

Body Composition and Body Nutritional Status in Bulgarian Students at the Beginning of the 21st Century — Anthropological Assessment

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The aim of the present work is to characterize anthropometrically the body composition and the body nutritional status during the transitional age between youth and maturity in Bulgarian students at the beginning of the 21st century. Anthropometrically are examined % Body Fat (% BF), total Body Fat in kg (BF), Lean Body Mass (LBM), waist/hip circumference ratio (W/H) and BMI in 142 students — 72 male and 70 female aged 19-20 years. Males have lower per cent Body Fat and higher per cent Lean Body Mass compared to females. In males the mixed and android type of Subcutaneous Fat Tissue distribution prevails, and almost all females have gynoid type. According BMI none of the investigated individuals belongs to the II and III overweight categories. Highest is the per cent of normal body nutritional status in them.

Key words: body composition, body fat, body nutritional status, obesity, students.

Introduction

The basic anthropological features, which determine the physical development of human body, are those of the various body components and their proportions that indicate the body nutritional status and the obesity of the individual, as well.

The Aim of the following work is to characterize anthropometrically the body composition and the body nutritional status during the transitional age between youth and maturity (19-20 years) in Bulgarian students at the beginning of the 21st century.

Material and Methods

The material is collected during the period March — May 2002. Anthropometrically are examined 142 students — 72 males and 70 females aged 19-20 years. The investigation was taken at the University of Sofia “St. Kliment Ohridsky” and the Technical University of Sofia where students from all around the country are studying. The

anthropometrical investigation was conducted according to the classical method of Martin and Saller [2]. For the assessment of body composition and body nutritional status are used the following features: % Body Fat (% BF), total Body Fat in kg (BF), Lean Body Mass in kg (LBM), waist/hip circumference ratio (W/H). These features give general idea of the male and female types of subcutaneous fat tissue accumulation and distribution, as well as, of BMI that is accepted by the WHO as unified indicator about body nutritional status and obesity.

The features for determination of body composition and body nutritional status are estimated by the following formulas:

$$\% \text{ BF male} = 17,305 \times \lg \text{ SF triceps} + 12,012 \times \lg (\text{SF subscapular} + \text{SF X-th rib}) + 6,293 \times \lg \text{ SF abdomen} - 20,9 \text{ [3];}$$

$$\% \text{ BF female} = 9,367 \times \lg \text{ SF triceps} + 13,462 \times \lg (\text{SF subscapular} + \text{SF X-th rib}) + 5,298 \times \lg \text{ SF abdomen} - 16,2 \text{ [3];}$$

$$\text{BF} = \frac{\text{body weight} \times \% \text{ BF}}{100}; \quad \text{LBM} = \text{body weight} - \text{BF};$$

$$\text{BMI} = \text{weight (kg)} / \text{stature (m}^2\text{)}$$

The intersexual differences are evaluated by the ISD data according to the formula:

$$\text{ISD} = \frac{\bar{x}_{\text{female}}}{\bar{x}_{\text{male}}} \cdot 100$$

The evaluation of the established intersexual differences is done the by T-criteria of Student at $P < 0.05$.

Results

According to literature data about body composition the ratio between body fat and lean body fat vary significantly during the different ages. Largest is the percentage of LBM in the 20 years old individuals, whose body fat percentage is lowest [4].

➤ **Per cent Body Fat** (Table 1, Fig. 1). At the age of 19-20, the studied young males have 16.58 % BF, and the females — 17.59 % BF. The 30-40 years old Bulgarian males (unpublished data by National Anthropological Program) have 23.1 % BF, and the adult female — 24.7 % FT. The comparative evaluation shows that at the age of 19-20 males have 6.52 % BF and females 7.11 % less BF than their 30-40 years old contemporaries. It is interesting that although the amount of body fat is different in 19-20 years old and 30-40 years old individuals, the intersexual differences have almost equal character in both age groups. In adults the males have 1.6 % less body fat than females, and the sexual differences for 19-20 years old individuals are 1.1 %.

➤ **Body Fat** (Table 1, Fig. 1). The average value of this feature for young males is

Table 1. Data about body composition and body nutritional status

No	Features	Males				Females				T-test	ISD
		\bar{X}	SD	S \bar{X}	V	\bar{X}	SD	S \bar{X}	V		
1	%BF	16.58	4.99	0.59	30.10	17.59	2.94	0.35	16.71	1.47	106.09
2	BF	11.90	4.53	0.53	38.07	9.34	2.65	0.32	28.37	4.12*	78.49
3	LBM	58.51	6.04	0.71	10.32	43.04	4.85	0.58	11.27	16.85*	73.56
4	W/H	0.85	-	-	-	0.76	-	-	-	-	89.41
5	BMI	22.04	2.56	0.30	11.62	19.44	2.21	0.26	11.37	6.48*	88.20

* $P < 0.05$

11.90 kg BF and for young women — 9.34 kg BF. The intersexual differences are statistically significant. ISD shows that BF is with 21.51 % more for males than females.

