Published in final edited form as:

Obes Res Clin Pract. 2016 September ; 10(Suppl 1): S48–S56. doi:10.1016/j.orcp.2015.04.004.

Accuracy of body weight perception and obesity among Chinese Americans

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Abstract

Background—Accuracy of body weight perception is an individual's perception of their body weight in comparison with actual body weight and is associated with weight related behaviors. Chinese Americans have increased risk for obesity but no studies have examined accuracy of body weight perception.

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Methods—This study was a descriptive and cross-sectional study, which was conducted in a community health center in New York. Study subjects were all Chinese-American adults. Demographic information, accuracy of perception of body weight, anthropometric measures (Weight, Height, BMI, weight to height ratio, weight to hip ratio), fasting plasma glucose (FPG), HbA1C and obesity related disease including hypertension, diabetes, heart disease, stroke were assessed.

Results—A total of 162 Chinese American were recruited. 52 subjects (32%) did not perceive body weight correctly, in which 32 subjects had underestimation and 20 subjects had overestimation of body weight. Significant differences were found among subjects in three groups of different accuracy of body weight perception in terms of gender ($p=0.003$), age ($p=0.003$), education years ($p=0.047$). WC ($p<0.001$), HC ($p<0.001$), weight/height ratio ($p=0.001$), BMI ($p<0.001$). Subjects in consistent/accurate estimation group and underestimation group had similar obesity related-characteristics but different from subjects in overestimation group.

Discussion and Conclusion—The study identified around one third of Chinese American did not perceive their body weight correctly. Intervention studies for obesity management in Chinese American should address gender difference, target on older subjects, and focus on educating the normal values and significances of WC, HC and HbA1C among Chinese Americans.

Keywords

Chinese American; Obesity; Accuracy of body weight perception

INTRODUCTION

The prevalence of obesity is increasing throughout the world. According to World Health Organization (WHO), worldwide obesity has nearly doubled since 1980 and 35% of adults aged 20 and over were overweight in 2008, and 11% were obese [1]. Chinese Americans make up the largest subgroup of Asian American and represent 4% of the total U.S. population. [2]. Compared to Chinese population in China, Chinese Americans have increased risk for obesity in the United States due to immigration and environmental change [3]. Obesity has been identified as a major source of unsustainable health costs, and morbidity and mortality due to hypertension, type 2 diabetes, cardiovascular diseases and certain types of cancer [4, 5].

Accuracy of body weight perception is conceptualized as an individual's perception of their body weight (normal weight, overweight, or underweight) in comparison with actual body weight [6]. Research has shown that accuracy of body weight perception was associated with life style behaviors, efforts to lose weight and even medical visit [6–8]. Accuracy of body weight perception might be different in different ethnicities and cultures. Previous research reported that white women were more likely to consider themselves overweight even they had normal weight [9, 10]. Obesity is consistently and substantially underestimated by self-report data from non-Hispanic European American women, non-Hispanic African American women, and Mexican American women and men [11]. South Asians women with obesity tend to underestimate themselves as normal weight in comparison with Europeans

[12]. As to our best knowledge, no studies have been examined the accuracy of perception of body weight among Chinese American.

PURPOSE OF THE STUDY

The purpose of this study was to examine the accuracy of body weight perception and explore the impact of it on obesity in Chinese Americans. Specifically, the study tries to answer the following research questions:

1. What is the accuracy of perception of body weight among Chinese Americans?
2. What are the associations between accuracy of body weight perception and obesity indicators (BMI, waist circumference [WC], hip circumference [HC], weight to hip ratio, weight to height ratio) among Chinese Americans?
3. What are the associations between accuracy of body weight perception and obesity related physical characteristics such as, glycosylated hemoglobin [HbA1C], Fasting Plasma Glucose (FPG), hypertension, diabetes, heart disease and stroke among Chinese Americans?

