Comparison of Self-reported and Measured Height, Weight and BMI in Turkish University Students

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ABSTRACT

Accuracy and validity of self-reported height and weight, and body image satisfaction have not been yet evaluated particularly in young adult population in Turkey. The aim of the study was to establish the differences between self-reported and measured height and weight, and body mass index (BMI). The study was conducted on 617 university students (304 males and 313 females) aged 17–30 years from Ankara and Sivas, Turkey. Height and weight were measured and obtained by a questionnaire. From both measured and self-reported values for accuracy absolute differences were calculated. BMI was calculated from both self-reported and measured height and weight values using World Health Organization (WHO) cut-offs. The results showed that mean accuracy for the overestimated height was 1.83 cm for males (Ankara 1.59 cm and Sivas 2.05 cm), and 2.42 cm for females (Ankara 2.12 cm and Sivas 2.74 cm), and for underreported weight was 0.35 kg (Ankara 0.13 kg and Sivas 0.56 kg) and −0.95 kg (Ankara 0.33 kg and Sivas 1.07 kg), respectively for males and females. Self-reported BMI >25 was 33.9% for males (Ankara 27.6% and Sivas 39.6%), and 15.7% for females (Ankara 9.9% and Sivas 16.8%), while measured BMI >25 was 38.2% in males (Ankara 30.3% and Sivas 45.3%) and 25.9% in females (Ankara 21.7% and Sivas 35.5%). In conclusion, study group tended to overestimate height but underestimate weight, therefore the self-reported weight and height studies should evaluate them more cautiously, using direct measurements or correction equations for adjustment to obtain reliable results.

Key words: self-report, height, weight, body mass index, Turkish university students

Introduction

Anthropometric measurements like height and weight, and generated body mass index (BMI) are generally accepted as a valid measure of public health and frequently used due to being convenient and cost effective[1]. Obesity is a severe health problem and declared to be epidemic by the World Health Organization (WHO), that affects people of all socio-economic strata, both sexes, and all ages around the globe. Genetic and biological factors tend to affect obesity as well as environmental factors, and technologic, cultural and economic changes[2]. In 2016, the adult obesity rate was about 13% in the world, with more than 1.9 billion adults diagnosed to be overweight and obese[3]. In 2010 the adult obesity rate was 30.3% in Turkey[4]. It seems that obese individuals tend to underestimate their weight, whereas underweight individuals tend to overes-

timate their weight[5]. On the other hand, shorter individuals often overestimate their height[6]. Height seems to be related with positive social characteristics such as power and attractiveness[7]. Tall males seem to be perceived as more dominant and healthier[8].

Since the 1960s thinness has become culturally desirable in contrast to historically fashionable symbol of plump women[9]. Nowadays, many young women are concerned about their body shape and body weight. In this sense, body weight has become strongly related to women's perception of their body. Mass media play an important role in the changes of women's body image by promoting thinness. A number of studies show that the ideal body size is thin body due to the media effect[10, 11]. Body weight norms, comments of other people about one's

body weight, and media effect are all related to changes in body image. Media plays a negative role as thin body images can cause body dissatisfaction in women who spend too much time on mass media or social media[12, 13]. Girls may seem more influenced by media in adolescent period, while on the other hand boys desire to be more muscular because of media. Women want to be thin and men desire to be muscular[14–16].

There are different methods of gathering self-reported weight and height such as; face-to-face interviews, sending out questionnaires through the mail, telephone interviews[17] or web-based questionnaires[18]. Data determined using self-reported surveys might be controversial. There is a debate over the self-reported measures, because such data might be affected by individual's desired body image[19]. The results of the studies show that shorter and heavier individuals tend to perceive themselves as taller and thinner. Thus, BMI based on self-reported values is lower than measured BMI. It has been reported that in various studies weight was underestimated and height was overestimated[20–22]. As a result of false declaration, participants are misclassified. Therefore, self-reported height and weight data should be used cautiously, and researchers should determine the magnitude of the error within this information[23].

