



Nutrición Hospitalaria

ISSN: 0212-1611

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Sociedad Española de Nutrición  
Parenteral y Enteral  
España

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Nutrición Hospitalaria, vol. 34, núm. 5, 2017, pp. 1112-1118  
Sociedad Española de Nutrición Parenteral y Enteral  
Madrid, España

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## Trabajo Original

Valoración nutricional

### Body shape as body image determinant in university students

#### *La forma corporal como determinante de la imagen corporal en estudiantes universitarios*

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### Abstract

**Introduction and objectives:** Body shape (BSP) and body image (BI) are part of the external physical structure, then modifications in body shape necessarily affect body image; however, both combined have not been studied. The purpose of the study was to evaluate the statistical relationship between BSP and BI in university students.

**Method:** Two hundred and ninety-six participants (17-35 years) were included in this study. Different anthropometric measurements were used to define their somatotype (BSP), body mass index (BMI), waist to hip ratio (WHR) and waist circumference (WC). In addition, a questionnaire on body image perception was applied (McElhone et al.), regarding "how do I look?", "how do I think others see me?", "how do others see me?", and "how do I want to look like?"

**Results:** On average, men perceived themselves in normal weight; in contrast, women perceived themselves as overweight. Men were meso-endomorphic, while women were endo-mesomorphic as an average.

**Conclusion:** Body shape measured as somatotype as well as WC and WHR were excellent determinants of body image. Participants who presented a higher endomorphy, WC and WHR and a lower ectomorphy had a higher appreciation of being overweight or obese and wish to become thinner.

#### Key words:

Abdominal fat. Body constitution. Mental health.

### Resumen

**Introducción y objetivos:** la forma corporal (FC) y la imagen corporal (IC) son parte de la estructura física externa, por lo tanto, las modificaciones en la forma del cuerpo afectan necesariamente a la imagen corporal; sin embargo, combinados ambos no han sido estudiados. El objetivo del estudio fue evaluar la relación estadística entre FC e IC en estudiantes universitarios.

**Método:** doscientos noventa y seis participantes (17-35 años) fueron incluidos en este estudio. Se utilizaron diferentes medidas antropométricas para definir el somatotipo, índice de masa corporal (IMC), índice cintura/cadera (ICC) y circunferencia de cintura (CC). Además, se aplicó un cuestionario sobre la percepción de la imagen corporal (McElhone et al.), relacionado con: "¿cómo me veo?", "¿cómo pienso que los demás me ven?", "¿cómo me ven los demás?" y "¿cómo quiero parecer?"

**Resultados:** en promedio, los hombres se perciben en peso normal; en cambio, las mujeres se perciben con sobrepeso. En promedio, los hombres fueron meso-endomórficos, mientras que las mujeres endo-mesomórficas.

**Conclusión:** la forma corporal medida como somatotipo, ICC y CC fueron excelentes determinantes de la imagen corporal. Los participantes que presentaron mayor endomorfia, mayor ICC, mayor CC y menor ectomorfia tuvieron una mayor apreciación de sobrepeso u obesidad, y el deseo de verse más delgados.

#### Palabras clave:

Grasa abdominal. Constitución corporal. Salud mental.

Received: 16/11/2016

Accepted: 07/03/2017

**Authorship:** RPHT, RUR, AWM, IB and RVM compiled and analyzed the data in the manuscript; ARJ conceptualized the study, participated in its design and coordination and helped draft the manuscript. All authors have read and approved the final version of the manuscript and agree with the order of presentation of the authors.

**Disclaimers:** The opinions expressed here are those of the authors and do not represent an official position of the participating institutions.

**Funding source:** The present study received founding from PRODEP, SEP, Mexico. The study sponsors were not involved in the research design, implementation or publication.

