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Secular Changes of Physical Development in 19-20 Years Old Youths from the Beginning of the 20th Century till the Beginning of the 21st Century

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The secular changes of physical development in 19-20 years old youths during 20th century are evaluated, and the specificity of physical development in students at this age at the beginning of the 21st century is characterized. Anthropometrically are studied 72 Bulgarian male students and 70 female ones during 2002 in Sofia City. The secular changes are assessed at universal body features: stature; body weight; chest measurements; biacromial and bicristal diameters. The secular trend is traced out using analogous data of youths at the same age from the beginning of the 20th century. The secular changes point out that the investigated in 2002 male and female youths are taller than the ones of previous generations lived during the 20th century. Deceleration of body weight and chest circumference is available after the 80s. A tendency for gracilization of body diameters is observed after the 80s, more strongly expressed among young females.

Key words: secular changes, physical development, anthropometry, youths.

Introduction

The human physical development is characterized by a complex of morphological and functional peculiarities on which normal human development and health depends during different ages. Indicators for physical development most often are the basic morphological and physiological features. Their realization after birth depends as on heredity, so on environmental factors – geographical, social, economical, etc. The changes of basic characteristics in human physical development that come in the course of time are denoted as "secular trend" and are well known to the experts who work in the field of anthropology and medicine. These changes affect as the increment and decrement of body measurements, so the rate and velocity of body and sexual maturation. During the past century

were discussed mainly the processes of increment in stature and body massiveness and of the speeded maturation, as well, i.e. the processes of acceleration. In last two decades, however, more and more experts gain results (published in many scientific papers), which make them to speak about acceleration delay and even about deceleration in some characteristics of human physical development. During 1993-2001 in the Department of Anthropology at the Institute of Experimental Morphology and Anthropology with Museum, Bulgarian Academy of Sciences was carried out a wide anthropological investigation including 7-14 years old schoolchildren from Sofia City. The data about secular changes in children from Sofia City, from the beginning till the end of the 20th century, show that the increment of stature, body weight and chest circumference has delayed between the 70s and 80s, while at the end of the century a tendency of gracilization is observed [8. 9]. In the symposium "Secular growth changes in Europe", edited by E. Bodzsár and C. Susanne, are summarized results of different investigations carried out in Europe during the last hundred years. S t o e v, Y o r d a n o v [12] have studied the secular changes in children, adolescents and adults in Bulgaria after literature data, emphasising mainly on the maturation terms and the brachycephalization process. The data about France display increment of mean stature during the period 1900-1990 (mainly between 60s and 80s), after which a tendency of deceleration is observed [3]. A study of children and youths in Sweden established acceleration delay at the end of the 20th century [6]. In Great Britain were carried out investigations (1974, 1980, 1994) for adults aged from 18 till 24 years that show increment of mean stature 12,5 cm for 18-year-old males, and 9,5 cm for 20-24 years old ones, while the increment for females is lower than 5.0 cm [10]. Š t e f a n č i č et al. [11] has established that secular increment of stature, body weight and biacromial diameter delayed around the 80s in 7-18-year-old children and adolescents from Ljubljana, concerning the period 1939-1992. In Russia the investigations from the end of 19th century till 1980 in children and adolescents aged 0-15 years and in adults (20-29 years) showed intensive secular changes till 1970, followed by stabilization and deceleration of somatic features [4]. In the closing paper [2] E. B. Bodzsár and C. Susanne summarised that greatest are the acceleration changes of growth and development in children and adolescents from Europe at the end of the 70s and the beginning of the 80s within the 20th century. After this period acceleration delay has been observed, while positive secular changes still are available.

In literature was not established purposeful anthropological study of young Bulgarians (19-20 years old) made after 1980 with a view to use this information for assessment of secular changes in this age group during the past century.

The aim of the present work is to evaluate the tendencies of secular changes in physical development of 19-20 years old youths during the 20th century and to characterize the specificity of physical development in same age students at the beginning of the 21st century.

