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Self-perceived body image and its influence on weight management among adults in South Africa

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Background. Misperception of body image is common, and may prevent individuals from undertaking healthy corrective measures.
Objectives. To investigate how misperception of body image and weight among adults may influence efforts to improve health and illnesses associated with metabolic syndrome (MetS).
Methods. A cross-sectional study involving 1 889 adults aged ≥20 years was conducted. Participants were required to complete a questionnaire and to estimate their weight prior to anthropometric measurements (weight, height, waist and hip circumferences). The Stunkard figure rating scale (FRS) was used for participants to select silhouettes that they believed closely resembled their body types. Biochemical parameters were measured for all participants.
Results. Obesity (51.2% v. 15.9%) and MetS (49.9% v. 25.5%) were more prevalent in women than men. Most participants with overweight/obesity underestimated their body size, and over 75% reported no intention to lose weight. Only 13% reported efforts to lose weight. The FRS results showed poor body size recognition, particularly in men with obesity. Logistic regression analyses adjusted for age, sex and MetS parameters showed that waist circumference significantly predicted weight management efforts (odds ratio 5.7, 95% confidence interval 3.8 - 8.4, $p<0.0001$).
Conclusions. Incorporating visual body shape guides in obesity management settings can help to bridge this perception gap and promote healthier behaviours.

Keywords: obesity, South Africa, weight management, body image, metabolic syndrome

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Obesity is a well-documented health risk with a high prevalence reported worldwide.[1] Obesity is often associated with cardiometabolic derangement, including the symptoms defining metabolic syndrome (MetS). Studies have shown that misperception of one's own body image is widespread, and may prevent the implementation of corrective measures, either by the affected individual or through intervention programmes.[2-5] A study involving 15 068 undergraduate university students recruited from 21 low, middle and emerging economy countries reported that 67% of students living with obesity did not perceive themselves as having obesity or being at health risk due to their weight.[6] Although perceived overweight is associated with a higher likelihood of attempting to improve health, the approaches adopted may range from beneficial behaviours (such as increased physical activity and healthier eating habits) to harmful practices (including disordered eating and the inappropriate use of medications intended for obesity as a chronic disease).[4] Unhealthy weight management strategies are linked to the stigmatisation of overweight and obesity, which in turn contributes to weight gain, as well as poor mental and physical health among individuals with overweight and obesity.[7]

In South Africa (SA), there are many different stigmas associated with body shape. Individuals with overweight or obesity may be perceived as wealthy, while those who are underweight may be associated with ill health or communicable diseases, such as tuberculosis and HIV/AIDS.[8-10] Opinions of immediate family members may influence how individuals perceive their body shape and overall health. A SA study has shown that pre-adolescent daughters, regardless of ethnicity, preferred a body size similar to their mothers.[11] Reports from the SA National Health and Nutrition Examination Survey (SANHNES)[12] showed that 84.5% of study participants aged ≥15 years had a distorted body image, with individuals living with overweight/obesity tending to underestimate their weight.

The aim of this study was to evaluate the perceptions regarding body image and weight management amongst the mixed-ancestry population of SA. By understanding the perceptions in this understudied population, we aim to contribute valuable insights into the broader field of metabolic health, which may contribute to improving health and illnesses associated with MetS by focusing on obesity prevention and lifestyle changes, particularly within diverse and historically marginalised communities.

Methods

Study participants and procedures

A total of 1 889 study participants aged ≥20 years were recruited from a population of predominantly mixed-ancestry individuals residing in Bellville South, Cape Town, a previously marginalised population with an increasing incidence of diabetes mellitus.[13] This cohort included 455 men and 1 434 women. A questionnaire was administered to

the participants prior to any anthropometric or biochemical measurements. The questionnaire addressed sociodemographic information (e.g. age, sex, education, lifestyle), as well as a self-evaluation of weight status (underweight, normal weight, overweight, or obesity). In addition, the questionnaire included an image derived from the original Stunkard FRS (Fig. 1).[14]

Our questionnaire included nine silhouettes arranged in a random manner as shown in Fig. 2.[14] Participants were asked to view the presented picture and rate how they perceived their current body shape by responding to the following instructions: select the picture you most look like right now; select the picture most people your age look like; men: select the male picture that women prefer men to look like; or women: select the female picture that men prefer women to look like. The participants were also asked to indicate the ideal body shape they desired: select the picture you would prefer to look like now.