Studies conducted by Shiely et al.[19] in 1998, 2002 and 2007 showed that Irish adults had lower weight and higher height predictions, and no changes reported during time. Researchers suggested that individuals had lacked information about their weight and height in all surveys. Studies conducted on Australian adults showed that middle-aged women underestimated both height and weight[24]. In a study in Turkish adults from Ankara (aged 25–65 years) it was found that obese individuals tended to consider themselves as normal weight[25]. Similar results were found in adolescents. A Japanese study showed that adolescent boys perceived themselves as thin and girls to be overweight[26]. Australian adolescent boys and girls perceived themselves taller and thinner[1]. The common point reached by researchers from different countries is that different factors play a role in body perception and that individuals often perceive themselves as taller and thinner. The aim of the present study was to compare measured and self-reported height, weight, and BMI of university students in Turkey as self-reported values are used to determine the prevalence of obesity in Turkey, although the number of studies that examine the validity of this method is limited.

Material and Methods

The present study, based on voluntary participation, was conducted on university students in Ankara and Sivas throughout March-April 2016. Sivas is a province in central part of Turkey and Ankara is the capital of Turkey. The sample included 617 university students (304 males and 313 females) aged between 17–30 years (mean age 22.05±2.19). Ethical approval was provided by the Research Ethics Committee of Ankara University.

Height and weight values were obtained by a questionnaire and then the measurements were performed by anthropometric methods and taken by a trained anthropologist according to standard protocols[27]. Weight was measured to nearest 0.1 kg with a high-precision digital scale (Tanita Body Composition Analyzer BC-418) while participants were wearing light clothing and no shoes. Height was recorded to the nearest 0.1 cm with a Martin type anthropometer, in barefoot participants. Self-reported height and weight were obtained with a questionnaire asking "What is your current weight?" and "What is your height?" BMI was calculated as weight divided by height squared (kg/m^2). Self-reported and measured BMI were calculated using self-reported and measured height and weight. According to WHO cut-offs[28], students were classified as underweight (BMI < 18.5 kg/m^2), normal weight (BMI of 18.5–24.9 kg/m^2), overweight (BMI of 25.0–29.9 kg/m^2), and obese (BMI ≥ 30.0 kg/m^2) from self-reported and measured values. The data were analyzed by Statistical Package for Social Science (SPSS) version 20.0. Differences between self-reported and measured values were tested by paired sample t-test and agreement between self-reported and measured height, weight and BMI was assessed using Bland-Altman plots.

Results

Table 1 presents the measured and self-reported height, weight and BMI values by sex and city. There were significant differences between self-reported and measured height for both sexes (p<0.05, p<0.001). The mean self-reported height was 2.13 cm higher than measured height, while the difference in height was higher among females. The difference in height among males was 1.83 cm and among females 2.42 cm. The results showed that there were significant differences between self-reported and measured weight values (p<0.05, p<0.001). Self-reported weight was 0.52 kg lower than measured weight. The difference in weight among males was 0.35 kg and among females 0.69 kg. Self-reported BMI mean values were found −0.62 kg/m^2 for males and −0.92 kg/m^2 for females.

There were significant differences in measured and self-reported height in Ankara sample, and in measured and self-reported BMI in Sivas sample. In the Sivas sample, differences of weight and height were higher for both sexes than in Ankara sample. Both males and females overestimated self-reported height and underestimated self-reported weight. There were significant differences by city and gender (p<0.05; p<0.001).

Only 10.7% (Ankara 14.4% and Sivas 7.1%) of participants reported correctly their height and 11% (Ankara 4.6% and Sivas 17.4%) of participants reported correctly their weight. About 24.6%, 43.9% and 20.7% of participants reported their weight within ±1 cm, ±2 cm and ±5cm difference of actual height respectively. 45.9%, 34.8% and 8.3% of participants reported their height within ±1 kg, ±2 kg and ±5 kg difference of actual weight, respectively (Table 2).

TABLE 1

MEASURED AND SELF-REPORTED HEIGHT, WEIGHT AND BMI DIFFERENCES

	Male			Female		
	Ankara	Sivas	Total	Ankara	Sivas	Total
			Self-reported			
Height (cm)	176.84	175.82	176.31	162.02†	159.04	160.57††
Weight (kg)	73.63	75.08	74.39**	57.57††	60.67	59.07
BMI (kg/m²)	23.53	24.29	23.93*	21.91†	23.95	22.90†
			Measured			
Height (cm)	175.25†	173.77	174.48**	164.14†	61.78	162.99††
Weight (kg)	73.76	75.64	74.74**	57.24††	59.60	58.38
BMI (kg/m²)	23.99††	25.05	24.55*	21.22†	22.78	21.98†
			Difference			
Height (cm)	1.59*	2.05*	1.83*	2.12	2.74	2.42††
Weight (kg)	-0.13	-0.56	-0.35	-0.33	-1.07	-0.69††
BMI (kg/m²)	-0.46	-0.76*	-0.62†	-0.69	-1.17	-0.92†

