

## Association between lifestyle-related risk behaviors, chronic diseases, and body image distortion: gender differences in follow-up 1 of the ELSA-Brasil cohort

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### ABSTRACT

**Aim:** To determine the prevalence of body image accuracy/distortion in Brazilian men and women and to investigate sociodemographic and lifestyle-related factors, and the presence of chronic diseases associated with body image distortion.

**Methods:** Data from 6,357 men and 7,657 women participating in the Brazilian Longitudinal Study of Adult Health (ELSA-Brasil) were collected using a multidimensional questionnaire covering sociodemographic characteristics, health behaviors, health conditions and body image perception.

**Results:** Most participants (53.5% of the women and 54.7% of the men) were found to have an accurate self-perception of their body. When the factors associated with the perception of being heavier than reality were investigated, adopting weight loss measures and not being hypertensive proved protective against this distortion, both in women and men. Conversely, the perception of being lighter than reality was associated, in both women and men, with better education, being black or of mixed race, adopting weight loss measures and not being hypertensive or diabetic. Additional factors associated with underestimating weight were not consuming alcohol (only in women) and belonging to a lower social class (only in men).

**Conclusion:** These findings may contribute to the implementation of public health policies and interventions to promote health and well-being in the Brazilian population.

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## Introduction

Body image is a complex concept. When an individual perceives their own image as it really is, their perception is accurate; when this is not the case, it is distorted (Brooks et al., 2016; Hosseini & Padhy, 2022). Body image distortion involves cognitive, perceptual, and affective components. The cognitive component relates to thoughts and beliefs about the shape and appearance of the body and the mental representation of the body. The perceptual component involves the identification and estimation of the body and indicates the accuracy of individuals' assessment of the size, shape, and weight of their body in comparison to its actual proportions. The affective component includes the feelings that individuals develop about their bodies and their satisfaction or dissatisfaction with their bodies (Gaudio et al., 2014; Hosseini & Padhy, 2022).

There are different techniques for assessing one's own body image, and these can be defined as belonging to one of three classes: analogue scales, image marking and optical distortion methods (Farrell et al., 2005; Hsu & Sobkiewicz, 1991). Regardless of the methodology used, most of these techniques assess body image perception according to the formula 'estimated size/actual size' (Farrell et al., 2005).

Interest in studying body image distortion has increased progressively over recent years due to its association with a series of health-related issues. Underestimation of body weight has been associated with obesity and the aggravation of some chronic diseases (Duncan et al., 2011). Conversely, overestimation of weight has been associated with eating disorders (Sadibolova et al., 2019), unhealthy weight loss behaviors and nutritional imbalance (Lee & Lee, 2016; Sagar, 2005), suicidal ideation (Lee & Lee, 2016; Shin et al., 2015) and depression (Lee & Lee, 2016).

The determinants that contribute towards distorting body image dimensions have been reported to involve sociodemographic, psychosocial, behavioral, and health-related factors such as self-rated health status, health and lifestyle behaviors (Patrão, Almeida, et al., 2017; Patrão, da Conceição Almeida et al., 2022; Song et al., 2020), use of drugs and dietary supplements (Silva, et al., 2018), age (Song et al., 2020), economic status, the influence of the mass media, parental influence and peer pressure (Musaiger, 2015).

Gender differences with respect to body image perception have been widely reported (Ejike, 2015; Lynch et al., 2009; Song et al., 2020; Yager et al., 2020) and, indeed, body image perception is strongly affected by gender roles in society (Brooks et al., 2020). Social pressures regarding female beauty or beauty associated with women (Bonell et al., 2021; Puraikalan, 2018), as well as life events such as pregnancy, childbirth, the postpartum period (Yager et al., 2020), and menopause (Nazarpour et al., 2021), exert a very particular effect on women's body image perception. Men also try to comply with their beauty ideals and adopt specific behaviors to do so, including performing physical exercise and attempting to achieve a more muscular physique (Bassett-Gunter et al., 2017; Puraikalan, 2018), which may be related to issues of hegemonic masculinity (Connell, 2005). Furthermore, there is some evidence that women, compared to men, are more likely to perceive their bodies as larger than they really are (Ejike, 2015; Lee & Lee, 2016; Medeiros de Morais et al., 2017).

