

# **BODY MASS INDEX IN RELATION TO PERSONAL CHARACTERISTICS, SOCIAL ENVIRONMENT AND INDIVIDUAL`S PERCEPTIONS IN A REPRESENTATIVE POPULATION IN ROMANIA: A CASE-STUDY**

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## **Abstract**

Aim of study. In this study I investigated Body Mass Index (BMI) and its relation to personal characteristics (gender, age, ethnicity), social environment (marital status, place of study), and individual weight and activity level perceptions in a statistically representative population of students in Romania. Material and method. The method was observational inquiry (case-study) and consisted of a questionnaire with 60 items from which I considered only 9 items (Q1.a–gender, Q1–age, Q2–marital status, Q3–nationality, Q49.a–weight, Q50–height, Q53–perception of own weight, Q54–perception of activity type and Q60–place of study) applied in 13 universities to 1364 students (39.3% male, 60.7% female, aged 19-30 years). The questionnaire application lasted 30 minutes and the students completed it individually and anonymously. Consent was asked for and the aim of the study was explained to participants. The Body Mass Index (BMI) was calculated using the Quetelet formula. Statistical work was performed using a SPSS 20 Program. Results. I found significant associations between: BMI–perception of the person’s own weight ( $\chi^2=449.95$ , Sig.=0.000;  $\gamma=0.84$ , Sig.=0.000), BMI–place of study ( $\chi^2=105.87$ , Sig.=0.000;  $\gamma=-0.15$ , Sig.=0.000), BMI–gender (Chi square– $\chi^2=111.19$ , Sig.=0.000; gamma coefficient– $\gamma=-0.56$ , Sig.=0.000) and BMI–marital status ( $\chi^2=24.28$ , Sig.=0.002;  $\gamma=0.27$ , Sig.=0.000). In conclusion a relation BMI–perception of the person’s own weight, BMI–social environment and BMI–gender is suggested.

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**Keywords:** BMI, body image, gender, marriage

## **Introduction**

Gender and age of a person relate to his/her physical development. Individuals belonging to different ethnic groups or races show differences between body dimensions (Mungreiphy et al., 2012). Marital status could create different nutritional patterns followed by different nutritional behaviors in people. Perception of body weight or activity type of the evaluated students corresponded or did not correspond with the evaluation results in different studies (Yost, Krainovich-Miller, Budin & Norman, 2010; Sand et al., 2014).

BMI (Body Mass Index) is a valuable indicator for estimating the nutritional status of students and is also useful in case-studies. The importance of anthropometry complex application was proved by epidemiological research studies on healthy individuals and patients with various diseases (Petykhov, Maev & Deriabin, 2012; Tutkuvienė, 2006).

In the second part of the twentieth century, evolution of the physical development of children in Romania was quite different from western European countries. The secular trend (maximal rate of physical development parameters achieved in the 20<sup>th</sup> century in Western Europe and US) did not manifest itself (Arbore et al., 1998; Vlaicu, Doroftei, Petrescu & Fira-Mladinescu, 2000). The transition to the post-communist period (1989-2015) was characterized by many gaps in physical development measurements.

The rationale of this study is Body Mass Index investigation in young people who have grown up during this transition period for Romania. The aim of this study was to investigate Body Mass Index (BMI) and its relation to: personal characteristics (gender, age, and ethnicity), social environment (marital status and place of study), and the perception of their own weight and level of physical activity provided by students from thirteen universities in Romania.

## **Material and method**

The material of study consisted in a statistically representative sample (1364 students, 39.3% male, 60.7% female, aged 19-30 years) selected from 13 universities (Tirgu-Mures, Bucharest, Constanța, Tulcea, Timisoara, Zalău, Cluj-Napoca, Baia Mare, Brașov, Sibiu, Iași, Pitești, Craiova) of Romania through stratified random sampling.

The method was an observational inquiry (case-study) and consisted in applying a Health Questionnaire (60 items) from which I chose 9 items (Q1-age, Q1.a-gender, Q2-marital status, Q3-nationality, Q49.a-weight, Q50-height, Q53-perception of own weight, Q54-perception of activity type and Q60-place of study). The students were given a 30-minute questionnaire

and completed it individually and anonymously. Consent was asked for and the aim of the study was explained to participants.

For each student I calculated the Body Mass Index (BMI) using the Quetelet formula:  $BMI = \text{weight (Kg)} / \text{height (m)}^2$  (Quételet, 1832).

