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Body Shape in Relation to Socio-Economic Status in Young Adults from the Basque Country

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A B S T R A C T

Body shape has a great variability determined, partly, by energy intake and physical activity, as well as by gender and age. The aim of this research was to analyse the relation between socio-economic status (SES) and body shape estimated through the somatotype, in a sample of university students. The sample included 316 males and 635 females aged 18–33. Somatotype was estimated by the Heath-Carter anthropometric technique[1]. The information included data of SES. A MANOVA test was used to test differences among groups. The mean somatotypes were 4.0–4.4–2.3 in males and 5.4 –3.4–2.2 in females. Sexual dimorphism for the whole somatotype was found ($p<0.001$). There is a greater stability of the body shape in females regarding SES and more variability in males. Males' somatotype was significantly related to SES, low socioeconomic levels were associated with high values of endomorphy and mesomorphy.

Key words: *body shape, anthropometric somatotype, socio-economic status, young adults, university students*

Introduction

Body shape has a great variability in human populations. It is determined by genetic factors, dietary patterns, physical activity, socio-cultural or environmental factors as well as by sex and age. Although several different techniques are useful to describe the physique, anthropometric somatotype, which defined body type through the analysis of metric characters[1], has been frequently used as a method of physique assessment. Furthermore, anthropometric somatotype is a convenient indirect way for the estimation of body composition, which provides an easy and comprehensive picture of body shape independently of the body size[2–4]. The first and second components (endomorphy and mesomorphy) are very sensitive to changes in body composition. For this reason, many authors have assessed the relation between somatotype and health. In fact, unlike ectomorphy, high endomorphy and mesomorphy have been related to an increase in risk of coronary diseases[2,3,5,6].

Some of the aspects which determined the variability of the anthropometric somatotype in human populations have been widely analysed in the scientific literature, particularly those related to sporting activities, sexual dimorphism, growth and aging[1,4,7,8]. However, factors related to socio-economic status (SES), particularly in young adults, have been less studied.

Attitudes towards body weight and preferences for slim body images are mediated by local social and cultural factors, and perceptions may vary in predictable ways among population subgroups. Although nutrition and SES are closely connected, the SES acts in different and more complex ways in developed societies than in developing countries, where nutritional stress is a major factor. Thus, dietary habits, exercise, social mobility and other environmental variables may mediate the relationship between SES and body shape. The studies of familial resemblance in twins and in nuclear families indicate that the degree of anthropometric somatotype heritability is moderate[1,9–13]. For this reason, socio-familial environment, where the individual develops, can influence on body shape, more due to exercise, physical activity, occupation, feeding habits or hygienic-sanitary conditions than for the shared genes.

Young adults, and particularly college students, could be a very interesting group of population for the study because of the peculiarities of their dietary habits. Stu-

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dents' habits frequently include not having all meals, eating between meals, a preference for fast food and frequent alcohol consumption. These habits could be partly related to SES. Since the number of young adults studying at the university in developed countries is quite high, the studies of this group of population must be promoted in order to develop prevention measures to reduce the risk of diseases[14].

The aim of this research is to analyse the relation between SES and body shape estimated through the anthropometric somatotype, in a sample of young adults of both sexes from the University of the Basque Country (Spain).

Subjects and methods

Subjects

The data were obtained from a cross-sectional sampling of voluntary students of the University of the Basque Country (Spain). The sample included 316 males and 635 females aged 18–33 (mean ages were 22.27 and 21.39 years, respectively). The 90.3% of the individuals were born and they were living in one of the three provinces which nowadays constitute the Basque Autonomous Region (BAR). The rest of the sample comes from neighbour provinces, even though they are studying in the University of the Basque Country. The aim of the study and the kind of measurements were explained to the participants, who gave their written informed consent. The University Ethical Committee on Human Research approved the experimental protocols.

Anthropometry

Measurements were taken on the left side of the body by the same researcher. Height (cm), body weight (kg), four skinfolds (triceps, subscapular, suprailiac and medial calf, mm), flexed and tensed upper arm girth (cm), calf girth (cm), biepicondylar breadth of the humerus (cm) and biepicondylar breadth of the femur (cm) were measured following the IBP criteria[15]. Anthropometric somatotype was estimated through the Heath-Carter anthropometric method[1], following the equations of Carter[16] and the criteria of Carter et al.[17].

