Original Article

Physical fitness of modern students based on the results of psychophysiological diagnostics

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Abstract.
Adequate physical activity is a significant component of the successful development of any nation and is the leading factor in stimulating the adaptive capabilities of the body, and also ensures a healthy lifestyle for students. According to most scientists, in order to improve the organization of physical education classes, it is advisable to use a differentiated control of the physical and functional state of students based on the results of a comprehensive psychophysiological diagnosis and assessment of individual psychomotor qualities. Until now, the normative ranges that determine the physical fitness degree of student youth require clarification. There is no doubt that an important factor for improving the diagnosis of the students' psychophysical state is the hardware-software using that allows to carry out the medical control in physical education classes properly. The authors have made a comparative analysis of the students' physical fitness (Odessa Academy of Food Technologies) with created normative ranges of the psychophysiological state of their mates (general medical group) according to the next indicators: the latent period duration of a simple and complex visual-motility reaction, the level of sensorimotor excitation, sensorimotor accuracy, rapidity of leading hand, functional brain asymmetry coefficient. We used the next techniques: "Sensorimotor reactions", "Reaction to a moving object", "Tapping test" and "Koos' Cubes". Comparative analysis with the created normative ranges showed that in a randomly selected young men and women, the average value of most parameters corresponds to the estimated range "satisfactory", and the latent period duration of complex visual-motor reaction (CRT) – "unsatisfactory." This testifies to the insufficient physical fitness level of modern student youth, which, according to the authors' opinion, is advisable for optimizing the educational process in physical classes and creation the individually oriented manners of physical education.
Key Words: psycho-motility, students, physical readiness.

Introduction

The deterioration of the young people health has become an actual problem; therefore, adequate physical activity as a significant component of the successful national development is the leading factor in stimulating the adaptive abilities of the body and ensuring a healthy lifestyle for students. This is important for improving the physical and mental development of youth, improving efficiency, prevention of overweight or underweight, as well as the pathological processes developing. Universities successfully use various types and forms of health related physical activity, but leading experts in the educational sphere note that the methodology of organizing physical education classes requires further development because of the students' physical state level does not correspond to the optimal one. To improve the physical education classes' organization, according to many scientists' opinion, it is advisable to use differentiated control of the physical and functional state of students based on the psychophysiological diagnostics results and individual psycho-motility assessment [2, 3, 6, 7, 8, 13].

The search of valid criteria for assessing the psychophysiological state of students to determine the algorithm of their adaptation to physical loads remains relevant [6, 11, 12]. The methodology for assessing the state of psychomotor skills of youth has not been established enough, since the normative ranges that determine the degree of physical fitness of young men and women have not been established or are outdated.

The fundamental provisions of the generally accepted theory of assessments make it possible to determine the algorithm for constructing normative tables, which can be used to identify the physical fitness of student youth [13] and allow implementing an individual approach to the organization of physical classes [4, 16].

Only proper organization of the physical education process in higher school will help Ukraine to be able to overcome the negative trends in the health and physical fitness of modern student youth. It is important to combine compulsory and extracurricular activities, intensify physical culture and sports activities, take into consideration the personal preferences of students in choosing motor activity, individualization of pedagogical

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control to physical activity adaptation and modernization of scientific and technical base. The above important components are able to build an adequate model of physical education in higher education [3, 12, 14, 15].

In the last decade, the expediency of studying the most "simple" genetically determined personal traits, which include sensory thresholds and rapidity of motor reactions, has been recognized [1, 9, 10]. Only after obtaining these characteristics according to the actual parameters of assessing the psychophysiological state, it is possible to identify the individual characteristics of the psychomotor organization [14]. Nowadays, the convincing evidences that the methodology of psychophysiological diagnostics in relation to a valid assessment of psychomotor qualities makes it possible to determine the degree of students' adaptation to physical activity have been obtained [7, 12, 15].

The formation of adequate and timely psychomotor reactions plays an important role in the daily activities of student youth both during busy periods of study and after graduation. The combination of optimal psychomotor reactions and personality traits is especially important in the life and adaptation of students to new tasks and today's realities, because the speed of important decisions, their feasibility and timeliness should be the key to individual success in all forms of socially significant mental activity.

Aim of research: to carry out a comparative analysis of the physical fitness of modern students (men and women) by the earlier created normative indicators of the psychophysiological state of their mates based on the results of psychomotor characteristics individualized assessment.

