

Obesity and Central Obesity in Elderly People in Latin America and the Caribbean – Are we fat?

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This study provides estimates of obesity and central obesity in six countries of Latin America and the Caribbean from a large representative sample of elderly individuals. Levels of obesity are so high in this region that women in these countries are usually fatter than their counterparts in the United States. Elders from Uruguay have the highest obesity rate followed by those from Chile and Mexico. Elderly men and women from Cuba have the lowest average weight and the lowest prevalence of obesity. Brazilians, Chileans and Mexicans have highest values of waist circumference and waist-to-hip ratio, which implies that elderly in these countries are at higher risk of developing diabetes and cardiovascular disease. Men are taller than women and heavier as well (Barbados is an exception), but average body mass index is higher among women. Height and weight tend to decline with increases in age and this may be associated with historical trends and aging itself. Current levels of obesity among elderly require changes in lifestyle, changes on their diets and increases in physical activity, but in many cases professional help is already necessary to reduce body weight.

Introduction

The prevalence of obesity in Latin America and the Caribbean is growing rapidly. The economic development of past decades has increased the availability of food, generally rich in saturated fat and refined carbohydrates – but low in complex carbohydrates and fiber. In fact, there is evidence that in poor countries people tend to get fatter as their incomes increase (Eberwine 2002). Economic development and urbanization also decreased the energy consumption – there were large reductions on the physical demands at work. The imbalance between higher intake of calories and decreased physical activity brings the organism to pile up the excess of lipids. Genetic factors may also play a role. The Neel’s ‘thrifty gene’ hypothesis sustains that the susceptibility of developing diabetes is genetically determined. The argument is that populations that had experienced famine are genetically different in their ability to increase insulin secretion from those that did not experience food shortage (Vadheim and Rotter 1992). More specifically, those exposed to undernutrition early in life, usually stunted, suffer alterations in their metabolism towards energy conservation. It is also possible that the individuals in Latin America are not metabolically well adapted to cope with recent dietary changes. The “genetically unknown foods” hypothesis argues that those populations have their metabolism well adjusted to work using low-energy density and low-fat diets (Baschetti 1998; 1999). More likely, it is that genetic factors interact with environment changing the individual’s susceptibility of developing obesity.

The situation is even more complicated in Latin America where obesity is seen as a symbol of wealth and status in Latin America, which contributes to the rise of the obesity among Latinos (Fall 2000). The general trend is towards higher levels of obesity in Latin

America and the Caribbean. However, there is considerable variability in the prevalence among populations and different ethnic groups have important differences on body composition. Genetic, nutritional status, environmental and lifestyle factors play an important role explaining the different levels of obesity among countries.

Obesity among elderly is even more complex to be analyzed because with aging there are bone and muscle losses that influence the body composition. The objective of this work is to estimate and to compare the anthropometric measures with particular attention to those related to obesity and central obesity in elderly individuals in six countries in Latin America and the Caribbean. Analysis is performed taking into consideration age groups and sex. The results from the analysis of the variance are also shown. Estimates presented here can be used as reference data for Latin America and Caribbean.

Anthropometric measures at older ages

Anthropometric measures are obtained relatively inexpensively, using non-invasive methods for assessing size and proportions of human body. Variation of the body composition may indicate changes in nutrient intake, metabolism, and disease stress among others. In particular, obesity and overweight are associated with an increased risk of diabetes mellitus and hypertension. Body fat has also been associated to metabolic alterations leading to increased mortality – particularly, stroke, heart disease, and some cancers – and morbidity, particularly back and joint pain. Not only excess weight, but also body fat distribution has been shown to be an important risk factor (Lundgren et al 1989; Ohlson et al 1985). Many studies have demonstrated that abdominal fat, characterized as the “apple body shape” in men and “pear body shape in women, is associated with the adult onset of diabetes.

Individuals with abdominal adiposity tend to have fat accumulated around and in the liver, pancreas and bowel and the excess of internal fat is strongly related to insulin resistance,

hyperinsulinemia and glucose intolerance. In addition, there is evidence that excessive weight gain or weight loss is linked to increased mortality (Andres et al 1993). As a matter fact, physicians frequently evaluate the body composition for diagnoses and prognoses purposes. Anthropometric measures have also been used to predict survival.

