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Socioeconomic status and misperception of body mass index among Mexican adults

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Abstract

Objective. To estimate the association between perceived body mass index (BMI) and socioeconomic variables in adults in Mexico. **Materials and methods.** We studied 32 052 adults from the Mexican National Health and Nutrition Survey of 2006. We estimated BMI misperception by comparing the respondent's weight perception (as categories of BMI) with the corresponding category according to measured weight and height. Misperception was defined as respondent's perception of a BMI category different from their actual category. Socioeconomic status was assessed using household assets. Logistic and multinomial regression models by gender and BMI category were estimated. **Results.** Adult women and men highly underestimate their BMI category. We found that the probability of a correct classification was lower than the probability of getting a correct result by chance alone. Better educated and more affluent individuals are more likely to have a correct perception of their weight status, particularly among overweight adults. **Conclusions.** Given that a correct perception of weight has been associated with an increased search of weight control and that our results show that the studied population underestimated their BMI, interventions providing definitions and consequences of overweight and obesity and encouraging the population to monitor their weight could be beneficial.

Key words: weight perception; obesity; body mass index; Mexico

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Nivel socioeconómico y percepción del índice
de masa corporal en adultos en México.
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Resumen

Objetivo. Estimar la asociación entre la percepción del índice de masa corporal (IMC) y las variables socioeconómicas en adultos de México. **Material y métodos.** Se estudiaron 32 052 adultos que participaron en la Encuesta Nacional de Salud y Nutrición 2006. Se estimó la percepción incorrecta del IMC clasificando la percepción del entrevistado sobre su peso en categorías de IMC y comparándola con la que le correspondía de acuerdo con la medición real de su peso y estatura. El nivel socioeconómico se evaluó mediante los activos en los hogares. Se estimaron modelos de regresión logística y multinomial por género y categoría de IMC. **Resultados.** Las mujeres y hombres adultos subestiman su categoría de IMC. La probabilidad de tener una percepción correcta es menor que la probabilidad de obtener un resultado correcto sólo por azar. Los individuos con mayor nivel de escolaridad y socioeconómico tienen mayor probabilidad de percibir correctamente su IMC, particularmente en personas con sobrepeso. **Conclusiones.** Dado que una correcta percepción del peso se ha asociado con mayor búsqueda de su control y que nuestros resultados muestran que la población estudiada subestima su IMC, las intervenciones que provean información sobre definiciones y consecuencias del sobrepeso y la obesidad y que promuevan el monitoreo del peso corporal pueden ser benéficas.

Palabras clave: percepción del peso; obesidad, índice de masa corporal; México

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The combined prevalence of overweight and obesity, defined as a body mass index (BMI) equal to or greater than 25, has reached 73% of adult women and 69% of adult men in Mexico.¹ Studies have reported that underestimation of body weight is related to higher energy intake,^{2,3} lower intention to lose weight²⁻⁵ sedentary lifestyles^{2,3} and overestimation of health status.⁶ Therefore the health consequences of body weight misperceptions can be particularly serious in Mexico, given its high prevalence of overweight and obesity, as it is also known that a correct self-perception of weight status—particularly of overweight or obesity—is associated with an increased search of weight control.⁷ Understanding factors associated with weight misperception are crucial in designing public health interventions to tackle the obesity epidemic in the country.

Worldwide, perception of body size has changed over time.^{2,3,8} Because perception of body weight is influenced by cultural norms and the body sizes of our peers, and since overweight and obesity is now more prevalent than normal weight, today bigger body sizes are frequently considered as “normal”.⁹⁻¹¹ Studies have shown that gender,^{4,9} age, ethnicity, education level,^{9,12} and not having been told by a physician or other health professional that the respondent was overweight or obese¹² are strongly correlated with misperception of body size. The majority of the studies on the determinants of weight perception have been conducted in high and middle-income countries. In less developed nations, determinants of weight perception may be different for several reasons: coexistence of undernutrition and obesity, as larger body shapes may be seen as a sign of wealth in poorer areas;¹¹ low health coverage and screening for obesity, and lack of prevention campaigns to reduce obesity.