With very few exceptions in the literature (Pandolfi et al., 2020), studies on factors associated with body image in Brazil are rare. This situation is compounded when the objective is to analyze the different types of distortion and gender specificities. Therefore, studies involving large cohorts such as that of the Brazilian Longitudinal Study of Adult

Health (ELSA-Brasil), the largest study on adult health in Brazil and in Latin America (Aquino et al., 2012), are of great relevance. Previous studies conducted with the ELSA-Brasil baseline cohort have investigated factors associated with body image satisfaction/dissatisfaction (e.g. Albuquerque et al., 2021; Coelho et al., 2015; De Oliveira da Silva et al., 2018); however, distortion has seldom been investigated. Therefore, the principal objective of the present study was to evaluate the prevalence of body image distortion/accuracy in men and women in the ELSA-Brasil cohort at the first follow-up assessment after baseline. In addition, sociodemographic factors, lifestyle factors, and chronic diseases associated with body image distortion were analyzed from a gender perspective, highlighting the differences between men and women in the study population.

## Methods

### *Participants and procedures*

This study was conducted using data from the first follow-up of the ELSA-Brasil (four years after baseline). The population eligible for inclusion in this cross-sectional study consisted of working or retired men and women with no cognitive impairment or physical disability that would prevent them from providing information or undergoing the required assessments. Individuals who were very ill or who failed to answer the questions on body image perception were excluded from the study. Consequently, 7,657 women and 6,357 men, with a mean age of  $55.7 \pm 8.8$  years ( $\pm$  SD) and  $55.7 \pm 9.2$  years, respectively, were included in the analysis.

At baseline, the ELSA-Brasil included a cohort of 15,105 active or retired civil servants (8,218 women and 6,887 men) from six public teaching and research institutes in Brazil. At the first follow-up, 92.8% of these participants continued in the study. Losses were higher among women and older participants. The reasons included participant dropout, death, illness or disability, pregnancy, being out of the country, moving to another city, and unavailability for interviews and examinations. There were no systematic differences in losses and the cohort maintained its characteristics, with no differences between those who remained and those who left the cohort. Each of the institutions involved has its own ELSA research center at local level, where interviews, clinical examinations, and other relevant assessments (e.g. weight and height measurements) take place. Details of the methodology involved in the ELSA-Brasil have been published previously (Aquino et al., 2012; Schmidt et al., 2015).

The ELSA-Brasil was approved by the internal review boards of the participating teaching and research institutions (the Federal Universities of Bahia, Espírito Santo, Minas Gerais and Rio Grande do Sul, the University of São Paulo and the Oswaldo Cruz Foundation in Rio de Janeiro) and by the Ministry of Health's National Research Ethics Committee (CONEP 976/2006). All the candidates who agreed to participate in the study signed an informed consent form. More details on all the ethical procedures involving this cohort can be found at Aquino et al. (2013).

### *Variables and instruments*

Details regarding the instruments used in the ELSA-Brasil have already been published (Chor et al., 2013; Schmidt et al., 2015). The variables used in this study are as follows:

### **Sociodemographic characteristics:**

A sociodemographic questionnaire was used to investigate age group, self-reported ethnicity/skin color, education, marital status, and social class.

### **Lifestyle-related health behaviors**

*Hours of sleep:* Evaluated from the question ‘How many hours on average do you sleep in a normal night?’ Answers were later dichotomized into  $<7$  h/night and  $\geq 7$  h/night (Hirshkowitz et al., 2015).

*Recreational screen time:* Evaluated from the question ‘On an average day, how much time do you normally spend watching television, videos or another type of screen such as a computer or video game at weekends and when you are not working on weekdays?’ The answers were later dichotomized into  $<2$  h/day and  $\geq 2$  h/day (Dunstan et al., 2010).

*Current smoking:* Evaluated based on whether the individual was a current or former smoker or had never smoked.

*Alcohol consumption:* Participants were asked whether they consumed alcohol, even if only occasionally (yes/no).

*Leisure time physical activity:* Measured using the International Physical Activity Questionnaire (IPAQ) (Haskell et al., 2007), with respondents being classified as active ( $\geq 150$  min/week of walking or moderate physical activity or  $\geq 60$  min/week of intense physical activity) or inactive ( $<150$  min/week of walking or moderate physical activity or  $<60$  min/week of intense physical activity).

*Weight reduction measures:* evaluated from the answers to two questions, one related to the practice of weight loss diets (yes/no) and the other regarding whether the individual has undergone bariatric surgery (yes/no).

