

## SHORT REPORT

# Can self-reported height and weight be relied upon?

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<b>Aims</b>	To assess whether self-reported height and weight [and body mass index (BMI)] can be used in workplace health promotion campaigns.
<b>Methods</b>	Volunteers were instructed how to measure their weight, height and waist circumference (WC). Self-reported values were compared with direct measurements. Accuracy was assessed using simple (self-report – actual) and percentage difference [(self-report – actual)/(actual measurement)]. The distribution of differences (in weight, height and BMI) across age and BMI classes was calculated plus Pearson (parametric) and Spearman (non-parametric) coefficients of correlation, to assess relation of differences (simple and percentage) with actual values. For percentage differences, classes were created to explore differences in mean values of actual measurements across various difference classes, using analysis of variance.
<b>Results</b>	Eight hundred and fifty-seven workers took part; 585 (68%) provided all requested data. ‘Statistical analysis showed that men and the whole group underestimated their BMI due to overestimating their height and underestimating body weight’. Similar trends were seen in females, especially the centrally obese ones (WC >80 cm), but women as a group were more accurate than men in anthropometric self-reports. Males >40 years of age underestimated their weight.
<b>Conclusions</b>	This study showed that the differences between actual and self-reported values depend on the actual values and self-reported anthropometric measurements cannot be relied upon, at least in males. Females seem to provide more accurate reports than men and we could consider their measurements reliable, although a further study with a larger number of female participants would be needed.
<b>Key words</b>	Body mass index; height; obesity; weight; workplace health promotion.

## Introduction

Obesity is a disorder in which there is increased body fat to the extent that health is impaired. The National Institutes of Health has recommended the use of body mass index (BMI) in the classification of weight status [1]. It is derived by dividing the body weight (in kilograms) by the square of the height (in metres). Individuals with BMI 25–29.9 kg/m<sup>2</sup> are classified as overweight and those with BMI ≥30 kg/m<sup>2</sup> as obese.

Latterly research has shown that the distribution and biological properties of fat tissue are more important than the body weight or BMI [2]. Central obesity, defined by a waist circumference (WC) ≥80 cm in women and ≥94 cm in men, is considered an independent risk factor for the development of diabetes later in life [3].

Obesity is an important health condition because of the associated co-morbidities, including hypertension, diabetes and osteoarthritis and the economic cost [4].

In the workplace, obesity has been reported to lead to increased sickness absence and disability benefits [4,5].

As small reductions in weight reduce the medical complications, healthy lifestyle promotion is important. The workplace could be a site for health promotion, but the success of such initiatives depends upon several factors including minimal time away from work (down time). An effective way to reduce down time is to use self-reported data on height and weight rather than spend time measuring individuals.

## Methods

In 2005, a large global engineering company undertook a 3-month educational campaign called ‘Reduce Hazardous Waist!’ with the aim of reducing obesity. As part of this initiative, workers were provided with instructions on how to measure their weight and height

and were made aware of how to avoid errors in reading the scales or height measures. Workers were asked to self-report their measurements and the values were compared with direct measurements. WC was not self-reported but was directly measured by researchers.

Statistical package, SAS v 9.0, was used for analysis. Simple difference [expressed as (self-report – actual value)] and percentage difference [expressed as  $100\% \times (\text{self-report} - \text{actual value}) / (\text{actual measurement})$ ] was calculated in order to assess accuracy in weight and height (and BMI) estimation. Descriptive statistics (mean,

standard deviation, median, minimum and maximum) were used for continuous variables (initial values and differences). Simple *t*-test was applied in order to assess the significance of each difference; *P*-values < 0.05 were considered statistically significant. Pearson (parametric) and Spearman (non-parametric) coefficients of correlation were used to assess relation of differences (simple and percentage) with actual values. For percentage differences, we created classes and tried to explore differences in mean values of actual measurements across various difference classes, using analysis of variance (ANOVA). To specify

