Emotional Eating and Poor General Lifestyle Prevalent among Obese Young Adults

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Abstract **Aim:** To evaluate the association between obesity and lifestyle factors, eating behaviors related to emotional eating, and body perception. **Methods:** A cross-sectional study was carried out with individuals of both sexes by taking anthropometric, biochemical and clinical measurements. Questionnaires were used to evaluate lifestyle, eating habits, emotional eating behavior and self-perception of body image. The participants were stratified according to body mass index (BMI). **Results:** A total of 318 subjects were evaluated (44% women), with an average age of 34 ± 8 years. Regarding the lifestyle questionnaire, the normal BMI group obtained a higher score [78.5 (71-82)] than did the overweight [76 (69-80)] and obesity groups [73 (65-79)], (p=0.005); this finding indicated that the normal BMI group had a healthier lifestyle. Conversely, the questionnaire on emotional behaviors related to emotional eating showed that the normal BMI group had lower scores [7 (3-13)] than the overweight [8 (3-15)] and obesity groups [12 (5 -21)], (p=0.008). Being a very emotional eater significantly increases the risk of obesity (OR= 3.83 (95% CI, 1.67-8.7) (p=0.002). Overall, 51.1% of the participants had a self-perception that was incorrect according to their BMI. **Conclusion:** Individuals frequently have a misperception of their body shape. People with obesity had lifestyle factors that were less favorable for their health as well as higher rates of emotional eating, both of which are risk factors for obesity.

Keywords: *body perception, lifestyle, eating behaviors, BMI, emotional eating, obesity*

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1. Introduction

Being overweight or obese is associated with pathologies that have high mortality [1] and higher risk of chronic disease and show clinical parameters for developing metabolic syndrome (MS) [2] and tissue stress and dysfunction. As an asymptomatic condition, MS can go unnoticed, but it increases the risk of cardiovascular disease and type 2 diabetes mellitus (T2D) [3]. Eating habits are an important aspect of being overweight or obese, associated with increased energy consumption due to lack of control over eating or a reduction in energy expenditure, resulting in a positive energy balance and, consequently, obesity [4]. Obesity is also favored by the current environmental conditions of our society, such as urbanization, decreased physical activity and more time spent in sedentary leisure activities [5,6]. The psychological factors are also significant, such as eating behaviors that

condition "eating in response to negative emotions such as anxiety, depression, anger and loneliness", also known as emotional eating [7]. Previous studies have reported the relationship among eating, emotions and increased energy intake [8], which could be an important factor for weight gain.

According to the World Health Organization (WHO), interventions for the prevention and treatment of overweight and obesity are recommended based on a body mass index (BMI) of 27-29.9 kg/m^2, and they include weight loss through dietary measures, an increase in physical activity and a modification of other habits related to lifestyle [9]. However, the motivation to lose weight is based on the willingness of the overweight/obese individual [10]. This willingness is influenced by the individual's perception of his/her weight, which could be distorted. A distorted perception of weight occurs when the individual has a self-perception that is different from that established by an objective measurement method [11,12]. The distortion may negatively influence the clinical outcomes of overweight and obese patients.

For this reason, this study aimed to evaluate the association between obesity and lifestyle factors, eating behaviours related to emotional eating, and body perception. We hypothesized that the participants with obesity have poor general lifestyle, more prevalence of emotional eating and distorted self-image versus the participants without obesity.

2. Materials and Methods

2.1. Study Design

This was a cross-sectional and descriptive study that was conducted in a third level institution carried out in 2017 using non-probabilistic (consecutive) sampling in an urban population of Mexico City.

2.2. Patients

The study included adults of both sexes, in an age range of 18–60 years, with BMI >18.5 Kg/m2 and individuals who were unable to answer the written questionnaires (illiterate). Exclusion criteria included subjects who receiving treatment for previously diagnosed chronic diseases (such as hypertension, diabetes, dyslipidemia and thyroid diseases), weight loss >3 kg in the last 3 months, cancer, acquired immune deficiency syndrome, kidney or liver disease, pregnancy, substance abuse, or having taken any medication were not enrolled in the study. All procedures performed were in accordance with the ethical standards of the institutional research committee and with the Helsinki Declaration. Approval from the Research Ethics Board was obtained before were collected for the current analysis. All participants gave and signed their informed consent to take part to the study.