### **Chronic diseases**

Participants were asked whether they had ever been diagnosed with cancer, hypertension or diabetes (yes/no). The question on cancer was only asked in Wave 1 of the ELSA-Brasil (Baseline, 2008–2010).

### **Body image perception:**

Evaluated using the Stunkard Silhouettes (Stunkard et al., 1983), which consist of 9 numbered silhouette figures that increase gradually in size from very thin to very obese (1–9, respectively). For this variable, the figure used was the one selected by the participant when asked to choose the figure that reflects how they think they look. At the same time, the participants were weighed to the nearest kilogram, and their height was measured, without shoes, to the nearest 0.1 cm. Body mass index (BMI) was then calculated and later classified into four ordinal categories according to the World Health Organization standard definition: underweight ( $<18.5$  kg/m<sup>2</sup>), normal weight (18.5–24.9 kg/m<sup>2</sup>), overweight (25.0–29.9 kg/m<sup>2</sup>) and obese ( $\geq 30$  kg/m<sup>2</sup>) (NHLBI Obesity Education Initiative, 1998). Finally, differences between the real and perceived images were evaluated to determine whether the individual’s perception of his/her body image was accurate or distorted (over – or under-estimated).

### **Data analysis**

To assess the prevalence of body image distortion/accuracy in men and women, a descriptive analysis was performed, with calculation of measures of central tendency

and dispersion and prevalence rates for the study variables. The differences in proportions were tested using Pearson's chi-square test, when appropriate, with the significance level set at 5%. The unadjusted measures of association (odds ratios) and their respective 95% confidence intervals (95%CI) were calculated using univariate logistic regression.

To analyze the factors associated with body image distortion/accuracy, multivariate models were constructed, with the selected variables being adjusted simultaneously. The variables for the investigation were selected based on a theoretical model. Subsequently, using statistical criteria, the variables that showed an association with the outcome at a significance level of 10% in the crude analysis were selected to remain in the model. Next, those variables that were statistically significant at 5% were allowed to remain in the final model. The goodness-of-fit test was performed using the receiver operating characteristic (ROC) curve. The analysis was stratified in accordance with sex, and separate models were constructed for distortion of weight status according to whether weight was over – or under-estimated.

### **Ethics statement**

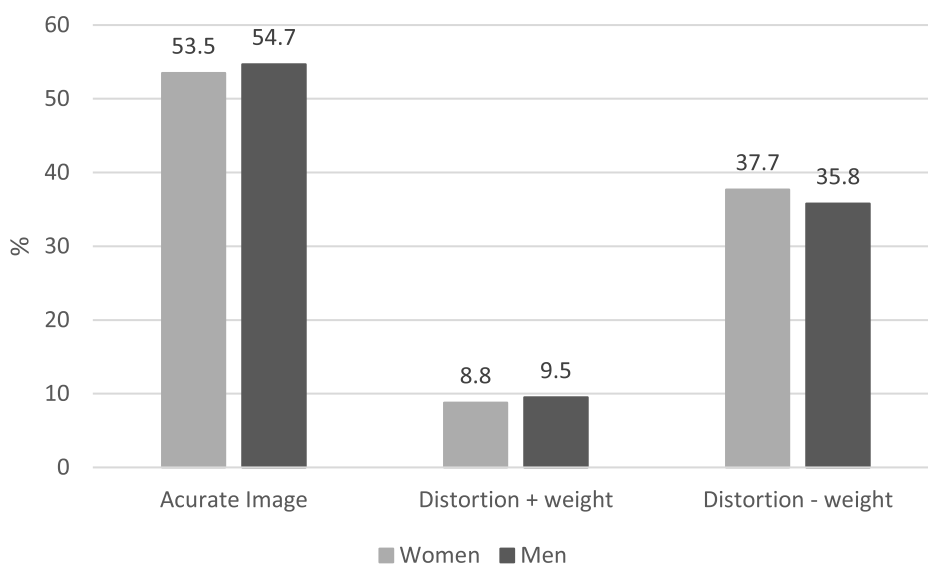
The internal review boards of the six participating institutes (the Federal Universities of Bahia, Espírito Santo, Minas Gerais and Rio Grande do Sul, the University of São Paulo and the Oswaldo Cruz Foundation in Rio de Janeiro) approved the ELSA-Brasil protocol. The study was approved at national level by the Ministry of Health's National Research Ethics Committee (CONEP 976/2006). All the candidates who agreed to participate in the study signed an informed consent form.

