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Investigating BMI Discrepancies in Subjective and Objective Reports among College Students

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Abstract

Objective: In the United States, at least one in three adults is obese, childhood obesity is rising alarmingly, and these statistics are expected to get worse. As a public health crisis that requires action, this underscores the need to better understand the measurement of obesity and relationships between obesity and other psychosocial factors. As such, the goal of the current study was to investigate perceptual differences between subjective (one's own perception), objective (measured using biometric instruments), and ideal (one's own desired state) body mass index (BMI) estimates and to explore influential psychosocial factors (e.g., body image).

Methods: Through convenience sampling (n = 517), participants were recruited from introductory psychology courses to complete an online questionnaire in which they provided estimates of their height and weight as well as indicated levels of other psychosocial variables (e.g., body image perception, eating habits, mood). Following completion of the survey participants completed a brief objective assessment of their height and weight with researchers.

Results: Results demonstrate a general underreporting of subjective BMI compared to objective BMI estimates and a desire to conform to an ideal BMI that is much lower than objective measurements. Moreover, analyses of relationships amongst psychosocial variables revealed that body image, subjective health, and neuroticism were important explanatory variables of these discrepancies, which varied according to gender.

Conclusion: These findings suggest important perceptual differences in BMI between the genders and highlight the need for further research to explore mechanisms by which to address the obesity epidemic.

Keywords: Body Mass Index; Obesity; Subjective Health; Body Image; Neuroticism

Introduction

Throughout the United States, the prevalence of obesity has become an alarming public health issue as the number of Americans who are obese has jumped to more than one out of three adults in recent years. In fact, among adults aged 20 and older, prevalence reached 34.9% in the year 2012 and increased to 39.8% in the year 2016 [1,2]. This pattern also applies to youth, of whom 20.6% between the ages of 12 and 19 met the standards for obesity [2]. Obesity has been causally linked to a host of preventable diseases/disorders including major causes of death (e.g., cardiovascular disease, cancer; CDC, 2018), has a strong negative impact on mental health, and is a financial burden to the U.S. economy, costing an additional $1,429 for each person treated that is obese or overweight beyond those of normal weight, in the year 2008 alone [3,4]. These facts highlight an urgent need to research the spectrum of etiological factors, as well as potential solutions to this widespread and potent public health problem.

Representing an important transitional period, obesity prevalence disproportionately increases among the age group known as emerging adults, generally ages 18 to 25 [5]. For many Americans, this period is dedicated to university studies, elevating concern that college students are at risk for developing obesity and obesity-related conditions. The transition into the college lifestyle is frequently associated with a faulty perception of diet, disordered eating, and insufficient physical activity-all of which contribute to an unhealthy spike in body mass index from weight gain [6]. Body weight continues to rise until graduation, with some studies reporting as many as 70% of students demonstrating a significant increase in weight and body fat percentage [7]. Discouragingly, on average, this continued increase in weight is even more extreme than the initial jump during freshman year [8].

Although a great deal of research has been devoted to addressing obesity within adolescent and emerging adulthood populations, there remains a need in the literature to examine factors that may contribute to this rise in obesity [9-11]. As two such potential issues, obesity measurement and obesity perception remain underexplored, particularly in terms of comparison between objective, subjective, and ideal BMI. Moreover, psychosocial factors that explain any discrepancies between these could yield important insight. As such, the purposes of the current study were to (a) examine discrepancies between objective (measured using biometric instruments), subjective (one's own perception), and ideal (one's own desired state) estimates of weight, height, and BMI, including gender-specific discrepancies and (b) explore psychosocial variables related to these observed discrepancies to explain these differences.

Objective, Subjective and Ideal BMI

Obesity is defined by body mass index (BMI) where those over 25 are overweight, those over 30 are obese, and those over 40 are morbidly obese. While this metric is useful and predicts important health outcomes such as mortality, BMI calculation itself may contribute to the rise in obesity prevalence [12]. Although beyond the scope of this current investigation to review every potential issue with BMI, three main concerns include: disagreement about appropriate cutoffs, exclusion of body composition, and the frequent reliance on self-report (i.e., subjective) of height and weight [13,14]. The third concern, and primary focus of the current study, is problematic as it involves subjective self-report of height and weight, which are subject to self-report bias. Indeed, body weight often demonstrates inconsistencies between self-reported and more objective estimates, with lower BMI resulting from a general under-reporting of weight and overestimation of height in self-reports [15-17]. Furthermore, gender is a major factor as, in general, women report significantly lower estimates of weight, BMI and other body size descriptors than men [15,16,18]. Women may be motivated to under-report these body size metrics to conform, at least perceptually, to the cultural thin ideal that women should be smaller, petite, and physically resemble popular icons in media-who are often underweight. On the other hand, men overestimate their height and are more likely to overestimate their weight than women, which may represent the desire to fit in with the more masculine ideal of antifemininity, status and achievement, and aggressiveness associated with being large and muscular [19-22]. Related to perceived cultural gender norms, another explanation for these weight and height discrepancies may be social desirability bias. One's estimate of subjective weight is better predicted by social desirability than by objective weights themselves and this seems to have a stronger influence on women than men [15,23]. Moreover, age groups tend to vary in just how influential the social context (e.g., peers) is, with adolescence and emerging adulthood being particularly sensitive time periods. Therefore, with the strong influence of the dominant American cultural ideal and perceptions of others in their social networks expecting them to conform to these ideals, it seems men and women will present biases in their self-reported estimates of body metrics related to BMI. Thus, as our Hypothesis 1, we expect that men and women will both underestimate their BMI and these discrepancies would be different in magnitude between the genders.

