ORIGINAL ARTICLE

Modeling of functional preparedness of women 25-35 years of different somatotypes

Yuriy M. Furman[1AVSD], Vyacheslav M. Miroshnichenko[1ABVSD], Victoria Yu. Boguslavska[1AVDE], Natalia V. Gavrilova[1AVDE], Oleksandra Yu. Brezdeniuk[1AVDE], Svitlana V. Salnykova [2ABDE], Viktoria V. Holovkina[1AVDE], Igor Vypasniak[3CDE], Vasyl Lutskyi[3CDE]

[1]*Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Ukraine*
[2]*Vinnytsia Institute of Trade and Economics of Kyiv National University of Trade and Economics, Ukraine*
[3]*Vasyl Stefanyk Precarpathian National University, Ukraine*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; ; E – Funds Collection

Abstract

Background and Study Aim The level of functional preparedness of the population is influenced by many factors. The greatest influence is exerted by the economic condition of the country, climatic features of the region, food quality, environmental factor, social status of the population. Therefore, functional readiness standards should be updated periodically. For an objective assessment of functional readiness, all energy potential should be considered: aerobic, anaerobic lactatic and alactatic. Women of different somatotypes have significant differences in the degree of development of indicators of functional preparedness. The models of functional preparedness developed by us for women of different somatotypes will clearly demonstrate significant differences in the level of preparedness in representatives of different somatotypes. The aim of the study is to develop standards of functional readiness for women aged 25-35 and models of functional preparedness for women of different somatotypes.

Material and Methods The study involved women aged 25-35 years (n = 392). Somatotype was determined in all subjects. The power of aerobic energy supply processes was determined by the method of bicycle ergometry according to the PWC 170 test. The threshold of anaerobic metabolism was determined by the test with a stepwise increasing load. The capacity of anaerobic lactatic energy supply processes of muscular activity was determined by a bicycle ergometric 60-second test. The power of anaerobic lactatic and alactatic energy supply processes was determined by Wingate anaerobic tests WAnT 30 and WAnT 10. Standards of functional preparedness were developed according to the author's method based on the rule 3σ.

Results Functional preparedness standards have been developed for women aged 25-35 according to the full range of muscular energy supply regimes. Models of functional preparedness for women 25-35 years of different somatotypes have been developed.

Conclusions The developed standards are based on modern experimental data and consider all human energy potential (aerobic, anaerobic lactatic and anaerobic alactatic). Standards of functional preparedness cannot be universal for different countries and even different regions of large countries. Models of functional preparedness of women of different somatotypes show a significant difference from the standards set for women without somatotype. Somatotype should be considered when assessing indicators of functional preparedness.

Keywords: standards, aerobic, anaerobic productivity, mature age.

Introduction

The level of functional preparedness of the population is influenced by many factors. The greatest influence has the economic condition of the country, climatic features of the region, food quality, environmental factors, social status of the population [1]. As these factors are not stable, the functional capabilities of the population are also changing. Therefore, functional preparedness standards should be updated periodically. Thus, a study by Davidson and McNaughton [2] found that women aged 22.6 ± 7.6 years who had no experience of systemic physical activity VO_{2max} averaged 34.1 ± 2.1 ml·min^{-1}·kg^{-1}. The study by Astorino et al. [3] found that the average value of VO_{2max} in women aged 22.8 ± 2.8 years is 41,1 ml·min^{-1}·kg^{-1}.

Currently, there are standards of aerobic performance on the basis of VO2max rel. for all age groups of the adult population of the United States [4]. $VO_{2max\ rel.}$ standards for all age groups have been developed for the population of the USSR [5, Art. 35]. A "safe level of health" for women and men has been defined for the population of Ukraine, which is assessed by the $VO_{2max\ rel.}$ indicator [6]. Also identified

doi:10.15561/26649837.2022.0206

standards of aerobic performance on the threshold of anaerobic metabolism (TAM) for men [7]. As all of the above standards were developed more than 20 years ago, they need to be updated.

