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Self-Reported Anthropometrics: An Adequate Evaluation?

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Abstract

The aim of the study was to assess the accuracy of self-reported weight, heightand body mass index in a sample of a Romanian population. A questionnaire containing itemss about socio-demographical data, weight and height was administered to 251 participants and after the respondents were weighed and measured. Significant correlations between self-reported and measured weight ($r = .994$; $p < .001$), height ($r = .990$, $p < .001$) and body mass index BMI ($r = .991$, $p < .001$) were noticed. Mean self-reported weight was lower than the measured one with 0.71 kg, while self-reported height was greater with 0.1 cm, so that self-reported BMI was on average significantly lower than those determined by weighing with 0.20 kg/m2. Weight was under-reported by 20.3% of participants and over-reported by 4.1% of people. A high agreement was noticed between self-reported and measured BMI categories (κ Cohen 0,880, $p < .001$). Self-report measures may be a useful tool for estimating the prevalence of overweight and obesity, especially when their measurment is not feasable.

Keywords: *Self-Reported Weight; Self Reported BMI; Anthropometrics*

Introduction

Self-reported weight and height are not a new area of research, but the debate on this issue continues with intensity today. Self-reported anthropometric measurements and calculation of derived indices are an easy assessment of nutritional status, especially in epidemiological studies, where there aren't retrospective records of these parameters. In addition, there are many epidemiological studies that used self-reported anthropometric parameters. One of the oldest population-based studies conducted in the United States is the National Health Interview Surveys, in which self-reported weight was used to assess nutritional status of various age, social or economic groups. One of the questions of this study was: "About how much do you weigh without shoes?".

However, there are still criticisms of this method, so it is sometimes frowned upon and regarded with skepticism. In many studies, it has been observed a highly significant correlation between self-reported and measured weight, with common values of the correlation coefficients are above 0.9 [1].

Analysis of data from the National Health and Nutrition Examination Survey registered during 1976-1980 has generally concluded that anthropometric data are usually correctly reported and the errors aren't significant. However, separate analysis of data by subgroups of age, socio-economic, gender or body mass index (BMI), revealed the existence of some self-reporting errors which are significant [2]. Other studies have shown that most adults tend to underestimate their weight and overestimate height [3], especially overweight people [4]. It was observed that the presence or absence of errors caused by the use of self-reported anthropometric parameters and their extent varied in relation to geographical regions or by country [4]. This statement and controversies in the literature motivated a study to assess the accuracy of self-reported weight, heightand body mass index in a sample of our population.

Materials and Methods

During October to December 2015, a group of 4 students invited a total of 300 adults randomly chosen to answer a questionnaire on weight and height. A total of 20 people have refused to complete the questionnaire and 40 people could not answer the questions on weight ("How much do you weigh casually dressed and without shoes"?) and / or height ("What is your height without shoes"?). The questionnaire contained questions about the area of residence, age, income, occupation, formal education level, presence of hypertension or diabetes, use of recent diet and frequency of weighing.

Once the participants have answered the questionnaire, we asked them permission to be weighed or measured. Participants were not informed initially regarding the measurement of height and weight in order not to influence their responses to the questionnaire.

The determination of height was performed by stadiometer, which consisted in a vertical bar attached to a straight horizontal ruler divided in millimeters, which could be put into contact with the top head region. The measured person was barefoot and casually dressed. The height was determined standing on a hard-flat surface with stitched heels, so the weight was distributed evenly on the lower limbs. The head was positioned in a horizontal plane as described by Frankfort.

Weight was measured with a platform provided with a weight scale. The individuals were casually dressed and sat in the center of the platform, so that the body weight was evenly distributed on both feet. The weight was recorded with an accuracy of 100 grams [5].

Based on measurements and self-reported data, we determined measured and respectively self-reported body mass index. To assess the nutritional status, World Health Organization classification was used: underweight (BMI < 18.5 kg/m^2), normal weight (BMI 18.5 - 24.9 kg/m^2), overweight (BMI 25 - 29.9 kg/m^2) and obese (BMI > 30 kg/m^2).

