Original article

Validation of self-reported weight among users of the Belo Horizonte Health Fitness Center Program, Minas Gerais, Brazil, 2017*

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Abstract

Objective: to validate self-reported body weight of Programa Academia da Saúde (PAS) users in Belo Horizonte, MG, Brazil, and to identify factors associated with weight error. **Methods:** self-reported body weight, obtained by telephone interview, was compared to measured weight; we used Student's t-test, ANOVA, Lin's concordance correlation coefficient, the Bland-Altman method and Kappa coefficient; women's self-reported weight was corrected according to measured weight using multiple regression. **Results:** 441 users participated; weight self-reported by men was valid (error=0; p=0.15); overweight classification concordance was 94.3% (Kappa=0.88); errors were greater in the case of self-reported weight by women over 30 years old and overweight women (-0.8kg; error≠0; p<0.01); after correction using multiple regression, self-reported weight validity was satisfactory (error=0; p=0.99). **Conclusion:** self-reported weight of men can be used for research and health surveillance, but for women correction is required.

Keywords: Body Weight; Validation Study; Health Programs and Plans; Self Report.

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Introduction

Growing prevalence of excess weight, obesity and other noncommunicable chronic diseases (NCDs) have a heavy impact on Public Health and highlight the importance of studies of the population's nutritional status.[1]

Self-reported measurements of body weight are frequently used due to the convenience and low cost of obtaining information, whether by telephone or by online questionnaire.[2-5] Their use, however, is subject to greater error than measurements taken by examiners.[4] Be that as it may, above all it is important to analyze the validity of self-reported information.[3,6]

> ***Self-reported measurements of body weight are frequently used due to the convenience and low cost of obtaining information, whether by telephone or by online questionnaire.***

Although several studies have shown the validity of self-reported weight,[4-11] the quality of this information has not yet been investigated among health service users who routinely participate in initiatives such as the Health Academy Program - HAP (Programa Academia da Saúde, PAS, in portuguese) a Primary Healthcare service of National Healthcare System (in portuguese: Sistema Único de Saúde, SUS) aimed at health promotion and health care, especially for patients with NCDs.[12] People who use PAS have peculiar characteristics such as apparently being more disposed to looking after their health and taking part in six-monthly checkups, including having their weight measured. These aspects can interfere directly in reporting of body weight, resulting in more precise measurements.[13]

Valid body weight measurements self-reported by PAS users can contribute to epidemiological studies being conducted in a simpler and less costly manner, enabling greater agility and efficiency in longitudinal monitoring of health service users and surveillance by telephone of those who stop using the service. Self-reporting of weight can reduce the need for human resources, time and equipment, favoring the sustainability of health surveillance actions.[3,4,11]

The objective of this study was to validate self-reported body weight of users of the Programa Academia da Saúde - PAS – and to verify factors associated with errors in self-reported weight.

Methods

A validation study was conducted in order to compare self-reported body weight information with measured body weight of PAS users in Belo Horizonte, in the state of Minas Gerais, Brazil.[14]

The data were obtained by means of a community randomized controlled trial (CRCT), conducted between March 2013 and March 2018, with the objective of performing nutritional intervention and assessing its effectiveness. Further details of this research can be found in Menezes et al.[14] We used baseline sociodemographic and height data gathered at the CRCT (time 0 – 2013/2014), body weight measurements obtained through telephone interviews (carried out 36 months after baseline – 2016/2017) and then validated in face-to-face interviews. Landline and cell telephone numbers were obtained during the baseline interviews.

The study was conducted in the context of the PAS. This program has infrastructure, equipment and qualified professionals. In Belo Horizonte, the program's units offer guided physical exercise and health promotion, maintenance and recovery actions in partnership with the Family Health Strategy .[15] The PAS was chosen as the scenario for the study because it is an important element of the Chronic Diseases Care Network and is a privileged space for developing interventions to promote healthy lifestyles, in addition to its health surveillance potential.[16]

Forty-two out of the fifty PAS units operating in the municipality at the time the study began were considered eligible for the sample. The inclusion criteria for the participating units were: not having been involved in food and nutrition studies in the last 24 months; and being located in areas with a medium or high health vulnerability index (HVI), prioritized for having this service in the municipality. HVI is an indicator comprised of socio-economic and environmental variables. It ranges from 0 to 1: the higher the score, the greater health vulnerability is. Risk is classified as being very high, high, medium or low.[17]

