



PHYSIOLOGICAL CHARACTERISTICS OF YOUNG PEOPLE IN THE ABSENCE OF MANDATORY PHYSICAL ACTIVITY REQUIRED AT THE UNIVERSITY

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Abstract

The purpose of the study was to determine the parameters of the physiological characteristics of young men with different somatotypes, which they achieved by performing physical activity in the conditions of the Covid-19 quarantine.

Materials and methods. 39 young men aged 17.6 ± 0.5 , who had no restrictions in the use of different amounts of physical activity and belonged to different somatotypes, took part in the study. Somatotypes were diagnosed using the Shtefko-Ostrovsky method in the modification of S. Darskaja. To obtain the necessary data, well-known functional tests were used to establish blood pressure, heart rate in various states, vital capacity, vital capacity index, index maximum isometric strength, and Robinson index. We evaluated the parameters of these characteristics in representatives of each somatotype during the academic year and compared these parameters in different somatotypes. In the latter case, the results at the beginning (January) and at the end (May-June) of the study were used; they lasted for one academic year.

Results. At the beginning, and to an even greater extent at the end of the school year, the parameters of the studied characteristics in the representatives of the existing somatotypes differed among themselves (p at the level from 0.05 to 0.0001). The volumes and conditions of physical activity used during the academic year led to the deterioration of the physiological characteristics of all young men. However, there were peculiarities caused by belonging to a certain somatotype.

Conclusions. Establishing the specifics of changes in the parameters of the physiological characteristics of young freshmen, taking into account their somatotypes, is an important task for the modernization of physical education in a higher education institution. The obtained data contribute to the individualization of the substantive and normative foundations of physical education of young people, using for this purpose data on the manifestation and change of parameters in various characteristics, including physiological ones.

Keywords: physiological characteristics, differentiation, students, physical activity, Covid-19.

Introduction

The physical activity of students during their free time from studying is today considered the most effective means of solving physical education tasks in universities (Get Active, 2020; Global action plan on physical activity 2018-2030;

Physical education, 2018). One of the reasons is that the number of physical education classes during the week, which are provided by the programs of the first and second years of study at the universities of Ukraine, does not provide the necessary effect in achieving the goal (Sliusarchuk et al., 2022; Chernenko et al., 2020; Solohubova et al., 2020). Another, but no less important, the reason is related to the peculiarities of the educational process in universities caused by the Covid-19 pandemic (Romero-Blanco et al., 2020; López-Valenciano et al., 2021; Piestrzyński et al., 2021).

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Taking into account the above, we note the actualization of the problem of students achieving a high level of functional characteristics during their studies at the university. This is because the state of solving such a task today differs from the necessary one, that is, it does not contribute to the qualitative performance of professional duties by young people in the near future and various types of activities in everyday life, including for maintaining health and ensuring a high quality of life (Institute of Medicine, 2013; Schmidt & Lee, 2013; Abrantes et al., 2022).

The conducted analysis revealed that today there is not enough information about the peculiarities of the physiological characteristics of students, and this complicates the development of new approaches and ways to improve the existing situation. One of the effective ones is the determination of the individual trajectory of achieving the goal, that is, the design of an educational route for each specific student, the implementation of which allows him to achieve a positive result (Banakh, 2019). Designing such an effective route is impossible without taking into account the individual characteristics that characterize the physiological characteristics of students (Wilmore, Costill, & Kenney, 2022). One of the reasons for such features is belonging to a certain somatotype, as evidenced by the results of researchers (Iedynak et al., 2017). According to other results obtained (Brtková et al., 2014; Kvintová & Sigmund, 2016; Iedynak et al., 2021), taking into account the somatotype of children and youth is effective in the implementation of an individual approach in the process of physical education. Taking into account all the above, they noted the need to conduct research in a certain direction.

Materials and methods

Study participants

39 young men took part in the study, the age of each was within the range of 17.6 ± 0.5 years, they had no restrictions in the use of various amounts of physical activity, but differed in somatotypes. So, 8 had asthenic somatotype (A-type), 12 – had thoracic somatotype (T-type), 10 – were muscular (M-type), and 9 – were digestive (D-type). The main attention was focused on obtaining parameters that reflected the state of functional capabilities of various body systems. The results were recorded during one calendar year, namely at the beginning of the study (January) and at the end of the study (May-June).