Experts in the physiology of motor activity note that information on functional readiness only in terms of aerobic performance is incomplete [8]. There are standards of anaerobic performance focused on professional activities. Such developments are available for athletes in various sports [9] and criteria for specific professions (firefighters [10], special forces [11], police [12]). No standards for anaerobic productivity for the population have been identified.

We have developed standards for assessing aerobic and anaerobic productivity for girls and men aged 17-19 [13]. Furman et al. [14] developed standards of functional preparedness for women and men aged 20-22 years and for adolescents aged 11-12 years [15]. There is a need to develop standards of aerobic and anaerobic performance for other age groups.

In modern theory and practice of sport, the method of modeling has become widely used [16]. The use of modeling in health-improving physical culture is a reserve for improving the efficiency of classes. Women 25-35 years of age of different somatotypes have significant differences in aerobic and anaerobic performance [17]. Significant differences in V_{o2max} in representatives of different somatotypes indicate Goran Spori et al. [18]; threshold of anaerobic metabolism Zimnitskaya et al. [19]; indicators of anaerobic lactate productivity Ryan-Stewart et al. [20]. Therefore, we hypothesized that the models of functional preparedness developed by us for women of different somatotypes will clearly demonstrate significant differences in the level of preparedness in women of different somatotypes. Such data can be convincing evidence of the need to consider somatotype in the assessment of functional preparedness.

The aim of the study. Develop standards of functional preparedness for women aged 25-35 and models of functional preparedness for women of different somatotypes.

Material and Methods

Participants

The study involved females 25-35 years old (the first period of mature age) n=392. All subjects in the past had no experience in sports. Each subject gave written consent to participate in the experiment.

Procedure

The power of aerobic energy supply processes of muscular activity was investigated by the indicator of maximum oxygen consumption ($VO_{2\,max}$). $VO_{2\,max}$ was determined by the Karpman et al. [21] method. For this purpose was used a bicycle ergometric test of the PWC 170 version. The subjects performed two loads of different power. The power of the first load (N_1) was 1 W per 1 kg of body weight, the other (N_2) - 2 W per 1 kg of body weight. Pedaling frequency - 60 revolutions per 1 minute. The duration of each load was 5 minutes with 3 minutes interval. At the end of each load, the heart rate (f_1 and f_2) was determined. PWC 170 was calculated according to the algorithm [22]. To determine the values of Vo2 max, the value of PWC 170 abs was substituted into equation 1:

$$VO_{2max\ abs.} = 1.7 \cdot PWC\ 170_{abs.} + 1240, \qquad (1)$$

where , $VO_{2\ max\ abs.}$ displayed in $ml \cdot min^{-1}$;
$PWC170_{abs.}$ displayed in $kg \cdot min^{-1}$.

The threshold of anaerobic metabolism (TAM) was determined by the test of Conconi et al. [23] in a modification of Furman [5, Art. 37-38]. The subjects performed a stepwise increasing load on the ergometer starting from a power of 60 watts, adding 10 watts at each stage. The duration of work and the frequency of pedaling at each stage are constant - the duration is 40s, and the frequency is 60 rpm^{-1}. At the end of each stage, heart rate was recorded. The level of TAM corresponded to the inflection point on the graph of heart rate growth. Results were presented in W.

To determine the capacity of anaerobic lactatic energy supply processes of muscular activity was used a method developed by Shogy et al. [24]. This method involves determining the maximum quantity of mechanical work for 1 minute (MQMK). The subject performed a bicycle ergometric load with 1 min duration, power of 225 W and maximum pedaling frequency. Results were presented in $kg \cdot min^{-1}$.

The power of anaerobic alactatic energy supply processes of muscular activity was determined using the Wingate anaerobic test WAnT10 [25]. This test consists in performing a bicycle ergometric load 10sec duration with a power of 225 W and maximum possible pedaling frequency. The number of full pedal revolutions was counted. By mathematical calculations, the result was expressed in $kg \cdot min^{-1}$.

The power of anaerobic lactatic energy supply processes of muscular activity was determined using the Wingate anaerobic test (WAnT30) [25]. The conditions of this test are similar to the WAnT10 test. The difference is duration of the load that lasted 30 seconds. Result was expressed in $kg \cdot min^{-1}$.