The participating units were selected by sampling by clusters. Sampling was stratified in each of Belo Horizonte's nine administrative regions. Two units were randomly selected in each geographic stratum, resulting in a total of 18 (42.8%) participating units, considered to be representative of the municipality's medium, high and very high HVI units, with a 95% confidence interval and error of less than 1.4%, calculated *a posteriori*.[14]

At each selected PAS unit all service users aged 20 or over who had regularly attended the service activities during the last month (attending at least one lesson) were invited to take part in the study. The exclusion criteria were (i) being pregnant and (ii) having a disability making it impossible to answer the interview questions.[14]

All participants with telephone numbers recorded at baseline were contacted for CRCT reassessment. Four attempts were made to call each available telephone number on different days (Monday to Saturday) and at different times (morning, afternoon and night). The interview could also be arranged for a specific time depending on the service user's needs. If contact was not made after four attempts (telephone unavailable or busy or calls directed to the message box), the research team checked the PAS registry to see if there was another contact number and, if there was, a further four attempts were made. If there was no answer the user was excluded from the study.

The research team interviewed 2,371 users by telephone and 15% of them were selected to take part in the self-reported body weight validation study. The sample was calculated based on previous validation studies,[7,8] with the aim of achieving a 95% data confidence level, capable of representing the PAS users attending the units participating in the study and enabling validation of self-reported weight. The sample was stratified for each PAS unit in the study according to user attendance at the service (attending at least one lesson in the last month), sex (female; male), age range (in years: 20-29; 30-59; 60 or over) and nutritional status (low weight/good nutrition; overweight/obesity]).[18,19] The random selection of the sample was performed so as to contain, when possible, two people in each established class, with the aim of minimizing possible bias in self-reported answers in relation to the characteristics of the participants. The sample power was 99%, calculated *a posteriori*.

Random selection of sample participants was done with the aid of an online program (www.sorteiador.org). If a user refused to take part, was not contacted after three telephone call attempts or did not attend three appointments, they were replaced by means of a new draw using the same stratum.

Data were collected face-to-face at time 0, and at face-to-face validation at the user's registered PAS unit; as well as by telephone interview 36 months after initial assessment.

The following baseline (time 0) variables were used:

a) sex (male; female);
b) age (in years);
c) schooling (in years of study);
d) marital status (married/common law marriage; separated/single/widowed);
e) occupation (retired/pensioner, unemployed; housewife; other); and
f) self-assessment of health (very poor/poor/regular; good/very good).[14]

Height was measured a single time using a portable Alturexata® stadiometer (up to 220cm, 0.5cm precision); and body weight was measured using Marte® PP 180 digital weighing scales (up to 180kg, 100g precision). The scales were placed on a level surface and participants were weighed without their shoes and wearing light clothes.[20]

During the telephone interview at 36 months after baseline, participants were asked about their attendance at PAS activities ("*Do you still attend the Health Fitness Center Program?*") and self-reported body weight ("*What is your current weight?*").

At the face-to-face validation stage the following data were collected: recent attempts to lose weight since the last study assessment (yes; no); and body weight measured using the same procedures as at baseline.

Multiple linear regression was used to estimate corrected body weight of women, based on a formula that considered the characteristics associated with error in self-reported weight. This included information on baseline nutritional status, age and self-reported weight during the telephone interview. The characteristics of each participant were multiplied by the coefficients obtained through multiple linear regression, added together in order to obtain the corrected measurement. Measured body weight – at the face-to-face data validation interview – and height – measured at database – were used to obtain the measured body mass index (BMI):

$_{\text{measured}}$BMI = measured weight at validation (kg)/ height measured at baseline (m)^2

Classification as 'overweight' (yes; no) was done in a differentiated manner, according to the age of the participants: adults (20-59 years) with overweight= BMI≥25kg/m^2; and elderly (60 years or over) with overweight = BMI≥27kg/m^2.[18,19]

BMI was also calculated using self-reported weight ($_{\text{self-reported}}$BMI = self-reported weight [kg]/height measured at baseline [m]²) and corrected weight ($_{corrected}$BMI = corrected weight [kg]/ height measured at baseline [m]²), always using height measured at baseline.

