https://doi.org/10.52449/1857-4114.2021.38-2.05

CZU: 159.9:796.015

DETERMINATION OF MAXIMUM ANAEROBIC POWER INDICES OF FEMALE JUDOKAS BY APPLYING SPECIFIC EFFORTS

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The aim of this research is to study the indices of the level of special and functional physical training of female judokas of different qualifications and age categories using specific efforts: maximum anaerobic power. In total, more than 35 female athletes were examined (approximately 5 in each weight category). During the research, the duration of the complete cycles of throws performed, the volume and intensity of the efforts were recorded.

Using intervalometry, the maximum result and duration of each throw cycle were determined, the strength of the effort performed, the dynamics of fatigue and its degree (fatigue coefficient), as well as HR indices before and immediately after exertion and the dynamics of its change during recovery. Before the start of the test, the indices of the orthostatic test were established, and with the help of the pulse oximeter - the degree of saturation of the blood with oxygen at rest, immediately after the execution of the test efforts and at the end of the recovery period.

Keywords: *maximum test, test effort, intervalometry, maximum anaerobic power, fatigue coefficient.*

The actuality. The maximum test is one of the most informative and widespread methods in the practice of sports physiology, sports medicine and pedagogy [1, 7, 8, 9]. At the same time, the increase in the accuracy of the investigated, the metrological argumentation of the selection of safer and more easily accessible means of obtaining information acquires a special importance and, in this respect, the advantages of physical efforts specific to each sporting event determine us to ask the question. the predilection for this method [2, 3]. The simplicity and accessibility of this method fully justify its popularity. The complex assessment of the level of special and functional physical training of athletes who practice various individual sporting events, especially of wrestlers, requires the testing of both aerobic and anaerobic abilities. In view of this, the program of current and phased investigations on special work capacity must include the whole body of aerobic and anaerobic capacity indexes of the body. In this context, the metrological argumentation and the evaluation of the results of the maximum anaerobic power test (MAP), which, being a method of quantitative research, must have the necessary degree of accuracy [7, 10, 11], of particular importance.

In the manifestation of the special resistance of the fighters, in addition to a high level of development of aerobic capacity, an important role belongs to the indices that reflect the level of development of anaerobic work capacity. In particular, it is interesting to investigate the interaction of the anaerobic work capacity indices of athletes, calculated

based on the MAP test performed in laboratory conditions, with those of the volume of effort performed [6, 12].

In the new accessible literature, there is only partial information about the values of these indicators and no systemic analysis of MAP parameters is performed. In addition, there are only a few scattered data on the comparative analysis of these indicators depending on the sports specialization and the size of the energy demand of the activity performed [1, 4, 5, 8].

In scientific papers, the instrumental methods for recording the results of the MAP test are usually used, being applied, in particular, the veloergometry, which involves the execution of three consecutive efforts of maximum intensity, with a duration of 10 seconds each and rest breaks 1 minute between them, followed by their analysis, regardless of the specifics of the athlete's competitive activity.

In this context, our research, in which we aimed to determine the indices of the special performance of female judokas by applying specific physical efforts will be more informative, because the proposed test, in our opinion, will in this case be as close as possible to natural conditions. of sports activity. All of the above confirms the actuality of our research.

Thus, the **purpose of** this research was to study the size of MAP ergometric indices for female judokas of different qualifications and weight categories based on the application of specific physical effort.

Research objectives:

1. To determine the degree of development of the maximum anaerobic power indices of female judokas of different qualifications and weight categories.

2. To highlight the correlations between the indices of the level of sports achievements and the criteria of the maximum anaerobic power of female judokas.

In order to achieve the formulated objectives, the following **research methods** were applied: the analysis of the scientific-methodical literature and the generalization of the advanced experience in the field; pedagogical observations; interviewing and investigating well-known coaches and athletes; anthropometry (waist, weight, length of lower limbs); intervalometry, in order to determine the indices of the level of special and functional physical training of athletes - HR at rest, after exertion and during the recovery period, duration and dynamics of recovery processes [2, 7], constant fatigue (correlation between maximum strength and the minimum when performing throws during the test) [11], as well as the volume of effort performed, blood pressure, blood saturation with oxygen using the pulse oximeter "Sp02 PRdpm slepmonitoring", orthostatic test [2, 3, 5, 6]; statistical-mathematical methods.

Research organization. The research included 35 athletes of different qualifications (starting with SMC and ending with sports category III) and ages, who specialize in judo, on average 5 athletes for each weight category. All participants in the research are students at high schools and sports schools in Chisinau. In addition to MAP testing, all those surveyed were given an indication of their physical performance, maximum oxygen consumption, and the best results they demonstrated in performing the maximum test with the application of specific efforts of maximum intensity: throwing. of the 40 kg manikin within 15 seconds. During the test, the duration of each of the executed throwing cycles was fixed, with the simultaneous video recording of the first three throwing cycles. The maximum test results were determined by the intervalometry method [3].

The volume of external effort (absolute and relative) of the specific test performed by each of the participants in the experiment, according to the weight category (average values) is presented in Table 1.

The determination of MAP consisted of the execution of physical test effort by the subjects: 3 exercises of 2 cycles of throws,

performed with maximum intensity, the exercises being separated by breaks lasting 1 minute.

