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Adolescents' somatic development in accordance with biological growth rate

Introduction

Significant anthropometric indices and both chronological and biological age correlation relations among boys and girls from 11 to 16 years old are revealed. But more significant correlation is stated between these indices and biological age than the chronological one.

In pedagogical theory and practice more importance is dedicated to students' individual peculiarities studying and to the developing of individual and typological approach to students in the teaching process. Individual approach to students is regarded as one of the most important principles of training and education in works of many researchers and involves the problems specification of educational and pedagogical work, a variety of techniques including both general and individual peculiarities of each student's personality. However, such approach does not require individual work with each student; it involves the front, group and individual studies connection for increasing each student's learning and development quality.

A number of scientists worked upon the problems of differential physical education taking into account individual morphological and functional peculiarities and physical fitness efficiency However, these studies did not take into account the hormonally dependent development indicators, namely, the rate of biological maturation of adolescents, which are crucial nowadays.

Taking into account the individual peculiarities of the organism condition and development of each student makes it possible through the selection of adequate means of physical education to ensure the harmonious development of motor skills. While the use of improper means and methods of physical education to students' individual needs may negatively affect upon the health of students, slow the pace of their development and be accompanied by a loss of interest in physical education studies.

Further investigation requires questions concerning each feature proportion during puberty and how closely the gradation character of each feature both individually and in an integrated form associated with the level of biological maturity. »

To analyze sex differences and correlation between students' physical development and the rate of their biological maturation.

As a result of ascertaining pedagogical experiment 1305 Lutsk schools students 11-16 years old (752 boys and 553 girls) were examined. In particular, length and weight, girth of the chest, the development of bone and muscle and fat components of body composition have been studied.

Evaluation of biological development rate was carried out in terms of puberty.

1. Stages of secondary development

In the process of studying a considerable scope in the stages of secondary sexual characteristics development of girls 11-16 years old was revealed. Within age groups isolated subgroups with accelerated, medium and slow development due to the pace of secondary sexual characteristics progress are revealed. Stratification by age development speed, i.e. the difference between chronological and biological age, can reach 4-5 years. Due to this adolescents of the same age have a different level of morphological structures development and related functional phenomena, i.e. unequal biological age. The biggest differences between the passport and biological age have been observed in adolescent girls aged 13-14 years, and the lowest - aged VI and 16. Obviously, this is due to the fact that the largest difference of biological age is possible in the period of the greatest growth intensity, within more explicit individual differences. Strengthening the impact of exogenous factors on the physical signs development is being observed during the complex inversion genotype, i.e. at the age of 13-18, but the main importance in their implementation coincides according to the genotype.

A comparative analysis of correlation between some anthropometric indices and chronological and biological age of students aged 11-16 years old has been carried out.

Within the organism growth morphological and functional development increases as well, so it is natural that older children have some higher indices than the younger ones. Therefore, during the process of organism growth among children, unlike adults, there is a correlation between some morphological and functional parameters and age. The easiest way to detect it is to determine the coefficient of correlation. Since the growth of certain morphological and functional parameters of teenagers depends on the age, and the dynamics of their growth is close to linear, that is why the correlation analysis makes it possible to determine

what has the greater influence on the formation of specific morphological or functional characteristics of the development, adaptation time (chronological age) or growth *rates genetic* program (biological age).

It is stated that there is a relation between studied individual parameters of anthropometric indices and both chronological and biological age among girls.

It is stated that girls' anthropometric indices correlate more closely with the biological age, than the chronological one, but such indices like body weight, Quetelet index, body area, absolute and relative parameters body weight *fat* component are statistically significant (Table 1).

2. Somatic developmentwithin studens

Among boys the correlation analysis of researched individual anthropometric indices has *produced* a strong and reliable relationship between examined parameters and both chronological and biological age.

Table 1.