**Table 1.** Correlation of differences (self-reported – actual) with age, WC and actual height–weight

Difference in		Sex	Pearson coefficients	Pearson <i>P</i>	Spearman coefficients	Spearman <i>P</i>
Weight	Age	Male	–0.11	<0.05*	–0.04	NS
		Female	–0.01	NS	–0.01	NS
		All	–0.11	<0.01*	–0.06	NS
	Actual weight	Male	–0.15	<0.001*	–0.13	<0.01*
		Female	–0.15	NS	–0.16	NS
		All	–0.17	<0.001*	–0.17	<0.001*
	Actual height	Male	0.08	NS	0.08	NS
		Female	–0.05	NS	–0.05	NS
		All	0.00	NS	–0.02	NS
	Actual BMI	Male	–0.12	<0.01*	–0.18	<0.001*
		Female	–0.18	NS	–0.16	NS
		All	–0.12	<0.01*	–0.17	<0.001*
	Waist circumference	Male	–0.10	<0.05*	–0.08	NS
		Female	–0.07	NS	–0.07	NS
		All	–0.11	<0.01*	–0.11	<0.01*
Height	Age	Male	0.06	NS	0.09	<0.05*
		Female	–0.01	NS	0.04	NS
		All	0.06	NS	0.10	<0.05*
	Actual weight	Male	0.08	NS	0.10	<0.05
		Female	0.34	<0.01*	0.33	<0.01*
		All	0.13	<0.001*	0.15	<0.001*
	Actual height	Male	–0.12	<0.01*	–0.14	<0.001*
		Female	<b>0.24</b>	NS	0.12	NS
		All	–0.03	NS	–0.04	NS
	Actual BMI	Male	0.15	<0.001*	0.19	<0.001*
		Female	<b>0.26</b>	<0.05*	0.29	<0.05*
		All	0.16	<0.01*	0.20	<0.001*
	Waist circumference	Male	0.10	<0.05*	0.12	<0.01*
		Female	<b>0.31</b>	<0.01*	0.32	<0.01*
		All	0.14	<0.001*	0.16	<0.01*
BMI	Age	Male	–0.05	NS	–0.05	NS
		Female	–0.03	NS	–0.06	NS
		All	–0.06	NS	–0.06	NS
	Actual weight	Male	–0.07	NS	–0.08	NS
		Female	<b>–0.33</b>	<0.01*	–0.33	<0.01*
		All	–0.12	<0.01*	–0.14	<0.001*
	Actual height	Male	0.04	NS	0.09	<0.05*
		Female	–0.15	NS	–0.05	NS
		All	–0.02	NS	0.02	NS
	Actual BMI	Male	<b>–0.32</b>	<0.01*	–0.31	<0.001*
		Female	<b>–0.39</b>	<0.001*	–0.36	<0.01*
		All	–0.32	<0.001*	–0.31	<0.001*
	Waist circumference	Male	–0.07	NS	–0.09	<0.05*
		Female	<b>–0.26</b>	<0.05*	–0.28	<0.05*
		All	–0.11	<0.05*	–0.13	<0.01*

\*Reached statistical significance; ns = statistically not significant.

differences, Tukey's *post hoc* test was applied. Finally, the distribution of differences (in weight, height and BMI) across age and BMI classes was explored. Pearson's chi-square test was applied in the above contingency tables to assess statistically significance.

Ethical approval was not required or sought for this study as it involved analysis of data, which was already being collected for the campaign and did not relate to named individuals.

## Results

Eight hundred and fifty-seven workers participated in the study, 585 (68%, 517 males and 68 females) reported the requested anthropometric parameters. Characteristics of the participants and the relative self-reported assessments are shown in Table S1 (available as Supplementary data at *Occupational Medicine* Online).

Accuracy of the participants' measurements was assessed with the calculation of simple and percentage difference. The statistical analysis showed that misreports were significant in the total and in males, while the differences for the total were mainly attributed to male subjects. In contrast, female measurements were accurate Table S2 (available as Supplementary data at *Occupational Medicine* Online).

In order to see if age and anthropometric characteristics (weight, height, WC and BMI) of the participants affected the accuracy of the self-reports, we used the Pearson (parametric) and Spearman (non-parametric) coefficients of correlation. Taking a correlation coefficient of 0.3 as a noticeable relation, we found statistically significant (and noticeable) correlations mainly for female subjects (Table 1). This is an interesting finding as females as a group were generally accurate in their reports by simple and percentage differences. But using Pearson (parametric) and Spearman (non parametric) coefficients of correlation, we identified that females who reported higher values for weight, BMI and WC also tended to overestimate their height. In contrast, we found negative correlations with actual weight and WC, suggesting that heavier and more centrally obese women underestimated their BMI.

In men, those with higher BMI tended to underestimate their BMI. Differences were calculated as (self-reported – actual), so a positive difference means overestimation, while negative difference means underestimation of actual value.

One-way ANOVA revealed statistically significant errors in anthropometric measurements only in men who were shorter and heavier as they tended to overestimate their height and underestimate their weight; on the other hand, taller men and females were accurate in their estimations.

Statistical analysis of data on measured WC showed that for percentage difference, central obesity was related

with significant underestimation of BMI but only in females. With regards to age, in men over 40 years of age, there was statistically significant underestimation of weight.

## Discussion

The study shows that self-reported anthropometric measurements are not reliable and are not a substitute for direct measurements in men. This is compatible with findings from previous studies in populations with variable demographic and anthropometric characteristics [6,7]. Self-reports were influenced by factors such as weight, height and BMI and by gender and age. Women generally appeared to provide more accurate self-reports but numbers in the study were relatively small whilst women with central obesity seemed to represent a subgroup that behaved differently, in that they significantly underestimated their BMI. Finally, ageing seemed to affect accuracy of self-reports, especially in men. In conclusion, we do not believe self-reported height and weight can be relied upon to replace direct measurements in workplace obesity programmes.

## Conflicts of interest

None declared.

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