AEROBIC AND ANAEROBIC ORGANISM PRODUCTIVITY AS FACTORS THAT DETERMINE THE LEVEL OF PHYSICAL HEALTH

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Annotation. *Purpose*: to identify and assess the level of physical health of men of the first coming of age 21-23 years. *Material*: the study involved 413 students and 17 teachers and sports doctors. *Results*: the influence of cross-country training aerobic and anaerobic focus on physical performance, aerobic and anaerobic performance of the student body. The efficiency impact exercises using running loads of aerobic and anaerobic focus on the physical health of students. It is proved that the level of aerobic performance drops to safe limits and requires correction. To correct the body's aerobic performance is recommended to use for running load. *Conclusions:* found that the correction would be the most efficient and effective through the development and implementation of health technologies based on the use of extracurricular classes jogging exercises. It should take into account the frequency and methods of learning, physical work mode power supply and energy value of each class.
Keywords: aerobic, anaerobic, lactate, productivity, physical health, jogging workout.

Introduction

Today the requirement of health improvement with students' youth is of the greatest importance. Here one of the most prospective ways of the problem solution is to develop health improving technologies and to introduce them into educational process. The best reserves for such technologies implementation are represented in effective arrangement of extracurricular lessons for students [11; 25].

We investigated the influence effectiveness of lessons using run loads of aerobic and anaerobic direction upon physical health of male students of the first mature age (21-23 years old). The choice of such cohort for study in run programs under investigation was conditioned by availability of scientific information on the fact that the level of physical health with men of the given age represented as relative index $VO_{2\ max}$ at the average is lower than with women. The average $VO_{2\ max}$ value with men is lower than the safe health level while with women it substantially exceeds the level [15; 23].

Purpose, tasks of the work, material and methods

Aim of the study was to determine and estimate the level of physical health of men of the first mature age 21-23 years old.

Task of the study was to study the influence of run training of aerobic and anaerobic direction upon physical working capacity, aerobic and anaerobic (lactate) organism's productivity with students 21-23 years old.

Methods of the study: increase of physiological processes under the influence of physical training is of phase character and demonstrated in the form of immediate, delayed and cumulative effect [24]. Immediate training effect is determined through amount and character of biochemical and functional changes arising in organism during physical load execution, as well as after its termination up to the full elimination of oxygen debt. Delayed training effect is characterized by restoration of organism's functions altered in the course of the organism functions' activity as well as restoration or super-restoration of energy resources and protein structures of the organism. In its turn cumulative training effect arises as a consequence of traces summarization of great number of immediate and delayed training effects, and is characterized by intensification of synthesis of nucleic acids, high-energy compounds, and specific albumens. As a result of such changes energy and functional reserves of an organism grow the fact being demonstrated through their economical utilization in the status of relative muscular rest and standard physical loads.

Experimental and research work was conducted at Lugansk National University named after Taras Shevchenko Governmental Institution. The total number of 21-23 years old male students who took part in the study was 413, with 17 sports educators and doctors.

Results of the research

Health can be characterized in terms of quantity. It is established that among known methods of quantitative estimation of health level the highest diagnostic importance belongs to those allowing determination of bio-system's energy potential [13; 18]. The foundation of this concept of physical health includes the idea based on the second law of thermodynamics, and namely the higher bio-system's energy potential the higher its stability. Its reduction results in entropy growing and degradation of the system. Energy potential is characterized by maximal aerobic capabilities of an individual that is maximal oxygen utilization. Scientific literature represents numerous proofs of the fact that the value of maximal oxygen consumption means resistance of an organism against multiple factors of external and internal environment, from hypoxia and blood losses to penetrating radiation [14; 19]. It is the simple system of tests developed by G.L. Apanasenko [4] which implementation is practicable by middle medical staff: it does not require any complicate devices and has the high correlation coefficient with indices of maximal oxygen consumption ($r = 0.8$).

Wide approval of the method allowed description of the phenomenon of the safe level of health as health reserve characterized in quantitative terms preventing formation of endogenous factors of risk of diseases development or manifestation. It is logical to state that the safe health level means scientific ground of primary prophylaxis of

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chronic non-infectious diseases. For individuals of male sex it corresponds to 42 ml min^{-1} kg^{-1} of the value of maximal oxygen consumption.

When an organism leaves the safe health zone then the phenomenon of self- development of pathologic process appears without the change of the acting factor force. Transient or the third conditions is characterized by the health level that borders upon the safe health level on the one hand and manifestation commencement of a pathologic process on the other hand. The mechanism of health reserves accumulation is developed to allow the organism turn towards the safe health zone that are united under the same title of preventive rehabilitation. Individual health control is the controlled process of health improvement of a certain person taking into account the abovementioned phenomena allowing positioning of primary prophylaxis of chronic non-infectious diseases onto exclusively scientific basis.

Phenomenon of the safe health level described by G.L. Apanasenko gives us the opportunity to discover direct reason of epidemic development of chronic non-infectious diseases in the second half of the previous century. This reason is reduction of maximal aerobic human opportunities on the level of population thus exceeding the frames of the safe health level. Considering the above any quantitative estimation of physical state requires determination of indices characterizing aerobic productivity of an organism especially the index of maximal oxygen consumption. Though physical health of a human depends on values of maximal oxygen consumption [2; 17; 22; 23; 26] the important role in the physical health formation also belongs to anaerobic lactate processes of metabolism [1; 5]. T. Kostka with coauthors emphasizes the fact of depending of physical health on anaerobic productivity of an organism. The level increase of anaerobic lactate productivity results in myocardium immunity against hypoxia [10]. Findings of studies by O.A. Pirogova with coauthors [16] demonstrate positive interconnection between data of heart activity, and the status of aerobic and anaerobic metabolism. On the ground of comparative analysis conducted with practically healthy people who do not go in for sports it appeared that the higher data of subendocardial blood flow, transport of oxygen to myocardium, and its lower consumption by heart muscle with relatively similar values of organism's aerobic productivity was noted with persons whose level of anaerobic lactate productivity was higher.