The influence of social desirability bias and gender strongly suggest that one's idealistic view of BMI influences BMI perception, especially regarding cultural ideals. In fact, even though it is healthy to increase in BMI as an individual goes through childhood, adolescence and adulthood, nearly half of young adults who had a greater BMI at age 23 than when they were children perceived their bodies as being "fatter than ideal" [24]. This relationship is stronger among women, who are more likely to perceive themselves as overweight and even women with normal BMI often report wanting to reduce weight [25]. Depictions of ideal female beauty have changed to be even thinner in the past several decades and women report greater dissatisfaction with their bodies after viewing popular magazines regardless of the media source [26-28]. While media exerts a strong influence, BMI and body image dissatisfaction have also been linked, in both genders, to the internalization of the thin-body ideal [27,29]. In general, women want to lose weight and one reason for this is because they often perceive that this is an expectation of them held by men, other women, and society [30]. Thus, for Hypothesis 2, we expected that both male and female college students would provide their ideal BMI as lower than their objective biometrics and these discrepancies would be different in magnitude between the genders.

Psychosocial Factors Influencing Body Biometric Estimates

The literature indicates some factors that may contribute to these discrepancies in BMI estimates. Starting with cognitive factors, body image, or the way in which one views their own body, influences body perceptions. Importantly, body image perception correlates with total body weight, affect, and cognitions, suggesting that body image is central to perceptions of the self. When questioned directly about ideal measurements, women desire a more extreme thin image compared to men and express a stronger desire to achieve their ideal image [31]. Relatedly, personality traits influence these perceptions and the most prominent of these is neuroticism. In fact, neuroticism is consistently and positively related to a misperceived heavier weight, more intense dissatisfaction with one's body, and disordered eating [14,28,32,33]. These findings collectively suggest that cognitive factors (i.e., body image, neuroticism) will be related to differences between subjective, ideal, and objective body biometrics.

Social media, as a source of communication of societal ideals, serves as an important source of social comparison and may influence perceptions of biometrics, especially the more daily time spent on social media. Moreover, many health factors can influence body perceptions. Specifically, subjective overall health and well-being (including physical health complaints) have been identified as strong predictors of mortality and is often a better predictor than objective health ratings [25,34]. Additionally, positive mood is associated with better self-reported health, whereas negative mood is related to lower self-reported health, suggesting that affect is an important factor as well. In a similar vein, BMI and depressive symptoms are often related with body image perception [6,34].

Indeed, mental health can certainly influence appraisals-particularly depressive symptomology-which is consistent with a more pessimistic and negative view of oneself, including self-esteem and self-efficacy [35].

Finally, engagement in health behaviors (e.g., adequate sleep, regular physical exercise, healthy diet) is associated with a longer and higher quality life while engaging in risky health behaviors demonstrates the opposite effect. In a recent study on TV "binge watching", Spruance and colleagues (2017) identified college students as a population at-risk of this sedentary behavior that limits physical activity and encourages unhealthy eating, which impacts BMI and perceptions of one's body [36,37]. Moreover, while total duration of sleep seems to have little effect on BMI, sleep quality is important for weight management and BMI stabilization. As such, engaging in health behaviors could help achieve a healthy BMI and develop a realistic appraisal of one's own body [38,39]. As our Hypothesis 3, we predict that these psychosocial factors will be related to discrepancies between objective, subjective, and ideal estimates of BMI, weight, and height.

Therefore, the purpose of the present investigation was to examine subjective, ideal, and objective estimates of BMI (i.e., height, weight) for discrepancies among a college student population and examine psychosocial factors that explain these hypothesized discrepancies to address the rising prevalence of obesity in the United States.