Material & methods

Psychophysiological diagnostics was carried out in the following groups:
1) university students, assigned to the general medical group (GMG), who underwent full medical control and were admitted to physical education classes (n = 200: 100 boys and 100 girls aged 17-18);
2) 1st year randomly selected students of the Odessa National Academy of Food Technologies (n = 140: 70 boys and 70 girls aged 17-18).
Psychomotor qualities for above groups of students were determined by NS-Psychotest (hardware-software equipment) accordingly to classical psychodiagnostic techniques [10]. Individualized assessment of students' physical fitness provided by examination of their psychomotor parameters with the following indicators:
- the latent period duration of the simple visual-motility reaction (SRT);
- the latent period duration of the complex visual-motility reaction (CRT),
- level of sensorimotor excitation (SM excitation);
- sensorimotor accuracy (SM accuracy);
- rapidity of leading hand;
- functional brain asymmetry coefficient (FAC);
- rapidity of action (activity of thinking).

Psychophysiological diagnostics was carried out by the following techniques: "Sensomotor reactions", "Reaction to a moving object", "Tapping test" and "Koos' cubes"), which are described in the corresponding Methodological manuals [9, 10]. An important factor for improving the psychophysical state diagnostics is the hardware-software introduction, which allows realizing the proper medical control in physical education classes [3]. The basic requirements for a psychodiagnostic examination realizing are: short testing time and software availability; the ability to check the determined parameters for many years (observing in the dynamics); the urgent information of the person's psychophysical state; reliability, validity and objectivity [6, 8].

Results

To estimate the physical fitness degree of randomly selected 1st year students, it is necessary to compare them with the normative data obtained by examining students of the general medical group (GMG). The normative ranges of psychophysiological parameters that determine the psychomotor state of general medical group students (separately for boys and girls) are presented in table 1.

Accordingly with presented in the table data (GMG students), the speed qualities in young men are higher for the parameters of latent periods of visual sensorimotor reactions (SRT, CRT) than in young women. The normative ranges for indicators of sensorimotor excitation level and sensorimotor accuracy, as well as the functional brain asymmetry coefficient and the rapidity of action in boys and girls did not differ significantly (presented in the table by a common line). As to the leading hand rapidity, the male normative ranges were slightly higher than the female.

The comparative analysis of psychophysiological diagnostics, which was carried out with using of formed normative ranges made it possible to determine the level of psychomotor qualities in first-year randomly selected students. Comparison of the obtained individual estimated values of the psychomotor state of these students with the normative ranges for each diagnostic tests allowed determining the success of the proposed psychomotor tasks accordingly with the selected criteria.

Thus, the average value of the latent periods duration of a simple visual-motility reaction (SRT) in young men was 287.08±5.05 ms, and in women – 298.35±4.42 ms (p <0.01), which corresponded to the estimated value "Satisfactory" of the normative range. Indicators of the latent periods duration of the complex

visual-motility reaction averaged 444.14±5.93ms for young men, and 463.71±4.37 ms (p <0.01) for young women, which corresponded to the estimated value "unsatisfactory" of the normative range.

The technique "Reaction to a moving object" in the examined contingent of students allowed determining the indicators of sensorimotor excitation and sensorimotor accuracy. Testing using this technique revealed that for young men the SM excitation time was 8.92±1.27 ms, and the CM accuracy time was 29.00±1.01 ms.

Table 1
Normative ranges of psychomotor qualities for general medical group students

Indicators	Sex	Estimated values of psychomotor qualities				
		Bad	Unsatisfactory	Satisfactory	Good	Excellent
SRT, ms	young men young women	>341 >361	340–301 360–321	300–261 320–281	260–220 280–240	<220 <240
CRT, ms	young men young women	>471 >501	470–431 500–461	430–391 460–421	390–351 420–381	<350 <380
SM excitation, ms	young men young women	>22,1	18,1–22	14–18	10,1–14	<10
SM accuracy, ms	young men young women	>39	38–33	32–26	25–19	<18
Rapidity of leading hand, times	young men young women	<5,6 <5,8	5,7–6,2 5,9–6,4	6,3–6,8 6,5–7,0	6,9–7,4 7,1–7,6	>7,5 >7,7
FAC, nominal units	young men young women	>11,1	11,0–9,1	9,0–7,1	7,0–5,1	<5
Rapidity of action, s	young men young women	>496	495–401	400–306	305–211	<210

The indicators of sensorimotor excitation and sensorimotor accuracy for young women averaged 11.61±1.17 ms and 31.42±0.56 ms respectively, which reveals a tendency towards higher values of these indicators in girls compared with boys. Comparative analysis of these indicators with the normative ranges revealed the following: a) according to the level of sensorimotor excitation, the young men corresponded to the evaluation criterion "excellent", and the women – "good" (this may be resulting that modern schoolchildren play a lot of computer games, and boys are much more than girls, especially games that train reaction speed); b) in terms of sensorimotor accuracy, both boys and girls corresponded to the estimated value "satisfactory".

