Comparative Anthropometric Characteristics of Bulgarian Students (1986-2002)

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It is made a comparison of basic anthropometric data of total 1019 university students in Sofia. Of them 297 male and 580 female students, were investigated in 1986 and 72 male and 70 female students were investigated in 2002. Twenty-one directly measured parameters and eight relative ones were analyzed. The study demonstrated that the height has increased in both sexes, more significantly in males. Unlike height, weight decreases sharply, especially in female students. This affects the massiveness of the body /BMI decreases/ and is due primarily to the reduction of subcutaneous fat tissue. Most body diameters and circumferences also decrease, especially in female students. These changes in some degree coincide with the worldwide tendency of gracilization and acceleration, but seem influenced also by the socioeconomic and cultural changes during this period in our country.

Key words: university students, physical development, anthropometric characteristics, secular changes, gracilization.

Introduction

Human growth and development are genetically determined, but they are under influence of a series of environmental factors. Among them the socio-demographic factors hold a special position [2, 13, 14]. Therefore the alteration in the anthropometric characteristics are used for evaluation of the living conditions in the society [1, 4, 10].

The late 20th and the early 21st century is a time of great socioeconomic changes in Bulgaria, sudden changes in living standards (mostly in the negative direction) and increasing social stratification. Although university students (especially these in the capital) are usually children of more educated and with better material status strata; they are not isolated of the society. Therefore the anthropometric characteristics of the students and their eventual alterations are of special interest. Moreover, research on physical development of young adults (about 20 years) in Bulgaria are sparse - the last reliable data for the whole Bulgarian young population, aged 18-25, are from measurements in 1970s [15].

Material and Methods

In the present paper are used anthropometric data of 297 male and 580 female students, investigated in the spring of 1986 in Sofia by R. Stoev and of 72 male and 70 female students, investigated in the spring of 2002 in Sofia by N. Atanassova-Timeva and Y. Zhecheva. The mean age of students investigated in 1986 was 23.9 years for male individuals and 22.0 years for female ones while those ones investigated in 2002 were younger — a mean of 19,5 and 19.6 years. In both cases it refers to young adults which growth is almost closed [3], thus the comparison between the both sample data is justified. Twenty-one absolute anthropometric features were analyzed, taken by standard anthropometric methods [6, 7]: height, body weight, sitting height, lower extremity length (height to *illiospinale*), circumferences of: chest in pause, waist, hip, thigh, calf, upper arm and forearm; biacromial diameter (breadth of shoulders), transversal and sagital chest diameters, bicristal diameter (bicristal breadth), skinfolds of: thigh, X-th rib, subscapular, calf, suprailiac and triceps. On the basis of these absolute features, 8 relative parameters are calculated: Body Mass Index (BMI), relative (relation to the height) sitting height, relative lower extremity length, relative chest circumference, relative biacromial and bicristal diameters, chest index (relation of sagital and transversal chest diameters) and pelvic index (relation of bicristal to biacromial diameters).

Data processing is used a standard variation-statistical analysis including Student's *t* criterion to compare the accuracy of the identified differences and standard deviation method of accounting for their relative size (variation statistic, t-test of Student and z-score).

Results and Discussion

Height of the investigated students of both samples (Tables 1 and 2, Figs 1 and 2) is greater than the national average, and this for Sofia, even compared with investigation data from 1980 [12]. This is easily explained — as noted, students are usually children of families with higher social status than the average. Such excess of students' height in comparison to the relevant age group of the whole population is well described in the literature in general and in particular in Bulgaria [5, 11]. It is more interesting that since 1986 the increase continues, which is more pronounced in male students. Obviously the socioeconomic difficulties in the 90s have not affected the height of male individuals of this social group. One possible explanation is that the early childhood of the students, investigated in 2002, falls in early 1980s, which is the period of maximal living standard in Bulgaria. The investigated students in 2002 have been around 8,5 and 14,5 years during the great economic difficulties in 1991 and 1997, i.e. before and after puberty leap in growth. However, socioeconomic crisis has probably left its mark — in male students, whose growing period lasts longer, the increase in growth is greater than that of the female ones, whose growth is almost completed by 16-17 years [3]. The difference in height between the two reference groups for males is 3,2 cm, while for females is twice less — 1,5 cm.

