UDC 6126.003.12/161.263

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The problem of determining biological age in the assessment of physical development and preclinical diagnosis of constitutional diseases

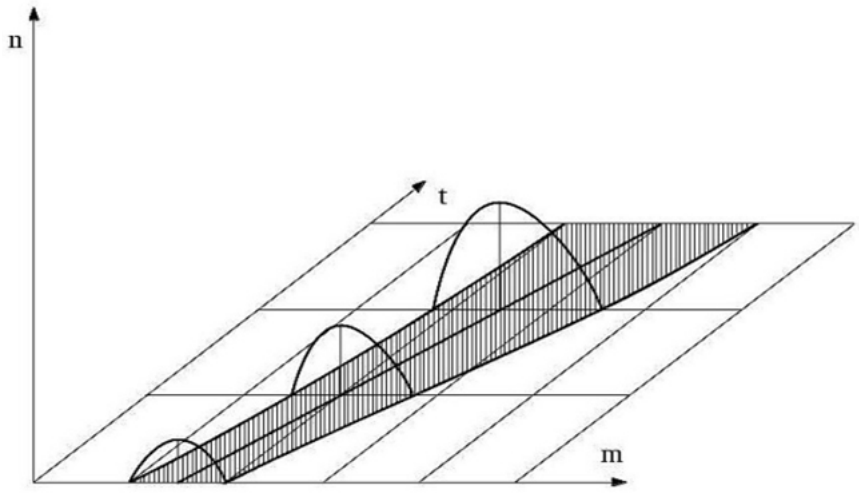
Abstract. ***The purpose****: to set base principles of process of physical development and reasons, originative the features of his individual occurrence.* ***Material and methods:*** *analysis and generalization scientific literature on this problem, and anthropometric studies observed contingent.* ***Results:*** *the process of physical development is presented as two independent relations - height of body and his weight formation, which allowed presenting the structure of variant of body formation.* ***Conclusions:*** *features of the structure forming mass in its accumulation to a certain extent implemented in the organogenesis of morphological and functional entities reflect their maturation. Norm of interdependence of these relations determines the individual features of physical development of organism.*
Keywords: *biological age, individual physical development, norm of independent relations.*

Introduction. Improving the efficiency of physical training based on the an individual approach, taking into account the current state of health, level of physical fitness and physical development especially requires solving the basic problem, which consists in establishing nature and content of individual differences in physical development. Its solution is directly connected to the concept of biological age and the establishment of course of characteristics of a real physical maturation of the developing organism. The history of the study of this question observed from Aristotle and Hippocrates. Equally important part in the improvement of physical education is to understand the nature of the "standards" in general and in particular individual standards of physical development, that is the main task of the research under the project "Innovative approaches to health technology in school physical education."

The aim of the study is to establish the basic foundations of the process of physical development and causes of the observed individual characteristics of its occurrence.

Material and methods: problem solving based on analysis and generalization of data sources, scientific literature and conducted anthropometric studies of the observed population.

Results and discussion. The process of physical development consists of three interdependent components: growth in biological mass and its formation. Forming reflects morphological and functional maturation of the systems of the body, mutually coordinated work which determines its viability. Body weight monitored contingent of chronological age is a variation of density which obeys the normal distribution [1]. The mathematical expectation, as the most characteristic value of this distribution in a particular chronological age corresponds to the "biological age" of the subject population. Within specified range of variation monitored trait (body weight) administered local population measurement deviations from the mathematical expectation in fractions of sigma that allows you to select the retarded, normal and faster growth of the body. Therefore biological age of the first component of the characteristic physical development connected with increasing body weight can be defined enough, as reflected in Figure 1.



