FACTORS OF PHYSICAL DEVELOPMENT AND PHYSICAL EFFICIENCY OF STUDENTS FROM THE UNIVERSITY OF NATIONAL AND WORLD ECONOMY

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ABSTRACT

The aim of our research is to reveal the factor structure and to identify the main factors of the physical development and physical capacity of the studied population. Subject of the study are the factors of physical development and physical capacity of students. Object of the study are 41 student girls from UNWE.

The following research methods were used to solve the aim and tasks of the study: Theoretical analysis, anthropometry, sports-pedagogical testing, mathematical and statistical methods.

Six morpho-functional indicators were used to assess the physical development, including calculation of Body Mass Index (BMI). In order to determine the physical capacity of the students, 8 indicators were tested.

In order to process the results of the study, we used: Variable and Factor Analysis - To reveal the factor structure and to identify the main factors of physical development and physical capacity in the studied population. Correlation matrices are factorized by the main component method, followed by Varimax orthogonal rotation (Wainer, Braun, 1988).

The factor structure of the physical development and the physical capacity of the students studied by us from the University of National and World Economy is made up of 5 main factors, which in their entirety explain the high percentage of the initial variance of the studied phenomenon - 76.51%.

Key words: *students, physical development, physical capacity, factor structure*

INTRODUCTION

Physical education and sports in higher education system is seen as a subsystem of training, improving student health and preparation with the means of physical exercises and sports, and as an important factor for successful future professional realization. Improvement of this system is mainly associated with increasing the effectiveness of management of the educational process.

The role and importance of physical education and physical activity for the younger generation are incontestable. Above all, they neutralize hypodynamic to varying degrees and increase physical capacity. Enrichment of the motor skills (motor culture) of the person and the positive transfer of motor skills and habits with applied character, improve the health status and, respectively, positively influence the psycho-emotional state, professional realization and efficiency (Slanchev, 2014; Mavrudiev, 2018).

Physical development and physical capacity are important complex indicators that characterize the health status and reactivity of all age groups, in-

cluding students. Physical fitness is a very accurate and objective indicator that can be used to evaluate the effectiveness of training in physical education and sports, health status, and last but not least affect the future professional realization, which is why the search of the scientific community in these problems, especially in the context of the ever-increasing motor deficit of modern society, continue and do not lose their relevance. In our opinion, the identification of the main factors of physical development would help to improve the physical education process for students.

The use of factor analysis allows to determine the most important for each set of features, which are grouped in the so-called factors, reveal the priority sides of the factor structure of physical development and physical capacity, which is why it is extremely widely used in sports science, as in sportsmanship (Boshkova, 2007; Boshkova, Boshkov, 2017; Bonova, Labros, 2018; Borukova, 2018; Hristova, 2003; Tzarova, 2013) and physical education in the educational system (Mavrudieva, 2008; Mavrudieva et al, 2017; Borukova, 2019; Kasabova, 2011; Tzarova-Vasileva, 2012, 2017; Mavrudiev, 2018).

The aim of our research is to discovery the factor structure and the identification of the main factors of physical development and the physical capacity of the studied population.

METHODOLOGY

The subject of research are the factors of physical development and physical capacity of students. Object of research are total of 41 female students from the UNWE.

The following research methods were used to solve the purpose and tasks of the research: *Theoretical analysis, anthropometry, sports-pedagogical testing, mathematical-statistical methods.*

6 morpho-functional indicators were used to assess physical development, including and the calculated (Index 4) Body Mass Index (BMI). To determine the physical fitness of students during the 2017/18 academic year, testing was performed on 8 indicators (Petkova, Kvartirnikova, 1985; Evrofit, 1992; Makenzi, 2011) (Table 1). In processing the results of the study, the following has been applied: *Descriptive statistic and factor analysis* - To discover

the factor structure and identify the main factors of physical development and physical capacity in the population studied. Correlation matrices are factorized by the principal component method, followed by Varimax orthogonal rotation (Wainer, Braun, 1988; Gigova, 2002). The following criteria and parameters are taken into account when identifying and drawing the factors: Percentage of the variance of the studied phenomenon (α^2) explained by each factor; the degree of detection (manifestation) of the corresponding trait in the common factor structure, the information of which is given by the values of h^2 ; the factor weight of each indicator of a given factor and its direction (sign), which reveal the strength and nature of the relationship (positive or negative) between the indicators of the individual factor.

RESULTS

The results from the descriptive statistic of the observed indexes of physical fitness (Table 1 and Table 2) show that the values have a normal distribution, and the researched students are relatively homogeneous as regards the characteristics these indexes provide information for.

