THE EXPEDIENCY OF THE USE OF THE EXPRESS METHOD OF ESTIMATING THE SOMATIC HEALTH LEVEL OF YOUNG ADOLESCENT ATHLETES BY THE BIOENERGETICS RESERVES

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Abstract

Recently, a series of scientific works has been published in accessible literature, in which the authors pronounce a thought that the express method of estimating the level of somatic health by the bioenergetics reserves cannot be used in the estimation of health of highly trained athletes. The reason for that is the specificity of the impact of different sports on the structure of energy metabolism. As for the problem of the quantitative estimation of physical health of young adolescent sportsmen by the bioenergetics reserves, it is still unresearched.

The objective – to substantiate the issue concerning expediency/inexpediency of using this method in estimating the somatic health level of young adolescent athletes of 13–16 years old.

Methods. Theoretical: analysis of scientific, research and methodological literature concerning the problems of diagnosis of individual health; empiric: pedagogical questioning and observation; peda-gogical experiment: somatometrical and physiometrical studies; analytical: statistics methods.

Results. The dynamics of changes of somatic health levels of young sportsmen of Speed-Power sports (group A), endurance sports (group B) and pupils of a general educational institution who do not do sports (group C) has been established by the researches.

Conclusions. On the grounds of the conducted researches the authors of the article consider the use of the express method of estimating the somatic health level of young adolescent athletes to be inexpedient in the sports practice, sports medicine and rehabilitation of athletes.

Key words: health, estimation, athletes, pupils, adolescent age.

Introduction

Health as a transcendental well-being of a person [24], which, according to the thought of the WHO (1948) experts is defined as a state of complete physical, mental (psychological) and social well-being, and not only a lack of illnesses and physical impairments (defects) [16, 22, 23, 26], may be described in three diagnostic models: 1) nosological diagnostics of health, 2) pre-nosological diagnostics of health and 3) health diagnostics by direct parameters [2, 3]. The first two models are designed for the so-called «static health» by the data of registration of qualitative indices that are measured in conditions of muscular relaxation, while the third model, respectively – «dynamic health», which, as opposed to «static», implies the registration of qualitative characteristics of adaptive capacities of the organism [9]. In the capacity of the last model the common use has been acquired by two methods: the first – the express method of estimating the somatic health level by the bioenergetics reserves of the organism [2, 3], the second – the so-called test of motor and cardiac correlation (MCC test) [13, 14, 18]. The first method is based on the fact of dependency of somatic health on mechanisms of the aerobic energy supply of functions (particularly,

from energy potential of the organism) and involves the use of the parameters that characterize the vitality of the organism (survival in specific conditions of existance) and the possibility of performing social functions by a person. The second method – on the research of the morphofunctional integration as a factor that ensures a balanced cooperation of functions and organs of the person.

Nevertheless, the organism vitality – power and efficiency of the aerobic energy supply [5, 7] may serve as health criterion factors for the people who do not do sport, while: «… this approach is inexpedient for estimation of athlete's health due to key distinctions in the structure of energy metabolism, dependent on the training direction» (Rus. lang.) [4, p. 94; 6, p. 37]. Thus, according to the thought of G. Apanasenko, the deviance from the "norm" is "normal" for highly trained athletes (sports perfection stage), and the main criterion for health of the mentioned athletes (the latter should be underlined) is their sporting result [4, 6]. However, not all the scientists accept the above-stated idea. Thus, for example, K. Andersen [1], S. Blair [11], Y. Boirie [12] and others [25] consider that the value of the energy potential cannot always serve as a measure of health, as well as the integral index of the energy potential of the organism – maximum oxygen consumption (MOC) is a measure of a physical working capacity, but not a measure of physical health and life span of a person.

In regard to the problem of estimation of physical health of young athletes (specialized basic athletic performance stage and primary athletic performance stage) by the bioenergetics reserves, it is still unresearched. Taking into account everything stated above, coducting a research for dealing with the issue concerning the expediency (or inexpediency) of the use of the mentioned method in the estimation of health level of young athletes is pressing nowadays and has a significant practical importance for the sport, sports medicine and rehablitation.