†$p<0.05$; ††$p<0.001$ Significant difference of sexes ; *$p<0.05$; **$p<0.001$ Significant difference of cities

TABLE 2

THE DIFFERENCES BETWEEN MEASURED AND SELF-REPORTED HEIGHT AND WEIGHT

	Total n (%)		Ankara n (%)		Sivas n (%)	
	Height (cm)	Weight (kg)	Height (cm)	Weight (kg)	Height (cm)	Weight (kg)
±1	152 (24.6)	283 (45.9)	91 (29.7)	184 (60.1)	61 (19.6)	99 (31.8)
±2	271 (43.9)	215 (34.8)	115 (37.6)	86 (28.1)	156 (50.2)	129 (41.5)
±5	128 (20.7)	51 (8.3)	56 (18.3)	22 (7.2)	72 (23.2)	29 (9.3)
Correct	66 (10.7)	68 (11.0)	44 (14.4)	14 (4.6)	22 (7.1)	54 (17.4)

TABLE 3

MEASURED BMI AND SELF-REPORTED BMI CATEGORIZATION

		Ankara n (%)	Sivas n (%)	Total n (%)
		Male		
Measured	BMI <25	101 (69.7)	87 (54.7)	188 (61.8)
	BMI >25	44 (30.3)	72 (45.3)	116 (38.2)
Self-reported	BMI <25	105 (72.4)	96 (60.4)	201 (66.1)
	BMI >25	40 (27.6)	63 (39.6)	103 (33.9)
		Female		
Measured	BMI <25	134 (83.2)	98 (64.5)	232 (74.1)
	BMI >25	27 (16.8)	54 (35.5)	81 (25.9)
Self-reported	BMI <25	145 (90.1)	119 (78.3)	264 (84.3)
	BMI >25	16 (9.9)	33 (21.7)	49 (15.7)

The Bland-Altman plots display the differences between self-reported and measured data against the mean values of self-reported and measured data by gender (Figure 1). Middle lines represent mean difference of two methods, upper and lower lines represent 95% limits of agreements are within +1.96SD and −1.96SD from mean differences, respectively. Height was between +6.94 cm and −2.67 cm, weight was +5.04 kg and −6.08 kg, BMI was +1.66 kg/m² and −3.20 kg/m². Six participants over-estimated their height for 10 cm and two participants overestimated or underestimated their weight for more than 10 kg. Most of difference values were within the range of 1.96SD. In the plots, the mean differences of weight and BMI were closer to zero than height indicating that agreements between self-reported and measured weight and BMI were higher than for height.