In order to avoid low number cases (under five) I reduced the 7 intervals of BMI to 3 (1.BMI lower than 18.5; 2.BMI 18.5-25 - etalon and 3.BMI higher than 25Kg/m<sup>2</sup>). Statistical work (Chi square and gamma correlation) was performed using a SPSS 20 Program.

## Results

### BMI related to personal characteristics

In the investigated sample I noticed a BMI variation for each year of the students` age. Therefore the median (21.87) was lower than the mean (22.38) of BMI, and I observed a tendency of BMI to increase with age (from median=20.31 at 19<sup>th</sup> to median=25.08 at 30<sup>th</sup>) (figure 1).

BMI for males (median=23.66) was higher than BMI for females (median=20.56) and was also higher than the BMI of the entire sample (median=21.81) (figure 2a). The BMI of Hungarians (median=22.46) was higher than the BMI for Romanians (median=21.79) and was higher than the BMI of the entire sample (figure 2b).

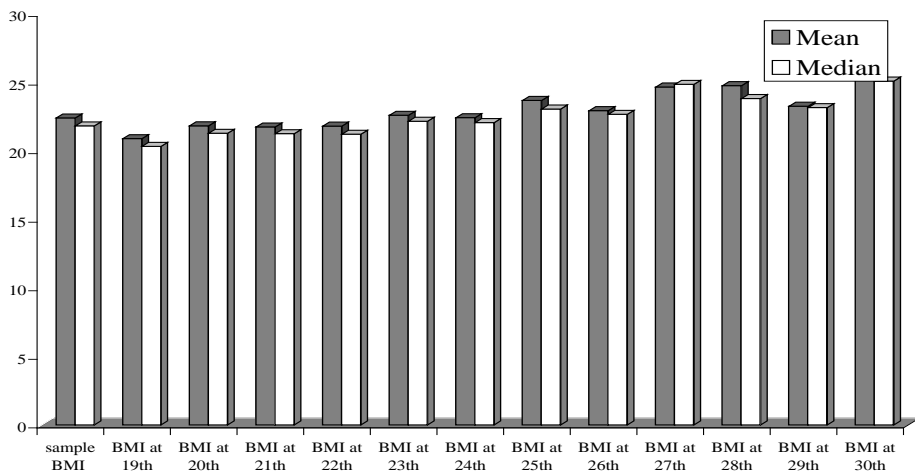


Figure 1. BMI values (mean, median) depending on age

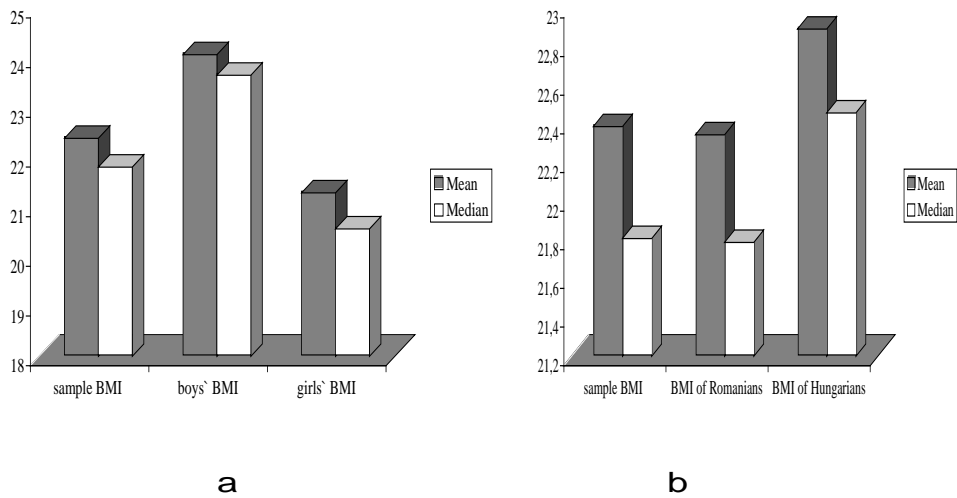


Figure 2. BMI values (mean, median) depending on gender (a) and ethnicity (b)

### BMI related to social environment

BMI of married students (median=22.98) was higher than BMI of the entire sample (median=21.81) and higher than the BMI of unmarried students (median=21.6) (figure 3). The highest values (mean and median) of BMI in terms of place of study were found in Bucharest (24 and 24.82), Tulcea (23.2 and 22.8), Zalau (24.15 and 23.41), Cluj (22.62 and 22.15) and Baia Mare (22.94 and 22.49). These values were included in the normal nutritional status interval of BMI (18.5–25) (figure 4).