The objective – to discover and to substan-tiate scientifically the issue of expediency/inexpe-diency of the use of the express me-thod of estimating the somatic health level of young adolescent athletes by the bioenergetics reserves.

Methods

Theoretical: analysis of scientific, re-search and methodological literature concerning the problems of diagnosis of individual health;

empiric: pedagogical questioning and observation; pedagogical experiment: somatometrical and physiometrical studies; *analytical:* statistics methods.

One hundred and twenty-two young adolescent athletes [boys 13–16 (n=77) and girls 13–15 (n=45) years old] have taken part in the research, and, according to the classification of sports by A. Dembo [15], they have been divided into two groups: *group A* – Speed-Power sports (boxing, freestyle wrestling); *group B* – endurance sports (skiing, cycling, track-and-field athletics: running 800, 1500, 3000 and 5000 m, speedwalking). The *control group* includes 55 pupils of Brovary General Educational Institution № 3 (among them: boys – 30 individuals, girls – 25 individuals) of the same age who have not done sport.

The estimation of the results of the research has been conducted according to the data of the comparative analysis of the first and the second (a year later) stages of examination of the teenagers after such a pattern: the athletes have been examined in the middle of their preparatory period, while their peers – pupils of the GEI, who have not done sport, – at the beginning of an academic year (September – October). The examinations have been held in the first part of the day from 9.00 to 13.00 and in the second part – from 16.00 to 19.00, in other words in periods of the augmented working capacity of the organism. The day before the examination the athletes did not exercise in the second part of the day. The food has been eaten not earlier than two hours prior to the beginning of trainings. The air temperature during the time of conducting laboratory testing has been within the frame of + 18 °C to + 24 °C. For the duration of the research all the examined have been healthy.

Results and discussion

Considering the fact that the same indices (in points) of the somatic health level (SHL) of the teenagers who specialize in sports of various training directions, as the results of our researches

have shown, are in substantially different ways influenced by values of the vitality (VI) and power indices (PI) and to a lesser degree by other constituents of the express method (height, body weight, Robinson's index, Rufe's index), hereafter we provide the characteristics of change of only two from the above-mentioned parameters.

Dynamics in values of the vitality and power indices of the three groups of the examined is provided in Table 1. Analyzing the data of the table, it is necessary to mark: it is possible to trace a veridic (under p<0,01) increase in the power index in the absence of possible changes on the part of the vitality index (p>0,05) in young athletes of Speed-Power sports (group A). As for the character of changes of the mentioned indices in endurance sports representatives (group B), then according to the data of this table it can be seen that a possible (under p<0,01) improvement in the VI in the absence of significant changes (p>0,05) of the PI is registered in them. Statistically veridic differences in the character of changes of the vitality and power indices (p>0,05 in both cases) are not found in the teenagers of the control group.

Table 1

Dynamics of Vitality and Power Indices Values in Young Athletes and the Pupils of the GEI, X±m, (n=107)

№	Groups of the Examined	Stages of the Research	n	Vitality Index, ml·kg^{-1}	Power Index, %
1	Group A	I	45	60,4±1,18	77,9±1,97
		II	45	60,6±1,38	87,6±2,01
	Significance of differences PI-PII			>0,05	**<0,01**
2	Group B	I	32	67,2±1,51	61,9±1,99
		II	32	73,8±1,77	62,5±1,89
	Significance of differences PI-PII			**<0,01**	>0,05
3	Group C	I	30	57,3±1,34	73,5±2,17
		II	30	57,4±1,30	75,9±2,15
	Significance of differences PI-PII			>0,05	>0,05

Notes: group A – athletes of Speed-Power sports; group Б – athletes of endurance sports; group C – pupils of a general educational institution who do not do sports

It is necessary to add to the above-considered that the somatic health level (according to the three-level scale of G. Apanasenko [2]) is estimated as «high» in young athletes regardless of the direction of their training process (from 12 to 14 points), while in the pupils of the GEI who do not do sport – «average» (from 7 to 8 points respectively).

