



Between perception and reality: BMI in adolescence

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Abstract:

Adolescence is the transition period from childhood to adulthood, which involves a transformation of the body. It is in this exact period of time that one's body image starts to develop. Body image is influenced by social, psychological and emotional factors through interaction with peers, parents and the mass media. In the adolescent this causes a constant comparison between their own body and the ideal one, resulting in developing an idea of self which may lead to a sense of dissatisfaction with their own physical form. Such behaviour, in serious cases, may interfere with the everyday life of the individual.

The following observational, descriptive,

retrospective and multicenter study was created with the aim to describe the reality of adolescents regarding BMI, this by examining a sample consisting of 422 students in total, whom 266 were males and 156 were females, aged between 17 and 19 years.

The students were given a paper questionnaire from which we later obtained the following data: gender Q1, age Q2, height Q3, body weight Q4 and perception of their BMI Q5.

The significance of the observed and calculated data was evaluated by the Pearson chi-square test, and a p-value <0.05 was considered to be statistically significant. The statistical processing of the data allowed us to respond to the first objective of the study, namely to observe the BMI perceived by each individual student and the actual BMI. The second objective was to examine the altered perception of BMI, if overestimated or underestimated. Finally, the third objective was to analyse the distribution of actual and perceived BMI among the male and female population in relation to their age.

INTRODUCTION

The body image is “the picture we have in our minds of the size, shape and form of our bodies; and to our feelings concerning these characteristics and our constituent body parts” (Peter Slade, 1988).

The body image is composed of the characteristics of the person as a whole. Therefore, it consists of a perceptual component - which indicates how the size and shape of one's own body is viewed; an attitudinal component - which defines what one thinks and knows about his/her own body; an affective component - in which the feelings one has towards his/her own body emerge; and a behavioural component, which includes, for example, nutrition and physical activity.

The perception of their body among infants is linked to proprioception, or rather related to the information detected by peripheral receptors concerning the control of position, movement and balance of the body. This is where a process begins, which later will lead the child to recognition of his/her own reflected image around the age of three.

Adolescence entails a transformation of the body and it is in this very period that the creation of the body image takes place. This can be influenced by social, psychological and emotional factors, through interaction with peer group, parents and the mass media.

This causes in the adolescent an incessant comparison between his/her own body and the ideal one, thus leading to the creation of an idea of self which in both sexes could result in dissatisfaction with their own physical form. This phenomenon can cause high levels of suffering, resulting in an interference with the individual's life.

The basis of this study came from the idea of portraying the reality of adolescents about the perception of their own body, by examining a sample made up of male and female students (aged 17-19) attending third, fourth and fifth year of four Italian high schools in Lecce. The first objective of the study will be to observe the perceived BMI by each single student and the actual

BMI calculated according to their height and weight.

Subsequently, in order to answer the second objective of the study, we are going to analyse if the perception of BMI is overestimated or underestimated among both sexes. Finally, the distribution of real and perceived BMI in the male and female population taken into consideration is going to be observed based on the age group.

Body Mass Index is a biometric value created in 1832 by Adolphe Quetelet, a Belgian mathematician and statistician. Known at the time as 'the Quetelet Index', it was developed through anthropometric studies of human growth.

This index was reviewed in 1972 and renamed as Body Mass Index by physiologist Ancel Keys.

The BMI links one's body weight to height and it is calculated by dividing body weight (kg) by the square of the body height (m). BMI assesses the following weight categories: Normal weight (18.50 -24.99), Severely underweight (<16.00), Underweight (16.00 -18.49), Overweight (25.00 -29.99), Class I obesity (30.00 -34.99), Class II obesity (35.00 -39.99) and Class III obesity (≥ 40.00).

METHODOLOGY AND MATERIALS

The following clinical study is an observational, descriptive, retrospective and multicenter study.

A paper questionnaire was given to students aged between 17 and 19 years attending the third-, fourth- and fifth-year classes of the following Italian high schools, all located in Lecce: I.I.S.S. "E. Fermi" - which contributed to the study with 205 questionnaires, L.S.S. "G. Banzi Bazoli" (69 questionnaires), L.S. "Pietro Siciliani" (74

questionnaires) and L.S. "Galileo Costa" (74 questionnaires).

A total of 422 students participated anonymously in the study, 156 of whom were female and 266 were male. The consent for the data collection was requested in 2015 through a registered procedure addressed to principals of involved schools. The study was conducted in 2015.

Participation in the study was on voluntary basis and no incentives were offered. The aim of the study was explained to the students by the professors of the participating classes.

The sample was selected through simple randomization. The data were processed by guaranteeing and respecting the principles of the Declaration of Helsinki.