Socio-economic status (SES)

In this research, the profession and educational level of each subject's parents, based on a preliminary interview, were assessed in order to define the SES. These variables are, together with the income, occupation and education, the most frequently used indicators of the social class by Western sociologists[18,19], and they have been incorporated in most of the Human Biology studies.

The parents' occupations were grouped in three categories: high (1), medium (2) and low (3). The high level included professionals, managers, office and administrative occupations; medium level included sales and related occupations, self employment, hotel and catering industry, services sector, farmers, seamen, fishermen, skilled workers and unskilled workers; low level was integrated by housekeepers, unemployed persons, students, retired persons and others. Moreover, the educational level also was split into three groups: high (1), medium (2) and low (3) level. The high level was composed of graduates and engineers, the medium level included secondary school graduates, vocational training and primary school graduates; persons without studies were placed in the lowest level.

Globally, the analysed sample can be considered as belonging to a medium social class. Although the term "medium class" is normally used to describe the social stratification in contemporaneous societies, this classification can be quite imprecise because it includes different sectors of population. Medium class is placed in an intermediate level between hardship and luxury, and due to that wideness it is obvious that inside this group subjects who have different cultural and economical levels can be found.

Statistical analysis

In a preliminary analysis of the data, a Kolmogorov-Smirnov test and a Box's M test were used to assess normality and homogeneity of the covariances, respectively. The results of these tests were taken into account in order to apply a parametric or a non parametric test of comparison among groups (regarding sex and SES). A multivariate analysis of the variance (MANOVA) was used to test whether the whole somatotype was significantly different between sexes. This analysis was also performed by introducing parents' occupation and educational level, in order to analyse whether the somatotype changed owing to SES. Afterwards, F-one way, Kruskal-Wallis or Mann-Whitney's U tests were used to check which somatotype component had the highest contribution on the differences among sex and SES groups.

Results

Sex variation

Table 1 shows the descriptive statistics (mean and standard deviations) for anthropometric variables, somatotype components and decimal age in males and females. Males showed higher values for height, weight, osseous measurements and girths. However, females had higher values for skinfolds. Mean somatotypes were 4.0–4.4–2.3 in males and 5.4–3.4–2.2 in females. Females displayed higher rates of endomorphy or relative body fat, whereas mesomorphy tended to be higher among males and ectomorphy was similar in both sexes. Differences between sexes were found by Pillai's trace for whole somatotype ($p<0.001$). Analysis for each somatotype component were also performed and significant differences were found for endomorphy ($p<0.001$) and mesomorphy ($p<0.001$) but not for ectomorphy (Table 2).

TABLE 1
DESCRIPTIVE STATISTICS (MEAN AND STANDARD DEVIATIONS) FOR ANTHROPOMETRIC VARIABLES, SOMATOTYPE COMPONENTS AND DECIMAL AGE IN MALES AND FEMALES OF THE UNIVERSITY OF THE BASQUE COUNTRY

Variables	Males (N=316)		Females (N=635)	
	Mean	SD	Mean	SD
Height (cm)	175.5	6.26	162.2	5.74
Weight (kg)	73.2	9.90	58.4	8.07
Triceps skinfold (mm)	12.4	5.77	19.9	5.49
Subscapular skinfold (mm)	15.0	6.40	15.5	5.84
Suprailiac skinfold (mm)	15.0	7.95	17.9	7.27
Medial calf skinfold (mm)	12.2	6.09	21.7	6.56
Flexed and tensed upper arm girth (cm)	30.8	2.67	26.5	2.44
Calf girth (cm)	37.2	2.57	35.3	2.42
Biepicondylar breadth of the humerus (cm)	6.7	0.40	5.8	0.34
Biepicondylar breadth of the femur (cm)	9.5	0.47	8.7	0.47
Endomorphy	4.0	1.53	5.4	1.35
Mesomorphy	4.4	1.07	3.4	1.02
Ectomorphy	2.3	1.09	2.2	1.09
Decimal age (years)	22.3	2.70	21.4	2.61