The results of the comparative analysis of the VI and PI values of the two groups of adolescent athletes and their peers – the pupils of the GEI who do not do sport, according to the data of the first stage of the research, are provided in Table 2. As it can be seen in this table, the value of the power index is considerably higher in the teenagers doing Speed-Power sports comparing to the teenagers doing endurance sports (p<0,001), but any difference has not been found (p>0,05) in comparison to the non-athletes pupils. As paradoxical as it can be, the value of the PI in teenagers of the control group (group C) is better in comparison with the athletes of group B (p<0,001). Thus, analyzing the indices of the VI, it is possible to discover the following: the value of the mentioned index is reliably higher in athletes who predominantly develop the quality of endurance in comparison with the athletes of Speed-Power sports (p<0,01) and the pupils of the GEI who do not do sport (P<0,001); a veridic difference between individuals of group A and group C has not been discovered (p>0,05).

Table 2

Comparative Analysis of the Parameters of the Vitality and Power Indices in Young Athletes and Pupils of the GEI According to the Data of the First Stage of the Research, X±m, (n=107)

№	Groups of the examined	n	Vitality index, ml·kg^{-1}	Power index, %
1	Group A	45	60,4±1,18	77,9±1,97
2	Group B	32	67,2±1,51	61,9±1,99
3	Group C	30	57,3±1,34	73,5±2,17
Significance of Differences		P1-P2	**<0,01**	**<0,001**
		P1-P3	>0,05	>0,05
		P2-P3	**<0,001**	**<0,001**

Notes: group A – athletes of Speed-Power sports; group Б – athletes of endurance sports; group C – pupils of a general educational institution who do not do sports

The same results are obtained during the analysis of Table 3 (the data of the second stage of the research), which demonstrate a significant growth of the value of the PI in the teenagers doing Speed-Power sports comparing to the teenagers doing endurance sports and the non-athletes pupils (p<0,001 in both cases). It is possible to notice of a similar to the results of the first stage of the research character change of indicators of the PI, namely: veridicly higher arithmetic mean values of the mentioned parameter in young athletes of group B than in individuals of group A (p<0,01) and the control group (p<0,001) is registered.

Table 3

Comparative Analysis of the Parameters of the Vitality and Power Indices in Young Athletes and Pupils of the GEI According to the Data of the Second Stage of the Research, X±m, (n=107)

№	Groups of the Examined	n	Vitality Index, ml·kg^{-1}	Power Index, %
1	Group A	45	60,6±1,38	87,6±2,01
2	Group B	32	73,8±1,77	62,5±1,89
3	Group C	30	57,4±1,30	75,9±2,15
Significance of Differences		P1-P2	**<0,01**	**<0,001**
		P1-P3	>0,05	**<0,001**
		P2-P3	**<0,001**	**<0,001**

Notes: group A – athletes of Speed-Power sports; group Б – athletes of endurance sports; group C – pupils of a general educational institution who do not do sports

Thus, on the grounds of the conducted longitudinal studies, it has been discovered that similarly high levels of somatic health in young athletes (boys) with different directions of the training process are reached in a variety of ways, namely: in Speed-Power sports (group A) it is possible to notice a veridic (under p<0,01 and p<0,001) growth of the power index and an inconsiderable (p>0,05) growth of the vitality index, while in endurance sports (group B), vice versa, a veridic (p<0,01) growth of the VI and inconsiderable (in other words, the so-called «loss» phenomenon [13, 21] occurs) changes of the PI are registered. We would also underline the fact that the pupils of the GEI (group C) do not show veridic differences in the character of the change of the VI and PI parameters, namely, an unreliable growth (p>0,05) in the dynamics of the mentioned values is seen.

The following facts have been determined in the materials of the longitudinal study of parameters

of the vitality and power indices in estimating the somatic health level in 13–15-year-old girls – young female athletes (groups A and B) and their peers – pupils of the GEI who do not do sports: 1) in the female athletes doing Speed-Power sports a veridic (under p<0,001) growth of the parameter of the PI and inconsiderable changes of the VI parameter (p>0,05) are registered; 2) in the female athletes doing endurance sports a veridic (under p<0,001) growth of the parameter of the vitality index and inconsiderable changes of the parameter of the power index (p>0,05) are noticed; 3) as one can expect, the representatives of the control group do not show any veridic differences (p>0,05) in the character of the change of the above-mentioned values (Table 4).