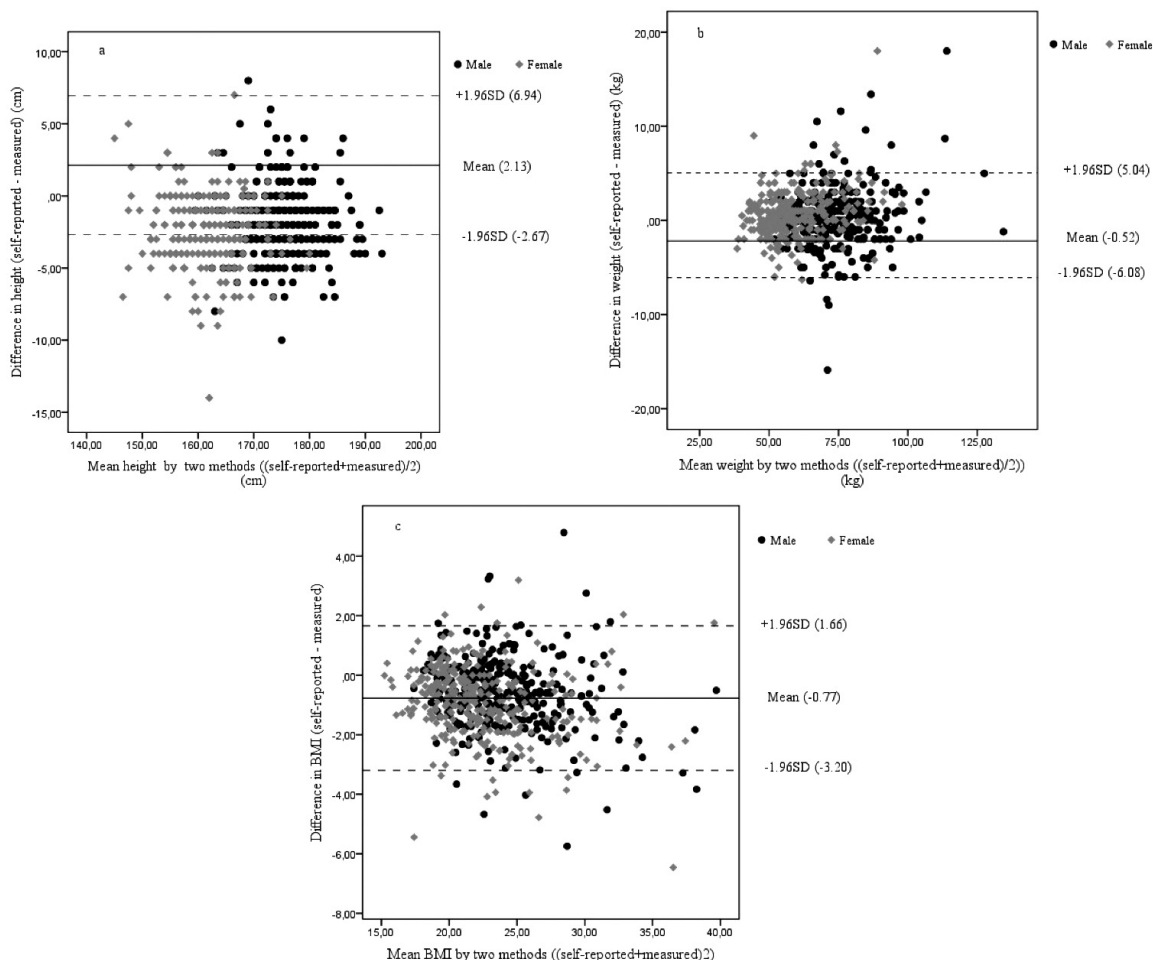Self-reported and measured BMI were calculated using self-reported and measured height and weight.

Fig. 1. Difference between measured (M) and self-reported (SR) vs. mean height (a), weight (b) and BMI (c)

Differences between self-reported and measured BMI were higher in females. Results showed that participants' self-reported BMI >25 was 33.9% in males, and 15.7% in females, while measured BMI >25 was 38.2% and 25.9%, respectively. In Ankara sample, self-reported BMI >25 was 27.6% in males, and 9.9% in females, while measured BMI >25 was 30.3% and 16.8%, respectively. In Sivas sample, self–reported BMI >25 was 39.6% in males, and 21.7% in females, while measured BMI >25 was 45.3% and 35.5%, respectively (Table 3).

About 1.5% of normal weight participants were categorized as overweight, 33.8% of overweight participants were categorized as normal weight, and 36% of obese participants were categorized as overweight according to self-reported height and weight. In Ankara sample, 5.8% of normal weight participants were categorized as overweight, 3% of overweight participants were categorized as normal weight, and 0.7% of obese participants were categorized as overweight according to self-reported height and weight. This may be related to the fact that taking body measurements in physical education classes is not continued after high school so that participants

may not know their own actual height when they finish it. In Sivas sample, 10% of normal weight participants were categorized as overweight, 3.5% of overweight participants were categorized as obese, and 0.3% of obese participants were categorized as overweight according to self-reported height and weight (Table 4).

