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The Functional State of the Cardiovascular System of the Ammosov NEFU 1st Year Girl-Students

ABSTRACT

The adaptive capacity of the circulatory system of the NEFU named after M.K. Ammosov 1 st year she-students in terms of adaptation to training in high school was studied.

In the girls somatometric data (height, weight) and hemodynamic parameters (heart rate, blood pressure) by conventional techniques, as well as indicators of circulatory system adaptive capacity (AP) and double product (DP), or Robinson index were determined.

DP analysis showed that the functional reserves of the cardiovascular system has been stretched and depleted in 55.5% of cases. AP in 98.5% of cases was unsatisfactory.

Indicators of reserves of the cardiovascular system of the 1st year students were worse than in the control group, indicating the emergency power of stress or of its long duration.

Thus, the adaptive reserves of an organism of students are characterized as unsatisfactory. The observed decrease in the adaptive capacity of the organism, even in the absence of the manifested disease testifies a lower level of health and increases the risk of disease.

Keywords: students, adaptive capacity, the cardiovascular system, the Robinson index.

INTRODUCTION

At the present time the researchers use methodological approaches to assess the state of adaptation to determine the health of both the individual and organized groups [4- 7].

The body composition and functionality of the body can be measured to evaluate the adaptive capacity of the organism. Parameters which are characterised the state of metabolism, the immune status of the organism, the state of the adaptive potential (AP) of the circulatory system were passed for assessment of adaptive reserves [2, 3].

The circulatory system plays a leading role in ensuring the adaptation of the organism as a general indicator of adaptive reactions. This role is defined by its function of transport of nutrients and oxygen – the main source of energy for cells and tissues. Energy mechanism has a leading position in the process of adaptation. Energy deficit is the trigger signal that triggers the

whole chain of regulatory devices that form the necessary adaptive capacity at the new homeostatic level.

Research and evaluation of the AP of the circulatory system allows determining the distribution (%) of individuals with varying degree of adaptation to the specific conditions of life.

In high school freshmen first of all are to adapt to a large teaching load, the volume of information, the length of the school day.

Research aim: to study adaptation potential of the circulatory system of the 1st year she-students to the terms of educating.

MATERIALS AND METHODS

476 she-students of different faculties of the Ammosov North-Eastern Federal University (NEFU) aged 15 to 22 years were involved in the study (mean age 18.2 ± 0.9 yrs). The number of Yakut girls amounted to 85.9%, other nationalities - 14.1%.

Control group consisted of young women (n = 156) aged 24 to 29, on average 26.3 ± 1.6 years.

Work performed in the Institute of Health NEFU, Department of propaedeutic and faculty therapy with endocrinology and physical therapy Medical Institute NEFU. The study was approved by the Ethics Committee FGBI "YSC ILC" SB RAMS. Participants provided written informed consent before entering the study. The work was performed as part of the base portion of the governmental assignment of Russian Ministry of Education on "Adaptive potential and health of the indigenous population of Yakutia in the modernization of the social and economic system."

The girls 1st year NEFU determined somatometric data (height, weight) and hemodynamic parameters (heart rate, blood pressure) by conventional techniques, calculated body mass index (BMI). BMI is determined by the formula Kettle BMI = W / L2, where W - weight in kg, L2 - height in meters squared. BMI is considered to be insufficient for values below 18.5, normal – 18.5-25, redundant – 25-30, obese – 30-40, obese – above 40.

The heart rate can be seen as an integral indicator of the level of functioning of the cardiovascular system, which depends on the energy needs of the body. The higher the energy potential, the more stable the system. As the reduction of the reserve capacity of the organism and, therefore, the level of adaptation (which may be due to the impact of unfavorable factors of production, or age-related changes) to provide the energy needs of the body are included compensatory-adaptive mechanisms and, in the first place, there is an increase in heart rate. AP

of the circulatory system in the score is calculated by the formula AP = 1.238 + 0.09 * HR where HR – heart rate, beats per minute; 1.238 and 0.09 – coefficients of the equation. If the value is less than 7.2 points AP the level of adaptation is estimated as satisfactory, with the AP from 7.21 to 8.24 points – the strain of adaptation mechanisms, at the AP from 8.25 to 9.85 points – poor adaptation, with more than 9, 86 AP points – the failure of adaptation mechanisms [1].

A very important indicator of the circulatory function is double product or index Robinson (DP or IR), which reflects the level of hemodynamic load on the cardiovascular systems and characterizes the work of the heart muscle. DP describes the reaction of the individual to the load and is calculated by the formula: DP = SBP * HR / 100 (c.u.). If the value is less than 69 DP c.u. the functional reserves of the cardiovascular system are assessed in great shape, a value of DP 70-84 c.u.– OK, a value of DP 85-94 c.u. – Lack of functionality of the cardiovascular system, a value DP 95-110 c.u. – Deregulation of the cardiovascular system, at a value of more than 111 DP c.u.– Regulation of the cardiovascular system is broken [9].

RESULTS AND DISCUSSION

General characteristics of the students are presented in Table 1. Growth rate NEFU 1 students ranged from 112.5 to 176 cm. Body weight also varied over a wide range from 38 to 87 kg. BMI was in the range of 14.5 to 39.1. BMI: insufficient – 17.5 ± 0.9 (14.5-18.4) in 52 (11.0%) patients, normal – 21.3 ± 1.6 (18.5-25) in 378 (79.4%) of the participants, excess – 26.6 ± 1.2 (25.1-29.3) in 38 (8.0%), obesity – 33.2 ± 2.9 (31.2-39.1) in 6 (1.4%), obese students - 0.

