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DETERMINATION OF THE REQUIREMENTS FOR THE COMPLEX OF PHYSICAL PREPARATION DURING THE TRAINING PROCESS OF ATHLETES IN MILITARY AVIATION PENTATHLON

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Purpose: to analyze the initial indicators characterizing the level of development of physiometric parameters among first-year cadets of a higher educational institution, who are the applicants for the national team in international military aviation pentathlon.

Material and methods: analysis of literary sources, testing, statistical analysis. The reseach was involved 48 first-year cadets of the Kharkiv National University of the Air Force named after Ivan Kozhedub (men) aged 17-18, of whom 38 Candidates in Master of Sports and 10 Masters of Sports.

Results: taking into account the initial data on the distribution of male cadets of the first course of KhNUPS by types of sports, the indicators of the proportionality coefficient and the strength of the physique were determined in order to prevent the influence of any random parameters on the final results of the reseach. To solve the goals and objectives of the research, we have selected and systematized tests to assess

the functional state of the cardiovascular system. The data on the indicator of physical performance according to the PWC170 test were determined and analyzed. The analysis of the results in the form of a verbal description, tables, an analytical description of the obtained patterns is carried out.

Conclusions: it was determined that the training of athletes in military aviation pentathlon in the future requires the development of a universal complex of physical exercises, the implementation of which does not require special equipment, it is understandable, and meets the requirements of training. The importance of assessing the functional state of the cardiovascular system in the process of selecting athletes for the national team in international military aviation pentathlon and for determining the algorithm for further training has been determined. It has been established that the training for a long time in one or another (game, cyclic, complex coordination, martial arts) kind of sport before being included in the national team in the military aviation pentathlon makes it necessary to develop a universal complex of physical training and the method of circular training (crossfit) is such that most consistent with the requirements of a universal complex of physical exercises to prepare for competitions in military aviation pentathlon competitions.

Keywords: military aviation pentathlon, physiometric parameters, functional state, circuit training, crossfit.

Introduction

It is known that the International Military Sports Council (IMSC) or the Conseil International du Sport Militaire (CISM) is one of the largest interdisciplinary sports organizations in the world, which is under the influence of the US Army and receives support from its representatives in Europe and has in its ranks 140 countries. Completed in 1948 in Nice [1, 3]. Its main purpose is to organize and support sports competitions between members of the armed forces, to promote the development of military-applied sports and to expand ties between armies [2]. It is also known that in order to exchange experiences and scientifically study issues related to sports training, in 1957 the Academy of CISM was established with sections of physical

training and sports, sports medicine and sports training [2, 3].

The International Council of Military and Applied Sports annually organize a number of major competitions in certain sports, which involve both ordinary servicemen and top athletes from around the world [2, 3].

One of the most popular and at the same time complex sports is the competition with MAP (military aviation pentathlon), which is held under the auspices of CISM and consists of air and sports competitions [3].

To use a list of individual exercises for training or to search for an existing set of exercises that already make up a certain system, it is necessary to understand the features of each of the components of the sports competition in MAP tournaments with the definition of generalizing qualities that affect the result as a whole, considering to obtain a high result features of the functional state of the leading systems of the body. The relevance of monitoring the latter is an important component of the management of the training process in the application of loads in preparation for competitions.

It is known that the final result of the competition is influenced by a lot of initial data. Even with the successful distribution of athletes who are planned to be included in the team of military aviation pentathlon by somatoscopic and somatometric indicators, it is important to determine the physiometric parameters of each of them. Since the results of military aviation pentathlon are determined in individual and team competitions, depend on the threshold parameters of speed and strength of the athlete, it is important to achieve maximum physiological capabilities of the body on the day of competition, especially during the final tournament - overcoming the obstacle course and orienteering.

The purpose of the study is to analyze the initial indicators that characterize the level of development of physiometric parameters in first-year cadets of higher education, who are candidates for the national team in international military aviation pentathlon.

Material and Methods of research

In order to avoid the influence of any random parameters on the final results and to determine the maximum stratification of the study participants - cadets-candidates for the national team in international military aviation pentathlon, we determined:

- coefficient of proportionality (CP) = (D1 - D2) × 100%, where D1 - standing height, D2 - sitting height (CP 97-92% - normal body proportion);

- body strength index (according to Pinier) (BS) = C - (M + O), where C is height, M is body weight, O is chest circumference on exhalation (BS is less than 10 - strong physique), 10-20 - physique is good, 21-25 - average physique, 26-35 - physique is weak, 36 and more - physique is very weak).