Questions and answers required for this study were taken from a questionnaire on adolescent risk factors.

The test consisted of two sections: the first - called 'initial data' - included three multiple choice questions, namely the interviewee's sex, blood type and age.

The second section consisted of questions on risk factors such as smoking, alcohol, sedentary or active lifestyle, obesity, and drugs. These will be the subject of a further in-depth analysis.

Five questions concerning the 'obesity' topic were taken from the questionnaire: gender Q1, age Q2, height Q3, weight Q4 and self-perception of BMI Q5.

The used BMI classification has considered 4 categories: underweight (≤ 18.49), normal weight (18.50 - 24.99), overweight (25.00 - 29.99) and obesity (≥ 30.00), without any variation between classes of obesity.

This choice of classification was due to the fact that the study does not aim to investigate in detail what type of obesity or underweight is present in the analysed population, but it mainly focuses on the perception of one's own body by the boys and girls sampled, based on the four macro-ranges taken into consideration.

The assessed statistical data were processed using Microsoft Excel spreadsheets (Microsoft Corporation, Redmond, USA) through multivariate statistics calculations.

In order to meet the study objectives, it was necessary to calculate the BMI based on the height and the weight reported by the interviewee. This data was subsequently compared with the perception declared by the same.

In order to meet further objectives, whereas there was a discrepancy between the actual BMI data and the perceived one, the over- or underestimation by the interviewee was then calculated. Finally, the latter two phenomena were statistically analysed to observe their distribution in the two sexes.

All answers collected in the questionnaire were processed and the results for each question were summarized in numbers (n) and percentages (%). The statistical significance of the observed data was evaluated by the Pearson's chi-square test. A p-value < 0.05 was considered statistically significant. Analyses were performed using the R software (version 3.5.2). Tables and figures were used to show the results.

RESULTS AND DISCUSSION

The total population included 422 students, of whom 156 were female (37%) and 266 were male (63%). The students were divided into three categories: 109 pupils aged 17, of whom 63 were male (58%) and the remaining female; 199 aged 18, of whom

124 (62.3%) male and the remaining female; and a third group of 19-year-olds made up of 114 students of whom 79 (69%) male and 35 (18%) female.

For this population the actual BMI was therefore investigated in order to assess the class of obesity between students. The result was that in the general population the 0.37% of males (1 male aged 18) and the 1.28% of females (2 girls, one aged 18 and the other aged 19) were actually obese.

On the contrary, males were more conspicuous regarding the overweight group: in fact, the 17.30% of males (n 46) and the 8.98% of females (n 14) belonged to this subgroup. Concerning males, the highest percentage was found in the age group of 17-year-olds (20.64% vs. 16.93% of 18-year-olds and 15.19% of 19-year-olds). As far as the overweight girls are concerned, the distribution was divided as follows: 13.04% among 17-year-olds, 8% for 18-year-olds and a lower percentage, 5.71%, in the 19-year-olds.

The difference between the two sexes was noticed to be higher especially for the underweight category, which was more significant among girls (13.46% of the total female population) rather than in boys (4.51%).

Based on these data we checked the perceived BMI trying to understand if there was an actual distortion in one's body perception.

From these results it was found that 22.56% of all male participants (60 boys) had an altered perception of their body, with a predominance of boys who saw themselves thinner (underestimation of their own BMI in 46 males) and a remaining 23.34% (14 boys) who overestimated their own weight. As for females, the absolute percentage of

altered perception of their own BMI was higher (28.20%, namely 44 girls); nevertheless only 13.64% (namely 6 girls) of them underestimated their own BMI, whereas the 86.36% (38 girls) overestimated it.

In the context of this altered perception, no boy has ever perceived being obese, while in one case of the girls group the altered perception led to the conception of obesity.

Analysing these data by dividing them in age groups, it was found that as regards the seventeen-year-olds the majority of the boys (84.14%, namely 53 boys) perceived themselves as normal weight (vs. 76.19% normal weight of actual BMI); 7.93% (5 boys) as overweight (vs. 20.64% of actual BMI) and 7.93% (5 boys) as underweight (vs. 3.17% of actual BMI). None of them had the perception of obesity, confirming the actual data that obese people were absent in this group. As far as the seventeen-year-old female subgroup is concerned, 82.61% (38 girls) perceived themselves as normal weight (vs. 73.91% of actual normal weight BMI), 15.22% (7 girls) as overweight (vs. 13.04% of actual BMI), 2.17% (1 girl) as underweight vs. an underweight BMI reality of 13.05% (6 girls).

