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OVERWEIGHT AND OBESITY AS MARKERS FOR THE EVALUATION OF DISEASE RISK IN OLDER ADULTS

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Abstract: *Objectives:* To explore disease risk through the measurement of BMI scores and waist circumferences in older Mexican adults with favorable health statuses and to determine how this risk is associated with sociodemographic characteristics. *Methods:* Using data from the National Health and Nutrition Survey of 2006, we created a cross-sectional design and selected 878 participants (60 years or older) who had favorable health statuses. The demographic data, health status, body mass index (BMI), waist circumference (WC), and an estimation of disease risk (arterial hypertension, diabetes type 2, and metabolic syndrome) were obtained through the survey. *Results:* The prevalence of overweight, obesity, and abdominal obesity were 42.1%, 29.7%, and 80.9%, respectively. Disease risks, which were classified as least, increased, high, or very high, were 14.7%, 17.5%, 38.7%, and 29.1%, respectively. We observed that younger age has a higher risk for disease and that this decreases as age increases until it becomes minimal. After controlling for some risk factors such as tobacco, alcohol, and physical activity, we observed that being female, younger, and married are all factors significantly associated with a high and very high risk for disease. On the other hand, being indigenous, having a low education level, living in a rural setting are all protective factors with a minimum disease risk. *Conclusions:* The prevalence rates of overweight, obesity, and abdominal obesity are high among older Mexican adults. We observed that as age increases, disease risk decreases, which also occurs with some lifestyle factors such as living in a rural setting, being indigenous, having a low education level, and being married.

Key words: Obesity, overweight, abdominal obesity, healthy elderly, disease risk.

Introduction

Almost all countries are experiencing a population-wide aging process leading to an increase in the number and proportion of older adult individuals, and Mexico is no exception. According to data from the National Population Council (CONAPO), it is estimated that by the year 2050, our country will have 25.9 million individuals 65 years of age and older (1). This growth goes hand-in-hand with the population's health profile, which shows both high mortality rates for infectious diseases and an increase in chronic-degenerative diseases. According to data from the National Health Survey 2000 (ENSA 2000), hypertension, obesity, diabetes mellitus type 2, and hypercholesterolemia are among some of the most frequent diseases in individuals 60 years of age and older (2).

Obesity and being overweight may be considered some of the main public health problems in Mexico given their high occurrence in all age groups and the risk they represent. According to data from the National Health and Aging Survey 2001 (NHAS), 43.3% of individuals older than 60 years of age are overweight and 20.9% are obese (3). These data in general are consistent with findings from the National Health and Nutrition Survey 2006 (NHNS), which revealed that 40.2% of the population was overweight and 28.2% obese (4), observed only an increase in obesity of about 8% after five years. The National Health and Service Utilization Survey (NHSUS) found that 62.3% of older adults in good health conditions were overweight (5).

These national data are similar to results in several studies on the prevalence of obesity in Latin America and unfortunately Mexico is one of the top spots (6-8).

Body mass index (BMI) and waist circumference (WC) are two simple and easy-to-use measurements that can be used to detect being overweight and obesity and to evaluate disease risk in an individual. It has been shown that high values of these indicators are closely related to a risk for developing diabetes type 2, hypertension, and dyslipidemia, which in together characterize the metabolic syndrome (9).

In middle men and women with normal BMI scores and increased WC measurements have twice the risk of presenting with a disease than individuals with normal values for each measurement. In women, when a BMI score of 30 to 34.9 kg/m^2 is accompanied by an increase in WC, the risk for having metabolic syndrome is up to 27 times higher compared to women with normal values. Among men with these same values, the risk is minimal for presenting a disease and there is no risk for hypertension (10).

Based on these findings, this study has the objective of evaluating the disease risk for older Mexican adults in good health using BMI and WC measurements simultaneously, as

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well as evaluating the association between the disease risk level and sociodemographic characteristics in this group of older adults.