The data were included in a database using Microsoft Office Excel 2007. For statistical analysis we used SPSS programme (Statistical Package for Social Sciences) version 13.0 for Windows (Chicago, IL, USA). The Kolmogorov test was used to evaluate the normal distribution of the analyzed data. To assess the association between variables Spearman correlation coefficients were determined. Wilcoxon test (the distribution of the data wasn't normal) was used to calculate if there were significant differences between the values of repeated measurements. Chi-square test was used in order to evaluate the significant difference between two or more samples formed from the frequency data.

Bland Altman plot for self-reported and measured weight (in kilograms) and BMI was determined. Middle line represents the mean difference between measured and self-reported anthropometrics. Lines above and below represent 95% limits of agreements (LOA), where upper LOA is +1.96 SD and lower line is −1.96 SD from overall mean differences.

Cohen's kappa was calculated to provide the level ofagreement between self-reported and measured classification of BMI categories. The degree of agreement between measured and self-reported BMI categories was assessed as follows: $\kappa < 0$ is none/poor; $0 \leq \kappa \leq 0.20$ is slight; $0.21 \leq \kappa \leq 0.40$ is fair; $0.41 \leq \kappa \leq 0.60$ is moderate; $0.61 \leq \kappa \leq 0.80$ is substantial; and $0.81 \leq \kappa \leq 1.0$ is almost perfect.

Results

In the studied sample, 63.9% of participants lived in the urban area. Mean age was 35.66 years old (95%CI: 34.16 - 37.15) and most people (46.5%) were between 35and 59 years old (Table 1).

Significant correlations between self-reported and measured weight ($r = .994$; $p < .001$), height ($r = .990$, $p < .001$) and BMI ($r = .991$, $p < .001$) were noticed (Figure 1). The same powerful significant relations between self-reported and measured anthropometric indices were observed when they were analysed in relation with age categories, gender, area of residence, formal education or BMI.

		No.	%
Sex	**male**	**83**	**34,4**
Area of residence	**urban**	**154**	**63,9**
Age (y.o.)	< 25	67	27,8
	25 - 35	57	23,7
	35 - 59	112	46,5
	≥ 60	5	2,1
Formal education (grades)	<9	17	7,1
	9 - 12	155	64,3
	> 12	69	28,6
Diet	yes	41	17,0
High blood pressure	yes	50	20,7
Diabetes mellitus	yes	36	14,9
BMI (kg/m^2)	< 25	93	38,3
	25 - 29,99	78	32,5
	≥ 30	70	29,2

Table 1: *Socio-demographical characteristics.*

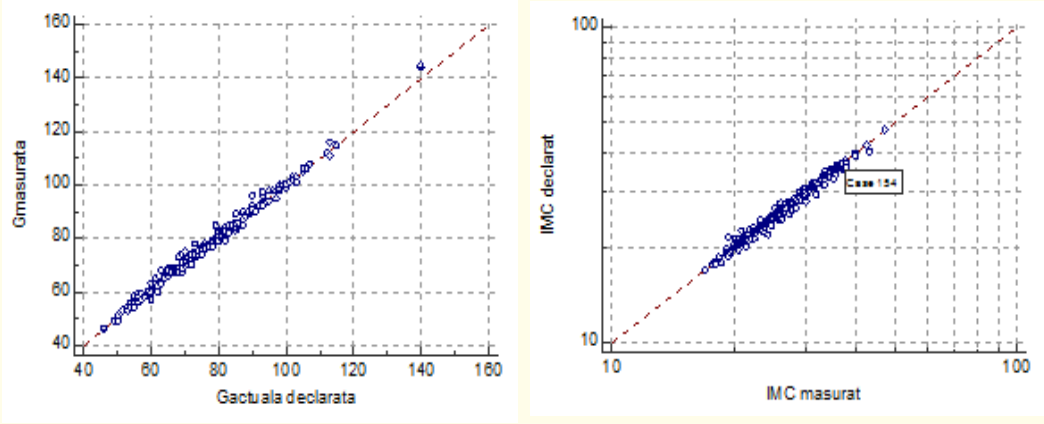

Figure 1: *The correlation between self reported and measured weight and BMI.*

Mean self-reported weight was lower than the measured one with 0.71 kg, while self-reported height was greater with 0.1 cm, so that self-reported BMI was on average significantly lower than those determined by weighing with 0.20 kg/m^2 (Table 2).