The test was completed with a 5-minute recovery phase, followed by blood pressure, HR, and oxygen saturation. Based on the data recorded with the help of special programs, developed within the SUPES SRCPESF, MAP and a series of other indices were calculated, which are presented in tables.

Each participant was previously explained the test procedure, morphofunctional indices were determined: weight, height, lower limb length, HR, blood pressure, blood saturation with oxygen, and the orthostatic test, in order to assessment of the body's functional condition (COM phase) at the time of testing.

Research results. The data presented in Table 1 reflect the fact that the physical effort tested to complete a complete throwing cycle, which consists of four phases, lifting the athlete from the lying position, ie the phase of "holding" or "fixing"; lifting and positioning the manikin vertically, grabbing the mannequin and throwing it over the shoulder itself) is in the range of 113,9 kgm, in the case of female judoka athletes in the weight category <48 kg, up to 155,8 kgm, in the case of female athletes in the weight category> 78 kg.

Table 1. Volume of specific physical effort of judokas of different weight categories when performing a complete throw cycle (throwing over the 40 kg manikin, average values)

Weight categories (kg)	1	2	3	4	5	6	7
	<48 kg	48 - 52 kg	52 - 57 kg	57 - 63 kg	63 - 70 kg	70 - 78 kg	> 78 kg
Average weight	47.05	50.10	54.65	60.15	66.60	74.10	79.05
Effort volume (1 cycle) (kgm)	113.87	117.86	123.75	130.95	139.45	149.27	155.75
Effort volume / kg (1 cycle) (kgm / kg)	2.27	2.21	2.14	2 07	2.02	1.97	1.93

The difference between the values of the executed effort reaches up to 4,.9 kgm, which makes up 73.1%. At the same time, the relative effort indices, at first sight, do not differ considerably - in the range from 2,27 kgm / kg (in the weight category <48 kg) to 1,93 kgm / kg (in the weight category > 78 kg), ie the difference is only 0,34 kgm / kg (P <0.05), but this difference is 85,0%. At the same time, if we take into account the height-weight indices (Quételet index) of female judokas and the volume of testing efforts, the same correlation would be different.

In the new accessible literature, the methods for determining the MAP indices have been described, with the application, as a test effort, of three repeated runs on steps or of the effort on veloergometry with duration of 10 sec. We tried to determine the MAP indices by applying a specific effort to the fighters: 3x2 mannequin throws. The choice of the volume and duration of a test effort (not more than 10 seconds) - 2 throws of the mannequin were not accidental. It was based on the results of previous research, ie the maximum test with the application of specific efforts of maximum intensity: the execution of the mannequin throws for 15 seconds (Table 2).

Table 2 shows not only the number of throwing cycles performed - the best results of the athletes separately, by weight categories, but also the duration of the throws, the average speed of the execution of the throwing cycles, the volume and strength of the physical effort

performed. From the data presented in the table it is observed that the results of female judokas of different weight categories (average values) differ in terms of the number of throws performed - up to 0,9 throwing cycles (the difference is 22,45%); at the same time, in terms of throwing speed, the differences are only 0,02 throwing cycles per second, which is 8,77% (P <0.05). In fact, for female judokas of all weight categories, the number of complete throwing cycles performed in 10 sec is, on average, 2,1-2,5. At the same time, the minimum duration of a complete throw cycle (t "min) was recorded in the range from 3,75 sec (weight category> 78 kg) to 4,5 sec (weight category <48 kg). The duration of two complete throwing cycles (T "t) ranged from 7,6 sec (V = 0.25 c.a / sec) to 9,3 sec (V = 0,23 c.a / sec), which, in our opinion, can fully satisfy the requirements for the application of the test for determining the maximum anaerobic power indices.

At the same time, the volume of physical effort performed by sportswomen reached values from 562 kgm in the case of female judokas in the weight category <48 kg (at the execution of two complete cycles of throws - up to 227 kgm), up to 700 kgm in the case of sportswomen in the category weight> 78 kg (when performing two complete throwing cycles - up to 312 kgm). It should be noted that, as a whole, as the test task was performed, from the first to the last throw cycle, the duration of each separately analyzed throw cycle gradually increased, which is explained by the increase in fatigue (Table 2). In addition, in some female judokas (8 athletes) there was a reduction in the duration of the second cycle, and sometimes in the third cycle of throws (Figure 1). In our opinion, this situation is explained both by the way in which the level of development of motor skills, will (with a sports character) is manifested, and by the technical mastery of female judokas.

In the research carried out, it was highlighted that the average values of the intensity of physical effort (W) with a specific character performed by female judokas of different weight categories, also differ and fall within the range from 29,7 kgm / sec, in the case of female judokas of category <48 kg, up to 41,3 kgm / sec, the difference being 39% (P <0.05).

We can assume that the differences in the volume of effort during the test are determined not only by the number of throwing cycles, the weight of the athlete, but also by her body size: the length of the lower limbs and torso, which influences the height to which one must lift the own body (lifting into position before throwing), during throwing cycles. Calculations show that female athletes, even those in the same weight category, despite having identical results - the number of throws performed during the testing perform different physical exertion (Table 3) not only in volume: from 220, 65 ± 0,34 kgm (in the case of athletes in the weight category <48 kg) up to 293,31 ± 3.49 kgm (in the case of judokas in the weight category> 78 kg, P <0.05), but also as intensity: from 25,20 ± 2,21 kgm / sec, for female judokas in the weight category <48 kg, up to 38,93 ± 3,49 kgm / sec - for those in the category> 78 kg (P <0, 05). This is determined primarily by the number of throwing cycles executed and the speed of execution of each separately analyzed throw.