In Mexico, studies on the determinants of perceived weight are scarce and the samples included in the existing literature analyze populations that are often not representative at the national level. Perez-Gil *et al.*, in a study describing how women from three rural areas perceive their bodies, found that there are significant differences between self-perception and actual BMI category.¹³ In a study conducted in the state of Morelos, that compared weight perception with actual BMI among workers from the social security system, 72% underestimated their weight status.¹⁴ Underestimation decreased with education, was lower among current workers and higher among the retirees. One recent study that compared actual versus perceived weight between Mexican women living in Mexico and Mexican-American women living in United States, concluded that low medical screening affected both countries but that misperception was more common in Mexico.¹⁵

The aim of this paper was to estimate the association between perceived BMI and socioeconomic factors using a national cross-sectional survey conducted in Mexico in 2006. Understanding the determinants of perceived BMI would help target individuals with low awareness of their BMI status and to design interventions according to their specific needs.

Materials and methods

Data

Data come from the Mexican National Health and Nutrition Survey 2006 (Ensanut 2006), a cross-sectional survey conducted in that year.¹⁶ Ensanut 2006 has a multistage, probabilistic, stratified sample design; it reached 48 308 dwellings; 24 098 children (0-9 years old); 25 166 adolescents (10 to 19 years old), and 45 446 adults (aged 20 and over). The survey is representative at the national and state levels.

Subjects

Adult individuals (20 years old and over) with measures of weight and height were included in the analysis. We eliminated extreme values, considering 99% of the center values by gender. Pregnant women were excluded from the analysis. Our analytical sample included 32 052 individuals, among them 19 232 non-pregnant women and 12 820 men.

Variables

Perception of BMI was created based on a question where participants chose whether they considered themselves as overweight, obese, of low or normal weight. We created a dummy variable that equals 1 if BMI perception is incorrect (actual BMI different than the BMI category selected by the respondent), and 0 otherwise. We also created a categorical variable to compare individuals with a correct perception with those who underestimated (actual BMI higher than selected) and overestimated (actual BMI lower than selected) their BMI category. In Ensanut 2006, weight was measured using portable electronic scales (Tanita, Model 1583, Tokyo, Japan) with a precision of 10 g, and height was measured using a portable stadiometer (Dynatop E1, Mexico City, Mexico) with a precision of 1 mm. All measurements were taken by standardized personnel using internationally accepted techniques.^{17,18} The cut-off points for BMI categories were defined as follows: BMI below 18.5 for low weight, equal or higher than 18.5 and lower than 25

for normal weight, between 25 and less than 30 for overweight and 30 or higher for obese.¹⁹

We included household assets (possession of radio, television, video, blender, refrigerator, washing machine, telephone, water heater, car) as a measure of socioeconomic status. An index was created using factor analysis. A dummy variable was created to distinguish between high and low wealth. To model nonlinear associations between perception of BMI and education, we created five dummy variables using the highest level of education completed as reported in the survey: no education, primary school, secondary school, high school, and university or higher.

We created age groups using tertiles to reflect a cohort effect on perceived BMI and to distinguish differences in body size between age groups. We also included a variable that takes 1 if participants in the survey responded whether a physician or a nutrition specialist told them they had obesity. We included a dummy variable if the individual reported to speak an indigenous language to reflect cultural differences in BMI perception. To model contextual effects, we added the categories for place of residence rural vs urban (rural being less than 2 500 inhabitants), and a marginality index at the locality level divided in two groups: high and low marginality. The marginality index is a measure of social deprivation that combines in a principal component analysis census data on illiteracy, education, housing conditions, population size, employment and income.²⁰

Empirical estimation

We compared actual BMI categories with perception of BMI category and used the chance corrected concordance (CCC) to correct for concordance due to chance alone.²¹ We estimated a CCC by BMI category and an overall CCC using equal weights.

Two regressions for BMI perception were estimated. A logistic regression to estimate factors associated with the probability of incorrect compared to correct perception (correct perception was left as the reference group in the model), and a multinomial logistic regression to compare characteristics of individuals who underestimated or overestimated their BMI with those with a correct perception (correct perception was left as the reference group).