### **Results**

Slightly over 50.0% of the 6,357 men and 7,657 women had an accurate perception of their body weight (Figure 1). Nevertheless, comparison between the sexes showed that a greater proportion of women underestimated their weight (37.7%).

Most of the women who underestimated their weight status were  $\geq 60$  years of age (39.8%), had studied only up to elementary school level (52.6%), had no partner (39.9%), self-reported their ethnicity as black (45.6%) or indigenous (50.0%) and were middle class (38.2%). Conversely, the men who underestimated their weight status were between 50 and 59 years old (35.0%), single with a partner (38.6%), and of low social class (42.1%) (Table 1). Irrespective of sex, excessive alcohol consumption was common, as was the adoption of weight reduction measures. Among men, the proportion of smokers or former smokers was greater among those who underestimated their weight (35.4%). In men and women with hypertension and/or diabetes, body image distortion tended to be more towards perceiving themselves as lighter than reality (Table 1).

The factors associated with perceiving oneself as heavier included weight reduction measures both in the women (OR = 0.68; 95%CI: 0.55–0.85) and in the men (OR = 0.49; 95%CI: 0.36–0.66) and not being hypertensive (OR = 0.60; 95%CI: 0.50–0.73 and OR = 0.72; 95%CI: 0.60–0.87 in women and men, respectively) (Table 2). In women, perceiving oneself as lighter was positively associated with a better education level, being



**Figure 1.** Distribution of women and men in the ELSA-Brasil cohort (Follow-up 1: 2012–2014) according to self-image perception.

black or of mixed race, adopting weight loss measures (OR = 1.65; 95%CI: 1.47–1.85), and not being hypertensive or having diabetes. Excessive alcohol consumption was negatively associated with perceiving oneself as lighter than reality in women alone (OR = 0.81; 95%CI: 0.77–0.91). In men, this was also associated with being of low social class (OR = 1.34; 95%CI: 1.10–1.69) (Table 3).

## Discussion

The majority of women and men were found to have an accurate perception of their own bodies. Nevertheless, when the two different types of distortion were compared, the men were slightly more likely to perceive themselves as heavier than they actually were, while the women were more likely to perceive themselves as lighter. When the factors associated with perceiving oneself as heavier were investigated, adopting weight loss measures and not being hypertensive were associated with a more accurate perception, both in women and in men. On the other hand, perceiving oneself as lighter than reality was associated, in both groups, with having better education, being black or of mixed race, adopting weight loss measures and not being hypertensive or diabetic. In women, not consuming alcohol was an additional factor, whereas in men being in the lowest social class constituted an additional factor.

In contrast with the findings of other studies (e.g. Raj & Ploriya, 2018; Song et al., 2020), including some conducted in Brazil (Nazaret et al., 2020; Pandolfi et al., 2020), most of the men and women in the ELSA-Brasil cohort had an accurate perception of their own body, which may offer them protection against certain health issues given that body image distortion is associated with risk factors and behaviors that include obesity, weight fluctuation, and mental health issues such as depression or even suicidal ideation (Lee & Lee, 2016; Lynch et al., 2009; Raj & Ploriya, 2018; Sagar, 2005; Shin et al., 2015).

**Table 1.** Body image perception according to the sociodemographic characteristics, health behaviors, lifestyle-related behaviors and chronic diseases in women and men in the ELSA-Brasil cohort (2012–2014).