As for the 18-year-olds, most of the boys (76.61%, namely 95 boys vs. 75.81% of actual BMI) perceived themselves as normal weight (data overlapping with the actual values), the 13.71% as overweight (17 boys) and the 9.68% (12 boys) as underweight (slightly higher data than the actual one, where the percentage of underweight respondents was 6.45%). No one had the perception of obesity even though there was one such subject in this range. As far as the 18-year-old female subgroup is concerned, 78.67% (59 girls) perceived themselves as normal weight and the data corresponded exactly to reality; 20% (15 girls) perceived

themselves as overweight, although only 8% of the interviewees were actually overweight; 1.33% (1 girl) perceived herself as underweight despite being not the only one in reality (12%, namely 9 girls).

Finally, as for the group of nineteen-year-olds, most of the boys (83.54%, namely 66 boys) perceived themselves as normal weight (data almost overlapping with the actual values, 82.28%); 7.60% as overweight (6 boys), namely half of those actually overweight; and 8.86% (7 boys) as underweight (notwithstanding the actual value being 2.53%). None had the perception of obesity and no real obese case was actually included in this subgroup. As far as the 19-year-old female variable is concerned, the 60% (21 girls) perceived themselves as normal weight regardless the percentage of girls with a truly normal BMI weight being higher (74.29%); the 28.57% (10 girls) as overweight, although only 5.71% of the interviewees were actually overweight; and 8.57% (3 girls) as underweight, despite being much more in reality (17.14%, namely 6 girls). Then one girl (2.86%), which was actually obese, had a correct perception.

Analysing these data, it emerged that for girls the perception is more altered in the underweight range - where perception is always lower than reality - and in the overweight group - where on the other hand it is always higher than reality. In fact, in 17-year-old girls with altered BMI, the 25% underestimate themselves, while the remaining 75% overestimate their own BMI. This overestimated alteration in the perception of one's BMI tends to increase in the 18-year-olds, in which the overestimation is equal to 85.72%, up to 100% as far as concerning the 19-year-olds, although the examined sample is significantly lower.

As for males, however, this data is reversed, so much so that a greater percentage of boys perceive themselves as underweight even when they are not. In 18-year-olds, for instance, with an altered perception of their own BMI, the 66.70% underestimate themselves.

Nonetheless, the total altered perception remains more significant in females.

The data obtained through the observational study, concerning the actual and perceived BMI, was statistically analysed in order to understand its statistical significance.

According to the data concerning the actual BMI distributed within the male and female population and taking into account the four variables relating to weight (underweight, normal weight, overweight, obesity), we obtain the chi-square equal to 16,025, the p-value = 0.001, 3 degrees of freedom, Cramer's V equal to 19.5% of association. Therefore, we state that the observed results are statistically significant with a $p < 0.05$.

In regards to the collected data of the perceived BMI distributed within the male and female population and taking into account the four variables relating to weight, we obtain a chi-square = 13.734, a p-value = 0.003, 3 degrees of freedom, a Cramer's V equal to 18.2% of association. We can therefore state that even in the perceived BMI there is a statistical significance of $p < 0.05$.

It shall be taken into account that, with the same BMI, women tend to have more body fat than men, and young people less than the elderly. Moreover, those who have a very developed muscle mass weigh more, not falling within the range of obese or overweight subjects.

Both sexes perceived their own body image

in an altered way, albeit with different characteristics for one and for the other. These results are similar to previous studies in the literature.

In literature females seem more inclined to mistakenly consider their body mass index and so does result also in our study, albeit Chung et al. as other previous studies have highlighted exactly the opposite.

The female tends to overestimate the weight in relation to a slimmer body shape taken as a model. Therefore, the students perceive the body weight problem probably because of the role models promoted by mass media and supported by modern society. These statements match our findings exactly.

'Positive stereotype' of thinness prevails in Western society, and this leads women to pursue such ideals because by doing so they are considered more competent and, above all, successful. This explains why some women assimilate the idea of thinness and develop a self-evaluation criterion that is excessively dependent on weight and physical fitness. From the 2015 ISTAT data it emerges that in the 18-24 age group 9.5% of the total population is underweight, also including severe thinness. In particular, it's 3.4% of the total male sample, whereas it's 15.9% concerning females.

In 2019, the percentage of underweight people in the total population decreased, reaching 8.1%. In particular, in the female sample the percentage was 12.6%, while there was a slight increase in the male sample, reaching 4%. It can be noticed a percentage increase in the male sample equal to +0.6%, while the female sample is positively surprising, registering -3.3%.

Epidemiological data suggest a link between frequent 'dieting' and the developing of an eating disorder such as anorexia or bulimia, a real red flag among adolescents. These

phenomena are closely related to some socio-cultural factors: in studies conducted before 2002 there was a disparity in the prevalence of eating disorders among the different ethnic groups in the United States. In particular, there was a higher prevalence among white women not from Latin America, whereas recent studies show instead that the prevalence has become similar in different ethnic groups.