Testing was conducted during the first week of training (i.e. 01.09.2018 - 08.09.2018).

To solve the purpose and objectives of research, we have selected and systematized tests to assess the functional state of the cardiovascular system:

- determination of blood pressure response to exercise: normotonic - increase or stability of systolic blood pressure, decrease in diastolic blood pressure, hypotonic - decrease in systolic and diastolic blood pressure, hypertonic - increase in systolic and diastolic blood pressure, diastonic - decrease in systolic blood pressure, increase in diastolic blood pressure 4, 5];

- determination of the reserve of the cardiovascular system (CVS) (RC - reserve capabilities) according to Carvonen's formula: RC = 220 - B - heart rate, where 220 - maximum allowable heart rate (HR), B - age, heart rate - heart rate in calm [5,6]

- determination of the Rufier index (IR) = (6 × (P1 + P2 + P3) -200/10 - reactive properties of the CVS: measured the heart rate of the subjects at rest for 10 seconds (P1), then measured the heart rate (P2) in the first 10 seconds after 20 deep squats in 30 seconds with arms outstretched (sitting position), heart rate was measured for the third time in the last 10 seconds (P3) of the first minute of the recovery period. The results of calculations to assess the level of performance /

functional state of heart rate were rated as low> 15, less than average - 9-14, average - 7-9, above average - 3-6, high <3 [4,5];

- determination of physical performance by test PWC170. Test PWC170 is recommended by the WHO to assess both general and special performance in athletes, reproducing aerobic performance. The study was performed on a bicycle ergometer by performing two loads of moderate power without rest. The pedaling frequency was constant in the range of 60-80 revolutions, the duration of each load from 3 to 6 minutes. The intensity of the first load was 1 w / kg, the second - 2 w / kg. At the end of each exercise for the last 30 seconds, heart rate was determined. The calculations were performed according to the formula of Karpman V.L. [7,8]: PWC170 = P1 + (P2 - P1) × 170 - heart rate1 / heart rate2 - heart rate1 (W), where P1 and P2 - power 1 and 2 load, heart rate1 and heart rate2 - pulse at the end of 1 and 2 loads. Used a bicycle ergometer Spirit CR800, Taiwan.

To determine the initial values of the above indicators, we used the method of circular training (crossfit) - a set of exercises for strength and endurance. We chose this method precisely because each training session using this technique necessarily includes exercises that develop endurance, flexibility, strength and coordination [9,10]. The more rounds of a set of exercises per unit time an athlete does, the higher his functionality.

A number of exercises were selected for testing, consisting of sprinting for 400 m, L-pull-up 10 times, burpee 20 times, jumping rope for 30 seconds, flexion and extension of the arms lying on the floor 20 times, jumping on the stand 10 times. Count the number of complete circles under the conditions of high-quality exercises for 30 minutes.

Methods of parametric statistics were used to process the obtained data (Glanz S., 1999). Statistical processing of data entered in Excel spreadsheets was performed. Quantitative characteristics of the main functional indicators were processed statistically, namely, determined the arithmetic mean, the error of the mean. The significance of the obtained data was checked using Student's t-test (for n <100) at a given level of reliability p = 0.95. To be able to use the Student's t test, the Fischer-

Snedekor test was calculated - the ratio of the larger variance to the smaller. All mathematical operations and graphical constructions were performed using the software packages "Microsoft Office XP": "Microsoft XP Home" and "Microsoft Excel XP" on a personal computer (license numbers: 00049 153 409 442 and 74017 640 0000106 57664, respectively).

Results of the research

Given the initial data on the distribution of male cadets of the first year of KhNUPS, it was important to determine the proportionality and strength of their physique in order to prevent the impact of any random parameters on the final results (Table 1).