	Measured	Self-reported	p-value*	r#	Measured	Self-reported	p-value*	r#
Total sample								
Body weight (kg)	78.26	77.54	.000	.996				
Body Height (cm)	169.6	169.5	.000	.989				
BMI (kg/m^2)	27.25	27.05	.000	.993				
Male					**Female**			
Body weight (kg)	83.41	82.59	.000	.995	75.55	74.89	.000	.995
Body Height (cm)	177.6	177.25	**.054**	.979	165.53	165.44	.296	.984
BMI (kg/m^2)	26.49	26.31	.013	.990	27.65	27.44	.000	.993
Age <35					**Age >35**			
Body weight (kg)	71.85	71.02	.000	.994	85.05	84.46	.000	.995
Body Height (cm)	171.71	171.40	.016	.989	167.55	167.50	**.701**	.989
BMI (kg/m^2)	24.31	24.12	.002	.987	30.37	30.15	.001	.991
Formal education	**≤12 schooling years**				**>12 class schooling years**			
Body weight (kg)	79.97	79.95	.000	.995	73.98	73.32	.000	.996
Body Height (cm)	168.61	168.34	.000	.988	172.39	172.36	.000	.991
BMI (kg/m^2)	28.25	28.05	.000	.993	24.78	24.54	.000	.988
Environment	**Urban**				**rural**			
Body weight (kg)	78.71	78.07	.000	.997	77.61	76.45	.000	.994
Body Height (cm)	169.89	169.72	**.140**	.988	169.32	169.11	.000	.991
BMI (kg/m^2)	27.42	27.32	.001	.994	26.96	26.42	.001	.990
Diet	**Yes**				**No**			
Body weight (kg)	89.07	88.39	.030	.991	76.04	75.32	.000	.996
Body Height (cm)	168.26	168.12	.000	.978	169.98	169.79	.000	.991
BMI (kg/m^2)	31.60	31.60	**.054**	.988	26.36	26.16	.000	.992
High blood pressure	**Yes**				**No**			
Body weight (kg)	89.31	88.8	**.312**	.996	75.38	74.61	.009	.995
Body Height (cm)	168.58	168.62	.009	.993	168.59	168.71	.000	.998
BMI (kg/m^2)	32.31	32.07	.013	.991	25.93	25.73	.000	.991
Diabetes mellitus	**Yes**				**No**			
Body weight (kg)	91.18	90.66	.079	.991	75.99	75.24	.000	.996
Body Height (cm)	167.99	168.06	.688	.978	169.13	169.08	.066	.991
BMI (kg/m^2)	32.44	32.32	.357	.988	26.33	26.12	.000	.992

Table 2: *Differences between measured and self-reported antropometric indices.*

**Wilcoxon Signed Ranks test*

#Spearman correlation; p < .001

Weight was frequently under-reported by men, thus determining the under-reporting of BMI. In women, a tendency to under-report the weight was observed, so the declared weight was significantly lower than that resulting from weighing (74.89 vs. 75.55 kg).

The median age in the analyzed sample was 35 years. The trend of under-reporting of weight was observed in relation to age group. In people under the age of 35, measured mean weight was 71.02 kg, and the self-reported one was 71.85 kg, resulting in a significantly lower value of self-reported BMI. A similar situation was observed in people over 35 years whom the only difference was the height. In this age category, there wasn't a significant difference between the self-reported and measured height (Table 2).

Although in general there was a good correlation between the measured and self-reported data in both hypertensive and normotensive persons, the mean values of anthropometric measurements were significantly different, except for weight in the case of hypertensive participants (p = .312). When analyzed in relation to the presence of diabetes mellitus (DM), it was observed that in general there was a good correlation of self-reported data. The measured values were significantly different from those declared only in the case of non-diabetic participants. In people with diabetes anthropometric data were correctly reported: weight (p = .79), height (p = .688), BMI (p = .357) (Table 2).

Average measured values were significantly different from those declared in all BMI categories. There was noticed the presence of weight over-reporting in the case of the overweight and obese participants. Under-reporting was observed in the case of normal-weight people. The mean self-reported BMI significantly differed from that measured in all BMI categories (Table 3).