Study organization

Somatotypes were diagnosed at the beginning of the experiment, the Shtefko-Ostrovsky scheme was used in the modification of S. Darskaja. Based on the basic characteristics of a very similar to it, there is the Heath-Carter scheme, which is most often used by researchers from Europe and the United States. Selection Shtefko-Ostrovsky scheme causes the possibility to establish a certain trend, especially manifestations and changes of physical readiness in comparison with the data of other researchers (Ashmore, 2005; Sands, 2012; Iedynak et al., 2021).

The parameters of the characteristics reflecting the activity of the cardiovascular, respiratory, and neuromuscular

systems of young men were studied. Used well-known functional tests recommended by researchers (American College of Sports Medicine, 2017; Bar-Or & Rowland, 2004; Wilmore et al., 2022). Determined: blood pressure (systolic – SBP, diastolic – DBP); heart rate (HR) in different states (at rest, after exercising, during recovery); vital capacity (VC); vital capacity index ($VCI = VC / \text{body mass}$), index maximum isometric strength ($IMIS = \text{maximum isometric strength} / \text{body mass}$); Robinson index ($RI = SBP \times HR / 100$).

All requirements were met during the tests. In this case, HR reflected the state of the heart, and together with blood pressure and RI – the state of the cardiovascular system at rest; the value of VC indicated the ability of the lungs to receive oxygen, the value of VCI – the state of the respiratory system in terms of a full supply of oxygen to the body. The value of IMIS allowed the establishment of the state of development of skeletal muscles of young men. This indirectly indicates the state of excessive accumulation in the muscles of structural and energy potentials that increase their working capacity. We used certified equipment: to determine the blood pressure – BP AG1-30 Microlife, to determine the IMIS – handgrip Camry dynamometer, to determine the VC and VCI – Cardio-Spiro, NDD EasyOne Plus System 2000-2 spirometer. VCI and IMIS provided for the determination of body mass, for which OMRON BF 511 was used.

Data for the study were quantitative values of functional samples. They were established at the beginning and the end of the study, then compared with each other first in each somatotype, then in different somatotypes. So determined the increase or decrease in the value of a particular functional characteristic or its manifestation at the achieved level.

The study was planned and carried out following the principles of bioethics set forth by the World Medical Association (WMA-2013) in the Helsinki Declaration “Ethical Principles of Medical Research Involving Humans” and UNESCO in the “General Declaration on Bioethics and Human Rights”. In this regard, the requirements of the principles of voluntariness, anonymity, and trust were met; all young men provided written informed consent to participate in the study. The study protocol was approved by the Ethical Committee of Kremenets Taras Shevchenko Regional Academy of Humanities and Pedagogy.

Statistical analysis

All statistical analyzes were performed using SPSS Version 21. For each assessment, the following calculations were performed: arithmetic mean (M), standard deviation (SD), and Kolmogorov-Smirnov Test (KS). The latter made it possible to establish a normal distribution of individual values in each sample of young men. Therefore, when comparing two means, Student’s t-test was used for related and unrelated samples; the 0.05, 0.01, 0.001 levels of probability were used to indicate statistical significance (Vincent, 2005).

Results

Before starting the analysis of the data obtained at the beginning of the study, the conformity of the values of each physiological characteristic to the normal distribution was

determined. For this, the K-S Test was applied, and the results obtained showed a normal distribution of values in all indicators (Table 1).

A comparison of the parameters of young men with different somatotypes revealed large differences between them. The largest number was found in representatives of the T-type. When comparing their results with those obtained by representatives of other somatotypes, it was noted that in each pair of such samples, the parameters of 6 out of all 9 characteristics differed from each other by a statistically significant amount (Table 2).