Anthropometric measurements (weight, height, waist and hip circumferences) were obtained for all participants following the World Health Organization (WHO) STEPwise manual.[15] Fasting blood samples were collected from all participants, and were sent to an ISO 15189-accredited pathology practice, Pathcare Reference Laboratory (Cape Town, SA) for the measurement of fasting blood glucose (FBG) (mmol/L) (Hexokinase, Beckman AU, or DXC), insulin (mIU/L) (paramagnetic particle, chemiluminescence), triglycerides (mmol/L) (GPO-POD Endpoint, Beckman AU), low-density lipoprotein (LDL) cholesterol (mmol/L) (enzymatic selective protection – Endpoint, Beckman AU) and high-density lipoprotein (HDL) cholesterol (HDL-chol) (mmol/L) (Enzymatic Immunoinhibition – Endpoint, Beckman AU).

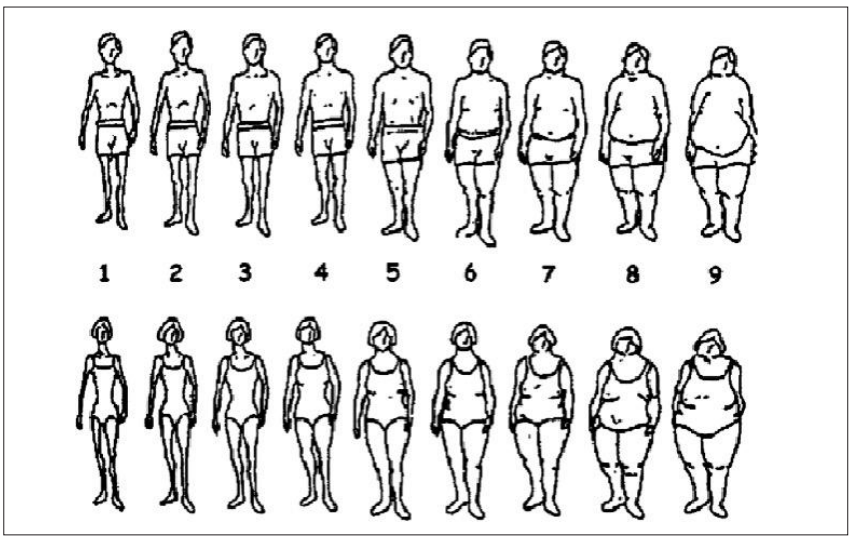


Fig. 1. Original Stunkard figure rating scale for men and women.[14]

Calculations and definitions

Body mass index (BMI) was calculated as weight per square metre (kg/m^2), and participants ranked for BMI as underweight <18.50; normal range 18.50 - 24.9; overweight ≥25.00 - 29.99; and obese ≥ 30.00 kg/m^2.[16] MetS classification was adapted from the Joint Interim Statement (JIS) criteria, which include the presence of any three of the following conditions, with recommended population- and country-specific definitions for waist circumference (WaistC):[17] WaistC: ≥90 cm for both men and women, as previously reported in this population,[18] FBG: ≥5.6 mmol/L; HDL cholesterol: men ≤1 mmol/L and women ≤1.3 mmol/L; and triglycerides: ≥ 1.7mmol/L. Diabetes mellitus (DM) status was defined according to WHO guidelines. DM was defined as a fasting plasma glucose level >7.0 mmol/L and/or a 2-hour post-oral glucose tolerance test (OGTT) plasma glucose level >11.1 mmol/L, or self-reported by participants indicating that they are currently using diabetes medication. Prediabetes was defined as a fasting plasma glucose level between 6.1 mmol/L and 6.9 mmol/L and/or a post 2-hour OGTT glucose level between 7.8 mmol/L and 11.1 mmol/L.[19]

Statistical analysis

Data were analysed using SPSS software version 24 (IBM Corp, USA). General characteristics of the study participants are summarised as medians, with 25th and 75th percentiles for continuous variables and number and percentage for categorical variables. The Mann-Whitney U test was used to compare medians, and Pearson's χ^2 tests were used to compare continuous and categorical variables across groups of participants. Logistic regressions were used to derive the odds ratio for the likelihood of weight loss management, adjusting for other factors such as age, sex and MetS parameters (waist circumference, hypertension, hyperglycaemia, high triglycerides and low levels of HDL cholesterol). $P<0.005$ was considered significant.