Anthropometric measures represent convenient ways of obtaining useful information, however there are difficulties in obtaining anthropometric measures in elderly people. The measurement of weight in immobile people is difficult and it may provide unreliable measures since it is influenced by fluid retention. The measurement of height is equally burdensome in those who cannot stand. Also, loss of muscle mass, strength and function (sarcopenia) is very prevalent among elderly and with aging there is a vertebral collapse that causes reduction in height (Baumgartner 2000; Velásquez-Meléndez et al 1999). In addition, the abdominal muscles loosen up with aging, which interferes in the measurement of the waist circumference (Steen 1988).

For those in which height and weight can be measured, the usual values of body mass index (BMI) cutoff are 25 Kg/m^2 for overweight and 30 Kg/ m^2 for obese. However, there is evidence that those fixed cutoffs can generate substantial misclassification when analyzing elderly people. As a matter fact, BMI does not correlate well with body fat in elderly people as it does in adults. Moreover, with aging there is a reduction in the lean body mass. The basal metabolic rate also declines, which means that the energy requirement per unit of weight declines.

Cutoffs for BMI may also depend on individual's height. It has been shown that individuals with short stature may be considered 'obese' at lower levels of BMI. This happens because those with short stature have higher levels of body fat at each level of BMI. As a consequence, the National Consensus for Obesity in Mexico defined that those with

short stature should be considered obese if their BMI is higher than 25. Study from Lopez Alvarenga et al (2003) confirms that this is a better cutoff for those with short stature. Also, lower values for BMI cutoffs have been suggested for Mexican adult populations as better predictors of diabetes mellitus and hypertension. For example, Sánchez-Castillo et al (2003) suggested BMI cutoff values around 26-27 for men and for women around 28-29.

Some studies have also shown that measures of central fat distribution (waist circumference, hip circumference, waist-to-hip ratio and waist-to-height ratio) are better for assessing elevated metabolic risks than BMI (Blair et al 1984; Hsieh et al 2003). More recently it has been shown that waist circumference and sagittal abdominal diameter are better associated with visceral adiposity than waist-to-hip ratio (Zamboni et al 1998). Those measures are also more closely associated with cardiovascular diseases risk factors in old age (Turcato et al 2000). Also, typical skinfold measures such as the ones obtained in the biceps, triceps, and subscapula are not as useful indicating the amount of elderly body fat as it is for adults (Dupler and Tolson 2000). This happens because with aging, there is a rearrangement of fat storage from peripheral subcutaneous sites to the abdomen.

With aging, there is a decrease in height, weight and body cell mass (Chiu et al 2000, Going et al 1995, Hsieh et al 2003). There are three possible explanations for the smaller size of older people: a) aging (Dey et al 1999); b) historical trends on height – younger cohorts tend to be taller and heavier (Dey et al 1999; 2001) and c) selective mortality – those with worse weight profiles may be more likely to die prematurely. Baumgartner (2000) argues that aging is associated with decreases in obesity prevalence, but increases in the prevalence rates of sarcopenic obesity. His argument is that obese individuals become sarcopenic obese with age, as they maintain their fat mass levels constant, but lose muscle mass. Indeed, the use of BMI at older ages may underestimate the body fat in those who lost muscle mass. Another

finding is that changes on BMI tend to be less pronounced since weight and height vary in the same direction (Dey et al 1999), but again elderly individuals may be losing weight from muscle mass and not from fat. In effect, BMI is a measure of weightiness rather than fattiness. On the other hand, there is evidence that measures of central obesity such as waist-to-height ratio are positively associated with age (Hsieh et al 2003). However, waist circumference and waist-to-hip ratio have to be carefully analyzed in obese subjects, because umbilicus may fall under the line of the hip in obese individuals (Guerrero Romero and Rodríguez-Morán 2003).

Finally, there are difficulties of establishing a valid criterion for cross populations analysis. As a matter of fact, some studies have demonstrated that cutoff values of anthropometric measures may be population specific and disease specific (Okosun et al 2000).