Pic. 1. Distribution of the growth of body weight relative to their biological age:
where n - number of observed values of monitored characteristic; m - mass of the body; in the plane of n, m given to the distribution curve of monitored parameter in a particular chronological age; min weight of the observed value in the chronological age is correct surveyed an earlier chronological age of the population; max value corresponds to a later age of this population, which is derived from the statistical monitoring of materials [2]. Therefore it sets the range of variation with respect to its biological age norm development. Min value can be taken as malnutrition (the retarded the process - rotendantnost) and the value max as hypertrophy (leading process – akselerantnost).

Any increase in body weight as a natural process it is accompanied by the emergence of occupied volume. The amount of mass in the volume occupied by it generates a third index, determined by the density forming mass in the occupied

volume. This characteristic is a main factor differentiating morphological and functional processes in the body. [3] Upon reaching a certain density of the initial “elements” to an external display of their intrinsic properties (internal order), which follows from the theory of self-organization in the spaces tolerant (fuzzy sets). [4]. Each of these characteristics as an indicator of physical development of a sufficient array of homogeneous material in chronological age has a certain density of its manifestation, which is described by a normal distribution [5].By submitting each of the marked descriptions in the scale of their measuring, that in corresponding age has a certain range of variation, from the minimum display to maximal with frequency of met of these values, conformable to the law of normal distribution, translation of them comes true in the dimensionless descriptions shown in the stakes of the sigma measuring. It allows to talk about by share their correlation in the shape-generating process of the accumulated body weight. Each of these descriptions can come forward as an independent index of biological maturity is in corresponding chronologic age. Due to non-uniform density of these indicators, the real biological age in a given chronological age local population will act as individuals; have the characteristic of measured features that match their expectation. Consequently there more than one is a variety of variant of description of biological age at the increase of number of signs. to the expected value. At the use of only sign in the set range of variation of biological age in relation to his norm in identical chronologic age can talk about a minimum border as hypertrophy rejection - late process or rotendantnost; about hypertrophy - passing ahead process or acceleration and normally current process. It belongs analogical character and to other examined signs. At their synchronous flowing the same classification of biological age is observed. If there is asynchronous of flowing of process relation of the used signs, then biological age has more difficult structure of the presentation. Such the character of cooperation of the examined signs determines their compatibility, originative insufficiency of viability, that predetermines predisposition to development of constitutional somatic diseases, or more enhance able stability to the certain rejections of environment.

Each of the marked signs, in turn, can be gone into detail on making components. To more enhance able stability to the certain rejections of environment. The volume of body at his formation changes in three directions: length, width (longitudinally-transversal direction), in a thickness (front-back direction).

Ratio of growth in activity in these areas of the body determines its structure. Body weight is not a uniform education and its qualitative difference depends on embryonic lobe (ecto, endo, or mesodermal) , from which it got its development. The density of the tissue is determined by the interaction of the forces of attraction and repulsion among their constituent components and the way the internal structure of it . The generality of this phenomenon in the self-organizing process is determined by a single pattern of their occurrence, and leads naturally to the construction of three-dimensional space, based on the independent image of the “ original “ signs .

The number of “forming” mass, its volume and density are the initial signs that characterize biological age and the individual characteristics of its course. The density of accumulated mass is the determining factor in the differentiation of tissues in the morphological and functional organogenesis, which is characterized as an external display of internal properties in the form of formation of mutually “related” systems that generate coherent in its development “independent system” - the body. The totality of these “autonomous” systems in particular their accumulation reach their social maturity of its repeating the same principles of self-organization of the stages and signs of “social” maturity [6].

Variety of options for forming catfish at different ratios of mass, volume and density formation tissue does not alter the general pattern of this process. An individual feature of its development is associated with the difference in factors preservation of the constancy and permanence of their relationship occurrence of these relations [7].

The subsequent appearance of the various features is the forming parameters of morphological and functional maturation of the structures, reflecting the next phase of biological development. Dates of manifestation of these phases of biological development are the “nodal line of norms” of this process [8].

The rating of biological age of the line standards of its course is acceptable to the synchronous organization of formative processes regarding the chronological age.