The data on the response of the cardiorespiratory system (Tables 4, 5) recorded at rest, after the execution of the specific test with maximum intensity and during the recovery period, as well as the duration of the recovery processes, allowed us to highlight substantial changes of HR values, blood pressure and oxygen saturation of the blood, which reflects the degree of influence of the test load on the body of judokas.

Recording the duration of each throwing cycle separately, in the process of testing the athletes (Table 2) gave us the opportunity to track the dynamics of the speed of the throws, the increase in fatigue and the ability to withstand it.

Table 2. Indices of duration, speed of throwing cycles and heart rate of judokas of different weight categories in the MAP test - 3 consecutive efforts of 2 throws over the shoulder of the 40 kg mannequin (average values)

Weight category (kg)	t "$_1$ (sec)	t"$_2$ (sec)	T "t (sec)	Vx (ca / sec)	HR	
					at rest (rpm)	after exertion (rpm)
	X ± m	**X** ± m	**X** ± m	**X** ± m	**X** ± m	**X** ± m
	Effort I					
<48 (6)	**4.52** ± 0.04	**4.54** ± 0.04	**9.05** ± 0.08	**0.223** ± 0.01	**69.22** ± 2.18	**177.54** ± 0.36
48 - 52 (5)	**4.45** ± 0.24	**4.48** ± 0.25	**8.93** ± 0.48	**0.238** ± 0.01	**72.75** ± 2.20	**182.51** ± 0.89
52 - 57 (6)	**4.05** ± 0.08	**4.04** ± 0.09	**8.09** ± 0.16	**0.255** ± 0.02	**70.29** ± 2.16	**179.64** ± 1.27
57 - 63 (5)	**3.98** ± 0.20	**3.98** ± 0.21	**7.96** ± 0.41	**0.261** ± 0.01	**68.05** ± 1.06	**175.14** ± 1.27
63 - 70 (4)	**3, 82** ± 0.29	**3.83** ± 0.27	**7.66** ± 0.56	**0.272** ± 0.02	**69.38** ± 1.10	**174.9** ± 1.22
70 - 78 (4)	**3.75** ± 0, 24	**3.74** ± 0.24	**7.50** ± 0.48	**0.276** ± 0.02	**70.63** ± 2.14	**174.54** ± 5.29
> 78 (5)	**3.81** ± 0.27	**3.81** ± 0.26	**7.62** ± 0.52	**0.266** ± 0.02	**71.61** ± 2.57	**171.46** ± 2.01
	Effort II					
<48 (6)	**4.56** ± 0.0 4	**4.54** ± 0.04	**9.1** ± 0.08	**0.223** ± 0.01	**70.75** ± 2.36	**181.12** ± 0.38
48 - 52 (5)	**4.50** ± 0.24	**4.55** ± 0.24	**9.05** ± 0.48	**0.227** ± 0.01	**71.29** ± 2.58	**186.29** ± 0.93
52 - 57 (6)	**4.08** ± 0.08	**4.12** ± 0.08	**8.20** ± 0.16	**0.246** ± 0.01	**72.05** ± 2.43	**183.30** ± 1.32
57 - 63 (5)	**4.01** ± 0.19	**4.08** ± 0.21	**8.09** ± 0.41	**0.253** ± 0.01	**67.38** ± 2.25	**178.62** ± 1.32
63 - 70 (4)	**3.87** ± 0.25	**3.92** ± 0.26	**7.79** ± 0.52	**0.264** ± 0.01	**69.63** ± 2.32	**178.37** ± 1.27
70 - 78 (4)	**3.81** ± 0.25	**3.85** ± 0.25	**7.65** ± 0.49	**0.265** ± 0.02	**71.61** ± 2.79	**177.99** ± 2.50
> 78 (5)	**3.86** ± 0.30	**3.91** ± 0.29	**7.77** ± 0.59	**0.259** ± 0.02	**70.41** ± 2 38	**174.79** ± 2.09
	Effort III					
<48 (6)	**4.52** ± 0.04	**4.59** ± 0.04	**9.11** ± 0.08	**0.227** ± 0.01	**71.68** ± 1.89	**186.76** ± 0.40
48 - 52 (5)	**4.57** ± 0.24	**4.60** ± 0.23	**9.17** ± 0.48	**0.224** ± 0.01	**70.27** ± 1.85	**192.26** ± 0 .99
52 - 57 (6)	**4.12** ± 0.08	**4.15** ± 0.08	**8.27** ± 0.17	**0.248** ± 0.01	**69.75** ± 1.84	**189.08** ± 1.40
57 - 63 (5)	**4.08** ± 0.20	**4.10** ± 0.21	**8.17** ± 0.41	**0.255** ± 0.01	**71.29** ± 1.88	**184.11** ± 1.40
63 - 70 (4)	**3.93** ± 0.26	**3.92** ± 0.26	**7.82** ± 0.53	**0.269** ± 0.01	**72.05** ± 1.90	**183.84** ± 1.35
70 - 78 (4)	**3.82** ± 0.27	**3.89** ± 0.2 6	**7.71** ± 0.52	**0.267** ± 0.02	**71.38** ± 1.88	**183.45** ± 5.85
> 78 (5)	**3.92** ± 0.31	**3.98** ± 0.30	**7.9 0**± 0.62	**0.266** ± 0.02	**71.63** ± 1.89	**180.04** ± 2.22

Note: The number of athletes tested is indicated in parentheses.