BMI category			p*	r#
Normal weight	Declared - Measured Height	171.76 - 171.36	.000	.992
	Declared - Measured Weight	64.41 - 65.01	.000	.983
	Declared - Measured BMI	21.83 - 21.95	.015	.956
Overweight	Declared - Measured Height	171.33 - 171.11	.000	.983
	Declared - Measured Weight	79.12 - 78.89	.000	.991
	Declared - Measured BMI	26.98 - 27.18	.004	.920
Obesity	Declared - Measured Height	165.14 - 165.25	.000	.992
	Declared - Measured Weight	93.12 - 93.94	.000	.993
	Declared - Measured BMI	34.00 - 34.34	.001	.972

Table 3: *Differences between measured and self - reported antropometric indices and the BMI category.*

**Wilcoxon Signed Ranks test*

#Spearman correlation; p < .001

Figure 2 shows the extent of misreporting of body weight and BMI. It can be observed that there were individual differences in the accuracy of self-reported anthropometrics. The difference between measured and self-reported values of BMI ranged from – 1.1 kg/m^2 (over-reporting) to 1.5 kg/m^2 (under-reporting).

To determine the accuracy of anthropometric measurements, the difference between measured and declared height and weight was calculated. Height was underestimated by about 0.18 cm and weight with 0.71 kg. Under-reporting was considered if the difference for weight was higher than 2 kg, and respectively greater than 2 cm for height. Over-reporting was defined if the difference was lower than -2 kg for weight and respectively, -2 cm for height (Table 4).

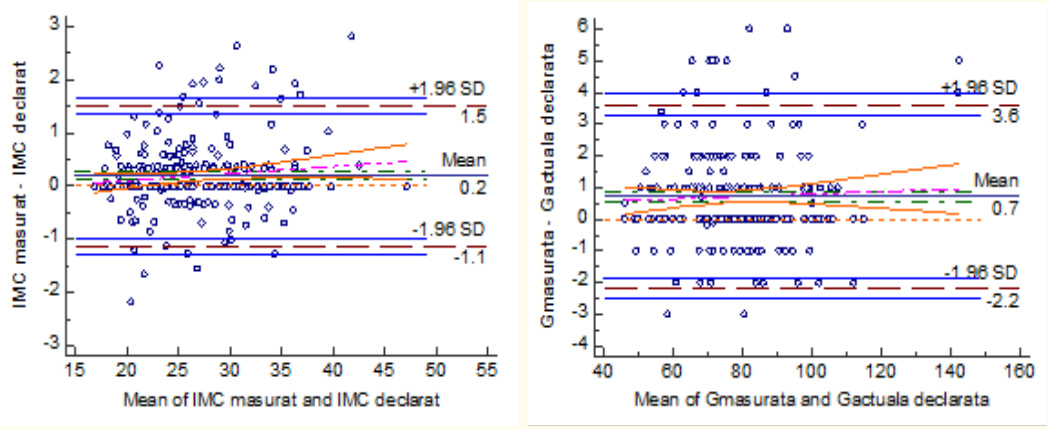

Figure 2: *Bland Altman plot for self-reported and measured weight (in kilograms) and BMI.*

		Under-reporting		Accurate reporting		Over-reporting		p
Weight		No.	%	No.	%	No.	%	
Gender	Male	20	24.1	60	72.3	3	3.6	.564
	Female	29	18.4	122	77.2	7	4.4	
Area of residence	Urban	30	19.5	120	77.9	4	2.6	.228
	Rural	19	21.8	62	71.3	6	6.9	
HBP	Yes	7	14.0	41	82.0	2	4	.741
	no	42	22.1	140	73.7	8	4.2	
DM	Yes	7	19.4	25	69.4	4	11.1	.076
	no	42	20.5	157	76.6	6	2.9	
Diet	Yes	8	19.5	30	73.2	3	7.3	.536
	no	41	20.5	152	76	7	3.5	
Age (yo)	<35	29	23.4	90	72.6	5	4	.479
	≥35	20	17.1	92	78.6	5	4.3	
BMI	Normal weight	16	17.4	73	79.3	3	3.3	.804
	Overweight	18	23.1	57	73.1	3	3.8	
	Obese	15	21.4	51	72.9	4	5.7	
Education (grades)	≤12	39	22.7	125	72.7	8	4.7	.269
	>12	10	14.5	57	82.6	2	2.9	
Height		No.	%	No.	%	No.	%	
Gender	Male	6	7.2	75	90.4	2	2.4	.596
	Female	8	5.1	143	90.5	7	4.4	
Area of residence	Urban	10	6.5	137	89	7	4.5	.549
	Rural	4	5.8	81	90.5	2	3.7	
HBP	Yes	1	2	46	92	3	6	.631
	no	13	6.8	171	90	6	3.2	