But there were peculiarities: in T-type young men, the parameters in all 6 indicators were better than the parameters of A-type and D-type young men; parameters of HR after exercise, VCI and RI of T-type young men were better, but the parameters of VC, HR at rest and SBP, on the contrary, were significantly worse than those of M-type young men.

At the same time, all parameters that differed by a statistically significant value when compared were better in M-type boys than in A- and D-type boys. Thus, in M-type there was greater VC and lower HR at rest than in A-type, as well as D-type; a lower value of HR is evidence of a more

Table 1. Results of young men with different somatotypes at the beginning of the study

N	The name of the parameter	On beginning				K-S, p
		M ₁	SD	Min	Max	
A-type (n=8)						
1	VC, ml	2767.50	326.00	2380.0	3340.0	>0.20
2	HR at rest, bpm ⁻¹	79.75	2.31	77.0	84.0	>0.20
3	HR after loading, bpm ⁻¹	124.13	4.42	116.0	130.0	>0.20
4	SBP, mmHg	120.00	4.00	114.0	126.0	>0.20
5	DBP, mmHg	70.88	2.36	66.0	74.0	>0.20
6	Recovery time after load, sec	140.50	8.93	120.0	150.0	>0.20
7	VCI, ml·kg ⁻¹	50.00	3.78	44.0	54.0	>0.20
8	IMIS, %	50.50	3.34	46.0	54.0	>0.20
9	RI, conditional units	96.50	3.63	89.0	102.0	>0.20
T-type (n=12)						
1	VC, ml	3070.00	156.90	2750.0	3250.0	>0.20
2	HR at rest, bpm ⁻¹	77.50	3.75	73.0	85.0	>0.20
3	HR after loading, bpm ⁻¹	117.42	7.55	109.0	130.0	>0.20
4	SBP, mmHg	122.50	4.25	116.0	130.0	>0.20
5	DBP, mmHg	76.25	3.25	72.0	82.0	>0.20
6	Recovery time after load, sec	143.58	11.12	120.0	160.0	>0.20
7	VCI, ml·kg ⁻¹	57.25	4.85	46.0	64.0	>0.20
8	IMIS, %	56.75	3.47	50.0	62.0	>0.20
9	RI, conditional units	81.25	5.29	72.0	90.0	>0.20
M-type (n=10)						
1	VC, ml	3332.00	223.89	3000.0	3700.0	>0.20
2	HR at rest, bpm ⁻¹	74.20	2.97	68.0	77.0	>0.20
3	HR after loading, bpm ⁻¹	128.00	7.10	118.0	140.0	>0.20
4	SBP, mmHg	124.10	5.57	117.0	131.0	>0.20
5	DBP, mmHg	76.40	3.27	70.0	81.0	>0.20
6	Recovery time after load, sec	131.50	8.58	116.0	142.0	>0.20
7	VCI, ml·kg ⁻¹	50.60	3.66	45.0	58.0	>0.20
8	IMIS, %	57.2	4.39	49.0	63.0	>0.20
9	RI, conditional units	96.80	6.07	90.0	109.0	>0.20
D-type (n=9)						
1	VC, ml	2838.89	236.88	2550.0	3150.0	>0.20
2	HR at rest, bpm ⁻¹	80.00	2.55	75.0	84.0	>0.20
3	HR after loading, bpm ⁻¹	133.11	9.79	116.0	145.0	>0.20
4	SBP, mmHg	125.44	6.58	118.0	139.0	>0.20
5	DBP, mmHg	80.00	2.50	76.0	84.0	>0.20
6	Recovery time after load, sec	139.56	12.99	116.0	152.0	>0.20
7	VCI, ml·kg ⁻¹	42.78	3.42	40.0	50.0	<0.15
8	IMIS, %	49.78	2.86	46.0	56.0	>0.20
9	RI, conditional units	98.44	5.83	90.0	106.0	>0.20

Note: a reliably significant difference between the two means is highlighted in color

Table 2. Differences in results of young men with different somatotypes at the beginning of the study