Based on the intervalometry data, the fatigue constant (CGO) was calculated - the correlation between the minimum power and the maximum (Tables 8, 9), when performing throws during the test exercise [8, 12].

As the results of our research have shown, the CGO value (Table 4) for judokas of all weight categories (average data), calculated according to the intensity of each of the 6 separate throwing cycles, on the one hand, is practically identical and makes up 0.97 - 0.98 (P> 0.05).

On the other hand, the CGO indices (individual data) of judokas in the weight categories 63-78 kg oscillate in the range of 0,92 – 0,99 (0.7% - 8.5%); in the weight categories <48 kg and> 78 kg - in the range 0,93 – 0,99 (0.9% - 7.5% and 5.8% - 7.5%, respectively), in judokas in the weight category 48-52 kg - in the range 0.94 - 1.00 (0.4% - 6%), and in those in the category 52-

57 kg - in the range 0.95 - 0.99 (0, 6% - 5.0%) and, finally, for judokas in the 57-63 kg category - within the limits of 0.83 - 0.99 (0.6% - 20%).

Table 3. Indices of the level of special physical training of judokas of different weight categories (average values) in the MAP test (3 x 2 throws over the shoulder of the 40 kg mannequin)

Weight category (kg)	**t ”$_1$** (sec)	**t”$_2$** (sec)	**t "$_X$** (sec)	**t" (1-2)** min. (Sec)	**Effort volume** (kgm)	**W** (kgm / sec)
	Effort I					
<48 (6)	**4.52** ± 0.04	**4.54** ± 0.04	**4.53** ± 0.04	**4.44** ± 0.03	**220.65** ± 0.34	**25.20** ± 0.24
48 - 52 (5)	**4.45** ± 0.24	**4.48** ± 0.25	**4.46** ± 0.24	**4.28** ± 0.12	**230.50** ± 1.04	**27.36** ± 1.00
52 - 57 (6)	**4.05** ± 0.08	**4.04** ± 0.09	**4.04** ± 0.08	**4.02** ± 0.08	**235.76** ± 1.45	**29.58** ± 0.70
57 - 63 (5)	**3.98** ± 0.20	**3.98** ± 0.21	**3.98** ± 0.21	**3.89** ± 0.11	**247.74** ± 0.68	**32.29** ± 0.96
63 - 70 (4)	**3.82** ± 0.29	**3.83** ± 0.27	**3.83** ± 0.26	**3.77** ± 0.18	**253.35** ± 0.65	**34.44** ± 1.90
70 - 78 (4)	**3.75** ± 0.24	**3.74** ± 0.24	**3.75** ± 0.27	**3.74** ± 0.27	**272.71** ± 1.71	**36.98** ± 2.45
> 78 (5)	**3.81** ± 0.27	**3.81** ± 0.26	**3.81** ± 0.31	**3.79** ± 0.31	**293.31** ± 12.25	**38.93** ± 3.49
	Effort II					
<48 (6)	**4.56** ± 0.04	**4.54** ± 0.04	**4.55** ± 0.04	4.44 ± 0.03	**220.65** ± 0.34	**25.15** ± 0.22
48 - 52 (5)	**4.50** ± 0.24	**4.55** ± 0.24	**4.52** ± 0.24	**4.29** ± 0.13	**230.50** ± 1.04	**27.20** ± 0.90
52 - 57 (6)	**4.08** ± 0.08	**4.12** ± 0.08	**4.10** ± 0.08	**4.08** ± 0.08	**235.76** ± 1.45	**29.17** ± 0.67
57 - 63 (5)	**4.01** ± 0.19	**4.08** ± 0.21	**4.05** ± 0.20	**3.93** ± 0.32	**247.74** ± 0.68	**31.94** ± 0.89
63 - 70 (4)	**3.87** ± 0.25	**3.92** ± 0.26	**3.90** ± 0.26	**3.81** ± 0.20	**253.35** ± 0.65	**33.91** ± 1.53
70 - 78 (4)	**3.81** ± 0.25	**3.85** ± 0.25	**3.82** ± 0.25	**3.79** ± 0.25	**272.71** ± 1.71	**36.44** ± 2.41
> 78 (5)	**3.86** ± 0.30	**3.91** ± 0.29	**3.88** ± 0.30	**3.86** ± 0.30	**293.31** ± 12.25	**38.33** ± 3.62
	Effort III					
<48 (6)	**4.52** ± 0.04	**4.59** ± 0.04	**4.56** ± 0.04	**4.43** ± 0.03	**220.65** ± 0.34	**25.15** ± 0.20
48 - 52 (5)	**4.57** ± 0.24	**4.60** ± 0.23	**4.59** ± 0.24	**4.31** ± 0.12	**230.50** ± 1.04	**27.03** ± 0.82
52 - 57 (6)	**4.12** ± 0.08	**4.15** ± 0.08	**4.13** ± 0.08	**4.12** ± 0.08	**235.76** ± 1.45	**28.85** ± 0.65
57 - 63 (5)	**4.08** ± 0.20	**4.10** ± 0.21	**4.09** ± 0.21	**3.98** ± 0.11	**247.74** ± 0.68	**31.44** ± 0.84
63 - 70 (4)	**3.93** ± 0.26	**3.92** ± 0.26	**3.91** ± 0.26	**3.82** ± 0.18	**253.35** ± 0.65	**33.76** ± 1.45
70 - 78 (4)	**3.82** ± 0.27	**3.89** ± 0.26	**3.86** ± 0.27	**3.82** ± 0.27	**272.71** ± 1.71	**36.25** ± 2.62
> 78 (5)	**3.92** ± 0.31	**3.98** ± 0.30	**3.95** ± 0.31	**3.92** ± 0.31	**293.31** ± 12,25	**37,79** ± 3,75