Method

Participants and Procedure

Following approval by the university's ethics review board, participants (*n* = 517) were solicited from General Psychology classes across five different semesters (one course each semester) with an average of 103 students in each round of data collection. Participation in the study was connected to students' grades, though an alternate assignment was provided. Average age of the sample was 20.29 years (*SD* = 2.08), the majority of which were female (61.1%), and the ethnicity of the sample was mostly White (83.6%). The majority of the sample was single (66.0% single, 23.8% in a committed relationship/engaged to be married, 10.1% married) and in their freshman year (59.2% freshman, 27.5% sophomore, 9.9% junior, 3.1% senior) at the time of participation. Most participants were full-time students enrolled with an average of 13.50 credits (*SD* = 2.04). Participants completed an online survey (average completion time was 15 minutes) that queried subjective body metrics and psychosocial variables using the Qualtrics® (Provo, UT) survey platform where they provided consent to participate. Following which, participants visited a research lab set up to objectively measure their height and weight. Researchers verified that each participant had completed the online survey before collecting the objective biometric data. Following data collection in the lab (~5 minutes), participants were debriefed as a class when summarized results were shared. A total of 31 student participants completed the online survey and failed to complete the in-person assessment and only one woman indicated she could have been or was pregnant. These were excluded from analysis (*n* = 485).

Measures and Materials

Our self-report measures were assessed in the online survey questionnaire. First, participants were asked to provide their own subjective estimates of their current weight (in pounds) and height (in feet and inches) and identify their ideal weight and height. Whereupon researchers computed subjective and ideal BMI calculations using standard computations. Second, cognitive factors were examined including body appreciation and neuroticism. Participants' body appreciation was queried on a 7-point scale (1 = *not at all true*, 7 = *very true*) using the 13-item Body Appreciation Scale (α = .93) and neuroticism (α = .86) was measured on a 4-point scale (1 = *strongly disagree*, 4 = *strongly agree*) using the 10-item measure from the International Personality Item Pool [40,41]. Third, daily time spent on social media during the past month was assessed using a single item from Wright, *et al.* (2018) that ranged from 1 (*10 minutes or less*) to 6 (*3 hours or more*).

Overall subjective health was queried using the 1-item EuroQol Fifth Dimension (EQ5D) measure, where participants rated their own health on a Likert-type scale from 0 (*worst physical health*) to 100 (*best physical health*) [42]. Physical health symptoms were assessed using Spector and Jex's (1998) 18-item Physical Symptoms Inventory of physical ailments during the prior 30 days. Affect was examined with an 8-item measure of mood on a 5-point Likert-type scale (1 = *not at all*, 5 = *extremely*) regarding how much a certain mood descriptor described their mood over the past month along positive (i.e., happy, alert, enthusiastic, relaxed; α = .60) and negative (i.e., sad, irritable, bored, nervous; α = .65) dimensions. Acute depressive symptoms during the past week were captured using the CES-D 5-item measure (α = .78) [43-45].

Physical activity was assessed using 2 items on an 8-point Likert-type scale from 0 (*0 days*) to 7 (*7 days*) that examined how many days a person participated in hard or moderate physical activities during the past month [46]. Fruit and vegetable consumption over the past month were assessed using one item for each on a 10-point serving frequency scale, where serving sizes were specified (i.e., 1 serving = ¼ cup dried fruit, ½ cup canned, or 1 medium-size fresh fruit; and 1 serving = ½ cup canned or fresh vegetable including beans, or 1 cup of leafy greens such as lettuce or spinach) [44]. Representing an unhealthy diet, frequency of consumption of sugary snacks (e.g., cakes, cookies, and donuts), sugary drinks (e.g., soda, sport drinks) and fast food (e.g., McDonalds, Burger King) were queried on the same 10-point scale. Sleep quality was assessed by a single item asking participants to report their sleep quality on a 5-point Likert scale (1=very poor, 5=very good) during the past month. Finally, regarding our objective biometric measures, we used a standing bioelectric impedance scale (TANITA, BF-350) to estimate weight and body fat percentage and a portable stadiometer (SECA, 213) to collect objective height estimates. Following which BMI was calculated.