Table 1

General characteristics of girls (M ± σ)

Characteristics	1st year student NEFU n = 476	Control group, n = 156
Height, cm	159.2±6,1	163.7±5.9
Weight, kg	54.4±7.1	61.6±12.7
BMI	21.5±2.8	23.1±47
SBP, mm Hg	104.2±10.8	104.2 ±14.9
DBP, mm Hg	66.4±8.4	70.5±11.6
P, beats per minute	83.4±11.7	69.6±10.3
HR per minute	83.4±11.7	69.6±10.3
AP, scores	8.7±0.9	7.5±0.9
DP, arbitrary units	87.1±14.4	72.9±14.2

Note: SBP – Systolic blood pressure, DBP – Diastolic blood pressure, P – Pulse, HR – Heart rate.

It is known that the adaptation of the body provides a coordinated in time and space and by subordinate to each other specialized functional systems. In this case, the main adaptive system, limiting mental and physical performance, is the cardiovascular system. Clear information on the degree of perfection of development and level of physical health of the individual gives a level of energy production, indicating the ability to adapt to the conditions of existence and the possibility to implement a program of development. The most valuable criteria for the energetic state of the reserve is the cardiovascular system. One indicator of this reserve is DP (IR), which characterizes the somatic work of the heart. The larger the figure at the height of physical activity, the greater is the functional capacity of the heart muscle [9].

So, the girls' systolic blood pressure ranged from 80 to 140 mm Hg, diastolic blood pressure – 50-102 mm Hg, heart rate – from 60 to 188 beats / min. One of the main indicators of the functional state of the cardiovascular system, determining the development of the adaptation of the whole organism, is the heart rate. This figure is traditionally used as a vegetative and correlate emotional stress. According A.V. Shakhanova et al. heart rate changed upward depending on the shape and control of the degree of emotional stress [8]. This indicates a sharp decline in the functional capacity of the circulatory system and reflects the presence of stress adaptation mechanisms, as evidenced by indicators of DP and AP.

DP analysis showed that 10.2% of the examined cardiovascular system functional reserves were in great shape, at 34.3% – normal, at 24.9% – failure, at 25.4% – a violation of the regulation, at 5.2% – regulation is violated, i.e. functional reserves cardiovascular system were tense and exhausted in 55.5% of cases (tab. 2). Thus, only 1.5% of AP was satisfactory, while in 98.5% of cases – poor (tab. 3).

Table 2

Indicators of double product of the NEFU 1st year students (M ± σ)

Double product, n=461	Conventional units
Great n=47	63.9±3.1
Good n=158	77.4±4.2
Average n=115	89.2±2.8
Poor n=117	100.5±4.6
Very bad n=24	120.0±5.7

Table 3

Indicators of adaptive potential of the NEFU 1st year students (M ± σ)

Adaptive potential, n=476	Points
Satisfactory adaptation, n = 7	6.8±0.2
Stress adaptation mechanisms, n = 118	7.7±0.3
Poor adaptation, n = 269	8.8±0.4
Disruption of the mechanisms of adaptation, n = 82	10.3±0.6

Somatometric data of the control group were as follows: growth ranged from 149 to 178 cm, weight ranged from 43-116 kg (Tab. 1). BMI varied over a wide range of 15.6 to 44.4 (Tab. 1). Hemodynamic parameters were as follows: systolic blood pressure was from 70 to 170 mm Hg, diastolic blood pressure – 40-115 mm Hg, heart rate – from 42 to 100 beats per min. (Tab. 1). AP figures ranged from 5.018 to 10.238 points, characterized by satisfactory only in 40% of cases (Tab. 5). DP varied within 37.8-108.57 c.u. which was satisfactory in 94% (Tab. 4).

Comparative analysis showed that the control group had better somatometric and hemodynamic parameters (the growth $p < 0.0000$, the weight $p < 0.0000$, BMI $p < 0.001$, DBP $p < 0.0000$, HR $p < 0.00$). Indicators of cardiovascular system reserves of the NEFU 1st year girls

students were worse (AP p <0.00, DP p <0.0000), indicating the extreme force of impact or a long duration. Overstrain of regulation system can lead to the disruption of adaptation to changes in the level of inadequate functioning of the heart and blood vessels, to disruption of homeostasis with the advent of pathological syndromes and diseases.

Table 4

Indicators of adaptive potential of the control group (M ± σ)

Adaptive potential, n=156	Points
Satisfactory adaptation, n = 62	6.8±0.6
Stress of adaptation mechanisms, n = 56	7.7±0.2
Poor adaptation, n = 37	8.6±0.4
Disruption of the adaptation mechanisms, n = 1	10.2

Table 5

Indicators of double product of the control group (M ± σ)

Double product, n=156	Points
Great n=66	60.0±7.6
Good n=58	76.1±4.6
Average n=22	89.7±3.1
Poor n=10	101.2±4.7
Very bad n=0	-

Thus, adaptive body reserves of NEFU students are characterized as unsatisfactory. The observed decrease in adaptive capacity of the organism even in the absence of the manifested disease indicates a lower level of health and increases the risk of disease.

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