Materials and methods

We conducted a secondary analysis using data from the NHNS 2006 (11). The NHNS 2006 has information related to the health status and nutrition of the Mexican population as well as of the evolution of quality, response of health services, politics and programs that affect the population's health and the health expenses of Mexican homes.

The sample used in the NHNS 2006 consisted of a group of 45,000 people selected by probabilistic, multi-stage, stratified, and cluster sampling that was representative of the population at the national, regional, and state levels (12). Informed consent was obtained before data collection. A survey was given to each participant that included information regarding health status, sociodemographic characteristics, individual perception of health status, and opinion on health care provider response to service demand, as well as measurements such as weight, height, WC, blood pressure, and a venous blood sample. These procedures were performed by a team with two components (health and nutrition) and were applied to children, adolescents, and adults through home visits. These procedures were approved by the Ethical Committee of the National Institute of Public Health in Mexico.

The sample consisted of individuals 60 years of age and older who were in good health. This health condition was defined by the following characteristics: no report of negative self-health perception, no limitations in the performance of activities of daily living (basic or instrumental), no symptoms of depression, no excessively low weight (BMI < 18.5 kg/m^2), no use of ambulance services in the previous two weeks, and no hospital admissions in the 12 months prior to the survey. In addition, not having a diagnosis of cancer, diabetes mellitus, dyslipidemia, gout, or hypertension or a history of myocardial infarct, cerebrovascular events, chronic obstructive pulmonary disease, mental health disorders, hepatic cirrhosis, gallstones, gastric or duodenal ulcers, chronic renal insufficiency, kidney stones, prostate hyperplasia, hip or femur fractures, other fractures, or any other disease with a duration longer than three months were required for individuals to be considered in good health.

The anthropometric measurements used are described below.

Body mass index (BMI): this measure is based on weight and height; it is calculated by dividing weight (kg) by height squared (m^2) (13).

Nutrition status based on BMI: the following weight classifications were used based on BMI values: low, defined as <18.5 kg/m^2; normal, defined as 18.5-24.9 kg/m^2; overweight, defined as 25-29.9 kg/m^2, and obese, defined as ≥ 30 kg/m^2 (14, 15).

Abdominal obesity: we considered a WC >80 cm in women or >90 cm in men to be indicative of abdominal obesity, as per the criteria of the International Diabetes Federation (16).

Disease risk: The level of disease risk (hypertension, diabetes type 2, and metabolic syndrome) for each individual was classified according to BMI and WC (14, 17).

The relative disease risk is then graded on the basis of the combined BMI and WC. The disease risk increases in a graded fashion when moving from the normal-weight through obese BMI categories and is assumed that within the normal-weight, overweight and obese BMI categories, patients with high WC values have a greater health risk than patients with normal WC values. This classification system was developed on the basis of the knowledge that an increase in BMI is associated with an increase in disease risk, that abdominal or android obesity is a greater risk factor than lower-body or gynoid obesity, and that the WC is an index of abdominal fat content (18).

The Canadian directives for body weight in adults were applied in clinical practice for the detection of being overweight and obesity as well as for the evaluation of disease risk (14) and adapted for the older Mexican adult population. Disease risk levels were classified as least, increased, high and very high (Figure 1).

Figure 1
The level of disease risk for each individual was classified according to BMI and WC

Abdominal obesity	Nutrition status based on BMI: Normal 18.5-24.9 Kg/m^2	Overweight 25-29.9 Kg/m^2	Obese ≥ 30 Kg/m^2
Men < 90 cm Women < 80 cm	Least risk	Increased risk	High risk
Men ≥ 90 cm Women ≥ 80 cm	Increased risk	High risk	Very high risk

Statistical Analysis

Data were analyzed with the Statistical Package for the Social Sciences (SPSS) for Windows, version 15.0 (19).