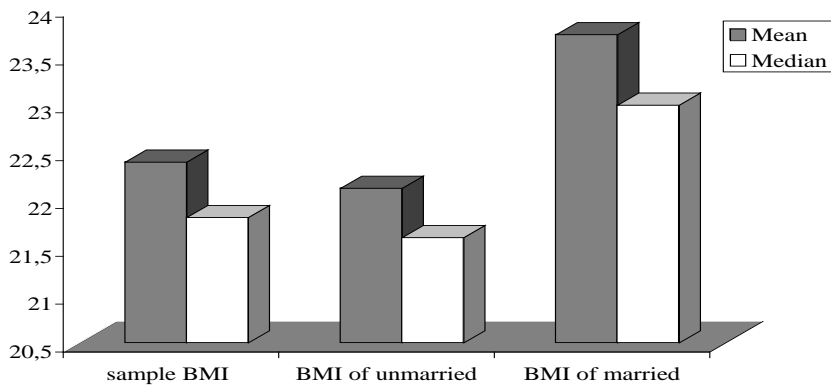


Figure 3. BMI values (mean, median) depending on marital status

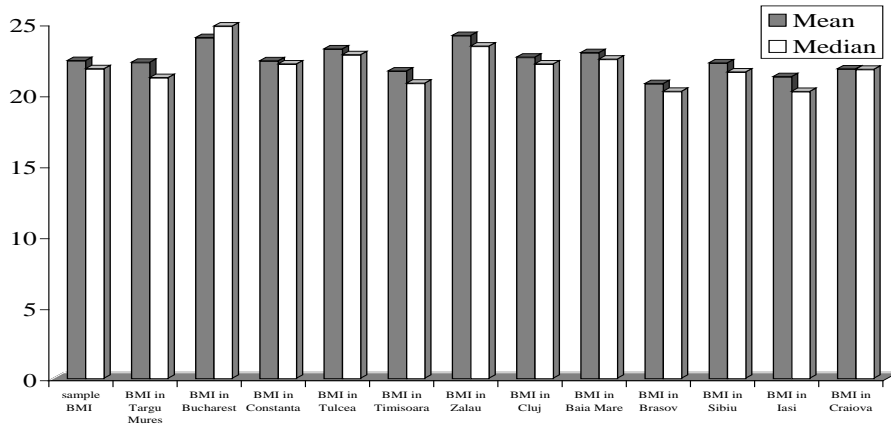


Figure 4. BMI values (mean, median) depending on place of study

### BMI related to the students' own weight perception and activity levels

In this study I found that the students' perception of their own weight in relation to their BMI was correct (figure 5a). Therefore, BMI (median=18.5) of the students who perceived themselves as underweight was at the lower limit of the normal BMI interval (18.5-25), BMI (median=21.6) of the students who perceived themselves as having normal weight was included in the normal BMI interval and BMI (median=25.71) of the students who perceived themselves as overweight surpassed the upper limit of the normal BMI interval.

BMI of those who considered themselves sedentary (median=22.49) is higher than the BMI of the entire sample (median=21.81), the BMI of active students (median=21.79) and the BMI of extremely active students (median=21.52) (Figure 5b).

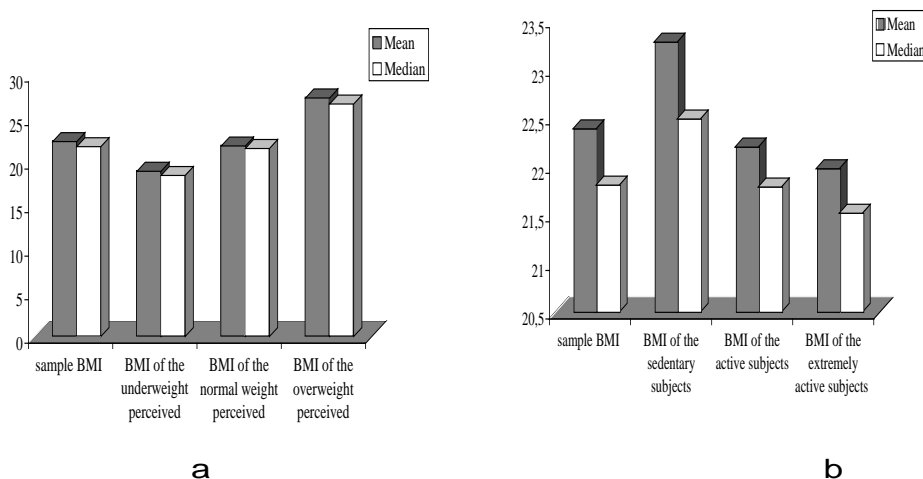


Figure 5. BMI values (mean, median) depending on students' perception of the own weight (a) and activity type (b)