Unlike height, weight decreases sharply, especially for female students (by 6,7 kg = −0,75 SD). This affects the massiveness of the body (BMI decreases) and is due primarily to the reduction of subcutaneous fat tissue (skinfolds thickness). It conld not be said yet to what extent this is a consequence of changes in nutrition, associated with major socioeconomic and cultural changes in the late 20th century, but the general tendency of gracilization coincides with the observed secular

Table 1. Basic anthropological features — male students

	1986				2002				$p\leq$	Z
	N	M	SD	SE	N	M	SD	SE		
Body weight	297	75,01	10,4	0,60	72	70,4	8,63	1,02	0,001	−0,44
Height	297	175,61	5,78	0,34	72	178,78	6,63	0,78	0,001	0,55
Sitting height	297	90,88	3,93	0,37	72	93,17	3,76	0,44	0,001	0,58
Lower extremity length	297	101,34	4,7	0,27	72	99,09	5,18	0,61	0,001	−0,48
Chest circumference — pause	296	92,4	6,38	0,37	72	87,37	5,79	0,68	0,001	−0,79
Waist circumference	297	80,54	7,82	0,45	72	77,53	6,11	0,72	0,001	−0,38
Hip circumference	296	96,06	5,92	0,34	72	91,06	5,54	0,65	0,001	−0,84
Thigh circumference	296	55,4	4,37	0,25	72	56,05	4,11	0,48		0,15
Calf circumference	297	37,42	2,57	0,15	72	35,65	2,49	0,29	0,001	−0,69
Upper arm circumference	297	29,68	3,05	0,18	72	29,73	2,84	0,33		0,02
Forearm circumference	297	27,85	2,04	0,12	72	27,11	1,62	0,19	0,001	−0,36
Biacromial diameter	296	40,01	1,97	0,11	72	41,19	2,05	0,24	0,001	0,60
Transversal chest diameter	296	29,3	1,84	0,11	72	29,51	2	0,24		0,11
Sagital chest diameter	296	21,1	1,94	0,11	72	20,91	1,71	0,20		−0,10
Bicristal diameter	296	28,14	2,01	0,12	72	27,23	1,65	0,19	0,001	−0,45
Thigh skinfold	293	18,28	6,45	0,38	72	14,74	6,12	0,72	0,001	−0,55
Xth rib skinfold	293	11,49	5,11	0,30	72	7,08	2,87	0,34	0,001	−0,86
Subscapular skinfold	293	12,46	4,74	0,28	72	9,66	3,56	0,42	0,001	−0,59
Calf skinfold	292	10,69	5,08	0,30	72	10,76	3,77	0,44		0,01
Suprailliac skinfold	293	11,04	5,91	0,35	72	6,99	3,04	0,36	0,001	−0,69
Triceps skinfold	293	11,28	4,14	0,24	72	9,39	3,48	0,41	0,001	−0,46
BMI	297	24,29	2,93	0,17	72	22,04	2,56	0,30	0,001	−0,77
Relative sitting height	297	51,58	3,38	0,20	72	52,12	1,31	0,15	0,05	0,16
Relative lower extremity length	297	57,70	1,49	0,09	72	55,41	1,67	0,20	0,001	−1,54
Relative chest circumference	296	52,66	3,72	0,22	72	48,92	3,49	0,41	0,001	−1,01
Relative biacromial diameter	296	22,80	1,10	0,06	72	23,06	1,21	0,14	(0,15)	0,24
Relative bicristal diameter	296	16,03	1,05	0,06	72	15,24	0,91	0,11	0,001	−0,75
Chest index	296	72,09	5,94	0,35	72	71,05	6,43	0,76		−0,18
Pelvic index	296	70,38	4,73	0,27	72	66,22	4,43	0,52	0,001	−0,88

