Evaluation of anthropometric parameters in a national sample of Mexican older adults

Evaluación de los parámetros antropométricos en una muestra nacional de adultos mayores mexicanos

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Abstract

The purpose of this study was to describe anthropometric parameters in a population of Mexican older adults (OA). 516 OA (277 women, 239 men) aged ≥ 65 years were interviewed. Anthropometry and a sociodemographic data questionnaire were performed. Means and standard deviations, prevalence (%) and confidence intervals are reported in the results. SPSS v20.0 was used in the statistical analysis. The combined prevalence of overweight and obesity in our population was 77%. The mean WHR values obtained were (0.97 in men and 0.89 in women). Finally, the percentage of fat in men was 30.6% and in women it was 39.8%. The results of this investigation showed significant differences between men and women in most of the anthropometric measures and nutrition indicators. The prevalence of overweight and obesity reported in the Mexican elderly population was higher than that reported in other studies, which shows an important public health problem in Mexican older adults. More studies are needed at the national level on nutritional parameters in the elderly in order to detect cardiovascular risk factors in a timely manner.

Keywords: anthropometry, nutritional surveys, mexican older adults.

Resumen

El propósito de este estudio fue describir los parámetros antropométricos en una población de adultos mayores (AM) mexicanos. Se entrevistó a 516 AM (277 mujeres, 239 hombres) con ≥ 65 años de edad. Se realizó antropometría, y un cuestionario de datos sociodemográficos. En los resultados se reportan medias y desviaciones estándar, prevalencias (%) e intervalos de confianza. En el análisis estadístico se utilizó el SPSS v20.0. La prevalencia conjunta de sobrepeso y obesidad en nuestra población fue de 77%. Los valores medios de Indice Cintura-Cadera obtenidos fueron (0.97 hombres y 0.89 en mujeres). Por último, el porcentaje de grasa en hombres fue 30.6 % y en mujeres fue 39.8 %. Los resultados de esta investigación arrojaron diferencias significativas entre hombres y mujeres en la mayoría de las medidas antropométricas e indicadores de nutrición. La prevalencia de sobrepeso y obesidad reportada en la población mexicana de edad avanzada fue más alta que lo reportado en otros estudios, lo que muestra un importante problema de salud pública en los en adultos mayores mexicanos. Se requieren más estudios a nivel nacional sobre los parámetros nutricionales en AM con el fin de detectar de forma oportuna factores de riesgo cardiovascular.

Palabras clave: antropometría, encuestas nutricionales, adultos mayores mexicanos.

Introduction

Most developing and middle-income countries are undergoing demographic and epidemiological transitions, generated by changes in mortality profiles (from communicable diseases to chronic noncommunicable diseases), increased life expectancy, declining fertility rates, migratory processes (which have transformed the population into a predominantly urban one), as well as by advances in medical care, leading to the fact that in Mexico the age group of 60 years and older is the fastest growing population segment, with an annual rate in 2010 of 3 - 4% (López-Ortega & Arroyo, 2016). According to data from the INEGI (Instituto Nacional de Estadística y Geografía, 2020) around 12% of the total Mexican population corresponded to the group of older adults (OA) aged 60 years.

At the individual level the aging process produces physiological and nutritional changes that should be considered in the care of OA (Menezes & Marucci, 2005), these changes are manifested by a decrease in height, weight loss, loss of muscle mass and increase in fat mass, as well as by a redistribution of adipose tissue, with accumulation of fat in the trunk and viscera (Batsis et al., 2014; Gómez-Cabello et al., 2011; Sánchez-García et al., 2007; Silva et al., 2015). Anthropometry provides detailed information on the different components of the body structure from physical measurements, especially the muscle and fat components, and has proven to be important indicator of the nutritional status of a population, in addition, it is an inexpensive, non-invasive method that is easy and quick to perform (Menezes & Marucci, 2005; Sánchez-García et al., 2007; Silva et al., 2015). Likewise, anthropometric measurements are associated with functional and health outcomes. For example, an increase in measures of adiposity has been associated with increased frailty, increased risk of falls, reduced functional performance, increased dependency, cardiometabolic risk and cardiovascular problems (Gregson et al., 2019; Khosravian et al., 2021; Kioh et al., 2019; Wojzischke et al., 2021; Xu et al., 2020; Zhang et al., 2021). On the other hand, a low body mass index (BMI) is also related to greater frailty and dependence (Xu et al., 2020; Zhang et al., 2021). Therefore, anthropometric assessment is an essential feature of geriatric assessment (Sánchez-García et al., 2007).