Obesity and central obesity in Latin America and Caribbean

There is very limited information available regarding obesity and central obesity in Latin America and Caribbean. Most of the available information focuses on preschool children and women in reproductive years (Kain et al 2003). Moreover, data generally come from samples that sometimes are not representative for the whole countries. Different studies have also used different methodology and diagnose criteria. Therefore, most of the available data is not comparable and not necessarily focus on elderly people.

However, despite these limitations there is some evidence that obesity is on rise in Latin America (Braguinsky 2002, Kain et al 2003). Also, there is evidence that Hispanics have higher abdominal obesity, which increases their risk of diabetes (Haffner et al 1986; Karter et al 1996). Prevalence of obesity in more developed countries in the region seems to be increasing among those in the lower socioeconomic strata, rates are also higher in urban

settings and women tend to have higher prevalence rates than men in most countries (Filozof et al 2001, Braguinsky 2002, Kain et al 2003).

Barbados

There is some evidence that prevalence of diabetes is on rise in Barbados (Fraser 2001, 2003). Economic changes in the last decades contributed to reduce the levels of physical activity since predominance of agriculture gave place to tourism. Food availability increased and it has been estimated that energy intake is higher than required (FAO 2003). As a consequence obesity levels became a public health concern. It has been estimated that 7% of the total health care costs are associated with obesity (WHO 1998). Prevalence data from urban areas in the early 1990s show that 10% of males and 31% of adult females aged 25 and older are obese (Wilks et al 1998). Foster et al (1993) focus on a sample of individuals aged 40 to 74 and find that over half of men and 42% of women in Bridgetown were overweight. Also, 30% of women and 10% of men were obese. There is evidence that BMI in Barbados increases with age up to the mid-50s and then it declines or at least levels off after it (Rotimi et al 1995).

Brazil

The prevalence of obesity almost doubled among adults between mid-70s to late 1980s in Brazil – rates rose from 5.7% to 9.6% (Braguinsky 2002). Among elderly, estimates of prevalence of obesity in Brazil vary considerably. Barreto et al (2003) analyzed a sample of 1,443 elderly men and women residing in the Southeast region and estimated in 12.8% the prevalence of obesity. Cabrera and Jacob Filho (2001) analyzed a sample of 847 elderly outpatients in the South region and estimated in 18.9% the prevalence of obesity. Regarding gender, women in Brazil have a higher prevalence of obesity and central obesity than men (Sichieri et al 1994, Barreto et al 2003; Martins and Marinho 2003). Cabrera and Jacob Filho

(2001) estimated in 9.3% the obesity among elderly men and 23.8% among elderly women, while Barreto et al (2003) estimated in 4.7% and 21.5%, respectively. Abrantes et al (2003) using a large sample from the Southeast and Northeast regions estimated in 6.4% the prevalence of obesity among men aged 60-69 and 19.2% among women. Selection of different age groups and data from different settings may explain those differences.

There is also evidence that BMI and obesity prevalence among elderly people decreases with age (Cabrera and Jacob Filho 2001; Abrantes et al 2003; Barreto et al 2003). Cabrera and Jacob Filho (2001) found that the waist-to-hip ratio increases with age among elderly women. Brazilians with higher abdominal fat accumulation have poorer metabolic profiles, higher prevalence of diabetes mellitus and hypertension (Cabrera and Jacob Filho 2001; Lerario et al 2002; Barreto et al 2003). Also, women with short stature in Brazil are also more likely to be overweight and to have high waist-to-hip ratio than women with normal height (Velásquez-Meléndez et al 1999). This finding can be related to nutritional stunting at earlier ages. For instance, Hoffman et al (2000) analyzed children at shantytowns in Brazil and found that undernutrition during childhood is associated with impaired fat oxidation, which predicts body fat gain.

