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Biological age as a determinating factor of individualization of physical education of children

Abstract. ***Purpose:*** *to examine the existing methods of determine biological age of the children and choose the most affordable for the population.* ***Material and Methods:*** *theoretical analysis and generalization of literary sources.* ***Results:*** *the article presents a comparative analysis variety methods for determining the biological age. The qualitative component ratio of the body structure without its total volume and weight of body weight is the most effective method of determining the quality indicators of biological age.* ***Conclusions:*** *the main indicator of the biological age should be considered as a function of weight formation (weight) of the body that is associated in meaning with average population values.*
Keywords: *physical education, physical development, biological age, chronological age, types of constitution.*

Introduction. The problem of individualization of physical education presumes first of all an account of age-specific habits of the developing organism. The traditional approach of an account of age-specific rates of physical growth and development is based on the average screening survey indexes of basic signs of differentiation and maturation of the certain systems of the organism. Such criteria are: skeletal age, dental age, the age reached by the shape of the body, secondary sexual characteristics chronological age and some others.

A significant drawback of this approach in the determination of the biological age is chronological inconsistence of these indicators for a single person. The choice of statistical indexes on the marked signs of biological age enables to create a model of an coincident chronological and biological age of the personal growth that satisfy the requirements. However in real terms in the criteria of biological development there is no coincidence with a chronological model of normal physical development. Taking into account an importance of problem solving, there were conducted an analysis of the scientific literature on this issue, an analysis of the statistical data of the examined contingent, the development of theory for building indicative semantic spaces with an introduced measure of their elements closeness, on the basis of what was installed a unified model that reflects the structure relations of the signs which characterize the biological age.

Connection research with academic programs, plans, themes. Research was conducted according to the thematic plan Kharkiv state academy of physical culture of research work: «Scientific methodical bases of the use of information technologies at the preparation of specialists in the area of physical culture and sport» (state registration number 0113U00120).

Purpose: to examine the existing methods of determine biological age of the children and choose the most affordable for the population.

Materials and Methods: theoretical analysis and generalization of literary sources.

Research results and their discussion. In construction of the healthy lifestyle system the national system of physical education is one of the main components, which should be based on the results of a permanent monitoring of physical population development, it’s physical readiness and physical state.

Current stage of construction of the physical education system implies obligatory systematic monitoring of physical development and the features of its individual manifestations, which determine the necessary and sufficient level of the physical readiness. This requires for one’s turn the development of tools and methods to ensure the physical load for each physical development age level, which arsenal should meet the necessary requirements that are determined by the individual physical development characteristics.

First of all it is necessary to take into account the biological organism maturation and the true biological age. Physical person development is an exclusively multilateral concept. The doctrine of physical development is one of the most soon formed independent directions in physical anthropology. In a modern anthropology by the physical development it is comprehended the complex of morphological and functional organism properties which determinate the reserve of their physical potentialities, a measure of active capacity, as well as the process of formation of the basic morphofunctional and somatic indicators itself that can be monitored to assess their development. In the study of the human health it plays a large role [1].

In the basis of the characteristics of physical development are commonly used signs that reflect the “structural-functional” properties of the organism. The correlation of morphological and functional aspects of the biological person status constitutes the central anthropometric constitutiology issue, since the constitutional concept is based on the unity of form and function. The need for a comprehensive approach to the person body constitution is justified by the existence of common factors that determine the integrity of the developing, mature and aging organism, which corresponds to the integral principle in the study of the biological person status.

The correlation of constitution types with a predisposition to certain diseases is part of the general problem of the relation between the characteristics of morphofunctional person organization and of the organism reactivity and resistance to environment alternating factors, as well as the study of «individual reaction norm» of the organism. Different variants of individual norms in the relevant least reflect different types of adaptive behaviour, which

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are equal evident at both individual and population levels. Constitutional variety of populations reflects the measure of it's reactions to the influence of the environment. The concept of «predisposition» is the basis of extreme variants allocations of deviations morphofunctional organization in normal human populations and marked in them shifts represent the ontogeny of a number of diseases. This allows using constitutional typology as diagnostic and predictive characteristics, as relatively high sensitivity to certain environmental factors, as well high resistance to other environmental factors.

One of the main tasks of the sports anthropology is the study of the influence of different means of physical activity on physical development and somatic body features that determines success in various kinds of sports specialization, as well as on morphofunctional status of the youth generation in general. Not less important task is the organization of children and adolescents development monitoring in different environmental conditions with the delineation of the extreme values of these conditions for each category of the surveyed contingent, which in turn requires the tests standardization that evaluate the physical readiness and physical development level.