Variations in lifestyle during their different stages (sedentary and physical activity patterns), sex differences, social factors (such as educational level), other environmental factors affecting genetic potential, as well as differences in health status led to heterogeneous changes in OA that can be reflected in anthropometric characteristics (Gómez-Cabello et al., 2011; López-Ortega & Arroyo, 2016; Sánchez-García et al., 2007). The combination of these factors makes geographic, sociocultural and ethnic variations in anthropometric and nutritional characteristics frequent, and consequently reference values derived from populations in one geographic area may not be applicable to other populations even if they belong to the same age group. This makes it necessary to obtain specific data by country and even in populations within countries, considering different ages, ethnic groups, and men and women separately (López-Ortega & Arroyo, 2016; Sánchez-García et al., 2007). Therefore, the aim of this study was to describe the anthropometric parameters and nutritional indicators in a population of Mexican OA, beneficiaries of the Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE), performing a comparative analysis by sex.

Methods

Participants

Cross-sectional population-based study conducted in Mexico (2017). The sample size was 516 OA (≥ 65 years, 277 women, 239 men). Interviews, anthropometric measurements, were conducted in ISSSTE hospital delegations.

Ethics

All participants were informed of the purpose and methods of this study and signed informed consent before enrollment. The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Committee of Ethics in Research of the National Institute of Public Health, Cuernavaca, Morelos, Mexico (ref. 613-CI-210-2007).

Anthropometric measurements

Height was measured with a mobile stadiometer (Seca 213, Germany), with an accuracy of 0.5 cm, with the subject's head in the Frankfurt plane. Body weight was determined to the nearest 100 g using a digital scale (Seca 354, Germany). Subjects were upright, barefoot, fasting and wearing light clothing, which was accounted for by subtracting 300 g from the average weight. Height and weight were measured in duplicate, and the average of each variable was used for calculations and analysis. BMI was calculated as body weight (kg) divided by height (m) squared. The World Health Organization categories, normal (BMI 18.5 - 25), overweight (BMI 25 - 30) and obese (BMI ≥ 30), were used for comparisons with previously published data from Mexican groups or populations from other countries. The thickness of the skinfolds, biceps (BSF), triceps (TSF), subscapular (SSSF), and suprailiac (SISF) were measured in triplicate with a plicometer (Harpenden 120, United Kingdom), with millimeter approximation, and with the mean of the four measurements the percentage of body fat (%BF) was estimated according to the equations of Siri (1961), Brožek et al. (1963), Rathbun - Pace (1945), and Wilmore - Behnke, (1969). Waist circumference (WC) and hip circumference (HC) were measured with a fiberglass tape measure (Seca 120, Germany). Subjects were asked to stand on a flat surface in a relaxed position with their feet together. WC was measured as the smallest horizontal circumference between the costal margins and the iliac crests at minimal respiration. The HC was taken as the largest circumference at the level of the greater trochanter (widest portion of the hip) on both sides. Measurements were taken to the nearest 0.1 cm. Two measurements of WC and HC were made, and the mean of the two readings was taken as the final value. The waist-hip ratio (WHR) was calculated as the WC (cm) divided by the HC (cm).

General questionnaire

The questionnaires included information on participants' health care coverage. The following categories were used for educational level: elementary (6 years of education), middle school (6 - ≤ 9 years of education), high school (> 9 - ≤ 12 years of education), and bachelor's, master's, and doctoral degrees (≥ 12 years of education). Tobacco use was self-reported and categorized as "current" for those subjects who had smoked at least 100 cigarettes during their lifetime and currently smoked, "ex-smoker" for those who had smoked at least 100 cigarettes during their lifetime and no longer smoked; and "never." Other variables included in this analysis were "sex" and "age" stratified as 65-69, 70-74, 75-79 and over 80 years.

The variable "Region" was stratified as northern region (Baja California, Baja California Sur, Chihuahua, Coahuila, Nuevo León, Sinaloa, Sonora and Tamaulipas), central-western region (Distrito Federal, Estado de México, Hidalgo, Morelos, Puebla, Querétaro and Tlaxcala), central (Aguascalientes, Colima, Durango, Guanajuato, Jalisco, Michoacán, Nayarit, San Luis Potosí and Zacatecas) and southern (Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz and Yucatán).