The data were collected by Nutrition course undergraduates and health professionals, trained beforehand to use the instruments and conduct the interviews, under the guidance of a field supervisor and the principal investigator. Training courses were held every six months with the entire team, field manuals and data collection logistic were developed for different moments of the study.[14]

During face-to-face data collection, data consistency was checked by the field supervisor who gave the questionnaire back to the interviewer in cases of inconsistency. During data collection by telephone, the supervisor reviewed the answers and accompanied the telephone calls.

The analyses were performed in two stages. In the first stage, we identified the sociodemographic and health characteristics of individuals with the biggest errors between self-reported weight and measured weight. Self-reported data was then corrected when necessary. All tests were performed using the Data Analysis and Statistical Software (Stata) version 14.0 taking a 5% ($p<0.05$) significance level.

The Kolmogorov-Smirnov normality test was used to verify distribution of the numerical variables and the data were presented in the form of averages and 95% confidence intervals (95%CI); except for the time interval between interviews, which was presented in the form of medians and interquartile ranges (p25-p75). The participants' sociodemographic and health characteristics were presented according to frequency distribution.

When analyzing the data, individuals were removed who had very large differences between measured weight and self-reported weight, i.e. those above the third quartile or below the first quartile, based on the Interquartile Range [IQR] method.[21] This information was later corrected.

The following were calculated to validate the data: variation in self-reported weight and measured weight errors (error = self-reported weight – measured weight); and variation in erros analized according to participant characteristics.

Student's paired t test was used to check for differences between self-reported weight and measured weight; and Student's t test for single samples was used to check whether average weight error was equal to zero. The ANOVA analysis model was used to compare average weight error according to participant characteristics (age; schooling; occupation; marital status; self-assessment of health; previous attempts to lose weight; nutritional status).

Following this, multiple linear regression (MLR) was applied in order to identify characteristics associated with weight error. The tested variables were input to the model in blocks in the following order: sociodemographic characteristics (age; occupation; schooling; marital status); general characteristics (participation in the PAS; self-assessment of health); and characteristics related to weight (nutritional status; satisfaction with weight; previous attempts to lose weight). Variables associated with weight error ($p<0.05$) were input to a MLR model in order to estimate corrected weight. With the aim of checking the quality of the models, the variance inflation factor (VIF) test was performed to remove the possibility of multicollinearity between independent variables. Residue normality, homoscedasticity and independence analyses were also performed.

Concordance between the two information sources – self-reported weight and measured weight – was assessed using Lin's concordance correlation coefficient (CCC).[22] The method proposed by Bland & Altman[23] was used to identify errors and differentiation patterns between self-reported values and measured values. The Kappa concordance index was used to verify differences between classification of overweight for (i) self-reported versus measured body weight and (ii) corrected versus measured body weight.

The study was conducted in accordance with the norms for research involving human beings after having been submitted to and approved by the Federal University of Minas Gerais Research Ethics Committee (COEP/UFMG) – 0537.0.0203.000-11; 52683916.0.0000.5149 – and the Belo Horizonte City Hall Research Ethics Committee – 0537.0.0203.410-11A; 52683916.0.3001.5140. All participants were informed about the study and signed a Free and Informed Consent form.

Results

Validation data collection took place in an interval of no more than two months (2016-2017) following the telephone interview (average interval = 23.2 days [95%CI 22.4;24.1]). There was no relationship between weight error and time interval between obtaining self-reported and measured weight ($p=0.94$). This validation study found a predominance of female participants (85.7%), participants in the 30-59 year age group (54.2%), with

9-11 years of schooling (30.8%), men and women who were retired or pensioners (37.6%) and married or with common law partners (64.9%) (Table 1).

The average difference between participants' self-reported weight and measured weight was -0.7kg (95%CI -1.1;-0.4): men underestimated their weight by 0.6kg (95%CI -1.3;0.2), and women by 0.8kg (95%CI -1.1;-0.4) (Table 2).

Concordance was substantial for the general population (CCC=0.97) and when stratified by sex (CCC=0.97 for women; CCC=0.98 for men). Distribution of the self-reported weight error among men was found to be close to zero (p=0.15), while for the general population and specifically for women, there was deviation in relation to zero: p<0.01 (Table 2). As such, we investigated factors associated with weight error among women.

Weight concordance, according to the women's characteristics, showed greater variations among those aged 20-29 and with unfavorable self-perception of health (Table 3). Average self-reported weight error varied according to occupation, attempt to lose weight and nutritional status.