Discussion

The present study investigated the comparison of self-reported and measured height, weight and BMI. The results showed that the self-reported and measured height difference of participants was 1.83 cm in males and 2.42 cm in females. In the Sivas sample, both sexes had higher values when compared to the Ankara sample. Consistent with other studies, our results showed that both sexes overestimated their height. This may be related to the fact that taking body measurements in physical education classes is not continued after high school so that participants may not know their own actual height when they finish it. In previous studies, similar results indicated that self-reported height was higher than measured height

TABLE 4

CROSS TABULATION OF BMI USING MEASURED AND SELF-REPORTED DATA

	Self-reported BMI	Underweight	Normal	Overweight	Obese	Total
			Measured BMI n (%)			Total
	Underweight	20 (40.8)	29 (7.2)	0	0	49 (7.9)
	Normal	0	367 (91.3)	49 (33.8)	0	416 (67.4)
Total	Overweight	0	6 (1.5)	93 (61.4)	18 (36)	117 (19)
	Obese	0	0	3 (2.1)	32 (64)	35 (5.7)
	Total	20 (3.2)	402 (67.5)	145 (23.5)	50 (8.1)	617 (100)
Ankara	Underweight	14 (4.6)	12 (3.9)	0 (0)	0 (0)	26 (8.5)
	Normal	0 (0)	206 (67.3)	18 (5.9)	0 (0)	224 (73.2)
	Overweight	0 (0)	3 (1.0)	35 (11.4)	7 (2.3)	45 (14.7)
	Obese	0 (0)	0 (0)	2 (0.7)	9 (2.9)	11 (3.6)
	Total	14 (4.6)	221 (72.2)	55 (18)	16 (5.2)	306 (100)
Sivas	Underweight	6 (1.9)	17 (5.5)	0 (0)	0 (0)	23 (7.4)
	Normal	0 (0)	161 (51.8)	31 (10.0)	0 (0)	192 (61.7)
	Overweight	0 (0)	3 (1.0)	58 (18.6)	11 (3.5)	72 (23.2)
	Obese	0 (0)	0 (0)	1 (0.3)	23 (7.4)	24 (7.7)
	Total	6 (1.9)	181 (58.2)	90 (28.9)	34 (10.9)	311 (100)

in adults[29–31, 5]. According to the findings of a previous study, being very short or being very tall is considered socially undesirable for women and being taller is more desirable than shorter stature for men[32].

The results of the present study showed that weight was underestimated in both sexes. Self-reported and measured weight differences were 0.35 kg in males and 0.69 kg in females. In the Sivas sample, both sexes had higher values when compared to the Ankara sample. As most of the Sivas sample lived in the dormitory, we assumed that their residence might have had a negative effect on nutritional status and the body weight perception. However, although there was a significant difference in values between Ankara and Sivas samples, this difference was not correlated with the type of residence (data not shown). Another study from Turkey showed that both sexes underestimated their weight like in our results[33]. Studies also showed that weight tends to be underestimated in young adults[34–36] and that self-reported weight was lower than measured weight[37–39, 21]. On the contrary, some studies found that males over-reported their weight when compared to measured weight[40, 41].

The results of the present study showed that BMI values were underestimated in both sexes. Females were more likely than males to perceive themselves as thin. According to self-reported BMI, overweight prevalence was 26.6% in males and 11.5% in females, whereas anthropometric measurements showed that overweight prevalence was 28.3% in males and 18.8% in females. It is interesting that obese individuals tend to underestimate their weight and individuals with normal weight tend to overestimate it. Consequently, BMI calculated from self-reported data was determined to be lower than measured BMI, and obese individuals were classified as non-obese[42, 43]. Some studies showed that there were sig-

nificant differences between self-reported and measured BMI values[44, 23], and some other studies found that there were no significant differences between self-reported and measured BMI values[24, 42]. A Body Weight Perception Survey in Turkey[45] found that only 18.9% of the obese individuals perceived themselves as obese. Also, two thirds of overweight individuals and three quarters of obese individuals had inaccurate perception of their body weight. In a previous study, conducted on university students from seven countries of Europe, Mikolajczyk et al.[46], reported that overweight and obesity values were most prevalent in Danish and German females (BMI was 13.3% and 8.9%), while underweight values were highly prevalent in Bulgaria and in Turkey (BMI was 30.4% and 20.8%, respectively).