Statistical analysis

Analyses were performed with SPSS 20.0. All tests were stratified by sex. Normality of all variables was assessed using Kolmogorov-Smirnov test. Descriptive statistics of the sample were calculated. Significant differences in prevalence were calculated using Chi.. Differences between group means were analyzed by ANOVA.

Results

Table 1 shows the characteristics of the participants. Of the total study population, 239 (46.32%) were men and 277 (53.68%) were women. The mean age in men was 71.4 years and in women 70.9 years, with no significant differences. Similarly, there were no significant differences in BMI, level of schooling and region of residence. The combined prevalence of overweight and obesity in this population was 77% according to the parameters used. The level of schooling with the highest prevalence was the ≥ 12 years category (Bachelor's, Master's and PhD), however, a similar proportion of the population had only primary education or lower (35.3% vs 30.2%). Height, weight, smoking and WC were higher in men than in women. On the other hand, HC, skinfolds and total body fat were higher in women.

The mean weight was 8 kg higher in men than in women (73.7 kg vs. 65.7 kg), likewise, height was 11.3 cm higher (162.7 cm vs. 151.4 cm), despite these differences, BMI was similar in both sexes (27.7 kg/m. and 28.3 kg/m. respectively). There was a high prevalence of overweight and obesity according to BMI without significant differences between men and women (overweight 48.9% and 46.1%; obesity vs. 26.4% and 32.3% respectively). The WC was higher in men (98.9 cm vs. 94.3 cm), on the other hand, women had a higher HC (105 cm vs. 101.4 cm), values that were reflected in the WHR which was significantly lower in women than in men (0.89 vs. 0.97). The skinfolds showed higher values in women than in men; the greatest differences were found in the BSF (37%, higher in women), followed by the TSF (33.1%), SISF (24%) and SSSF (7%), in the latter, although the differences were smaller, they were also considered significant ($p < .05$). As expected, a higher %BF was found in women than in men (39.8% vs. 30.6%).

Table 1. Characteristics of participants

	Men (n = 239)	Women (n = 277)	Total (n = 516)
Age (years)	71.4 ± 5.62	70.9 ± 5.49	71.1 ± 5.55
Height (cm)	162.7 ± 6.94	151.4 ± 7.41	156.5 ± 9.12***
Weight (kg)	73.7 ± 11.58	65.7 ± 14.84	69.4 ± 14.01***
BMI (kg/m^2)	27.7 ± 3.85	28.3 ± 4.08	28.1 ± 3.98
BMI status (%)			
Normal weight	24.7	21.6	23.0
Overweight	48.9	46.1	47.4
Obese	26.4	32.3	29.6
WC (cm)	98.9 ± 10.75	94.3 ± 10.97	96.4 ± 11.10***
HC (cm)	101.4 ± 9.21	105.0 ± 10.32	103.3 ± 9.98***
WHR	0.97 ± 0.08	0.89 ± 0.08	0.93 ± 0.09***
TSF (mm)	16.0 ± 7.72	21.3 ± 7.93	18.9 ± 8.25***
BSF (mm)	11.6 ± 6.75	15.9 ± 7.96	13.9 ± 7.73***
SSSF (mm)	21.3 ± 7.79	22.8 ± 7.87	22.1 ± 7.86*
SISF (mm)	20.4 ± 8.84	25.3 ± 8.89	23.1 ± 9.19***
Total body fat (%)	30.6 ± 5.41	39.8 ± 4.17	35.6 ± 6.64***
Level of schooling (%)			
Less than elementary school	0.9	0.4	0.6
Primary	30.8	28.6	29.6
Secondary	19.5	22.0	20.8
High school	11.3	15.7	13.7
Bachelor's + Master's + PhD	37.6	33.3	35.3
Smoking habit (%)			
Smoker	9.6	3.2	6.2***
Ex-smoker	39.3	12.6	25.0***
Never smoked	51.0	84.1	68.8***
Region of residence (%)			
Central-West	28.9	39.0	34.3
Central	20.5	24.2	22.5
North	24.3	20.6	22.3
South-Southeast	26.4	16.2	20.9

Abbreviations: *BMI*, body mass index; *WC*, waist circumference; *HC*, hip circumference; *WHR*, waist-hip ratio; *TSF*, tricipital skinfold; *BSF*, bicipital skinfold; *SSSF*, subscapular skinfold; SISF, suprailiac skinfold. Significant differences between men and women by ANOVA: **p* < .05, ***p* < .01, ****p* < .001.