Characteristics of older adults in favorable health conditions were described in terms of their frequencies and proportions. The analysis of variance (ANOVA) test was used to establish differences between the anthropometric measurements by male and female age groups and by total sample. When statistical differences were found, we used the Bonferroni post hoc test to establish which groups the difference occurred between. The Student's t-test was used to evaluate the difference between women and men by age group as well as in the total sample. Finally, we conducted a multinomial logistic regression analysis to determine the strength of the association between disease risk level and sociodemographic characteristics of older adults in good health. These characteristics were gender, age, being indigenous, education level, place of residency, marital status, having a housemate, medical insurance, and employment. We used least disease risk as the comparison category, and we adjusted for tobacco use, alcohol use, and physical activity (20, 21).

We used a confidence interval of 95%. Results and statistical estimations were adjusted by weighting of the survey design. The weight factor was calculated based on the mechanisms of complex sampling used to obtain the corresponding quantifications.

Results

The ENSANUT 2006 included 5,480 individuals 60 years of age and older; according to the expansion factors of the sample, this can be taken to represent all 9,501,807 older adults in Mexico. From these 5,480 individuals, only 16% (n=878) of older adults were selected for the present study due to their favorable health status, in accordance with the selection criteria. These represented 1,093,914 individuals in all of Mexico, with an average age of 68.5 ± 7.0 years. Fifty-three point six percent of the population (n= 586,328) were women with an average age of 68.9 ± 7.0 years and 46.4% (n= 507,586) were men with an age of 68.0 ± 7.0 years. The age group with the greatest number of individuals was of 60-64 years (37.3% of the total selected individuals), followed by 65-69 years (23.3%). Twenty-four point two percent of the population reported being indigenous. With respect to education level, 31.5% of older adults did not complete any years of study, 53.3% had at least one to six years of basic education, and only 15.2% had ≥7 education years. Seventy-three point six percent resided in an urban setting. Regarding marital status, 64.9% stated that they were married. Fifty-nine point four percent reported living alone, 48.9% reported having medical insurance, and only 27.4% reported having a paying job. The characteristics for the population of individuals in good health who were 60 years of age and older by gender are shown in Table 1, according to the expansion factors of the sample (age groups are presented in quintiles).

The anthropometric means by age and gender are shown in Table 2. We observed differences between the means of the anthropometric values per age group in weight, height, and WC and BMI in women, men, and the total sample ($p<0.001$). With respect to the weight of men, with the exception of the age groups of 70-74 and 75-79 years, we did not observe a statistically significant difference ($p>0.05$). Differences were found in height for men by age between the age groups of 80-84 and 85 years or more ($p<0.05$) as well as in WC between the age groups of 60-64 and 65-69 years in women and 60-64 and 75-79 in men ($p<0.05$).

The difference between women and men per age group, as well in the total sample, was statistically significant in all anthropometric measurements ($p<0.05$).

According to the nutritional status categories by BMI, 28.2% of individuals were classified as normal, 42.1% as overweight, and 29.7% as obese. We classified 80.9% of individuals as having abdominal obesity. Table 3 shows the BMI categories and abdominal obesity in women and men by age group as well as for the total sample.

Table 1
Characteristics of the population 60 years of age and older in good health. ENSANUT 2006 survey, Mexico

	Women n = 586,328	**Men** n= 507,586	**Total** n = 1,093,914
Age (Mean ±SD)	68.9±7.0	68.0±7.0	68.5±7.0
60-64	36.1%	38.7%	37.3%
65-69	23.2%	23.4%	23.3%
70-74	16.7%	21.0%	18.7%
75-79	11.8%	9.2%	10.6%
80 -84	9.6%	5.3%	7.6%
85 and older	2.5%	2.4%	2.4%
Indigenous background			
Yes	20.3%	28.7%	24.2%
Education			
0 education, years	31.9%	31.2%	31.5%
1-6 education, years	53.9%	52.6%	53.3%
≥7 education, years	14.3%	16.3%	15.2%
Place of residency			
Rural	21.6%	31.9%	26.4%
Urban	78.4%	68.1%	73.6%
Marital status			
Married	52.5%	79.2%	64.9%
Single	47.5%	20.8%	35.1%
Living alone			
Yes	33.0%	89.9%	59.4%
Medical insurance			
Yes	51.4%	46.0%	48.9%
Salaried job			
Yes	7.7%	50.2%	27.4%