To increase the informativeness of all indicators, absolute and relative values were studied. All tests were performed on a Christopeit Sport AX-1 bicycle ergometer (Christopeit, Germany).

Somatotype was determined by the Carter et al. [26] method.

Statistical analysis

Initially, the STATISTICA 13 program checked the data series for compliance with the normal distribution law. Determined: - arithmetic mean, σ - standard deviation.

Standards of functional preparedness were developed according to the author's method. This technique is based on the rule 3σ. The main condition was that the data series correspond to the normal distribution law. The range of values of ± 0.5σ of the data series of all studied women aged 25-35 years (n = 392) was taken as the average level of the trait. The scheme according to which the rating scale is built is shown in Table 1. Such calculations should be made based on a large number of experimental data of persons of the same age, sex, region of residence, lack of experience in sports. This technique is copyrighted.

Results

We have developed standards of functional fitness for women aged 25-35 for the full range of muscle energy of muscular activity (Table 2).

Having determined the somatotype, it was found that 4 somatotypes are characteristic for women aged 25-35: endomorphic, ectomorphic, endomorphic-mesomorphic and balanced. Using the author's standards, we developed models of functional preparedness for women of different somatotypes, which are shown in tables 3, 4, 5, 6.

In women of endomorphic somatotype, the indicators of aerobic productivity of the body (VO_{2max}, TAM) are at a lower level than the indicators of anaerobic productivity of the body (MQMK, WAnT 30, WAnT 10) (table 3).

Opposite tendencies were found in women of ectomorphic somatotype. Indicators of aerobic productivity of an organism (VO_{2max}, TAM) correspond to "above average" and "high" levels. Indicators of anaerobic productivity (WAnT 30, WAnT10) correspond to the level "below average" (table 4).

For women of endomorphic-mesomorphic somatotype, the "average" level of aerobic productivity (VO_{2max}, TAM) and capacity of anaerobic lactate productivity (MQMK) is characteristic. "High" and "above average" levels are characteristic of the performance of anaerobic lactatic and alactatic

Table 1. Scheme of formation of an assessment scale for indicators of functional preparedness

Interval	% of all values of the general population	Evaluation scale
> 2.0 σ	≈ 2	very high
1.1 – 2.0 σ	≈ 13	high
0.6 – 1.0 σ	≈ 17	above average
± 0.5 σ	≈ 34	average
-0.6 – -1.0 σ	≈ 17	below average
-1.1 – -2.0 σ	≈ 13	low
< -2.0 σ	≈ 2	very low

Table 2. Standards of functional preparedness for women of 25-35 years of the Podilsk region (Ukraine)

The level of development of the indicator	Indicators of aerobic productivity alactatic		Indicators of anaerobic productivity		
			alactatic	lactatic	
	VO_{2max} (ml·min·kg^{-1})	TAM (W·kg^{-1})	WAnT10 (kg·min^{-1}·kg^{-1})	WAnT 30 (kg·min^{-1}·kg^{-1})	MQMK (kg·min^{-1}·kg $^{-1}$)
Very high	> 48.2	> 2.8	> 47.06	> 44.24	> 31.9
High	45.1 – 48.2	2.7 – 2.8	42.69 – 47.06	39.33 – 44.24	28.2 – 31.9
Above average	43.5 – 45.0	2.5 – 2.6	40.50 – 42.68	36.87 – 39.32	26.4 – 28.1
Average	43.4 – 40.3	2.4 – 2.2	40.49 – 36.11	36.86 – 31.94	26.3 – 22.6
Below average	40.2 – 38.8	2.1 – 2.0	36.10 – 33.92	31.93 – 29.48	22.5 – 20.7
Low	38.7 – 35.6	1.9 – 1.8	33.91 – 29.54	29.47 – 24.56	20.6 – 16.9
Very low	< 35.6	< 1.8	< 29.54	< 24.56	< 16.9

Note: TAM - threshold of anaerobic metabolism; WAnT10 - Wingate anaerobic test for 10 seconds; WAnT30 - Wingate anaerobic test for 30 seconds; MQMK - maximum quantity of mechanical work for 1 minute.