Table 4

Dynamics in the Values of the Vitality and Power Indices in Young Female Athletes and Pupils of the GEI, X±m, (n=70)

№	Groups of the Examined	Stages of the Research	n	Vitality Index, ml·kg^{-1}	Power Index, %
1	Group A	I	25	45,1±1,19	55,8±1,71
		II	20	46,8±1,52	69,4±2,35
	Significance of Differences PI-PII			>0,05	**<0,001**
2	Group B	I	20	55,2±0,63	52,1±1,01
		II	16	62,1±1,25	53,0±1,31
	Significance of Differences PI-PII			**<0,001**	>0,05
3	Group C	I	25	49,7±1,26	54,4±1,70
		II	22	50,2±1,50	54,9±1,60
	Significance of Differences PI-PII			>0,05	>0,05

Notes: group A – athletes of Speed-Power sports; group Б – athletes of endurance sports; group C – pupils of a general educational institution who do not do sports

The comparative analysis of the parameters of the vitality and power indices in the examined females according to the data of the first stage of the research (Table 5) has confirmed higher (under p<0,05–<0,001) values of the parameter of the PI in the female representatives of endurance sports in comparison to the individuals doing Speed-Power sports and these who do not do sport. At the same time, statistically valid differences in the character of the PI parameter changes among the three groups of the examined have not been found (p>0,05 in all the cases).

Table 5

Comparative Analysis of the Parameters of the Vitality and Power Indices in Young Female Athletes and Pupils of the GEI According to the Data of the First Stage of the Research, X±m, (n=70)

№	Groups of the Examined	n	Vitality Index, ml·kg^{-1}	Power Index, %
1	Group A	25	45,1±1,19	55,8±1,71
2	Group B	20	55,2±0,63	52,1±1,01
3	Group C	25	49,7±1,26	54,4±1,70
Significance of Differences		P1-P2	**<0,001**	>0,05
		P1-P3	**<0,05**	>0,05
		P2-P3	**<0,001**	>0,05

Notes: group A – athletes of Speed-Power sports; group Б – athletes of endurance sports; group C – pupils of a general educational institution who do not do sports

From the materials of the second stage of the examination of the girls (Table 6), similarly to the results of the examination of the boys (see Table 3), it is possible to find a practically the same character of changes of the mentioned parameters: substantially higher growth of the arithmetic mean values of the PI in female athletes the training process of which is usually directed at the development of Speed-Power qualities than in their peers – respresentatives of endurance sports ($p<0,001$). While the results of the research confirm that under the influence of training loads, mostly directed to the development of the endurance quality, vice versa, veridicly higher (under $p<0,001$) values of the vitality index in comparison to the Speed-Power sports are registered.

We will add to the stated above that the level of physical health of the young female athletes (similarly to the male athletes) is also estimated as «high», and that of the pupils of the GEI who do not do sport – «average».

Table 6

Comparative Analysis of the Parameters of the Vitality and Power Indices in Young Female Athletes and Pupils of the GEI According to the Data of the Second Stage of the Research, X±m, (n=58)

№	Groups of the Examined	n	Vitality Index, ml·kg^{-1}	Power Index, %
1	Group A	20	46,8±1,52	69,4±2,35
2	Group B	16	62,1±1,25	53,0±1,31
3	Group C	22	50,2±1,50	54,9±1,60
Significance of Differences		P1-P2	**<0,001**	**<0,001**
		P1-P3	>0,05	**<0,001**
		P2-P3	**<0,001**	>0,05

Notes: group A – athletes of Speed-Power sports; group Б – athletes of endurance sports; group C – pupils of a general educational institution who do not do sports

On the grounds of the results of the conducted studies it is possible to make a conclusion that the same by the value levels of somatic health (in our case – «high» level) can be reached in numerous ways: in one case – by means of a substantial growth of the PI parameter (for example, in young athletes who do Speed-Power sports), in another – of the VI parameter (in teenagers who do endurance sports respectively).