2.3. Clinical and Anthropometric Parameters

Body weight, height, and waist and hip circumference were determined according to the Lohman method [13]. The BMI was calculated as the weight (kg)/height (m)^2 and corresponded to the following categories according to WHO[9]. Blood pressure was measured with a digital automatic blood pressure monitor.

2.4. Clinical and Anthropometric Parameters

Five mL sample of fasting blood was taken from all eligible subjects who agreed to participate to determine biochemical parameters. Blood samples were taken after a 12-hour fast and stored at -70°C until analysis. The lipid profile (total cholesterol, low-density lipoproteins (LDL), high-density lipoproteins (HDL) and triglycerides) was determined by enzymatic photometric methods, glucose levels were determined by an enzymatic method (Cobas C111, Roche Diagnostics).

The presence of MS was diagnosed according to established consensus [14,15] with the presence of at least three of the following five criteria: waist circumference ≥90 cm in men and ≥80 cm in women (with specific ethnic values [16]), triglycerides ≥150 mg/dL, c-HDL ≤40 mg/dL in men and ≤50 mg/dL in women, fasting glucose ≥100 mg/dL, systolic and diastolic blood pressure ≥130 mmHg and 85 mmHg, respectively.

2.5. Questionnaires

The questionnaires described below were applied, surveys were self-applicable, the incomplete questionnaires were discarded from the analysis.

2.5.1. Lifestyle

To evaluate lifestyle factors, the FANTASTIC questionnaire was applied, consisting of 25 closed items regarding lifestyle (e.g., activity, nutrition, tobacco and alcohol consumption, sleep, stress) [17]. The questionnaire was translated into Spanish and included 5 response options and was previously validated in the Mexican population. The reported test-retest correlation coefficient is 0.91 (p = 0.01) for the total scale [18]. A higher score indicates a healthier lifestyle. The survey was categorized as follows: 0-35, at risk; 36-55, poor; 56-65, normal; 66-80, good; and 81-96 fantastic (excellent).

2.5.2. Eating Habits

Eating habits were measured through the behavioral and eating habits questionnaire, consisting of 22 items, where a higher score indicates healthier behavior, and it evaluates the following aspects: caloric content of the diet, questions 1-8; follow-up eating for psychological well-being, questions 9-11; physical exercise, questions 12-14; healthy eating, questions 15-20; consumption of alcohol, questions 21-22. The alpha reliability reported was> 0.75 for 4 of the five categories, the test-retest stability >0.90 in all dimensions except in alcohol consumption (0.85) (p <0.001). The coefficient of Correlation referred to the total scores of the questionnaire was 0.95 (p <0.001). The set of the five factors explains 61.4% of the total variance (construct validity), and the content validity was evaluated by inter-judge agreement, where the questions were grouped in the same way to the factorial analysis with agreement rates close to 1 [19].

2.5.3. Emotional Eater

Emotional eater was assessed using the Emotional Eater Questionnaire (EEQ), a self-reported questionnaire specifically oriented to emotional eating behaviors, consists of 10 items, and is categorized according to the following score: 0-5, non- emotional eater; 6-10, slightly emotional eater; 11-20, emotional eater and 21-30, very emotional eater. The questionnaire was developed and validated directly with Spanish overweight and obese subjects [20]; principal component analysis of the EEQ results identified three factors that explained 60 percent of the total variance in emotional eating. These factors were Disinhibition (Factor 1), type of food (Factor 2) and finally Guilt (Factor 3). Internal consistency showed that Cronbach´s alpha was 0.773 for the "Disinhibition" subscale, 0.656 for the "Type of food" subscale and 0.612 for the "Guilt" subscale. The test-retest stability was r = 0.70. The data showed that the percentage of agreement between the EEQ and the Mindful Eating Questionnaire [21], was around 70% with a Kappa index of 0.40 (p< 0.0001).

2.5.4. Self-perception of Body Image

For the measurement of self-perception of body image, we used the scale of Stunkard et al. [22], which consists of nine silhouettes of women and men ranging from very thin to very obese [23]. The 9 models are classified according to the BMI criteria: model 1, malnutrition 3; model 2, malnutrition 2; model 3, malnutrition 1; model 4, normal; model 5, overweight; model 6, obesity I; model 7, obesity II; and model 8 and 9, obesity III. For comparison issues, models 1-3 were grouped into malnutrition; model 4 was normal; model 5 was overweight; and models 6-9 were obese. Receiver operating curves indicated that the scale was effective in classifying individuals as obese or thin. The Areas under the curves reveal that the silhouettes performed quite well in correctly classifying individuals as obese (0.93 for women and 0.88 for men) or thin (0.87 for women and 0.88 for men) in Caucasian population [24].