Statistical Analysis

We conducted a series of paired-samples t-tests for Hypotheses 1 and 2 and independent samples t-tests for the gender comparison analyses. In order to test Hypothesis 3, two difference score variables were calculated and then transformed to enable a correlational analysis between the psychosocial variables discrepancies in biometric estimates. The first difference score was produced by subtracting the subjective BMI estimates from the objective estimates of BMI, so that a negative value indicated an underestimate of BMI and a positive value meant an overestimate. A wide range was observed (-9.64 to 5.57), where some people overestimated their BMI, though most underestimated BMI. Since the difference score variable represented both under- and overestimates, a transformation was performed where the absolute value of the lowest scores (9.64) was added to each variable. We also calculated the difference between objective estimates of BMI and ideal estimates of BMI, so that a positive value indicated a desire to reduce BMI and a negative value denoted a desire to increase BMI. Similar to the first difference score, a wide range was observed (-4.75 to 24.10), where some people wanted to increase BMI, though most wanted to decrease BMI and transformation was performed where the absolute value of the lowest score (4.75) was added to each variable. These transformations enabled comparison of these variables with other continuous variables where a zero score signified no value instead of no difference or no change.

Results

Means, standard deviations, and bivariate partial correlations of study variables are presented in Table 1. We found no evidence for systematic differences between the classes in their average biometric difference scores. A total of 210 participants (43.2%) in the sample had attempted a significant weight loss (at least 10 lbs.) before and, on average, this subgroup had lost 13.07 lbs (*SD* = 13.35) with the majority losing weight within the past year (55.1%). Of those who attempted a weight loss, 162 were women (77.1%) and the average weight loss was 11.45 lbs. (*SD* = 11.64), which significantly differed from the men's average of 16.04 lbs. (*SD* = 16.04; $t[378] = 2.82$, $p = .005$). Objective average measurements revealed a relatively healthy sample with BMI in the normal range (though elevated) at 24.97 (*SD* = 5.14) and body fat percentage was 25.33% (*SD* = 9.39). On average, men (recommended <23%) were at a healthy 19.14% (*SD* = 7.78) and women (recommended <32%) were also healthy at 29.46% (*SD* = 8.39). Average subjective, ideal and objective estimates are reported in Tables 2 and 3.

Variable	*M(SD)*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17
1. Subjective/Objective BMI Difference	9.13 (1.32)	NA															
2. Ideal/Objective BMI Difference	7.54 (3.76)	-.51**	NA														
3. Body Appreciation	5.12 (1.18)	.10*	-.39**	.93													
4. Neuroticism	2.66 (.54)	-.06	.23**	-.54**	.86												
5. Social Media Time	3.55 (1.35)	-.06	.09	-.13	.10	NA											
6. Subjective Health	73.17 (16.06)	.03	-.32**	.48**	-.33**	-.12	NA										
7. Physical Symptoms	5.90 (3.46)	-.01	.10*	-.20**	.33**	.04	-.29**	NA									
8. Positive Mood	3.51 (.62)	.03	-.15**	.36**	-.55**	-.21**	.29**	-.18**	.60								
9. Negative Mood	2.81 (.78)	-.03	.11*	-.35**	.68**	.07	-.29**	.33**	-.42**	.65							
10. Depressive Symptoms	9.12 (3.40)	-.05	.10*	-.32**	.66**	.08	-.28**	.39**	-.55**	.62**	.78						
11. Physical Activity	2.99 (1.63)	-.02	-.06	.02	.02	-.02	.03	.10	-.01	.07	.03	NA					
12. Sugary Snack Cons.	.67 (.80)	.04	-.01	-.01	.07	-.10	-.05	.07	-.01	.11**	.07	-.02	NA				
13. Sugary Drink Cons.	.44 (.69)	-.10*	.12**	-.05	.05	.00	-.06	.00	.00	.03	.06	.03	.31**	NA			
14. Fast Food Cons.	.20 (.34)	-.14**	.14**	-.06	.06	.21**	-.04	-.03	-.01	.04	.09*	-.03	.27**	.45**	NA		
15. Fruit Cons.	.89 (.86)	.03	-.11*	.00	.02	.00	.10*	-.08	.03	.02	.03	.02	.04	.01	-.08	NA	
16. Vegetables Cons.	.89 (.95)	-.03	.03	.01	-.02	.02	.07	-.03	.06	-.03	-.01	.07	-.02	.03	-.04	.70**	NA
17. Sleep Quality	3.73 (.76)	.11*	-.13*	.25**	-.33**	-.10	.21**	-.28**	.32**	-.28**	-.43**	-.05	-.03	-.10*	-.15**	-.05	-.03

Note: * $p < .05$, ** $p < .01$; Internal consistency estimates, where appropriate, are listed on the diagonal. Difference scores presented here are the transformed variables. Body appreciation was on a 7-point scale (1 = *not at all true*, 7 = *very true*); Neuroticism was on a 4-point scale (1 = *strongly disagree*, 4 = *strongly agree*); Social Media Time was on a 6-point Likert scale (1=10 minutes or less, 2=10-30 minutes, 3=31-60 minutes, 4=1-2 hours, 5=2-3 hours, 6=3 hours or more) of time spent per day; Subjective Health was on a scale of 0-100; Physical symptoms and depressive symptoms were both sum scores; Positive and Negative mood were on a 5-point scale (1 = *not at all*, 5 = *extremely*); Physical Activity is in number of days per week; Sugary Snacks, Sugary Drinks, Fast Food, Fruit and Vegetable Consumption are reported as servings per day; and Sleep Quality is on a 5-point Likert scale