In the multivariate analysis of the women's data, only age and nutritional status remained associated with weight error (Table 4). The final model determination coefficient (R^2) showed that 98.1% of the variation in women's self-reported weight error was explained by these variables. In general, the older the women, the greater the weight error in comparison to women aged 20-29 (Table 4).

Based on these values, we were able to calculate weight corrected according to nutritional status and age, using multiple linear regression:

Corrected weight = 0.61 + nutritional status (low weight/normal weight) X (1) + nutritional status (overweight) X (0.85) + age (20-29 years) X (1) - age (30-59 years) X (1.04) - age (>60 years) X (1.03) + self-reported weight X (1.01)

Table 1 – Sociodemographic characteristics of the self-reported weight validation study of Programa Academia da Saúde users, Belo Horizonte, Minas Gerais, 2013-2017

Variables	Validation study	
	n	%
Sex		
Female	378	85.7
Male	63	14.3
Age (in years)		
20-29	122	3.6
30-59	158	54.2
≥60	161	42.2
Schooling (in years of study)		
≤4	152	34.5
5-8	115	26.1
9-11	136	30.8
≥12	38	8.6
Occupation		
Retired/pensioner	166	37.6
Unemployed	6	1.4
Housewife	141	32.0
Other	128	29.0
Marital status		
Married/common law marriage	286	64.9
Separated/single/widowed	155	35.1

Note:
N = 441 individuals.

Table 2 – Self-reported weight[a] and measured weight, and errors according to sex of Programa Academia da Saúde users, Belo Horizonte, Minas Gerais, 2017

Population	Variable	n	Value	95%CI[b]	p-value
TOTAL	Self-reported weight (kg)	441	69.6	68.3;70.8	0.64[d]
	Measured weight (kg)	441	70.3	69.0;71.6	
	Weight error (kg)	441	-0.7	-1.1;-0.4	<0.01[e]
	CCC[c] (95%CI)[b]		0.97	0.96;0.97	
Sex					
Men	Self-reported weight (kg)	63	78.4	74.9;81.9	0.99[d]
	Measured weight (kg)	63	79.0	75.3;82.6	
	Weight error (kg)	63	-0.6	-1.3;0.2	0.15[e]
	CCC[c] (95%CI)[b]		0.98	0.96;0.98	
Women	Self-reported weight (kg)	378	68.1	66.8;69.4	0.49[d]
	Measured weight (kg)	378	68.9	67.5;70.2	
	Weight error (kg)	378	-0.8	-1.1;-0.4	<0.01[e]
	CCC[c] (95%CI)[b]		0.97	0.96;0.97	
Age (in years)					
20-29	Self-reported weight (kg))	15	73.5	61.1;85.8	0.01[d]
	Measured weight (kg)	15	75.6	62.3;88.8	
	Weight error (kg)	15	-2.1	-3.7;-0.5	0.01[e]
	CCC[c] (95%CI)[b]		0.99	0.97;0.99	
30-59	Self-reported weight (kg)	226	70.9	69.1;72.8	<0.01[d]
	Measured weight (kg)	226	71.6	69.8;73.5	
	Weight error (kg)	226	-0.7	-0.9;-0.4	<0.01[e]
	CCC[c] (95%CI)[b]		0.99	0.98;0.99	
≥60	Self-reported weight (kg)	173	67.1	65.3;68.9	<0.01[d]
	Measured weight (kg)	173	67.7	65.9;69.5	
	Weight error (kg)	173	-0.6	-0.9;-0.3	<0.01[e]
	CCC[c] (95%CI)[b]		0.98	0.98;0.99	
Nutritional status					
Low weight/good nutrition	Self-reported weight (kg)	170	59.9	58.7;61.1	0.25[d]
	Measured weight (kg)	170	60.1	58.9;61.3	
	Weight error (kg)	170	-0.2	-0.4;0.1	0.25[e]
	CCC[c] (95%CI)[b]		0.97	0.96;0.98	
Overweight	Self-reported weight (kg)	244	76.2	74.5;77.8	<0.01[d]
	Measured weight (kg)	244	77.3	75.6;78.9	
	Weight error (kg)	244	-1.1	-1.4;-0.8	<0.01[e]
	CCC[c] (95%CI)[b]		0.98	0.98;0.98	

a) Weight assessed in kilos.
b) 95%CI: 95% confidence interval.
c) CCC: Lin's concordance correlation coefficient.
d) Student's paired t test.
e) Student's t test to assess whether weight errors are equal to zero.