In this study I found a statistically significant difference between BMI depending on age, BMI depending on marital status and the students' perception of their own weight (table 1) and positive gamma correlations BMI-age, BMI-marital status and BMI-students' perception of their own weight (table 2). I also found in this study a significant statistical difference of BMI depending on gender, place of study and level of activity and no statistical significant difference of BMI depending on ethnicity (table 1).

Table 1. Chi square test BMI – age, marital status, own weight perception, place of study, gender, type of activity, ethnicity

	X <sup>2</sup> value	df	Asymp. Sig. (2-sided)
Marital status * BMI	24.28(a)	4	0.000
Own weight perception * BMI	449.95(a)	4	0.000
Place of study * BMI	105.87(a)	24	0.000
Gender * BMI	111.19(a)	2	0.000
Type of activity * BMI	12.18(a)	4	0.016
Ethnicity * BMI	2.35(a)	8	0.968

a 0 cells (0%) have expected count less than 5. The minimum expected counts are 9.41, 11.82, 8.72; 60.01 and 18.96 respectively.

Table 2. Gamma correlations BMI with age, marital status, own weight perception, place of study, gender, type of activity, ethnicity

	γ values	Asymp. Std. Error(a)	Approx. T(b)	Approx. Sig.
Marital status * BMI	0.271	0.062	4.092	0.000
Own weight perception * BMI	0.848	0.021	14.904	0.000
Place of study * BMI	-0.156	0.034	-4.48	0.000
Gender * BMI	-0.566	0.042	-11.18	0.000
Type of activity * BMI	-0.127	0.052	-2.40	0.016
Ethnicity * BMI	0.106	0.109	0.95	0.341

<sup>a</sup>Not assuming the null hypothesis;

<sup>b</sup>Using the asymptotic standard error assuming the null hypothesis.

I found no significant statistical difference in the students's BMI in terms of their age. Negative gamma correlations resulted between BMI-gender, BMI-place of study, BMI-level of activity and no correlation was found between BMI-ethnicity of students (table 2).

## Discussions

Healthy students investigated in the 13 universities of Romania were born and have grown up during the transition period (1989-2014). Body mass index is an appropriate screening test to identify young people who should have further evaluation and follow-up for being overweight, obese, or malnourished (Freedman et al., 2009). BMI needs to be completed by a free fat mass and fat mass estimation (especially for gender and ethnic differences) for a better estimation of these differences (Nightingale et al.,

2013). Although the BMI is an imperfect tool, it is the most commonly used measure for assessing nutritional status in adults (Must & Anderson, 2006). In the performed study the calculated BMI (mean, median) of the investigated students is included in normal values interval (18.5-25 Kg/m<sup>2</sup>) and it suggests a normal physical development.

There is a tendency to create a supportive environment to combat obesity and to improve services with a role in modifying BMI (Ashrafiyan et al., 2014). Special programs of prevention and intervention (after-school or summer programs) influence diet and physical activity behavior and offer benefits for youth (Robinson, Webster, Whitt-Glover & Ceaser, 2014). It is interesting that the synthesis of school-based physical activity and nutritional education interventions showed no statistically significant mean reduction in children's and adolescents' body mass index (Guerra, Nobre, da Silveira & Taddei, 2014). On the other hand it is not necessary for obese individuals to attain a BMI of less than 25 to achieve a health benefit and a weight loss of 5% to 10% is the usual goal (Kushner & Ryan, 2014).