Result (points)	The name of the parameter								
	1	2	3	4	5	6	7	8	9
A – T									
t	-2.791	1.507	2.256	-1.318	-4.011	-.654	-3.560	-4.007	7.085
F	4.317	2.630	2.915	1.131	1.903	1.552	1.643	1.079	2.132
p	0.012	0.149	0.037	0.204	0.001	0.521	0.002	0.001	0.000
A – M									
t	-4.354	4.325	-1.344	-1.749	-4.006	2.172	-0.341	-3.562	-0.123
F	2.120	1.651	2.580	1.937	1.929	1.083	1.068	1.731	2.803
p	0.000	0.001	0.198	0.099	0.001	0.045	0.738	0.003	0.904
A – D									
t	-0.521	-0.211	-2.382	-2.027	-7.715	0.172	4.138	0.481	-0.812
F	1.894	1.213	4.902	2.705	1.125	2.117	1.222	1.360	2.589
p	0.610	0.836	0.038	0.061	0.000	0.865	0.000	0.638	0.429
T – M									
t	-3.221	2.250	-3.362	-0.764	-0.107	2.806	3.569	-0.269	-6.421
F	2.036	1.593	1.130	1.713	1.014	1.681	1.755	.791	1.315
p	0.004	0.036	0.003	0.454	0.916	0.011	0.002	10.604	0.000
T – D									
t	2.693	-1.718	-4.156	-1.247	-2.875	0.765	7.627	4.900	-7.055
F	2.279	2.168	1.682	2.392	1.691	1.364	2.008	1.467	1.214
p	0.014	0.102	0.000	0.228	0.010	0.454	0.000	0.000	0.000
M – D									
t	4.664	-4.537	-1.313	-0.483	-2.670	-1.611	4.799	4.307	-0.601
F	1.119	1.361	1.900	1.397	1.714	2.293	1.144	2.354	1.083
p	0.000	0.000	0.207	0.636	0.016	0.126	0.000	0.001	0.556

Note: a reliably significant difference between the two means is highlighted in color

efficient activity of the heart at rest. In addition, VCI and IMIS parameters were higher in M-type young men than in D-type young men, i.e., evidenced a better development of the respiratory system in terms of a full supply of oxygen to the body and the development of the muscular system.

When comparing the results of A- and D-type young men, it was found that HR parameters after exercise were better in the former, as they were 124.13 ± 4.42 bpm⁻¹ and 133.11 ± 9.79 bpm⁻¹, respectively ($t = -2.382$; $p < 0.05$), and also VCI – 50 ± 3.78 and 42.78 ± 3.42 ml•kg⁻¹ ($t = 4.138$; $p < 0.0001$).

At the end of the academic year, the parameters of young men of each somatotype showed a similar trend and certain features. The tendency was that during the academic year, there were changes in the parameters of the studied indicators. It was found in all somatotypes, but there were certain peculiarities. Thus, in young men with A-type, a statistically significant change was found in the parameters of 4 out of all 9 studied characteristics, in young men with T-type – 3 characteristics, M- and D-types – 2 and 5 characteristics, respectively (Table 3). At the same time, in A-type, this referred to the state of activity of the cardiovascular system at rest (HR at rest and HR after exercise), under the influence

of physical exertion (RI) and neuromuscular system, namely indicates the state of excessive accumulation in the muscles of structural and energy potentials that increase their working capacity (IMIS). Changes in all these indicators indicated a negative trend, i.e. reflected a deterioration in the state of functioning of the specified systems.

In young men with T-type, at the end of the study, HR after exercise was higher, on average, by 11.08 bpm⁻¹ than at the beginning ($t = -7.571$; $p < 0.0001$). The same applied to the recovery of the body after exercising, because at the beginning of the study, the average result was 143.58 ± 11.12 seconds, and at the end of the study – 148.08 ± 7.63 ($t = -2.642$; $p < 0.05$). The state indicates the state of excessive accumulation in the muscles of structural and energy potentials that increase their working capacity (IMIS) at the beginning of the academic year was at the level of $56.72 \pm 3.47\%$, at the end – only $52.17 \pm 2.86\%$ ($t = 5.093$; $p < 0.0001$).