The distribution of the risk levels for health problems was the following: in women, 5.8% had a least risk, 17.7% had an increased risk, 38.9% had a high risk, and 37.6% had a very high risk. In men, 24.9% had a least risk, 17.1% had an increased risk, 38.5% had a high risk, and 19.4% had a very high risk. For the total sample, 14.7% had a least risk, 17.5% had an increased risk, 38.7% had a high risk, and 29.1% had a very high risk (Table 4).

The strength of association between disease risk level and sociodemographic characteristics of older adults in good health obtained by multinomial logistic regression analysis is shown in Table 5, where least risk was considered to be the comparison category and adjustments were made for tobacco and alcohol use and physical activity. All of the associations were statistically significant ($p<0.05$). In this analysis, we found that factors such as being indigenous, having a low education level, living in a rural setting, and having a low socioeconomic status were protective against increased health risks. In other words, these factors minimize the disease risk level. Being female and having an age between 60-79 years, being married, and having a salaried job were all factors associated with a high or very high risk.

Table 2
Means for weight, height, abdominal circumference, and body mass index in the population 60 years of age and older in good health status. ENSANUT 2006 Survey, Mexico

	Women Mean (SD)	Men Mean (SD)	Total Mean (SD)
Weight (Kg)[d]	62.8 (13.2)	70.4 (13.3)	66.4 (13.8)
Age			
60-64[a,b,c]	68.3 (14.2)	73.3 (14.7)	70.7 (14.6)
65-69[a,b,c]	64.9 (10.9)	71.2 (12.8)	67.8 (12.3)
70-74[a,c]	59.3 (10.0)	68.0 (9.7)	63.8 (10.7)
75-79[a,c]	58.5 (8.9)	68.1 (13.6)	62.4 (12.0)
80 -84[a,b,c]	52.4 (12.3)	64.0 (10.4)	56.1 (12.9)
85 and older[a,b,c]	49.3 (8.0)	60.4 (12.6)	54.3 (11.7)
Height (cm)[d]	148.0 (6.7)	161.6 (7.1)	154.3 (9.7)
Age			
60-64[a,b,c]	150.4 (6.2)	162.3 (7.8)	156.1 (9.2)
65-69[a,b,c]	148.4 (5.2)	162.4 (5.9)	154.9 (8.9)
70-74[a,b,c]	146.6 (7.3)	161.0 (6.3)	154.1 (9.9)
75-79[a,b,c]	146.0 (7.4)	159.7 (7.0)	151.5 (9.9)
80 -84[a,c]	144.2 (6.4)	160.2 (6.2)	149.4 (9.8)
85 and older[a,c]	142.8 (4.8)	160.2 (11.6)	150.7 (12.2)
Waist Circumference (cm)[d]	97.0 (11.8)	95.6 (11.4)	96.4 (11.5)
Age			
60-64[c,d]	98.7 (11.8)	97.0 (12.3)	97.9 (12.1)
65-69[b,c,d]	98.7 (10.9)	95.5 (10.5)	97.2 (10.8)
70-74[a,b,c,d]	96.7 (13.2)	94.0 (8.8)	95.3 (11.2)
75-79[a,c,d]	94.8 (9.3)	97.0 (12.3)	95.7 (10.6)
80 -84[a,b,c,d]	91.3 (12.0)	93.1 (9.5)	91.9 (11.3)
85 and older[a,b,c,d]	91.0 (10.4)	88.9 (8.3)	90.1 (9.5)
Body Mass Index[d]	28.5 (5.0)	26.8 (4.3)	27.7 (4.8)
Age			
60-64[a,b,c,d]	30.0 (5.3)	27.7 (4.6)	28.9 (5.1)
65-69[a,b,c,d]	29.4 (4.4)	26.9 (4.6)	28.2 (4.6)
70-74[a,b,c,d]	27.6 (4.7)	26.2 (3.0)	26.9 (4.0)
75-79[a,b,c,d]	27.4 (3.9)	26.5 (4.1)	27.1 (4.0)
80 -84[a,b,c,d]	24.9 (4.4)	24.9 (4.4)	24.9 (4.1)
85 and older[a,b,c,d]	24.1 (3.3)	23.3 (3.3)	23.7 (3.4)