Ramos Jiménez A, Hernández Torres RP, Wall Medrano A, Urquidez Romero R, Barahona I, Villalobos Molina R. Body shape as body image determinant in university students. Nutr Hosp 2017;34:1112-1118  
DOI: <http://dx.doi.org/10.20960/nh.744>

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## INTRODUCTION

Among university youth, both body image and body shape are affected by nutrition, physical activity, psychological, environmental and even socio-cultural factors (1,2). During this period, several lifestyle changes occur in youth related to their own body self-perception, due to the acquisition of stereotype habits and the social desire to be “in good shape” associated to social models imposed by the mass media (1), while sedentarism and consumption of energy-dense nutrient-low foods are also prevalent at this age. In addition, youth are resistant to behavioral change (3,4), experiencing a plethora of abnormal eating behaviors and body dysmorphic disorders (BDD) (2,5). According to the *Diagnostic and statistical manual of mental disorders* (DSM-5), preoccupation with flaw in appearance associated to repetitive behaviors, distress, impairment with or without a clinically defined eating disorder are major symptoms of BDD (6). Factors that trigger BDDs are unknown, but brain size and functioning (7) seem to be involved in BDD, and they often occur in people with other mental disorders. Also, self-concept clarity, thin-ideal internalization and the appearance-related social comparison among peers are important as predictors of body dissatisfaction, all of the factors of the so-called “tripartite influential model” (8). It is noteworthy that body dysmorphic disorders have a negative impact in mental health and quality of life in those whom suffer them, but also, they become prone to other diseases, including death (2,9).

Body image and body shape make a complex construct, where the body image represents the subjective and intangible, and it is composed of the following four elements: a) how do I look?; b) how do I want to look like?; c) how do I think others see me?; and d) how do others see me independent of my perception?. On the contrary, body shape is an objective and external measure of the human being which is composed by weight, height, length of arms/legs, diameter of waist, hip and arms, total or partial volumes, texture and color of skin, and hair. The importance of both, image and shape, is that we communicate and socialize through them, and when one of them is affected communication becomes nonassertive (1). Therefore, they are associated with diagnoses of obesity, eating disorders, and body dissatisfaction (1,10), and diminished quality of life as a consequence. Body image has been determined through the application of questionnaires and representative body figures, where the individual chooses the answer or figure that best defines his/her beliefs and wishes about his/her image (11,12). The image could be impaired due to a pathology, bringing dissatisfaction and health problems or bringing actions to have a better shape and image by doing physical exercise, a dietary regime and/or taking medical drugs (1,13).

On the other hand, some biometric indexes have been suggested to define body shape, and through them the individual's health status may be determined. When those indexes are altered, they are associated with cardiovascular diseases, hypertension, dyslipidemia, diabetes, cancer, and osteoporosis, among others (14-17). BMI is the best known parameter, followed by different indexes related to abdominal obesity such as the WC, the WHR, the conicity index (CI), and the A body shape index ( $ABSI = WC/$

$BMI^{2/3} \times height^{1/2}$ ). Krakauer & Krakauer (18), in a study of 14,105 adults followed for 4.8 years, found that ABSI was 33% more powerful than BMI and WC to determine premature death in general population, while Urquidez-Romero et al. (16) reported that individuals with abdominal obesity show a risk factor (odds ratio [OR]) between 4.3-5.7 to develop hypertension and between 1.4-4.8 to suffer dyslipidemia. Murguía-Romero et al. (19) observed that WC showed between 63% and 83% specificity/sensitivity to determine the prevalence of metabolic syndrome in young Mexicans. In addition, it has been shown that metabolic indexes are better predictors of dyslipidemia in persons with Down syndrome when those are adjusted by height (20). All these data suggest a strong association between body shape and physical health.

After a literature search of the last five years, we have found few reports focused on the associations between physical shape and body image; some of those studies showed that overweight or obese persons bear insecurity, body image dissatisfaction and lower quality of life compared to their normal weight counterparts (10,21,22). Given the above, we think that, at least in young adults, there must be a close relationship between body shape and body image, that is, changes in body shape affect the perception of body image. Therefore, this work investigates the possible associations, either positive or negative, between body shape and body image in a sample of university students.

## METHODS

### EXPERIMENTAL DESIGN

During 2015 we invited university students who were apparently healthy, according to a short health questionnaire applied before the studies (18-25 years old; Universidad Autónoma de Ciudad Juárez, Chihuahua, Campus Ciudad Universitaria), to participate in a study to evaluate their body shape and body image. The total sample included 297 participants (145 women). The study was non-probabilistic in design, and all students signed a letter of informed consent according to the Declaration of Helsinki. All participants were examined by a trained physician.