Table 1

The results of the comparison of the coefficient of proportionality and strength of the physique of first-year cadets depending on the sport, $\bar{x}$ + m

№	Test	Group I (n_1=12)	Group II (n_2=14)	Group III (n_3=10)	Group IV (n_4=12)
1	CP, %	93,6±1,4	95,4±1,4	95,6±1,2	94,1±1,1
	CP: t, p	$t_{1,2}$=1,52 $p_{1,2}$>0,05; $t_{1,3}$=1,44 $p_{1,3}$>0,05; $t_{1,4}$=1,63 $p_{1,4}$>0,05; $t_{2,3}$=1,36 $p_{2,3}$>0,05; $t_{2,4}$=1,46 $p_{2,4}$>0,05; $t_{3,4}$=0,54 $p_{3,4}$>0,05			
2	BS, conv. units	14,8±1,7	16,1±1,6	10,7±1,4	9,4±1,2
	BS: t, p	$t_{1,2}$=1,37 ($p_{1,2}$>0,05); **$t_{1,3}$=3,25 $p_{1,3}$<0,05; $t_{1,4}$=3,21 $p_{1,4}$<0,01**; **$t_{2,3}$=3,17 $p_{2,3}$<0,01; $t_{2,4}$=2,72 ($p_{2,4}$<0,05);** $t_{3,4}$=0,61 ($p_{3,4}$>0,05)			

Groups: Group I - game sports; Group II - cyclic sports; Group III - complex coordination sports; Group IV - martial arts.

Tests: KP - Coefficient of proportionality; BS - body strength index.

When analyzing the data in table 1, during the evaluation of the initial indicators of the coefficient of proportionality, no statistically significant differences were identified ($p < 0.05$). However, it should be noted that, despite the fact that all cadets without exception, this figure was in the range of reference values - 92 - 97% - the proportion of the body is normal, in the studied groups II and III its figures were greater, 95.4 ± 1, 4% and 95.6 ± 1.2%, respectively, than in groups I and IV - 93.6 ± 1.4% and 94.1 ± 1.1%, respectively, which characterizes the cyclical and complex coordination sports as such , which more than game and sports martial arts contribute

to the development of normal body proportions, which should be taken into account in preparation for competitions in military aviation pentathlon.

In turn, the analysis of the strength of the physique revealed significant statistical differences at the initial level among the cadets-candidates for the national team in military aviation pentathlon. Thus, in the subjects of group I, 12 cadets, who on the eve of admission to the free economic zone had sporting achievements in game sports, the strength of the physique according to Pinier was 14.8 ± 1.7, which indicated the characteristics of their good body structure, and probably ($p_{1,3}$<0,05) differed from the figures of this indicator in group III (10,7 ± 1,4) and in group IV (9,4 ± 1,2) ($p_{1,4}$<0,01), where the cadets determined the strong physique of the body.

In the stydy group II, this indicator was at the initial level of 16.1 ± 1.6, which was not statistically different from its value in group I, but probably ($p_{2,3}$<0.01) differed from the data in group III, 10.7 ± 1.4 and in group IV - 9.4 ± 1.2 ($p_{2,4}$<0.05).

Given the data obtained, it can be noted that the development of a strong physique is more conducive to martial arts and complex coordination sports. Game and cyclic sports develop a good physique, but not as strong as the previous ones, which should be taken into account when developing a training complex for athletes in military aviation pentathlon.

When passing the circles, which consist of a set of exercises on the crossfit system, an analysis of the number of circles, which were completed in a full 30 minutes (Figure 1).

Thus, the cadets, who at the time of admission to KhNUPS had sporting achievements in game sports, the average number of rounds of crossfit exercises for 30 minutes was 1.7 ± 0.2, in cyclic - 1.4 ± 0.1, in difficult -coordination - 2,0 ± 0,1, representatives of martial arts passed the offered crossfit test on the average full 1,6 ± 0,2 circles. Given the data obtained, it can be noted that the sports activity the day before, which had cadets-applicants for membership in the national team in military aviation pentathlon, emphasizes certain qualities of development of abilities, including body shape in general, which should be taken into account in the development of a training complex to achieve results in the sports competition VAP.