METHODS

Study Design, Study Setting and Participants

This study was a descriptive and cross-sectional study, which was conducted in a community health center in New York. Study participants were all Chinese-American adults. Both first generation and succeeding generations were recruited. Inclusion Criteria: (a) self-identified Chinese Americans over age 21; (b) willing to give consent for the researchers to verify laboratory values by reviewing their medical records; and (c) able to communicate in English, Mandarin, or Cantonese. Exclusion Criteria: Chinese-Americans with other severe diseases since bioimpedance device (BIA) device for BMI and body composition may not be accurate according to the manufacture; and (b) unable to communicate verbally.

The study was approved by the institutional review board of the university. Participants who came to the community health center for both routine health check-ups and diabetes follow-up visits were invited to the study. The study invitation was distributed by physicians or nurses working in the community health center. The research nurses met individuals who expressed interest in the study in person to determine whether the individuals met the inclusion criteria and provide detailed explanation of the study and. All participants signed the informed consent. Participants had the choices to sign either the informed consent either in English or Chinese language.

Measurements

Demographic Information—Demographic characteristics were assessed to include age, gender, educational level, occupation, immigrant background (year of immigration, primary language), and living status (live alone, live with family, assistant living).

Accuracy of Perception of Body Weight—Each participant was asked to rate his or her own body weight category as underweight, normal weight, or overweight before anthropometric measurement. Each participant then was measured and categorized the actual body weight into the category of “underweight, normal weight, or overweight” based on measurements of BMI [13]. By comparing participants’ perceived body weight category with their actual body weight category, participants were divided into 3 groups: consistent estimation (participants’ perceived body weight is consistent with their actual body weight), underestimation (participants’ perceived body weight is lighter than their actual body weight) and overestimation (participants’ perceived body weight is heavier than their actual body weight).

Anthropometric Measures—Weight was measured by an electronic scale to the nearest 0.01 kg. Height was measured by a portable stadiometer to the nearest 0.1 cm. A flexible and inelastic tape was used to measure waist circumference (WC) and hip circumference (HC). Three measurements of WC and HC were obtained to compute the mean values. Body Mass Index (BMI) was calculated based on a ratio between body weight and height: $BMI = \text{weight (lb)}/\text{height (inches)} \times 703$. Actual body weight was categorized into three types according to WHO and Asian American Diabetes Center [13, 14] the BMI cutoff points ($BMI < 18.5$, underweight; $18.5 \leq BMI \leq 23.9$, normal; $BMI > 24$, overweight).

Fasting Plasma Glucose (FPG), HbA1C—The participants’ medical records were reviewed and FPG, HbA1C were retrieved from the latest lab data within 90 days.

Hypertension, Diabetes, Heart disease, Stroke—The participants’ medical records were reviewed regarding obesity related diseases including hypertension, diabetes, heart disease and stroke.

Data Collection

The research nurses were oriented and continuously trained monthly to make sure the inter-rater and intra-rater reliability in anthropometric measures. The research nurses who were fluent in both English and Chinese interviewed each participant in person for data collection. All data collection was conducted in a private room in the community health center.

Data Analysis

Data analysis was performed with SPSS for windows (IBM SPSS Inc., 2013). Descriptive statistics (means, standard deviations for continuous variables and frequency distributions and proportions for categorical variables) were employed to describe the participants’ demographic and clinical characteristics. Chi-Squared tests for contingency tables and one-way analysis of variance (ANOVA) for continuous variables were used to compare the differences of obesity indicators and obesity related physical characteristics in three groups of different accuracy of body weight perception. For the continuous variables not in normal distribution, corresponding non-parametric method Kruskal-Wallis was used. Multiple regression analysis was used to examine the associations between accuracy of perception of body weight, obesity indicators and obesity related physical characteristics, controlling for

all demographic factors. All statistical tests were estimated at the 0.05 significance level (2-sided) and 95% confidence intervals (CI).

RESULTS

Demographic Characteristics of Participants

A total of 162 Chinese American were recruited from January to July 2012. Table 1 provided detailed information about participants' demographic characteristics. Among 162 participants, 32 participants had underestimation, that was, participants' perceived body weight was lighter than their actual body weight; 20 participants had overestimation, that was, their perceived body weight was heavier than their actual body weight; and 110 participants had consistent/accurate estimation that was, perceived body weight was consistent to their actual body weight.