### BODY IMAGE

To know students' perception of body image they answered the questionnaire on body image perception described by McElhone et al., a questionnaire validated in a large European population composed of several somatotypes, including Latinos (23). The questions asked in the questionnaire were: “how do I look?”, “how do I think others see me?”, “how do I want to look like?” A fourth question, “how do others see me?”, was answered by a third person watching the participant at the moment. The questionnaire shows a series of nine figures about body image, where images 1-3 represent low weight persons ( $BMI < 20 \text{ kg/m}^2$ ), figures 4-5 represent normal weight persons ( $BMI = 20-24.99 \text{ kg/m}^2$ ), figures 6-7 represent overweight persons ( $BMI 25-29.99 \text{ kg/m}^2$ ), and

figures 8-9 represent obese persons ( $\text{BMI} \geq 30 \text{ kg/m}^2$ ) (23). In other words, the higher the number the higher the weight regarding stature.

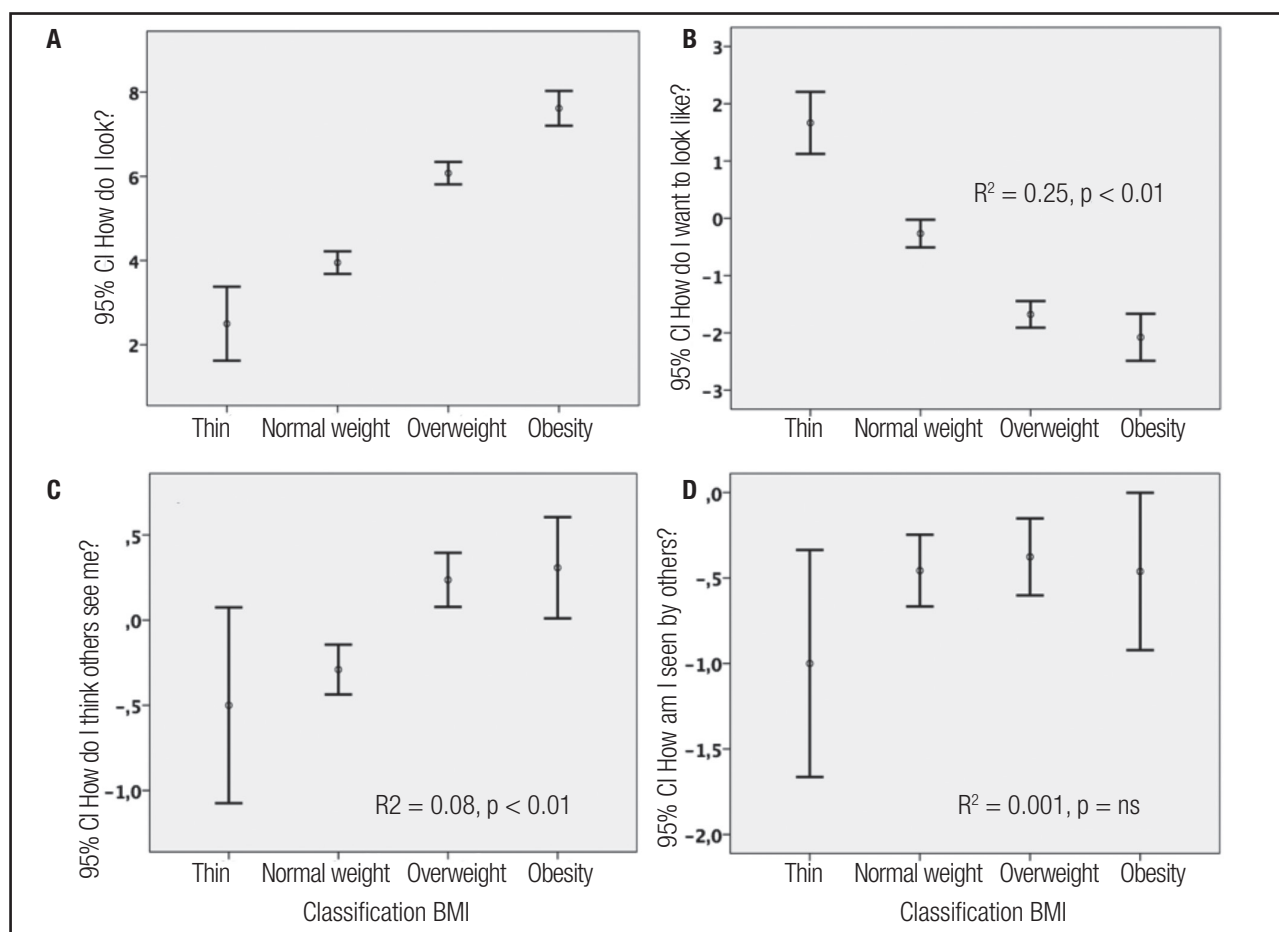
to subject's stature according to the Phantom model, i.e., it has to be multiplied by 170.18 cm and divided by the height of the evaluated person (24).