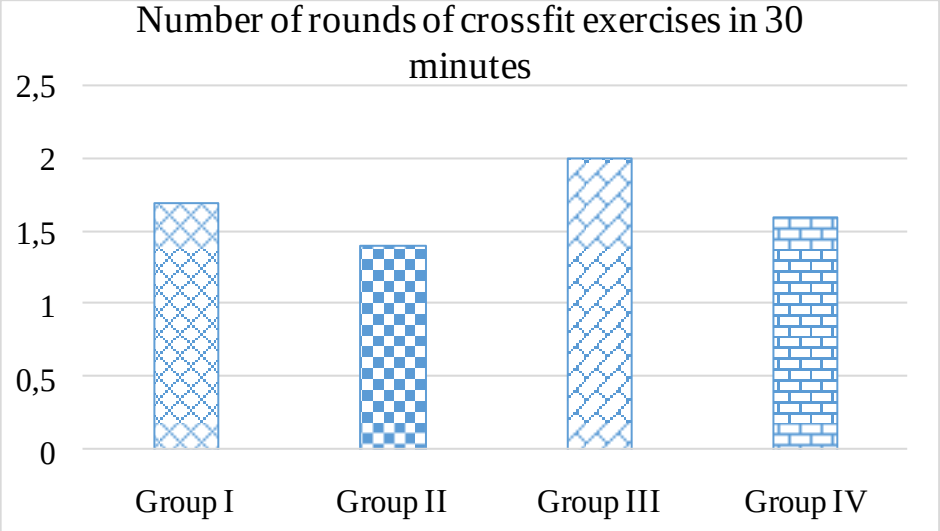

Figure 1. The number of rounds of crossfit exercises, which are fully passed by cadets, depending on the original sport for 30 minutes, where: Group I - game sports; Group II - cyclic sports; Group III - complex coordination sports; Group IV - martial arts

An important point in determining the functional state of the cadets was the measurement and statistical analysis of tests to assess the functional state of the cardiovascular system, which we conducted immediately after passing the circles of crossfit exercises (table 2).

It should be noted that in all subjects without exception in determining the body's response to exercise was recorded normotonic blood pressure response, which is a favorable factor for further intensive training. When analyzing the state of RC and IR after 30 minutes of cross-fit exercises, no statistical differences ($p < 0.05$) were recorded between the values in groups of cadets, which makes these tests not indicative in relation to the assessment of the functional state of the organism. This may be due to a sufficient level of training of cadets at the time of the test, or its diagnostic weakness in relation to the studied contingent.

When analyzing the physical performance of the test PWC170, on the contrary, were found statistically significant differences between the data in different groups of cadets.

Table 2

The results of determining the CVS reserve according to the Carvonen formula, the reactive properties of the CVS according to the Rufier index, physical performance according to the PWC170 test in first-year cadets depending on the sport, $\bar{x}$ + m

№	Test	Group I (n_1=12)	Group II (n_2=14)	Group III (n_3=10)	Group IV (n_4=12)
1	RC, ум. од.	141,4±3,9	142,6±4,2	146,8±3,1	144,2±3,9
	RC: t, p	$t_{1,2}$=1,54 $p_{1,2}$>0,05; $t_{1,3}$=1,46 $p_{1,3}$>0,05; $t_{1,4}$=1,61 $p_{1,4}$>0,05; $t_{2,3}$=1,38 $p_{2,3}$>0,05; $t_{2,4}$=1,44 $p_{2,4}$>0,05; $t_{3,4}$=0,56 $p_{3,4}$>0,05			
2	IR, conv. units	3,1±0,2	3,2±0,4	2,9±0,4	3,1±0,4
	IR: t, p	$t_{1,2}$=1,56 $p_{1,2}$>0,05; $t_{1,3}$=1,43 $p_{1,3}$>0,05; $t_{1,4}$=1,58 $p_{1,4}$>0,05; $t_{2,3}$=1,36 $p_{2,3}$>0,05; $t_{2,4}$=1,42 $p_{2,4}$>0,05; $t_{3,4}$=0,59 $p_{3,4}$>0,05			
3	PWC170, к/m.	1608,4±42,2	1674,1±29,2	1141,7±37,1	1259,4±41,6
	PWC170: t,p	$t_{1,2}$=1,53 $p_{1,2}$>0,05; **$t_{1,3}$=2,47 ($p_{1,3}$<0,05); $t_{1,4}$=2,21 ($p_{1,4}$<0,05); $t_{2,3}$=2,18 ($p_{2,3}$<0,05); $t_{2,4}$=2,3 $p_{2,4}$<0,05;** $t_{3,4}$=1,54 ($p_{3,4}$>0,05)			

Groups: Group I - game sports; Group II - cyclic sports; Group III - complex coordination sports; Group IV - martial arts.

Tests: RC - reserve capabilities of the cardiovascular system; IR - Rufier index (reactive properties of the cardiovascular system); PWC170 - physical performance.

Thus, in group I, where cadets had sports achievements in game sports, mainly basketball, volleyball, football, the rate of aerobic productivity of the body after undergoing 1.7 cross-fit range of exercises for 30 minutes was 1608.4 ± 42.2 kg / min., which probably ($p_{1,3}$<0,05) exceeded its value, 1141,7 ± 37,1 kg / min, in group III - sports achievements in complex coordination sports - after passing 2 full circles of crossfit exercises for 30 minutes and in group IV ($p_{1,4}$<0,05) - sports achievements in martial arts, 1259,4 ± 41,6 kg / min.

