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Validity of self-reported weight - A study of urban brazilian adults*

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SCHMIDT, M.I. et al. Validity of self-reported weight - A study of urban brazilian adults. *Rev. Saúde Pública*, 27: 271-6, 1993. In order to evaluate the validity of self-reported weight for use in obesity prevalence surveys, self-reported weight was compared to measured weight for 659 adults living in the Porto Alegre county, RS Brazil in 1986-87, both weights being obtained by a technician in the individual's home on the same visit. The mean difference between self-reported and measured weight was small (-0.06 +/- 3.16 kg; mean +/- standard deviation), and the correlation between reported and measured weight was high (r=0.97). Sixty-two percent of participants reported their weight with an error of < 2 kg, 87% with an error of < 4 kg, and 95% with an error of < 6 kg. Underweight individuals overestimated their weight, while obese individuals underestimated theirs ($p<0.05$). Men tended to overestimate their weight and women underestimate theirs, this difference between sexes being statistically significant ($p=0.04$). The overall prevalence of underweight (body mass index < 20) by reported weight was 11%, by measured weight 13%; the overall prevalence of obesity (body mass index ≥ 30) by reported weight was 10%, by measured weight 11%. Thus, the validity of reported weight is acceptable for surveys of the prevalence of ponderosity in similar settings.

Keywords: Obesity, epidemiology. Body weight. Validity.

Introduction

Self-reported weight, if accurate, can be very useful in public health studies, obviating the need for in the field weight measurements. However the validity of this information has not been uniformly accepted[6,8,9,11,13,14].

A literature search covering the last ten years revealed no study evaluating the accuracy of self-reported weight in an adult Brazilian population.

The purpose of this study is to evaluate the validity of reported personal weight in a survey of 659 adults living in Porto Alegre, RS, in 1986-87, by comparing the self-reported weight with a measured weight, both obtained in the individual's household during the same interview.

Methodology

Data were collected in the Porto Alegre county (Brazil) as part of a Pan-American Health Organization multicenter study of non-communicable disease risk factors[10]. The methodology used in this study has been reported in greater detail previously[3]. In brief, a sample of 1,157 men and women between 15 and 64 years of age were interviewed in 1986 and 1987 in randomly selected households in selected census zones of the city.

Weight was measured during the chronological second half of the data collection. During this period, 699 individuals were interviewed. Of these, 39 did not have a self-reported weight, and one did not have his height recorded. Thus, analysis here were performed on the remaining 659 individuals. Small differences in the total number of individuals in categories of race and educational level reflect two missing values for each of these variables.

Educational achievement, measured by the number of grades completed, was categorized on the basis of Brazilian educational levels. Race was assessed by the interviewer and, for the purposes of this study, the categories of black and "mulato" (a mixed white and black appearance) were grouped together as black.

Weight was always self-reported before being measured. Measurement was performed to the nearest kilogram using a portable bathroom scale with individuals dressed lightly with shoes removed; height was assessed to the nearest centimeter using a metallic tape. Scales were regularly calibrated according to a pre-established protocol. Categories of ponderosity were defined using a

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recommended[2,5,15] body mass index (BMI: weight in kilograms/height in meters squared) cutpoints of underweight (BMI < 20), normal (20 < = BMI < 25), overweight (25 <= BMI < 30), and obese (BMI > 30).

Error in the reporting of weight was calculated as the difference between self-reported and measured weight, negative differences thus representing underestimation and positive differences overestimation. The statistical significance of these differences was tested by paired t-tests. The correlation of self-reported weight with measured weight was expressed using Pearson's correlation coefficient[1]. The association of various factors with under and overreporting of weight was evaluated through multiple linear regression modelling of the differences between reported and measured weight as a function of these factors[7].

Error in the classification of individuals as underweight, overweight and obese on the basis of self-reported weight was evaluated through contingency tables comparing self-reported weight with measured weight classifications. The sensitivity and specificity of using self-reported weight in this process was calculated along with appropriate confidence intervals[4]. Sex-specific linear regressions were used to evaluate the degree to which true (measured) weight can be predicted on the basis of reported weight[7].