Table 1: Descriptive Statistics of Study Variables with Biometric Difference Scores

Outcome	Subjective (*SD*)	Objective (*SD*)	*Δ (SD)*	*t(df)*	*Δd*
Entire Sample Comparisons					
BMI	24.58 (4.87)	25.09 (5.29)	-.51 (1.32)	8.39(477)***	.41
Weight	159.25 (37.64)	160.72 (39.21)	-1.47 (6.89)	4.67(477)***	.22
Height	67.30 (3.81)	66.76 (3.52)	.54 (.81)	14.52(484)***	.70
Men Only Comparisons					
BMI	25.14 (4.69)	25.85 (5.12)	-.71 (1.31)	7.44(184)***	.57
Weight	179.18 (36.93)	180.37 (38.89)	-1.18 (7.26)	2.21(184)*	.17
Height	70.71 (2.84)	69.79 (2.81)	.93 (.79)	15.98(186)***	1.17
Women Only Comparisons					
BMI	24.23 (4.96)	24.60 (5.35)	-.37 (1.31)	4.89(292)***	.30
Weight	146.66 (32.32)	148.31 (34.05)	-1.65 (6.64)	4.26(292)***	.26
Height	65.16 (2.58)	64.86 (2.42)	.29 (.73)	6.93(297)***	.42

Note: * $p < .05$, ** $p < .01$, *** $p < .001$. *Δ* represents difference between variables indicated where positive values represent an overestimate and negative values represent an underestimate. Effect size (*Δd*) was computed for non-independent observations and is interpreted as: small is $d > .20$, medium is $d > .50$, and large is $d > .80$. Body weight is in pounds, and height is in inches.

Table 2: Paired Samples t-tests on Subjective and Objective Biometrics

Outcome	Objective (*SD*)	Ideal (*SD*)	*Δ (SD)*	*t(df)*	*Δd*
Entire Sample Comparisons					
BMI	25.13 (5.34)	22.34 (2.88)	2.79 (3.76)	16.30(481)***	.93
Weight	160.73 (39.11)	148.31 (28.80)	12.42 (23.59)	11.57(482)***	.58
Height	66.75 (3.52)	68.10 (3.94)	1.35 (1.89)	15.69(482)***	.72
Men Only Comparisons					
BMI	25.86 (5.06)	23.56 (2.65)	2.30 (3.83)	8.18(184)***	.74
Weight	179.97 (38.58)	173.98 (23.80)	5.98 (25.68)	3.18(185)**	.28
Height	69.79 (2.83)	72.06 (2.60)	2.27 (1.75)	17.69(184)***	1.31
Women Only Comparisons					
BMI	24.68 (5.46)	21.58 (2.76)	3.10 (3.69)	14.46(296)***	1.16
Weight	148.68 (34.38)	132.23 (17.97)	16.45 (21.25)	13.34(296)***	1.16
Height	64.86 (2.42)	65.64 (2.29)	.78 (1.75)	7.68(297)***	.45

Note: * $p < .05$, ** $p < .01$, *** $p < .001$. *Δ* represents difference between variables indicated where positive values represent a desire to decrease and negative values a desire to increase the biometric. Effect size (*Δd*) was computed for non-independent observations and is interpreted as: small is $d > .20$, medium is $d > .50$, and large is $d > .80$. Body weight is in pounds, and height is in inches

Table 3: Paired Samples t-tests on Objective and Ideal Biometrics

Objective and Subjective Estimate Differences (Hypothesis 1)

Mean differences across BMI, weight, and height were not very pronounced between subjective and objective estimates. Participants, on average, underestimated their BMI by only .51 units (*SD* = 1.32), though this difference was statistically significant (Table 2). Consistent with this finding, average differences in weight and height were relatively slight, though also statistically significant (Table 2). While these results statistically support Hypothesis 1a, the effect sizes were rather small (save for height), providing limited support. Next, we compared objective body measurements and subjective estimates for BMI, weight, and height for each gender separately (Hypothesis 1b). Male participants, on average, significantly underestimated their BMI by 0.71 units (*SD* = 1.31), underestimated their weight, and overestimated their height (Table 2). Female participants, similarly, significantly underestimated their BMI by 0.37 units (*SD* = 1.31), underestimated their weight, and overestimated their height (Table 2). Again, these overall results statistically support Hypothesis 1b, though the effect sizes of the differences between subjective and objective estimates remained small, except for height for men, which was large ($d = 1.17$).