2.6. Statistical Analysis

The continuous variables are expressed as the mean ± standard deviation for parametric data and median (interquartile range 25-75) for non-parametric data; the categorical variables as percentages. The demographic characteristics, anthropometric, clinical and biochemical measurements, and questionnaire scores were compared between groups using one-way analysis of variance (ANOVA), while proportions were compared by Chi-squared analysis. The questionnaire scores related to behaviors and eating habits were categorized using quartiles as cut-off points. Odds ratio (OR) with 95% CI were obtained using a multivariable logistic regression model. The logistic regression model was used to evaluate the relationship of the questionnaire factors and the risk of obesity. The multivariate model was adjusted by sex and age.

The statistical analyses were performed using the statistical package SPSS (version 25, IBM, Inc., Chicago, IL). P values of $p<0.05$ were considered to be significant. The recommended sample size for an exploratory analysis is a ratio of 5 to 10: 1 (at least 5 subjects for each item). A ratio of 8:1 was considered to reduce inference errors [25], having a maximum of 38 items on one of the questionnaires, and the total calculated sample size was 304 participants.

3. Results

A total of 318 subjects were included in the study, with an average age of 34 ± 8 years, and 139 (44%) were women.

3.1. Anthropometric and Clinical Parameters

The average BMI was 28.5 ± 5.1 kg/m^2. Three groups were formed according to BMI: 61 participants (19%) composed the normal BMI group, 160 (50%) participants composed the overweight group and 97 (31%) participants composed the obesity group. No differences in sex and age were found among the 3 groups. The average BMI was 22.7 ± 1.5 kg/m2 for the normal BMI group, 27.3 ± 1.4 kg/m^2 for the overweight group and 34.3 ± 4.7 kg/m^2 for the obesity group. This last group showed a difference in BMI when analyzing by sex, where women presented a higher BMI (35.8 ± 6.1 kg/m2) compared to men (33.3 ± 3.3 kg/m^2) p=0.027.

According to the anthropometric parameters, as expected, the obesity group featured waist (105 ± 10 cm) and hip (112 ± 8 cm) circumferences that were higher than those in the overweight (waist 92 ± 8.5 cm, hip 102 ± 5 cm) and normal (waist 81.9 ± 7 cm and hip 96 ± 5 cm) BMI groups, p<0.0001. No differences were found between the groups in systolic blood pressure (113 ± 13 mmHg). However, the obesity group showed the highest diastolic pressure (79 ± 12 mmHg) compared to those of the overweight (75 ± 8 mmHg) and normal (73 ± 8 mmHg) BMI groups, p<0.0001.

3.2. Biochemical Parameters

No significant differences were found between the groups in total cholesterol and fasting glucose concentrations. However, 1.8% of the normal BMI group, 2% of the overweight BMI group and 6.5% of the obesity BMI group showed glucose concentrations >7 mmol/L. Triglyceride concentrations and HDL cholesterol were different among the three groups, showing higher LDL cholesterol in the obesity group than those in the other two groups. Conversely, the obesity group showed a lower concentration of HDL cholesterol than did the overweight and normal groups. A total of 9.8% (n = 6) of the subjects in the normal BMI group met the MS criteria, versus 34.4% (n = 55) of the overweight group and 52.6% (n = 51) of the obesity group (Table 1).

3.3. Lifestyle Questionnaires and Eating Habits

According to the survey that evaluated lifestyle factors (FANTASTIC survey), we found that the obesity group had lower [73 (65-79)] than did the overweight [76 (69-80)] and normal [78.5 (71-82)] groups (p=0.005). This indicated that the normal BMI group had a healthier lifestyle, as measured through the constructs of physical activity, nutrition, tobacco and alcohol consumption, sleep, and stress, that were evaluated by the questionnaire.

When categorizing the scores, none of the participants in the three groups were in the category 'at risk', which is the lowest category (0-35 points). We grouped the survey categories into two strata, one for the highest categories (excellent and good) and the other for the lowest categories (normal and poor). The results showed that 93.8% of the subjects in the normal BMI group were in the higher categories, which was more than those in the overweight (82%) or obesity (74.5%) groups, p=0.037. In turn, the behavioral and eating habit survey, where a higher score indicates better health-related habits and behaviors, showed higher scores for the normal BMI group [(68 (64-78)] than the overweight [68.5(61-76)] and obesity BMI groups [66 (59-76)]. However, the differences among the three groups were not statistically significant.