The above-mentioned is the result of a specific impact of the training loadings of various character on the functions of the organism of people of different age and professional activities (in our case – on the peculiarities of energy metabolism of the young athletes's organism) [13, 15, 21].

From our researches which have been conducted earlier [20] it is possible to learn the fact about the specificity of the impact of training loadings of different directions on the level of the energy potential on the basis of the comparative analysis of some parameters of somatic health and physical preparation of young athletes. We will provide the following fact as an example: two athletes of the age of 16, who specialize in different (by the direction of the training process) sports (a wrestler V. N-y – representative of Speed-Power sports and a skier M. B-s – representative of endurance sports) have been under our observation. Both athletes have had the same level of the energy potential of the organism, and their somatic health level is estimated as «high» according to the express method scale of G. Apanasenko (14 points).

The arith-metic mean values of the power index (PI) substantialy higher of the wrestler V. N-y than of the skier M. B-s (84,1 % – the wrestler versus 51,4 % – the skier), while analogous values of the vitality index (VI) are higher of the skier in comparison with the wrestler (67,1 ml·kg^{-1} – of the skier versus 54,5 ml·kg^{-1} – of the wrestler respectively).

Due to the fact that there exists a close interdependence between somatic health and physical preparation of teenagers [8], it is possible to hope that athletes with the same level of LEP (level of the energy potential) should have approximately close values of the parameters of strength and endurance in estimation of the physical preparation. As paradoxical

as it can be, it is a fact that, according to the results of the conducted examination, in estimation of the physical preparation of the studying youth of Ukraine veridic differences in conducting examinations in estimation of the quality of strength and endurance exist. Thus, the quality of strength of the wrestler (according to the data of chin-ups) is estimated as «high» (5 points according to the test scale), while the endurance (the result running 1500 m) – as «low» (2 points), respectively, high parameters at running (the time of crossing the mentioned distance – 4 min, 48 sec) and relatively low (more than a three times less than that of the wrestler) parameters at the chin-ups (10 and 32 times respectively) are registered in the skier.

The researches of M. Fournier [19] that states that the specific «interference» of different by directions trainings in the structure of the energy metabolism in young athletes may be interesting, in our opinion (as an example). The researchers have established that narrow-directed (an- and aerobic) 5-month trainings of 16–17-year-old athletes, in one case (sprint trainings), have substantially intensified activities of phosphofructokinase in the muscles («anaerobic» ferment), at the same time the activity of the succinyl dehydrogenase (oxidative phosphorylation ferment) does not change, in another (aerobic trainings), vice versa, - intensify activities of the «aerobic» ferment, while the «anaerobic» stays practically unchanged.

Thus, the main factor that makes it impossible (and in such a way indicates the inexpediency) to use the express method in establishing the somatic health level of young adolescent athletes by the bioenergetics re-serves, in our opinion, is the phenomenon of the «loss» of functional capabilities during the process of a workout. The latter is the result of the specific (selective) influence of exercises with physical loadings of different directions on both the structure of the energy metabolism [4, 13, 15, 21], the character of changes on the physical level of the person's health as the integral or bioenergoinformosocial system [10, 17] with the Maslow's hierarchy's construction principle and on the mental and spiritual levels [21].

Conclusions

On the grounds of the conducted re-searches we consider the use of the express level of the quantitative estimation of the young adolescent athletes's somatic health lev-el (specialized basic athletic performance stage) by the bioenergetics reserves, similar to the highly trained athletes (sports perfection stage), in our opinion, to be inexpedient in the sports practice, sports medicine and rehabilitation of athletes. The reason is the substantial differ-ences in the structure of the energy metabolism during the muscular activity, which are condi-tioned by the specificity of the impact of the different directions training loadings on the functions of the person's organism.

Conflict of interest

The author claims that there is no conflict of interest.

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