Materials and Methods

In the period March-May 2002 were investigated anthropometrically 72 Bulgarian male students and 70 female ones aged 19-20 years from Saint Kliment Ohridski University of Sofia and Technical University, Sofia. The mean age is 19.49 years for males and — 19.57 years for females. The programme includes 20 directly measured features, 18 derivative ones, body proportions and indexes, and their distribution into rubrics and categories. In the present work secular changes of the following anthropometrical features are discussed: stature, body weight, bicristal and biacromial diameters, transversal and sagittal chest diameters and chest circumference. The anthropological characterization is made by the classical method of R. M a r t i n and K. S a l l e r [7]. Standard anthropometrical

instruments are used. The investigated by us sample claim not to be representative for the present generation of 19-20 years old Bulgarians, but still we expect to get a notion about specificity of physical development for this generation Bulgarians compared to data about different generations of their coevals lived during the past century.

To trace back the secular changes of physical development in 19 years old youths during the 20th century are used corresponding data from investigations of:

- St. V a t e v, a study carried out in 1907, published in 1939 [13];
- B. Y a n e v et al., a study carried out in 1960, published in 1965 [15];
- B. Y a n e v et al., a study carried out in 1970/72, published in 1982 [16];
- P. S l a n c h e v et al., a study carried out in 1980/82, published in 1992 [14].

Results and Discussion

Stature

The evaluation of metrical changes in stature during the past century shows that for the entire period (1907-2002), young men became 10.9 cm taller, and young women — 7.2 cm taller (Table 1, Fig. 1). During the first half of the 20th century till 1960, the increment is 3.7 cm in young males and 1.6 cm in young females. As a whole, the stature increment is bigger — respectively 7.2 cm in male youths and 5.6 cm in female ones since the second half of the past century till the beginning of the 21st one. Interesting information gives the analysis about stature changes made after decades concerning the second half of the past century. The acceleration observed at the beginning of the 20th century delayed between the 60s and 70s — the stature being almost the same in both sexes. In male youths this tendency is preserved till the 80s. In female youths is available slightly stature increment (2.6 cm) between the 70s and 80s. Greater are the acceleration changes for both sexes between 1980 and 2002, being more underlined for young men i.e. the 19-20 years old males have already stature of 178.78 cm and the females of 164.0 cm at the beginning of the 21st century. This data differ from the results obtained by many European scientists [3, 6] who established a delay of stature secular growth around the 80s of the past century. This difference, probably, could be due to the fact that we have investigated students in 2002, who distinguish by their higher stature, well known from the literature [1, 5]. Series of studies in students are carried out in Hungary (Debrecen town) during the period 1930-1992. B o d z s á r [1] observed stature decrease in the period 1942-1951, a fact explained mainly by the worsened social conditions of life after the World War II. The stature increased considerably after 1950, as for one decade only it raised at an average of 2.31 cm. In the Technology Institute, Budapest City, investigations of students are carried out during the period 1976-1985. G y e n i s [5] established stature increment of 2.17 cm in young women and of 2.81 cm in young men.

Table 1. Secular changes in basic anthropometrical features

Features		Males						
		St. Vatev, 1907	B. Yanev et al., 1960	B. Yanev et al., 1970	P. Slanchev et al., 1980	Our data, 2002	St. Vatev, 1907	B
Stature	*n*	196	527	650	372	72	44	
	mean	167.9	171.6	171.3	172.3	178.8	156.8	
	SD		6.3	6.3	5.9	6.6		
Biacromial diameter	*n*		528		372	72		
	mean		39.2		41.0	41.2		
	SD		2.3		2.4	2.0		
Bicristal diameter	*n*		528		372	72		
	mean		28.4		29.0	27.2		
	SD		2.0		1.8	1.6		
Transversal chest diameter	*n*		518		372	72		
	mean		27.9		28.9	29.5		
	SD		1.9		2.2	2.0		
Sagital chest diameter	*n*		528		372	72		
	mean		20.0		20.8	20.9		
	SD		1.8		2.2	1.7		
Chest circum-ference	*n*	579	528	658	372	72	34	
	mean	85.9	90.2	88.5	89.6	87.4	76.6	
	SD		4.7	5.2	5.4	5.8		
Body weight	*n*	196	526	652	372	72	44	
	mean	58.8	67.0	67.6	71.2	70.4	53.2	
	SD		7.8	7.9	7.5	8.6		