a. Significant differences between age range in women ($p<0.001$); b.Significant differences between age range in men ($p<0.001$); c. Significant differences between age range ($p<0.001$); d. Significant differences between women and men ($p<0.05$)

Discussion

We found that 42.1% of the sampled population was overweight and 29.7% was obese (as determined by BMI), and abdominal obesity was found in 80.9% of individuals. These results confirm that these groups of older adults in good health have overweight and obesity prevalence similar to that of other groups of older adults who do not present with good health statuses in Mexico (2-5). These data support the use of BMI and abdominal circumference to estimate the disease risk for this population. The assessment of a patient s risk of health problems should be based on his or her BMI and abdominal circumference as well as other determinants of risk to establish the person s overall risk profile. The patient s overall risk profile will, in turn, determine whether lifestyle interventions, weight loss intervention and drug therapy are warranted to reduce his or her risk of health problems (5, 14). This should be tested in other studies in elderly.

With the obtained results, we were also able to corroborate that body mass decreases as age advances, given that a tendency exists to have a lower weight with older age. We estimate that the loss of body weight with respect to age is of approximately one kilogram per decade, a fact reflected in our study (22).

In the same manner, as age advances, the skeletal system presents modifications that are reflected in its structure. Height decreased 1 to 2 cm per decade starting at 50 years of age, mainly due to vertebral compression, changes in the size and form of vertebral discs, loss of muscle tone, and postural changes (23). Our results show that height tends to be less in groups with older age.

The value most widely used to determine overall nutritional status both in the clinical setting and at the epidemiological level is the BMI. BMI is a parameter that is considered to be correlated with morbidity, mortality, and longevity (24-26). In other words, individuals who have a higher BMI have a higher probability of dying and individuals with a lower BMI tend to live longer. Our study shows that the more elderly tend to have lower BMI values, while the less elderly present higher BMI values. The same occurs in the case of WC (27, 28).

We also found that women have a higher disease risk in the group of 60-64 years old and this risk gradually decreases as age increases. In the group aged 80 and more, the level of risk is the smallest. This trend is not very clear in men, since the risk of health problems is only lower when they turn over 85. The total sample shows the same trend as that for men, given that at a younger age, the frequency of very high disease risk is higher and decreases to a least disease risk. This could be explained by the fact that people with better health statuses have longer life expectancies and hence least disease risks. It is also possible that these were individuals who did not present with being overweight and having abdominal obesity throughout their lives.

In the final multinomial regression analysis, female gender was found to be associated in all three disease risk levels. These results agree with previous studies of older adults in the general population, such as that by Ruiz-Arregui et al. (3), who found that the adjusted female gender had a risk of 1.47 (1.15-1.88) compared to men.

As we discussed above, disease risk stayed significant throughout the different age groups and surprisingly the risk decreases drastically in those 80 years of age and older. This risk reduction is an obvious reflection of the decline of both BMI and WC values. It has been observed that over the years, the elderly tend to reduce the range of foods at the expense of protein and fiber intake in particular following the loss of natural teeth. This may also cause problems in forming the bolus by the lack of teeth to grind food and to be mixed with saliva, which does not allow for proper digestion. So it may be the reason behind the decline of both BMI and WC values that occur in the elderly over the years (29-31). Consequently the reduced disease risk found in this paper could have a different meaning in this group of age and longitudinal analysis will be necessary.