## BODY SHAPE

To know the body shape and the somatotype we measured full anthropometrics in the participants, as described by Norton and Olds (24) and recommended by the International Society for the Advancement of Kinanthropometry (ISAK). Measurements of folds, diameter and circumference were done with a Centurion anthropometric kit (Rosscraft, Vancouver, Canada). Body weight was recorded with a digital SECA 656 scale and height, with a SECA portable stadiometer 206 (Hamburg, Germany). The anthropometrist is an expert certified by the ISAK, and somatotype was calculated according to Norton and Olds (24), where endomorphy represents the obesity grade of persons, mesomorphy represents muscularity, and ectomorphy represents thinness. Since WC increases in proportion to person's height, it was adjusted

## STATISTICAL ANALYSIS

To analyze sex differences, we used Mann-Whitney U-test, and  $\chi^2$  for percentages, while bivariate correlation (Spearman) and linear regression analysis between dependent ("how do I look", "how do I want to look like", "how do I think others see me" and "How am I seen by others") and independent variables (endomorphism, mesomorphy, ectomorphy, BMI and WC) were used to analyze associations between variables body shape and image. To analyze the agreement degree in body image perception regarding the four questions asked in the McElhone et al. (23) questionnaire: to the recorded values for "how do I want to look like", "how do I think others see me", "how do others see me", the values for "how do I look" were subtracted, so that the positive values shown in figure 1 A-B mean that the individual wished either to



**Figure 1.**

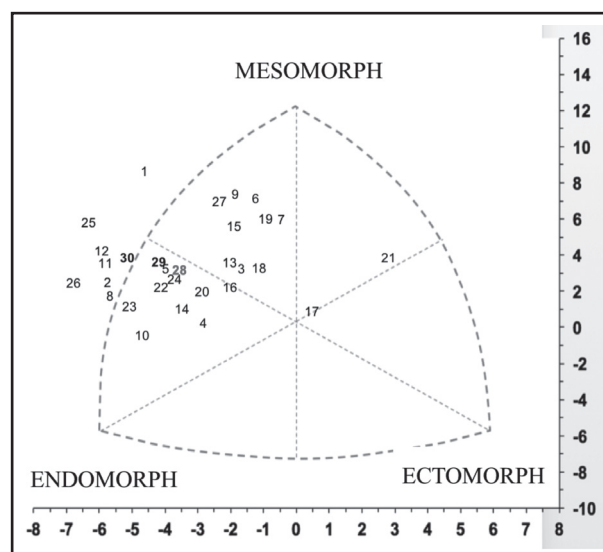
Body image with respect to BMI.

have higher body weight, believed or it was seen heavier; on the contrary, negative values mean lower body weight.

## RESULTS

Men were older, taller and heavier, while women showed higher WC and WHR (Table I). Regarding body composition, men showed normal weight in average, and women were overweight (Table I). When somatotype was evaluated, men were meso-endomorphic in average, and women were endo-mesomorphic; however, somatotype scattering in both populations, either athletes or non-athletes, was very broad, with values around endomorphy and mesomorphy (negative value for coordinate X and positive value for coordinate Y) (Fig. 2).

When body image was evaluated, 18% of men and 13% of women wished to look as they actually look, but a higher proportion of women wished to look thinner (79%); in contrast, more men wished to look with higher body weight (33%) (Table II). Around 45% of participants believed that they were observed exactly as they saw themselves, without sex difference in perception; the rest of individuals believed they were seen as thinner or heavier (Table II). When third persons were asked “*how do you see me*”, these persons saw men with normal weight and women with a little higher BMI (4.0-5.1) (Table I). However, only 36-37% of those third persons saw men exactly as they saw themselves (Table II), while women were seen as having higher body weight. In addition, figure 1 shows that the higher the BMI, the higher the appreciation of being overweight and obese (Fig. 1A), higher the wish to look thinner (Fig. 1B). Students believed they were perceived as heavier than they thought (Fig. 1C). Lastly, in general,



**Figure 2.**

Somatotype of participants. Numbers represent different sports; 28 is the average somatotype.

third persons perceived that participants were thinner than they believed (Fig. 1D), mainly women (Table II).