Note:
N = 441 individuals.

Figure 1 shows the scatter plot prepared using the Bland & Altman method. Taking the concordance limits, corrected weight for women improved precision, increasing the CCC value from 0.97 (95%CI 0.96;0.97) to 0.99 (95%CI 0.98;0.99), with distribution of the new error close to zero (p=0.999).

Overweight prevalence among women, calculated as per the BMI obtained based on self-reported weight and measured weight, was 65.5% and 63.6%, respectively, showing 94.3% concordance (Kappa=0.878). After correction of self-reported weight, overweight prevalence was 63.9% and concordance with measured weight was 94.6% (Kappa=0.883).

Table 3 – Distribution of average self-reported weight errors and concordance correlation coefficients according to the characteristics of women Health Fitness Center Program participants, Belo Horizonte, Minas Gerais, 2017

Characteristics	n	Average	95%CI[b]	p-value[c]	CCC[d]	95%CI[b]
Age (in years)						
20-29	15	-2.33	-4.16;-0.51	0.07	0.98	0.95;0.99
30-59	212	-0.74	-1.14;-0.35		0.98	0.97;0.98
≥60	151	-0.65	-1.3;-0.01		0.95	0.93;0.96
Occupation						
Retired/pensioner	125	-0.90	-1.64;-0.16	0.04	0.96	0.95;0.97
Unemployed	4	0.90	-0.27;2.07		0.97	0.85;1.00
Housewife	140	-0.53	-1.00;-0.06		0.98	0.97;0.98
Other	105	-1.02	-1.63;-0.41		0.97	0.96;0.98
Schooling (in years of study)				0.58		
≤4	133	-0.90	-1.68;-0.12		0.94	0.92;0.96
5-8	101	-0.92	-1.43;0.40		0.98	0.96;0.98
9-11	115	-0.52	-1.06;0.01		0.98	0.97;0.99
≥12	29	-0.65	-1.30;0.00		0.99	0.98;0.99
Marital status						
Separated/single/widowed	137	-0.67	-1.40;0.05	0.29	0.98	0.97;0.98
Married/common law marriage	241	-0.83	-1.19;-0.47		0.95	0.94;0.97
Nutritional status				<0.01		
Low weight/good nutrition	152	-0.19	-0.55;0.17		0.95	0.94;0.96
Overweight	226	-1.16	-1.68;-0.64		0.95	0.94;0.97
Self-assessment of health				0.78		
Very poor/poor/regular	11	-3.47	-9.67;2.72		0.95	0.92;0.97
Good/very good	306	-0.62	-0.97;-0.26		0.98	0.97;0.98
Attempt to lose weight				0.02		
No	194	-0.62	-1.16;-0.09		0.95	0.93;0.96
Yes	184	-0.93	-1.36;-0.49		0.95	0.94;0.96
Taking part in PAS[e]				0.15		
No	162	-1.07	-1.68;-0.47		0.97	0.96;0.98
Yes	216	-0.54	-0.95;-0.14		0.97	0.96;0.98

a) Weight assessed in kilos.
b) 95%CI: 95% confidence interval.
c) ANOVA method.
d) CCC: Lin's concordance correlation coefficient.
e) PAS: Programa Academia da Saúde.

Note:
N = 441 individuals.

Discussion

Thus study consisted of validating body weight reported by PAS users during a telephone interview, compared to measured weight in a face-to-face interview, together with analysis of factors associated with self-reported weight error. The results show the validity of self-reported weight for men. For women, self-reported weight was sufficient to assess nutritional status but statistical correction was needed in order to use the continuous measurement. The self-reported weight error identified among women was associated with nutritional status and age.