Table 3. Model of functional preparedness of women 25-35 years of endomorphic somatotype

Indicators	Evaluation criteria						
	very low	low	below average	average	above average	high	very high
VO_{2max}(ml·min·kg^{-1})	< 35.6	35.6 – 38.7	38.8 – 40.2	40.3 – 43.4	43.5 – 45.0	45.1 – 48.2	> 48.2
TAM (W·kg^{-1})	< 1.8	1.8 – 1.9	2.0 – 2.1	2.2 – 2.4	2.5 – 2.6	2.7 – 2.8	> 2.8
MQMK (kg·min^{-1}·kg^{-1})	< 16.9	16.9 – 20.6	20.7 – 22.5	22.6 – 26.3	26.4 – 28.1	28.2 – 31.9	> 31.9
WAnT 30 (kg·min^{-1}·kg^{-1})	< 24.56	24.56 – 29.47	29.48 – 31.93	31.94 – 6.86	36.87 – 39.32	39.33 – 44.24	> 44.24
WAnT10 (kg·min^{-1}·kg^{-1})	< 29.54	29.54 – 33.91	33.92 – 36.10	36.11 – 40.49	40.50 – 42.68	42.69 – 47.06	> 47.06

Note. The model zone for women of endomorphic somatotype is within the range of the highlighted cell–

Table 4. Model of functional preparedness of women 25-35 years of ectomorphic somatotype

Indicators	Evaluation criteria						
	very low	low	below average	average	above average	high	very high
VO_{2max}(ml·min·kg^{-1})	< 35.6	35.6 – 38.7	38.8 – 40.2	40.3 – 43.4	43.5 – 45.0	45.1 – 48.2	> 48.2
TAM (W·kg^{-1})	< 1.8	1.8 – 1.9	2.0 – 2.1	2.2 – 2.4	2.5 – 2.6	2.7 – 2.8	> 2.8
MQMK (kg·min^{-1}·kg^{-1})	< 16.9	16.9 – 20.6	20.7 – 22.5	22.6 – 26.3	26.4 – 28.1	28.2 – 31.9	> 31.9
WAnT 30 (kg·min^{-1}·kg^{-1})	< 24.56	24.56 – 29.47	29.48 – 31.93	31.94 – 36.86	36.87 – 39.32	39.33 – 44.24	> 44.24
WAnT10 (kg·min^{-1}·kg^{-1})	< 29.54	29.54 – 33.91	33.92 – 36.10	36.11– 40.49	40.50 – 42.68	42.69 – 47.06	> 47.06

Note. The model zone for women of ectomorphic somatotype is within the range of the highlighted cell –

Table 5. Model of functional preparedness of women 25-35 years of endomorphic-mesomorphic somatotype

Indicators	Evaluation criteria						
	very low	low	below average	average	above average	high	very high
VO_{2max}(ml·min·kg^{-1})	< 35.6	35.6 – 38.7	38.8 – 40.2	40.3 – 43.4	43.5 – 45.0	45.1 – 48.2	> 48.2
TAM (W·kg^{-1})	< 1.8	1.8 – 1.9	2.0 – 2.1	2.2 – 2.4	2.5 – 2.6	2.7 – 2.8	> 2.8
MQMK (kg·min^{-1}·kg^{-1})	< 16.9	16.9 – 20.6	20.7 – 22.5	22.6 – 26.3	26.4 – 28.1	28.2 – 31.9	> 31.9
WAnT 30 (kg·min^{-1}·kg^{-1})	< 24.56	24.56 – 29.47	29.48 – 31.93	31.94 – 36.86	36.87 – 39.32	39.33 – 44.24	> 44.24
WAnT10 (kg·min^{-1}·kg^{-1})	< 29.54	29.54 – 33.91	33.92 – 36.10	36.11 – 40.49	40.50 – 42.68	42.69 – 47.06	> 47.06

Note. The model zone for women of endomorphic-mesomorphic somatotype is within the range of the highlighted cell –

Table 6. Model of functional preparedness of women 25-35 years of balanced somatotype