In medicine which is the main branch of practical human biology as extirpation of infectious diseases is increasingly paid attention to the constitutional diseases. Behncke as one of the first who studied the somatic constitution formulated in 1881 the goal of this direction with the following expression: «Different constitutions and the resulting different resistance degree of the organism pave the way for the development of certain diseases, if the individual is in adverse conditions. No need to explain how important is this point of view for general hygiene and therapy. With the correctly identifying of the various constitutional types and realizing of their physiological differences we can help people to walk safely through all the vicissitudes of life» [2].

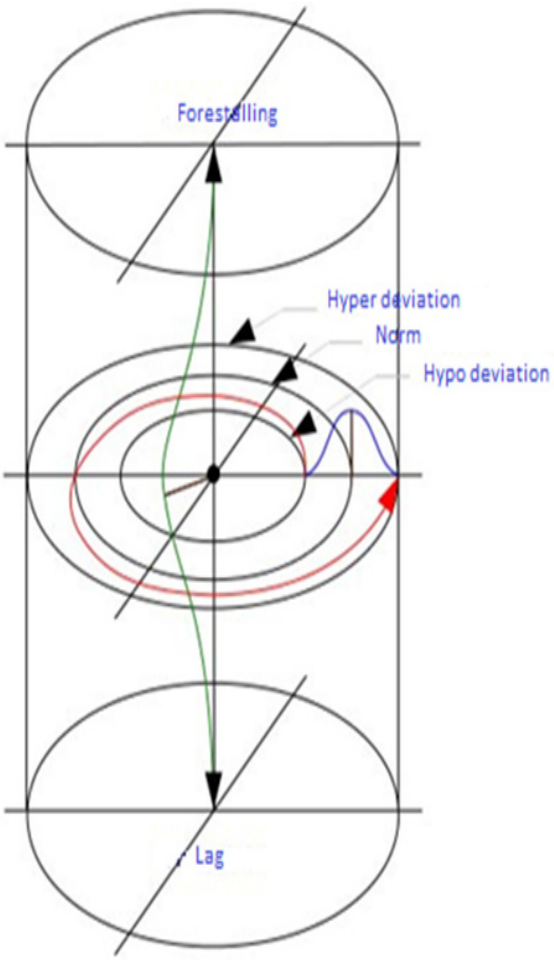
In turn, speaking about the development process, Dearest, Göriach, Koch showed that with increasing of tissue energy is broken the correlation between growth and form. The formation accelerates so, that ends with a nanoid growth [1]. Considering the process of development, Geoffroy Saint-Hilaire pays attention to the need to distinguish the growth from formation (Paris, 1836) [3]. Thus, the basic factor of the development process is the body growth – its mass formation rate, which is in compliance with the study of this process takes place on a strictly defined regularity [4]. As a consequence of this process it is involved a differentiation of tissues by the accumulation of a certain mass, which is reflected in the formation of the body structure. By the imaging of the body structure as a three-dimensional object you could say about its growth in three directions [5, 6], which is reflected in shaping body volume. The most convenient indicator of this is shaping body length. The ratio of the two signs, reflecting the process of development, is most revealing of its representation, which reflects all the variety of possible somatotypes structures[7].

Based on the process of a body mass formation rate, relatively to the principles of course of its trend to each its value, by comparing the shape of the body, you can observe all the variety of variations of its structures occurring in the interval from a minimum monitored object to the maximum occurring [8; 9].

In the process of the body development and the formation there is their maturation, which is an indicator of their chronological development. It occurs because a metabolic processes course feature by the different hormonal ratio, which is expressed in the external body structure, leads to various speed of ripening of selected markers of biological evolution. If the average characteristics of used biological evolution (age) indicators will be taken as a standard which corresponds to the weight growth standard, then relative to this standard all leading and lagging in ripening time signs of biological development can be ranked in order of their deviations from the minimum value of development speed to the maximum. This relation can be represented in multidimensional sign semantic space with an introduction of a single function action (pic.).

Thus, the widely used concept of skeletal, dental age, age reached by the body shape and other observed by a particular individual, reflects a qualitative feature of the body form building from the same volume of formed body mass.

The ratio of body parts to the total growth is qualitative structure of the body formation of the body. By the coincidence of the structure relations of the compared object with a standard of relations for all body parts, their ratio is equal to one, which allows to represent the standard as a circles with unit radius, to which each body part has its place, united by the radius vector [10].