In testing Hypothesis 1c, we examined gender differences in these discrepancies. Regarding BMI, the genders significantly differed in their underestimates of BMI, with women ($M = -0.37$ units, $SD = 1.31$) underestimating less than men ($M = -0.71$ units, $SD = 1.31$; $t[476] = 2.77$, $p = .006$, $d = .26$). Regarding weight and height, women ($M = -1.65$ lbs., $SD = 6.64$) underestimated their weight similar to men ($M = -1.18$ lbs., $SD = 6.65$; $t[476] = 0.73$, $p = .465$, $d = .10$), but men ($M = +0.93$ in., $SD = .79$) overestimated their height significantly more than women

(M = +0.29 in., SD = .73) by an additional .64 inches (t[406] = 8.99, $p < .001$, d = .84). As such, the genders, with the exception of height, did not significantly differ in their discrepancies of estimates between subjective and objective estimates, providing only partial support for Hypothesis 1c. Additionally, many of the statistically significant differences had relatively small effect sizes (save height). Therefore, collectively, these results provide some limited support for Hypothesis 1, though the inaccuracies were not as pronounced as predicted except for height among men.

Objective and Ideal Differences (Hypothesis 2)

Overall, participants expressed a desire to reduce their BMI by 2.79 units (SD = 3.76), to reduce weight, and to increase height and these were all statistically significant (Table 3). As such, the discrepancies between one's actual objective biometric condition and one's ideal biometric state were large, suggesting a strong desire to change by decreasing BMI, providing support for Hypothesis 2a. Consistent with Hypothesis 2b, male participants, on average, expressed desire to reduce their BMI by 2.30 units (SD = 3.83), reduce their weight, and increase their height, which were all statistically significant (Table 3). Furthermore, effect sizes varied across all three variables with a small effect size for weight, medium effect size for BMI, and large effect size for height. Female participants, on the other hand, desired to reduce their BMI by 3.10 units (SD = 3.69), reduce their weight, and increase their height, all of which were statistically significant. Interestingly, women had large effect sizes for both weight and BMI, but only a small/medium effect size for height. Taken together, these results suggest that height discrepancies are most notable among men and weight discrepancies are most notable among women.

In testing Hypothesis 2c, the genders significantly differed in their desires to reduce BMI, with women (M = -3.10 units, SD = 3.69) desiring a reduction significantly more than men (M = -2.30 units, SD = 3.83; t[480] = 2.28, p = .023, d = .21). Regarding weight and height, women (M = -16.45 lbs., SD = 21.25) wanted to lose weight significantly more than men (M = -5.98 lbs. , SD = 25.68; t[481] = 4.65, $p < .001$, d = .44) and men (M = +2.27 in., SD = 1.75) wanted to gain height significantly more than women (M = +0.78 in., SD = 1.75; t[481] = 9.12, $p < .001$, d = .85). As expressed by these results, both genders seem unified in their overall desires to lower BMI, reduce weight, and increase height. However, men focused more on gaining height (1.49 in. more than women) and women emphasized the loss of weight (10.47 lbs. more than men).

Psychosocial Variables and the Difference Scores (Hypothesis 3)

For Hypothesis 3, we conducted bivariate correlation analyses between the psychosocial variables and the transformed difference scores to identify variables that explained observed discrepancies. Regarding Hypothesis 3a, we examined variables related to the transformed subjective/objective estimates difference scores for the entire sample and for the separate genders. Four variables were related across the entire sample: body appreciation, sugary drink consumption, fast food consumption, and sleep quality. This indicated that as body appreciation and sleep quality declined by one unit, respondents' subjective estimations of their BMI became more accurate, on average, by .10 and .11 BMI units, respectively. Conversely, as sugary drink and fast food consumption increased by one unit, respondents become less accurate in their estimates of BMI by .10 and .14 BMI units, respectively (Table 1).

Next, examining the psychosocial variables among men only, two variables emerged as significantly related: subjective health (r = .18, R^2 = .03, $p < .05$) and fast food consumption (r = -.21, R^2 = .04, $p < .01$). Thus, as subjective health declined by one unit, subjective estimates of BMI became more accurate, on average, by .18 BMI units and as fast food consumption declined by one unit, subjective estimates of BMI became less accurate by .21 BMI units. Similarly, two variables were significantly related to the subjective/objective discrepancy scores for women only including body appreciation (r = .16, R^2 = .03, $p < .01$) and sugary snack consumption (r = .12, R^2 = .01, $p < .05$). As such, for women, as body appreciation and sugary snack consumption increased, their estimates of BMI all become more accurate, but the magnitude of all these gender-specific relationships remained small.