The results of the tapping test revealed the next: the number of touches by the leading and non-leading hands in young men was 7.39±0.06 and 6.94 ±0.05 times respectively; among young women, the number of touches by the leading hand was 6.74±0.05 times, and by the non-leading hand – 6.54±0.05 times. The obtained data indicate that the speed of the leading hand in men is significantly higher than that of women. As for the comparison with the normative ranges, it was found that for randomly selected students the leading hand rapidity for young men corresponds to the estimated value "good", and for young women corresponds "satisfactory".

The functional brain asymmetry coefficient for young men was 6.31±0.21 n.u., while for young women it was slightly higher – 7.12±0.22 n.u. (p <0.05). Comparison with the normative FAC range showed that in men the average indicator corresponds to the estimated value "good", while in young women it was "satisfactory".
A study of action rapidity among randomly selected students (characterizes the activity of a personal thinking) revealed that the time for completing a psychomotor task ("Koos' Cubes") by young men was 361.59±11.35 s, and by young women – 357.12±7.8 s (p <0.05), which practically turned out the equal and corresponded to the estimated value of psychomotor qualities "satisfactory".

The undertaken comparative analysis of the psychophysiological state of randomly selected students of both sexes with the created normative evaluative criteria of the psychomotor qualities their mates (general medical group) showed that the physical fitness of modern students who started their education at the university is insufficient; it is necessary to optimize the physical education classes in higher education.

Discussion

The motility level belongs to an individual personality profile and depends on many factors, primarily on the typological manifestations of the nervous system main properties, which are genetically determined [1, 4, 5]. Psychomotor qualities of a person, particularly, his maximal capabilities of performing any psychomotor function and the motility level largely depend on the individual typological characteristics of the nervous system main properties manifestations, and in addition, psychomotor qualities play a significant role in the processes of perception and cognition. The relationship of the personal psychomotor organization with the cognitive characteristics of the individual is intensively studied by modern differential psychophysiology. Our preceding research has shown a high level of correlative relationships between parameters that assess the personal psychomotor qualities and the cognitive functions state [2]. This scientific direction has not only important theoretical significance, but also arouses an important practical interest for developing of individualized approaches implemented in educational and behavioral processes.

The implementation of the psychophysiological paradigm provided an opportunity (with modern hardware-software equipment using) to objectively assess the peculiarities of the psychophysiological state of students who began their studies at the university according to their psycho-motility parameters. The performed psychophysiological diagnostics has the following advantages: a specialized focus on identifying individual typological characteristics and psychomotor qualities in each student; uniformity of the examination procedure in accordance with the standard set of tasks; short testing duration and simplification of examination using classical methods; safety and non-invasiveness. The solution ways of debatable issues concerning the theoretical and methodological principles of adequate medical and pedagogical support of student youth in physical education classes continues to be perspective and relevant.

Comparison of psycho-motility state in randomly chosen 1st year students with the created normative range of psychomotor skills in students of the general medical group showed that the psychophysiological indicators of the examined contingent mainly corresponded to the estimated values "satisfactory". The analysis of the obtained data indicates the expediency of timely psychophysiological diagnostics of students who entered the university to identify possible deviations from the normative ranges of psychomotor indicators for individually oriented manners of physical education creating. The obtained results testify to the expediency of introducing medical-psychological and pedagogical support of students in physical education classes.
We have been developing the individual-oriented specialized training programs consisting of certain physical exercises that are focused on improving the psycho-motility of students. For the modern system of physical education modeling in higher school, the effectiveness of the sectional form of classes' organization is proved, it involves the individual characteristics of the psychophysiological state of students accounting [14].

Conclusions
1. Psychophysiological diagnostics in first-year students with using the created estimated values of psychomotor qualities is advisable for implementation into the practice of higher school teachers, since it can be used to determine the physical readiness of modern student youth.
2. Comparative analysis of psychomotor skills among first-year students (both sexes) with the general medical group showed an insufficient level of physical readiness of modern student youth.
3. Identification of individual characteristics of psychomotor skills in students is perspective for predicting possible deviations in their psychosomatic health state, which is extremely important for optimizing the educational process in physical classes.
4. The results of this research are important not only for determining the deficiency of physical readiness of students, but also for individually oriented manners of physical education development.
5. The obtained results of the diagnostic parameters of the students' psychophysiological state expand scientific information about the necessity of accounting the individual psychomotor qualities of students and are the great practical importance for improving the physical classes' organization in higher education.

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