A previous study demonstrated that university students had difficulty in perceiving their body shape correctly[47]. Females perceived themselves as overweight even though prevalence of obesity was low in students[46, 48]. A number of researchers consider that females would like to be thin for social acceptance so they are under huge pressure to lose weight[49, 50]. Desire to be thin could be related to social desirability as a reflection of the media promotion of thinness[51]. Idealization of thinness by mass or social media plays an important role in changes in body perception[52, 53]. Actual weight and weight perception can be affected by cultural norms, personal expectations, eating habits and mass media[46]. Other factors may include fear of not being liked by the opposite sex, fear of not finding suitable clothes for one's own body or an influence of Western culture. The increased effect of Western culture can lead to lifestyle and cultural changes that can also affect body image and perceived body weight among adolescents and young adults[54, 47]. Studies showed that individuals, including obese individuals, are likely to underestimate their weight

while short stature individuals overestimate their height[34, 1]. Self-reported data can be used instead of anthropometric measurements but their reliability is questionable for the determination of obesity, clothing sizes or ergonomic design etc. Sex, age and body perception affect the accuracy of self-reported data[55]. On the other hand in some studies, self-reported data are preferred because of their convenience, lower costs of measurement, and their high correlation with measured data[39, 5].

Strengths and Limitations

The strengths of the present study were that anthropometric measurements were performed by trained anthropologists, and self-reported data were asked from participants by a questionnaire before the anthropometric measurements were taken. However, the present study has some limitations. As it was carried out at two universities in two different cities including participants from only one faculty in each university, our sample does not reflect the general student population. In addition, due to limited time and voluntary participation in the survey, as many participants could not be reached as desired.

Conclusions

The present study was carried out in Ankara and Sivas provinces. Ankara, is a large, cosmopolitan city and the capital of Turkey. Sivas is a moderately sized city and the seat of Sivas province located in Central Anatolia, with a comparatively small population and more local sociocultural characteristics. Thus the present study compared two cities of different sizes and with different cultural features and lifestyles, which probably affected our results.

In conclusion, we found that both sexes overestimated their height and underestimated their weight. Similar to other findings in literature, the present study showed that self-reported weight was lower than measured weight. Although there was a significant difference in values between Ankara and Sivas samples, this difference was not correlated to parental education or parental working status (data not shown). According to the results, both sexes underreported their weight and overestimated their height, while the difference between self-reported and measured height tends to be greater than that for weight. Therefore, it may be concluded that self-reported height and weight studies should be taken more cautiously for the Turkish adult population due to their low accuracy and reliability. We believe that self-reported data should not be used to determine the obesity rate in our country without further studies. It is recommended to take direct measurements or to evaluate correction equations for adjustment for reliable results.

Conflicts of interest: None declared.

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USPOREDBA METODA SAMOPROCJENE I MJERENJA VISINE, TEŽINE I INDEKSA TJELESNE MASE U TURSKOJ STUDENTSKOJ POPULACIJI

SAŽETAK

Preciznost i valjanost samoprocijenjenih vrijednosti visine, težine i zadovoljstva tijelom nisu do sada dovoljno istraživani u mlađoj populaciji u Turskoj. Cilj rada je utvrditi razlike između samoprocijenjenih i izmjerenih vrijednosti visine, težine i indeksa tjelesne mase (BMI). Istraživanje je provedeno na 617 ispitanika (304 studenta i 313 studentice) u dobi između 17 i 30 godina u Ankari i Sivasu u Turskoj. Vrijednosti visine i težine su izmjerene i prikupljene upitnikom. Na temelju obje vrste podataka izračunate su vrijednosti BMI prema klasifikaciji Svjetske zdravstvene organizacije. Rezultati pokazuju višu samoprocijenjenu srednju vrijednost visine za 1,83 cm u muškaraca (Ankara 1,59 cm; Sivas 2.05 cm), i za 2,42 cm u žena (Ankara 2,12 cm; Sivas 2,74 cm) i nižu srednju vrijednost težine za 0,35 kg u muškaraca (Ankara 0,13 kg i Sivas 0,56 kg) te za 0,95 kg u žena (Ankara 0,33 kg; Sivas 1,07 kg). Samoprocijenjeni BMI >25 je utvrđen u 33,9% muškaraca (Ankara 27,6%; Sivas 39,6%) te 15,7% žena (Ankara 9,9%; Sivas 16,8%), a izmjereni BMI >25 u 38,2% muškaraca (Ankara 30,3%; Sivas 45,3%) i u 25,9% žena (Ankara 21,7%; Sivas 35,5%). Općenito uzevši, ispitanici su percipirali više vrijednosti visine i manje vrijednosti težine od onih stvarnih što ukazuje na potrebu kritičkog korištenja samoprocijenjenih podataka i oslanjanja na izravna mjerenja ili statističku prilagodbu samoprocijenjenih podataka kako bi se dobili pouzdani rezultati.