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ORIGINAL PAPER

Validity of Self-reported Height and Weight in Women of Reproductive Age

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Abstract *Objectives*: Height and weight are key variables in epidemiologic research, including studies of reproductive outcomes. Optimally, this information is collected by trained study personnel. However, direct measurements are not always feasible. The purpose of this study was to investigate the accuracy of self-reported height and weight, as well as the resultant body mass index (BMI) calculated from self-reported height and weight (referred to as self-reported BMI), among a group of women of reproductive age according to select demographic variables.

Methods: A total of 381 women provided self-reported height, weight, and demographic information on a questionnaire for a study of contraceptive trends while attending a Family Medicine clinic. Height and weight were also abstracted from medical records for 275 of these study participants. Self-reported and measured values for height, weight, and BMI were compared using paired *t*-tests. Analysis of variance, chi-square tests, and Fisher's Exact tests were used to examine how differences between self-reported and measured values varied by select demographic factors.

Results: Women underestimated weight by 4.6 pounds, overestimated height by 0.1 inches, and underestimated BMI by 0.8 kg/m^2. All women, regardless of age, education, race/ethnicity, or marital status, underestimated their weight. These differences were statistically significant for all groups ($p < 0.01$) with the exception of women with a high school education. Self-reported height and weight measures classified 84% of women into appropriate BMI categories.

Conclusions: Overall, self-reported height and weight were found to give an accurate representation of true BMI in this study. There were some demographic differences in the ability to accurately report height and weight, particularly with respect to race/ethnicity. Future studies should investigate these racial/ethnic differences among a larger population.

Keywords Body mass index · Self-reported weight · Height · Validity

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Introduction

Obesity and overweight are an American public health epidemic. According to the National Health and Nutrition Examination Survey (NHANES), 64.5% of adults in the United States were overweight and 30.5% were obese during 1999–2000 [1]. Among women of reproductive age, prevalence rates of overweight and obesity were 54.3% and 28.4%, respectively [1]. The obesity epidemic continues to spread in the United States [1–4], Accompanying this spread are major health consequences and economic costs [5, 6].

Overweight and obesity are known risk factors for a number of chronic diseases, as well as reproductive and pregnancy outcomes [5]. Thus, height and weight are used as main exposure variables or potential confounding factors in numerous epidemiologic studies. Optimally, this information is collected by trained study personnel. However, in many settings such direct measurements are not feasible and height and weight information is instead collected via self-report. Though prior validity studies of height and weight indicate that individuals self-report these measurements with reasonable accuracy [7–16], the use of self-reported weight was

recently questioned in a study examining the role of obesity in oral contraceptive failure [17].

In general, individuals tend to slightly overestimate their height and underestimate their weight by a few pounds. When body mass index (BMI) is derived from self-reported height and weight, inaccuracies may be compounded. Although prior studies have examined the degree of accuracy in self-reported height and weight in relation to some demographic variables, the results have not been consistent [7–10, 12–16, 18]. The purpose of this study was to investigate the accuracy of self-reported height and weight, and the resultant calculated BMI among a group of women of reproductive age according to select demographic variables. For ease of reporting, we will refer to the BMI calculated from self-reported heights and weights as self-reported BMI.

Materials and methods

Data collection

The Contraceptive History, Initiation, and Choice (CHIC) Study was conducted at a suburban Family Medicine clinic in the Atlanta area during 2004. The clinic is affiliated with Emory University and serves as the primary training area for residents of the Family Medicine Residency Program. The CHIC Study protocol was approved by the Emory University Institutional Review Board on April 24, 2004. The primary purpose of the CHIC Study was to evaluate contraceptive trends and adherence to contraceptive methods [19]. Women between the ages of 18–45 who were using any method of birth control were approached while waiting for their appointment ($n = 413$), and those who agreed to participate signed an informed consent form and filled out a short, baseline questionnaire ($n = 381$).

The baseline questionnaire collected information on height, weight, age, race/ethnicity, marital status, education, dual method use (use of an additional contraceptive method), prior contraceptive method use, and reason for discontinuation of a contraceptive method. Trained nursing assistants took height and weight measurements of patients prior to escorting them to their examination rooms. These measurements were compared for a sample of 275 women enrolled in the CHIC Study.

