



BIOLOGICAL AGE AS A DIAGNOSTIC BIOMARKER LEVEL OF THE HEALTH OF STUDENTS

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Abstract

The article presents the study to determine the biological age (BA), adaptive potential (AP), level of physical condition (LPC) and shown to be informative for the diagnosis of the level of health of students. With a battery of tests for BA were tested 50 students aged 17 to 19 years. Analyzed the factors that have the strongest relationship with the index BA. Determination of BV can identify risk groups and effectively valeological recreational activities at school.

Key words: health, biological age, adaptive potential, level of physical condition.

Introduction

Health is a psycho-somatically human state, characterized with the absence of pathological changes and functional reserve that is satisfactory for the valuable adaptation and conservation of physical and mental working capacity under environmental conditions [1]. The point of health is the vital activity of organism, but the most essential point for this vital activity assessment is given to general biological characteristic of its state rather than to sickness rate coefficient. Such an assessment is submitted by the biological age of a human [4].

Biological Age (BA) – is a coefficient of structure and certain structural element functions deterioration degree of organism in general, expressed in the units of time in a way of correlations of measured individual biomarkers values with sample average – populated conversion dependences of these biomarkers from the calendar age [4]. The norms of BA can be morphological, functional, biochemical, immunological, cytochemical coefficients, the value of which in determination of maturity degree of organism changes in relation to the stages of postnatal ontogeny. The passport age comes at the same time for everybody. BA directly depends on the state of health.

The research activation of these problems in recent years is caused by the coefficient of health status of different age groups, especially by the premature “wearing out”, senescence of organism [3, 6]. The considerable number of works is devoted to the problems of premature senescence, namely: Akhaladze N. studied the assessment of human aging rate, health status and viability being evaluated from biological age assessments [2]; Romanyshyn O. and others [11] studied the level of somatic and physical condition and biological age of students of pedagogical college; Loshyts`ka T. [8] determined the level and rates of senescence of organism; Shamardina G. [12] studied the complex approach to donozological diagnosis of human health. However, in our opinion, the problem of BA evaluation concerning pupils and students is not studied enough.

The research was conducted under the research work programme of the department of anatomy, physiology and valeology of Drogobych State Pedagogical University named after Ivan Franko.

Purpose:

examine the peculiarities of aging rate of students based on the biological age definition and assess the health status in terms of adaptive

capacity, "rapid assessment" and the level of physical condition.

Materials and methods

50 first-year students of the Faculty of Physical Education of Drogobych State Pedagogical University named after Ivan Franko were involved in the pilot study. The total assessment of level health (TALH) (after Apanasenko G.) [1], adaptive potential (AP) (after Bayevs'kyi R.) [7], level of physical condition (LPC) (after Pyrogova E.) [9] and biological age (BA) (after Vojtenko V.) [4] were determined under the results of biomedical research.

We used the following formulas for BA calculation:

$$BA_{m.} = 26,985 + 0,215*SP - 0,149*II - 0,151*SB + 0,723*SRH;$$

$$BA_{w.} = - 1,463 + 0,415*PP - 0,141*SB + 0,248*W + 0,694*SRH.$$

SP – Systolic pressure; PP – pulse pressure; II – Inhibition of respiration in the inspiratory; SB - static balancing; W – weight; SRH – self-rating health.

Individual BA was compared with proper calendar age in order to judge in what extent the degree of aging corresponds to the calendar age (CA) of the inspected. The magnitude of PBA was determined with the formulas:

$$PBA_{m.} = 0,629*CA + 18,56;$$

$$PBA_{w.} = 0,581*CA + 17,24.$$

Senescence evaluation of examined contingent included the following steps: calculating the actual value of BA for each individual, calculating the proper value of BA (PBA) according to calendar age, the collation of the actual BA and calendar age. The difference between the BA and PBA coefficients characterizes the rate of senescence.

The software package "Microsoft Excel 2007" was used for the statistical analysis.

Results and discussion

BA is the integral coefficient that is determined as correspondence of individual morpho-functional level to a certain average rate of the given population and reflects the disproportional development, maturity and senescence of various physiological systems and rate of age-related changes in adaptive capacity of the organism.