Characteristics	Women's body image				Men's body image				p-value	
	Accurate n = 4035	Distorted weight perception		p-value	Accurate n = 3512	Distorted weight perception		p-value		
		Overestimated n = 663	Underestimated n = 2842			Overestimated n = 651	Underestimated n = 2104			
<b>Sociodemographic characteristics</b>										
<b>Age</b>										
38–49 years	57.0	9.0	34.0	<b>0.001</b>	58.9	11.1	30.0			<b>&lt;0.001</b>
50–59 years	53.3	8.3	38.4		55.0	10.0	35.0			
≥60 years	51.0	9.2	39.8		54.7	11.3	34.0			
<b>Schooling</b>										
Completed elementary school	42.5	4.8	52.6	<b>&lt;0.001</b>	46.9	8.2	44.9			<b>&lt;0.001</b>
Completed high school	49.6	6.4	44.0		55.1	8.6	36.3			
Completed university	57.2	10.7	32.1		59.1	12.0	28.9			
<b>Marital status</b>										
Stable union	54.4	9.0	36.6	<b>0.005</b>	56.0	10.5	33.5			<b>0.031</b>
Single with partner	58.0	7.8	34.2		52.0	9.4	38.6			
Single without a partner	51.3	8.8	39.9		59.7	10.3	30.0			
<b>Ethnicity/skin color</b>										
Black	48.8	5.6	45.6		48.9	9.4	41.7			
Mixed race	51.4	7.2	41.4	<b>&lt;0.001</b>	53.7	9.9	36.4			<b>&lt;0.001</b>
White	56.4	10.4	33.2		59.0	11.2	29.8			
Asian origin	54.1	16.9	29.0		64.1	11.7	24.2			
Indigenous	45.2	4.8	50.0		44.4	2.5	53.1			
<b>Social class</b>										
Lower	47.4	6.0	46.6	<b>&lt;0.001</b>	50.0	7.9	42.1			<b>&lt;0.001</b>
Middle	54.0	7.8	38.2		57.1	10.1	32.8			
Upper	57.0	12.0	31.0		59.4	12.8	27.8			
<b>Health Behaviors</b>										
<b>Sleep</b>										
≥ 7 h/day	53.9	8.9	37.2	0.693	56.9	10.3	32.8			0.363
< 7 h/day	54.0	8.8	38.2		55.2	10.4	34.4			
<b>Recreational screen time</b>										
≤ 2 h/day	54.5	8.7	36.8	0.251	56.1	10.4	33.5			0.997
> 2 h/day	52.7	8.8	38.5		56.2	10.3	33.5			
<b>Smoking</b>										
				0.118						<b>0.011</b>

(Continued)

**Table 1.** Continued.

Characteristics	Women's body image				Men's body image			
	Accurate n = 4035	Distorted weight perception		p-value	Accurate n = 3512	Distorted weight perception		p-value
		Overestimated n = 663	Underestimated n = 2842			Overestimated n = 651	Underestimated n = 2104	
Never-smoker	52.6	9.0	38.4		57.1	10.9	32.0	
Current or former smoker	56.0	8.5	36.5		54.9	9.7	35.4	
<b>Alcohol consumption</b>				<b>&lt;0.001</b>				<b>&lt;0.001</b>
No	49.5	7.7	42.8		53.3	9.3	37.4	
Yes	56.3	9.6	34.2		57.1	10.8	32.1	
<b>Physical activity</b>				<b>0.002</b>				0.092
Active	54.9	9.9	35.2		57.5	10.3	32.2	
Inactive	52.9	8.2	38.9		54.9	10.4	34.7	
<b>Weight reduction measures (dieting and bariatric surgery)</b>				<b>&lt;0.001</b>				<b>&lt;0.001</b>
Yes	46.9	5.6	47.5		50.9	4.7	44.3	
No	55.9	9.9	34.2		57.1	11.5	31.4	
<b>Chronic Diseases</b>				<b>0.046</b>				0.116
<b>Cancer ≥ 2 years ago</b>								
Yes	53.6	12.1	34.2		53.3	14.3	32.4	
No	53.5	8.6	37.9		56.1	10.2	33.6	
<b>Hypertension</b>				<b>&lt;0.001</b>				<b>&lt;0.001</b>
Yes	47.9	5.4	46.7		53.3	7.9	38.8	
No	56.9	10.8	32.4		58.4	12.4	29.2	
<b>Diabetes</b>				<b>&lt;0.001</b>				<b>&lt;0.001</b>
Yes	42.6	5.2	52.2		51.4	7.7	40.9	
No	55.7	9.5	34.8		57.3	11.2	31.5	



**Table 2.** Unadjusted measures of association and the final model for body image distortion towards perceiving oneself as heavier than reality and selected factors according to the sex of the participant in the ELSA-Brasil cohort (2012–2014).