Ethical considerations

The current cross-sectional study forms part of the Cape Town Vascular and Metabolic Health study. Ethical approval for the study was obtained from the research ethics committees of the Cape Peninsula University of Technology and Stellenbosch University (ref. no. NHREC: REC – 230 408 – 014, CPUT/HW-REC 2015/H01 and ref. no. N14/01/003, respectively). The study was conducted according to the code of ethics of the World Medical Association (Declaration of Helsinki). All participants signed written informed consent after all procedures had been fully explained in the language of their choice.

Results

General characteristics and MetS parameters

The general characteristics of participants according to sex are summarised in Table 1. The median (with 25th and 75th percentiles) age of participants was 51 (38 - 61) years. BMI was significantly higher in women than in men: 30.1 (24.8 - 35.7) and 23 (20.2 - 28.1), respectively ($p<0.001$). Consequently, 51.2% of women were living with obesity (BMI ≥30 kg/m^2) compared with 15.9% of men. The distribution of MetS status and central obesity was significantly different across BMI categories, in the overall sample, and in men and women taken separately; all $p<0.001$. Male (23.4%) and female (23.6%) participants showed a similar rate of overweight. LDL and HDL cholesterol levels were significantly higher in women than men ($p<0.001$). DM status was concerning when comparing female and male participants. Female participants presented with pre-diabetes (16.3%) and DM (20.7%) to a greater extent than male participants (pre-diabetes: 11% and DM: 15.6%) ($p<0.001$). The prevalence of MetS was significantly higher in women than in men (49.9 v. 25.5%; $p<0.001$).

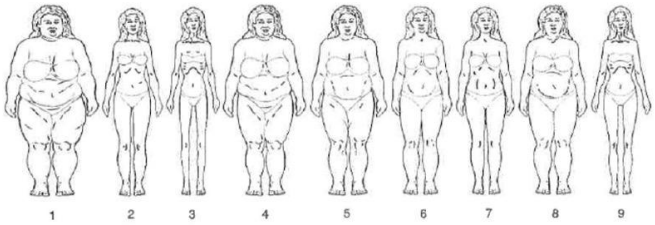
Estimation of body weight and shape

In general, both women and men underestimated their actual weight and body shape. This trend was most evident

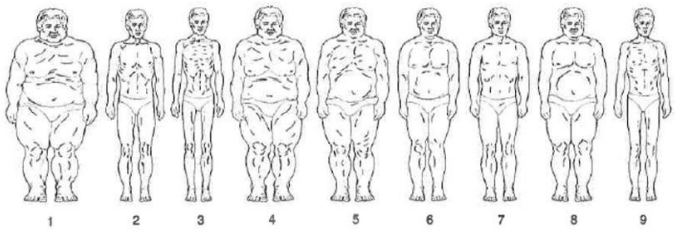
among participants with overweight and obesity, at ~58% and ~53%, respectively, demonstrating inaccurate self-perception of body weight. Approximately 65% of normal-weight men and women correctly identified the picture that most accurately described their current body shape. However, 44% of overweight women and 63% of overweight men incorrectly selected the underweight or normal weight silhouette as the image that represented their current weight status. When asked how the participants would prefer to look, 24.5% of men and 32.6% of women preferred the overweight silhouette, while overweight men (71.6%) and women (65%) wanted to be thinner. Although none of the individuals living with obesity expressed a desire to be heavier, men in this group were more likely to misclassify their body size, with only 20.8% selecting the silhouette representing obesity as the silhouette that most closely matched their current weight, compared with 49.2% of women. Furthermore, only 2.8% of men with obesity and 7% of women with obesity preferred to look as such. Interestingly, 25% of overweight men and 31% of overweight women preferred an overweight body shape and a small percentage of overweight men (2.8%) and women (3.8%) desired to be heavier.

