

ASSESSMENT OF STUDENTS' HEALTH CONDITION BY INDICATORS OF ADAPTATION POTENTIAL, BIOLOGICAL AGE AND BIO-ENERGETIC RESERVES OF ORGANISM

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Abstract. *Purpose:* to assess students' health condition by indicators of adaptation potential, biological age and express-assessment. *Material:* in the research 47 first and second year girl students participated, who belonged to main health group. *Results:* we distributed the girl students into three groups: 14.89% of them were included in group with "safe" health condition; 34.04% - in group of "third state"; 51.06% were related to group with "dangerous" health condition. We established that *dangerous* level was characterized by energy potential of below middle and low level. It is accompanied by accelerated processes of organism's age destructions and tension of regulation mechanisms. *Conclusions:* the received results permit to further develop and generalize the data of students' health's assessment by indicators of adaptation potentials, biological age and physical health's condition.

Key words: assessment, level, health, students, youth.

Introduction

It is known that in order to preserve and strengthen health of sound people information about conditions of health's formation, final result of this information's realization: specific indicators, characterizing individual's or population's health condition, is required [1, C. 22]. Besides, some authors [6, 8, 25-28, 32, 33] noted that for effective realization of health related tasks in process of students' physical education it is necessary to implement objective criteria of assessment of students' health in educational process. The choice of assessment's diagnostic model depends on the purpose of research. With it, the main thing will be not rather symptomatic, but interpretation and combining in certain wholeness of diagnostic results when finally forming summarizing conclusions about organism's status [22].

In the course of our researches we found that by the present time, for assessment of students' health condition and for study of effectiveness of health related physical culture methodic the most popular and actual have been the following models:

- *pre-nosological diagnostic* [7, 20, 23, 24] – assessment of organism's functional state as well as its adaptation potentials in period, when obvious symptoms of disease are absent;
- *diagnosing by direct indicators* – determination of biological age [4, 16, 17, 19] and assessment of organism's energy potential (bio-energy reserves) [5, 6, 8, 11], which characterize biological function of survival (as one of main signs of health) [2].

We have found significant quantity of works, devoted to these problems [29-31, 34-39]. Alongside with it, there are single publications [10, 14] about results of application of complex approach to assessment of human health's condition by indicators of adaptation potential, biological age and by bio-energetic reserves.

The above mentioned conditions urgency of our work and the received results permit to expand and supplement existing data about assessment of students' health.

Purpose, tasks of the work, material and methods

The purpose of the work is: on the base of complex approach to assess students' health condition by indicators of adaptation potential, biological age and express-assessment.

Material and methods: As a result of generalization of theoretical knowledge and practical experience of specialists [4, 6, 10, 15, 17, 18, 20, 21, 40-47] we selected simple and accessible methods of health's assessment. Their usage does not create any organizational and material-technical difficulties in process of mass testing: methodic of adaptation potential's determination by R.M. Bayevskiy; methodic of biological age determination [14] and determination of bio-energy reserves by express-assessment of physical health [9].

Pedagogic experiment was conducted at the beginning of 2014-2015 academic year on base of physical education and sports' department of State HEE "National mining university" (Dniepropetrovsk). In the research 47 first and second year girl students participated, who belonged to main health group.

Results of the research

In table 1 we present students' quantitative distribution into groups by adaptation potentials', biological age indicators and by results of express assessment.

Table 1

Quantitative distribution into groups by adaptation potentials', biological age indicators and by results of express assessment, received in the course of pedagogic experiment (%), (n=47)