Indicators	Evaluation criteria						
	very low	low	below average	average	above average	high	very high
VO_{2max}(ml·min·kg^{-1})	< 35.6	35.6 – 38.7	38.8 – 40.2	40.3 – 43.4	43.5 – 45.0	45.1 – 48.2	> 48.2
TAM (W·kg^{-1})	< 1.8	1.8 – 1.9	2.0 – 2.1	2.2 – 2.4	2.5 – 2.6	2.7 – 2.8	> 2.8
MQMK (kg·min^{-1}·kg^{-1})	< 16.9	16.9 – 20.6	20.7 – 22.5	22.6 – 26.3	26.4 – 28.1	28.2 – 31.9	> 31.9
WAnT 30 (kg·min^{-1}·kg^{-1})	< 24.56	24.56 – 29.47	29.48 – 31.93	31.94 – 36.86	36.87 – 39.32	39.33 – 44.24	> 44.24
WAnT10 (kg·min^{-1}·kg^{-1})	< 29.54	29.54 – 33.91	33.92 – 36.10	36.11 – 40.49	40.50 – 42.68	42.69 – 47.06	> 47.06

Note. The model zone for women of balanced somatotype is within the range of the selected cell –

productivity of the body (WAnT 30, WAnT10) (table 5).

For women of balanced somatotype is characterized by the absence of high and low levels of functional preparedness (table 6).

Thus, it was found that women of different somatotypes differ in the level of development of energy supply of muscular activity.

Discussion

In the scientific literature published several versions of standards for indicators of functional preparedness for different countries [4,7]. But in these publications, the authors do not disclose what methodology they used to develop standards. The method used by us is based on the fact that the "average" level will correspond to about 34.0% of all values; levels "below average" and "above average" - about 17%; "high" and "low" level - about 13%; "very high" and "very low" levels - about 2% (see Table 1). In our opinion, this approach provides an objective assessment.

Comparing our standards with those of other authors, we found some differences. Thus Gerald F. Fletcher et al. [4] published updated standards for maximum oxygen consumption for the American Heart Association. According to their data, the norm of $VO_{2max\ rel.}$ for women 20-29 years there is a range of 36.0 ± 6.9 ml·min·kg^{-1}, and for women 30-39 years - 34.0 ± 6.2 ml·min·kg^{-1}. Such data differ significantly from the data obtained by us. In our opinion, there are several reasons for this. The authors combined into one category of persons aged 30-39 years, which in our opinion is impractical. According to Solodkov and Sologub [27], at the age of 35 involutionary processes in the body begin to predominate. Accordingly, VO_{2max} in women 36-39 years will be lower than in women 30-35 years. In addition, lower VO_{2max} standards for women in the United States may be associated with obesity in a significant percentage of the adult population. According to Ashleigh L. May [28], the percentage of obese people in the United States increased from 13% in 1960 to 36% in 2009. Regional differences also have an important influence, as O. Dulo points out in his works [29].

In addition to the VO_{2max} standards published in the scientific literature, there are several regulatory tables that are additions to training programs and additions to the instructions for electronic GPS devices for sports (including the Garmin Race Predictor). Such data have significant differences. In particular, the norm for women 25-35 years according to some data is 33-34 ml·min·kg^{-1}, and according to others - 38-40 ml·min·kg^{-1}. However, these appendices do not specify the authors of the criteria and the method by which they were developed.

W Larry Kenney et al. [8] note that information on functional preparedness only in terms of aerobic performance is incomplete. We did not find any standards of functional preparedness for the whole spectrum of energy supply modes of muscular activity (aerobic, anaerobic lactatic and anaerobic alactatic). There are studies where Ramírez-Vélez Robinson et al. [30] determined anaerobic productivity rates for Colombian adults. But the authors determined by WAnT 30 test other indicators, in particular PP - peak power. Therefore, it is impossible to compare such data with ours.

We have set standards of functional preparedness for girls 17-19 years of age according to indicators VO_{2max}, TAM, MQMK, WAnT 30 and WAnT 10 [13]. Furman et al. [14] developed standards of functional preparedness for women and men aged 20-22. The standards developed by us for women aged 25-35 expand the age range.