Table 1. Baseline characteristics of the participants stratified by BMI.

Features	Normal n=61	Overweight n=160	Obese n=97	*P value*[2]
Sex, *n (%)*				
Female	31 (50.8)	69 (43.1)	39 (40.2)	0.385
Male	30 (49.2)	91 (56.9)	58 (59.8)	
Age, years	33 ± 9	35 ± 8	34 ± 8	0.267
Biochemical parameters				*P value*[1]
Glucose, *mg/dL*	87 ± 19	85 ± 26	93 ± 31	0.072
Glucose, *n (%)*				
Normal (<100 md/dL)	50 (84.7)	135 (85.4)	75 (80.6)	
Pre-diabetes (100-125 mg/dL)	8 (13.5)	20 (12.6)	12 (12.9)	0.108
Diabetes (>126 mg/dL)	1 (1.8)	3 (2)	6 (6.5)	
Total cholesterol, *mg/dL*	187 ± 31	190 ± 37	184 ± 30	0.444
Triglycerides, *mg/dL*	116 ± 68[b]	157 ± 117[a]	183 ± 95[a]	*0.001*
HDL cholesterol, *mg/dL*	52 ± 13[a]	42 ± 10[b]	39 ± 10[b]	*<0.0001*
Females	54 ± 13[a]	39 ± 10[b]	44 ± 11[b]	*<0.0001*
Males	49 ± 13[a]	46 ± 8[b]	36 ± 9[b]	*0.002*
LDL cholesterol, **mg/dL**	108 ± 33[b]	118 ± 32[a]	106 ± 26[b]	*0.011*

Data are presented as the mean ± standard deviation or n (%). [1]One-way analysis of variance (ANOVA) with post hoc Bonferroni test. a > b > c. [2]Chi-squared test.

3.4. Emotional Eating

Given the close relationship between emotional eating behaviors and weight gain, we applied a questionnaire that evaluates this behavior through 10 items, where a lower score indicates lower emotional eating. Our results showed a lower score in the normal BMI group [7 (3-13)] than in the overweigh [8 (3-15)] and obesity [12(5-21)] groups, which was significant among the three groups (p=0.008). When analyzing by category, 64.3% of the subjects in the normal BMI group were categorized as non-emotional or slightly emotional eaters, which was a higher percentage than that for the overweight (61.1%) and obesity (44%) groups.

Conversely, for the very emotional eater category, 29.7% of the subjects with obesity were in this category, which was the highest percentage of participants (overweight (14.6%) and normal (5.4%) BMI groups, p=0.002). As shown by the FANTASTIC and emotional eater scores, there is a very interesting contrast—when the BMI increased, higher emotional eater scores were observed (emotional and very emotional eater). In contrast, as the BMI increased, lower scores on the eating habits questionnaire were found, showing that those subjects with higher BMI had less healthy eating habits (Figure 1).
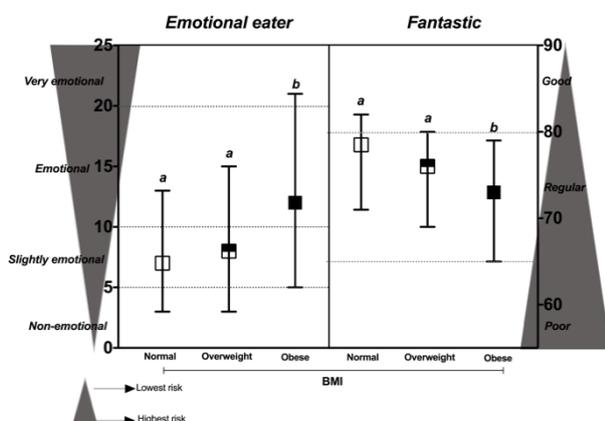
3.5. Self-perception of Body Image

Once the self-perception of body image was obtained using silhouettes, we compared this result to the calculated BMI of the individual (using their weight and height). Regarding the normal BMI group, we found that 41% of the subjects correctly perceived themselves; however, 26.2% perceived themselves to be overweight, and 27.9% perceived themselves to have a lower BMI than they actually had. In the overweight BMI group, 35.6% had a correct perception of their category; however, 42.5% had a perception of obesity, and 20.6% had a perception of normal BMI. In the obesity group, 76% perceived themselves correctly, although 15.7% perceived themselves as overweight and 7.3% as having a normal BMI.