Factors	Women				Men			
	Unadjusted OR	95%CI	Adjusted OR*	95%CI	Unadjusted OR	95%CI	Adjusted OR*	95%CI
<b>Age</b>								
38–49 years	1.00		–		1.00		–	
50–59 years	0.98	0.80–1.21	–	–	0.88	0.71–1.08	–	–
≥60 years	1.14	0.92–1.41	–	–	1.10	0.89–1.35	–	–
<b>Schooling</b>								
Completed elementary school	1.00		–		1.00		1.00	
Completed high school	0.68	0.56–0.83	–	–	0.77	0.63–0.94	0.89	0.69–1.16
Completed university	0.61	0.41–0.89	–	–	0.86	0.66–1.13	1.06	0.74–1.53
<b>Marital status</b>								
Stable union	1.00		–		1.00		–	
Single with partner	0.81	0.60–1.09	–	–	0.96	0.71–1.31	–	–
Single without a partner	1.03	0.87–1.23	–	–	0.92	0.69–1.21	–	–
<b>Ethnicity/skin color</b>								
White	1.00		–		1.00		–	
Mixed race	0.77	0.62–0.94	–	–	0.97	0.80–1.18	–	–
Black	0.62	0.48–0.81	–	–	1.00	0.77–1.30	–	–
<b>Social Class</b>								
Upper	1.00		–		1.00		1.00	
Middle	0.69	0.57–0.82	–	–	0.82	0.67–0.99	0.85	0.67–1.06
Lower	0.60	0.47–0.78	–	–	0.73	0.58–0.91	0.77	0.56–1.06
<b>Smoking</b>								
Never-smoker	1.00		–		1.00		–	
Current or former smoker	0.89	0.76–1.07	–	–	0.93	0.78–1.10	–	–
<b>Alcohol consumption</b>								
No	1.00		–		1.00		–	
Yes	1.09	0.92–1.29	–	–	1.07	0.87–1.30	–	–
<b>Physical activity</b>								
Active	1.00		–				–	
Inactive	1.16	0.97–1.37	–	–			–	–
<b>Weight reduction measures</b>								
No	1.00		1.00		1.00		1.00	
Yes	0.67	0.54–0.83	0.68	0.55–0.85	0.46	0.34–0.62	0.49	0.36–0.66
<b>Cancer ≥ 2 years ago</b>								
Yes	1.00		–				–	
No	1.40	1.00–1.96	–	–			–	–
<b>Hypertension</b>								
Yes	1.00		1.00		1.00		1.00	
No	0.60	0.49–0.72	0.60	0.50–0.73	0.70	0.59–0.83	0.72	0.60–0.87
<b>Diabetes</b>								
Yes	1.00		–		1.00		1.00	
No	0.71	0.54–0.94	–	–	0.77	0.61–0.96	0.89	0.71–1.13

**Table 3.** Unadjusted measures of association and the final model for body image distortion towards perceiving oneself as lighter than reality and selected factors according to the sex of the participant in the ELSA-Brasil cohort (2012–2014).

Factors	Women				Men			
	Unadjusted OR	95%CI	Adjusted OR*	95%CI	Unadjusted OR	95%CI	Adjusted OR*	95%CI
<b>Age</b>								
38–49 years	1.00		–		1.00		–	
50–59 years	1.21	1.07–1.36	–	–	1.28	1.12–1.47	–	–
≥ 60 years	1.31	1.16–1.49	–	–	1.22	1.06–1.40	–	–
<b>Schooling</b>								
Completed elementary school	1.00		1.00		1.00		1.00	
Completed high school	1.58	1.42–1.76	1.34	1.20–1.51	1.35	1.10–1.52	1.05	0.89–1.25
Completed university	2.21	1.86–2.62	1.66	1.36–2.00	1.95	1.67–2.28	1.33	1.07–1.67
<b>Marital status</b>								
Stable union	1.00		–		1.00		–	
Single with partner	0.88	0.74–1.03	–	–	1.24	1.03–1.49	–	–
Single without a partner	1.16	1.04–1.28	–	–	0.84	0.70–1.01	–	–
<b>Ethnicity/skin color</b>								
White	1.00		1.00		1.00		1.00	
Mixed race	1.36	1.22–1.53	1.16	1.03–1.31	1.34	1.18–1.52	1.18	1.03–1.35
Black	1.59	1.39–1.81	1.22	1.06–1.40	1.69	1.43–1.98	1.37	1.15–1.63
<b>Social Class</b>								
Upper	1.00		–		1.00		1.00	
Middle	1.30	1.16–1.46	–	–	1.23	1.08–1.40	1.08	0.91–1.27
Lower	1.80	1.57–2.07	–	–	1.80	1.57–2.06	1.34	1.10–1.69
<b>Smoking</b>								
Never-smoker	1.00		–	–	1.00		–	–
Current or former smoker	0.91	0.82–1.00	–	–	1.15	1.03–1.28	–	–
<b>Alcohol consumption</b>								
No	1.00		1.00		1.00		–	–
Yes	0.70	0.64–0.77	0.81	0.77–0.91	0.80	0.71–0.90	–	–
<b>Physical activity</b>								
Active	1.00		–				–	–
Inactive	0.87	0.79–0.97	–	–			–	–
<b>Weight reduction measures</b>								
No	1.00		1.00		1.00		1.00	
Yes	1.65	1.49–1.83	1.65	1.47–1.85	1.58	1.37–1.81	1.57	1.35–1.81
<b>Cancer ≥ 2 years ago</b>								
Yes	1.00		–	–	1.00		–	–
No	0.90	0.72–1.13	–	–	1.01	0.76–1.34	–	–
<b>Hypertension</b>								
Yes	1.00		1.00		1.00		1.00	
No	1.71	1.55–1.89	1.38	1.24–1.54	1.45	1.30–1.62	1.22	1.06–1.41
<b>Diabetes</b>								
Yes	1.00		1.00		1.00		1.00	
No	1.96	1.72–2.22	1.60	1.39–1.83	1.45	1.27–1.64	1.22	1.06–1.41