T a b l e 2. Basic anthropological features — female students

	1986				2002				$p \leq$	Z
	N	M	SD	SE	N	M	SD	SE		
Body weight	580	59,13	9,03	0,37	70	52,39	6,99	0,84	0,001	−0,75
Height	580	162,55	5,59	0,23	70	164,05	5,06	0,60	0,05	0,27
Sitting height	580	86,44	3,45	0,14	70	87,22	3,12	0,37	(0,10)	0,23
Lower extremity length	579	93,36	4,25	0,18	70	89,97	3,91	0,47	0,001	−0,80
Chest circumference — pause	578	85,33	6,58	0,27	70	73,05	4,45	0,53	0,001	−1,87
Waist circumference	579	67,43	6,22	0,26	70	65,92	5,18	0,62	0,05	−0,24
Hip circumference	580	95,54	7,07	0,29	70	87,21	5,43	0,65	0,001	−1,18
Thigh circumference	580	55,38	5,2	0,22	70	54,13	4,42	0,53	0,05	−0,24
Calf circumference	579	34,9	2,65	0,11	70	33,1	2,65	0,32	0,001	−0,68
Upper arm circumference	578	24,98	2,85	0,12	70	24,72	2,29	0,27		−0,09
Forearm circumference	579	23,19	1,82	0,08	70	22,73	1,39	0,17	0,05	−0,25
Biacromial diameter	577	35,77	1,89	0,08	70	34,84	1,87	0,22	0,001	−0,49
Transversal chest diameter	576	25,46	1,77	0,07	70	24,91	1,56	0,19	0,01	−0,31
Sagital chest diameter	577	18,17	1,66	0,07	70	17,72	1,48	0,18	0,05	−0,27
Bicristal diameter	576	27,25	2,71	0,11	70	25,45	1,46	0,17	0,001	−0,66
Thigh skinfold	562	25,49	6,14	0,26	70	19,29	4,5	0,54	0,001	−1,01
Xth rib skinfold	563	13,45	6,19	0,26	70	8,79	3,34	0,40	0,001	−0,75
Subscapular skinfold	563	14,63	6,18	0,26	70	10,53	3,75	0,45	0,001	−0,66
Calf skinfold	560	21,61	6,24	0,26	70	14,61	3,37	0,40	0,001	−1,12
Suprailliac skinfold	563	14,94	7,00	0,30	70	8,35	2,77	0,33	0,001	−0,94
Triceps skinfold	562	15,93	5,46	0,23	70	13,62	3,53	0,42	0,001	−0,42
BMI	580	22,36	3,12	0,13	70	19,44	2,21	0,26	0,001	−0,94
Relative sitting height	580	53,19	1,56	0,06	70	53,17	1,26	0,15		−0,01
Relative lower extremity length	579	57,43	1,41	0,06	70	54,83	1,32	0,16	0,001	−1,84
Relative chest circumference	578	52,53	4,04	0,17	70	44,55	2,70	0,32	0,001	−1,98
Relative biacromial diameter	577	22,02	1,11	0,05	70	21,24	1,04	0,12	0,001	−0,70
Relative bicristal diameter	576	16,77	1,63	0,07	70	15,52	0,84	0,10	0,001	−0,77
Chest index	577	71,49	5,87	0,24	70	71,32	6,26	0,75		−0,03
Pelvic index	576	76,19	6,63	0,28	70	73,16	4,68	0,56	0,001	−0,46

Fig.1. Z-score in male students

-2,00　-1,50　-1,00　-0,50　0,00　0,50　1,00

body weight

height

sitting height

lower extremity length

chest circumference-pause

waist circumference

hip circumference

thigh circumference

calf circumference

upper arm circumference

forearm circumference

biacromial diameter

transversal chest diameter

sagital chest diameter

bicristal diameter

thigh skinfold

X-th rib skinfold

subscapular skinfold

calf skinfold

suprailiac skinfold

triceps skinfold

BMI

relative sitting height

relative lower extremity length

relative chest circumference

relative biacromial diameter

relative bicristal diameter

chest index

pelvic index

Fig.2. Z-score in female students

-2,00 -1,50 -1,00 -0,50 0,00 0,50 1,00

body weight
height
sitting height
lower extremity length

chest circumference-pause
waist circumference
hip circumference
thigh circumference
calf circumference
upper arm circumference
forearm circumference

biacromial diameter
transversal chest diameter
sagital chest diameter
bicristal diameter

thigh skinfold
X-th rib skinfold
subscapular skinfold
calf skinfold
suprailiac skinfold
triceps skinfold