In M-type young men, as well as in T-type, HR parameters after exercise and recovery of the body after exercising worsened during the academic year. Only the achieved values differed, because the HR after exercise increased by 8.1 bpm⁻¹, compared to the parameters at the beginning of the study ($t = -16.809$; $p < 0.0001$); the recovery

Table 3. Results of young men with different somatotypes at the end of the study and the statistical reliability of their change

N	The name of the parameter	At the end				(M ₁ – M ₂)	
		M ₂	SD	Min	Max	t	p
A-type (n=8)							
1	VC, ml	2645.0	286.65	2380.0	3150.0	0.1615	0.876
2	HR at rest, bpm ⁻¹	85.875	1.1260	84.0	87.0	-11.158	0.000
3	HR after loading, bpm ⁻¹	137.125	3.3991	131.0	140.0	-17.197	0.000
4	SBP, mmHg	120.75	2.96	116.0	125.0	-1.528	0.171
5	DBP, mmHg	71.0	2.07	69.0	75.0	-0.174	0.867
6	Recovery time after load, sec	142.88	7.00	127.0	148.0	-2.040	0.081
7	VCI, ml·kg ⁻¹	47.06	5.82	35.50	54.50	1.355	0.224
8	IMIS, %	49.38	2.62	46.00	52.0	3.813	0.007
9	RI, conditional units	105.18	1.98	102.70	108.40	-5.174	0.001
T-type (n=12)							
1	VC, ml	2991.67	92.52	2800.0	3100.0	2.065	0.063
2	HR at rest, bpm ⁻¹	78.08	2.91	73.0	82.0	2.065	0.349
3	HR after loading, bpm ⁻¹	128.50	8.30	117.0	142.0	-7.571	0.000
4	SBP, mmHg	123.5	3.53	119.0	128.0	-1.509	0.160
5	DBP, mmHg	76.75	2.42	73.0	81.0	-1.149	0.275
6	Recovery time after load, sec	148.08	7.63	132.0	158.0	-2.642	0.023
7	VCI, ml·kg ⁻¹	56.00	3.57	47.0	61.0	2.068	0.063
8	IMIS, %	52.17	2.86	48.0	57.0	5.093	0.000
9	RI, conditional units	83.00	4.11	77.0	88.0	-1.473	0.169
M-type (n=10)							
1	VC, ml	3276.00	162.70	3000.000	3540.000	1.292	0.228
2	HR at rest, bpm ⁻¹	75.60	1.65	73.000	78.000	-2.040	0.072
3	HR after loading, bpm ⁻¹	136.10	6.47	127.000	146.000	-16.809	0.000
4	SBP, mmHg	123.80	5.71	116.000	132.000	0.410	0.691
5	DBP, mmHg	77.00	2.71	72.000	80.000	-1.616	0.141
6	Recovery time after load, sec	137.00	4.94	129.000	144.000	-2.811	0.020
7	VCI, ml·kg ⁻¹	49.50	2.07	46.000	54.000	2.079	0.129
8	IMIS, %	55.90	2.47	50.000	58.000	1.647	0.134
9	RI, conditional units	96.00	4.00	91.000	104.000	1.037	0.327
D-type (n=9)							
1	VC, ml	2654.44	188.89	2400.000	2950.000	8.829	0.000
2	HR at rest, bpm ⁻¹	81.22	1.64	78.000	83.000	-1.976	0.084
3	HR after loading, bpm ⁻¹	145.00	6.60	134.000	152.000	-8.686	0.000
4	SBP, mmHg	125.00	4.18	120.000	134.000	0.457	0.660
5	DBP, mmHg	81.11	2.52	78.000	86.000	-1.754	0.117
6	Recovery time after load, sec	147.44	12.71	124.000	160.000	-12.909	0.000
7	VCI, ml·kg ⁻¹	40.56	3.43	38.000	47.000	8.000	0.000
8	IMIS, %	46.89	2.42	45.000	53.000	6.353	0.000
9	RI, conditional units	100.44	3.32	95.000	104.000	-1.732	0.122

Note: a reliably significant difference between the two means is highlighted in color

time of the body after exercising increased by 5.5 seconds (t=-2.811; p < 0.02).