Following a similar analytic strategy for Hypothesis 3b, the transformed objective/ideal estimate difference scores for the entire sample revealed eleven variables that were significantly related, with the strongest relationships emerging with body appreciation, subjective health, neuroticism, and positive affect. Body appreciation, subjective health, and positive affect can be interpreted that as each of these variables decreased one unit, desire to lower BMI increases. On the other hand, as neuroticism increased by one unit, the desire to lower one's BMI increased by .23. For men only, seven of the eleven variables were related to the difference scores including subjective health (r = -.38, R^2 = .14, $p < .01$), body appreciation (r = -.30, R^2 = .09, $p < .01$), neuroticism (r = .25, R^2 = .06, $p < .01$), fast food consumption (r = .23, R^2 = .05, $p < .01$), negative mood (r = .22, R^2 = .05, $p < .01$), sugary drink consumption (r = .17, R^2 = .03, $p < .05$), and sleep quality (r = -.17, R^2 = .03, $p < .05$). Thus, as subjective health, body appreciation, and sleep quality increase, men, on average, had less discrepancy between their objective and ideal biometrics and the inverse was true for neuroticism, negative mood, fast food, and sugary drink consumption (Table 1).

Similarly, seven variables were related to the objective/ideal difference scores for women only: body appreciation (r = -.43, R^2 = .19, $p < .01$), subjective health (r = -.27, R^2 = .07, $p < .01$), neuroticism (r = .19, R^2 = .04, $p < .01$), positive affect (r = -.14, R^2 = .02, $p < .05$), sugary drink consumption (r = .14, R^2 = .02, $p < .05$), fruit consumption (r = -.14, R^2 = .02, $p < .05$), and physical activity (r = -.12, R^2 = .01, $p < .05$). As such, as body appreciation, subjective health, positive affect, fruit consumption, and physical activity increased, desire to reduce one's BMI among women, on average, decreased and as neuroticism and sugary drink consumption increased, desire to reduce BMI also increased. In sum, the results here suggest some clear psychosocial variables that explain the difference between objective and ideal biometric estimates (e.g., body appreciation, subjective health, neuroticism) with a few specific differences between the genders (e.g., physical activity for women).

Discussion

The purpose of the present investigation was to examine discrepancies between different modes of BMI estimation (i.e., self-report, ideal, objective) among a college student population and to examine variables that might explain these discrepancies. First, we found statistically significant differences in the underestimation of weight and overestimation of height in self-report estimates, though these relationships had rather small effect sizes. Discrepancies also differed systematically according to gender with men overestimating height and women underestimating weight. Second, we found substantial differences between ideal and objective estimates for BMI, with a strong desire to lose weight and gain height, in general, with medium to large effect sizes. Again, gender was an influential factor with men showing a stronger desire to gain height and women to lose weight. Third, we identified several factors explaining these discrepancies including body image appreciation, subjective health, neuroticism, affect, and many health behaviors, though all varied in their strength according to gender. Thus, this study sheds light on understanding obesity assessment, factors that influence perceptual biases, and directions for future interventions.

First, regarding the differences observed in the objective and subjective estimates of BMI, weight, and height in the current study, all differences were statistically significant, though some relationships are more noteworthy. Considering the literature, it is not surprising that both men and women desired to reduce their BMI. However, while both genders, on average, underestimated weight and overestimated height (leading to lower BMI estimates), men had a stronger tendency to overestimate their height while women reported lower weight, which is supported by the literature [17,47]. Indeed, this is a theme throughout all our results, especially in differences between objective and ideal estimates of BMI, weight and height. Whereas in the objective/subjective analyses many of the effect sizes were rather small and inconsequential, in the objective/ideal analyses, effect sizes were much larger, suggesting the desire to increase height for men, decrease weight for women, and reduce BMI for both.

Perhaps the best explanation for this pattern of results stems from the masculine model in the dominant American culture of being "tall, dark, and handsome" and the feminine goal of being thin and petite. From an early age, men are socialized and encouraged to become muscular, tall, and powerful so as to fit the masculine norm. Moreover, men who do not fit this masculine norm are strongly criticized and ostracized by other men and, to a certain extent, by women, providing strong motivation to conform to these ideals [21,48]. The thin ideal for women dominates most media and is prominently featured in various forms ranging from adult social media platforms (e.g., Facebook, Instagram) to children's books and dolls [18,19,20,22,26]. Women are continually informed both directly and indirectly that if they do not conform to these ideals, they are not valued within society [18,26]. Therefore, together these two stereotypes may explain the desire to increase height in men, while the women desired to decrease weight.