Note: The number of athletes tested is indicated in parentheses

The average CGO values for each weight category, calculated according to the running time of each of the 3 pairs of throwing cycles, are approximately similar to those of throws analyzed separately: in the range from 0.97 to 0.98 (P> 0.05).

However, the individual CGO indices, calculated according to the duration of two throwing cycles performed by judokas during testing, are somewhat different: in the range 0.83 - 1.00 were recorded in athletes in the weight categories <48 kg (0, 8% - 19.8%) and those in the 57-63 kg category (0.4% - 20.9%); in the range from 0.95 to 0.99 were recorded in athletes in the weight category 52-57 kg (0.5% - 5.3%) and weight category> 78 kg (2.3% - 5 , 3%) and finally in the range from 0.94 to 0.99 - for judokas in the 63-70 kg category (0.7% - 6.3%) and in the 70-78 kg category (0.7% - 6.3%).

Table 4. Indices of the special physical performance of judokas of different weight categories (average values) at the execution testing (3 x 2 throws over the shoulder of the 40 kg mannequin)

	Vmin	**V**max	**ΔV**	**A**	**W**	**W / кg**	**MAP**	**CGO**
	c.a / sec	c.a / sec	c.a / sec	kgm	kgm / sec	kgm / sec / kg	W / sec / kg	**u.c**
<48 (6)	**0.22** ± 0.01	**0.23** ± 0.01	**0.01** ± 0.001	**220.65** ± 0.17	**25.28** ± 0.25	**5.56** ± 0.06	**54.51** ± 0.57	**0.9506** ± 0.001
48 - 52 (5)	**0.22** ± 0.24	**0.23** ± 0.01	**0.01** ± 0.001	**230.50** ± 0.52	**26.68** ± 1.38	**5.24** ± 0.27	**51.44** ± 2.64	**0.9637** ± 0.001
52 - 57 (6)	**0.24** ± 0.25	**0.25** ± 0.01	**0.01** ± 0.001	**235.76** ± 0.72	**29.58** ± 0.70	**5.41** ± 0.13	**53.06** ± 1.27	**0.9695** ± 0.001
57 - 63 (5)	**0.25** ± 0.26	**0.26** ± 0.01	**0.01** ± 0.001	**247.74** ± 0.34	**32.02** ± 1.26	**5.25** ± 0.22	**51.48** ± 2.18	**0.9645** ± 0.01
63 - 70 (4)	**0.26** ± 0.29	**0.27** ± 0.02	**0.01** ± 0.001	**253.35** ± 0.33	**34.22** ± 2.11	**5.30** ± 0.33	**52.04** ± 3.24	**0.9693** ± 0.01
70 - 78 (4)	**0.26** ± 0.26	**0.27** ± 0.02	**0.01** ± 0.001	**272.71** ± 0.86	**36.98** ± 2.45	**4.83** ± 0.29	**47.33** ± 2.89	**0.9601** ± 0.01
> 78 (5)	**0.26** ± 0.02	**0.26** ± 0.02	**0.01** ± 0.001	**293.31** ± 1.13	**38.93** ± 3.49	**4.24** ± 0.25	**41.62** ± 2.41	**0.9537** ± 0.02

Note: The number of athletes tested is indicated in parentheses.

Such a large dispersion of results within each of the weight categories can be explained by differences in both concerns the qualification of the athletes, their seniority in sports, as well as the level of physical and functional training of the judokas.

Another parameter, which we recorded in our research, was heart rate (HR), which, as we know, is a comprehensive index of the influence of physical effort on the subject's body. During the testing process, the HR was determined by intervalometry [2, 3] several times: at rest before testing, immediately after the throw, during the one-minute break and during the entire recovery period, with an interval of 30 seconds, until complete recovery (Figures 1 and 2).

As the test results show, the test (3x2 mannequin throws over the shoulder) proved to be not at all easy for judokas from virtually all weight categories. Figures 4 and 5 clearly show the continuous increase of the HR values from one series to another, in the range from 171.4 b / min (effort I, weight category> 78 kg) to 192.3 b / min (third effort, weight category 48-52 kg). The increase in HR indices at the end of the throw-in, compared to the same indices recorded at rest, reached the figure of 93 b / min for judokas in the 57-63 kg category. This difference between HR indices can be explained by the correlation between the weight of the athlete and that of the mannequin, which constitutes from 49% (in the case of judokas in the category> 80 kg) to 85% (in the case of those in the category <48 kg) in weight. the athlete's own body, which, on the one hand, places them in unequal conditions and, on the other hand, creates difficulties in comparing the results of the research undertaken, both those recorded within each weight category and between weight categories (Table 5).