Models of functional preparedness for women of different somatotypes show significant differences in the level of functional preparedness in relation to women without consider somatotype. Therefore, when assessing functional preparedness should take into account the somatotype of the subjects. For example, if a woman of endomorphic somatotype shows a low level of $VO_{2max\ rel.}$, please keep in mind, that for endomorphs this level is the norm (Table 3). Conversely, for women of ectomorphic somatotype, the value of $VO_{2max\ rel.}$ corresponding to a high level is the norm (Table 4). Such data are confirmed by other researchers. Goran Spori et al. [18] prove the need to take into account the somatotype when assessing the professional abilities of sailors by aerobic and anaerobic tests. Kornienko et al. point to the need to take into account the somatotype by studying the anaerobic productivity of the organism. [31]. The authors note that the difference in anaerobic parameters within one age group in women of different somatotypes may be greater than the difference between men and women.

Conclusions

The author's method of developing standards allows to objectively assess the indicators of functional preparedness in women 25-35 years. The developed standards are based on modern experimental data and take into account the entire energy potential of man (aerobic, anaerobic lactatic and anaerobic alactatic). Standards of functional preparedness cannot be universal for different countries and even different regions of large countries.

Models of functional preparedness of women of different somatotypes show a significant difference from the standards set for women without consider somatotype. Somatotype should be taken into account when assessing indicators of functional preparedness. The models developed by us should be used in fitness clubs to adequately assess the physical fitness of women aged 25-35.

Acknowledgements

The authors financed the study on their own.

Conflict of interest

The authors state that there is no conflict of interest.

References

1. Ramos-Jiménez A, Chávez-Herrera R, Castro-Sosa S, Pérez-Hernández LC., Hernández Torres, Olivas-Dávila D. Body Shape, Image, and Composition as Predictors of Athlete's Performance. *Fitness Medicine*, 2016; 1(2): 19–36. https://doi.org/10.5772/65034
2. Davidson K, McNaughton L. Deep water running training and road running training improve VO_{2max} in untrained women. *J. Strength Cond. Res,* 2000; 14(2): 191– 195. https://doi.org/10.1519/00124278-200005000-00012
3. Astorino TA, Allen RP, Roberson DW, Jurancich M. Effect of High-Intensity Interval Training on Cardiovascular Function, Vo_2max, and Muscular Force. *Journal of Strength and Conditioning Research*, 2012; 26(1): 138–145. https://doi.org/10.1519/JSC.0b013e318218dd77
4. Gerald F. Fletcher, Gary J. Balady, Ezra A. Amsterdam, Bernard Chaitman, Robert Eckel, Jerome Fleg, Victor F. Froelicher, Arthur S. Leon, Ileana L. Piña, Roxanne Rodney, Denise A. Simons-Morton, Mark A. Williams, Terry BazzarreExercise Standards for Testing and Training. *American Heart Association Scientific Statements*. 2001;104:1694–1740. https://doi.org/10.1161/hc3901.095960
5. Furman YuM, Miroshnichenko VM, Drachuk SP. *Promising models of physical culture and health technologies in physical education of students of higher educational institutions*. Kyiv: Olympic literature; 2013. (In Ukrainian)
6. Apanasenko GL. *Selected articles about health*. Kiev: 2005. (In Russian)
7. Pałka MJ, Rogoziński A. Standards and predicted values of anaerobic threshold. *European Journal of Applied Physiology and Occupational Physiology*, 1986; 54: 643–646. https://doi.org/10.1007/BF00943354
8. W Larry Kenney, Jack H Wilmore, David L Costill. *Physiology of Sport and Exercise*. Human Kinetics; 2019.
9. Zupanr MF, Arata AW, Dawson LH, Wile AL, Paynz TL, Hannon ME. Wingate Anaerobic Test Peak Power and Anaerobic Capacity Classification for Male and Female Intercollesiate Athletes. *Journal of Strength and Conditioning Research*, 2009; 23(9): 2598–2604. https://doi.org/10.1519/JSC.0b013e3181b1b21b
10. Taylor NAS, Fullagar HHK, Sampson JA, Notley SR, Burley SD, Lee DS, Groeller H. Physiological employment standards for firefighters: Report 2: The physiological demands of performing physically demanding fire-fighting duties, *Journal of Occupational and Environmental Medicine*, 2015; 57(10): 1072–1082. https://doi.org/10.1097/JOM.0000000000000526
11. Carlson MJ, Jaenen SP. The development of a preselection physical fitness training program for Canadian special operations regiment applicants. *J Strength Cond Res*, 2012; 26: 2–14. https://doi.org/10.1519/JSC.0b013e31825d7ff9
12. Collingwood TR, Hoffman R, Smith J. Underlying Physical Fitness Factors for Performing Police Officer Physical Tasks. *J.Police Chief*, 2004; 71(3): 32–37.