Models were stratified by gender and BMI category (underweight, normal weight, overweight and obese). The rationale for stratifying by BMI category is as follows: weight could be endogenous if unobservable variables are correlated with perceived BMI and any of the covariates in the model. For instance, if parents'

education was related with both perceived BMI and socioeconomic status, the association between socioeconomic status and BMI perception would be biased. To avoid biased estimations of body perception, BMI category was not included as a variable in the models but it was used for stratification.

Estimations were conducted using Stata version 10.* Descriptive analysis and regressions use weights to reflect the sampling design.

Results

Table I shows that 38% of the population studied had a correct perception of their BMI, slightly lower among women (37%) compared to men (39%). Around 58% of men and women underestimated their BMI (their actual BMI was higher than their perceived BMI category) and less than 5% overestimated it (their actual BMI was lower than their perceived BMI category). Around 45% of the sample completed primary school, only 21% finished high school or higher education and 9.7% reported they were of indigenous origin.

We compared the perceived BMI category with the actual BMI category among women (table II) and men (table III) and found that 67% of women with normal BMI perceived themselves correctly. Only 44% of women with low weight perceived themselves correctly, and the rest of this group overestimated their BMI. Among overweight women, only 46% perceived themselves as overweight, 46.7% with normal weight and 4.9% with low weight. Only 4.9% of obese women perceive themselves as such, 74.5% as overweight, 19.1% with normal weight and 1.5% with low weight. As expected, overweight and obese women tended to underestimate their BMI. Compared to women, a higher percentage of men with normal weight identified themselves correctly. However, a lower percentage of overweight and obese men identified their BMI category correctly. By BMI category, we found a positive but low CCC among women and men with normal weight and overweight. However, the overall CCC is negative, showing that the probability of a correct classification is lower than the probability of getting a correct result by chance alone.

The logistic regression model for incorrect versus correct BMI perception is presented in table IV. Most of the statistically significant associations are seen among overweight and obese adults. Among the overweight and the obese, older adults (men and women) were more likely to misperceive their BMI. Overweight women

* Stata Corporation. Stata 10.1 Special Edition. 1984-2009.

Table I
Characteristics of 32 052 individuals in Ensanut 2006. México

	Means (linearized standard error) or proportions		
	All N=32 052	Women N=19 232	Men N=12 820
Dependent variables			
Perceived weight (incorrect perception=1)*	62.40	63.38	60.89
Perceived weight (three categories)*			
Correct perception	37.60	36.58	39.13
Underestimates	58.42	58.87	57.75
Overestimates	3.98	4.55	3.12
Covariates			
Age*	43.28(0.10)	42.87(15.90)	43.91(16.45)
Indigenous	9.73	9.99	9.46
Education*			
No education	11.22	12.36	9.57
Primary school	45.44	46.61	43.68
Secondary school	22.05	21.49	22.88
High school/higher	21.26	19.53	23.85
Household assets *	-0.055 (0.91)	-0.39 (0.005)	0.44 (0.009)
Rural *	27.99	28.97	26.53
Medical diagnosis*	7.53	8.81	5.62
Poverty index at the locality level	-1.14(0.50)	-1.14(0.003)	-1.16(0.004)

ENSANUT: Mexican National Health and Nutrition Survey

* Chi-square statistic to compare all variables between men and women, significant at 1%

Table II
Actual and perceived body mass index category among 19 232 adult women in Ensanut 2006. México

Perceived body mass index category	Actual body mass index category			
	Low weight	Normal	Overweight	Obese
Low weight	65 (44.2%)	944 (18.7%)	357 (4.9%)	105 (1.5%)
Normal weight	74 (50.3%)	3 403 (67.5%)	3 344 (46.7%)	1 317 (19.1%)
Overweight	8 (5.4%)	662 (13%)	3 323 (46.4%)	5 125 (74.5%)
Obese	0 (0.0%)	31 (0.6%)	139 (1.9%)	335 (4.9%)
Total	147 0.8%	5 040 26.2%	7 163 37.2%	6 882 35.8%
Chance corrected concordance (CCC)	-0.32	0.01	0.12	-0.29
Overall CCC (equal weights)	-0.11			

ENSANUT: Mexican National Health and Nutrition Survey

between 35 and 48 years were 1.2 times more likely to have an incorrect perception, but women aged over 49 were 2.3 times more likely to misperceive their BMI; both compared to women in the 20 to 34 age group. Overweight men older than 49 years old were 1.2 more likely to misperceive their BMI and obese men older than 49 years old were 1.9 times more likely to misperceive

their BMI, compared to the youngest group. In contrast, older women with a normal weight were less likely to have an incorrect perception.