At the same time, if the first effort was performed on the basis of complete rest (69.2 b/min), then the second and third effort were performed on the background of an incomplete recovery (153-165 b/min and respectively 156-169 b/min). Towards the end of the 1-minute

rest break, HR decreased on average: after the first effort - by 13. b/min, after the second - by 12.6 b/min and after the third - with 11.7 b/min. At the same time, the individual indices changed over a much wider range (from 10.2 to 19.3 b/min). The influence of the continuous increase of the fatigue degree and the speed of the recovery processes, which depend on the functional capacities of the judokas body, is clearly observed (Table 5).

Table 5. Indices of the level of functional training of judokas of different weight categories (average values) in the MAP test (3x2 mannequin throws over shoulder)

Weight category (kg)	Rest / break 1 min			Effort			Break 1 min / recovery	
	HR (b.min)	$O_{2\ (\%)}$	BP (mm)	HR (b./min)	$O_{2\ (\%)}$	BP (mm)	T " (sec)	$O_{2\ (\%)}$
	effort I							
<48 (6)	**70.7** ± 2.36	**98.3**	115/75	177.54 ± 0.36	**97.1**	123/70	166.19 ± 0.22	**98.9**
48-52 (5)	**71.2** ± 2.38	**98.9**	110/75	182.51 ± 0.89	**97.8**	121/65	165.78 ± 0.85	**99.1**
52-57 (6)	**72.0** ± 2.40	**99.0**	115/75	179.64 ± 1.27	**97.2**	124/69	164.78 ± 0.61	**98.5**
57-63 (5)	**67.3** ± 2.25	**98.3**	120/80	175.14 ± 1.27	**97.3**	125/71	152.93 ± 1.46	**99.1**
63-70 (4)	**69.3** ± 2.32	**99.0**	110/75	174.9 ± 1.22	**97.1**	122/68	147.17 ± 0.79	**98.0**
70-78 (4)	**71.6** ± 2.39	**97.8**	115/75	174.54 ± 5.29	**97.4**	120/64	152.42 ±	**98.2**
1.39>78 (5)	**70.4** ± 2.35	**98.1**	110/70	171.46 ± 2.01	**98.2**	125/66	150.45 ± 0.43	**99.1**
	Effort II							
<48 (6)	166.19 ± 0.22	**98.9**	123/70	181.12 ± 0.38	**97.1**	124/67	170.49 ± 0.32	**98.9**
48 - 52 (5)	165.78 ± 0.85	**99.0**	121/65	186.29 ± 0.93	**97.8**	123/62	162.73 ± 0.99	**99.1**
52-57 (6)	164.78 ± 0.61	**98.3**	124/69	183.3 ± 1.32	**97.2**	126/67	154.95 ± 1.40	**98.5**
57 - 63 (5)	152.93 ± 1.46	**99.0**	125/71	178.62 ± 1.32	**97.3**	125/68	151.78 ± 1.40	**99.1**
63 - 70 (4)	147.17 ± 0.79	**97.8**	122/68	178.37 ± 1.27	**97.1**	122/65	152.27 ± 1.35	**98.0**
70 - 78 (4)	152.42 ± 1.39	**98.1**	120/64	177.99 ± 5.50	**97.4**	123/63	154.22 ± 5.85	**98.2**
> 78 (5)	150.45 ± 0.43	**99.0**	125/66	174.79 ± 2.09	**98.2**	125/62	147.18 ± 2.22	**99.1**
	Effort III							
<48 (6)	170.49 ± 0.32	**98.9**	124/67	186.76 ± 0.40	**97.1**	125/66	396.62 ± 13.30	**98.9**
48 - 52 (5)	162.73 ± 0.99	**99.0**	123/62	192.26 ± 0.99	**97.8**	125/62	424.10 ± 15.96	**99.1**
52-57 (6)	154.95 ± 1.40	**98.3**	126/67	189.08 ± 1.65	**97.2**	126/67	419.71 ± 10.41	**98.5**
57-63 (5)	151.78 ± 1.40	**99.0**	125/68	184.11 ± 1.34	**97.3**	125/67	421.50 ± 12.94	**99.1**
63-70 (4)	152.27 ± 1.35	**97.8**	122/65	183.84 ± 1.58	**97.1**	124/65	417.25 ± 14.88	**98.0**
70-78 (4)	154.22 ± 5.85	**98.1**	123/63	183.45 ± 2.03	**97.4**	124/63	398.80 ± 43.69	**98.2>**
78 (5)	147.18 ± 2.22	**99.0**	125/62	180.04 ± 0.46	**98.2**	125/62	362.09 ± 31.15	**99.1**