Studies show the validity of self-reported measurements in different populations.[8-10,14] However, women have been found to underestimate self-reported weight.[11,24-26] In this study, women underestimated their weight by approximately 0.8kg, this being less than that found in the United Kingdom (-2.6kg error) and in Salvador, BA (-0.9kg error), although it was higher than that found for university leavers in the state of Minas Gerais (-0.6kg error).[2,7,24] Differences between self-reported and measured weight are frequently associated with sex, nutritional status, age range and schooling.[22,25] The direct relationship found between greater age and lesser weight validity among women may be related to older women weighing themselves less frequently and not accompanying changes in body weight over time. This difference may also reflect the socially and culturally valued slimness model.[11,27]

Good concordance was found for nutritional status classification using self-reported measurements, both for men and women, thus corroborating the findings of other studies. An example of this is a population-based study conducted in a rural area in Northeast Brazil in 2011, notwithstanding it having found less accuracy among the elderly and those with less than four years of schooling. The study also showed that difficulty in accessing health services and places where weight could be measured also resulted in worse reporting.[28]

Validation of self-reported measurements in the 2013 National Health Survey found weight information error for all categories of sex, age and schooling assessed, although the error was lower among the elderly and people with no schooling or incomplete elementary education. The National Health Survey also showed that, despite the error found, self-reported weight can be used as a proxy for values measured in adults.[5] The researchers found that sensitivity for determining overweight and obesity based on self-reported measurements is greater among men than among women.[5]

A differential of this study was that it was conducted in a SUS service, namely the PAS, characterized by regular service user attendance and periodic physical assessments.[15] As PAS attendance is weekly (three times a week on average), we assumed that this implied attendees taking greater care of their health and checking their weight more frequently (at the PAS units studied, weight is measured every six months), so that self-reported measurements would be closer to real measurements. However, this hypothesis was not confirmed for women participants of our study.

With the aim of overcoming this problem, we opted to statistically correct self-reported weight, considering the characteristics that most impacted errors in women's reports. Concordance between the corrected measurement and measured weight was high, indicating that using this form of correction can be useful for longitudinal

Table 4 – Multiple linear regression model used to correct self-reported weight of women Programa Academia da Saúde users, Belo Horizonte, Minas Gerais, 2013-2017

Characteristics	Estimate	Standard error	p-value
Age (in years)			
20-29	1.00		
30-59	-1.04	0.52	0.05
≥60	-1.03	0.53	0.05
Nutritional status			
Low weight/good nutrition	1.00		
Excess weight	0.85	0.26	<0.01

Notes:
Adjustment by reported weight; adjusted R2 = 0.981.
N = 441 individuals.