In turn, in group II, where the cadets at the time of the study had sporting achievements in cyclic sports, mainly cycling, triathlon, performance in areas of moderate and high power (the leading source of energy - oxidative processes) after passing 1.4 crossfit -circle of exercise for 30 minutes was a maximum of 1674.1 ± 29.2 kg / min, which probably exceeded its value in groups III ($p_{2,3}$<0.05) and IV ($p_{2,4}$<0.05), and testified in favor of the most optimal level of functioning of their cardiorespiratory system.

Conclusions / Discussion

Given the heterogeneity of the starting capabilities of the body of athletes in determining the composition of the national team in military aviation pentathlon, it is determined that the training of athletes further requires the development of a universal set of exercises that do not require special equipment, is understandable and meets the requirements the number of repetitions of multidirectional skills can be formed by accelerating their performance and increasing their number depending on the phase of the training process with reaching the peak of opportunities immediately before the competition.

The introduction of testing to assess the functional state of the cardiovascular system in the process of selection of athletes to the national team in international military aviation pentathlon is an important point in determining the appropriate algorithm for further training.

Long-term practice of one or another (game, cyclic, complex-coordination, martial arts) sport on the eve of the status of a candidate for membership in the national team in military aviation pentathlon makes it necessary to develop a universal set of physical training, where for a certain number skill exercises can be formed by accelerating their performance and increasing their number depending on the phase of the training process with reaching the peak of opportunities just before the competition.

The crossfit method is the one that best meets the requirements for a universal set of physical exercises to prepare for military aviation pentathlon competitions.

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References

1. Aulik, I. V. (1990), Opredelenie fizicheckoi rabotocpocobnocti v klinike i sporte [Determination of physical workability in the clinic and in sports]. Moskva: Meditsina, 147 p. (in Russ.)

2. Kirpenko, V. M., Zolochevskii, V. V. and Poltavets, A. I. (2020), Podolannya pereshkod. Smuga pereshkod CISM [Overcoming obstacles. CISM obstacle course.]. Kharkiv: KhNUPS im.I.Kozheduba, 104 p. (in Ukr).

3. Kirpenko, V. M., Piddubnii, O., G. and Poltavets, A. I. (2016), Aeronavtichne bagatoborstvo [Aeronautical all-around.]. Kharkiv: KhNUPS im.I.Kozheduba, 168 p. (in Ukr).

4. Landa, B.Kh. (2011), Metodika kompleksnoi otsenki fizicheskogo razvitiya i fizicheskoi podgotovlennosti [Methodology for a comprehensive assessment of physical development and physical fitness].Moskva: Sovetskii sport, 348 p. (in Russ.)

5. Shchegolev, V. A., Sivak, A. N., Kochin, A. A. and Egorov, V. Yu. (2016), "Training of specialists in the military-physical profile in the armed forces of the leading NATO countries", Teoriya i praktika fizicheskoi kultury, №2, pp. 61-66. (in Russ.).

6. Knapik, J., Sharp, M., Darakjy, S. et al. (2006), "Temporal changes in the physical fitness of US army recruits", Sports Med, 36, pp. 613-634. (in Eng.)

7. Leyk, D, Erley, O, Ridder, D, Leurs et al. (2007) "Age related changes in marathon and half-marathon performances", Int J Sports Med, 28, pp. 513-517. (in Eng.)

8. Osipov, A.,Kudryavtsev, M., Gatilov, K.et al. (2017), "The use of functional training — crossfit methods to improve the level of special training of athletes who specialize in combat sambo", Journal of Physical Education and Sport, 17 Suppl., №3, pp. 2013–2018. (in Eng.)

9. Pattyn, N., Coeckelberghs, E., Buys, R., et al. (2014), "Aerobic interval training vs. moderate continuous training in coronary artery disease patients: A systematic review and meta-analysis", Sports Med, 44, pp. 687-700. (in Eng.)

10. Pryimakov, O., Iermakov, S. Kolenkov, O. et al (2016), "Monitoring of functional fitness of combat athletes during the precompetitive preparation stage", Journal of Physical Education and Sport, No. 16 (2), pp. 551–561. (in Eng.)

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