In relation to the correlation degree between “*how do I look*” vs other variables, correlation was very high with “*how do I think others see me*” ( $r = 0.93$ ), high with “*how do others see me*” ( $r = 0.81$ ), and moderate with “*how do I want to look like*” ( $r = 0.61$ ).

Regarding independence among variables, we found:

1. Ectomorphy, endomorphy and adjusted WC determine 95% of the variance in “*how do I look?*” =  $-0.412$  ectomorphy +  $0.339$  endomorphy +  $0.048$  WC;  $R^2 = 0.95$ .
2. Ectomorphy and endomorphy determine 50% of the variance in “*how do I want to look like?*” =  $-1.186$  +  $0.632$  ectomorphy –  $0.145$  endomorphy;  $R^2 = 0.50$ .
3. Ectomorphy and endomorphy determine 18% of the variance in “*how do I think others see me?*” =  $0.83$  +  $-0.344$  ectomorphy –  $0.6$  endomorphy;  $R^2 = 0.18$ .
4. WHR, endomorphy and mesomorphy determine 9% of the variance in “*how do others see me?*” =  $-2.729$  +  $2.836$  WHR –  $0.122$  endomorphy +  $0.133$  mesomorphy;  $R^2 = 0.90$ .

## DISCUSSION

As explained by Ramos-Jiménez et al. (25), the concepts of body image, body shape, and body composition should not be confounded and must be studied together. In addition, since changes in these three factors affect health, we should identify which one of them is more affected in each suffering. In this work, we studied the associations between body image and body shape in university students due to the fact that at this age body dysmor-

**Table I. Physical characteristics of participants**

	Men (n = 152)	Women (n = 144)
Age, y	22.0 ± 3.3	20.9 ± 2.8*
Height, cm	172.7 ± 6.8	160.5 ± 5.1*
Weight, kg	72.3 ± 11.8	64.9 ± 13.0*
BMI, kg/m <sup>2</sup>	24.3 ± 3.9	25.1 ± 4.5
WC adjusted by height, cm	79.4 ± 9.3	81.1 ± 10.1
Waist/hip, cm	95.4 ± 6.9	98.7 ± 8.4*
Endomorphy	4.1 ± 2.4	6.5 ± 1.8*
Mesomorphy	5.0 ± 1.5	4.6 ± 1.6*
Ectomorphy	2.1 ± 1.3	1.3 ± 1.2*
How do I look	4.1 ± 1.9	5.9 ± 1.7*
How do I want to look like	3.8 ± 1.2	4.5 ± 1.2*
How do I think others see me	4.0 ± 2.3	5.9 ± 2.1*
How do others see me	4.0 ± 1.9	5.1 ± 1.8*

U-Mann-Whitney test. All are different (except BMI) a \* =  $p < 0.01$

**Table II.** Difference in perception of body shape between sexes

	How do I want to look like?		How do I think others see me?		How do others see me?	
	M	F	M	F	M	F
Thinner, %	49	79 <sup>a</sup>	30	26	35	55 <sup>b</sup>
As he/she actually is, %	18	13 <sup>a</sup>	48	43	36	37 <sup>b</sup>
Heavier, %	33	8 <sup>a</sup>	22	31	29	8 <sup>b</sup>

M: Male; F: Female. <sup>a</sup> $\chi^2 = 23.01$ ,  $p < 0.001$ ; <sup>b</sup> $\chi^2 = 16.4$ ,  $p < 0.001$ .

**Table III.** Sports practiced by participants

ID	Sport	n
1	Male athletes (middle distance)	2
2	Female athletes (middle distance)	1
3	Dancing men	2
4	Dancing women	3
5	Baseball players	4
6	Boxers	1
7	Male bicycle riders	3
8	Female bicycle riders	1
9	Physical constructivism men	10
10	Physical constructivism women	3
11	Male footballers	4
12	Female footballers	2
13	Male soccer players	42
14	Female soccer players	15
15	Semi-professional referees	3
16	Male artistic gymnasts	1
17	Female artistic gymnasts	1
18	Male handball players	3
19	Judo men	2
20	Judo women	6
21	Male cheerleaders	1
22	Female cheerleaders	1
23	Roller derby women	4
24	No sport	170
25	Male softball players	1
26	Female softball players	4
27	Male volleyball players	4
28	Somatotype average	294
29	Cut-off point BMI	294
30	Cut-off point WC	294