TABLE 2
RESULTS OF THE STATISTICAL TEST FOR SEXUAL DIMORPHISM OF THE ANTHROPOMETRIC SOMATOTYPE (MANOVA)

N	Pillai's trace	Hotelling's trace
951	0.46***	0.86***
Univariate analysis	*t*-Student	Mann-Whitney's U
Endomorphy	–13.80***	–
Mesomorphy	–	53,970.00***
Ectomorphy	1.54 ns	–

*** p<0.001;

Socio-economic status (SES)

Table 3 shows, for males and females, the descriptive statistics (mean and standard deviations) of the somatotype components according to parents' educational level and occupation. In both sexes, the groups identified as high level showed the lowest values of endomorphy and mesomorphy but the greatest of ectomorphy, whereas, medium and/or low levels displayed the highest values of endomorphy and mesomorphy but the lowest values of ectomorphy.

SES, socio-economic status

Differences between mean somatotypes according to SES were more significant in males than in females, particularly for endomorphy ratings, which ranged between 3.5–3.8 in high level males, whereas, in low level ones the range of variation of the first somatotype component was 4.3–4.5. In females, the endomorphy range of variation was between 5.2–5.3 and 5.4–5.6 for those of high and low level, respectively (Table 3). In fact, the results of MANOVA (Table 4) in males showed differences among SES groups for whole somatotype (p<0.001): father's educational level and mother's occupation had a significant influence, whereas father's occupation and mother's educational level did not. Otherwise, the univariate analysis indicated that endomorphy and mesomorphy were the components with the highest contribution to the differences among SES groups (p<0.05), whereas, ectomorphy did not contribute to those differences. In females, MANOVA did not reveal significant differences among SES groups for whole somatotype (Table 4).

Since only males showed significant differences regarding father's educational level and mother's occupation, the means of anthropometric somatotype according to the combination of the three categories (high, medium and low) of those two variables are shown in table 5 (9 groups in total: A to I). Individuals of the A group (1–1) were those with the lowest rates of endomorphy (3.6) and the highest of ectomorphy (2.6), whereas those of the F category (2–3) were the most endomorphic (4.5) and mesomorphic, and the least ectomorphic (2.0). B (1–2), G (3–1), H (3–2) and I (3–3) groups showed a scarce number of data, but the results of the analysis did not vary when those data were or not used to make the statistical analysis.

Each group (A to I) includes both categories, the father's (1, 2 or 3) and the mother's (1, 2 or 3): A = 1.1; B = 1.2; C = 1.3; D = 2.1; E = 2.2; F = 2.3; G = 3.1; H = 3.2; I = 3.3. SES- socio-economic status

Discussion

In this study, the anthropometric somatotype, used as a descriptive method of body shape, has shown a remarkable sexual dimorphism. The sexual differences were due

TABLE 3
DESCRIPTIVE STATISTICS OF ANTHROPOMETRIC SOMATOTYPE COMPONENTS IN MALES AND FEMALES ACCORDING TO SES

	Males							Females						
		Endomorphy		Mesomorphy		Ectomorphy			Endomorphy		Mesomorphy		Ectomorphy	
	N	Mean	SD	Mean	SD	Mean	SD	N	Mean	SD	Mean	SD	Mean	SD
Father's occupation														
High level	139	3.8	1.42	4.3	1.07	2.4	1.07	272	5.3	1.29	3.3	1.00	2.3	1.04
Medium level	133	4.2	1.59	4.4	1.13	2.3	1.12	293	5.5	1.44	3.5	1.04	2.1	1.15
Low level	43	4.5	1.55	4.5	0.92	1.9	1.00	64	5.5	1.21	3.5	1.07	2.1	1.10
Father's educational level														
High level	98	3.8	1.40	4.3	1.05	2.5	1.06	190	5.2	1.27	3.3	1.01	2.3	1.00
Medium level	199	4.2	1.59	4.4	1.10	2.2	1.12	392	5.5	1.41	3.5	1.05	2.1	1.15
Low level	13	4.3	1.27	4.5	1.15	2.1	0.87	37	5.5	1.22	3.4	0.96	2.1	1.01
Mother's occupation														
High level	94	3.7	1.45	4.3	1.00	2.5	1.05	183	5.3	1.41	3.4	1.06	2.2	1.10
Medium level	70	3.9	1.52	4.3	1.03	2.4	1.02	145	5.5	1.32	3.4	0.98	2.2	1.08
Low level	152	4.3	1.54	4.4	1.14	2.1	1.13	301	5.4	1.32	3.5	1.02	2.2	1.09
Mother's educational level														
High level	67	3.5	1.57	4.3	0.97	2.5	1.07	122	5.2	1.39	3.3	1.04	2.3	1.10
Medium level	226	4.2	1.52	4.3	1.11	2.3	1.10	454	5.4	1.37	3.4	1.02	2.2	1.10
Low level	14	4.4	1.00	4.6	1.03	2.0	0.89	48	5.6	1.05	3.7	1.06	1.9	0.95