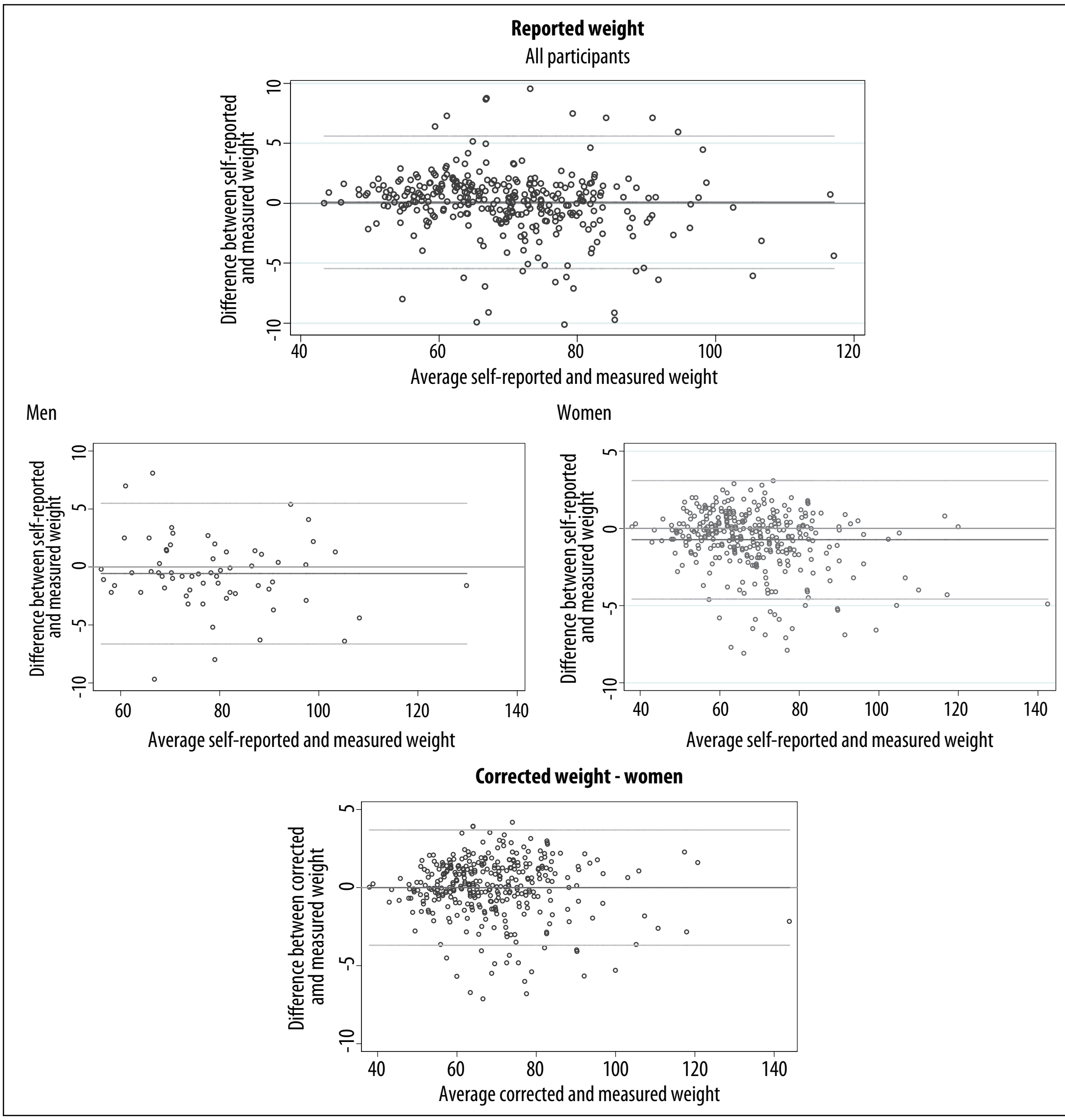

Figure 1 – Bland & Altman scatter plot for self-reported weight and corrected weight by sex of Programa Academia da Saúde users, Belo Horizonte, Minas Gerais, 2017

weight assessment studies in populations with similar characteristics. Additionally, once weight had been validated, the formula obtained was used to correct the self-reported weight of participants excluded from the analysis, and the concordance correlation coefficient was checked – CCC = 0.853 – for corrected weight, revealing that the correction formula is indeed valid for the population studied (data not shown). The results show the importance of using corrected measurements to get predictions that are more valid, as well as reinforcing the importance of this study.

Another important aspect of this study was the inclusion of infrequent PAS users in the analyses. As it is a health service with continuous participation, although turnover is high,[13,14] we opted to include them. The fact that differences were not found regardless of frequency of participation in this service may indicate that previous participation in PAS demonstrates continuous care of health. The authors' hypothesis is that despite not attending the PAS activity routine continuously, previous participation could have made these service users more aware and contributed to promoting their health. This hypothesis suggests that the existence of the PAS is an important strategy for controlling chronic noncommunicable diseases and promoting healthy lifestyles.[29]

This study also has limitations. The time that elapsed between data collection by telephone and the face-to-face weight validation interview may have had repercussions on real variation in weight. However, if this variation did occur it was of low magnitude, given that the interval of time between the measurements was small and that furthermore no correlation was found between the measurement interval and the weight error.

Validation of body weight measurement of SUS health promotion service users is unprecedented and allows it to be monitored by telephone. This simplifies the logistics of epidemiological studies and of the service itself, by favoring quicker and cheaper health surveillance actions with less need for human resources.

In conclusion, self-reported weight of Belo Horizonte PAS users was valid for men but needed to be corrected for women due to variations associated with nutritional status and age. Following this correction, women's body weight was found to have a satisfactory level of validity. Obtaining valid self-reported weight measurements simplifies continuous monitoring of health service users, especially infrequent ones, favoring longitudinal epidemiological studies and health surveillance being conducted in a sustainable manner.

Authors' contributions

Freitas PP contributed with the concept of the study, data acquisition, analysis and interpretation and drafting the manuscript. Mingoti SA contributed to the study design, data analysis and interpretation and critically reviewing the manuscript. Lopes ACS contributed to the concept and design of the study, data acquisition, analysis and interpretation and critically reviewing the contents of the manuscript. All the authors have approved the final version and are responsible for all aspects thereof, including the guarantee of its accuracy and integrity.

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