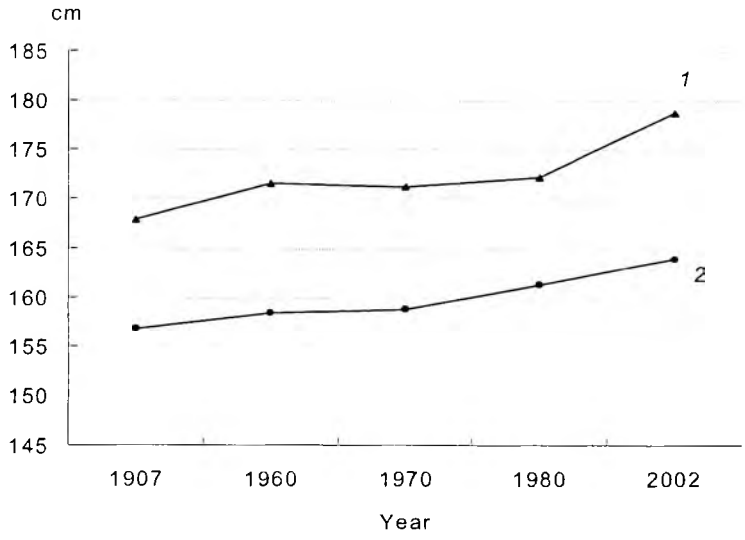

Fig. 1. Secular changes of stature
1 — males; *2* — females

Body weight

Body weight changes show that the young men studied by us are 11.6 kg heavier compared to their coevals investigated in 1907, while the young women are 0.8 kg lighter than their coevals examined at the beginning of the 20th century (Table 1, Fig. 2). Opposite to the stature, whose increment is more tangibly during the second half of the past century, the body weight growth is more significant for both sexes till 1960 — 8.2 kg in male youths and 4.2 kg in female ones. Body weight changes studied after decades concerning the second half of the 20th century show that similar to stature, between the 60s and 70s is available an acceleration delay for both sexes. In female youths this tendency remains till the 80s. In male youths, however, is established body weight increment (3.6 kg) between the 70s and 80s. It should be noted that body weight is greatest for both sexes during the 80s. After this period our data trace out a deceleration tendency that is more strongly expressed in females who have lowest body weight compared to all their coevals, as well. The males investigated in 2002 have mean body weight of 70.40 kg, being 0.8 kg lighter than the males examined during the 80s, and the females have respectively mean body weight of 52.4 kg being 6.0 kg lighter. The results obtained are in unison with the data by other European authors who reported about an acceleration delay in body weight established after the 80s.