Indigenous women in the low weight category, and overweight and obese men and women were more likely to misperceive their BMI. Non-educated adults (men and women) in the overweight group were more

Table III
Actual and perceived body mass index category among 12 820 adult men in Ensanut 2006. México

Perceived body mass index category	Actual body mass index category			
	Low weight	Normal	Overweight	Obese
Low weight	54 (43.9%)	675 (16.8%)	230 (4.1%)	49 (1.6%)
Normal weight	65 (52.8%)	3 030 (75.7%)	3 469 (61.8%)	796 (25.8%)
Overweight	4 (3.2%)	284 (7.1%)	1 859 (33.1%)	2 116 (68.7%)
Obese	0 (0.0%)	16 (0.4%)	54 (1%)	119 (3.8%)
Total	123 0.9%	4 005 31.2%	5 612 43.8%	3 080 24%
Chance corrected concordance (CCC)	-0.32	0.20	0.03	-0.31
Overall CCC (equal weights)	-0.10			

ENSANUT: Mexican National Health and Nutrition Survey

Table IV
Logistic model to predict the determinants of perceived body weight by gender and weight status in Ensanut 2006. México

Variables	Low weight		Normal		Overweight		Obese	
	Women	Men	Women	Men	Women	Men	Women	Men
Age group (35 to 48)	0.717 [0.339]	0.767 [0.552]	1.003 [0.0860]	1.098 [0.127]	1.253 [§] [0.0857]	0.961 [0.0819]	1.033 [0.170]	1.232 [0.327]
Age group (>49)	0.916 [0.465]	0.988 [0.509]	0.788 [‡] [0.0795]	1.177 [0.140]	2.351 [§] [0.191]	1.204* [0.115]	1.346 [0.257]	1.902 [‡] [0.567]
Indigenous	8.174 [‡] [6.821]	1.571 [1.148]	0.666 [§] [0.0792]	1.092 [0.157]	1.666 [§] [0.182]	1.845 [§] [0.271]	2.066* [0.887]	1.773 [1.064]
Primary school	0.984 [0.515]	1.190 [0.656]	0.867 [0.0985]	0.826 [0.116]	0.688 [§] [0.0714]	0.804 [0.110]	0.744 [0.210]	2.216* [0.951]
Secondary school	0.467 [0.273]	2.723 [2.040]	0.795* [0.110]	0.880 [0.149]	0.504 [§] [0.0605]	0.618 [§] [0.0952]	0.701 [0.219]	2.057 [0.990]
High school or higher	0.542 [0.360]	1.300 [0.878]	0.706 [‡] [0.100]	0.957 [0.167]	0.395 [§] [0.0488]	0.550 [§] [0.0846]	0.475 [‡] [0.149]	1.845 [0.882]
Wealth index (high=1)	0.729 [0.298]	0.381 [‡] [0.152]	1.026 [0.0894]	0.944 [0.0941]	1.031 [0.0712]	0.744 [§] [0.0672]	0.988 [0.157]	0.836 [0.242]
Rural	0.470* [0.181]	1.390 [0.715]	0.993 [0.0882]	0.867 [0.0974]	1.337 [§] [0.0986]	1.263 [‡] [0.116]	1.240 [0.243]	0.935 [0.331]
Specialist said you had obesity	0.409 [0.389]	3.319 [§] [1.465]	2.073 [§] [0.509]	2.436 [‡] [0.978]	0.369 [§] [0.0473]	0.262 [§] [0.0415]	0.176 [§] [0.0240]	0.157 [§] [0.0349]
Marginality index (high=1)	0.711 [0.311]	0.741 [0.473]	0.901 [0.0753]	0.779 [‡] [0.0798]	1.347 [§] [0.0895]	1.070 [0.0827]	1.200 [0.185]	1.319 [0.333]
Constant	2.643 [1.747]	123	0.663 [§] [0.0937]	0.385 [§] [0.0690]	1.152 [0.143]	3.411 [§] [0.561]	42.75 [§] [13.81]	18.06 [§] [9.154]
Observations	147	9	5,057	4,017	7,190	5,648	6,903	3,095