Teenagers are more likely to be exposed to subliminal body weight messages, resulting in a worse perception of BMI. It is considered that the increase of socio-cultural factors in eating disorders has started from the ideal of thinness which has been developing over the last fifty years in Western countries.

From a study conducted on two samples of female students from Fiji in 1995 - before the introduction of satellite television - and in 1998 - 3 years after the arrival of satellite television - it emerged an increase in the frequency of self-induced vomiting from 0% to 11% and an increase in the percentage of girls with scores of at least 20 on the Eating Attitudes Test from 12.7% to 29.2%. The Eating Attitude Test (EAT-26) is the widest used test in the world to evaluate the symptoms and peculiar concerns of eating disorders. The test has been used in many studies as a screening tool in order to early identify subjects with this type of disorders.

A Chinese study showed how body weight and the perception of correct weight may be related to a socio-economic level, and similar results also emerged in USA.

Chung also observed that both women and men of all age groups, who perceived themselves as overweight, were more likely to engage in weight loss behaviours rather than healthy children, nor less than those who accurately perceived themselves as overweight.

Several studies found a prevalence of eating disorders and concerns about weight and fitness in subjects engaged in sports such as dancing and swimming. Among pre-adolescent and adolescent girls, pressures to pursue the ideal of thinness from their own family favour body dissatisfaction more than the pressure from mass media or peers. This leads to an altered perception of their bodies among girls, who are constantly confronted with a model of thinness that does not actually exist.

Wang et al. didn't find differences related to the living place (rural context or city), nonetheless it is intuitive that a sedentary lifestyle or a life without sport is a risk factor for the development of obesity.

The misperception of BMI can potentially influence children and adolescents to adopt unhealthy lifestyle, also using, for example, nicotine or alcohol. School is a crucial place for teaching the culture of health.

Obesity, just like being overweight, is an important risk factor for chronic cardiovascular diseases such as hypertension and heart attack, as well as metabolic diseases such as type 2 diabetes or hypercholesterolemia.

The onset of obesity in children and adolescents prematurely exposes children and young people to breathing difficulties, cardiovascular problems, as well as to disorders of the digestive system and of a psychological nature.

When obesity is not impacted by organic pathology such as adrenal pathology, genetic or drug pathology, weight can be controlled by prevention and therefore by adopting healthy lifestyle, correct diet and undertaking adequate physical activities.

WHO has established the 'Commission on Ending Childhood Obesity' for the

management of childhood obesity, identifying in 2016 six recommendations in order to approach and intervene more effectively in different world countries.

The most relevant action plan in Europe to prevent childhood obesity is the 'Action Plan on Childhood Obesity 2014-2020', published in February 2014. This plan establishes eight priority areas of intervention and identifies the 3 main types of decisive stakeholders to achieve objectives.

In addition, the WHO European Office has encouraged the 'Childhood Obesity Surveillance Initiative' (COSI) project, aimed at collecting data on the spread of excess weight and at making a comparison between thirty countries, including Italy, which take part in European surveillance.

In 2015, the ISTAT data show that in the youngest group taken into consideration, i.e. those aged 18 to 24, 2.3% of the total population is obese. In particular, of the entire male sample, 2.6% are obese, in comparison with 2% of the female sample.

In 2019, the percentage of obese people among the total population increased, reaching 3%. Among the male sample is 3.1%, while in the female one is 2.9%. It can be noticed the percentage increase in the female sample equal to +0.9%, compared to the male sample increasing of +0.5%.

Below a BMI of 18.49 there is underweight and severe thinness. It is important to emphasize that the types of thinness are not all the same: it can, in fact, depend on excessive sports activity and/or reduced nutrition, or on the person's body constitution. On the contrary, pathological thinness is linked to certain diseases such as infections, tumours, mental or digestive disorders and endocrine diseases.

Dissatisfaction with body image and weight

seems to be not significantly related to self-esteem for boys, while it is for girls only. Appearance perception has been a significant area of study for psychologists, due to the negative outcomes caused by a dissatisfaction perceived with the results of one's appearance. Several researches suggested association between dissatisfaction with body image and poor mental adjustment, poor welfare and depression. There is certainly a correlation with distress.

The limit of this study can be maybe found in the homogeneous population of students, all coming from schools in the same city and, consequently, with the same cultural background.

Furthermore, this study does not prospectively evaluate any changes in body perception or in BMI following food and health education. Lifestyle, family situation nor any comorbidities are taken into consideration.

Through this study we solely intended to provide a snapshot of the current situation among adolescents from a specific Italian region, in order to continue with prospective studies aimed at modifying reference models and health goals.

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