Analysis

Summary statistics of the study population were obtained. Mean height (in inches), weight (in pounds), and BMI (calculated as kg/m^2) were calculated for both self-reported and measured values. The mean difference between self-reported and measured values was calculated to measure the accuracy of reporting and to indicate the direction of any bias. Paired *t*-tests were used to compare mean differences between self-reported and measured values for height, weight, and BMI. Analysis of variance was used to examine how differences between self-reported and measured values varied with respect to select demographic variables. Specifically, *F*-tests were used to determine if mean differences across demographic categoriess were homogeneous. Chi-square tests and Fisher's Exact tests were used to explore associations between the accuracy of self-reporting and demographic variables.

In addition, self-reported BMI (i.e. BMI calculated from self-reported height and weight) was cross-tabulated with measured BMI in order to assess the degree of misclassification that occurs from the use of self-reported height and weight. BMI was divided into four categories: underweight (< 20), normal (20–24.9), overweight (25–29.9), and obese (≥ 30). The selected BMI categories are widely used in studies of reproductive outcomes [20–26]. Measured height was not found in medical records for 25 of the study participants. Thus, analyses pertaining to height or BMI are based on 250 women while analyses relating to weight are based on 275 women. All analyses were performed using the SAS System for Windows Version 8.2 (Cary, NC).

Results

The majority of women were less than 35 years of age (82.6%, mean age 29.4 years) and well educated (63.0% college graduate or above; Table 1). Nearly 90% of the study participants self-reported their race/ethnicity as non-Hispanic Black (NHB) or non-Hispanic White (NHW) and most women were single (47.6%).

The overall mean BMI, based on measured values of weight and height, for this study population was 27.7 kg/m^2 (SE: 0.49). Generally, women tended to underestimate their weight by 4.6 pounds (SE: 0.61) and overestimate their height by 0.1 inches (SE: 0.06). Thus, the use of self-reported height and weight resulted in a less than one unit underestimation of BMI (0.8 kg/m^2 (SE: 0.12); data not shown).

When self-reported and measured values for weight, height, and BMI were considered by select demographic variables, these trends persisted. All women, regardless of age, education level, race/ethnicity, or marital status, underestimated their weight (Table 2). These differences were statistically significant for all groups at the $p < 0.01$ level except for women with a high school education. The majority of women accurately reported their height and none of the differences between self-reported and measured height was statistically significant. As seen with weight, the majority of women underestimated their BMI. Differences between self-reported and measured BMI were statistically significant ($p < 0.01$) for most demographic groups. However,

differences were not significant for women with a high school education, Asian women, or those women who reported living with a partner. Though many of the mean differences between self-reported and measured values were statistically significant, these differences only varied within the race/ethnicity category ($p < 0.05$).

When discrepancies between self-reported and measured weight were further examined, it was found that nearly 90% of women with a high school education accurately self-reported their weight within 5 pounds of their measured weight (Table 3). In comparison, only 65.7% of women with graduate degrees self-reported their weight with the same amount of accuracy. Forty percent of Hispanic women and 33% of NHB women underestimated their weight by >5 pounds. Obese women (BMI ≥ 30), but not overweight women, were more likely to misreport their weight. Only 48.6% of obese women self-reported their weight within 5 pounds of their measured weight, while 50.0% underestimated their weight by at least 5 pounds ($p < 0.0001$). These findings were similar to what was seen with quartiles of weight ($p < 0.0001$; range for weight: 84–350 pounds and median $=$ 152 pounds).

The majority of women (87.3%) were able to self-report their height within 1 inch of their measured height. Though based on small numbers, it appeared that Hispanic women were more likely to misreport their height (Table 4). Twenty percent of Hispanic women overestimated their height by over one inch.

Discrepancies between BMI based on self-reported and measured height and weight values were similar to what was seen with weight (Table 5). Sixty percent of Hispanic women and 37% of NHB women underestimated BMI by more than one unit ($p < 0.04$). Though there were few Asian women in this study, all of these women accurately reported their BMI within one unit of their true BMI. Underweight (BMI < 20) and normal weight (BMI 20–24.9) women accurately reported their BMI (80% and 75%, respectively), but only about half of overweight (BMI 25–29.9) and obese (BMI ≥ 30) women did so ($p < 0.0001$). The results for quartiles of weight paralleled these findings ($p < 0.0001$).