It was determined on the basis of attained values of morpho-functional indexes that mass-stature index coefficient of boys and girls is normal (table 1). The majority of examined groups had a high rate of power and respiratory index, vital capacity lung (VCL).

Table 1. Characteristics of average parameters for calculations AC, BA, TALH та LPC (n=50)

Indicators	Statistical characteristics of			
	boys		girl	
	M ± m	σ	M ± m	σ
Calendar age, years	17,68 ± 0,12	0,61	17,48 ± 0,11	0,57
Weight, Kg	68,71 ± 1,47	7,21	56,02 ± 1,41	6,93
Height, cm	176,64 ± 1,27	6,25	162,48 ± 1,14	5,62
Heart rate, beats/min	72,8 ± 2,12	8,01	74,36 ± 1,98	9,71
Systolic pressure, mm/Hg/c	124,68 ± 1,63	5,78	109,16 ± 1,94	9,54
Diastolic pressure, mm/Hg/c	70,28 ± 1,18	6,96	64,56 ± 1,31	6,43
Pulse pressure, mm/Hg/c	54,4 ± 1,42	10,41	44,6 ± 1,37	6,72
Average blood pressure, mm/Hg/c	88,41 ± 1,17	5,63	79,43 ± 1,41	6,92
Dynamometry, kg	47,48 ± 1,34	6,58	28,39 ± 0,96	4,17
Vital capacity of lungs, l	4,51 ± 0,11	0,56	2,91 ± 0,12	0,59
Self-rating health, points	3,8 ± 0,58	2,84	6,92 ± 0,64	3,13
Static balancing, s	14,74 ± 4,21	20,64	12,51 ± 2,84	13,92

Index Rufye, arbitrary units	7,55 ± 0,50	2,46	8,44 ± 0,73	3,58
Quetelet Index, arbitrary units	388,4±6,73	33,00	344,5±7,92	38,81
Respiratory index, arbitrary units	65,86±1,51	7,28	52,22±1,87	9,19
Power index, arbitrary units	69,35±1,67	8,04	51,06±1,65	8,10
Robinson`s index, arbitrary units	90,91±3,05	14,66	80,6±1,73	8,51
Breath-holding test (Shtange), s	65,94±2,65	12,73	45,52±3,92	19,23
Breath-holding test (Gench), s	31,55±2,16	10,4	30,86±2,03	9,97
The total assessment of level health (TALH), points	8,76±0,58	2,79	8,92±0,61	3,02
Adaptive potential, arbitrary units	2,11±0,04	0,22	1,876±0,03	0,14
The level of physical condition, points	0,68±0,02	0,11	0,73±0,01	0,07

The Robinson`s index rates reflect the state of cardiovascular system functioning and make 80,6±1,73 for girls and 90,91±3,05 for boys, that witnesses to have a slight declination and a satisfactory regulation of cardiovascular system functioning. The studying of adaptation possibility level of the organism after Rufye`s index showed that it corresponds to the average level of working capacity, namely: for girls – 8,44±0,73 arbitrary units and for boys – 7,55±0,50 arbitrary

units. The analysis of the gained results affirms the satisfactory adaptation reserve level of cardiovascular and respiratory systems in groups that were examined.

According to the results of computations, BA was divided into conditional groups. Tables 2, 3 present the data about distribution of female students on conditional age groups concerning BA indexes with an average corresponding data of CA, PBA, AP, TALH, LPC.

Table 2. These girls on the conditional distribution of age groups of BV indicators relevant to an average CA, PBA, AP, TALH, LPC

BA, years	Calendar age, years	PBA, years	TALH, points	AP, arbitrary units	LPC, points
To 25 (n=1)	18	27,7	9	1,79	0,646
26-30 (n=6)	17,33	27,31	8,5	1,84	0,721
31-35 (n=8)	17,5	27,41	10,25	1,87	0,715
36-40 (n=8)	17,63	27,48	8,62	1,87	0,758
More 40 (n=2)	17	27,12	6	2,03	0,735

Due to donological diagnosis it was determined, that TALH in female group is 8,92±0,61 points, LPC – 0,73±0,01 points, the value of AP – 1,876±0,031 arbitrary units, that

corresponds to satisfactory functioning of adaptive mechanism and medium level of physical health.