The distribution of self-perceived health status, self-estimated weight status and actual weight control efforts differed significantly across BMI categories in the overall sample, and between men and women (all $p<0.001$), with no evidence of interaction between statistical BMI categories and sex (all interaction $p>0.176$). Notably, most overweight women (84.2%) and men (79.2%) reported no intention to lose weight, a trend that persisted among individuals with obesity, with 75.2% of women and 69.4% of men indicating the same. Approximately 78% of participants were not engaged in any form of weight management, while 26.5% of underweight women were in a programme to gain weight v. 16.2% of underweight men (Fig. 3). Only 13% of participants with overweight and obesity were engaged in a weight loss programme, although 55% of individuals with overweight and obesity expressed a desire to improve their health and fitness levels.

Female:



Male:



Picture number	Definition	Definition for this study
1	Obese 3	Obese
2	Normal 1	Normal
3	Underweight 1	Underweight
4	Obese 2	Obese
5	Obese 1	Obese
6	Slightly overweight	Overweight
7	Normal 2	Normal
8	Moderately overweight	Overweight
9	Underweight 2	Underweight

Fig. 2. Figure rating scale derived from the original Stunkard Figure Rating Scale image with picture definitions and the definitions used for this study.[14]

FRS questionnaire

The results of the Stunkard FRS are summarised in Appendix Table S1. The distribution of self-perceived current body image, preferred body image, and perceived appearance preferences differed across BMI categories in the overall sample and by sex (all $p<0.001$), with the exception of desired body image in men ($p=0.918$). There was evidence of BMI category and sex interaction in the distribution of body image perception (both $p<0.004$) but not in the distribution of desired body image (interaction $p=0.119$).

Discussion

A notable trend observed in this study was the widespread underestimation of body shape and weight by both women and men, particularly participants with overweight and obesity. The Stunkard FRS questionnaire revealed discrepancies between actual and perceived body shape, especially among participants with overweight and obesity. Overweight women (44%) and men (63%) underestimated their body size by selecting underweight or normal-weight images. Approximately 58% of overweight and 53% of individuals with obesity demonstrated inaccurate self-perception of their body weight, while more than 65% of normal-weight individuals accurately estimated their body weight. Despite the high prevalence of overweight and obesity in this population, most participants did not report any efforts to manage their weight. Moreover, ~78% of all participants were not engaged in any weight management programme, and only 13% of individuals with overweight and obesity reported active participation in a weight loss intervention, despite 55% expressing a desire to lose weight. However, some overweight participants reported a preference for an overweight body shape, indicating potential cultural or psychological influences that may normalise a higher body weight.

Our study showed that individuals with overweight or obesity underestimated their body size, but none in these groups overestimated their weight. Overweight women were more accurate in identifying

Table 1. Anthropometric data and biochemical parameters of participants (*N*=1 889)