Overall, 84% of women were correctly classified into BMI categories using self-reported measures for height and weight (Table 6). All of the women classified as underweight by measured values were also classified as underweight when self-reported values were used. In addition, 81% of normal weight, 77% of overweight, and 90% of obese women were correctly allocated to the appropriate BMI category using self-reported measures.

Discussion

Direct measurement of height and weight is often not possible or practical in epidemiologic research. Results from the CHIC Study indicate that self-reported height and weight measurements from women of reproductive age give an accurate representation of measured height and weight. On average, women overestimated their height by 0.1 inches and underestimated their weight by 4.6 pounds. When self-reported height and weight were used to calculate BMI, this

Table 1 Characteristics of women participating in the Contraceptive History, Initiation, and Choice (CHIC) Study, 2004

Characteristic	Number (%) for women included in analyses of weight	Number (%) for women included in analyses of height and BMI
Age		
18–25 years	89 (32.4)	78 (31.2)
26–35 years	138 (50.2)	127 (50.8)
>35 years	48 (17.5)	45 (18.0)
Education		
High school	22 (8.0)	18 (7.2)
Some college	80 (29.1)	71 (28.4)
College graduate	100 (36.4)	94 (37.6)
Graduate school	73 (26.6)	67 (26.8)
Race/ethnicity[a]		
Asian	14 (5.1)	14 (5.6)
NHB	111 (40.4)	100 (40.0)
Hispanic	14 (5.1)	10 (4.0)
NHW	136 (49.5)	126 (50.4)
Marital status		
Married	82 (29.8)	72 (28.8)
D/S/W[b]	30 (10.9)	28 (11.2)
Living with partner	32 (11.6)	29 (11.6)
Single	131 (47.6)	121 (48.4)

[a] Within race/ethnicity NHB = non-Hispanic Black and NHW = non-Hispanic White.

[b] D/S/W is divorced, separated, or widowed.

Table 2 Mean (SE) weight, height, and body mass index (BMI) by demographic characteristics, Contraceptive History, Initiation, and Choice (CHIC) Study, 2004