13. Furman YuM, Miroshnichenko VM, Brezdeniuk OYu, Furman TYu. An estimation of aerobic and anaerobic productivity of an organism of youth aged 17-19 years old of Podilsk region. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports*, 2018; 22(3): 136–141. https://doi.org/10.15561/18189172.2018.0304
14. Furman Iu, Miroshnichenko V, Brezdeniuk O. An Estimation of Functional Preparedness of an Organism of Youth 20-22 Years Old. *Physical Education, Sport and Health Culture in Modern Society*, 2019; 2(46): 41–47. (in Ukrainian) https://doi.org/10.29038/2220-7481-2019-02-41-47
15. Furman Iu, Brezdeniuk O, Miroshnichenko V. Estimating functional fitness of teenagers aged 11-12 years by indices of aerobic and anaerobic productivity. *Sports Medicine and Physical Rehabilitation*, 2020; 1: 40–43. (in Ukrainian) https://doi.org/10.32652/spmed.2020.1.40-43
16. Woods CT, McKeown I, O'Sullivan M, Robertson S, Davids K. Theory to Practice: Performance Preparation Models in Contemporary High-Level Sport Guided by an Ecological Dynamics Framework. *Sports Med – Open,* 2020; 6(36). https://doi.org/10.1186/s40798-020-00268-5
17. MiroshnichenkoVM,FurmanYM,BohuslavskaVYu, Brezdeniuk OYu, Salnykova SV, Shvets OP, Boiko MO. Functional preparedness of women of the first period of mature age of different somatotypes. *Pedagogy of Physical Culture and Sports*, 2021;25(5):232–240. https://doi.org/10.15561/26649837.2021.0504
18. Goran Spori, Daniel Bok, Dinko Vuleta Jr., Dra`en Harasin. Impact of Body Composition on Performance in Fitness Tests among Personnel of the Croatian Navy. *Coll. Antropol.,* 2011; 35(2): 335–339.
19. Zimnitskaya R, Paramonova N, Jakubovskii D. Comparative analysis of functional state and working capacity on veloergometer of average training level women of age. *Sporto Mokslas*, 2017; 1(87): 32–37. https://doi.org/10.15823/sm.2017.5
20. Ryan-Stewart H, Faulkner J, Jobson S. The influence of somatotype on anaerobic performance. Barbosa TM (ed.) *PLOS ONE*. 2018;13(5): e0197761. https://doi.org/10.1371/journal.pone.0197761
21. Karpman VL, Gudkov IA, Koydikova GA. Indirect determination of maximum oxygen consumption of highly skilled athletes. *Theory and Practice of Physical Culture*, 1972; 1: 37–41. (in Russian)
22. Mackenzie B. PWC-170 Cycle Test. *Brianmac Sports Coache*, 2002: [updated 2021 Jul 8; cited 2022 Feb 23]. Available from: https://www.brianmac.co.uk/pwc170.htm
23. Conconi F, Ferrari M, Ziglio PG, Droghetti P, Codeca L. Determination of anaerobic threshold by a noninvasive field test in runners. *J. Appl. Physiol*, 1982; 52: 869–873. https://doi.org/10.1152/jappl.1982.52.4.869
24. Szögÿ A, Cherebeţiu G. Minutentest auf dem Fahrradergometer zur Bestimmung der anaeroben Kapazität [Minute test on the bicycle ergometer to determine anaerobic capacity]. *European Journal of Applied Physiology and Occupational Physiology*. 1974;33(2): 171–176. (In German) https://doi.org/10.1007/BF00449517
25. Bar-Or O. The Wingate anaerobic test: An update on methodology, reliability and validity. *Sports Medicine,* 1987; **4:** 381–394. https://doi.org/10.2165/00007256-198704060-00001
26. Carter J, Heath B. *Somatotyping – development and applications*. Cambridge University Press; 1990.
27. Solodkov AS, Sologub EB. *Human physiology. General. Sports. Age.* Moscow: Olimpiia Press; 2005. (In Russian)
28. May AL, Freedman D, Sherry B, Blanck HM. Obesity – United States, 1999–2010. *National Center for Chronic Disease Prevention and Health Promotion*, 2013;62(03):120–128.
29. Dulo OA, Furman UM. Comparative characteristics of aerobic productivity of girls with different somatotypes living in mountainous and lowland areas of Transcarpathia. *Biomedical and Biosocial Anthropology*, 2013; 20: 23–27. (in Ukrainian)
30. Ramírez-Vélez Robinson, López-Albán Carlos A., La Rotta-Villamizar Diego R., Romero-García Jesús A., Alonso-Martinez Alicia M., Izquierdo Mikel. Wingate Anaerobic Test Percentile Norms in Colombian Healthy Adults. *The Journal of Strength & Conditioning Research*, 2016; 30(1): 217–225. https://doi.org/10.1519/JSC.0000000000001054
31. Kornienko I, Son'kin V, Tambovtsev R, Panasyuk T. Development of the Energetics of Muscular Exercise with Age: Summary of a 30-Year Study: IV. The Development of the Energetics of Skeletal Muscles Depending on the Somatotype. *Human Physiology*, 2007; 33(6): 742–746. https://doi.org/10.1134/s036211970706012