In Table 2 when stratifying by age group, weight, WC and WHR showed no difference between men and women aged ≥ 80 years, while in the rest of the groups there were differences. And it was this same age group the only one in which significant differences were found in BMI being higher in women than in men. A lower weight was observed in men aged ≥ 80 years with respect to the other age groups, contrary to what was observed in women of the same age group who had the highest weight. The HC was significantly higher in women in the groups aged 65-69 years and, in the group, aged ≥ 80 years. Total body fat calculated by different formulas was significantly higher in women in all cases, of these formulas the one that yielded higher values of total body fat was the Rathburn Pace formula, both in men and women in all age groups.

Table 2. Anthropometric values according to age group and sex of the older adults. Mean ± standard deviation

	Men Media±DE	Women Media±DE	*p*		Men Media±DE	Women Media±DE	*p*
Weight (kg)				**Bicipital skinfold (mm)**			
65-69	74.1±11.0	67.0±12.0	< .0001	65-69	11.0±5.1	17.0±8.0	< .0001
70-74	76.0±13.0	64.0±12.0	< .0001	70-74	13.0±10.0	15.5±6.2	.057
75-79	74.0±12.0	62.4±9.0	< .0001	75-79	13.0±6.2	15.0±7.0	.293
≥ 80	68.2±10.2	69.0±31.4	.899	≥ 80	10.3±5.0	16.0±13.0	.033
Height (cm)				**Subscapular skinfold (mm)**			
65-69	163.0±7.0	153.0±6.0	< .0001	65-69	21.2±8.0	24.0±8.1	.009
70-74	164.0±6.1	150.1±6.0	< .0001	70-74	23.0±9.2	23.0±7.2	.919
75-79	161.1±8.1	150.0±6.0	< .0001	75-79	22.0±7.4	21.0±8.0	.508
≥ 80	162.0±8.2	152.0±15.0	.002	≥ 80	19.1±6.0	21.4±8.1	.229
***BMI* (kg/m^2)**				**Suprailiac skinfold (mm)**			
65-69	28.0±4.0	29.0±5.0	.155	65-69	20.4±8.0	26.0±9.2	< .0001
70-74	28.2±4.2	28.3±5.0	.816	70-74	20.4±11.2	25.0±9.0	.008
75-79	28.3±4.0	28.0±4.4	.682	75-79	21.2±9.3	23.0±8.1	.408
≥ 80	26.1±4.0	29.0±4.1	.026	≥ 80	20.0±7.2	28.0±9.0	.001
Waist circumference				**Siri-specific (%*BF*)**			
65-69	98.4±10.2	93.4±11.0	< .0001	65-69	30.4±5.1	40.3±4.3	< .0001
70-74	101.0±12.4	95.1±12.0	.013	70-74	31.0±6.1	40.0±4.0	< .0001
75-79	100.2±10.0	94.0±12.0	.017	75-79	32.0±5.1	39.0±4.1	< .0001
≥ 80	96.3±10.5	98.0±9.0	.633	≥ 80	30.0±5.3	40.1±4.0	< .0001
Hip circumference				**Brozeck-specific (%*BF*)**			
65-69	101.0±9.1	106.0±10.4	< .0001	65-69	29.3±5.0	39.0±4.0	< .0001
70-74	103.0±10.0	105.0±11.1	.306	70-74	30.0±6.0	38.0±4.0	< .0001
75-79	103.0±11.0	104.0±11.0	.679	75-79	30.4±5.0	37.0±4.0	< .0001
≥ 80	100.0±7.1	105.0±7.3	.017	≥ 80	29.0±5.0	38.2±4.0	< .0001
Waist-hip ratio				**Rathburn - Pace (%*BF*)**			
65-69	0.97±0.09	0.88±0.08	< .0001	65-69	34.0±6.0	45.1±5.0	< .0001
70-74	0.98±0.07	0.91±0.08	< .0001	70-74	35.0±7.0	44.3±4.4	< .0001
75-79	0.98±0.10	0.90±0.09	.001	75-79	35.4±6.0	43.2±5.0	< .0001
≥ 80	0.96±.06	0.93±0.07	.121	≥ 80	33.1±6.0	45.0±5.0	< .0001
Tricipital skinfold (mm)				**Wilmore - Behnke (%*BF*)**			
65-69	15.3±6.4	23.0±8.0	< .0001	65-69	29.0±5.2	39.1±4.4	< .0001
70-74	17.0±10.0	20.1±7.0	.032	70-74	30.0±6.3	38.4±4.0	< .0001
75-79	17.3±8.0	19.3±6.0	.250	75-79	30.2±5.2	37.3±4.2	< .0001
≥ 80	16.0±7.0	21.4±12.2	.032	≥ 80	28.2±5.4	39.0±4.1	< .0001