Odds ratios (standard errors in brackets)

ENSANUT: Mexican National Health and Nutrition Survey

* significant at 10%

‡ significant at 5%

§ significant at 1%. Reference groups: age group 20-34, no education, noindigenous, low wealth index, urban, poverty index low

likely to misperceive their BMI; the difference is seen at almost all levels of education but it is higher between those with primary school and those with no education. For obese women, the non-educated were more likely to misperceive their BMI compared to those with high school or higher. In contrast, for obese men, education was associated with an incorrect perception.

Higher socioeconomic status, measured by household wealth index, was related to a lower probability of misperceiving BMI only among low weight and overweight men. Living in a rural setting was associated with higher misperception for men and women in the overweight category. Overweight and obese adults who were told by a health specialist that they had obesity, were less likely to misperceive their BMI, in contrast with low weight men, and men and women with normal weight. At the locality level, we found that overweight and obese women living in more marginal communities were more likely to misperceive their BMI category.

The multinomial logistic regression shows that most of the associations that were statistically significant are seen among overweight and obese individuals (results not shown). Age was associated with a higher likelihood of underestimating BMI, where older overweight and obese adults underestimate their BMI. More education was associated with a lower probability of underestimating among overweight men and women. Living in a rural setting was associated to underestimation for men and women only in the overweight category. Men and women had less probability of underestimating their BMI and higher probability of overestimating their BMI if a health specialist told the respondent he/she had obesity. Obese and overweight women, and overweight men with a high poverty index were more likely to incur in underestimation.

We conducted a sensitivity analysis to see if the probability of underestimating was higher for overweight individuals with lower BMI (between 25 and 27.5) compared to overweight adults with higher BMI (between 27.6 and 30). We found that a higher percentage of overweight women with a BMI in the low range underestimated their BMI category compared to overweight women in the higher range (63% compared to 42%). Similarly, 78% of overweight men with a BMI in the low range underestimated their BMI category compared to 53% in the higher range.

Discussion

We found that 62% of adult men and women had an incorrect perception of their BMI; among them 58% underestimated their BMI category and 4% overestimated it. Overall, we found that the probability of a correct

classification is lower than the probability of getting a correct result by chance alone. Significant associations between demographic and socioeconomic variables are seen mainly among the overweight and obese. In this group, we found that older adults were more likely to have an incorrect perception and more likely to underestimate their BMI; and that education and the fact of having told by a health provider that they were obese decreased the likelihood of underestimation. We also found that overweight individuals living in localities with a higher poverty index had an also higher probability of misperception.

As in other studies, more educated individuals were less likely to have an incorrect perception or to underestimate their weight.²² Additionally, overweight and obesity in Mexico is less prevalent among women with higher education.²³ More educated adults, independent of their wealth, may have more health related information that raises awareness of their BMI, and individuals living in urban areas are exposed to more health related information.

In contrast, in rural areas, where underweight is still prevalent and obesity rates are lower, big body sizes may be seen a sign of wealth, success and ability to survive.¹¹ The opposite happens in urban areas, or among wealthier individuals, who may be more exposed to Western cultural norms that privilege slimmer body sizes;¹¹ and it has been suggested that body dissatisfaction is more likely among wealthier individuals.²²

Our findings on the association between age and perception of body image can be explained as follows: Older adults may think that it is normal to gain weight with age, so that their body shape should be different and their size larger compared to younger adults, and therefore they do not consider they have a weight problem, which may explain their higher likelihood to misperceive and underestimate their body weight. Adjusting for body size, total energy expenditure declines with age throughout life;²⁴ therefore, weight gain will occur if adjustments in intake or expenditure are not made by the individuals, which is usually the case.