Information about the authors:

Yuriy M. Furman; https://orcid.org/0000-0002-5206-7712; furman-dok@ukr.net; Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University; Vinnytsia, Ukraine.

Viacheslav M. Miroshnichenko; (Corresponding author); https://orcid.org/0000-0003-1139-4554; 29miroshnichenko@gmail.com; Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University; Vinnytsia, Ukraine.

Viktoriia Yu. Bohuslavska; https://orcid.org/0000-0003-3609-5518; Vik.bogusl@gmail.com; Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University; Vinnytsia, Ukraine.

Natalia V. Gavrylova; https://orcid.org/0000-0001-6209-5875; gavrilova.natal83@gmail.com; Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University; Vinnytsia, Ukraine.

Olexsandra Yu. Brezdeniuk; http://orcid.org/0000-0003-0844-8777; sandrikk86@gmail.com; Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University; Vinnytsia, Ukraine.

Svitlana V. Salnykova; https://orcid.org/0000-0003-4675-6105; aqvasveta@ukr.net; Vinnytsia Institute of Trade and Economics of Kyiv National University of Trade and Economics; Vinnytsia, Ukraine.

Viktoria V. Holovkina; http://orcid.org/0000-0001-9912-7754; akvavita72@gmail.com; Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University; Vinnytsia, Ukraine.

Igor P. Vypasniak; https://orcid.org/0000-0002-4192-1880; ihor.vypasniak@pnu.edu.ua; Department of Theory and Methods of Physical Culture; Vasyl Stefanyk Precarpathian National University; Ivano-Frankivsk, Ukraine.

Vasyl Y. Lutskyi; https://orcid.org/0000-0003-3940-1349; luckij55@gmail.com; Department of Theory and Methods of Physical Culture; Vasyl Stefanyk Precarpathian National University; Ivano-Frankivsk, Ukraine.

Cite this article as:
Furman YM , Miroshnichenko VM, Boguslavska VYu, Gavrilova NV , Brezdeniuk OYu, Salnykova SV , Holovkina VV, Vypasniak IP, Lutskyi VY. Modeling of functional preparedness of women 25-35 years of different somatotypes. *Pedagogy of Physical Culture and Sports*, 2022;26(2):118–125.
https://doi.org/10.15561/26649837.2022.0206

Received: 20.01.2022
Accepted: 06.04.2022; Published: 30.04.2022