Thus, we must estimate physical health considering not only aerobic but also anaerobic productivity of an organism.

Information on age dynamics of aerobic productivity of an organism for human physical health estimation is contradictory.

Some of researchers emphasize the growth of absolute value $VO_{2\ max}$ till 25 years old, stabilization from 25 to 33 years old, and gradual decrease after 38 [6; 20]. There exist data demonstrating the growth of the absolute index $VO_{2\ max}$ up to full completion of sexual maturity [21].

The highest increment of the index is detected in the age of 13-14 years old with male individuals (by 28%) and in the age of 12-13 years old with representatives of female sex. However beginning with the age of 16 years old with boys and 14 years old with girls there is no detected growth of the $VO_{2\ max}$ value. Besides, with representatives of female sex the absolute value $VO_{2\ max}$ in average is some lower than with boys thus comprising in the age of 12 to 15 years old 90.25 of male index, in 16 to 20 years old 82.5%, and in the age of 21 to 24 years old 82.1% [6; 25]. As for age changes of the $VO_{2\ max}$ index some authors insist on its permanence while other on its reduction. Making analysis of age dynamics of $VO_{2\ max\ relative}$ indices J. Rutenfranz and T. Hettinger emphasize its stability till 17 years old while K.L. Andersen with coauthors – till 35-40 years old. L.G. Yevseyev and O.A. Yakovlev [8] state that the relative index $VO_{2\ max}$ is practically stable from 6 to 25 years old comprising in average 50 ml min^{-1} kg^{-1}.

In accordance with information by H. Mellerovicz when we suppose the values $VO_{2\ max\ relative}$ in the age of 20-30 years old be 100% then in the age of 40-50 years old they comprise 82.5%, and 65% in the age of 60-70 years old. The similar age change the $VO_{2\ max}$ index is permissible in accordance with criteria of its estimation by Ya.P. Pyarnat and I. Astrand.

Findings of the study by O.O. Bekas [5] indicate the real reduction of the index $VO_{2\ max\ relative}$ beginning with 16 years old, either with male and female sex provided their body mass does not exceed the norm. Besides, in the period from 16 to 20 years old there is no sex difference in the average index $VO_{2\ max\ relative.}$ But in accordance with all existing criteria of physical health estimation in terms of the $VO_{2\ max\ relative}$ value men are substantially worse than women [7]. S.V. Khrushchyov points out the reduction of the relative index $VO_{2\ max}$ after the age of 16 years old with individuals of female sex.

As for information on age dynamics of anaerobic productivity of an organism it is also contradictory.

There exists information demonstrating the growth of anaerobic a-lactate and lactate productivity till 18 years old and its stability till 30 years old. With persons before 18 years old and after 30 years old the anaerobic productivity is reducing 1-2 per cent per a year of the life [9]. K. Bushar with coauthors specifies the uniform age dependent reduction of anaerobic productivity. As they state such reduction equals to approximately 6% per a decade, and the reduction dynamics is not connected with sex.

As other authors state, with young people of 10 to 14 years old the value of anaerobic lactate productivity that is recognized to be a relative index of outside mechanical activity during 30 seconds does not differ from that with adults. Here there is no any detected substantial sex difference of the index [26]. However the results of research by C.A. Gaul with coauthors get us convinced that lactate and a-lactate anaerobic productivity with children before pubertal period completion is much lower than with adults.

Results of examinations conducted by J. Jacobs among students of physical training department demonstrate the presence of difference in indices of lactate and a-lactate anaerobic productivity with representatives of both male

and female sex. Thus male students' maximal value of outside mechanical activity during 10 seconds comprises in average 61.8 ± 3.6 kgm min^{-1} kg^{-1} while during 30 second 51.0 ± 3.2 kgm min^{-1} $kg^{-1.}$ Female students have correspondingly 54.6 ± 4.8 kgm min^{-1} kg^{-1} and 45.0 ± 3.0 kgm min^{-1} kg^{-1}.

Conclusions

In the process of analysis of materials from literature, and generalization of practical experience by leading experts we established the following things. It was found that physical condition represents dynamic health of a human that must be estimated based on the level of functional and physical preparedness. Aerobic and anaerobic metabolic processes play the great role in forming physical health. On the modern stage of development of Ukrainian society the issue of physical health improvement of male students of the first mature age is critical. The problem solution could be provided due to correction of an organism aerobic and anaerobic productivity through improvement of mechanisms of specific adaptation to physical loads of those systems that limit aerobic and anaerobic processes of energy supply. It is expedient to make correction of physical health of male students of the first mature age using extracurricular lessons with cyclic exercises, in particular run loads. However one should take into account periodicity and methods of lessons conduct, energy supply mode, and energy consumption at each lesson.

Besides, for correction of aerobic productivity of an organism we could use run load stimulating not only aerobic but anaerobic processes of energy supply. To increase anaerobic productivity we must use loads that stimulate also anaerobic processes of energy supply. For better growth of aerobic productivity with male students of the first mature age it is expedient to use run exercises with stimulation of anaerobic processes of energy supply.

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