BMI, body mass index; *%BF*, body fat percentage; $p \leq .05$ was considered significant

Table 3 shows the BMI by age group and sex. No significant differences in BMI were found between age groups in both men and women. Table 4 shows the WC and WHR by age group and sex. The differences in WC and WHR between age groups were not significant in both men and women. A high prevalence of abdominal obesity was observed according to WC, mainly in men (65.7%). The prevalence of elevated WHR was similar in men and women (10.1% vs. 9.8%). Regarding the percentage of body fat, no significant differences were found between age groups in both sexes, as can be seen in Table 5.

Table 3. Body mass index according to age groups and sex of older adults

		Age groups										
		65-69 years old		70-74 years old		75-79 years old		≥ 80 years old		Total		*P*
	BMI	n	%	n	%	n	%	n	%	n	%	
Men	18.5 - < 25	24	22.2	15	25.0	7	21.2	10	38.5	56	24.7	.590
	25 - < 30	57	52.8	26	43.3	17	51.5	11	42.3	111	48.9	
	≥ 30	27	25.0	19	31.7	9	27.3	5	19.2	60	26.4	
Women	18.5 - < 25	25	18.4	17	23.6	9	27.3	7	25.0	58	21.6	.914
	25 - < 30	64	47.1	33	45.8	15	45.5	12	42.9	124	46.1	
	≥ 30	47	34.6	22	30.6	9	27.3	9	32.1	87	32.3	
Total	18.5 - < 25	49	20.1	32	24.2	16	24.2	17	31.5	114	23.0	.682
	25 - < 30	121	49.6	59	44.7	32	48.5	23	42.6	235	47.4	
	≥ 30	74	30.3	41	31.1	18	27.3	14	25.9	147	29.6	

BMI, body mass index; $p \leq .05$ was considered significant

Table 4. Waist circumference (WC) and waist-hip ratio (WHR) according to age groups and sex of the older adults

Waist circumference (cm)											
	65-69 years old		70-74 years old		75-79 years old		≥ 80 years old		Total		*p*
	n	%	n	%	n	%	n	%	n	%	
Men											
≥ 102	78	67.8	37	59.7	21	60.0	21	77.8	157	65.7	.323
< 102	37	32.2	25	40.3	14	40.0	6	22.2	82	34.3	
Women											
≥ 88	51	36.4	26	36.1	14	40.0	9	30.0	100	36.1	.868
< 88	89	63.6	46	63.9	21	60.0	21	70.0	117	63.9	
Waist-hip ratio											
Men											
≥ 1.00	9	8.7	6	10.9	3	9.4	4	15.4	22	10.1	.779
< 1.00	95	91.3	49	89.1	29	90.6	22	84.6	195	89.9	
Women											
≥ 0.85	15	12.3	5	7.4	3	10.0	1	3.8	24	9.8	.499
< 0.85	107	87.7	63	92.6	27	90.0	25	96.2	222	90.2	

$p \leq .05$ was considered significant

Table 5. Percentage of body fat according to age groups and sex of older adults. Mean ± standard deviation

	65-69 years old	70-74 years old	75-79 Years old	≥ 80 years old	Total	*p*
Siri-specific (%*BF*)						
Men	30.4±5.1	31.0±6.1	32.0 ± 5.1	30.0 ± 5.3	31.0 ± 5.4	.709
Women	40.3 ± 4.3	40.0 ± 4.0	39.0 ± 4.1	40.1 ± 4.0	40.0 ± 4.2	
Brozeck-specific (%*BF*)						
Men	29.3 ± 5.0	30.0 ± 6.0	30.4 ± 5.0	29.0 ± 5.0	30.0 ± 5.0	.709
Women	39.0 ± 4.0	38.0 ± 4.0	37.0 ± 4.0	38.2 ± 4.0	38.1 ± 4.0	
Rathburn - Pace (%*BF*)						
Men	34.0 ± 6.0	35.0 ± 7.0	35 ± 6.0	33.2 ± 6.0	34.3 ± 6.1	.709
Women	45.1 ± 5.0	44.3 ± 4.4	43.2 ± 5.0	45.0 ±5.0	45.0 ± 5.0	
Wilmore - Behnke (%*BF*)						
Men	29.0 ± 5.2	30.0 ± 6.3	30.2 ± 5.2	28.2 ± 5.4	29.2 ± 6.0	.709
Women	39.1 ± 4.4	38.4 ± 4.0	37.3 ± 4.2	39.0 ± 4.1	39.0 ± 4.3	

