

# Special physical training in frame running sport disciplines of persons with lesions of the musculoskeletal system

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## Abstract

**Objective of the study** was to identify the main directions and content of special physical training in the disciplines of frame-running sports of people with musculoskeletal disorders.

**Methods and structure of the study.** At the first stage, the leading athletes of the world, specializing in the studied disciplines, took part in the ascertaining experiment. This experiment was carried out to identify the main muscle groups involved in a competitive exercise, and also identified special physical qualities, the development of which is a paramount task in the physical preparation of a runner on a frame running. At the second stage of the ascertaining experiment, the leading athletes of Russia, specializing in the disciplines under study, took part in order to determine pedagogical tests that can comprehensively assess the level of development of special physical qualities of an athlete specializing in frame running disciplines.

**Results and conclusions.** It has been established that at a competitive distance of 100 m in frame running disciplines, special physical qualities are speed-strength qualities, explosive strength, speed endurance, strength endurance. The main muscle groups that need to be developed during special physical training are the hip flexors, lower leg flexors, knee extensors, and hip extensors.

As a result of the studies carried out in the course of the ascertaining experiment, a set of pedagogical tests was determined, with the systemic use of which it is possible to identify the dynamics of the special physical fitness of athletes in the studied disciplines.

**Keywords:** *Paralympic athletics, frame running, special physical training, pedagogical control.*

**Introduction.** The frame running disciplines until 2022 were called “race running” (frame running). Their development began in the 90s of the twentieth century, when a fundamentally new movement device was invented for people with significant spastic manifestations in the muscles of the legs, arms and / or body, which realized their desire to move not in wheelchairs, but with the help of their legs [ one]. Frame rann (race rann) is a three-wheeled balance bike with a bicycle saddle and chest support. Over time, competitions began to be held on the run - 100m running, first under the auspices of CRISPA, and since 2018 already under the auspices of the IPC - four disciplines were included in the medal program

of the European Championships in Paralympic Athletics-2018. Then the medals in these disciplines were played at the World Championships 2019, at the European Championships 2021. Despite the popularity and international recognition of these disciplines as an integral part of Paralympic athletics in our country, the recognition process was delayed due to bureaucratic barriers. But despite this, in order to create effective sports competition by Russian athletes at the next Summer Paralympic Games, it is already now necessary to create a scientifically based training methodology.

**Objective of the study** was to identify the main directions and content of special physical training in



the disciplines of frame-running sports of people with musculoskeletal disorders.

Methods and structure of the study. At the first stage, a stating pedagogical experiment ( $n=8$ ) was performed, during which, using biomechanical analysis, the involved main muscle groups were identified. The biomechanical analysis was performed on the basis of a video recording made at the 2020 and 2021 Russian Championships in Athletics for Persons with MSD impairment, as well as on the basis of a video recording made by the organizers of the World Championships in Paralympic Athletics 2019, which is in the public domain. During the biomechanical analysis in these disciplines, the functional features of the athlete associated with his defeat were taken into account - the method of accessible locomotions was used (according to I.N. Voroshin) [2].

At the second stage of the research, in order to determine the complex of pedagogical tests capable of assessing the level of development of special physical qualities of athletes specializing in the studied disciplines, from 2020 to 2021, a stating pedagogical experiment was carried out under the conditions of a natural training process. The personal trainers of the athletes of the experimental group ( $n=10$ ) were interviewed. Based on the data obtained and further analysis, 11 candidate tests were selected, after which a correlation analysis was carried out on the level of dependence between the results of pedagogical tests and the results of a competitive exercise - running a frame early at a distance of 100 meters. When choosing tests for the assessment complex, we took into account only those that have a high and very high degree of correlation in terms of the value of the Pearson correlation coefficient ( $r \geq 0.7$ ) [3] with the result of running one frame early at a distance of 100 meters.

**Results of the study** and their discussion. Running on a frame was previously carried out with the help of cyclic movements of the legs, while athletes have a significant spread in the angular characteristics of locomotion. The greatest difference was found in the flexion angles in the knee and ankle joints, which, in addition to the amplitude of locomotion, is also reflected in the angular velocities. It was revealed that the greater the value of spasticity in the muscles of the back of the thigh, the lower the speed of flexion in the knee joint, while the athlete performs a significant tilt of the body forward - from  $31^\circ$  to  $55^\circ$ , which reduces the load on this muscle group.

