapting the existing level of saved motor capabilities to the environment [3; 8; 10]. The results obtained during the study confirm the assertion that the classes of adaptive sports positively affect the physical fitness of people with disabilities. A statistically significant increase in the indicators of physical fitness can indicate the possibility of reducing the impact of lost functions of the athletes with disabilities using powerlifting and the effectiveness of the programme of training powerlifters at the initial stage training.

Conclusions. The testing results before and after the experiment proved the positive dynamics of the physical preparation of powerlifters who have damaged the musculoskeletal system at the initial stage of training. Comparison of indicators of physical fitness testing of athletes with musculoskeletal lesions has shown significant differences ($p < 0.01$) in these indices before and after the experiment. As a consequence, the highest growth rates have been identified at the development level of coordination qualities and strength.

As a result, the positive influence of the powerlifters' training programme on the physical training of athletes with damaged musculoskeletal system has been confirmed at the initial stage training stage. This indicates the possibility of improving athletes' level of social integration, restoration of lost functions, increase of the level of physical qualities development and motor activity with the help of powerlifting system in powerlifters with musculoskeletal lesions.

Prospects for further research are related to the development of training programs at various stages of multi-year training for athletes of different nosological groups in strength sports.

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