BMI

relative sitting height
relative lower extremity length

relative chest circumference

relative biacromial diameter
relative bicristal diameter

chest index
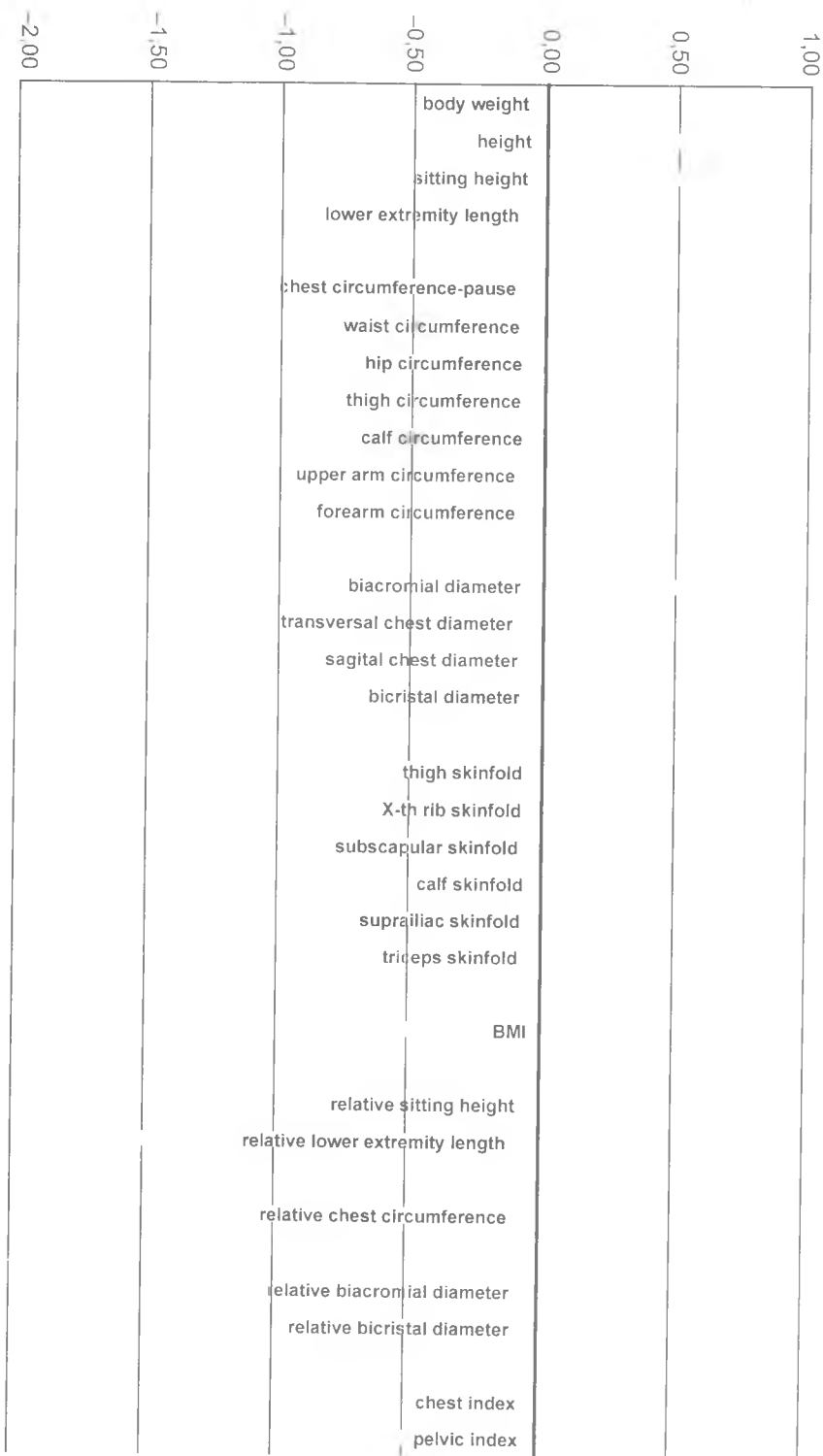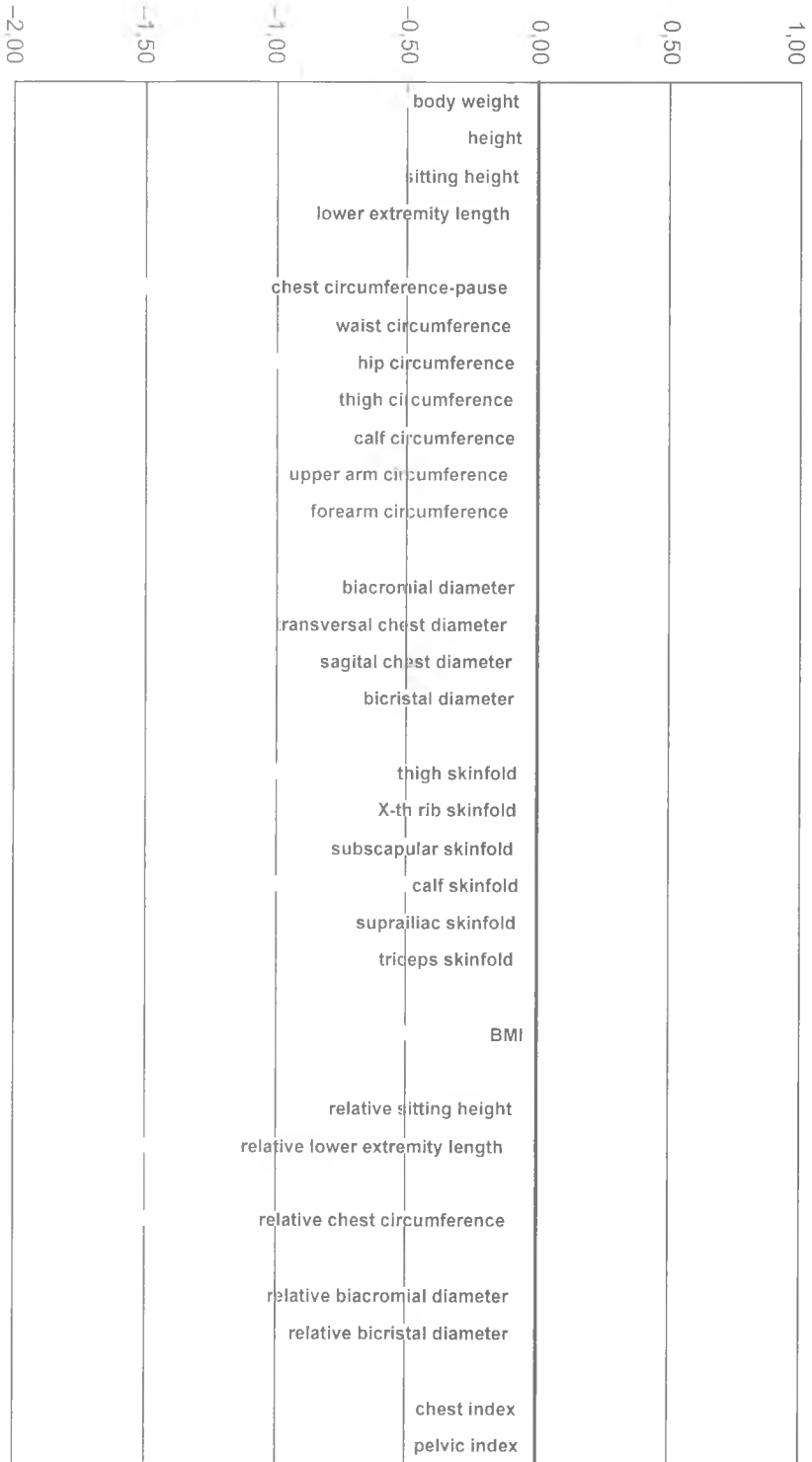pelvic index