But the largest number of functional characteristics, the parameters of which changed during the school year, were found in D-type young men. In particular, their VC decreased by 184.45 ml, HR increased by 12.0 bpm⁻¹ after exercise, and the recovery time of the body after exercising increased by 7.88 seconds (p < 0.0001). In addition, VCI parameters decreased by 2.22 ml·kg⁻¹, and IMIS parameters – by 2.89% in D-type young men. The results in both cases showed

a decrease in the ability of the body to supply oxygen to the systems involved in physical activity and the ability of skeletal muscles to perform their main function.

The identified changes led to an increase in discrepancies between the parameters achieved by young men with a certain somatotype at the end of the school year (Table 4). Yes, in the T-type, the number of such characteristics was 7 out of all 9 studied (at the beginning – 6 each), but there were also peculiarities: all the singled-out parameters were better in them than in the A-type, D-type, and 3 (HR after

Table 4. Differences in results of young men with different somatotypes at the end of the study

Result (points)	The name of the parameter								
	1	2	3	4	5	6	7	8	9
	A – T								
t	-3.939	7.178	2.770	-1.814	-5.505	-1.543	-4.277	-2.213	14.109
F	9.599	6.659	5.956	1.418	1.363	1.190	2.664	1.192	4.314
p	0.001	0.000	0.013	0.086	0.000	0.140	0.000	0.040	0.000
	A – M								
t	-5.900	15.021	.404	-1.365	-5.164	2.088	-1.238	-5.428	-5.909
F	3.104	2.138	3.625	3.713	1.711	2.004	7.925	1.121	4.082
p	0.000	0.000	0.692	0.191	0.000	0.053	0.234	0.000	0.000
	A – D								
t	6.992	-6.757	-2.325	.164	-2.865	-1.877	7.026	9.700	-2.043
F	1.293	1.272	1.224	1.583	1.855	10.291	14.033	2.957	1.548
p	0.000	0.000	0.035	0.872	0.012	0.080	0.000	0.000	0.059
	T – M								
t	-5.151	2.395	-2.357	-.151	-.229	3.945	5.081	-3.243	-7.474
F	3.092	3.116	1.643	2.619	1.256	2.384	2.975	.1336	1.057
p	0.000	0.027	0.029	0.881	0.821	0.001	0.000	0.004	0.000
	T – D								
t	5.411	-2.900	-4.907	-0.891	-4.018	.144	9.998	4.465	-10.413
F	4.168	3.135	1.582	1.405	1.089	2.772	1.081	1.391	1.533
p	0.000	0.009	0.000	0.384	0.001	0.877	0.000	0.000	0.000
	M – D								
t	7.708	-7.442	-2.966	-0.517	-3.412	-2.410	6.967	8.015	-2.617
F	1.348	1.006	1.039	1.864	1.153	6.608	2.753	1.041	1.451
p	0.000	0.000	0.009	0.612	0.003	0.280	0.000	0.000	0.018

Note: a reliably significant difference between the two means is highlighted in color

exercise, VCI, and RI) – than in M-type. In representatives of the M-type, 5 parameters were better than in the A-type (the rest did not differ in magnitude) and 8 parameters were better than in the D-type, except for SBP, which did not differ in them from the age norm. As for young men of A- and D-types, the parameters of HR after exercise, VCI and IMIS were better in the former, and VC and HR at rest, on the contrary, in the latter.

Discussion

One of the main tasks of physical education at the university involves students achieving a high level of functional characteristics. But the realities are such that the parameters of these characteristics during the entire period of their training differ from the necessary ones (Banakh, 2019; Piestrzyński et al., 2021). In a practical aspect, the existing condition to some extent does not allow the university graduate to perform his professional duties at the proper level, as well as various types of activities in the household, which contribute to the maintenance of his health and ensure a high quality of life (Schmidt & Lee, 2013; Abrantes et al., 2022). In connection with this and other existing shortcomings of physical education at the university (López-Valenciano et al., 2021; Piestrzyński et al., 2021), the problem of determining an individual trajectory for each specific student for his physical activity, which is implemented in different, but in certain forms, and contributes to achieving a positive result (Banakh, 2019). Thus, the effectiveness of considering

individual characteristics inherent in representatives of existing somatotypes is emphasized (Brtková et al., 2014; Kvintová & Sigmund, 2016).