Weight loss measures (dieting and/or bariatric surgery) and not having hypertension, constitute core issues in the debate since they appear as protective factors against distortion in terms of perceiving oneself as heavier than reality and are associated with perceiving oneself as lighter, both in women and in men. Regarding the effect of chronic diseases, diabetes has also been shown to be associated with perceiving oneself as lighter. Being careful with respect to one's weight and having good cardiovascular health insofar as hypertension is concerned would seem to protect against distortion in the sense of perceiving oneself as heavier, since such individuals are very probably concerned with their health and weight status and therefore exert greater control over these factors, hence also having an accurate self-perception of body image. On the other hand, other studies have shown a strong association between body image distortion, in the sense of perceiving oneself as lighter than one actually is, and weight control measures (Lee & Lee, 2016). Furthermore, and contrary to the present findings, this type of distortion appears associated with the presence, rather than the absence, of chronic diseases (Song et al., 2020). The explanation for this fact is linked to the previous one: since these individuals control their weight and presumably take great care to keep to a diet and/or maintain their progress following bariatric surgery, they are healthier insofar as chronic diseases are concerned and may perceive themselves as thinner than they actually are due to all these health behaviors and concerns. Diet and weight control are issues intrinsically associated with body image since the desire to lose weight or gain muscle mass, as so strongly emphasized in the mass media and in social networks, ends up influencing individuals' behaviors and perceptions (Lee & Lee, 2016), and this pressure may contribute significantly to dissatisfaction (not evaluated here) and body image distortion, both in women and in men. The presence and absence of chronic diseases such as hypertension and diabetes can also affect the perception of body image through dietary and lifestyle issues, weight control, and personal perceptions resulting from these forms of self-care.

With respect to perceiving oneself as thinner than one actually is, in addition to adopting weight loss measures and not having chronic diseases, as already discussed, better education and self-identifying as black or of mixed race appears to exert an effect at this level, both in men and women. The findings regarding schooling corroborate previous studies, also conducted with both sexes (Kim et al., 2004); however, to the best of our knowledge, no studies have yet explained this association between better education and being more likely to perceive oneself as thinner than reality. Nevertheless, we believe that this association may be linked to issues of body dissatisfaction, which is more common in better-educated individuals (McLaren & Kuh, 2004) and it is already known that body dissatisfaction and perceiving oneself as thinner than reality are significantly associated (Hosseini & Padhy, 2022; Shoraka et al., 2019). Regarding race, few studies have dealt with the question of distortion, and further research needs to be conducted on the subject, since the distinct experiences of black women and those of mixed race must be taken into account. These women bear the historic legacy of racism, which contributes to different dynamics in relation to body image (Watson et al., 2019). One of the few studies on this subject, conducted with North American adolescents, showed that African American men and women are more likely to underestimate their weight compared to white individuals (Martin et al., 2009), which is in agreement with the findings of the present study. Furthermore, various studies have shown that black individuals and

those of mixed race tend to be more satisfied with their bodies and less concerned with their appearance compared to their white counterparts (Gluck & Geliebter, 2002; Purai-kalan, 2018). In other words, the fact that an individual is satisfied with their body may help explain why, in the present study, the black individuals and those of mixed race were more likely, compared to the others, to underestimate their weight status.