Table 3
Nutritional status according to body mass index (BMI) and abdominal circumference by age and gender. ENSANUT 2006 Survey, México

	BMI								
	Women			Men			Total		
	Normal 18.5-24.9 Kg/m²	Overweight 25-29.9 Kg/m²	Obese ≥ 30 Kg/m²	Normal 18.5-24.9 Kg/m²	Overweight 25-29.9 Kg/m²	Obese ≥ 30 Kg/m²	Normal 18.5-24.9 Kg/m²	Overweight 25-29.9 Kg/m²	Obese ≥ 30 Kg/m²
Age	%	%	%	%	%	%	%	%	%
60-64	14.3	34.3	51.4	30.8	40.4	28.8	22.2	37.2	40.5
65-69	11.5	49.4	39.2	37.6	47.0	15.3	23.6	48.3	28.1
70-74	33.3	36.1	30.5	33.3	51.4	15.3	33.3	44.1	22.6
75-79	28.9	41.2	29.9	35.0	43.4	21.6	31.3	42.1	26.6
80 -84	45.1	43.7	11.1	41.0	50.4	8.6	43.8	45.9	10.3
85 and older	56.2	37.4	6.4	70.4	21.1	8.5	62.7	30.0	7.4
Total	22.6	39.9	37.6	34.8	44.6	20.6	28.2	42.1	29.7

	Abdominal obesity		
	Women	Men	Total
	Obese (≥ 80 cm)	Obese ≥ 90 cm	
Age	%	%	%
60-64	96.5	65.5	81.6
65-69	95.2	67.9	82.5
70-74	91.8	69.0	79.9
75-79	92.4	68.8	82.9
80 -84	80.3	68.2	76.4
85 and older	89.5	42.1	68.0
Total	93.2	66.7	80.9

Table 4
Risk for health problems by age and gender in the population 60 years of age and older. ENSANUT 2006, SURVEY, México

	Age groups (years)						
	60-64	65-69	70-74	75-79	80-84	85 and older	Total
	%	%	%	%	%	%	%
Women							
Least risk	2.8	4.8	7.2	2.6	19.7	10.5	5.8
Increased risk	12.1	6.7	27.1	31.3	25.4	45.7	17.7
High risk	33.6	49.4	35.2	36.2	43.7	37.4	38.9
Very high risk	51.4	39.2	30.5	29.9	11.1	6.4	37.6
Men							
Least risk	21.6	27.5	24.4	24.9	31.0	43.1	24.9
Increased risk	19.3	14.8	15.3	15.2	10.8	42.1	17.1
High risk	32.9	42.4	45.1	39.4	49.6	6.3	38.5
Very high risk	26.1	15.3	15.1	20.5	8.6	8.5	19.4
Total							
Least risk	11.9	15.4	16.2	11.6	23.4	25.3	14.7
Increased risk	15.6	10.5	21.0	24.8	20.7	44.0	17.5
High risk	33.3	46.1	40.4	37.5	45.6	23.3	38.7
Very high risk	39.3	28.1	22.5	26.1	10.3	7.4	29.1

On the other hand, factors such as indigenous background, low education level, and living in a rural area have an effect on the minimal disease risk because individuals with these factors tend not to present with being overweight, obesity, or abdominal obesity. Ruiz-Arregui et al. previously reported that having a low education level and socioeconomic status are protective factors against developing obesity in the elderly Mexican population. It was also reported in a cross-sectional study in three Mexican communities (urban, marginal urban, and rural) that fiber consumption is higher in the rural population because individuals who live in rural areas tend to have a greater number of teeth than do those in other communities (28). It should be mentioned that opposite results to those previously described have been reported in different populations not similar to ours. These studies have described that marginalization, poverty, and rural environment, among other things, are associated with the consumption of high-caloric foods and thus with an increase in being overweight or obese (32-34). We must continue analyzing the role of these factors in being overweight and obese in other studies because the characteristics of each population play an important role (35).