Characteristic	Self-reported weight	Measured weight	Difference[a]	Self-reported height	Measured height	Difference	Self-reported BMI	Measured BMI	Difference
Age									
18–25 years	150.8 (4.81)	154.3 (5.07)	*−3.5 (1.06)*[b]	65.0 (0.30)	64.8 (0.27)	0.2 (0.15)	25.3 (0.90)	25.9 (0.92)	*−0.7 (0.21)*
26–35 years	164.1 (4.07)	168.4 (4.27)	*−4.4 (0.67)*	64.9 (0.25)	64.9 (0.25)	0.04 (0.06)	27.0 (0.66)	27.8 (0.69)	*−0.8 (0.12)*
> 35 years	171.9 (4.89)	179.0 (5.97)	*−7.2 (2.33)*	64.9 (0.40)	64.9 (0.39)	−0.02 (0.13)	28.9 (0.82)	30.1 (1.00)	*−1.2 (0.44)*
Education									
High school	179.5 (13.34)	182.1 (14.17)	−2.6 (1.62)	63.8 (0.57)	64.0 (0.54)	−0.2 (0.30)	30.4 (2.39)	30.4 (2.29)	−0.03 (0.44)
Some college	164.1 (5.62)	168.5 (5.83)	*−4.4 (0.88)*	65.5 (0.33)	65.2 (0.31)	0.3 (0.14)	26.7 (0.95)	27.6 (0.96)	*−0.9 (0.18)*
College graduate	159.2 (4.19)	163.8 (4.50)	*−4.5 (1.10)*	64.5 (0.28)	64.5 (0.28)	−0.04 (0.07)	27.0 (0.70)	27.8 (0.76)	*−0.8 (0.20)*
Graduate school	154.8 (4.35)	160.2 (4.96)	*−5.5 (1.49)*	65.3 (0.31)	65.2 (0.31)	0.1 (0.10)	25.6 (0.78)	26.6 (0.88)	*−0.9 (0.27)*
Race/ethnicity[c,d]									
Asian	144.6 (15.14)	146.2 (15.03)	*−1.6 (0.55)*	62.4 (0.59)	62.5 (0.59)	−0.1 (0.14)	25.7 (2.17)	25.9 (2.16)	−0.2 (0.11)
NHB	180.3 (4.93)	187.4 (5.31)	*−7.1 (1.36)*	64.9 (0.29)	64.9 (0.27)	0.0 (0.11)	30.1 (0.85)	31.3 (0.90)	*−1.2 (0.26)*
Hispanic	156.1 (11.69)	159.0 (11.83)	*−2.9 (1.12)*	64.9 (0.80)	63.9 (0.81)	1.0 (0.60)	25.8 (2.10)	27.1 (1.98)	*−1.3 (0.46)*
NHW	147.6 (2.67)	150.6 (2.81)	*−3.0 (0.56)*	65.2 (0.22)	65.2 (0.22)	0.1 (0.06)	24.4 (0.45)	24.9 (0.48)	*−0.5 (0.11)*
Marital status									
Married	158.7 (5.32)	162.5 (5.39)	*−3.8 (0.94)*	64.7 (0.34)	64.6 (0.33)	0.1 (0.08)	26.5 (0.94)	27.2 (0.95)	*−0.7 (0.19)*
D/S/W[e]	169.5 (6.47)	174.1 (6.92)	*−4.6 (1.34)*	65.5 (0.58)	65.4 (0.50)	0.1 (0.27)	28.2 (1.20)	29.0 (1.26)	*−0.9 (0.27)*
Living together	156.6 (7.87)	159.5 (8.12)	*−2.9 (1.24)*	64.7 (0.46)	64.6 (0.48)	0.1 (0.27)	26.2 (1.35)	26.6 (1.32)	*−0.4 (0.34)*
Single	161.8 (4.05)	167.3 (4.49)	*−5.5 (1.10)*	65.0 (0.24)	65.0 (0.23)	0.03 (0.07)	26.8 (0.66)	27.8 (0.73)	*−0.9 (0.20)*

[a] Difference calculated as follows: Self-reported value-measured value.

[b] Italicized values indicate $p < 0.01$ significance of differences between self-reported and measured values by paired *t*-test.

[c] Within race/ethnicity NHB = non-Hispanic Black and NHW = non-Hispanic White.

[d] ANOVA indicated that differences between self-reported and measured values of weight, height, and BMI varied within race/ethnicity category at $p < 0.05$ level.

[e] D/S/W is divorced, separated, or widowed.

Table 3 Accuracy of self-reported weight according to percentage that deviated from measured weight by select characteristics, Contraceptive History, Initiation, and Choice (CHIC) Study, 2004

Characteristic	Deviation of self-reported weight from measured weight				
	Underestimated measured weight by > 10 lbs.	Underestimated measured weight by 5.1–10 lbs.	Within ±5 pounds of measured weight	Overestimated measured weight by 5.1–10 lbs.	Overestimated measured weight by > 10 lbs.
Age					
18–25 years	11.5	11.5	70.5	2.6	3.9
26–35 years	15.0	14.2	69.3	1.2	0.8
> 35 years	17.8	13.3	68.9	0.0	0.0
Education					
High school	11.1	0.0	88.9	0.0	0.0
Some college	16.9	14.1	63.4	2.8	2.8
College graduate	14.9	10.6	72.3	0.0	2.1
Graduate school	11.9	19.4	65.7	3.0	0.0
Race/ethnicity[a]					
Asian	0.0	7.1	92.9	0.0	0.0
Black	22.0	11.0	65.0	1.0	1.0
Hispanic	10.0	30.0	60.0	0.0	0.0
White	10.3	14.3	70.6	2.4	2.4
Marital status					
Married	16.4	12.3	67.1	1.4	2.7
D/S/W[b]	14.3	14.3	67.9	3.6	0.0
Living with partner	10.3	3.5	82.8	0.0	3.5
Single	14.2	15.8	67.5	1.7	0.8
BMI[c]					
< 20	0.0	6.7	80.0	6.7	6.7
20–24.9	2.8	13.0	80.6	2.8	0.7
25–29.9	12.3	15.8	70.2	0.0	1.8
≥ 30	37.1	12.9	48.6	0.0	1.4
Height quartile					
Q1 (shortest)	8.2	11.0	76.7	0.0	4.1
Q2	15.0	13.8	67.5	3.8	0.0
Q3	13.8	15.5	67.2	1.7	1.7
Q4 (tallest)	25.6	12.8	65.1	0.0	0.0
Weight quartilec					
Q1 (lightest)	0.0	13.6	81.1	3.0	1.5
Q2	3.1	12.3	78.5	3.1	3.1
Q3	18.3	15.0	66.7	0.0	0.0
Q4 (heaviest)	40.0	11.9	47.5	0.0	1.7