Health levels		By AP		By biological age					By express assessment				
		1	2	1	2	3	4	5	HL	AML	ML	BML	LL
By AP	1			4.26	6.38	12.7 7	8.51	2.13	4.26	10.64	17.02	2.13	-
	2			2,13	10.6 4	6.38	25.5 3	21.2 7	-	-	17,02	29.78	19.14
By biological age	1	4.26	2.13						2.13	2.13	-	2.13	-
	2	6.38	10.64						2.13	2.13	6.38	4.26	2.13
	3	12.77	6.38						-	4.26	10.64	2.13	2.13
	4	8.51	25.53						-	2.13	10.64	14.89	6.38
	5	2.13	21.27						-	-	6.38	8.51	8.51
By express assessment	BY	4.26	-	2.13	2.13	-	-	-					
	BC y	10.64	-	2.13	2.13	4.26	2.13	-					
	CY	17.02	17.02	-	6.38	10.6 4	10.6 4	6.38					
	HC y	2.13	29.78	2.13	4.26	2.13	14.8 9	8.51					
	HY	-	19.14	-	2.13	2.13	6.38	8.51					

With distribution of experiment's participants by adaptation potentials' indicators (AP) we accepted as the basis standard values for students [21], which were worked out on the base of centile corridors' method:

- satisfactory adaptation, 1st group, not more than 2 conv.un.;
- tension of adaptation mechanisms, 2nd group, 2.11 conv.un.;
- unsatisfactory adaptation, 3rd group, 3.21 – 4.30 conv.un.;
- failure of adaptation, 4th group, from 4.30 and more.

By results of AP registration we received:

- *First group* – satisfactory adaptation was registered in 34.04% (n=16) students;

- *Second group* – tension of adaptation mechanisms – in 65.96% (n=31). It should be noted that there were not found any students with unsatisfactory adaptation or with failure of adaptation.

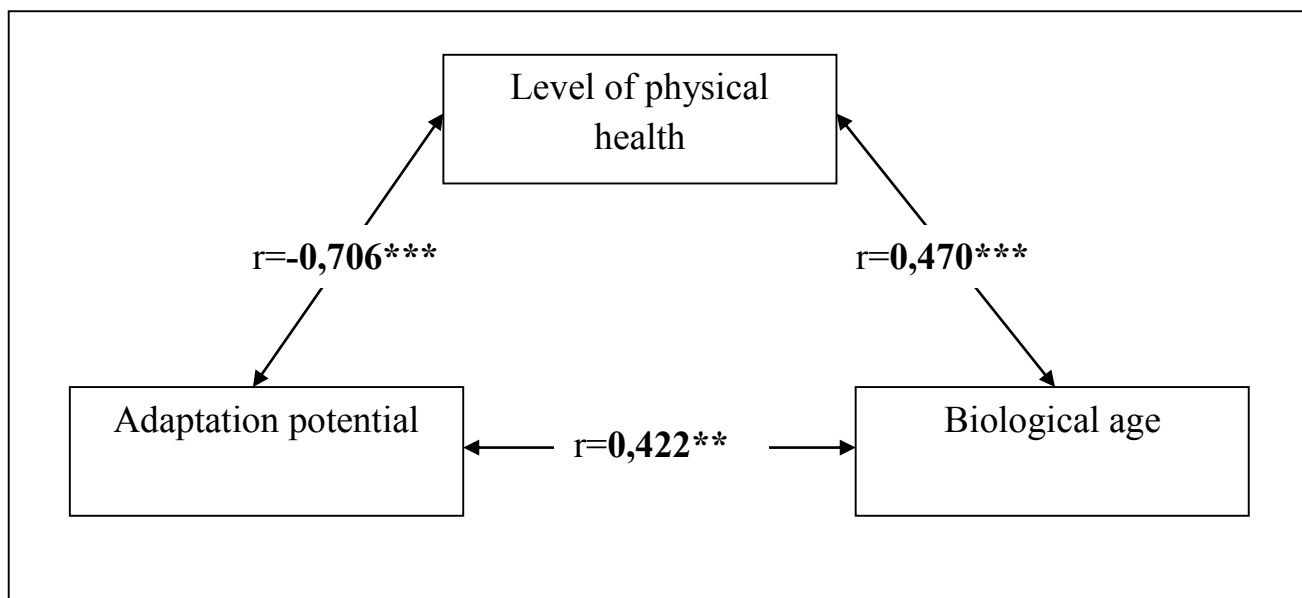
By results of determination of biological age (BA) we found:

- *First level of health* – slow ageing of organism was registered in 6.38% (n=3) students;
- *Second level of health* – middle temps of organism’s ageing – in 17.02% (n=8);
- *Third level of health* – coincidence of biological and calendar age was registered in 19.15% (n=9);
- *Forth level of health* – accelerated organism’s ageing – in 34.04% (n=16);
- *Fifth level of health* – quick temps of organism’s ageing – in 23.40% (n=11).