Table 3. These boys on the conditional distribution of age groups of BV indicators relevant to an average CA, PBA, AP, TALH, LPC

BA, years	Calendar age, years	PBA, years	TALH, points	AP, arbitrary units	LPC, points
To 25 (n=11)	17,82	29,77	9,81	2,03	0,728
26-30 (n=4)	17,5	29,57	8,75	2,18	0,604
31-35 (n=9)	17,56	29,6	7,44	2,16	0,659
36-40 (n=1)	18	29,88	7	2,2	0,65

Statistical analysis of health assessment of male students is average, namely AP is 2,11±0,04, TALH – 8,76±0,58, LPC – 0,68±0,02.

The BA distribution on conditional age groups and statistical analysis suffer to determine that with the increase of BA the reducing the reserve

capacity level of the organism, which provide the foundation of health, and the tensivity of regulatory mechanism occurs.

BA indexes of students of faculty of Physical Education are for girls 32,7 years, for boys – 26,68, in the comparison with an average data of other authors [8, 10, 11] differ significantly. In our researches we got the follow results: only boys were found to have abruptly slowed rate of aging (24%) and slowed rate of aging (24%); BA of 6 students coincide with passport age (24%). BA indexes of girls are

much worse, thus 5 girls are observing to have abruptly rapid rate of aging (32%), rapid rate of aging is recorded in 34%; and in 32% BA coincides with the passport age (fig. 1).

In our view, such differences with other authors can be explained by increased compensatory-adaptive possibilities of organism of students under the influence of increased weekly physical workload, kinds of sport, a good state of cardio-respiratory system and place of residence, the majority of respondents lives in the mountainous districts of Lviv region.

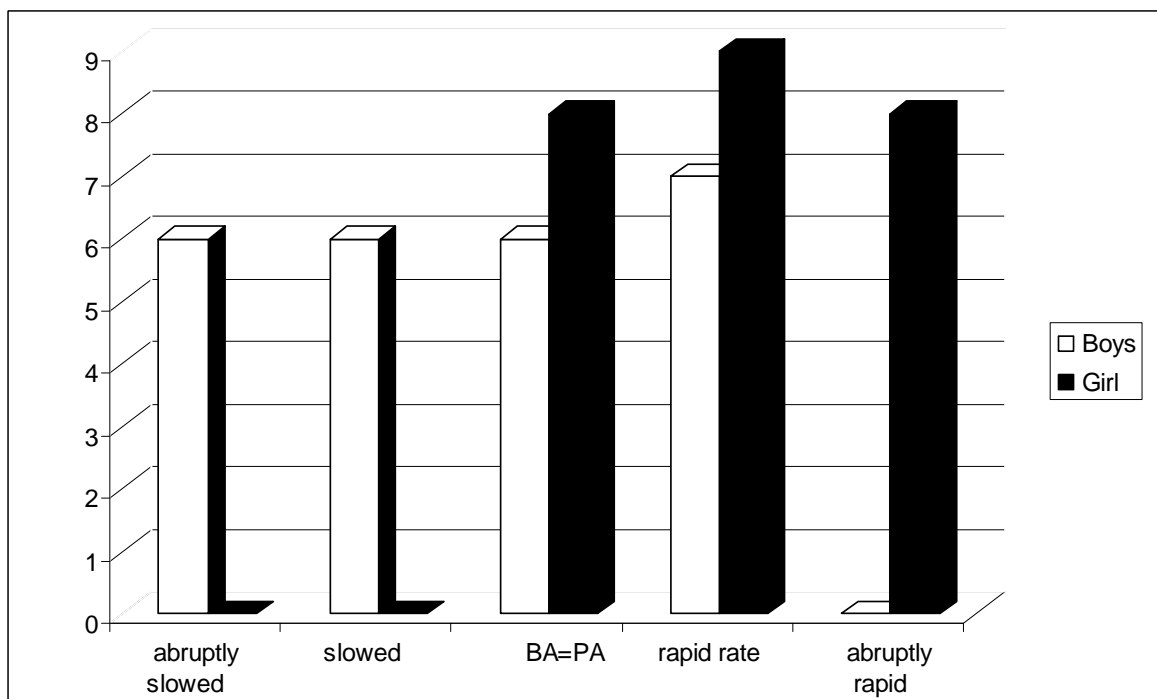


Figure 1. Correlation between BA and PA

Research made by Akhaladze N. showed the slow rate of aging is typical for Western Ukrainian population than for Crimea and Kiev population [13]. Dynamics of average indicators used to determine the BA and PBA, enabled us to judge the limiting levels that affect the rate of aging of student youth.