Pic. Semantic space of qualitative morphofunctional relations reflection and assessment of biological age

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By violation of synchronicity in the observed relation coherence of running morphofunctional processes will be observed forestalling and lag in the speed of ripening and corresponding form-building of parts of the whole. (In this case, the full amount of the whole form-building corresponds to one biological age, and parts of it to different). Deviations in both sides define the boundaries of interaction inconsistency or tolerance of semantic space that displays observed processes.

Within limits of functional optimum such deviations retain a sufficient level of viability, but determine the possible trend of systematic errors accumulation and transfer of this accumulation in a specific pathology. If the diversity has no systematic unidirectional accumulation and stores in a given area, such effect determines the level of inconsistency and equally likely development of violations which acquire strengthening of their direction depending on the conditions of interaction with the surrounding educational environment [11].

The more systematic interacting processes consistency heterogeneity is, the lower is the resistance of the organism in general and higher the liability to any violations. In this case, the determinating role plays the sensorial system of control over the current state of the interacting morphofunctional processes. The forestalling and lagging area in the history of the development of parts determines the allometry of their development and equity importance in general, which is the basis of prenosological diagnostics.

In the three-dimensional space such dynamics of the running process creates toroidal spiral by using of the polar coordinate system. In a rectangular coordinate system it is a pulsating sphere, which increases its volume. By the accumulation of systematically appearing violations it becomes apparent in the protrusion of its separate areas.

The quality ratio of the body structure components without taking into account the volume and mass of the body is the most effective method of the biological age quality characteristics determining. The estimation of the development speed using the shaping of the individual body structure components are fairly widely used in the assessment of biological age. It is used the concept of skeletal age, dental age, reached by the shape of the body age.

The dispersion of estimation of biological age parameters in each of the separate method of its assessment indicates the need of their generalized representations in the solution of the biological age assessment issue, since we are talking about shaping of the existing body weight. Practically this process is associated with the quantitative accumulation of body shaping components in its overall growth.

Correct equity ratio of shaping determines the most viable overall body structure which has the necessary stability, reliability and reproducibility (maintainability). Any deviation from this condition reduces the duration of existence, but this structure cannot be considered outside the stay environment.

In a practical manner the biological age in comparison with chronological plays a role of the synchrony development violations measure in the most viable holistic formation and in all cases this is a measure of remoteness from the average value, which is a population norm of optimal environmental cooperation «**object – stay environment**».

Conclusions:

1. The main index of the biological age should be considered as a function of body weight formation which value is compared with an average population value.
2. A common deviation from the average age norms of the population values of any of the biological age indicators points on the deviation in the mutual provision of functional systems, which argue the certain predisposition to constitutional diseases.
3. A system of evidence which reflects the biological age in a presented semantic space can be increased depending on the required accuracy of diagnostic conclusions about the features of the qualitative indicator of arising deviations.

Prospects for further research is to find effective ways of implementing chosen by us method for determining biological age in the process of physical education of children.

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Анотація. Ашанін В. С., Пятисоцька С. С., Жерновнікова Я. В. Біологічний вік як визначальний фактор індивідуалізації фізичного виховання дітей. ***Мета:*** *вивчити існуючі способи визначення біологічного віку дітей і обґрунтувати вибір найбільш доступного для даного контингенту.* ***Матеріал і методи:*** *теоретичний аналіз і узагальнення літературних джерел.* ***Результати:*** *у статті представлено порівняльний аналіз різноманітних способів визначення біологічного віку. Якісне співвідношення компонентів структури тіла без урахування загального його обсягу і маси тіла є найбільш ефективним методом визначення показників біологічного віку.* ***Висновки:*** *основним показником біологічного віку необхідно вважати функцію масоутворення тіла, зіставленого за своїм значенням з середньостатистичним популяційним значенням.*
Ключові слова: *фізичне виховання, фізичний розвиток, біологічний вік, хронологічний вік, типи конституції.*

Аннотация. Ашанин В. С., Пятисоцкая С. С., Жерновникова Я. В. Биологический возраст как определяющий фактор индивидуализации физического воспитания детей. ***Цель:*** *изучить существующие способы определения биологического возраста детей и обосновать выбор наиболее доступного для данного контингента.* ***Материал и методы:*** *теоретический анализ и обобщение литературных источников.* ***Результаты:*** *в статье представлен сравнительный анализ разнообразных способов определения биологического возраста. Качественное соотношение компонентов структуры тела без учета общего его объема и массы тела является наиболее эффективным методом определения показателей биологического возраста.* ***Выводы:*** *основным показателем биологического возраста необходимо считать функцию массообразования тела, сопоставленного по своему значению со среднестатистическим популяционным значением.*
Ключевые слова: *физическое воспитание, физическое развитие, биологический возраст, хронологический возраст, типы конституции.*

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