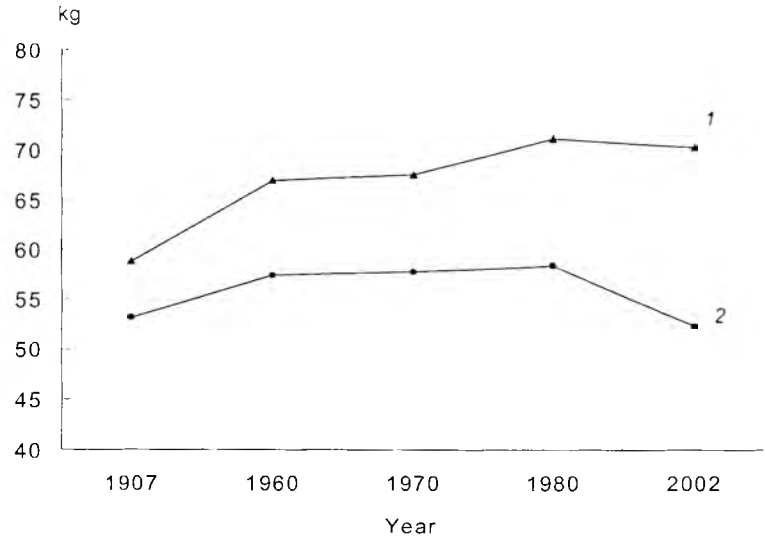

Fig. 2. Secular changes of body weight
1 — males; *2* — females

Chest circumference

The secular changes of chest circumference repeat to a great extent the ones of body weight but they are more slightly expressed (Table 1, Fig. 3). The investigated in 2002 male youths have 1.5 cm larger chest circumference compared to their coevals studied in 1907, while the females examined at the beginning of the 21st century have 3.6 cm smaller chest circumference. For the entire nearly hundred years period the investigated by us female students could be distinguished by smallest chest circumference. During the first half of the 20th century, an increment of chest circumference for both sexes is observed better expressed in young men (males — 4.3 cm; females — 1.6 cm). For the entire period under study (1907-2002), the male youths investigated in 1960 and the female ones examined in 1980 have greatest chest circumference. Analyzing the metrical changes of chest circumference after decades, concerning the second half of the past century, a certain decrement of chest circumference is established between the 60s and 70s (1.7 cm in male youths, and 0.7 cm in female ones), while it turned into poor increment between the 70s and 80s (1.1 cm in male youths, and 1.9 cm in females). The data about youths studied at the beginning of the 21st century compared to the youths examined during the 80s show considerably chest circumference decrement, better underlined in young women (2.2 cm smaller chest circumference in male youths, and 6.4 cm smaller — in female ones), i.e. a deceleration of this anthropometrical feature is available again after 1980 for the Bulgarian youths that is observed also in other European countries.

Chest diameters

The changes for both chest diameters — transversal and sagital, which determine also the chest form, are traced out in 20 years intervals: 1960-1980-2002 (Table 1, Figs. 4, 5). Smallest are the chest measurements in the 19 years old males studied during 1960. The chest diameters in young men increase consecutively till the end of the past century and the male youths, investigated at the beginning of the 21st century, have biggest chest mea-