Significant differences were found among participants in three groups of different accuracy of body weight perception in terms of gender ($p=0.003$), age ($p=0.003$), and education years ($p=0.047$). In the underestimation group, men had 2.34 times more odds than women to think that they were under the normal weight (OR=2.34, 95% CI 1.01–5.43). In the overestimation group, women had 3.59 times more odds to think that they were over the normal weight (OR=3.59, 95% CI 1.13–11.42). Participants in the overestimation group were significantly 13 years younger than participants in the underestimation group ($p=0.003$, 95% CI 4.07–23.27) and 14 years younger than participants in consistent/accurate estimation group ($p=0.007$, 95% CI 3.46–24.12). Participants in the underestimation group had significantly 3.2 less years of education than those in the overestimation group ($P=0.04$, 95% CI 0.11–6.21).

Obesity Indicators

The average BMI of participants was 24.3 (Mean + SD: 24.3 ± 3.9), waist circumference (WC) 84.3cm (Mean +SD: 84.3 ± 10.2), hip circumference (HC) 94.9cm (Mean +SD: 94.9 ± 9.1), waist/height ratio 51.7 (Mean +SD: 51.7 ± 5.9) and waist/hip ratio 0.89 (Mean +SD: 0.89 ± 0.07). Table 2 presented detailed information. Participants in consistent estimation group and underestimation group had similar WC HC and weight/height ratio, but much higher than the participants in overestimation group. For example, post-hoc test showed that participants in consistent estimation group had significantly 6.63cm larger WC ($p=0.019$, 95%CI 0.88–12.38), 5.54cm higher HC ($p=0.037$, 95%CI 0.26–10.63) and 3.88 higher weight/height ratio ($p=0.018$, CI 0.54–10.22) than the participants in overestimation group. Controlling for all demographic confounders, accuracy of perception of body weight continued to have significant relationships with obesity indicators. Accuracy of perception of body significantly predicted WC ($p<.001$), HC ($p<.001$), weight to height ratio ($p=0.001$), BMI ($p<.001$) and weight ($p<.001$).

Obesity related physical characteristics

For HbA1c, overestimation group had lower HbA1c (5.7 ± 0.4) than both consistent/accurate estimation (6.3 ± 1.0) and underestimation (6.5 ± 1.7) groups ($p=0.004$). Table 3 provided more detailed information. However, when controlling for demographic confounders,

accuracy of perception of body weight was no longer related to HbA1c. Accuracy of perception of body weight was also not related with obesity related diseases including hypertension and heart diseases.

Consistent estimation/Underestimation groups are Different from Overestimation group

Table 4 provided a brief summary of significant differences among 3 groups, controlling for all demographic confounders. Participants in the consistent estimation group and the underestimation group were similar in many characteristics such as age, education, WC, HC, weight to height ratio, but different from the participants in the overestimation group.

DISCUSSION

The results of this study added to the literature by assessing the concept of accuracy of body weight perception in Chinese American for the first time. The study compared the participant's participative perception of body weight to the objective measure of BMI which is a standard objective criterion for weight status. Exhausting literature review found that very limited studies have been reported regarding accuracy of body weight perception in adults and most available publications focused on adolescents [8, 15]. In our study, around thirty-two percent of Chinese American adults did not accurately rate their own weight status. The inaccurate rate (32%) in our study was higher than Albertan adults (17%) in the literature [16]. As to our best knowledge, no other publication was reported regarding body weight perception accuracy in Chinese American or Asian American groups, so we could not compare our findings with other Asian American groups. However, one third of the participants did not perceive their body weight status correctly could suggest that future studies for obesity management for Chinese American should examine how many patients have inaccurate perception of body weight, since perception of body weight status has been reported to be associated with efforts of losing weight and weight-related behaviors [6, 8].