Taking into account the above, an experimental study was conducted, which already at the beginning proved the existence of differences in the parameters of the physiological characteristics of young men with different somatotypes. In the end, there were also peculiarities, and they related to the unequal number of parameters and their values in the representatives of the existing somatotypes. The above was associated with a complex of reasons, one of the common ones being the unequal pace of morpho-functional maturation. Thus, representatives of the T-type lag behind the M-type, on average, by six months, representatives of the A-type – by one year, and representatives of the D-type – by one and a half to two years (Ashmore, 2005; Iedynak et al., 2021). This feature affects the manifestation of various characteristics, including physiological ones (Kvintová & Sigmund, 2016; Wilmore, Costill & Kenney, 2022). In this regard, it is noted (Katzmarzyk & Silva, 2013) that the development of the organism's capabilities largely depends on the morphological and functional maturation of the organs and systems involved in the manifestation of a certain characteristic. This is consistent with modern ideas about somatotype as an external reflection of the human constitution (Carter & Heath, 1990; Iedynak et al., 2021). It (constitution) is considered as the integrity of morpho-functional properties that are inherited and acquired, are relatively stable over time, associated with the pace of individual development, the

features of the body's reactivity, the style of activity and the material prerequisites of human abilities (Carter & Heath, 1990; Malina, et al, 2004; Frisancho, 2008; Stewart et al., 2014). In this regard, the different characteristics of each young person are marked by the peculiarities of the parameters, but when creating samples based on the "somatotype" feature, we can immediately see a certain trend in the manifestation of these parameters. According to the obtained results, the physical activity used during the academic year was one of the important reasons for the deterioration of the parameters of the studied characteristics. 2 out of 9 young men with M-type had such characteristics, 3 young men with T-type, 4 with A-type, and 5 with D-type. In this regard, it was noted that the Covid-19 epidemic caused a decrease in the amount of physical activity of young people, primarily due to the lack of mandatory physical education classes in the educational institution (Piestrzyński et al, 2021). Young people's use of physical activity other than the required amount indicated a lack of internal motivation to systematically implement such activity in their free time from school (Wiium & Säfvenbom, 2019; Coimbra et al., 2021). At the same time, the most unfavorable trend was found in D-type, then in A- and T-types, and the smallest was in M-type.

Consolidating the results in all somatotypes, the following was noted: the best values of HR after exercise, VCI and RI were in young men with T-type, and the values of the rest of the characteristics, except for SBP and DBP, were better in young men with M-type. The peculiarities of blood pressure parameters were not established, because according to the researchers, they were within the age norm in all young men (Wilmore et al., 2022). As for A-type representatives, the parameters of HR after exercise, VCI and RI were better in them than in young men with D-type; in the latter, the parameters of VC and HR at rest were better, and the parameters of other characteristics were practically the same. The obtained data to some extent confirm the results of other researchers (Gutnik et al., 2015; Iedynak et al., 2021).

The identified features should be considered in practical activities, in particular, when modeling the achievements of young people over a certain period, during the analysis of achievements, taking into account the features characteristic of representatives of a certain somatotype (D'Andréa et al., 2013; Cinarli & Kafkas, 2019).

The obtained results are important for the modernization of the content of physical education of young men in the direction of its individualization to achieve high parameters in various characteristics; to develop a differentiated system for evaluating the achievements of young people (Ryan-Stewart, 2018; Zhang, Lu & Wu, 2020). This, among other things, will also contribute to strengthening their motivation to engage in physical activity, because the proposed normative assessments will be realistic to achieve. Such a positive result is an incentive to continue the physical activity and even increase its volume (Noh et al., 2014; Kvintová & Sigmund, 2016). In addition, the obtained data can be used in the practice of sports activities, in particular when predicting achievements, and planning the amount of physical activity for athletes with a certain somatotype (Saha, 2014; Campa et al., 2020; Cinarli et al., 2022).