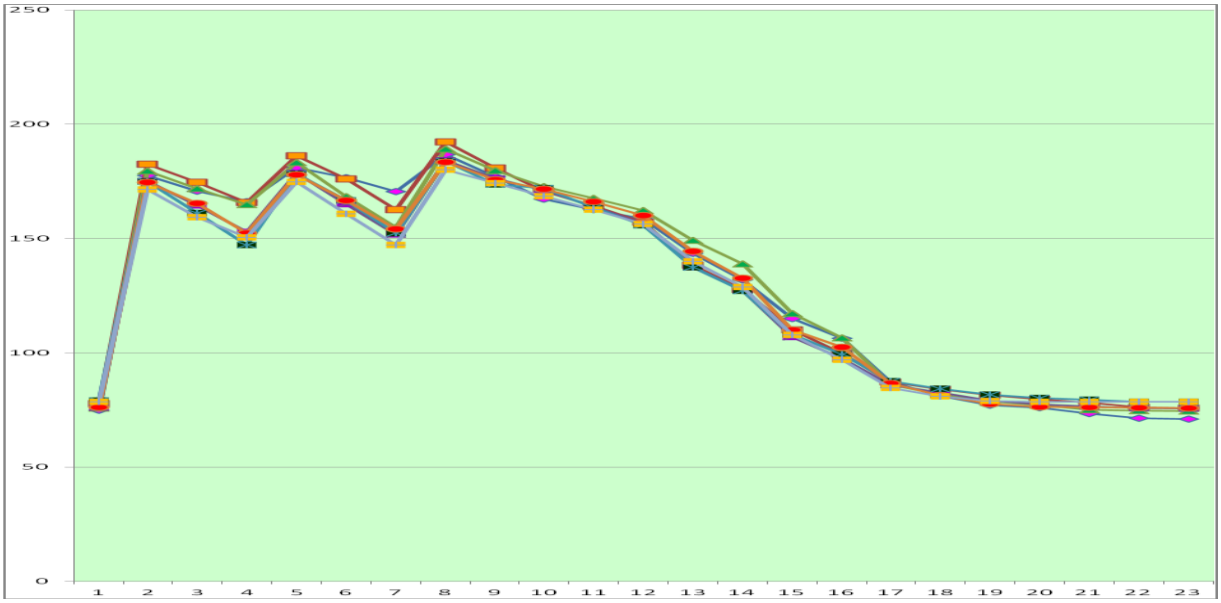
Note: the number of tested **athletes is** indicated in parentheses

The indices of the level of functional training of the judokas presented in the table show that the degree of saturation of blood with oxygen, practically, in all sportswomen, regardless of the series of throws, changes in the same way - in the range from 2% to 3%, in depending on the weight category and the correlation between the body weight of the athletes and the strength of the external resistance (the weight of the mannequin).

The reduction in the degree of saturation of blood with oxygen (O_2) after the test, compared to the same index recorded at rest, is statistically insignificant in virtually all athletes, falling within the range of 1.8 up to 2.6% (P> 0.05). In addition, the return of the indices of the degree of saturation of blood with oxygen to the initial values, in most athletes, was already taking place in the second minute of the recovery period. According to the data presented in Table 5, at

the end of the recovery period, in some athletes the degree of saturation of blood with oxygen slightly exceeded the initial level by 0.1 - 0.2%, but the differences were statistically insignificant (P> 0.05).

The classical method of determining MAP indices involved a 5-minute break, followed by the recording of HR indices. Of particular interest to us, however, are the processes of restoring the body of judokas, the dynamics and duration of the return of HR to the initial level (Figures 1, 2), as well as pulse values during the test (Figure 3) - total number of complete heart cycles (CHC), which ensures the execution of the test and the return of the HR to the initial values, which is, in itself, one of the important criteria for the level of special and functional physical training of athletes.



Legend: weight categories III - <48 kg; III - 48-52 kg; ?? - 52-57 kg; III - 57-63 kg; III63-70 -kg; III70-78 -kg; III -> 78 kg

Fig. 1. Dynamics of HR at rest (1), at the execution of the test task (2-7) and during the recovery period (9-23)