%BF, body fat percentage; $p \leq .05$ was considered significant

Discussion

The present study describes the anthropometric and body composition parameters in Mexican OA beneficiaries of the ISSSTE.

Based on data from the 2012 National Health and Nutrition Survey (ENSANUT 2012) Lopez-Ortega and Arroyo (2016) reported that in Mexico only 9.3% of OA had secondary or higher education. In our population 69.8% of the subjects exceeded secondary education and since educational level is one of the basic aspects of socioeconomic status (Vera-Romero & Vera-Romero, 2013), it can be considered as an indicator of the higher socioeconomic level of the studied population with respect to the general population of OA in Mexico.

In our study population 31.2% had ever smoked in life or currently smoked, which is below that found by Guimaraes et al. (2014), who conducted a study in Mexico City with OA and reported a smoking prevalence of 45.4%, which was similar to that found by Batsis et al. (2014) in US OA (46%), likewise, Easton et al. (2018) found a smoking and ex-smoking prevalence of 41.5% in OA (≥ 50 years) in Mexico, a figure similar to that reported by Gavriilidou et al. (2015) who reported a prevalence of 39.5% in Swedish OA. When differentiating by sex, in our results we found that the prevalence of tobacco use was 3 times higher in men than in women (48.9% vs. 15.8%) which agrees with what was found by Guimaraes et al. (64.8% vs. 20.2%).

The mean height in men was 162.7 cm, very similar to that reported by Sánchez-García et al. (2007) and López-Ortega and Arroyo (2016) in Mexican OA who indicated a mean of 163.2 cm and 161.9 cm respectively, on the other hand, it is lower when compared to that reported in studies conducted in other Latin American countries; Miranda et al. (2019) found a mean of 170 cm in Holguín, Cuba, similar to that of Diaz et al. (2015) who reported 169.2 cm in OA from Arica, Chile. Regarding females the mean height was 151.4 cm, slightly lower than that observed by Sánchez-García et al., (2007) but higher than López-Ortega and Arroyo (2016) who were 152.6 cm and 148.3 cm respectively. Referring to weight, the mean in males and females was higher than that found in the two studies mentioned above, being in the case of males 73.7 kg, 70.3 kg and 70.5 kg respectively, and in females 65.7 kg, 62.7 kg and 63.3 kg respectively.

While in other studies it has been observed that weight and height are lower in older age groups (Gavriilidou et al., 2015; Lopez-Ortega & Arroyo, 2016; Sánchez-García et al., 2007), in our study this was only observed in the weight of men aged ≥ 80 years, and in the case of women it was the reverse presenting higher weight in the older group, while in height there were no differences between the older groups with respect to the rest of the groups for both sexes. It is known that the gradual decrease in height with age is a result of vertebral compression and bone degenerative diseases, while weight loss may be related to sarcopenia due to atrophy and senility (Gavriilidou et al., 2015; Gomez-Cabello et al., 2011), that this was not clearly observed in the present study could be related to the fact that the population is limited to ISSSTE entitled individuals, whose characteristics might not be entirely the same as those of the general population, moreover, to assess weight and height decline more appropriately a longitudinal study would be necessary.

The mean BMI in this study was like that found by Batsis et al. (2014) in the United States and by Chavarría et al. (2017) in Chillán, Chile (28.1 kg/m., 27.1 kg/m. and 27.9 kg/m., respectively). Another study done in male OA from the province of Arica, Chile showed a mean BMI of 27.6 kg/m., a figure that is like the BMI of our population, which was 27.7 kg/m. in men (Díaz et al., 2015). In this study the mean BMI was similar between men and women in all age groups, except for the group ≥ 80 years, where it was significantly higher in women. As in our study Gavriilidou et al. (2015) and Sánchez-García et al. (2007) found similar BMI in men than in women, but without distinguishing by age groups (27.5 kg/m. vs. 27.2 kg/m. and 26. 4 kg/m. vs. 26.8 kg/m. respectively), on the other hand, López-Ortega and Arroyo (2016) and Gómez-Cabello et al. (2011) described that the mean BMI was higher in women than in men in all age ranges.