Table 1. Mean values and variability of the indexes of physical development of the UNWE students - women

№	VARIABLES	X	S	V	min	max	As	Ex
1.	Height	167,98	6,57	3,91	155	179	-0,22	-1,16
2.	Weight	58,54	9,53	16,29	42	78	0,31	-0,67
3.	Body mass index (BMI)	20,71	2,97	14,33	14,88	29,69	0,60	0,75
4.	Chest circumference – respiratory difference	6,61	1,73	26,18	3	10	-0,18	-0,45
5.	Hand dynamometer – convenient	23,95	5,64	23,54	11	38	0,18	0,04
6.	Hand dynamometer - uncomfortable	21,07	6,22	29,53	10	38	0,35	0,64

Table 2. Mean values and variability of the indexes of physical fitness of the UNWE students - women

№	VARIABLES	X	S	V	min	max	As	Ex
7.	Sprint 20 m	4.02	0.33	8.26	4.75	3.53	0.39	-0.91
8.	Shuttle 10 x 5 m	22.33	1.93	8.64	27	18.9	0.24	-0.49
9.	Long jump – from static position	1.41	0.22	15.92	0.9	1.85	-0.33	-0.35
10.	Throwing of tight ball – from sitting	1.89	0.36	19.33	1.2	2.6	0.11	-0.60
11.	Throwing of tight ball – from lying	1.58	0.48	30.32	0.7	2.9	0.38	0.10
12.	Abdominal presses	16.49	3.44	20.84	10	25	0.36	-0.26
13.	Flexibility	101.90	6.27	6.15	91	118	0.44	0.14
14.	Flamingo	2.88	2.18	75.80	7	0	0.50	-0.77

For the purposes of the study, we applied factor analysis. The first factor (Figure 1) explains 20.69% and is determined by 4 major items that have high

factor loading. It can be identified as 'the speed and the explosive power of the lower limbs, which are positively affected by equilibrium stability.

Table 3. Factor structure of physical development and physical capacity of UNWE students - women

Nº	Parameters	I	II	III	IV	V	h ²	1 - h ²
1.	Height	0,070	0,401	-0,092	0,729	0,187	0,741	0,259
2.	Weight	0,312	0,885	0,068	0,045	0,164	0,914	0,086
3.	Body mass index (BMI)	0,319	0,795	0,114	-0,344	0,065	0,870	0,130
4.	Chest circumference – respiratory difference	-0,208	0,018	0,094	0,005	0,832	0,744	0,256
5.	Hand dynamometer – convenient	-0,129	0,114	0,902	0,090	0,135	0,870	0,130
6.	Hand dynamometer - uncomfortable	-0,191	0,079	0,922	0,071	0,181	0,930	0,070
7.	Sprint 20 m	0,869	0,043	-0,159	-0,051	-0,221	0,834	0,166
8.	Shuttle 10 x 5 m	0,814	-0,074	-0,127	-0,145	-0,226	0,757	0,243
9.	Long jump – from static position	-0,824	-0,182	0,102	0,133	0,012	0,740	0,260
10.	Throwing of tight ball – from sitting	-0,178	0,782	0,187	0,274	-0,031	0,754	0,246
11.	Throwing of tight ball – from lying	-0,352	0,691	-0,173	0,246	-0,302	0,784	0,216
12.	Abdominal presses	-0,100	-0,072	0,199	0,755	-0,106	0,636	0,364
13.	Flexibility	-0,143	-0,013	0,724	-0,013	-0,467	0,762	0,238
14.	Flamingo	0,559	-0,001	-0,101	0,165	0,152	0,373	0,627
Σα		20,69	19,51	17,07	10,29	8,95	76,51 %	

The first factor (Figure 1) explains 20.69% and is determined by 4 major items that have high factor loading. It can be identified as the speed and the explosive power of the lower limbs, which are positively affected by equilibrium stability.

Figure 1. Relative proportions of the explained from the deductive factor's initial variance of the physical development and physical capacity of the students of UNWE - women **Figure 2.** Factor structure of the physical development and physical capacity of the UNWE women students – I and II factors

The second factor (19.51%) revealed the importance of body mass and its relationship with the manifestations of the explosive force of the upper limbs (fig. 2).

The third factor (17.07%) is largely a morphofunc-

tional factor. Determines the place in the factor structure of physical development and the physical capacity of the static force of the upper limbs (indicators 5 and 6 - factor loadings 0,902 and 0,922) and the flexibility of the body (indicator 13 - factor loading 0,724) - Figure 3.

Figure 3. Factor structure of the physical development and physical capacity of the UNWE women students – III, IV and V factors

The fourth factor (10.29%) has high factor loading in it by two of the studied traits - No. 12 (abdominal presses - factor weight 0.755) and No. 1 (height - factor loading 0.729). The factor can be identified as “the explosive force of the abdominal muscles, which is positively correlated with the height of future economists” (Figure 3).

The fifth factor (8.95%) revealed the contribution to the factor structure of physical development and the physical capacity of the functional capacity of the chest (Figure 3).

CONCLUSIONS

The factor structure of the physical development and the physical capacity of the students studied by us from the University of National and World Economy is made up of 5 main factors, which in their entirety explain the high percentage of the initial variance of the studied phenomenon - 76.51%.

The first factor explains 20.69% and is defined by 4 major items that have high factor loadings and identifies as “the speed and explosive power of the lower limbs, which are positively affected by their equilibrium stability”.

The second factor (19.51%) revealed the importance of body weight and its relationship with the manifestations of the explosive power of the upper limbs. The third factor (17.07%) is largely a morphofun-

ctional factor. Determines the place in the factor structure of the physical development and the physical capacity of the static force of the upper limbs and the flexibility of the body.

The fourth factor (10.29%) can be identified as “the explosive force of abdominal muscles that is positively correlated with the height of future economists”.

The fifth factor (8.95%) reveals the contribution to the factor structure of physical development and the physical capacity of the functional capacity of the chest.

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