TABLE 4
RESULTS OF MANOVA FOR TESTING DIFFERENCES IN ANTHROPOMETRIC SOMATOTYPE AMONG SES GROUPS FOR BOTH SEXES (MANOVA)

Males	N	Pillai's trace	Hotelling's trace
	300	0.14***	0.16***
	Univariate analysis	F one-way (df = 1)	Kruskal-Wallis
	Endomorphy	–	17.00*
	Mesomorphy	2.95*	–
	Ectomorphy	2.15 ns	–
Females	N	Pillai's trace	Hotelling's trace
	607	0.01 ns	0.01 ns

SES- socio-economic status; ***p<0.001; *p<0.05;

TABLE 5
MALE'S SOMATOTYPE ACCORDING TO THE COMBINATION OF CATEGORIES (HIGH, 1, MEDIUM, 2 AND LOW, 3) OF FATHER'S EDUCATIONAL LEVEL AND MOTHER'S OCCUPATION

SES	A (N=51)		B (N=7)		C (N=40)		D (N=42)		E (N=52)		F (N=105)		G (N=0)		H (N=7)		I (N=6)	
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Endomorphy	3.6	1.33	4.8	2.22	3.9	1.28	4.0	1.59	3.8	1.42	4.5	1.62	–	–	4.5	1.39	4.0	1.18
Mesomorphy	4.3	1.03	4.5	1.20	4.3	1.06	4.4	0.97	4.2	1.01	4.4	1.18	–	–	4.9	1.02	4.0	1.19
Ectomorphy	2.6	1.09	2.1	1.23	2.4	0.98	2.2	0.98	2.5	1.02	2.0	1.19	–	–	2.1	0.94	2.2	0.87

to the greater values for mesomorphy found in males and the higher values for endomorphy found in females. Other studies have shown similar results for sexual differences[5,20–22]. However, recently, in a subsample of individuals of 18 to 30 years-old, Kalichman and Kobyliansky[23] have found a higher endomorphy in females

whereas males of that sample have not shown higher values for mesomorphy. In our sample, endomorphy and mesomorphy contributed significantly to the differences found between sexes in contrast to ectomorphy, which did not caused differences between males and females in relation to the whole somatotype.

Male and female mean somatotypes of this sample were similar to those described in the 90's in other sample of the University of the Basque Country[24] and in a sample of 18,5 years-old boys and girls of the Biscay province (Basque Country) studied by Rebato and Rosique[25]. Even the aforementioned studies are separated by more than a decade, no secular trend has been found in body shape. In the present study, the endomorphy values were notably higher than those of the university students from Madrid studied by Pacheco et al.[24], possibly due to cultural differences related to nutritional trends and social behaviour concerning consideration of food intake in both Spanish regions. Nevertheless, it is important to note that mean somatotype is only a general trend for the whole sample, it does not represent the whole existing variability and it can be affected by multiple factors. In consequence, comparisons can be imprecise.