The joint prevalence of overweight and obesity in our population without differentiating sex was 77%, a high figure compared to what was found by López-Ortega and Arroyo (2016) who reported 68.9% in Mexican OA and by Miranda et al. (2018) who reported 64.5% in Cuban OA, likewise, Chavarría et al. (2017) reported lower prevalence of overweight and obesity (47%) in Chilean OA, however, in the latter study the large differences could be partly explained by the criteria used to classify nutritional status (overweight, BMI 28-31.9 kg/m.; obesity, BMI ≥ 32 kg/m.). In contrast to previous studies, the prevalence of overweight and obesity found by Gómez-Cabello et al., (2011) in Spanish OA was 84.3% exceeding the prevalence of the present investigation.

Describing the results according to gender, our study as well as that of Gómez-Cabello et al., 2011 showed that the most frequent nutritional status in both sexes was overweight (men 48.9% and 58.4%; women 46.1% and 43.1% respectively), however, the prevalence found of obesity in women by these authors was higher than ours (40. 9% vs. 32.3%) and in men very similar (26.6% vs. 26.4%), contrasting, in the study of López-Ortega and Arroyo, (2016) obesity was what predominated in women with 37.3%, and in the study of Chavarría et al., (2017) obesity was most prevalent in men with 39%. Despite the high prevalence of overweight and obesity found in this study, which is consistent with those found by other authors, some studies have associated elevated BMI in OA with lower mortality risk (Batsis et al., 2014; Chang et al., 2012). On the other hand, a high BMI in OA is also associated with dependence and cardiovascular problems (Gregson et al., 2019; Wojzischke et al., 2021). The fact that no underweight OA were found may reflect a favorable socioeconomic and cultural environment of the population studied (Chavarría et al., 2017; Osuna-Padilla et al., 2015).

The mean WC in men was 98.9 cm exceeding the mean found in Mexico by other authors which was 95.5 cm and 96.7 cm (Sánchez-García et al., 2007; López-Ortega & Arroyo, 2016); and resembling the values found in Swedish (99.7 cm) and Spanish (98.5 cm) population (Gavriilidou et al., 2015; Gómez-Cabello et al., 2011), however, it must be considered that in European population the stature is higher and therefore the fat distribution cannot be considered comparable despite the similarity of the values. As for the WC of women, it agrees with what was found in Mexican population by Sánchez-García et al. (2007) and López-Ortega and Arroyo (2016; 94.3 cm vs 93.7 cm and 95.5 cm, respectively), being higher than in European women (90.1 cm and 92.4 cm; Gavriilidou et al., 2015; Gómez-Cabello et al., 2011). When comparing WC between men and women, this study found that the mean was significantly higher in men, while López-Ortega and Arroyo (2016) reported no differences. The differences in body composition between men and women are attributed to the different patterns of use of energy substrates, men tend to oxidize more lipids while women tend to store them and have a greater sensitivity to insulin, which is influenced by the action of sex hormones and adipokines in each sex and is reflected in the patterns of visceral fat deposition and regional adipose tissue distribution (Ethun, 2016; Wei et al., 2019).

However, age-related alterations in sex steroid levels (decreased estrogen levels in postmenopausal women and decreased androgen levels in men) play a role in the differences between older men and women (Ethun, 2016).

The prevalence of WC (≥ 88 cm) in women reported in this study, despite being high, was lower than that found by López-Ortega and Arroyo (2016) in Mexico and Gómez-Cabello et al. (2011) in Spain (36.1% vs. 72.2% and 62.5% respectively), on the other hand, in men the prevalence of WC ≥ 102 was higher than in the two previous studies (65.7% vs. 33% and 34.1% respectively). Elevated WC has been associated with increased risk of frailty, dependency, cardiovascular disease and increased risk of mortality in OA (Gavriilidou et al., 2015; Hollander et al., 2012; Wojzischke et al., 2021; Xu et al., 2020), likewise, in post-menopausal women it has been associated with increased risk of hip fracture (Meyer et al., 2016) and in elderly women with type 2 diabetes mellitus it has been suggested that central adiposity may increase the risk of dementia (West et al., 2016).