Results

As seen in Table 1, 62% of the 659 individuals studied were women, slightly more than half under 35 years of age, 72% white, and most with either a primary or secondary school educational achievement. Thirteen percent were underweight, 48% of normal ponderosity, 28% overweight and 11% obese.

The overall comparison of self-reported and measured weight (Table 1, bottom) showed the two measurements to be remarkably similar. The mean of the differences between the weights obtained by the two techniques was -0.06 kg, with standard deviation of 3.16 kg. The correlation between the two, for the whole sample, was r=0.97.

Figure 1 illustrates the overall distribution of the differences between self-reported and measured weight. Approximately 62% of the sample reported their weight with an error of less than 2 kg. The largest underreporting overall was 28 kg (1 case, a 54 - year old, obese woman); the largest overreporting 12 kg (1 case, a 54 - year old, overweight woman). But large differences were rare. In fact, only 13% of the sample reported differences equal to or greater than 4 kg, and only 5% differences equal to or greater than 6 kg.

Table 1 also presents comparisons of self-reported and measured weight across categories of

Table 1. Difference between self-reported (SW) and measured weight (MW).

Characteristics of Individuals		N	%	SW - MW Mean	Correlation Coeficient (r)
Sex	Men	254	38	0.30+	0.98
	Women	405	62	-0.29+	0.95
Age (years)	15 a 24	133	20	-0.25	0.94
	25 a 34	232	35	0.15	0.98
	35 a 44	144	22	-0.21	0.98
	45 a 54	90	14	0.05	0.93
	55 a 64	60	9	-0.30	0.96
Race	Black	185	28	0.27	0.94
	White	472	72	-0.08	0.98
Educational Attainment					
	< 1 year	50	8	-0.70	0.88
	1 - 8 years	287	44	-0.14	0.97
	7 - 12 years	245	37	0.09	0.98
	> 12 years	75	11	0.20	0.99
Ponderosity					
	Underweight	87	13	1.21*	0.93
	Normal	313	48	0.11	0.94
	Overweight	187	28	-0.49+	0.93
	Obese	72	11	-1.26*	0.93
Overall		659	100	-0.06	0.97

