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PHYSICAL FITNESS INDICATORS OF MINERS AGE 35-39

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Abstract. This study is aimed at a comprehensive assessment of the physical fitness of miners aged 35-39 and the identification of the structural features of physical qualities formed under the influence of professional activity and age factors. 30 miners participated in the study, and their speed, endurance, strength, strength-endurance, coordination and flexibility were analyzed. The results showed that the speed indicators (30 m - 6.9±0.80 s, 60 m - 12.3±1.36 s) and explosive power (standing long jump - 200±20.50 cm) were assessed at level III, indicating a significant decrease in these qualities. At the same time, the endurance indicator (3000 m run - 15:15±1.90) was recorded at a relatively high level (level II), indicating the preservation of aerobic capabilities. Strength and power-endurance indicators (pulling up on the horizontal bar – 5±0.48 times, handstand push-ups – 15±1.90 times, lifting a 16 kg stone – 19±2.10 times) were recorded at an average level, while flexibility (forward bending – +3±0.30 cm) and coordination indicators were assessed at a low level. The results of statistical analysis (Cohen's d = 7.89–10.42, ηp^2 = 0.94–0.96) showed that the identified differences had a high level of effect. The results confirm the presence of selective formation of physical fitness in miners, that is, while endurance is relatively preserved, speed, explosive strength and coordination qualities decrease. The results obtained justify the need to apply an integrated approach to optimizing the physical fitness of miners.

Keywords: miners, physical fitness, selective adaptation, professional load, endurance, biomechanics.

The mining industry is considered one of the most complex production sectors that imposes significant physical and functional loads on the human body. This activity is characterized by factors such as high temperature, dusty environment, vibration, limited working space, and lifting heavy loads, which directly affect the health and physical development of workers [1,2]. Scientific sources note the widespread occurrence of musculoskeletal diseases, injuries and functional disorders among miners [3-5].

Physical loads that occur during professional activity form adaptation mechanisms in the body. Such adaptation processes are often selective and lead to the insufficient development of some physical qualities due to the development of others [6,7]. Long-term repetitive and monotonous loads increase endurance and strength, but they limit the development of such qualities as speed, coordination, and explosive power [8-10]. The labor activity of miners is often characterized by a combination of static and dynamic loads, repetitive movements, and awkward body positions. Such conditions cause excessive pressure on the spine and lumbar region, increasing the risk of musculoskeletal injuries [8-9, 11]. At the same time, heavy physical activity causes structural and functional changes in the muscular system, which in some cases increases work capacity, and in other cases forms disproportionate development [12-13].

Modern studies in the field of ergonomics and labor physiology show that physical loads in the work process and their characteristics directly affect the level of physical fitness [14-15]. Fatigue, vibration exposure, heat stress, and high energy expenditure observed in miners are considered the main factors determining their overall functional state [16-18].

The relationship between physical activity and health is manifested as a complex system, and in some situations, high physical activity leads to positive adaptation results, while in other cases, overload leads to negative functional changes [19]. Therefore, a comprehensive study of the level of physical fitness and its components formed as a result of professional activity is of great scientific and practical importance [20]. The period of 35-39 years is one of the important stages of labor activity, during which the functional capabilities of the organism show a tendency to gradually decrease. In particular, under the influence of long-term professional loads, there is a decrease in speed, coordination and explosive strength indicators, while endurance remains relatively stable. An analysis of existing scientific and methodological sources shows that the level of physical fitness of miners aged 35-39 has not been studied systematically and comprehensively enough. In particular, the issues of the interrelation of physical qualities and their structural organization have not been sufficiently covered.

Therefore, a comprehensive analysis of the physical fitness of miners aged 35-39 is considered an urgent scientific problem. This study is aimed at identifying the structural features of physical qualities formed under the influence of professional activity and age factors, and is of theoretical and practical importance.

Research objective: To conduct a systematic and comprehensive analysis of the physical fitness of miners aged 35-39 based on scientific and methodological literature and to identify the structural features of physical qualities formed under the influence of professional activity.

Research objectives: To conduct a comprehensive analysis of the physical fitness of miners aged 35-39 based on scientific and methodological literature; to identify the selective formation of physical qualities under the influence of professional activity and imbalances in their relationship.

Research object: Physical fitness of workers aged 35-39 operating at the Kochbulak mine of the Angren Mining Department of the Almalyk Mining and Metallurgical Combine.

Subject of research: The level of development of physical qualities (strength, speed, endurance, coordination and flexibility) formed under the influence of professional activity in miners aged 35-39 years and the structural features of their relationship.

Research results.