Regarding the overall subject population, 51.1% had an incorrect perception of their corresponding BMI category. When analyzing by group, in the normal weight group, most participants had an incorrect perception—27.9% underestimated their BMI, and 31.1% overestimated it. In the overweight group, 35.5% had a correct perception of BMI, while 42.5% overestimated their BMI. However, in the obesity group, the majority (76%) correctly perceived themselves (Figure 2).
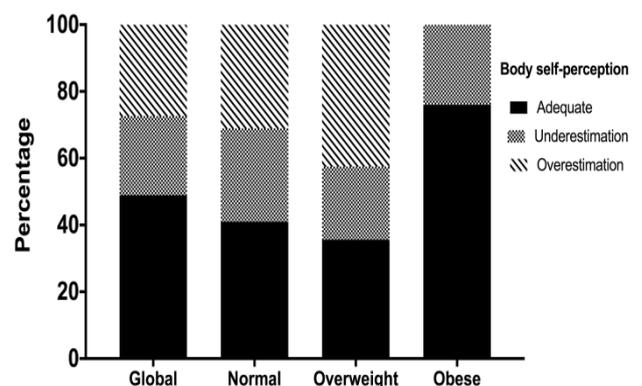

Figure 1. Emotional eating and lifestyle questionnaire scores. Emotional eating (left panel) and lifestyle (FANTASTIC) (right panel) questionnaire scores, stratified by BMI. a > b

Figure 2. Self-perception of body mass index. Percentage of participants with a correct self-perception of BMI (black graph), underestimation of BMI (dotted graph), and overestimation of BMI (diagonal line graph), stratified by BMI

Table 2. Factors related to emotional eating and lifestyle to obesity risk

Risk Factor	Frequency		Crude OR			Fitted OR[2]		
	Obesity n (%)	Without Obesity n (%)	OR	95% CI	P value	OR	95% CI	P value
Emotional eater					0.003[Ψ]			0.009[Ψ]
Non-emotional	26 (28.6)	76 (38)	Ref.			Ref.		
Slightly emotional	14 (15.4)	48 (24)	0.85	0.40-1.79	0.67	1.01	0.44-2.3	0.96
Emotional	24 (26.4)	52 (26)	1.34	0.69-2.60	0.37	1.66	0.78-3.5	0.18
Very emotional	27 (29.7)	24 (12)	**3.28**	**1.62-6.67**	**0.001[Ψ]**	**3.83**	**1.67-8.7**	**0.002[Ψ]**
Perform physical exercise					0.003[Ψ]			0.037[Ψ]
All the time	11 (11.5)	41 (18.7)	Ref.			Ref.		
Most of the time	11 (11.5)	47 (21.5)	0.87	0.34-2.22	0.775	0.78	0.25-2.3	0.66
Frequently	21 (21.9)	47 (21.5)	1.66	0.71-3.86	0.235	1.89	0.72-4.9	0.19
Rarely	18 (18.8)	46 (21)	1.45	0.61-3.44	0.390	2	0.76-5.3	0.154
Never	35 (36.5)	38 (17.4)	**3.43**	**1.52-7.70**	**0.003[Ψ]**	**2.99**	**1.20-7.42**	**0.018[Ψ]**
Time sitting during the day					0.008[Ψ]			
Never/Seldom	41 (45.1)	136 (61.8)	Ref.					
Frequently	14 (15.4)	37 (16.8)	1.25	0.61-2.54	0.529	**This variable was removed because of collinearity**		
Most of time	17 (18.7)	27 (12.3)	**2.08**	**1.03-4.20**	**0.039[Ψ]**			
All the time	19 (20.9)	20 (9.1)	**3.15**	**1.53-6.46**	**0.002[Ψ]**			
I eat small portions					0.003[Ψ]			0.28
All the time	20 (21.1)	20 (9.2)	Ref.			Ref.		
Most of the time/frequently	36 (37.9)	128 (58.7)	**0.28**	**0.13-0.57**	**0.001[Ψ]**	0.58	0.24-1.4	0.23
Rarely	26 (27.4)	46 (21.1)	0.56	0.25-1.23	0.154	1.05	0.40-2.7	0.9
Never	13 (13.7)	24 (11)	0.54	0.21-1.35	0.190	0.58	0.20-1.7	0.32
I eat low-kcal foods during off-hours					0.013[Ψ]			0.1
All the time	33 (34.4)	42 (19)	Ref.			Ref.		
Most of the time/frequently	29 (30.2)	91 (41.2)	**0.41**	**0.21- 0.75**	**0.004[Ψ]**	0.47	0.22-1.01	0.05
Rarely	16 (16.7)	54 (24.4)	**0.37**	**0.18-0.77**	**0.008[Ψ]**	0.47	0.19-1.1	0.09
Never	18 (18.8)	34 (15.4)	0.67	0.32-1.39	0.290	1	0.42-2.4	0.9

Ref: Reference, [Ψ]Statistically significant. Multivariable logistic regression model [1]Crude OR of univariate analysis. [2]OR fitted by sex and age.