By results of express-assessment we received:

- *High level of physical health (HL)* was registered in 4.26% (n=2),
- *Above middle level of physical health (AML)* – in 10.64% (n=5),
- *Middle level of physical health (ML)* – in 34.04% (n=16),
- *Below middle level of physical health (BML)* – in 31.91% (n=15),
- *Low level of physical health (LL)* – in 19.14% (n=9).

The data of table 2 witness that weakening of organism’s bio-energetic reserves is accompanied by organism’s accelerated ageing and tension of adaptation mechanisms. And vice versa, weakening of regulatory mechanisms’ functioning is followed by reduction of bio-energy reserves and acceleration of organism’s ageing. For determination of confidence and degree of statistic correlation between adaptation potentials’ indicators, biological age and results of express assessment we conducted correlation analysis (see fig. 1).



*** $\alpha \leq 0.001$, ** $\alpha \leq 0.01$

Fig.1. Correlation between adaptation potentials’ indicators, biological age and level of physical health, (n=47)

We detected that for the given category the most informative indicator by high absolute value of correlation coefficient was level of physical health (LPH). For example, LPH has significant confident correlation with adaptation potential ($r=-0.706$, $\alpha \leq 0.001$) and moderate with biological age ($r=0.470$, $\alpha \leq 0.001$).

Following “energetic” conception by G.L. Apanasenko [1], at finalizing stage of the researches, by the obtained results students were distributed into three groups (see table 2).

Table 2

Comparative analysis of mean-statistic values of indicators of morphological-functional indices of express assessment, adaptation potential, biological age of students depending on health level, which were received in the course of experiment, (n=47)

Indicators	$\bar{x} \pm \sigma$		
	“safe” level of health	“third state”	“dangerous” level of health
MHI, g/cm	305.73±23.59	339.27±31.51	369.48±63.57
SI, conv.un.	57.67±7.76	46.41±6.54	43.17±8.89
DP, conv.un.	69.61±18.72	91.93±16.05	99.51±12.42
PWC ₁₇₀ , Bт/кг	2.81±0.14	2.48±0.28	2.25±0.47
IRuffiet, conv.un.	8.17±3.29	10.35±3.30	14.88±5.15
LPH, points	16.57±2.44	11.5±1.59	5.88±2.69
AP, conv.un.	1.74±0.26	2.17±0.32	2.36±0.04
BA, years	23.43±7.07	30.22±5.90	32.37±8.21
PBA, years	27.59±0.55	27.50±0.47	27.56±0.50
BA-PBA, years	-4.16±7.09	2.71±5.83	4.80±8.12

Notes: MHI – mass-height index, SI – strength index, DP – “double product”, IRuffiet – Ruffiet’s index, PBA – proper biological age, BA – PBA difference between biological age and proper biological age.

In group with “safe” health level insignificant quantity of students were included– 14.89% (n=7) with high and above middle LPH. 34.4% (n=16) of students were related to group of “third state” (students with middle LPH. In group with “dangerous” health level rather significant quantity of students were included– 51.06% (n=24) with LPH low and below middle.

Comparative analysis of mean statistic values of indicators resulted in the following: it was established that “safe” level of health is characterized by the lowest values of mass-height index, index “double product” and Ruffiet’s index as well as adaptation potential, biological age with, at the same time, with high strength index’s indicators as well as PWC₁₇₀ index.

It is known that biological age and organism’s energy potential (bio energy reserves) characterize biological function of survival as one of main manifestations of health. [2]. Considering this aspect, we distributed students with middle LPH in group, named “third state”. According to mean statistic indicators this group is characterized by middle level of organism’s reserves, by coincidence of biological age with calendar one. However in this group we noticed tension of adaptation.