Overweight and obese individuals who are told by a physician or a nutrition specialist that they have obesity have a lower misperception; this diagnosis of obesity decreases the probability of underestimating because respondents may become more aware of their BMI status and may have been in contact with a health professional several times. Although it has been indicated that awareness of obesity can have a positive effect,²⁵ despite the high prevalence of overweight and obesity in the country, we found a very low percentage of reported diagnoses of obesity. We found more diagnoses among women, which may be explained by a higher

utilization of health services related to pre-, postnatal, and child health care visits. It is possible that contact with a health provider can also increase the likelihood of overestimating among adults with normal weight or overweight who may become concerned about their condition (even though they are not obese). Health professionals should be trained to provide accurate information on BMI status to their patients along with an explanation of the different BMI categories and the consequences for their health.

Lack of association in the low BMI category could be explained by a small sample size; the prevalence of underweight in the adult population was less than 1%. The association between body image and social position is complex and varies by gender. Although it is more likely that wealthier women in developed countries seek to have a slender body, some studies reveal similar patterns in developing countries.²⁶ Women tend to be more dissatisfied with their body shape compared to men, but evidence shows that wealthy men and women in developed countries are more concerned with their body image.²⁶ In terms of eating disorders, our study found that more than 50% of women with low weight overestimated their BMI. Evidence shows that the desire to be slim is surprisingly more prevalent in cultures with abundance of food.²⁷

Our study has some limitations. Although the female/male ratio in the country is about one, the Ensanut 2006 has 44% men in the original sample, which falls in our analytical sample to 40% due to missing values on BMI. Therefore, the results of the study are representative only of men who participated in the survey. Secondly, classification of overweight and obesity is based on BMI cut-off points. Individuals with BMI values in the lower range of a BMI category may perceive themselves in the BMI category below, underestimating their BMI status. The sensitivity analysis that we conducted showed that although perception is incorrect in both groups (low and high range of the overweight category), overweight adults had a better weight perception as BMI increased. A study from the State of Baja California Norte, where a sample of adults selected a figure that better identified their current and desired body weight, revealed by comparing these two measures that 84% of the individuals presented some level of body shape dissatisfaction, mainly among those who presented overweight and obesity.²⁸ Finally, having a chronic disease could be associated with BMI perception. We did not control for this variable in the analysis because of a potential reverse causality, where an incorrect BMI perception could lead to weight gain and hence to chronic diseases.

Although individuals may have not been familiar with the terms overweight and obesity, and despite the evidence that the population feels unsatisfied as their BMI increases, people may also have not been fully aware of the health consequences of excess weight. A study conducted in two cities in the North of Mexico in which a sample of teachers and parents were asked to select a figure as an ideal body shape for adults and children, showed that more than 25% of them identified figures slightly overweight or obese as ideal body shapes and 60% selected heavier figures as ideal shapes for children.²⁹ As the authors suggest, adults identifying heavier figures as ideal shapes are less likely to be aware of the consequences of excess weight on their children's health and their own's, and therefore less likely to promote healthy habits.

We recognize that BMI may be inaccurate for individuals with edema or for athletic men, because BMI is an indicator of body mass regardless of its composition; therefore subjects with edema and athletic body types could have BMIs incorrectly indicative of overweight or obesity. Athletic men or subjects with edema with high BMI would be classified as overweight or obese but would perceive themselves as normal, therefore underestimating their weight in our analysis. Despite the potential biases, we believe that the percentage of athletic men or subjects with edema at the population level is low.

The analysis is based on a cross-sectional survey, limiting our ability to derive causal inferences on BMI perception. Knowledge of being obese (through the diagnosis of a health professional) could have led to changes in weight. Education and household assets may be endogenous if unobservable variables such as self-esteem are related to socioeconomic status and BMI perception. Low self-esteem may be associated with lower educational achievements, lower income and BMI misperception.³⁰⁻³²

This study is the first to explore the determinants of BMI perception and to compare correct perception, misperception and overestimation using a large, nationally representative survey of the adult population in Mexico. Although our study looks at the socioeconomic factors associated with BMI perception at the individual level, interventions and any approach to the topic should recognize that BMI perception is the result of social determinants, peer and family influences, mass media and cultural factors.³³ Prevention and treatment interventions in Mexico should provide more information about the definitions and consequences of overweight and obesity and encourage individuals to monitor their BMI. Special attention should be given

to individuals with low education, living in rural areas and older adults.

Declaration of conflict of interests. The authors declare that they have no conflict of interests.

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