Accuracy of body weight perception was found to be an interesting indicator for obesity in our study. Gender difference was obvious. Male Chinese Americans were more likely to underestimate their weights while female were more likely to overestimate their weights. Research reported that Chinese girls with normal weight were more likely to misperceive themselves as overweight, whereas more Chinese boys misclassified their normal weight status as underweight [17]. The gender difference of adult Chinese American in this study was similar as Chinese adolescents and also similar as other ethnic groups [16, 18]. However, gender difference of body weight perception was not suitable for all ethnic groups. In the American Third National Health and Nutrition Examination Survey study, both male and female underestimated their weight status among all Non-Hispanic European Americans, Non-Hispanic African Americans, and Mexican Americans [11]. The finding of this study suggests that obesity research studies for Chinese American should pay attention to gender difference. Intervention studies to lost weight might need to focus more on male gender since underestimated weight is associated with weight increase and is a risk factor for obesity. On the other hand, female Chinese Americans who tended to overestimate their weight heavier than their actual weights, might have higher risks for unhealthy weight control practice such as eating disorders [19] and need for different interventions.

In this study, younger Chinese Americans were more likely to overestimate their weight. Again, we could not compare our finding with others due to limited research on the relationships between age and accuracy of body weight perception. In general, if a young person overestimates the weight, the person is more likely to trying to lose weight. On the other hand, if an old person underestimates the weight, the person is more likely to have obesity. Though we could not compare our finding with other studies directly, one recent studies surveyed 125 old Chinese Americans aged 50–98 years and reported that old Chinese American adults living in NYC had a high prevalence of overweight and obesity (67%) [20] The association of age and perception of body weight in our study suggested that the elderly Chinese Americans, majority of whom was in the consistent estimation & underestimation group in our study, may need more targeted intervention to lost weight.

In Asian, BMI for overweight is defined as more than 23kg/m² and WC is defined as more than 85cm for men and 80cm for women for obesity [13, 21]. The BMI cut point for identifying Asian Americans for undiagnosed type 2 diabetes is also suggested to be 23 kg/m²[22]. In our study, all three body perception groups had higher BMI (≥ 23 kg/m²) and consistent estimation and under estimation group have higher WC (≥ 85 cm), indicating the need of intervention studies to lost weight for obesity in the Chinese Americans.

When examining the relationship between perception of body weight accuracy and obesity indicators, our study showed that the perception of body weight in Chinese Americans were significantly associated with obesity indicators including WC, HC, weight, BMI and weight to height ratio, even after controlling for all demographic confounders. In this study, participants in both consistent estimation group and underestimation group had significantly much higher WC, HC than those in overestimation group. Accordingly, future interventions might focus on educating Chinese Americans normal and obese WC&HC values to promote accurate perception of weight status, thus to improve the weight-related behaviors for this group.

HbA1C is an important blood test that shows how well diabetes is being controlled, which provides an average of the blood sugar control over the past 3 months [23]. While only 40% of the participants in the consistent group and 15% in the underestimation group had diabetes, medical record review showed an abnormal average HbA1C in the two groups. These findings suggest the need for education about HbA1C for majority of participants, especially for the participants in the underestimation group, since underestimated body weight was related to decreased efforts to lose weight. We did a literature search on pubmed.gov and could not find any studies reporting significant relationships between body weight perception and obesity related diseases. Though body weight is well-known to be related to obesity related physical disease such as hypertension, heart disease etc, our study did not find any associations between perception of body weight and obesity related diseases.

In examining the accuracy of body weight perception, many studies categorized participants into two groups only [6–8, 16], “accurate/consistent perception” and “not accurate/consistent perception”. The findings of this study showed big differences between underestimation group and overestimation group. Future studies in examining accuracy of

body weight perception should separate different inaccurate perception of body weight groups. Participants in the overestimation group in his study had better obesity-related values and characteristics in general, so the obesity management studies for Chinese Americans might target on both consistent estimation and underestimation groups.

Limitations

There are several limitations in the study. First, the sample size of this study (162 participants) was small compared to epidemiological surveys. Given Chinese American was a minority population and usually very small sample size could be identified in national surveys in USA, the findings of this study should be able to help understanding obesity in this population. Second, the small groups with underestimation and overestimation do reduce power, but the analysis approaches (chi-square, oneway ANOVA, and Kruskal-Wallis) in this study do not assume equal group sizes and a number of significant associations are identified. Third, we did not examine “trying to lost weight” in this study, which was reported to be related to accuracy of body weight perception in the literature, future research studies should include this variable among Chinese Americans.