In this case, possible to speak about is late, and the normal advance synchronously occurring maturation process of the body. In all other cases the asynchronous development of morphological and functional structures, which leads to mismatch their mutual security. The qualitative nature of these relations is determined by the direction of the vector, reflecting the flow of this process, the degree of interdependence relations will characterize the length of the vector [9].

If the characterization of the biological age there is a need for more in-depth presentation of its course, in this case, an increasing number of signs, which is determined by the final result, or increases the accuracy of measurement, used features. Submission of this type of assessment of biological age requires a special structure of the semantic feature space reflection of the importance of the commensurability shared traits involved in this process and rank of their submission. [10]

Based on the the most accessible and informing enough indexes reflecting the individual features of flowing of the biological ripening and at the same time of qualifying this process, it is necessary to use control after the increase of mass of body. With the certain degree of assumption the body of man it maybe to present in three-dimensional space as a cylinder or rectangular parallelepiped. Entering description of specific gravity of tissue it is possible to talk about a bodyweight as work specifically of weight on a volume. If to divide all volume into equal “layers” that at that rate can be presented bodyweight as work of weight of separate cut on their number, height of that in the sum make the complete height of cylinder or parallelepiped. It allows to enter growth of the weight criterion of estimation of features of structure of body formed from an identical volume and weight, that exposes various variations of structure of body in the first approaching of their distinguished. Further differentiation of features of morphological and functional organogenesis it is related to introduction of additional signs appearing with the biological ripening of process of physical development of body.

Process of forming this mass in the morphological and functional l structures of body related to her redistribution in a volume that at his identical size can have variant on three constituents to descriptions (to length, thickness, width). The borders of this variation are certain mutually dependent life-support processes that generate the most characteristic

correlations of the marked indexes. Taken on separateness each of indexes, as well as the characteristic form of volume generated by them has variation of quantity of their display, corresponding to the law of normal distribution. The measure of viability of existence of such forms of structure of body is determined by the degree of remoteness of making indexes from the expected value of the most characteristic structure of forming the body in the inspected chronologic age, which sets to the norm of estimation of biological age on correlation of morphometric indexes of body. Quality description of violation of normal formation is estimated by the orientation of vector, which is reflected in the coefficient of relation of the controlled indexes from the norm of their age-related value. The variant of distribution of volume on three directions of body formation presented on a Figure 2.

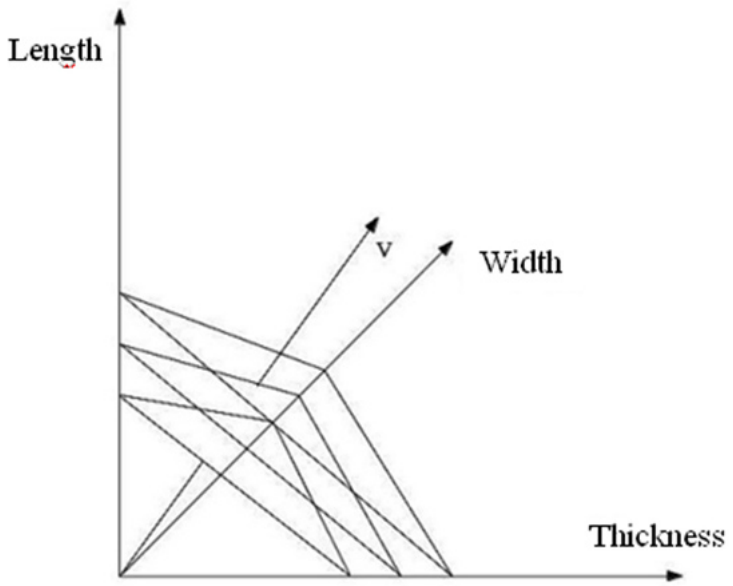


Fig. 2. Distribution of volume of mass formation on three constituents to the indexes.