The obtained results showed a significant variability of body shape in males regarding social class indicators, particularly, in relation to father's educational level and mother's occupation, whereas females did not show differences due to SES. In males, the endomorphy and the mesomorphy were the components the most influenced by SES, while ectomorphy was not specially affected. Independently of the statistical significance, in males as well as in females both components (endomorphy and mesomorphy) had greater values in low SES groups, while ectomorphy was higher in high SES groups. A similar trend was noted by Rebato and Rosique[25] in children and adolescents from the Basque Country, where it was observed that variations of the somatotype during adolescence and regarding socio-familial environment was higher in boys than in girls. In this research, even though most part of the individuals has finished their growth period, males still show an influence of the environment on their body shape.

It is necessary to take into account that the association between the different SES indicators and morpho--physiological variables can vary with age (adolescents, adults, aged people), sex and different groups of populations. In addition, it could change through time[18,26]. However, although a complex pattern possibly exists in the association between SES and body shape, the analysed sample is homogeneous enough regarding the age, the geographical origin, the culture, etc., to »avoid« some confusing factors, which could modify the results. In fact, as it has been noted this sample can be considered as medium class, although the division of medium class in three categories (high, medium, low) has allowed demonstrating a clear association between somatotype and SES.

As in the present study, in that carried out by Rebato and Rosique[25] endomorphy was the most variable component regarding SES, and boys whose parents were illiterate or with primary studies (low class) were more endomorphic and mesomorphic than those belonging to other categories. According to these authors, the changes of the somatotype in growing individuals were more evident when father's socio-professional categories were considered than when mother's profession was taken into account. However, mother's occupation as well as father's level of education of the analysed males, had higher influence on somatotype than the other two variables of SES.

Fathers' profession has been widely used to study the influence of the socio-economic status on the body morphology (specially stature). Nevertheless, as it has already been noted, the effect of the SES variables can be conditioned by the sex of the individuals (in fact, in the present sample its influence was only found in males) and it depends on the type of analysed morphological traits. Thus, even though the body shape was not influenced by the father's occupation, this variable had a significant influence on males' height ($p < 0.05$) but not on females. On the contrary, weight was not affected by this socio-economic variable (unpublished data).

Different studies have used several methods to evaluate the SES. A large number of researchers have used the household income to evaluate SES of the subjects. Besides, complementary information as the educational degree and occupational status has been used[26–29]. However, due to the complexity of getting data about the household income, most part of the studies use different socio-cultural factors to estimate the status of the subject without asking them about household income[30,31]. Parents' profession and educational level are variables which describe mainly the general conditions of the socio-familial environment. This environment can not be encompassed when it is only expressed as an income or purchasing power, since the education or the information got into the family (translated in familial habits or »way of living«) can notably make vary the conditions for a healthy and balanced feeding as well as for other hygienic or physical activity habits, which can influence on morpho-physiological variation of the individuals.

In summary, results showed a greater stability of the body shape in females regarding SES and more variability in males. Males' values of endomorphy and mesomorphy were related to SES: low socioeconomic levels were associated with high values of endomorphy and mesomorphy. In the analysed sample, the values of these components were not high enough to suppose current risks for health. However, the biological consequences of the SES must be taken into account in young adults to design preventive measures to reduce the risk of some future diseases, especially those related to the excess of body fat.

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OBLIK TIJELA U ODNOSU SA SOCIO-EKONOMSKIM STATUSOM MLADIH PUNOLJETNIH OSOBA IZ BASKIJE

SAŽETAK

Oblik tijela izrazito varira u odnosu na energetski unos, fizičke aktivnosti, spol i dob. Cilj ove studije bio je analizirati odnos oblika tijela i socioekonmskog statusa (SES) kroz somatotip. Uzorak je sadržavao 316 muških i 635 ženska studenta u dobi od 18-33 godina. Somatotip je analiziran Heath-Carterovom tehnikom. Informacija je sadržavala podatke SES-a. Korišten je i MANOVA test za razlikovanje grupa. Glavni somatotip bio je 4.0-4.4-2.3 kod muškaraca i 5.4-3.4-2.2 kod žena. Bio je pronađen seksualni dimorfizam za cijeli somatotip ($p<0.001$). Oblik tijela u odnosu na SES bio je stabilan kod žena, dok je nešto više varijabilnosti pronađeno kod muškaraca. Muški somatotip bio je značajno povezan sa SES-om na način da je lošiji socioekonomski status povezivan sa višim vrijednostima endomorfije i mezomorfije.