In women, perceiving oneself as thinner than reality was also associated with not consuming alcohol. Although this finding is surprising, similar situations have been found in other studies, with individuals who drink little or no alcohol tending to have a more distorted body image compared to those who drink more significant amounts of alcohol (Song et al., 2020). In the present study, this was the case only for women and for those who perceived themselves as thinner than they actually were. These results should be investigated in greater depth in future studies; however, a possible explanation may be the fact that alcohol consumption is generally associated with overweight and obesity (Suter, 2005; Traversy & Chaput, 2015), which could lead teetotalers to underestimate their weight since they consider their lifestyle to be more compatible with this image.

In the group of men alone, belonging to the lowest social class was associated with perceiving oneself as lighter than reality. This corroborates the findings of other studies that also reported low income as a determining factor in body image distortion (towards perceiving oneself as lighter or heavier than one actually is) in men but not in women (Song et al., 2020). Nevertheless, this direct relationship has yet to be fully explained and the literature on the subject is replete with conflicting findings (Kashubeck-West & Huang, 2013). Indeed, the studies that deal with body image and social class (McLaren & Kuh, 2004) are overwhelmingly conducted with women and tend to focus on the issue of dissatisfaction and not distortion, concluding that body image disorders are more preponderant in the upper classes. Consequently, future studies, including those to be conducted with the ELSA-Brasil cohort, should investigate this association, specifically between social class and body image distortion, in greater depth, with particular emphasis on men.

This study confirms the complexity of the concept of body image, as well as the diversity of factors associated with its distorted perception, especially when examining gender in these relationships. Since body image distortion encompasses cognitive, perceptual, and affective components, in health contexts it is vital to consider its implications in terms of chronic illnesses and mental health. Being aware of the factors associated with self-image misperception contributes towards preventing several health-related issues (both physical and mental) mentioned in the literature as influencing body image distortion. These include obesity (Raj & Ploriya, 2018), suicidal ideation (Lee & Lee, 2016; Shin et al., 2015), depression/sadness (Lee & Lee, 2016), unhealthy behaviors related to weight loss, including extreme calorie restriction and nutritional imbalance (Lee & Lee, 2016; Sagar, 2005), and eating disorders such as anorexia nervosa and bulimia nervosa (Farrell et al., 2005; Gardner & Brown, 2014; Mölbert et al., 2017).

Some limitations need to be taken into consideration in the interpretation of these results. The participants of the ELSA-Brasil are civil servants whose education level and income are higher than those of the general population. Therefore, caution should be taken concerning the external validation of these findings. In addition, this is a cross-sectional study in which the parameters were evaluated at one single moment. Nevertheless, since the ELSA-Brasil is an ongoing study, these same parameters could

be evaluated at a future moment. A strongpoint of this study is the fact that within the context of Brazil, this is an innovative study in that the factors identified as being associated with self-perception of body image were different in men and women. Furthermore, these results were based on a large study population.

## Conclusion

The present results contribute towards identifying factors associated with distorted body image perception in the Brazilian population, specifically the differences between women and men. With respect to health promotion, interventions focusing on social and behavioral factors such as education and alcohol consumption, which are malleable and modifiable, could be developed in an attempt to affect the way in which Brazilian women and men perceive their own bodies. This could have a significant effect on the course of chronic diseases such as diabetes and on mental disorders such as eating disorders and depression. Therefore, it is hoped that this study will contribute towards encouraging the implementation of public health policies to promote health in the Brazilian population.

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## Author's contribution

ALP, MdCA, EG, SA and EMLA contributed in planning the study; MdCA, SA and EMLA coordinated the data collection; ALP and MdCA ran the analyses; ALP, MdCA, SA and EMLA wrote the original text; CN, RG, MdJF and LR reviewed the draft; and all authors contributed in writing the final article.

## Data availability

In line with the ethical standards laid down by the internal review boards of each institution (the Federal University of Minas Gerais, the Federal University of São Paulo, the Federal University of Espírito Santo, the Federal University of Rio Grande do Sul, the Federal University of Bahia and the Oswaldo Cruz Foundation) and by the Publications Committee of ELSA-Brasil (publiELSA), the data used in this study can be made available for research proposals upon request to the ELSA-Brasil datacenter ([estatisticaelsa@ufrgs.br](mailto:estatisticaelsa@ufrgs.br)) and Publications Committee. Additional information can be obtained from the coordinator of the ELSA-Brasil at the research center in Bahia ([elsaufba@ufba.br](mailto:elsaufba@ufba.br)).

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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