The coefficients of the relationship were determined by the method of pair correlation. Under the analysis of indicators included in the formula for determining BV in young men, found that improving the functional state of the organism is primarily caused by the increase of breath-holding during inspiration ($r = -0,74$), static balance ($r = -0,52$), and less influenced by

self care – POPs ($r = 0,26$), systolic blood pressure ($r = 0,28$); for girls: self care – ($r = 0,71$), pulse pressure ($r = 0,67$), static balance ($r = -0,27$), weight ($r = 0,22$), that correspond to the results of other authors [8, 10]. Self assessment of health was determined subjectively – by the method of questioning.

Analysis of the data obtained during the investigation showed that students' POP (especially girls') is characterized with symptoms inherent neurosis and conformed to objectively data. This fact is confirmed by similar studies of O.V.Drozdz (1998).

The process of higher education is often connected with considerable intellectual and

emotional workloads, with didactic barriers that lead to adverse functional changes and deflections in health status of children and youth [5].

BA – a result of valeological knowledge and skills to serve their own body. In our opinion, the calculation of BV, AP, “rapid assessment” – a simple procedure that requires no special training or multiplex equipment, but gives the lecturer information on resistance of host defenses, physical condition, the flow of adaptive processes, reserves of cardio-respiratory system, stableness of nerve processes individually to each student and allows to match

means and methods of training, adequate to biological development.

Conclusions

Our research connected with determination of biological age, adaptive potential, the total assessment of level health and level of physical condition showed them informational content. Their dynamic determination promotes timely assessment of health level and functional reserves of the organism that allows you to conduct donozological diagnosis and identify the risk groups and effectiveness of conducted valeological curative activities in school.

BIBLIOGRAPHY

1. Апанасенко Г. Л. (1992). Эволюция биоэнергетики и здоровье человека. СПб, МГП Петрополис.
2. Ахаладзе Микола Георгійович (2007). Оцінка темпу старіння, стану здоров'я і життєздатності людини на основі визначення біологічного віку : Дис. д-ра мед. наук : 14.03.03. Київ.
3. Булич Э. Г. (2003). Здоровье человека: Биологическая основа жизнедеятельности и двигательная активность в ее стимуляции. Київ, Олимпийская литература.
4. Войтенко В. П. (1989). Методика определения биологического возраста. Вопросы геронтологии, 11.
5. Гончаренко М. С. (2006). Оцінка стану соматичного та психічного здоров'я студентів вищих навчальних закладів при адаптації до навчального процесу. Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту, 3.
6. Долженко Л. (2004). Захворюваність і рухова активність студентів з різними рівнями соматичного здоров'я. Теорія і методика фізичного виховання і спорту, 1.
7. Круцевич Т. Ю. (1999). Методи дослідження індивідуального здоров'я дітей та підлітків у процесі фізичного виховання. Київ, Олімпійська література.
8. Лошицька Т. І. (2010). Біологічний вік та темпи старіння організму студентів. Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту, 7.
9. Пирогова Е. А. (1986). Влияние физических упражнений на работоспособность и здоровье человека. Київ, Здоров'я.
10. Присяжнюк С. І. (2004). Взаємозв'язок біологічного віку та стану фізичної підготовленості студентів Національного аграрного університету. Теорія і практика фізичного виховання, 1.
11. Романишин О. (2010). Соматичне здоров'я, адаптаційний потенціал, фізичний стан та біологічний вік студентів педагогічного коледжу. Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту, 11.
12. Шамардіна Г. М. (2008). Комплексний підхід до оцінки рівня здоров'я жінок першого зрілого віку за прямими, функціональними показниками та резервами біоенергетики. Учені записки Тавричеського національного університету імені В. І. Вернадського. Серія “Біологія, хімія”, Т. 21 (60), 3.
13. Akhaladze N.G. (2003). Influence of modern chemical production on aging processes. Environment and human health: The complete works of International Ecologic Forum, June 29-July. SPb, SpecLit.

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