+ $p < 0.1$; * $p < 0.05$

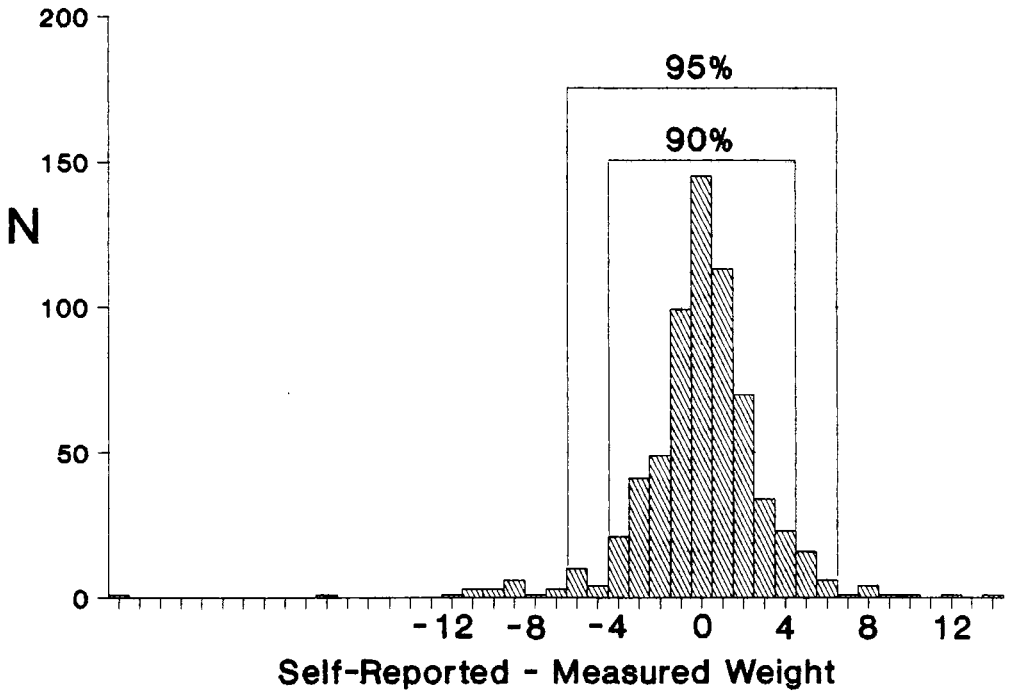

Figure 1. Frequency of the difference between self-reported and measured weights. The frequency of the boxed portions of the distribution is indicated above each box.

sex, age, race, educational attainment, and ponderosity. Correlations between self-reported and measured weight are high in all categories considered, ranging from 0.88 to 0.99. Examining the differences between self-reported and measured weight, one finds very similar results for men and women, perhaps with a small tendency for men to overreport (mean = 0.30 kg, $p < 0.1$) and for women to underreport (mean = -0.29 kg, $p < 0.1$) their actual weight. Even smaller differences are found across age and race categories. Greater differences are found when examining the data across educational and ponderosity categories, although statistically significant differences were found only for the latter. Underweight individuals overreport their weight on average 1.2 kg ($p<0.05$); overweight individuals tend to underreport their weight on average 0.5 kg ($p<0.1$), and obese individuals underreport their weight by 1.3 kg ($p < 0.05$).

As men and women, in general, err in different directions in their reporting of weight, as do underweight as compared to overweight individuals, mean differences between reported and measured weight were calculated separately for men and women by ponderosity category. Among men, the underweight overreported their weight by 1.2 kg, those with normal ponderosity by 0.42 kg, and the overweight by 0.22 kg, while obese men underreported their weight by 1.4 kg. Among women, the underweight overreported their weight by 1.2 kg, while those with normal poderosity underreported their weight by 0.07 kg, the overweight by 1 kg and the obese by 1.2 kg.

In multiple linear regression modelling of weight difference, after controlling for measured weight, only height, age and sex associated with significantly altered reported weight. In this model, for each centimeter of height, the difference between reported and measured weight was 0.05 kg greater ($p<0.01$); for each year of age 0.02 kg greater ($p=0.02$). Males reported a weight 0.67 kg lower than that reported by females ($p=0.04$). Neither race, educational achievement nor second-order interaction terms were significantly associated with discrepant reported weight in these analysis.

Figure 2 demonstrates the distribution of differences between self-reported and measured weight across categories of ponderosity. Consistent with the data in Table 1, this figure shows that the lean overreport their weight while the overweight underreport theirs. Additionally, the figure shows that the larger absolute differences tended to be reported by the overweight and the obese.

In order to evaluate the error associated with self-reported weights for the classification of individuals in different categories of ponderosity, sensitivity and specificity were evaluated using meas-