It is advisable to direct further research to the study of parameters of other characteristics, in particular physical qualities, and psychophysiological properties. Another

possible direction is the development of a program to improve physiological and some other characteristics of young men during physical education at the university, as well as individual programs of such orientation.

Conclusions

Against the background of the implementation of quarantine in connection with Covid-19, the physiological characteristics of first-year boys during the academic year are marked by features determined by somatotype. At the beginning, most characteristics, the parameters of which differ significantly (at the level of $p < 0.05 \div 0.0001$), were found in the T-type: there were 6 of all 9 studied, but not all of them were better, compared to those obtained in other somatotypes. The parameters in the M-type were better in all cases, and their number, when compared with the D-type, is 5, with the A-type – 4; in the latter parameters, HR after exercise and VCI were better than in D-type.

During the school year, parameters deteriorate: in D-type in 5 characteristics, in A-type – 4, T-type – 3, and M-type – 2. In the end, young men reach parameters that differ significantly from each other. In the T-type, there were 7 of all 9 subjects and all of them were better than in the A-, D-types, and 3 (HR after exercise, VCI and RI) – than in the M-type. The parameters of the latter are better in all cases, and the number is: when compared with the D-type – 5, with the A-type – 4. The parameters of HR after exercise and VCI in the A-type were better than in the D-type.

To increase the effectiveness of physical education of young people at the university, it is advisable to differentiate it and individualize the content, taking into account the peculiarities of the manifestation and changes of parameters, primarily psychophysiological and characteristics of physical capabilities.

Conflicts of interest

No conflicts of interest exist.

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ФІЗІОЛОГІЧНІ ХАРАКТЕРИСТИКИ ЮНАКІВ ЗА ВІДСУТНОСТІ ОБОВ'ЯЗКОВОЇ ФІЗИЧНОЇ АКТИВНОСТІ, ЩО ПЕРЕДБАЧЕНА В УНІВЕРСИТЕТІ

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Реферат. Стаття: 10 с., 4 табл., 40 джерел.

Мета дослідження полягала у визначенні параметрів фізіологічних характеристик юнаків із різними соматотипами, яких вони досягли здійснюючи фізичну активність в умовах карантину Covid-19.

Матеріал та методи. У дослідженні взяли участь 39 юнаків 17,6±0,5 років, вони не мали обмежень у використанні різних обсягів фізичної активності та належали до різних соматотипів. Діагностували соматотипи, використовуючи методику Shtefko-Ostrovsky в модифікації S. Darskaja. Для одержання необхідних даних використовували добре відомі функціональні тести для встановлення blood pressure, heart rate у різних станах, vital capacity, vital capacity index, index maximum isometric strength, Robinson index. Оцінювали параметри цих характеристик у представників кожного соматотипу протягом навчального року та порівнювали ці параметри в різних соматотипах. У останньому випадку використовували результати на початку (січень) та наприкінці (травень-червень) дослідження; тривало воно протягом одного навчального року.

Результати. На початку, а ще більшою мірою наприкінці навчального року, параметри досліджуваних характеристик у представників наявних соматотипів відрізнялися між собою (р на рівні від 0.05 до 0.0001). Використані протягом навчального року обсяги та умови реалізації фізичної активності призвели до погіршення фізіологічних характеристик усіх юнаків. Проте мали місце особливості, зумовлені приналежністю до певного соматотипу.

Висновки. Встановлення особливостей змін у параметрах фізіологічних характеристик юнаків-першокурсників із урахуванням їхніх соматотипів є важливим завданням для модернізації фізичного виховання у закладі вищої освіти. Отримані дані сприяють індивідуалізації змістової і нормативної основ фізичного виховання юнаків, використовуючи для цього дані про вияв і зміну параметрів у різних характеристиках, у тому числі фізіологічних.

Ключові слова: фізіологічні характеристики, диференціація, студенти, фізична активність, Covid-19.

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