Characteristic, median (25th - 75th percentile)	Overall	Female	Male (*n*=455)	*p*-value
Age, years	51 (38 - 61)	52 (39 - 61)	49 (34 - 59)	<0.001
Weight, kg	71.9 (59.1 - 85.5)	73.6 (60.9 - 86.8)	65.9 (57 - 80)	<0.001
BMI	28.5 (22.9 - 34.2)	30.1 (24.8 - 35.7)	23 (20.2 - 28.1)	<0.001
Waist circumference, cm	92.5 (79.2 - 104.5)	94.5 (82.5 - 106.5)	82.8 (73.5 - 96.6)	<0.001
Hip measurement, cm	103.5 (93.1 - 114.5)	106.5 (96 - 117.9)	93.5 (85.8 - 102.5)	<0.001
HbA1c, %	5.8 (5.4 - 6.2)	5.8 (5.4 - 6.3)	5.6 (5.3 - 6)	<0.001
Triglycerides, mmol/L	1.2 (0.9 - 1.7)	1.3 (0.9 - 1.8)	1.1 (0.9 - 1.7)	0.228
LDL cholesterol, mmol/L	3.2 (2.5 - 3.9)	3.3 (2.6 - 4)	2.9 (2.3 - 3.6)	<0.001
HDL cholesterol, mmol/L	1.3 (1.1 - 1.5)	1.3 (1.1 - 1.5)	1.2 (1 - 1.4)	<0.001
Biochemical parameter, *n* (%)				
JIS MetS				<0.001
No	1 055 (56.0)	716 (50.1)	339 (74.5)	
Yes	830 (44.0)	714 (49.9)	116 (25.5)	
BMI				<0.001
Underweight	71 (3.8)	34 (2.4)	37 (8.2)	
Normal	564 (30)	326 (22.8)	238 (52.5)	
Overweight	443 (23.6)	337 (23.6)	106 (23.4)	
Obese	803 (42.7)	731 (51.2)	72 (15.9)	
Central adiposity				<0.001
No	859 (45.5)	565 (39.4)	294 (64.6)	
Yes	1 030 (54.5)	869 (60.6)	161 (35.4)	
DM status				<0.001
Normal	1 235 (65.4)	901 (62.9)	334 (73.4)	
Prediabetes	284 (15.1)	234 (16.3)	50 (11)	
DM	368 (19.5)	297 (20.7)	71 (15.6)	

BMI = body mass index; HbA1c = haemoglobin A1c; LDL = low-density lipoprotein; HDL = high-density lipoprotein; JIS MetS = Joint Interim Statement metabolic syndrome; DM = diabetes mellitus.