Where on each of co-ordinate axes and formative by them (V) - volume the area of variation of the controlled indexes are marked. At the synchronous display of minimum values of all three indexes (lengths, widths, thicknesses) the possible volume of body shows up minimum. At the synchronous display of all maximums there is a maximally attainable volume of body in the controlled chronologic age. Within the limits of range of variation of body weight at the persons of identical chronologic age of the inspected contingent, having normal relations of linear sizes of the controlled signs it is possible to characterize as proportionally developing in accordance with biological age, but with chronologic delay, or with passing of standards of development. Such persons have synchronous development and on correlation of the signs presented in the dimensionless sizes of sigma values remain identical. By a characteristic feature is such index as a measure of constancy of relations.

Persons that has asynchronous development of the controlled signs and broken the criteria of constancy of relations can not simply be characterized the measure of passing or lag of biological age of development because on one of signs they pass ahead, and on other late in the development. The asynchronous of development in relation to the norms results in asymmetry the morphological structure of organization. In this case it is possible to talk about the criterion of constancy of met on the orientation of rejection, degree of rejection and set of reject able signs from the norms of biological development.

Each of the separately taken signs at deviation from the norm of the age-related display comes forward the symptom of functional violation of interrelated even relations, providing viability of organism. Totality of set of constancy of met of certain list of symptoms on the degree of their expressed and orientation; the displays ranged on a size determine a syndrome characteristic for some disease. Degree of display of criteria of constancy of relations and constancy of their met come forward prodrome of display of morphological and functional violations and is basis of preclinical diagnosis.

Exactness of the entered measuring of signs and amount of their plugging in the carried out control is determined prognostication of developing violations of relatively legitimate values on their set, measure of deviation from a norm and duration of these rejections. In this case it is possible to talk about the amount of signs abnormal from the norm of the possible development, to amplitude of rejection and duration of such rejection. Different speed of development of parts and beating in the interdependence providing on the required volume of trade-out of the masses and speed of their formation reflect the degree of development of pathology and expressed as violation of amplitude-frequency modulation at forming of end-point of cooperation.

Examining the height of biological mass formation on her characteristic signs and their criteria of constancy of relations and met, it is necessary to enter additional description, defining closeness in unit of volume. Introduction of third independent - orthogonal description generates an additional feature in the height of biological formation body weight such as friability and closeness of tissue in relation to the norm of her biological development. It increases variant of morphological and functional formation of lowing organogenesis and generations of viability of their independent relations providing adaptation possibilities in co-operating with an educational environment. It is assumed in this case, that such index as a relation of volume of build and his mass have a synchronous achievement of the norms of biological development.

At introduction of coefficient of commensurability of size of norm of biological development of mass and norm of biological volume of body the index of closeness of body will be equal to 1 (ρ=1). In case of asynchronous of biological age of these indexes there is additional description such as a specific closeness of body. The line of moving of synchronous biological age of achievement of norm of necessary volume of body and his mass will correspond to the norm of biological age of index of closeness that conditionally can be considered equal to unit. In relation to the line of norm of biological age of closeness of body at ρ>1 it is possible to talk about more dense build, and at ρ<1 about a loose build. This dependence can be presented as follows (fig. 3)

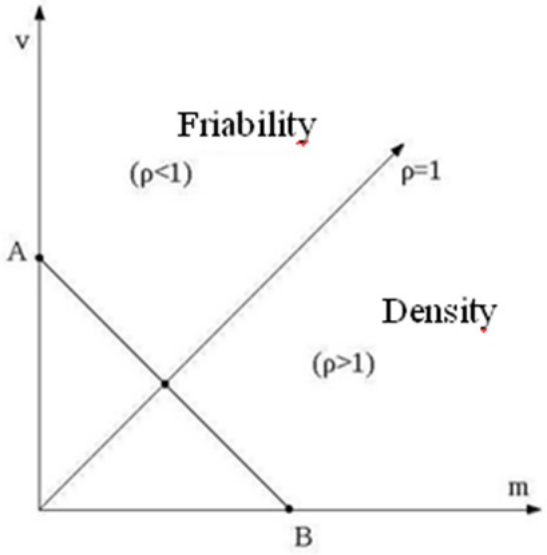


Fig. 3. Dependence of structure of mass of build on her closeness at synchronous correlation of biological maturity of development of mass and volume of body