Second, several psychosocial variables were related to inaccuracies in the subjective/objective estimates. Women's views of their own bodies and men's perceived overall health seem the most influential factors in explaining differences in perceived and actual biometrics. However, it must be noted that the estimate discrepancies were rather small, especially in terms of weight for women (1.65 lbs.) and height for men (.93 in.), suggesting that these variables likely do not exert a large effect on these inaccuracies. Moreover, weight normally fluctuates daily between 1.30 to 4.56 lbs. among young women, which suggests that the observed discrepancy of 1.65 lbs [48]. is not that inaccurate. Men's self-reported biometrics were even less prone to bias, though better subjective health seemed to improve accuracies in men's self-reported estimates. Similarly, the magnitude of the relationships with these psychosocial variables was rather small (all below .25), which warrant some caution in interpretation.

Regarding the objective/ideal estimate differences, genders were similar in which variables mattered, but differed regarding strength. Whereas body appreciation levels affected women more strongly, subjective overall health had a stronger impact on men's desires to reduce BMI. First, body appreciation's impact on women can be understood in two ways. First, it may indicate that when women are dissatisfied with their bodies, they feel that their health is less than ideal and they focus their attention on weight loss or decreasing BMI as a way to change those feelings. Alternatively, desires to lower BMI among higher BMI women may produce less satisfaction with their bodies, decreased perceived health, and poorer emotional and psychological health. Although both are viable, Pingitore and colleagues (1997) in a study among college-age men and women, found that BMI was a significant predictor of variance in body shape satisfaction, supporting the interpretation that higher BMI leads to lower body appreciation [49]. Men, on the other hand, focused on subjective overall health relative to desired BMI reduction. This is consistent with a gender differential effect where men who are obese demonstrate decreased subjective health beyond the functional impairments obesity (e.g., difficulty moving). Taken in this light, our findings suggest that men may use subjective assessments of their own health as an indicator of whether their BMI is healthy and if change (i.e., weight loss, height gain) needs to take place. Another plausible explanation may be that men who are overweight or obese have more negative views about their subjective overall health. Regardless, men focus more on their own personal health when considering their ideal body metrics [50,51].

Neuroticism, mood, and several health behaviors (to a lesser extent) were related to the objective/ideal discrepancies, suggesting the importance of emotional/mental health and health behaviors (e.g., sleep, diet, exercise). Given the strong connection between physical and mental/emotional health, examinations of obesity and BMI should employ measures of body appreciation and subjective overall health along with other psychological, emotional, and behavioral health constructs [34]. Although neuroticism is a likely exception (as a personality characteristic resistant to change), mood and health behaviors are amenable to alteration, which may, in turn, combat unhealthy expectations and perceptions in the report of body metrics. Indeed, these measures may help to identify persons for whom the discrepancies between objective and ideal weights/heights are more likely to cause further problems and offer leverage in the effort to curb obesity-related misperceptions [11,52].

Limitations and Future Directions

A potential limitation of the current study was the cross-sectional design, which may have hindered our ability to identify relationships between all the various psychosocial factors and the discrepancies between modes of BMI estimation. While the current study did identify twelve variables that were related to these discrepancies, it may be that some of these factors (i.e., social media use, vegetable consumption, sugary snack consumption) are not strong enough to exert an influence detectable with a cross-sectional design, pointing to the need for longitudinal designs in future investigations. Second, another concern is the reliance on self-report data collected using a one-time online survey, which can bias results. However, the collection of physical health data (i.e., height, weight) in tandem with the self-report data mitigates this concern. Future research could explore other sources of data relating to the psychosocial factors of interest such as ratings by significant others (e.g., spouse, family members, friends) or behavioral observations in naturalistic settings.

Third, although the current study identified several factors related to discrepancies in obesity measurement, it was not designed to examine effective means of improving obesity perception. Thus, interventions designed to target key factors such as body image, subjective health, mood, and health behaviors should be explored to foster more accurate and healthy appraisals of body health. Indeed, a potential use of these findings might be in designing an intervention aimed at college-age women and men, to educate on the realities of BMI (e.g., it increases into adulthood) and improve understanding on how to eat healthier within their time and budgetary limitations. Finally, despite our large sample size, generalizability of these results may be in question, particularly to other demographic groups who have relatively lower socioeconomic standing in the community. Future research should expand to include other populations such as the less educated, the less affluent, and other minorities not represented here.

Conclusion

These findings suggest important perceptual differences in BMI between the genders and highlight the need for further research to explore mechanisms by which to address the obesity epidemic. Finally, it is our hope that future research builds on these findings to formulate effective means whereby the obesity epidemic can be better understood, addressed, and, by doing so, improve overall health and quality of life.

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