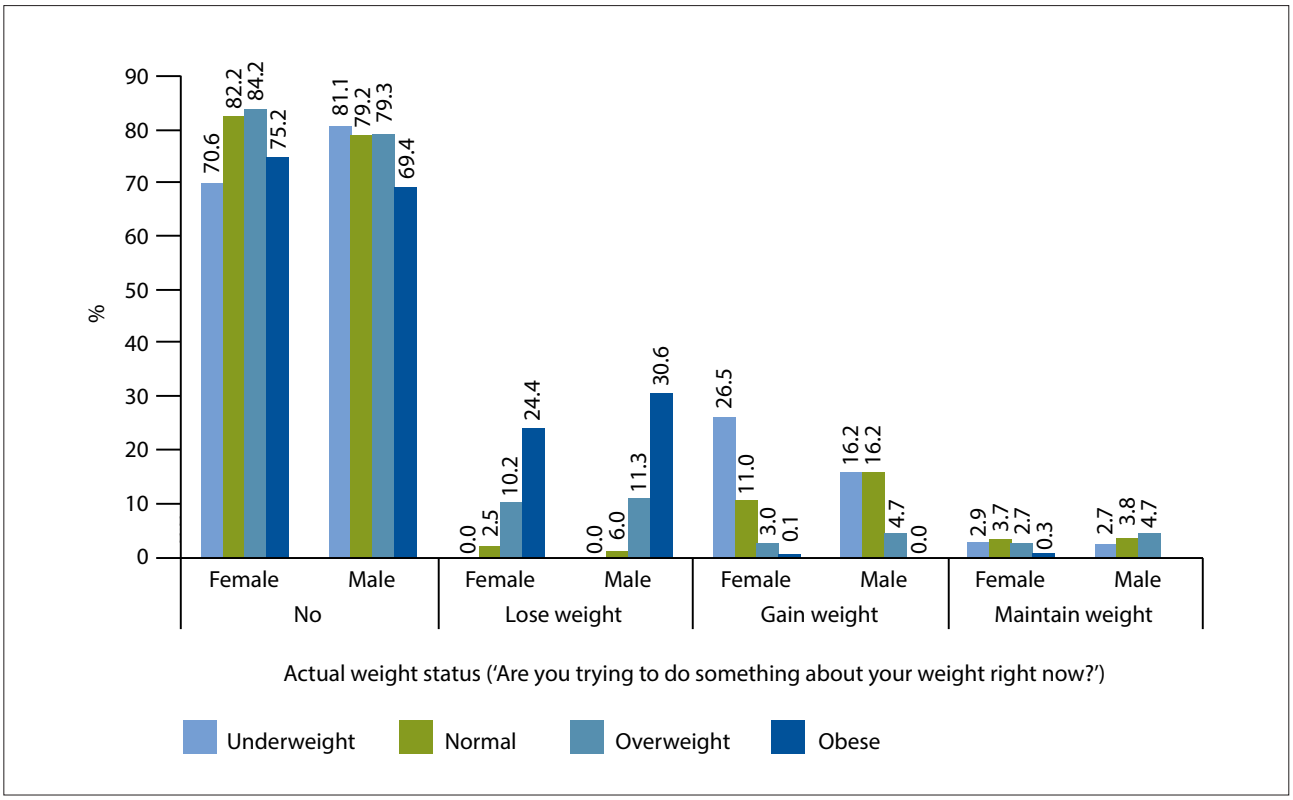


Fig. 3. The percentage of weight management responses across body mass index status, by sex. Results are shown as percentages within each sex group, highlighting current weight management and body mass index status.

themselves as overweight compared with men, with some women of normal weight classifying themselves as overweight. Our results agree with those published by Prioreschi *et al.*[20] A large proportion of men, particularly men with obesity, were more likely to perceive their weight as lower than it actually was, suggesting that this misperception may contribute to a lack of effort regarding weight management. Underweight individuals tended to overestimate their body size, and identified with a silhouette that overrepresented their actual weight. Our study also agrees with findings from Lopez-Bueno *et al.*,[21] who reported a significant underestimation of body weight among study participants (nursing students in Spain), with men exhibiting greater discrepancies than women. In their study, 57% of men v. 23% of women underestimated their actual BMI, which agrees with our results, highlighting a disconnect between perceived and actual weight among men and women.[21]

Many factors may contribute to these findings, including age, level of education and socioeconomic status. Cultural norms and body image ideals within this SA population may influence perceptions of acceptable body size,[12] contributing to the normalisation of body shapes associated with overweight and obesity.[20] Several studies have shown that misperception of body weight is an important barrier to obesity management.[3-6,12] Given the significant and growing impact of obesity in Africa, it is important to understand body size perceptions and attitudes to develop effective weight management strategies.[22] Chigbu *et al.*[23] surveyed 6 628 adults in southeast Nigeria, and reported that >25% of the study population were living with overweight or obesity, while 44% perceived a large body size as desirable. Limited awareness about health risks associated with excess weight, and a lack of access to weight management programmes, may explain the low engagement in weight loss efforts.

A study by Jiménez-Morcillo *et al.*[24] explored the impact of body image perception on health behaviours among young European adults, and showed that distorted image perceptions negatively impact health and cause psychological distress, further emphasising the need for accessible health resources. The SANHANES reported that 84.5% of South Africans aged ≥15 years either underestimated or overestimated their body size, which may be the result of societal norms that either emphasise or criticise either thinness or excess weight, and sometimes stigmatise thin individuals or those with obesity.[12] However, a recent study examining the relationships between body image and weight management strategies in rural and urban young SA females reported that living with overweight or obesity was positively associated with a desire to be thinner.[20] Our findings support this notion to some extent, particularly with respect to women, as most were able to identify the correct silhouette, and ~21% of women were engaged in weight management activities. Sex differences in body image perception and societal pressures may also play a role in weight management efforts, as seen in the higher accuracy of weight perception among women with obesity compared with men. Most participants reported dissatisfaction with their body image, yet only 13% of participants living with overweight and obesity reported attempting to lose weight, while a small percentage of underweight women (26.5%) and men (16.2%) were trying to gain weight. These findings highlight the need for targeted health education and culturally sensitive interventions that address body image, health literacy and accessibility to lifestyle modification resources.