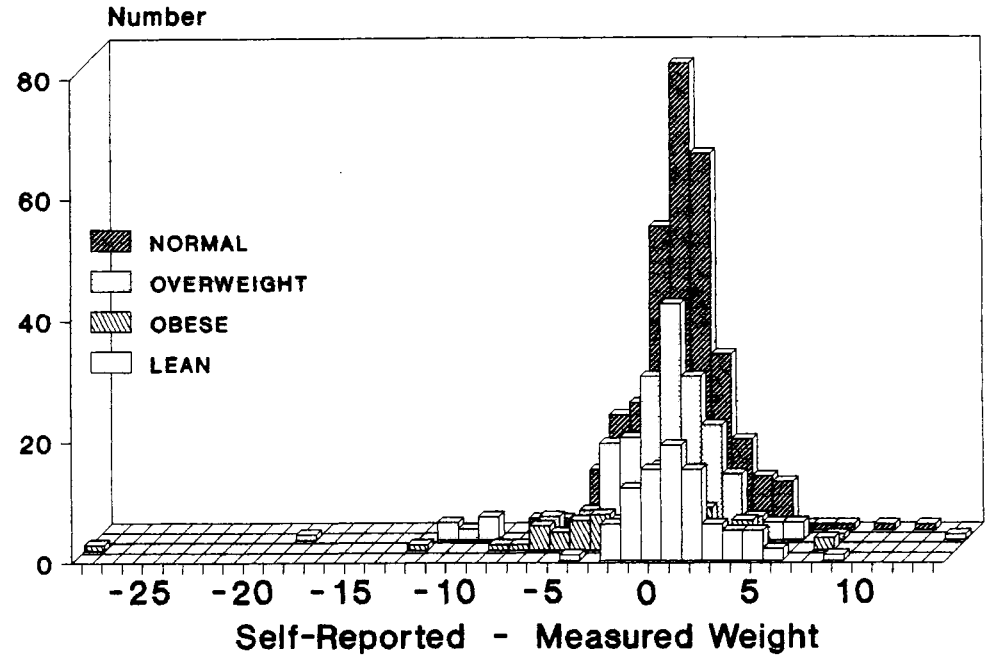

Figure 2. Frequency of the difference between self-reported and measured weights in different categories of ponderosity.

ured weight as a gold standard. Table 2 shows that the error was small and had as a main effect the generation of lower sensitivity indices.

Sensitivity was the lowest for the underweight classification - 28% of those underweight by measurement were not so by reported weight. False positive rates were very low for all categories, as indicated by the high specificity seen.

Table 2. Validity of self-reported weight for the classification of different degrees of ponderosity, using measured weight as the gold standard.

Category	Sensitivity			Specificity		
	%	95% CI		%	95% CI	
Underweight	72	(63	81)	97	(96	98)
Overweight*	89	(85	93)	97	(95	99)
Obese	87	(79	95)	99	(98	100)

* Category of overweight an obese combined.
95% CI = 95% confidence interval.

Table 3. Prevalence of categories of ponderosity according to self-reported and measured weight.

Category	Prevalence Based on Self-reported Weight %	Prevalence Based on Measured Weight %
Underweight	11	13
Normal	52	48
Overweight	27	28
Obese	10	11

To evaluate the impact of these false negative and false positive rates in the estimation on the frequency of ponderosity categories, Table 3 compares prevalences calculated using self-reported weight with those determined using measured weight. As was to be expected, given the fact that the sensitivities were considerably lower than the specificities, the net result was one of underestimation of the frequency of abnormal poderosity. The effect was small, 1-2%, for the abnormal categories.

Measured weight was predicted, in women, by the equation: Measured weight (kg) = 2.10 + 0.97 reported weight (kg) with R^2=0.95. In men, the equation was: Measured weight (kg) = -0.58 + 1.00 reported weight (kg), with R^2=0.98. In these sex-specific models, no other factor significantly predicted measured weight.

Discussion

The validity of self-reported weight of adults 15-64 years living in Porto Alegre, Brazil, in 1986-7, appears to be very similar to that reported for adults living in the United States and Finland[6,8,9,11,13,14]. Although comparability between studies is somewhat limited by differences in

study design or analysis, the following statements can be made. In this study, differrences between reported and measured weight greater than or equal to 4 kg were seen in 13% of the sample, compared with 11% in the Finnish study[6]. In the Porto Alegre study, differences greater than or equal to 2 kg occurred in 38% of the sample, and greater than or equal to 3 kg in 22%, in comparison with differences greater than or equal to 5 lbs (2.3 kg) in 37% of the Minnesota Lipid Research Clinic[11] sample. The remaining studies[8,9,13,14] either were not population-based or did not report data on the distribution of these differences.

In a society where few homes possess a weight-scale, this finding of relatively similar accuracy of weight reporting may be in part explained by widespread use of drug store scales, and, perhaps to a lesser extent, to fairly frequent medical contact in Porto Alegre.

It is also important to note that these data, collected in households at the same moment in time, derive from a community-based study rather than from one with a more restricted base, such as that of participants or volunteer potential participants in clinical studies or of applicants for life insurance[6,8,9,11,13,14]. Thus, it is less likely that the participants in this study would have specific reasons for misrepresenting their own weight or having unusually recently measured it, or that their weight should have changed during the time lapse that occurred between its report and measurement.