Other studies have reported that men who live alone have a low risk of obesity and therefore an increasing risk of malnutrition due to low food intake (36).

Studies have shown that the prevalence of obesity have had a great variability in Latin American populations, ranging from 9.9% to 35.7% (6). Women and individuals living in urban areas have been identified as the groups predominantly affected (37). In addition, obesity has been independently associated to low socioeconomic status and poorer educational level (38, 39), and contributes to the accentuation of health inequalities in the region (40). There is also evidence of a secular trend towards the increase in levels of obesity among the most economically developed Latin American countries during the past three decades (37, 41); however, similar data are not available for more disadvantaged populations. Indeed, most of the information on obesity has been obtained from nutritional surveys conducted during the first half of the nineties in adult women, mostly in urban settings, and little is known about adult men or the growing elderly population as well as rural obesity profiles (42). Unfortunately, there are no studies reported in the literature on the elderly in Latin America in health conditions similar to our study to be able to compare our results.

Table 5

Multinomial regression analysis of the health risk levels of the population 60 years of age and older. ENSANUT Survey 2006, México

	Increased risk* OR (95% CI)	High risk* OR (95% CI)	Very high risk* OR (95% CI)
Gender			
Women	5.12 (5.02-5.22)	5.39 (5.30-5.49)	17.18 (16.83-17.54)
Men	1	1	1
Age			
60-64	0.95 (0.91-0.98)	3.24 (3.12-3.37)	11.74 (11.11-12.41)
65-69	0.59 (0.57-0.61)	3.86 (3.71-4.02)	7.33 (6.93-7.75)
70-74	1.22 (1.17-1.26)	3.84 (3.69-4.00)	7.00 (6.62-7.40)
75-79	2.09 (2.00-2.17)	5.02 (4.81-5.24)	9.36 (8.83-9.92)
80 -84	0.51 (0.49-0.53)	2.19 (2.10-2.28)	1.15 (1.09-1.22)
85 and more	1	1	1
Indigenous background			
Yes	0.97 (0.95-0.98)	0.63 (0.62-0.64)	0.37 (0.36-0.38)
No	1	1	1
Education			
0 education, years	0.24 (0.23-0.25)	0.22 (0.21-0.23)	0.11 (0.11-0.12)
1-6 education, years	0.18 (0.17-0.19)	0.18 (0.18-0.19)	0.15 (0.14-0.15)
≥7 education, years	1	1	1
Residence			
Rural	0.36 (0.35-0.37)	0.38 (0.38-0.39)	0.42 (0.41-0.43)
Urban	1	1	1
Marital status			
Married	1.36 (1.33-1.38)	2.27 (2.23-2.30)	2.38 (2.34-2.42)
Single	1	1	1
Living alone			
Yes	0.57 (0.56-0.58)	0.79 (0.77-0.80)	1.28 (1.25-1.30)
No	1	1	1
Medical Insurance			
Yes	1.20 (1.18-1.22)	1.10 (1.08-1.11)	1.45 (1.43-1.48)
No	1	1	1
Salaried job			
Yes	1.70 (1.67-1.73)	1.09 (1.07-1.11)	1.22 (1.20-1.24)
No	1	1	1

* Least risk comparison category. Adjusted for tobacco and alcohol use and physical activity.

This study is representative of adults older than 60 years of age who are in good health because it was a national survey. However, to confirm these results, the findings of longitudinal studies are needed to verify this association because one of the limitations of a cross-sectional study is that no causality may be established; in other words, there is a lack of temporarily of the exposure-effect association.

In conclusion, we may say that a prevalence of overweight, obesity, and abdominal obesity are high among older Mexican adults. After controlling for tobacco and alcohol use and physical activity, we observed that being female, being of a younger age, and being married all have a significant association for carrying an elevated, high or very high disease risk compared to the threshold least risk status. Being indigenous, having a low education level and residing in a rural area are all factors associated with least and increased disease risk levels.

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