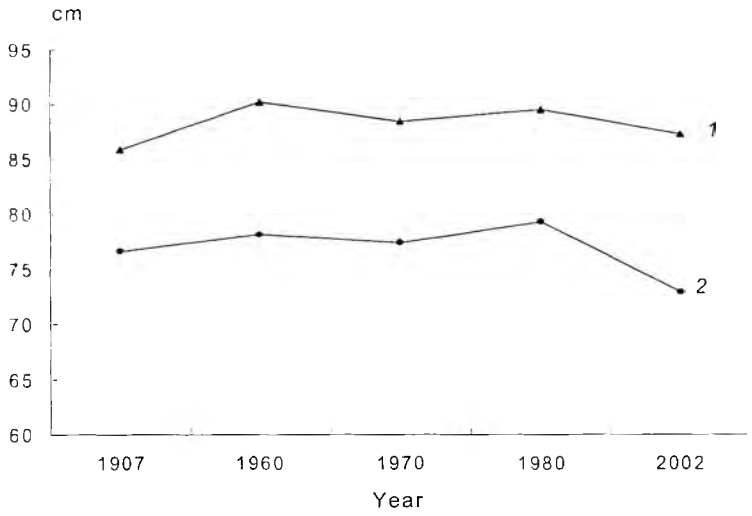

Fig. 3. Secular changes of chest circumference
1 — males; *2* — females

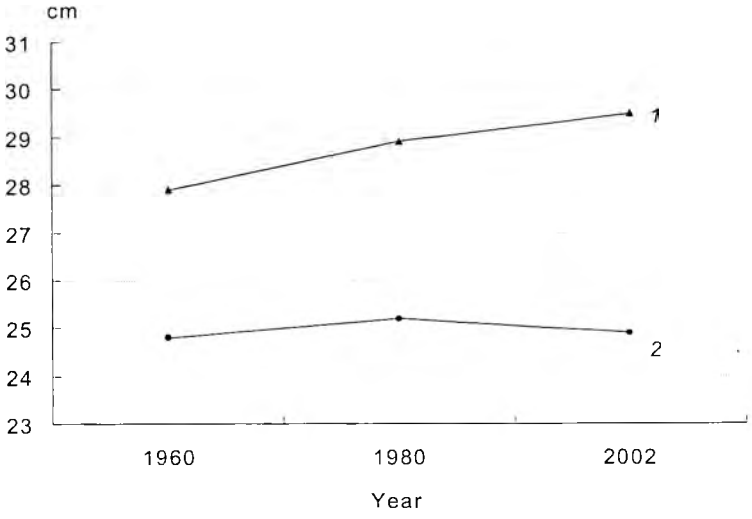

Fig. 4. Secular changes of transversal chest diameter
1 — males; *2* — females

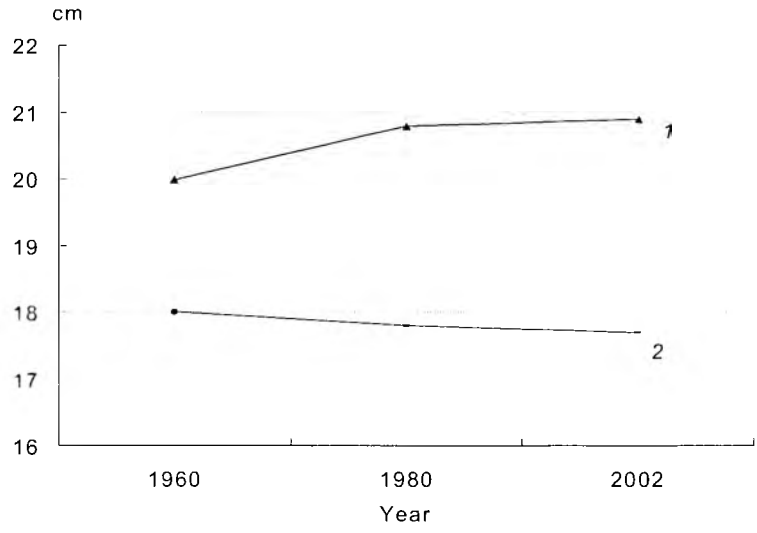

Fig. 5. Secular changes of sagital chest diameter
1 — males; *2* — females

surements. Differences in secular changes of transversal and sagital chest diameters are established in young women. From 1960 till 1980 the increment of transversal chest diameter is 0.4 cm for female youths, and throughout next 20 years it decreases and becomes equal to the transversal chest diameter for 19 years old women studied in the 60s. Opposite to the transversal diameter, the sagital chest diameter decreases, even very little (from 18.0 up to 17.7 cm) during the entire 40 years period.

Biacromial diameter

The analysis about this diameter is made again in 20 years intervals (Table 1, Fig. 6). The data show underlined sexual differences, similar to those for chest diameters. Narrowest shoulders have the young men investigated in the 60s. The male youths, researched in the 80s, have 0.8 cm bigger shoulder breadth compared to the previous generation. The young men studied by us (2002) have nearly the same biacromial diameter (41.2 cm) as the males examined during the 80s (41.0 cm), i.e. acceleration delay is available. In young women the biacromial diameter increases insignificantly (only 0.4 cm) between 1960 and 1980, while during the next 20 years period it decreases gradually, and the young women investigated at the beginning of the 21st century have smallest shoulder width (34.8 cm).

Bicristal diameter

The bicristal diameter increment is 0.6 cm for males from 1960 till 1980 (Table 1, Fig. 7). For the period under study (1960-2002), the bicristal diameter is biggest in young men examined during the 80s. Opposite to the males, in females the bicristal diameter decreases during the entire period under investigation, the decrement being more slightly expressed between the 60s and 80s (0.3 cm) and considerable between the 80s and the beginning of the 21st century (2.0 cm). It had to be underlined that bicristal diameter is significantly smaller in male and female youths studied at the beginning of the 21st century (mean bicristal diameter is 27.2 cm in male students and 25.4 cm in female ones), compared to their coevals born in the past century.