T a b l e 3. Comparable anthropometric features for students in Sofia (1986, 2002) and in Plovdiv (1993-1996)

Year	Males			Females		
	1986	1993-1996	2002	1986	1993-1996	2002
Height	175,6	176,9	178,8	162,6	163,3	164,0
Body weight	75,0	72,7	70,4	59,1	54,9	52,4
BMI	24,3	23,2	22,0	22,4	*20,6	19,4
Sitting height	90,9	94,4	93,2	86,4	87,8	87,3
Lower extremity length	101,3	100,0	99,1	93,4	91,4	90,0
Biacromial diameter	40,0	39,3	41,2	35,8	34,5	34,8
Bicristal diameter	28,1	27,8	27,2	27,2	25,7	25,4

*The index is calculated by us from the means.

changes in the late 20th century and in other countries (after [8]). The graciliza-tion is manifested in the fact that most body diameters and circumferences, also decrease, especially in female students. It is especially pronounced against the background of increasing growth (decrease of the relative indicators). A larger reduction of body fat in females could be associated with some cultural changes in diet, which particularly affects young women from educated families (distribution of different diets).

An exception of the gracilization tendency is biacromial diameter of male stu-dents, which increases. Back to male individuals the upper arm circumference, thigh circumference and chest diameters remained stable, whereas in female students these measures follow the general decreasing tendency. Thus in male students a slight tendency to more athletic constitution is presented, which tendency is missing in female students. One possible explanation is that this phenomenon may be related to increasing sporting activity in male youths.

In both sexes is observed a reduction of absolute and relative lower extremity length ($p < 0,001$), which is accompanied by increase of the sitting height. In male students, these changes are more pronounced in comparison with the changes in female students.

During the period between our two investigations, namely in 1993-1996, it has been conducted a research of the physical development of students in Plovdiv uni-versity [9, 14]. The published data do not include all anthropological features stud-ied by us. The comparison of the results of our two studies and the aforementioned study are listed on Table 3. They confirm the established tendency in Sofia students to increase of height and decrease of weight, of the lower extremity length and of bicristal diameter. The results in Plovdiv well fit between the results of two other investigations. Discrepancy with the tendencies established in Sofia observed in bia-cromial diameter (which in Plovdiv students is less) and in sitting height (which in Plovdiv students is bigger). This may be due to small differences in measurement technique.

Conclusion

The anthropometric characteristic of Bulgarian students in the late 20th and the early 21st century is changing. These changes partly coincide with the worldwide tendency of gracilization, but seem influenced by the socioeconomic and cultural changes during this period in our country.

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