Given the differences between the scores of emotional eaters and lifestyle factors among the BMI group, we analyzed some of their components as risk factors for obesity, fitted by sex and age. First, we analyzed the category of very emotional eater for obesity risk, and an OR of 3.83 was obtained (IC 95% 1.67–8.7), p=0.002, compared to non-emotional eaters. We also analyzed the frequency of physical activity, and the group that never exercised had an OR of 2.99 (95% CI 1.20–7.42), p=0.018, compared to the group with physical activity. Some other factors were analyzed, such as the time spent sitting during the day, "I eat small portions" and "I eat low-kcal foods during off-hours", where the univariate analysis showed significant values. However, when fitting the model, these were no longer significant (Table 2).

4. Discussion

The health belief model has become one of the most commonly used theoretical frameworks to explain health-related behaviors and prevent disease. According to these behaviors, perceiving the risk of becoming sick favors decision-making [26]. It has been proposed that the perception of health status and body image may influence individual behavior, as this perception may help individuals to identify potential risks and take to action for their prevention or treatment [27]. However, our findings showed that in general, less than half of the subjects evaluated had an accurate perception of the category in which they were classified according to BMI, which is a measure commonly used in clinical practice.

The individuals with obesity were generally found to have an accurate perception of the category to which they belonged. In this context, perceiving one's weight properly should be a probable motivator for weight loss. However, though the subjects are aware of their obesity, it is likely that they will remain in this category and even increase their obesity degree because some authors have shown that concerns about weight stigma may explain why obesity is associated with a greater tendency to overeat once the individual assumes this condition [28]. Communication between the patient and health personnel can be a critical intervention objective, seeking to reduce the perception of weight stigma in health interactions [29,30].

The results also showed that individuals in the obesity group have higher scores on the questionnaire that evaluated emotional eating, followed by those with overweight and normal BMIs. Emotional eating was identified as an important risk factor for obesity, as was never performing physical activity. These subjects have lower lifestyle scores, and considering the parameters evaluated, this is related to factors involved in their development.

Our results agree with those of Uribe et al., who documented that more than 90% of the population considered obesity to be a "serious or very serious" condition. As risk factors for its development, they found that being a woman (OR= 1.46, p=0.01), having abdominal obesity (OR = 1.69, p<0.01) and perceiving obesity as a "serious" condition (OR = 2.39, p=0.01) were positively related to the correct perception of body weight. On the other hand, age (OR = 0.99, p<0.01), living in rural areas versus urban areas (OR = 0.76, p=0.04) and being

overweight (OR = 0.36, p<0.01) or obese (OR = 0.05, p<0.01) versus having a normal weight were negatively related to a correct perception of weight [31].

Interestingly, although individuals were considered "healthy", we found that many of them met various MS criteria, and even T2D criteria, that were closely related to the stratum of BMI to which they belonged. The relevance of identifying these criteria is the cardiovascular risk and greater mortality that these diseases confer; therefore, it was very useful for the participants to have detected any MS or T2M criteria that were met, so as to receive general recommendations for the early care or prevention of related complications.

This study has limitations of sample size and non-probabilistic selection. The strength of the study is that it relates aspects involved in the physiopathology of obesity, represented by the questionnaires and categorized as self-perception of the body shape, lifestyle and eating habits, with clinical factors that sometimes are unnoticed until the pathologies have become advanced. In this sense, exploring these factors is relevant for individuals who are considered to be healthy.

5. Conclusions

A large proportion of the evaluated population had an inaccurate perception of their body shape. Individuals with obesity have lifestyles that are less favorable to their health and higher emotional eating. These conditions were identified as risk factors for obesity. In addition, we identified the presence of MS, or factors related to its presence, in subjects who were considered "healthy"; therefore, the relevance of this study is confirmed so that these subjects could get early treatment and thus avoid related complications.

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