[a] Within race/ethnicity NHB = non-Hispanic Black and NHW = non-Hispanic White.

[b] D/S/W is divorced, separated, or widowed.

[c] Statistically significant at $p < 0.0001$ level.

translated into a 0.8 m/kg^2 underestimation of measured BMI. In addition, 84% of women were classified into the correct BMI category when self-reported height and weight measurements were used to calculate BMI.

These findings are similar to what has been seen in other populations of adult women [7–16]. Like these previous studies, the CHIC Study also found that the heaviest women (as measured by both weight and BMI) were most likely to misreport their weight or BMI [8–10, 16]. Findings related to demographic variables have been inconsistent in prior validity studies. Some studies have found that as age increases, underestimation of weight also increases [14, 15]. The CHIC Study found no indication that the degree of under or overestimation of weight varied by age. This finding could be due to the fact that participants in the CHIC Study belonged to a relatively narrow age group as compared to other validity studies. The CHIC Study also found that the least educated women provided the most accurate weight measurements. Though this finding is based on small numbers, it is consistent with other studies [9, 18]. Unlike other studies, the CHIC Study also found some racial/ethnic differences in terms of the accuracy of self-reported BMI. While self-reported

Table 4 Accuracy of self-reported height according to percentage that deviated from measured height by select characteristics, Contraceptive History, Initiation, and Choice (CHIC) Study, 2004

Characteristic	Deviation of self-reported height from measured height		
	Underestimated measured height by >1 inch	Within ±1 inch of measured height	Overestimated measured height by >1 inch
Age			
18–25 years	2.6	92.3	5.1
26–35 years	0.0	96.1	3.9
> 35 years	2.2	95.6	2.2
Education			
High school	5.6	94.4	0.0
Some college	1.4	91.6	7.0
College graduate	1.1	96.8	2.1
Graduate school	0.0	95.5	5.5
Race/ethnicity[a]			
Asian	0.0	100.0	0.0
Black	3.0	94.0	3.0
Hispanic	0.0	80.0	20.0
White	0.0	96.0	4.0
Marital status			
Married	0.0	95.9	4.1
D/S/W[b]	0.0	96.4	3.6
Living with partner	3.5	89.7	6.9
Single	1.7	95.0	3.3
BMI			
< 20	0.0	100.0	0.0
20–24.9	0.9	95.4	3.7
25–29.9	1.8	89.5	8.8
≥ 30	1.4	97.1	1.4
Height quartile			
Q1 (shortest)	0.0	95.9	4.1
Q2	3.8	91.3	5.0
Q3	0.0	96.6	3.5
Q4 (tallest)	0.0	97.4	2.6
Weight quartile			
Q1 (lightest)	0.0	93.9	6.1
Q2	1.5	95.4	3.1
Q3	1.7	93.3	5.0
Q4 (heaviest)	1.7	96.6	1.7

[a] Within race/ethnicity NHB = non-Hispanic Black and NHW = non-Hispanic White.

[b] D/S/W is divorced, separated, or widowed.

measurements correctly classified all Asian women within one unit of their measured BMI, many NHB and Hispanic women underestimated their measured BMI. However, the findings related to Asian and Hispanic women must be interpreted with some caution since they were based on small numbers.