Conclusions

As the first study to examine the accuracy of body weight perception in Chinese Americans, the study identified around one third of Chinese American did not perceive their body weight correctly. The study also found that accuracy of body weight perception was associated with several demographic factors including gender, age, education, obesity related indicators such as WC, HC, weight to height ratio, and BMI. The study could lay a good foundation for future possible intervention studies for obesity management in the minority group of Chinese American.

Acknowledgments

This research was supported by a research grant awarded by NYU Pless Center of Nursing Research, Association of Chinese American Physicians, and the National Institute of Health (NIMHD Project # P60 MD000538-03). Its contents are solely the responsibility of the authors and do not necessarily represent the funders. The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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Table 1

Demographic Characteristics of Participants

Total Sample N=162	Total N=162	Consistent estimation group: perceived body weight was <u>CONSISTENT</u> to their actual body weight N=110	Underestimation group: perceived body weight was <u>LIGHTER</u> than their actual body weight N=32	Overestimation group: perceived body weight was <u>HEAVIER</u> than their actual body weight N=20	P value
		n (%)	n (%)	n (%)	
Gender					
Male	78 (48.1%)	52 (32.1%)	22 (13.6%)	4 (2.5%)	0.003**
Female	84 (51.9%)	58 (35.8%)	10 (6.2%)	16 (9.9%)	
Primary Language					0.166
English	16 (10.1)	9 (5.7%)	2 (1.3%)	5 (3.2%)	
Mandarin	82 (51.9)	62 (39.2%)	13 (8.2%)	7 (4.4%)	
Cantonese	53 (33.5)	31 (19.6%)	15 (9.5%)	7 (4.4%)	
Other	7 (4.4)	5 (3.2%)	1 (0.6%)	1 (0.6%)	
Speaking English at Home	52 (32.1)	34 (21%)	9 (5.6%)	9 (5.6%)	0.400
Marital Status					0.300
Married/partner	120 (74.1%)	85 (52.5%)	23 (14.2%)	12 (7.4%)	
Single/separated/divorced	25 (15.4%)	15 (9.3%)	4 (2.5%)	6 (3.7%)	
Widowed	17 (10.5%)	10 (6.2%)	5 (3.1%)	2 (1.2%)	
Residence status					0.454
Home alone	36 (22.2%)	26 (16.0%)	4 (2.5%)	6 (3.7%)	
Home family	124 (76.5%)	83 (51.2%)	27 (16.7%)	14 (8.6%)	
Assisted living	2 (1.2%)	1 (0.6%)	1 (0.6%)	0 (0.0%)	
Employment status employed	74 (45.7)	50 (30.9%)	13 (8.0%)	11 (6.8%)	0.597
	Mean±SD *	Mean±SD *	Mean±SD *	Mean±SD *	
Age	58.2±17.2	59.7±17.2	60.8±14.7	46.1±16.7	0.003**
Years in Education	12.6±4.6	12.8±4.6	11.2±4.4	14.4±3.9	0.047**

Total Sample N=162	Total N=162	Consistent estimation group: perceived body weight was <u>CONSISTENT</u> to their actual body weight N=110	Underestimation group: perceived body weight was <u>LIGHTER</u> than their actual body weight N=32	Overestimation group: perceived body weight was <u>HEAVIER</u> than their actual body weight N=20	P value
		n (%)	n (%)	n (%)	
Years lived in the US	22.4±13.9	22.4±14.1	22.8±12.3	22.0±15.7	0.977

* mean±standard deviation (SD)