➤ **Lean Body Mass** (Table 1, Fig. 1). LBM includes all non-fat tissues (bones, muscles, other soft tissues, liquids). Of all non-fat tissues, most eco-sensitive are the muscles therefore it is considered that data about LBM give information of its development. The average value of this component for the studied males is 58.51 kg, and for the females — 43.04 kg. The intersexual differences are statistically significant. ISD indicates that LBM is with 26.44 % more for males, than females.

➤ **W/H ratio** (Table 1, Fig. 1, 2). The W/H ratio determines two basic models of fat tissue distribution: android (abdominal) and gynoid (gluteofemoral). There is also a third one — mixed type of fat tissue distribution. The average value of this ratio for males is 0.85 (mixed type), and for females 0.76 (gynoid type). ISD indicates that W/H ratio is with 10.59 % more for males, than females.

➤ **Body mass index** (Table 1, Fig. 1, 3). The average values of this index are 22.04 kg/m² for men and 19.44 kg/m² for women. The intersexual differences are statistically significant. ISD indicates that the BMI for males is with 11.8% more than for females. Depending on the categorization of body nutritional status of the stud-

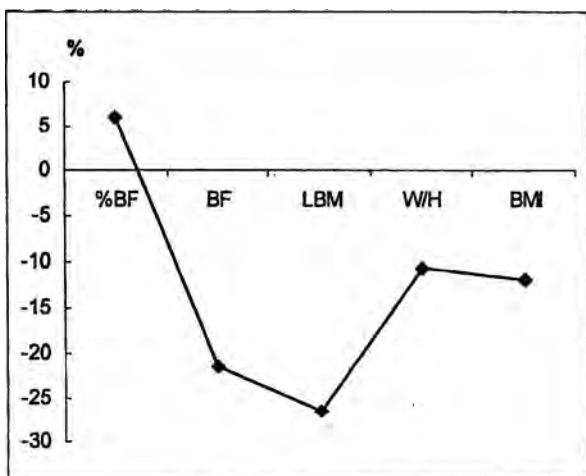


Fig. 1. Intersexual differences of body composition and body nutritional status (data by ISD)

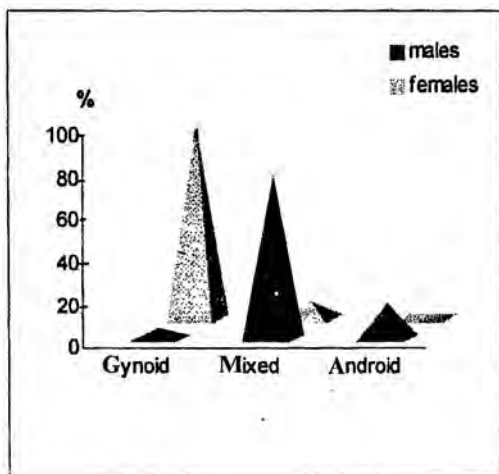


Fig. 2. Distribution of individuals according to W/H ratio

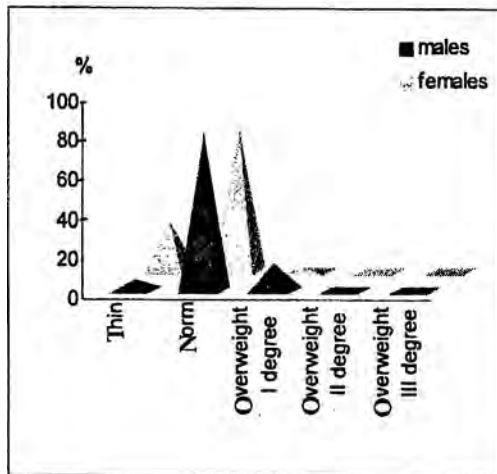


Fig. 3. Distribution of individuals according to BMI categories

ied students, according to the WHO categories elaborated by J. Garrow [1], none of the investigated individuals belongs to the II-nd and III-rd overweight categories. Biggest is the per cent of young men with normal body nutritional status — 80.56 %, 13.89% are I-st degree overweight, and the rest 5.55 % are categorized as thin. From the young women — 72.86 % are with normal body nutritional status, 25.71 % are belonging to the category “thin” and the rest 1.43 % are I-st degree overweighted.

Conclusions

- The 19-20 years old males have lower per cent Body Fat and higher per cent Lean Body Mass compared to the 19-20 years old females.
- The data about W/H ratio show that in young males the mixed and android type of Subcutaneous Fat Tissue distribution prevails, and almost all young females have gynoid type of Subcutaneous Fat Tissue distribution.
- The assessment of body nutritional status in males and females aged 19-20 years according to the WHO criteria about BMI shows that to the II-nd and III-rd overweight categories belongs none of the investigated individuals. Highest is the per cent of these with normal body nutritional status — 70-80 %, 13.9 % from males and 1.4 % from females are I-st degree overweighted.

Generalized the results obtained in the present paper give information about the specific peculiarities of basic characteristics in the individual's physical development namely about body composition and body nutritional status in the investigated 19-20 years old men and women who are a part of the young Bulgarian population living at the beginning of 21st century.

References

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