DM	Yes	1	2.8	35	97.2	0	0	.292
	no	13	6.3	183	89.3	9	4.4	
Diet	Yes	1	2.4	39	95.1	1	2.4	.520
	no	13	6.5	179	89.5	8	4	
Age (yo)	<35	12	9.7	107	86.3	5	4	.028
	≥35	2	1.7	111	94.9	4	3.4	
BMI	Normal weight	8	8.7	80	87	4	4.3	
	Overweight	4	5.1	73	93.6	1	1.3	.318
	Obese	2	2.9	64	91.4	4	5.7	
Education (grades)	≤12	11	6.4	157	91.3	4	2.3	.166
	>12	3	4.3	61	88.4	5	7.2	

Table 4: *Prevalence of under and over-reporting height and weight.*

Weight was under-reported by 20.3% of people and over-reported by 4.1% of participants. In 75.7% of the sample studied their weight did not differ by more than 2 kg than the measured one. Only 3.3% of individuals reported a lower weight with more than 5 kg compared to the measured one, while none declared to be heavier than 3 kg compared with the real weight. The height was under-reported by 3.7% of participants, accurate declared by 90.5% of individuals and over-reported by 5.8% of participants (Table 4).

No significant differences were observed regarding the frequency of under / over-reporting in relation to gender, level of education, area of origin, diet, presence of hypertension or diabetes. The only exception was the fact that people younger than 35 had more frequently under-reported their height. Regarding BMI, there was a tendency for under-reporting in people with excess weight, but it was not statistically significant (Table 4).

A percentage of 7.1 of participants who were considered to have normal weight were actually overweight, and 9.6% who were classified as overweight after self-reporting were actually obese. In the case of self-reported obesity, 7.4% had a BMI below 30 kg/m^2 after weighing. Kappa Cohen coefficient of 0.880 between the two classifications show a good concordance of self-reported data compared with the measured ones (Table 5).

		Measured BMI						**Kappa Cohen coefficient**	
	Normal weight		**Overweight**		**Obese**				
	N	%	N	%	N	%	.880	.000	
Self-reported BMI	Normal weight	92	92.9	7	7.1	0	0		
	Overweight	0	0	66	90.4	7	9.6		
	Obese	0	0	5	7.4	63	92.6		

Table 5: *Concordance between self-reported and measured BMI.*

Discussions

Overweight and obesity are defined as abnormal or excessive accumulation of fat, which can affect health. Obesity is a chronic, complex neuro-endocrine-metabolic disease and weight gain is considered the result of impaired energy homeostasis [6]. Obesity is a risk factor for many diseases such as diabetes, hypertension, kidney and heart disease. In 2008, 1.5 billions adults older than 20 years were overweight and 65% of the world population lived in countries where overweight and obesity kill more people than malnutrition [7].

Although the available data do not give adiposity disposition, BMI is used to acclaim the prevalence of obesity due to its easy determination. Its calculation is based on height and weight, which are parameters commonly self-reported in populational studies, due to financial and time reasons, allowing the assessment of a large number of people.

In this study we determined the feasibility and accuracy of collecting self-reported height and weight.

A lot of studies concluded that weight is commonly underestimated, while height is often overestimated [8], thus leading to underestimation of BMI [9]. These findings are similar to the results of our study. In our sample we noticed a small, but significant difference between self-reported and measured weight and height, thus conducting to a smaller value of self-reported BMI.

The discrepancies between self-reported and measured antropometric indices were found to be greater in studies that focused on certain subgroups. In our study the overestimation of weight and BMI was present in the case of overweight and obese people, while underestimation was noticed in the case of normal weight participants. Nyholm M., *et al*. (2007) [10] found that overweight or obese individuals underestimate their weight more frequent as compared to healthy or underweight individuals. Social desirability bias was considered the main explanation of weight's underreporting, especially among females and overweight/obese individuals [11].