Our analysis identified waist circumference as the only anthropometric marker that was significantly associated with active weight loss management. We observed that individuals with greater waist circumference measurements were more likely to lose weight, suggesting that awareness of weight gain (possibly triggered by the discomfort or tightness of clothing around the waist) may motivate the initiation of a weight loss programme. Our findings agree with previous research indicating that waist circumference is a useful tool for identifying patients at high risk for metabolic diseases, as well as a marker to encourage lifestyle changes to improve health.[25,26] These results underscore the relevance of waist circumference measurements as a practical screening tool. Therefore, we believe the use of visual representations of body shape should also be included in obesity management, rather than employing weight or BMI measurements alone.

Epidemiological data have demonstrated higher obesity rates in women than men worldwide.[27] Consequently, MetS is more prevalent in women.[28,29] Similarly, in this study, obesity and MetS were more prevalent in women than men. MetS was observed in 79% of men with obesity, compared with 67% of women with obesity. Waist circumference is used as a criterion for MetS, while obesity is measured using BMI. Therefore, these sex differences in MetS in individuals with obesity may be due to body shape. The gynoid (pear) shape, which is associated with fewer metabolic complications and a lower risk of MetS, is more prevalent in women, as evidenced in this study by a significantly greater average hip circumference in women than men.[30-32] The waist-to-hip ratio has previously been shown to be an important determinant of high triglycerides, which are associated with greater cardiovascular risk in men with obesity than in women.[33] An important distinction in obesity research is the recognition of distinct phenotypes, such as metabolically unhealthy normal-weight individuals, and metabolically healthy individuals with obesity, often referred to as the 'fit fat' phenotype.[34] A study by Wildman *et al.*[34] highlighted that not all individuals with obesity exhibit cardiometabolic risk factors, but some individuals with normal weight may do so. Moreover, a study by Murphy *et al.*[35] comprehensively reported the current status of metabolic health in SA, including challenges faced by both patients and clinicians, with an aim to improve knowledge and awareness of risk factors and useful parameters to improve overall health. This challenges the use of BMI as an indicator of metabolic health. In our mixed-ancestry SA cohort, which exhibits a high prevalence of overweight and obesity, with high risk of diabetes,[28] we observed that BMI distributions did not differ significantly between diabetic and non-diabetic participants.[36] These findings show the limitations of BMI as a diagnostic tool for metabolic risk, and emphasise the importance of evaluating body composition and fat distribution, as well as integrating non-invasive markers (such as waist circumference) when assessing the risk for metabolic disorders in this population.

Study strengths and limitations

The strength of this study lies in the use of randomly placed Stunkard figures, forcing the participants to think about selecting a silhouette that likely resembles their own bodies. However, the study is limited by the proportion of male and female participants. Although the sample number of this study was reasonable, the ratio of men to women was small, and should be considered when interpreting the overall data. Moreover, the results of this study may only be applicable to an older age group, while perceptions may differ in younger age groups (<40 years), especially considering that a significant portion of the population in SA is aged <40 years.[37] Socioeconomic status and level of education should also be considered.

Conclusion

Our study showed that both men and women underestimated their weight, which has a bearing on participation in weight loss programmes. Furthermore, the recognition of overweight or obesity

as shown by increased waist circumference is associated with a higher likelihood of engaging in weight loss programmes. Tailored strategies that incorporate visual tools, such as the FRS, may improve self-perception and encourage participation in weight management efforts, particularly among men and those with obesity, who are more likely to underestimate their body size. Research has shown that personalised tracking and visual tools improve the uptake of healthy behaviours and adherence to health goals.[38] We recommend that health facilities include visual representations corresponding to an individual's body weight as part of routine obesity management protocols.

Data availability. All data used in this study are shown in the tables and accompanying figures. Any further information may be made available from the authors upon reasonable request.

Declaration. None.

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Author contributions. TEM: conception and study design, data acquisition, funding acquisition, writing – original article draft; SFGD: data acquisition, data analysis and interpretation, article revision; RTE: conception and study design, article revision; APK: conception and study design, data analysis and interpretation; SR: data analysis and interpretation, writing – revised article draft, scientific revision for important content. All authors have approved the final version of the article for publication.

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Conflicts of interest. None.

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