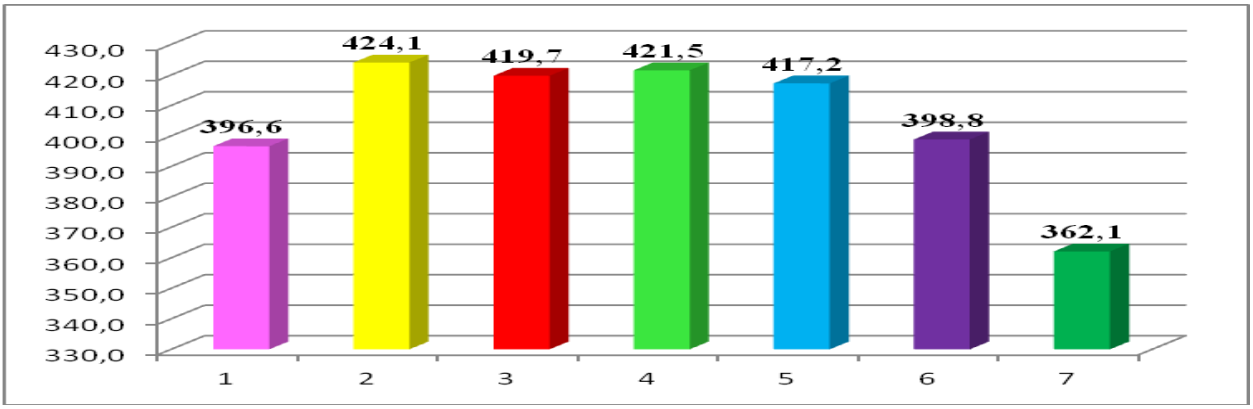
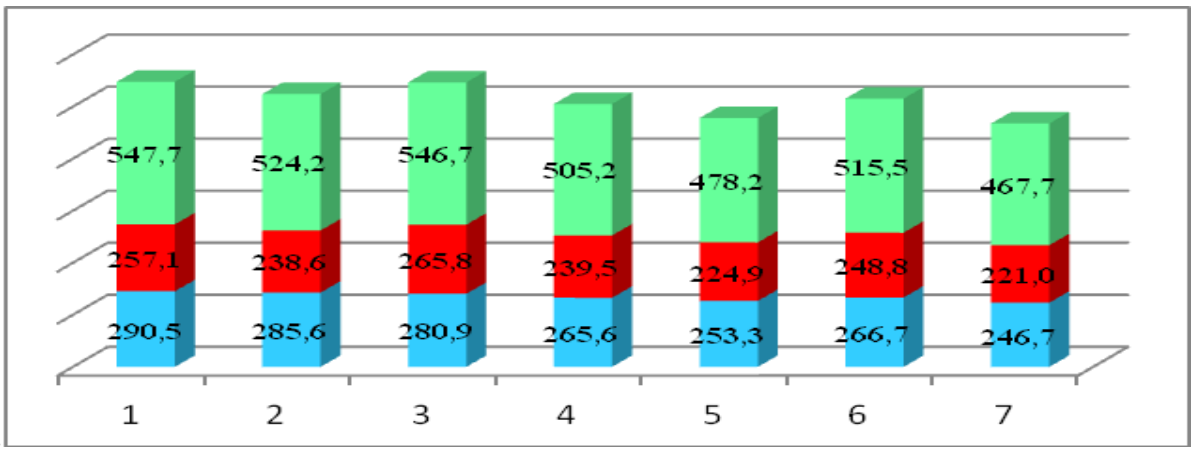


Fig. 2. Duration of HR recovery (seconds) after performing the test task at the MAP evaluation of judokas of different weight categories: 1 - <48 kg; 2 - 48-52 kg; 3 - 52 -57 kg; 4 - 57-63 kg; 5 - 63-70 kg; 6 - 70-78 kg; 7 – >78 kg

HR recovery after the test was also unambiguous (Figure 2, average results expressed in seconds) and was relatively uniform and gradual: in the case of 6 judokas (about 17.2% of the total number of female athletes included in research), the recovery period of HR to the initial level ranged from 4 min to 4.5 min; in the case of 8 judokas (23%), this process lasted up to 5 minutes; in 11 sports (31.5%), HR reached the initial values by the end of the sixth minute; in 4 sportswomen (11.5%) - within 6.5 - 7 min, 3 sportswomen reached the level of rest after 7 min 30 sec, and another 3 judokas (8.6%) reached these values only at the end of the 8th minute.



Legend: III - the number of complete heart cycles that ensure the execution of the physical effort; III - the number of complete heart cycles that ensure the recovery processes; III - pulse values during the test

Fig.3. Pulse values during the test (3 x 2 throws) when evaluating the MAP of judokas of different weight categories: 1 - <48 kg; 2 - 48-52 kg; 3 - 52 -57 kg; 4 - 57-63 kg; 5 - 63-70 kg; 6 - 70-78 kg; 7 -> 78 kg

In our research, we made extensive use of L. Brouha's [8] methodology for determining the number of complete heart cycles, which ensures not only the execution of physical effort, but also the processes of bodybuilding. Figure 3 shows the results of recording pulse values during the test (CHC, mean values) in judokas of different weight categories after performing specific test efforts: 3 sets of 2 mannequin throws over the shoulder, with maximum speed, separated by 1 minute rest breaks. The data obtained created the possibility to appreciate the depth of changes in the body of the subjects, their body's reaction to the specific effort performed with maximum intensity, its degree of influence, the nature of physiological processes, duration and character of HR recovery, and pulse values during the test. - the total number of complete heart cycles (CHC), which ensures the execution of the test task and the recovery processes in the body of judokas of different weight categories.

The research results allow us to formulate the following **conclusions**:

1. Throwing the mannequin over the shoulder can be used successfully in sports both as a specific test to determine the level of special and functional physical training of judokas - maximum anaerobic power at various stages of training, and as a means of controlling the dynamics of the sport form during an annual training cycle. The MAP method developed by us and the results of the testing undertaken are in line with the results previously obtained through the developed methodologies. MAP indices range from 41.62 watts in the case of a judoka in the weight category> 78 kg to 64.51 watts in the case of judokas in the <48 kg category.

2. In the present research, a high degree of correlation was determined for the first time between the maximum anaerobic power indices, the volume of specific physical effort performed with maximum and submaximal power (in the range from r = 0.87 to r = 0.93) and the level of development of the special resistance of female judokas (in the limits from r = 0.83 to r = 0.89).

3. The results of the research undertaken clearly show that, in addition to the already existing and widely applied methodologies in the field of sport (step running, veloergometry), the methodology proposed by us, which focuses on the application of specific efforts in combination with intervalometry, it has a more pronounced specific character for fighters, without requiring special inventory. It offers the opportunity to introduce appropriate research into the planning of the means and methods of developing the level of special physical training, as well as to rationally organize the tactics of conducting fights during competitions. Successful testing can be done during a regular training session.

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