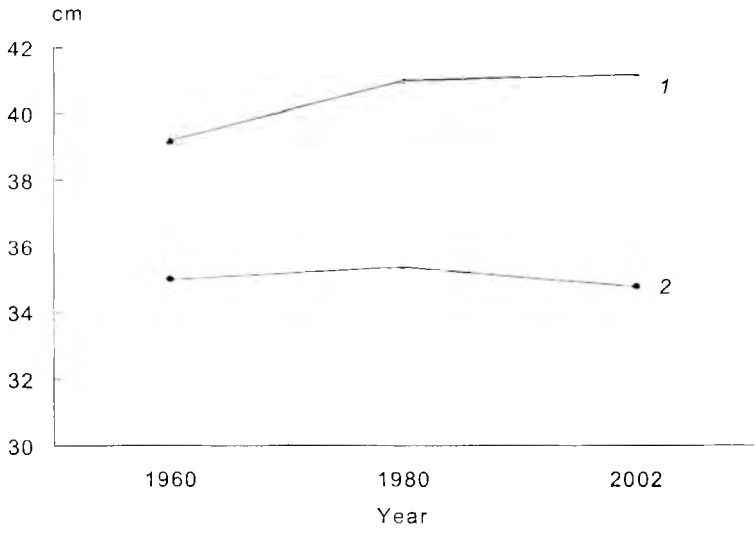

Fig. 6. Secular changes of biacromial diameter
1 — males; *2* — females

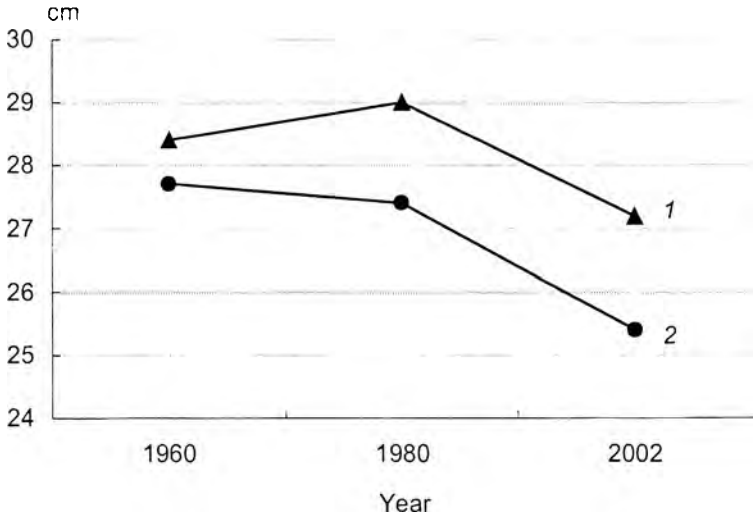

Fig. 7. Secular changes of bicristal diameter
1 — males; *2* — females

According to the summarized comparative analysis about body diameters is established a tendency of body gracilization after 1980 that is in unison to the results obtained in the Department of Anthropology at the Institute of Experimental Morphology and Anthropology with Museum, Bulgarian Academy of Sciences for 7-14-year-old children [8, 9]. It is obvious that at the end of the 20th century the decrement of body diameters during childhood and puberty retains in youth.

Conclusion

The results obtained about specificity of physical development in 19-20 years old students who are investigated at the beginning of the 21st century on the background of secular changes in their coevals examined during the 20th century show:

- a tendency of young males and females studied at the beginning of the present century to be taller than the ones examined during the 20th century;
- body weight and chest circumference to be smaller compared to these measurements in the generation researched in the 80s;
- a tendency of gracilization in body diameters after the 80s, more strongly expressed in females.

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