I analyzed BMI depending on students' personal characteristics (gender, age and ethnicity), I found similarities and differences in comparison with present research. For example, in this study a negative gamma correlation BMI–gender and a statistically significant difference between BMI values (mean, median) of male and female students were registered. In another study a similar significant difference in BMI was seen between women and men, suggesting gender differences (Kukreti & Bisht, 2013). Women proved to be less realistic than men regarding their weight appraisals (Morgenstern, Isensee & Hanewinkel, 2010). BMI (mean and median) increased with age and no statistical relevance BMI–age was found in this study. I did not find significant statistical differences between BMI of Romanian and of Hungarian ethnics and no correlation BMI–ethnicity resulted. In other studies different results regarding ethnicity were found, for example subjects belonging to three ethnic groups from India showed marked differences in different body dimension (Mungreiphy et al., 2012). The strong influence of social and economical factors on the nutritional indicators was seen in Georgia, with large variation depending on age, gender and ethnicity (Kharabadze, Khetsuriani, Betaneli, Mekokishvili & Chkuaseli , 2012).

In this study we found a statistically significant difference between the BMI values of married students and the BMI values of unmarried students and a positive correlation BMI–marital status resulted. Similarly, other studies showed that marital status and marital transitions, important features of the social environment, influence weight change over time and BMI change. Therefore, adverse social relationships can contribute to weight gain and BMI increase (Kouvonen et al, 2011). In Greek adults, marital

status was significantly associated with obesity and abdominal obesity status in both genders (Tzotzas et al., 2010).

This study showed real differences in BMI in terms of where the students learned and the place of study (another feature of social environment) correlated negatively with BMI. Therefore, BMI values were high in Bucharest, Tulcea, Baia Mare, Zalau, and Cluj areas, places where a dietary pattern with foods rich in fats and sweets is well known. To the contrary, it was demonstrated that young adults in Northern Finland, who live far away from local centers or in the most sparsely populated areas, are fatter than those who live close to local centers or in densely populated areas. This result was explained by variations in everyday physical activity in different residential environments (Näyhä et al., 2013).

A correct weight perception of underweight and overweight or obese students was found in this study as well as a tendency to include upper and lower limits of the normal BMI interval. In an American study correct weight perception was seen as useful in influencing weight-loss efforts in U.S. female adolescents (Yost, Krainovich-Miller, Budin & Norman, 2010). Gender differences were found in weight perception (Wang Liang & Chen, 2009) and inaccurate weight perception was associated with extreme weight management practices in high school students (Ibrahim, El-Kamary, Bailey & St George, 2014).

In this study I found a statistically significant association between the physical activity level reported by students and their BMI. A negative gamma correlation BMI - physical activity (from sedentary to extremely active) reported by students was found. Similarly, high moderate-to-vigorous physical activity time was associated with low body fat mass in both boys and girls and men and women (Kwon, Burns, Levy & Janz, 2013). Sedentary time could also be associated with PC activity and cellular phone excess usage. In both men and women, there was a relationship between self-assessed “good” physical fitness and high physical exercise, seen in a research study from southern Germany. Yet, in the study from Germany a large proportion of the study population was not physically active; the specific overweight subjects risk group was even less active (Rupps et al., 2012). The body fatness inheritability indicated in another study a smaller contribution of genetic factors and this result highlighted the importance of environmental factors in the etiology of weight gain and the obesity epidemic (Elder et al., 2012).

## **Conclusion**

Personal characteristics, social environment and the perception of their own weight and physical activity were all factors that were shown to be significant in terms of the students' BMI levels. Personal weight perception



and marital status related positively and statistically significantly with BMI. BMI values were higher in students who perceived themselves as overweight and in married students than they were in students who perceived themselves as underweight and unmarried students.

Gender, place of study and the students` own perception of physical activity related negatively and statistically significant with BMI. BMI levels were shown to be greater in boys, in localities with high density (Bucharest) and localities with a fatty and sweet diet pattern (Zalau, Cluj, Baia Mare) and in students who perceived themselves as sedentary than they were in girls, in the other localities of study and in the students who perceived themselves as extremely active. No statistically significant difference in BMI levels in terms of age and ethnicity was found in this study relation. A limit of this study is that it is a qualitative one and the relation between certain personal characteristics, social environment, and the personal perception of the students, regarding weight and physical activity to BMI, is only suggested.

Practitioners should pay attention to BMI in relation to: weight perception, gender and marital status in young adult populations (aged 19-30 years) with similar risky alimentary habits in order to prevent excessive weight gain and obesity.

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### **Ethical standards**

According to opinion no.285/ 05.08.2013 issued by the Ethics Committee of the Institute of Anthropology “Francisc I Rainer” research meets ethical standards stipulated by Act No.206/2004, as amended by Ordinance 28/2011 on good practice in scientific research and technological development and innovation.

**Declaration of interests:** None to declare.

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