Regarding the HC the mean was 101.4 cm and 105 cm for men and women respectively, values that are higher than those reported by López-Ortega and Arroyo (2016) in Mexican population that were 98 cm and 102.8 cm in the same order, on the other hand, Sánchez-García et al. (2007) reported values like ours (100.2 cm and 104 cm respectively). Similarly, in Sweden the mean HC found by Gavriilidou et al. (2015) was close to ours in both sexes (101.6 cm in men and 103.7 cm in women).

The mean values of WHR obtained in both sexes were lower than those of López-Ortega and Arroyo (2016) in Mexican general population (0.97 vs. 0.99 in men and 0.89 vs. 0.93 in women). Regarding the prevalence of subjects with central distribution of adipose tissue (WHR ≥ 1.0 in men or ≥ 0.85 in women), the data obtained in this study were low compared to what was found in other studies in Mexican population (9.9% vs. 43.24%, 69.2% and 65.7%; Easton et al., 2018; López-Ortega & Arroyo, 2016; Sánchez-García et al., 2007). When divided by sex the prevalence of high WHR in men was 10.1% compared to 19.1% and 42% found by Sánchez-García et al. and López-Ortega and Arroyo respectively; and in the case of women the difference was greater (9.8% vs. 73.7% and 86% respectively).

Of the studies that focus on analyzing the body composition of OA, few report skinfold measurements. BSF and TSF in men were larger than those found by Velázquez-Alva et al. (1996) in OA from Mexico City (16 mm and 11.6 mm vs. 14.5 mm and 9.8 mm respectively), while SSSF and SISF were smaller (21.3 mm and 20.4 mm vs. 22.3 mm and 25 mm respectively). When comparing our data with those of Diaz et al. (2015) in male OA from Arica, Chile it was found that all the folds evaluated by them were lower than ours (TSF 13.5 mm, BSF 7.9 mm and SSSF 20.6 mm), this could be related to the fact that their population was composed of soccer players, in this sense López-Fuenzalida et al. (2016) found an inverse association between the level of physical activity with the sum of skinfolds in adults. Similarly, the skinfolds evaluated by Gavriilidou et al. (2015) in Sweden were lower than those of this study in both sexes (TSF 14.1 mm and 20.8 mm; SSSF 19.4 mm and 19.6 mm for men and women, respectively). It should be noted that in the studies, including ours, all the skinfolds reported were greater in women than in men.

The percentage of body fat in men was like that found by Velázquez-Alva et al. (1996) in Mexico City and slightly higher than that reported in Spain by Gómez-Cabello et al. (2011; 30.6% vs. 31.7% and 28.9% respectively), while in women it was like that of both studies (39. 8% vs. 40.5% and 39.4% respectively), however, the equations used for estimation were different in the first study and in the second the method used for calculation was bioimpedance, which limits these comparisons.

The differences found with other studies conducted at the national level demonstrate that additional research is required to allow a more specific characterization of anthropometric measurements, considering factors such as lifestyle, socioeconomic level and level of physical

activity, and including minority populations such as those living in nursing homes or in rural communities.

Strengths and Limitations

It is worth noting these results were obtained from a sample of OA from different regions of the country, so the data from this study may be useful in the evaluation of the nutritional status of OA in Mexico; however, it should be considered that the results were obtained from the ISSSTE population, and do not include populations that do not have access to health services. In the same way, in this study the information collected in the ISSSTE delegations did not allow the anthropometric parameters to be related to any indicator of quality of life or the health status of the population. On the other hand, skinfolds were reported in this study, which is important given that there are few studies that describe them.

Conclusions

The results of this investigation showed significant differences between men and women in most of the anthropometric measurements and nutrition indicators; on the one hand, men were taller, heavier, had a higher WC and WHR, while HC, skinfolds (TSF, BSF, SSSF and SISF) and fat percentage were higher in women. No differences were found in BMI and in the prevalence of overweight and obesity, likewise, there were no differences in the prevalence of elevated WHR, while central obesity indicated by WC was more prevalent in the case of men. Unlike other studies, it was not possible to observe a decrease in anthropometric parameters in the older age groups.

Conflicts of Interest

The authors declared that they had no conflicts of interest.

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