For comparison, athletes with ataxia, athetosis,

are able to use the muscles of the back of the thigh more effectively, for this their landing is more vertical - tilting the body forward from  $15^\circ$  to  $30^\circ$ , while the length of steps is 15-17% longer. At the same time, such athletes, on average, have a reduced frequency of performing movements - 15-22% when compared with athletes who have spastic manifestations in the muscles of the legs.

Almost all athletes of the experimental group perform an active top-down-back foot placement, however, in some athletes, the effectiveness of this locomotion is reduced due to the presence of spasticity with constant critical pronation of the forefoot. The average length of steps in distance running among the athletes of the experimental group has significant variations - from 156 to 218 cm, which is explained by both anthropometric and nosological features. During the distance running, the athletes of the experimental group performed from 48 to 74 running steps. Running on frame running for a distance of 100 meters is performed with maximum intensity. Leading male athletes run a distance of 100 meters in 16-17 seconds (data for 2019), while performing from 48 to 65 steps. Women run this distance in 18-20 seconds (data for 2019), while performing from 61 to 74 steps.

Based on the foregoing, we can conclude that the main sources of energy supply during competitive activities in these sports disciplines will be creatine phosphate and anoxic (first) part of glycolysis (glycolytic power). Therefore, speed-strength qualities, explosive strength, speed endurance, strength endurance should be attributed to special physical qualities in frame running disciplines.

When developing a set of pedagogical tests capable of assessing the level of development of special physical qualities of athletes specializing in frame-running disciplines of sports for persons with musculoskeletal disorders, we proceeded from the fact that the number of tests should be minimal, but at the same time, the necessary complexity of assessing the development of special physical qualities should be maintained. . We also proceeded from the fact that the selected tests should be relatively safe when performed by athletes with certain musculoskeletal disorders and available for use as part of the training process [3].

When selecting pedagogical candidate tests, we were also guided by the fact that each test must meet four or more criteria of similarity with a competitive exercise - a similar structure for performing basic locomotion



tions; identical muscle groups involved in the exercise; similar amplitude and identical direction of movement; similar duration of effort; similar speeds of the main locomotions; similar modes of muscle work [3].

One athlete in the course of the ascertaining experiment performed several sections of tests in basic, pre-competitive, directly pre-competitive, competitive mesocycles of training. Competitive exercise was performed in conditions close to competitive ones.

An analysis of the correlation between the results of pedagogical tests and sports results in the disciplines of frame running sports of people with musculoskeletal disorders showed that in order to assess the special physical fitness of athletes specializing in these disciplines, it is advisable to use the following tests in a complex way: running a frame early 50 meters from the start ( $n=64$ ,  $r=0.73$ ); running a frame early 80 meters from the start ( $n=53$ ,  $r=0.92$ ); semi-squat in the simulator "Smith Machine", the number of times in 15 seconds with weight: men - 50 kg, women - 40 kg ( $n=54$ ,  $r=0.86$ ); "knee kicking", the number of times in 10 s ( $n=46$ ,  $r=0.76$ ).

It should be noted that the tests described above are able to be performed by athletes specializing in the frame-running disciplines of the sport of people with musculoskeletal disorders, the functionality of which allows them to complete a full running cycle on a frame early with both legs.

**Conclusions.** At the competitive distance of 100 meters in the disciplines of the frame running sport of persons with musculoskeletal disorders, special physical qualities will be speed-strength qualities, speed endurance, strength endurance, explosive strength.

The main muscle groups that need to be developed during special physical training will be the hip flexors, calf flexors, knee extensors, and hip extensors.

We have determined a set of pedagogical tests, with the systemic use of which it is possible to reveal the dynamics of the special physical fitness of athletes in the studied disciplines: running a frame early at 50 m from the start; running on a frame early at 80 m from the start; half-squat in the Smith Machine simulator, the number of times in 15 seconds with weight: men - 50 kg, women - 40 kg; "knee kick", the number of times in 10 s.

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