This study was unique in that it assessed the validity of height, weight, and BMI among a group of women of reproductive age. Such measurements are particularly important to the field of reproductive epidemiology. Overweight and obesity is particularly relevant to studies dealing with infertility, pregnancy complications, and contraceptive failure. The CHIC Study had a high participation rate and the baseline questionnaire allowed for the examination of demographic variables in relation to the validity of height, weight, and BMI. This study also highlights a potential problem with using objective measurements of height and weight. Of the 275 women included in the validity study, 25 were missing height information in their medical records. Although height and weight measurements are to be recorded by the clinic's nursing staff at every visit, this is clearly not always the case. As a result, medical records may be insufficient for providing measured values of these key variables.

Overall, self-reported height and weight were found to give an accurate representation of true BMI among this group of women of reproductive age. Specifically, nearly 85% of study participants were classified into the correct BMI category using self-reported values. While these findings suggest that misclassification resulting from the use of self-reported values to derive BMI would not impact the overall conclusions of a study, there were some demographic differences in the ability to accurately report height and weight.

Table 5 Accuracy of self-reported BMI (based on self-reported height and weight) according to percentage that deviated from measured BMI by select characteristics, Contraceptive History, Initiation, and Choice (CHIC) Study, 2004

	Deviation of self-reported BMI from measured BMI				
Characteristic	Underestimated measured BMI by > 2.0	Underestimated measured BMI by 1.1–2.0	Within ± 1.0 of measured BMI	Overestimated measured BMI by 1.1–2.0	Overestimated measured BMI by > 2.0
Age					
18–25 years	12.8	15.4	64.1	3.9	3.9
26–35 years	15.0	19.7	62.2	2.4	0.8
> 35 years	20.0	13.3	64.4	0.0	2.2
Education					
High school	11.1	11.1	66.7	5.6	5.6
Some college	18.3	18.3	57.8	2.8	2.8
College graduate	14.9	14.9	67.0	1.1	2.1
Graduate school	13.4	20.9	62.7	3.0	0.0
Race/ethnicity[a,b]					
Asian	0.0	0.0	100.0	0.0	0.0
Black	22.0	15.0	58.0	2.0	3.0
Hispanic	30.0	30.0	40.0	0.0	0.0
White	10.3	19.8	65.1	3.2	1.6
Marital status					
Married	15.1	17.8	63.0	1.4	2.7
D/S/W[c]	17.9	14.3	67.9	0.0	0.0
Living with partner	13.8	17.2	58.6	6.9	3.5
Single	15.0	17.5	63.3	2.5	1.7
BMI[d]					
< 20	0.0	13.3	80.0	0.0	6.7
20–24.9	3.0	15.7	75.0	4.6	0.9
25–29.9	15.8	26.3	54.4	1.8	1.8
≥ 30	35.7	12.9	48.6	0.0	2.9
Height quartile					
Q1 (shortest)	11.0	20.6	61.6	2.7	4.1
Q2	18.8	13.8	61.3	3.8	2.5
Q3	12.1	17.2	69.0	1.7	0.0
Q4 (tallest)	20.5	18.0	61.5	0.0	0.0
Weight quartiled					
Q1 (lightest)	3.0	21.2	72.7	1.5	1.5
Q2	6.2	12.3	70.8	7.7	3.1
Q3	16.7	23.3	60.0	0.0	0.0
Q4 (heaviest)	37.3	11.9	47.5	0.0	3.4

[a]Within race/ethnicity NHB = non-Hispanic Black and NHW = non-Hispanic White.

[b]Statistically significant at $p < 0.05$ level.

[c]D/S/W is divorced, separated, or widowed.

[d]Statistically significant at $p < 0.0001$ level.

Table 6 Number of women classified into standard BMI categories using self-reported and measured height and weight values, Contraceptive History, Initiation, and Choice Study, 2004

	Measured BMI				
Self-reported BMI	< 20	20–24.9	25–29.9	≥ 30	Total
< 20	**15**	13	0	0	28
20–24.9	0	**88**	12	0	100
25–29.9	0	7	**44**	7	58
≥ 30	0	0	1	**63**	64
Total	15	108	57	70	250

In particular, NHB and Hispanic women underestimated their weight the most. Because of the small sample sizes within some of these race/ethnicity categories, these findings should be considered exploratory. Future studies should investigate these potential racial/ethnic differences among a larger population. If confirmed, these differences could impact studies that rely on self-reported anthropometric measures to investigate the role of obesity in reproductive outcomes, particularly if the outcomes vary by a woman's race/ethnicity.

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