Anthropometric indices and chronological and biological age correlation among students from 11to16 years old

№ c/o	Indices	Boys n=752		Girls n=553	
		Chronological age	Biological age	Chronological age	Biological age
1.	Body length	0,718***	0,855***	0,632***	0,684***
		<0,001		>0,05	
2.	Body weight	0,643***	0,779***	0,630***	0,723***
		<0,001		<0,05	
3.	Quetelet Index	0,573***	0,705***	0,591***	0,684***
		<0,001		<0,05	
4.	Body area	0,643***	0,779***	0,630***	0,723***
		<0,001		<0,05	
5.	Chest girth	0,543***	0,717***	0,290***	0,373***
		<0,001		>0,05	

*Note: *, **, *** - correlation coefficient reliability respectively p<0,05, p<0,01, p<0,001.*

While comparing the correlation coefficients certain characteristics of the given relationships have been revealed. Thus, morphological parameters correlate significantly tighter with the boys' biological age than the chronological ones, except for the relative values of fat and bone components of body weight (Table 1).

Thus, the somatic development of students aged 11-16 years has closer correlation relations with biological age than the chronological one. But it is more revealed among boys than girls. There are some sex differences of relationships.

It has been determined that within girls there is a correlation between both chronological and biological age and a componential composition of body weight (Table 2).

While comparing the correlation coefficients certain peculiarities of the given relationships have been revealed. Thus, the componential composition of body weight correlates more closely with girls' biological age than the chronological pne, and absolute and relative parameters of the body weight fat component are statistically significant.

Table 2.

Body mass componential composition and chronological and biological age correlation among students from 11to16 years old

№ c/o	Indices	Girls n=553		Boys n=752	
		Chronological age	Biological age	Chronological age	Biological age
1.	Absolute fat body weight component	0,293***	0,416***	0,055	0,174***
		p<0,05		<0,05	
2.	Relative fat body weight component	0,104*	0,228***	-0,345***	-0,275***
		p<0,05		>0,05	
3.	Absolute muscle body weight component	0,356***	0,634***	0,659***	0,823***
		p>0,05		<0,001	
4.	Relative muscle body weight component	-0,139***	-0,178***	0,236***	0,345***
		p>0,05		<0,05	
5.	Absolute bone body weight component	0,465***	0,559***	0,632***	0,762***
		p>0,05		<0,001	
6	Relative bone body weight component	-0,354***	-0,346***	0,097**	0,107**
		p>0,05		>0,05	

*Note: *, **, *** – correlation coefficient reliability respectively p<0,05, p<0,01, p<0,001.*

But there has not been revealed a significant correlation between the absolute fat component of body weight and the chronological age.

While comparing the correlation coefficients certain characteristics of the given relationships have been revealed. Thus, the componential composition parameters correlate closer with the boys' biological age, than the chronological one, except for the relative values of fat and bone components of body weight (Table 2).

While comparing the correlation coefficients certain peculiarities of the given relationships have been revealed. Thus, the componential composition parameters of body weight correlate more closely with the girls' biological age than the chronological one, and such indices as absolute and relative values of the fat component of body weight are statistically significant.

So in adolescence the specificity of organism functioning to a greater extent is more determined by the degree of pubescence than the calendar age. Significant differences in the terms of boys and girls' puberty, individual features of its tempo, lead to a considerable heterogeneity of each class students' staff. Children with a different degree of sexual maturation can study in the same class, and, consequently, with different functional and adaptive capabilities. Therefore, within a given age period it is necessary to use a differentiated approach, and it is necessary to consider the rate of biological maturation to be the main criterion for differentiation.

ft is stated that the timing of puberty period, puberty rate and phase determine the level of the general somatic development.

There is a closer correlation between morphological parameters and biological age than the passport one.

Conclusion

There have been revealed significant correlation relations between anthropometric parameters and both chronological and biological age among boys and girls. But there have been set more consistent correlations of these indices with the biological age compared with the chronological one except for body length and chest girth among girls.

It is determined that among girls and boys there has been a reliable correlation of body weight componential composition parameters with both chronological and biological age except for the absolute fat component of body weight among boys.

While comparing the correlation coefficients of body weight componential composition parameters with both biological and chronological age there has been determined a closer correlation of these indices with biological age among boys and girls. Such absolute and relative indices of body weight fat component among boys and absolute fat, muscle and bone body weight component among girls are statistically significant.

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