** indicates significant difference among three body size perception groups

Table 2

Obesity indicators in Chinese American

Total Sample N=162	Total N=162	Consistent estimation group: perceived body weight was CONSISTENT to their actual body weight N=110	Underestimation group: perceived body weight was LIGHTER than their actual body weight N=32	Overestimation group: perceived body weight was HEAVIER than their actual body weight N=20	Bivariate P value [#]	Adjusted P value ^{##}
	Mean±SD [*]	Mean±SD [*]	Mean±SD [*]	Mean±SD [*]		
Weight (lb)	143.4±29.9	145.9±30.9	140.1±26.5	135±28.5	0.277	<.001 ^{***}
Body Mass Index (BMI)	24.3±3.9	24.7±4.0	23.6±3.9	23.1±2.7	0.120	<.001 ^{***}
Waist circumference (cm)	84.3±10.2	85.2±10.1	85.0±10.2	78.5±8.7	0.024 ^{***}	<.001 ^{***}
Hip circumference(cm)	94.9±9.1	95.9±9.7	94.3±8.7	90.4±4.5	0.044 ^{***}	<.001 ^{***}
Waist/hip ratio	0.89±0.07	0.89±0.06	0.90±0.06	0.87±0.09	0.240	0.396
Weight/height ratio	51.7±5.9	52.2±5.9	51.9±6.1	48.4±4.2	0.024 ^{***}	0.001 ^{***}

* mean±standard deviation (SD)

*** indicates significant difference among three body size perception groups

indicates ANOVA or Kruskal-Wallis analysis without controlling for other variables

indicates multiple regressions are done to control for demographic variables

Table 3

Obesity related physical characteristics in Chinese American

Total Sample N=162	Total N=162	Consistent estimation group: perceived body weight was <u>CONSISTENT</u> to their actual body weight N=110	Underestimation group: perceived body weight was <u>LIGHTER</u> than their actual body weight N=32	Overestimation group: perceived body weight was <u>HEAVIER</u> than their actual body weight N=20	Bivariate P value [#]	Adjusted P value ^{##}
	Mean±SD*	Mean±SD*	Mean±SD*	Mean±SD*		
Glycosylated hemoglobin [HbA1C]	6.2±1.2	6.3±1.0	6.5±1.7	5.7±0.4	0.004**	0.333
Fasting Plasma Glucose (FPG)	105.2±46.9	104.5±41.6	115.2±69.8	92.7±21.6	0.177	0.166
Diabetes	n (%)	n (%)	n (%)	n (%)		
	106 (65.4)	72 (44.4)	24 (14.8)	10 (6.3)	0.183	0.643
Hypertension	76 (46.9%)	55 (34%)	17 (10.5%)	4 (2.5%)	0.035**	0.524
Heart disease	25 (15.5%)	16 (9.9%)	5 (3.1%)	4 (2.5%)	0.833	0.624
Stroke	4 (2.5%)	3 (1.9%)	0 (0%)	1 (0.6%)	0.503	0.504

* mean±standard deviation (SD)

** indicates significant difference among three body size perception groups

indicates ANOVA or Kruskal-Wallis analysis without controlling for other variables

indicates multiple regressions are done to control for demographic variables

Table 4
Summary of significant differences among three groups of accuracy of body weight perception

Significant different variables	Consistent estimation group: perceived body weight was <u>CONSISTENT</u> to their actual body weight N=110	Underestimation group: perceived body weight was <u>LIGHTER</u> than their actual body weight N=32	Overestimation group: perceived body weight was <u>HEAVIER</u> than their actual body weight N=20
Gender	Similar percentage of Male and female [#]	More male [#]	More female [*]
Age	59.7 (older)	60.8 (older)	40.1 (younger)
Education years	12.8 (less education)	11.2 (less education)	14.4 (more education)
Waist circumference (cm)	85.2 (abnormal)	85.0 (abnormal)	78.5 (normal)
Hip circumference (cm)	95.9 (bigger)	94.3 (bigger)	90.4 (smaller)
Weight (lb)	145.9±30.9 (heavier)	140.1±26.5 (heavier)	135±28.5 (lighter)
BMI	24.7±4.0 (overweight) &	23.6±3.9 (overweight) &	23.1±2.7 (overweight) &
Weight/height ratio	52.2±5.9 (bigger)	51.9±6.1 (bigger)	48.4±4.2 (smaller)

[#] Orange color means “caution”

^{*} Green color means “good”

& Based on WHO obesity criteria for Asians.