Thus, we can assume that this category of students is on the border of transition from healthy conditions to pre-disease state [3].

Accordingly, “dangerous” level of health is characterized as below middle and low level of energy potential and is accompanied by accelerated age-destruction processes and tension of all regulation mechanisms.

Discussion

Recent time assessment of students' health condition by indicators of their regulatory mechanisms, "age wearing out"; by morphological - functional structures in organism per unit of biological time and by indicators of bio-energy reserves has been becoming the subject of multiple researches, in which students participate.

In general, the received by us data supplemented, expanded and in some cases coincided with results of most of researches in this direction. However, still there are some distinctions. For example our data a little differ with information of other authors [7, 24] in our using of standard values of adaptation potential for students. It concerns the students, who have satisfactory adaptation and tension of its mechanisms. With it we confirmed the existing conclusions about absence of unsatisfactory adaptation or its failure among students.

There are also some distinctions in distributions of experiment's participants by indicators of biological age in comparison with other authors (see table 4).

Table 4

Quantitative distribution of students by indicators of biological age, fulfilled by different authors, (%)

Authors	Contingent		Health levels by BA				
			1	2	3	4	5
Own data, (2015)	girls		6.38	14.89	19.15	36.17	23.40
Ye.V. Tserkivnaya et al., (2011)	girls	EG	-	9	15	45	31
		CG	-	-	10.6	38.5	50.9
I.E. Kopko et al., (2011)	girls		-	-	32	34	32
S.A. Korol, (2014)	girls		-	-	18.2	22.7	59.1

Notes: EG – experimental group; CG – control group.

Nevertheless our data agree quite good with researches' results of the mentioned above authors in the aspect that high percentage of students have forth and fifth levels of health by BA, and, accordingly, accelerated and rapid temps of organism's ageing.

Comparative analysis of our results of express-assessment of students' health condition with results of other researchers we considered to not be correct, because different assessment methods were used.

However, we can compare with own results of earlier conducted experiment, in which women of mature age (21-35 years) participated [14]. And the data received by us also a little differ. Among women of mature age 23.46% were registered as having high and above middle level of health, while among 1st- 2nd year girl students – only 14.90%.

It points at the fact that insignificant percentage of women of different age (in the given case of junior and age of first maturity) differ from their peers by "optimal" reserve of organism's bio energy. Also we can affirm that there is negative tendency to decreasing of health level among students of our country.

Thus, certain distinctive features of our work are that we did not render mean statistic characteristics of the received results. We conducted quantitative distribution of girls into groups by indicators of adaptation potential, biological age and express assessment of physical health (see table1).

Like some other researchers [6, 11, 23] (who followed energetic conception by G.L. Apanasenko) we fulfilled distribution of students by results of express assessment into groups according to health level. With it the distinctive feature of our work is application of complex approach in our researches. Its results supplement the existing data about health condition of students.

The first group with high and above middle health levels was defined as "safe" level of health. It agrees with data of researches of L. Dolzhenko (2004) and S.A. Korol (2014). We supplemented that "optimal" reserve of organism's bio-energy is accompanied by satisfactory functioning of regulatory mechanisms and slow temps of organism's ageing.

In available literature we could not find researches on distribution of students in group, defined as “*third state*”: border of transition from healthy condition to pre-disease state. Our data (see table 2) witness about it. In opinion of G.L. Apanasenko [1], on the base of express assessment at pre-medical stage of examination of persons with middle health level, they can be considered as group “*healthy*”.

The received characteristics of “*dangerous*” health level confirm scientific facts: the higher level of physical health is, the more balanced is adaptation [17], and the lower indicators of biological age are [12] and vice versa.

Conclusions:

The received in the course of pedagogic experiment results create opportunities for further development and generalization of students health condition’s assessment by indicators of adaptation potential, biological age and physical health’s level.

The prospects of further researches imply fulfillment of comparative analysis of indicators of adaptation potential, biological age, physical health of boys and girls – 1st – 2nd year students of State HEE “National mining university”.

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Conflict of interests

The authors declare that there is no conflict of interests.

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