Physical fitness indicators of miners aged 35-39 years (n=30)

№	Test type	M ± SD	95% CI	Grade level	Cohen's d	ηp²
1	30 m run (s)	6.9±0.80	6.60 – 7.20	Level III	8.63	0.95
2	60 m run (s)	12.3±1.36	11.79 – 12.81	Level III	9.04	0.95
3	3000 m run (min, s)	15:15±1.90	14:32 – 15:58	Level II	8.03	0.94
4	Pull-up on the horizontal bar (times)	5±0.48	4.82 – 5.18	Level III	10.42	0.96

5	Throwing a 700 g sports equipment (m)	28±3.10	26.84 – 29.16	Level III	9.03	0.95
6	Cut-out with bent arms while leaning on the ground (times)	15±1.90	14.29 – 15.71	Level III	7.89	0.94
7	Bending forward from a gymnastic bench (cm)	+3±0.30	2.89 – 3.11	Level II	10.00	0.96
8	Pull-up on the 90 cm low horizontal bar (times)	11±1.25	10.53 – 11.47	Level III	8.80	0.95
9	Lifting a 16 kg stone (times)	19±2.10	18.22 – 19.78	Level III	9.05	0.95
10	Raising the body 90° in 1 minute (times)	26±2.60	25.03 – 26.97	Level III	10.00	0.96
11	Long jump from a standing position (cm)	200±20.50	192.35 – 207.65	Level III	9.76	0.96

Analysis of physical fitness indicators of miners aged 35-39 years shows a more pronounced disproportionate and selective formation of physical qualities in this age group. According to the results obtained, most of all test indicators correspond to level III, indicating a tendency to a decrease in the overall level of physical fitness. At the same time, some indicators (3000 m run and flexibility) were recorded at a relatively higher (level II) level. The results of the 30 m and 60 m run in terms of speed indicators were 6.9±0.80 s and 12.3±1.36 s, respectively, and the location of the 95% confidence interval in a narrow range (6.60-7.20 s and 11.79-12.81 s) indicates that the results within the group are stable. However, the assessment of these indicators at level III indicates a significant decrease in the quality of speed. This is explained by the decrease in neuromuscular speed with age and the low share of fast movements in professional activities. The result of the 3000 m run (15:15±1.90), assessed as an indicator of endurance, was recorded at level II, indicating a relative preservation of aerobic capacity. This result is associated with the adaptation of miners to long-term and repeated physical loads. It is characterized by a significant decrease in strength and strength-endurance indicators. In particular, the results of the pull-up on the horizontal bar (5±0.48 times), hand curls (15±1.90 times) and 16 kg stone lifting (19±2.10 times) were assessed at level III, indicating a decrease in muscle strength and endurance to repeated loads. This process is explained by an age-related decrease in muscle mass and functional capabilities. The result of the throw (28±3.10 m), which represents upper body strength, was also recorded at level III, confirming the general downward trend in strength indicators. Although the flexibility indicator (forward bend – +3±0.30 cm) was assessed at level II, its value was low, indicating limited joint mobility. This is

associated with long-term static loads and a decrease in muscle elasticity. The results of the pull-ups on the lower horizontal bar (11±1.25 times) and the deadlift (26±2.60 times), which represent coordination and functional control, were recorded at level III, indicating a decrease in the ability to control complex movements. The result of the standing long jump (200±20.50 cm), which represents explosive strength, was also at level III, indicating a significant decrease in the ability of the lower body muscles to produce rapid force.

The results of the statistical analysis show a high level of reliability. In particular, the values of Cohen's d (7.89-10.42) and ηp^2 (0.94-0.96) indicate a large effect size for all indicators, confirming that the identified changes are systematic and regular in nature. When summarizing the results, it can be seen that physical fitness in miners aged 35-39 years was formed in a narrower functional direction, endurance was relatively preserved, but speed, explosive power, coordination and general muscle strength significantly decreased. This is explained by the long-term, monotonous and submaximal nature of professional activity, as well as age-related functional regression.

Conclusion. The results of the study showed that the physical fitness of miners aged 35-39 years did not develop evenly, but had a selective formation under the influence of professional activity and age factors. As a result of long-term and repeated physical loads, endurance was relatively preserved, while speed, explosive power, coordination and general muscle strength indicators decreased. The assessment of speed (30 m – 6.9±0.80 s; 60 m – 12.3±1.36 s) and explosive power (long jump – 200±20.50 cm) indicators at level III indicates insufficient development of speed-strength qualities in this age group. At the same time, the preservation of endurance indicators (3000 m – 15:15±1.90) at a relatively high level is explained as the result of adaptive mechanisms associated with long-term loads of professional activity. The decrease in strength and power-endurance indicators (pulling up on the horizontal bar – 5±0.48 times; lifting a 16 kg stone – 19±2.10 times) is associated with the one-sided effect of professional workload along with age-related regression of muscle function. The low level of flexibility and coordination indicators indicates limited joint mobility and the ability to control complex movements. The results of statistical analysis (Cohen's d = 7.89-10.42; ηp^2 = 0.94-0.96) show that the identified differences have a high level of effect, confirming that changes in physical training are not random, but systematic in nature. In general, physical training in miners aged 35-39 is narrowly focused and selective in nature, endurance is relatively preserved, but there is a decrease in speed, explosive power and coordination qualities. This situation is explained by the long-term, monotonous and submaximal nature of professional activity, as well as age-related functional decline. In practice, it is necessary to introduce special training programs aimed at optimizing the physical fitness of miners, aimed at developing agility, explosive strength and coordination. This will increase work efficiency, reduce the risk of injury and improve overall functional status.

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