Females are more frequent prone to overestimate their height and to underestimate their weight than men [12]. In our study both males and women reported a smaller weight and a higher height.

Some studies reported that dieters compared to non-dieters [10] and older individuals [10] had more often systematic errors. In our sample we noticed that the individuals older than 35 years reported more precisely their weight. BMI was more accurate self-reported by the dieters. Methods to limit this inaccuracy, such as a correction algorithm [13], or when feasible, advising participants ahead of time to weighand measure themselves before participating [14], would be necessary.

Despite these significant differences, we found a low proportion of people that under- or overestimate their height and weight. Approximately three quarters of males and females reported accurately their weight. Also, 90.5% of the individuals reported their height within two centimetres of the measured one. We didn't notice significant differences regarding the accuracy of self-reported anthropometrics between the subgroups. Younger people were more likely than older ones to under-report their height. This is contrary to other studies which have noticed a decreased accuracy of self-reported height with increasing age, perhaps explained by the changes in height over time [14].

In our sample, 7.1% of normal weight and 9.6% of overweight subjects would have been incorrectly classified as overweight or obese based on self-report (false positives), while 7.4% of obese people would have been reported as overweight (false negative). This highlighted a high level of agreement between self-reported and measured of BMI categories evaluation in all subgroups.

Conclusions

The present study confirms that self-reported measurments may be a useful tool to estimate the prevalence of overweight and obesity, particulary when independent evaluation is impractical.

Therefore, methods to limit their inacuracies are stil needed. Correction algorithms could be useful. Acknowledged anthropometric assessement before study participation could minimize self-reported errors.

Bibliography

1. Stunkard AJ and Albaum JM. "The accuracy of self-reported weights". *American Journal of Clinical Nutrition* 34.8 (1981): 1593-1599.

2. Rowland ML. "Self-reported weight and height". *American Journal of Clinical Nutrition* 52.6 (1990):1125-1133.

3. Spencer EA., *et al*. "Validity of self-reported height and weight in4808 EPIC-Oxford participants". *Public Health Nutrition* 5.4 (2002): 561-565.

4. Gorber SC., *et al*. "A comparison of direct vs. self-report measures for assessing height, weight and body mass index: a systematic review". *Obesity Reviews* 8.4 (2007): 307-326.

5. WHO Expert Committee on Physical Status. The Use and Interpretation of Anthropometry Physical status: the use and interpretation of anthropometry: report of WHO expert committee. Geneva, The Organisation (1995).

6. World Health Organization. „Global health risks: mortality and burden of disease attributable to selected major risks". *Geneva, World Health Organization* (2009).

7. De Bacquer D., *et al*. „Management of overweight and obese patients with coronary heart disease across Europe". *European Journal of Cardiovascular Prevention and Rehabilitation* 17.4 (2010):447-454.

8. Elgar FJ and Stewart JM. "Validity of self-report screening for overweight and obesity: Evidence from the Canadian Community Health Survey". *Canadian Journal of Public Health* 99.5 (2009): 423-427.

9. Nyholm M., *et al*. "The validity of obesity based on self-reported weight and height: Implications for population studies". *Obesity* 15.1 (2007): 197-208.

10. Larson M. "Social desirability and self-reported weight and height". *International Journal of Obesity* 24.5 (2000): 663-665.

11. Taylor AW., *et al*. "How valid are self-reported height and weight? A comparison between CATI self-report and clinic measurements using a large cohort study". *Australian and New Zealand Journal of Public Health* 30.3 (2006): 238-246.

12. Ezzati M., *et al*. "Trends in national and state-level obesity in the USA after correction for self-report bias: analysis of health surveys". *Journal of the Royal Society of Medicine* 99.5 (2006): 250-257.

13. De Vriendt T., *et al*. "Validity of Self-Reported Weight and Height of Adolescents, Its Impact on Classification into BMI-Categories and the Association with Weighing Behaviour". *International Journal of Environmental Research and Public Health* 6.10 (2009): 2696-2711.

14. Engstrom JL., *et al*. "Accuracy of self-reported height and weight in women: an integrative review of the literature". *Journal of Midwifery and Women's Health* 48.5 (2003): 338-345.

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