Before discussing the implications of the differences encountered between self-reported and measured weight, it is important to note their potential causes. The cause could be a problem of knowledge, that is to say, the person does not know his current weight. Or the problem could be related to the person's body image. Here, regardless of how regularly or accurately he measures his weight, the person erroneously forms an idea of his weight in accordance with an internally desired body image. Finally, the problem could be at the level of weight reporting - even a person with accurate knowledge, consistent with his body image, may be led by factors such as cultural norms or personal psychological needs to report his weight inaccurately to an interviewer.

The finding here presented - that self-reported weight is biased towards what appears to be a culturally ideal or a desirable body weight - is also consistent with the literature[6,8,9,11,13,14]: overweight individuals underreport while underweight individuals overreport their body weight. Whether the bias occurs at the level of body image, or at that of reporting, cannot be safely judged from this study nor from the previous ones. However, it is unlikely that mere differences in acquired knowledge of measured weight can explain the differential biases seen here by sex and ponderosity category. The fact that men tended to overreport their weight while women to underreport theirs probably reflects gender specificity in cultural ideals of weight, be they acting at the level of body image or misreporting. In this regard, results here are similar to those of the Lipid Research Clinic population in the USA[11]. Notably however, women in the USA sample tended to underreport across all categories of ponderosity, whereas in Porto Alegre, this underreporting occurred in significantly only for the overweight and the obese. This difference may well reflect some cross-cultural variation in the concept of "ideal weight".

Other factors associated with discrepancy in self-reported weight, consistent with the literature, were height and age. These associations were of smaller magnitude: for example, for each decade increase in age, overreporting increased by 0.2 kg; for each 10 cm increase in height, 0.5 kg.

What are the implications of these findings for field studies conducted in similar settings? If the purpose of such a study is to estimate the weight of groups of individuals, error in population weight parameter estimates should be small. Furthermore, it is possible to use the equations here presented to adjust the self-reported weight. Similarly, if the purpose is to describe prevalences of categories of ponderosity based on self-reported weight, the error in underestimation should also be small. It is possible to use the sensitivity and specificity here presented to produce an adjusted prevalence for each ponderosity category [12].

It must be noted, however, that these data do not address the effect or weight mis-reporting in analysis whose objective is to evaluate the association of weight with other variables.

Finally, it was concluded that the validity of self-reported weight is sufficient to permit its use in surveys of the prevalence of obesity and other weight categories in settings similar to the one here studied.

SCHMIDT, M.I. et al. [Validade do peso auto-referido. Estudo de população urbana de adultos, Brasil]. *Rev. Saúde Pública*, 27: 271-6, 1993. Para avaliar a validade do peso auto-referido em inquéritos de prevalência de obesidade, o mesmo foi comparado com o peso medido de 659 adultos, residentes em Porto Alegre, RS, Brasil, em 1986-87. Ambos os pesos foram obtidos por entrevistador, na casa do participante, na mesma ocasião. A média das diferenças entre peso auto-referido e peso medido foi pequena (-0,06 +/-3,16 kg; média +/- desvio padrão) e a correlação entre eles alta (r=0,97). Sessenta e dois por cento dos participantes referiram seu peso com erro < 2 kg, 87% com erro menor do que 4 kg e

95% com erro < 6 kg. Indivíduos de baixo peso hiperestimaram seu peso, o oposto ocorrendo com indivíduos obesos (p<0,05). Os homens tendiam a superestimar seu peso, o oposto ocorrendo com as mulheres (p=0,04). A prevalência geral de baixo peso (índice de massa corporal (IMC) < 20) por peso auto-referido foi de 11% e a por peso medido, de 13%; a prevalência geral de obesidade (IMC ≥ 30) por peso referido, foi de 10% e a por peso medido, de 11%. Concluindo, a validade do peso auto-referido é aceitável para inquéritos de prevalência realizados em contextos similares.

Descritores: Obesidade, epidemiologia. Peso corporal. Validez.

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