BMI: Body mass index; WC: waist circumference.

phics as well as eating disorders are more prevalent and complex (26). Our main finding is that, indeed, body shape, measured as somatotype, WC and WHR, independently determine between 9% and 95% of perception alterations in body image of apparently healthy young adults. The way students look, how they wish to look like, how they think others see them, and how others actually see them depend of their physical shape and anthropometric proportions. To the best of our knowledge this is the first work that reports these associations and dependency.

Determination of somatotype is commonly used in the sports field to characterize athletes, and to lead them to build their best shape through training and diet (27). On the contrary, it is poorly used in the general population, however, it is important to know it in order to keep a healthy physical shape, since regarding physical health those values close to the center and positive in the Y axis of the somatochart are recommended (25). In our study, excluding subjects 17 and 21 of the somatochart, most participants showed an endomorphic-mesomorphic somatotype, with women having slightly high endomorphy and slightly low mesomorphy as compared to men.

All participants were considered as clinically healthy and with no otherwise psychological distress related to body image. They were also far from being competitive sporty persons neither elite athletes (27,28), but they belonged to the general population or were sporty persons at a recreational level (29), since 42% of the subjects were overweight or obese (BMI  $\geq 25$  kg/m<sup>2</sup>, data not shown), with endomorphic values  $> 6$  and mesomorphic values  $< 4$ . Regarding WC and WHR, according to the literature search, we found that there are few reports studying central obesity influence on physical appearance and body dissatisfaction; however, it is common to observe in the electronic media that a swollen abdomen is a synonym of obesity, sedentarism, weakness and lack of health and, in contrast, a stylized figure and flat abdomen, with big breast and buttocks is a synonym of health, sensuality and vigor. Kolodziejczyk et al. (21) and O'dea (22) have shown that the higher the BMI, the lower the self-esteem and the lower the quality of life related to general health. While Willows et al. (30) observed that overweight or obese kids showed lower self-esteem and poor physical appearance, and felt less attractive, with less physical attributes and less physical strength. On the other hand, Pila et al. (31) reported that higher central adiposity leads to feeling guilty and shamed, but strangely enough, it is not related to self-esteem. All these reasons support that the studied



anthropometric variables represent both, image and body shapes. Studies simultaneously evaluating physical form and body image were not found.

Women, as compared to men, generally perceive themselves as being a little heavier, and wish to look thinner, confirming previous reports in university population (32), in adolescents (33), and in adults (34). We found 13% to 48% consistency among what participants thought about their body image and what they wish, and think, and believed how others see them (Table II). Moreover, both men and women showed high dissatisfaction with their own body shape (75%); the higher the overweight and obesity, the higher the dissatisfaction with their body shape. El Ansari et al. (32) reported 15% higher unconformity on body image in young university women vs men, and in both cases that unconformity was directly proportional to BMI; furthermore, it was associated with depression and poor life style. We found that women show 30% more disagreement with their bodies as compared to men, and they wish to be thinner (79%). Between 43% and 48% of participants think others see them as they think they look, and the rest think they are perceived as heavier or thinner. In addition, 36-37% coincide in how others see them, being higher the percentage of persons that perceived participants as thinner (35% vs 55% men to women, respectively).

In summary, the degree of unconformity with body shape depends on sex, and is directly related to obesity in women and to thinness in men, as has been described (32). We did not study why participants do not improve their body shape or keep healthy, however, it has been observed that many young have no motivation nor sufficient time to do sports and develop a desired body shape, and they do prefer social, cultural or artistic activities even though they know that an unhealthy body is synonymous of unhealthy practices (35). This might mean a lack of consciousness in education and health authorities to promote healthy practices.

## CONCLUSIONS

Body shape measured as somatotype, WC and WHR is an excellent determinant of body image in young university students. The higher the endomorphy, WC and WHR and the lower the ectomorphy, the higher the perception of being overweight or obese is, as well as the wish to be thinner. Although clinical studies are needed to demonstrate this, this study suggests that through anthropometric determinations we can diagnose possible alterations in the body dysmorphic disorder.

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