where, V is a volume of body; m is body weight; ρ it is a closeness of body weight; line (AB) perpendicular to the line ρ=1 is the scale of variant ness of mass in a range from possible friability to meeting maximal friability.

In turn, the tissue density is dependent on the ratio therein of dry remainder and water. Determining the middle closeness of body the average percent of water is set. It is possible to introduce the term “dry” and “wet” tissue. Terms “loose”, “dense”, “dry”, “important” tissue being the basis of formation processes of the morphological and functional systems for their biological ripening used in connection with that exactly this terminology was entered by Hippocrates and Aristotle at description of features of types of build and their predisposition to the certain diseases.

Therefore statement about normal, passing ahead and late development it is possible to carry out at the use of one sign feature. At including of independent additional signs of development such estimation can be given only at their synchronous development. In relation to every value at the account of possible deviation from the line of synchronous development it is possible to talk about variant ness of asymmetry and size of rejection of biological age of development of the used signs. The line of synchronous development in relation to the norm has a range of her maintenance from a maximum possible morphological and functional malnutrition to the maximum possible hypertrophy. In relation to the norm of synchronous development within the limits of one sigma rejection both to direction of trophic morphological and functional activity and malnutrition to her direction in a point to the corresponding norm of development, reflecting and asymmetrical of this activity it is possible to talk about the zone of optimal display of operative steady equilibrium relationship with an educational environment.

At addition of the third independent sign the synchronicity of development will present one of four diagonals of cube. A plane is perpendicular it is diagonals in a point reflecting the norm of synchronous development will determine the great number of variant asymmetrical, asymmetrical development of shape-generating morphological and functional processes of organogenesis. Area of one sigma deviation from crossing of diagonals in the point of norm biological determines the zone of functional optimum. The measure of deviation from the equilibrium state of norm of biological development reflects the decline of viability both operative and to base adaptation possibility. Orientation of vector connecting any point of sign semantic space and value of norm of biological development reflects quality description of violation of viability of organism.

The increase of number of observed features assess of estimation of biological age requires for the reflection of dynamics of their relations, providing orgagenez, use of not Cartesian three-dimensional space, and more difficult geometrical presentations in the arctic system of coordinates with certain semantic maintenance of concept of zero, as beginning of counting out and unit, as descriptions of criterion of constancy of relations of norms of biological time of development of the used signs reflecting shape-generating processes.

Conclusions. Physical development of an organism is determined by two interdependent processes that favor the growth of the mass and its morphogenesis, organogenesis generating differentiated morphological and functional development.

The rate of formation of morphological and functional maturation reflects the biological age of the developing organism. A volume and weight of growing body come forward the most general reflection of individual variation of this process.

In these interdependent descriptions of physical development of organism at their synchronous co-ordination it is possible to talk about passing ahead, normal and late biological age. At violation of synchronicity of concordance of relations description of biological age accepts more difficult presentation with pointing of the ranged presentation of the used indexes, but body weight that comes forward beginning of counting out in comparison of speed of differentiation morphological and functional formation of body comes forward in all cases a the determining index.

At the increase of number of comparable indexes of biological age of physical development of organogenesis it is necessary to use the special sign semantic spaces with introduction to them single measure.

Further development of focus set out studies related to the solution of problems set out in the project "Innovative approaches to wellness technology in school physical education."

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Received: 12.05.2015.
Published: 30.06.2015.

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