Monteiro et al (2001) analyzed men and women in two regions in Brazil and showed that income tends to be positively associated with obesity while education has a protective effect. Barreto et al (2003) and Lima-Costa et al (2003) also found a higher prevalence of obesity among non-poor Brazilian elderly. Nonetheless, Castanheira et al (2003) argue that there are different patterns for men and women. Their results show that white married men with higher family income had higher abdominal circumference whereas in women central obesity increases with less schooling. In a more recent study, Monteiro and colleagues show that the prevalence of obesity more than doubled among the poorest between 1975 and 1997

and remained stable among the richest (Monteiro et al 2004). This confirms an earlier finding that shows that there have been changes in the obesity trends in Brazil (Monteiro et al 2000). Indeed, there is some evidence that obesity is increasing faster in rural areas, among those in the bottom of the income distribution and among men (Monteiro et al 2000). Interesting to note, that urban women in upper income groups have experienced declines in obesity prevalence (Monteiro et al 2000). In fact, those with lower income in Brazil have lower consumption of fresh fruits or vegetables and are less likely to exercise during leisure time than the ones with better income. Important to note, that this finding holds for elderly people (Lima-Costa et al 2003).

Chile

Chile has undergone important nutritional shifts in the last decades. The prevalence of underweight has been considerably reduced and there is evidence that obesity rates are on rise (Vio and Albala 2000). Studies show that during the 1980s, the prevalence of obesity reached approximately 10-13% of males and 22-24% of adult women (Albala et al 1998; Berrios et al 1990). By the 1990s, those rates have doubled. Prevalence rates in Greater Santiago were about 20% in men and 40% in women (Rozowski and Arteaga 1997). There is evidence that women of low socioeconomic level have higher prevalence rates (Albala et al 1998). Santos et al (2004) use the same sample in this study and show that weight, height, waist circumference and BMI decline with age. Elderly men are heavier and taller than women, but their mean BMI is lower. Among indigenous populations prevalence rates of obesity and overweight are quite high. More than half (56.1%) of rural Mapuche natives are overweight - 40.0% in men and 62.9% in women (Pérez-Bravo et al 2001). Pérez B. et al (1999) estimated that obesity reaches 13% of men and 23.1% of women in the Aymara native

population. Even higher is the percentage with $BMI \geq 25$ – 47% among men and 56.9% among women.

Cuba

In the early 1980s, the prevalence of obesity among adults in Cuba was 13.3% in females and 7% in males. However, the collapse of the socialist system in the Soviet Union and Eastern Europe imposed difficulties for the population in Cuba. After 1989, there was a shortage of imported food and fuel. The availability of energy was reduced particularly due to decreases in the consumption of animal protein and other sources of fat. At the same time given the lower availability of fuel, individuals increased their physical activity (walking and riding bicycles became important means of transportation) and, as a result, the prevalence of obesity declined. It has been estimated that obesity declined to 6.2% and to 2.7% in men. But, by mid-1990s, the situation seems to have reversed with declines in physical activity and increase in food supply. As a consequence, the prevalence of obesity among adults increased reaching 10.2% among females and 7% among males (Rodrigues-Ojea et al 2002).

Mexico

Mexico has very high prevalence rates of obesity. As in other countries in Latin America, prevalence rates are higher among women (Velázquez-Alva et al 1996, González-Villalpando et al 2003) and in urban areas (Gutierrez et al 2001), even though differences are not always statistically significant (Fernald et al 2004). Data from early nineties show that about 21% of the adult urban population was obese (Arroyo et al 2000, Braguinsky 2002) and over half had BMI over 25. Among low-income urban population, the prevalence rates are even higher. González-Villalpando et al (2003) estimated in 29.2% the prevalence of obesity in Mexico. Over 1/3 of adult women and near 20% of men were obese at the

baseline. Moreover, the prevalence of obesity increased in the next two follow-ups. Even though, the mean BMI and average weight had followed an inverse U-shape curve.

Among elderly, Lerman-Garbel et al (1999) analyzed three Mexican communities and estimated in 15.6% the obesity prevalence among elderly men and 19.7% among women aged 60 and over. Data from a large national survey was conducted in urban areas in Mexico in the early 1990s show that prevalence rates reach a quarter of the population aged 60-69 (Castro et al 1996), 18.2% of men and 33.2% among women (Arroyo et al 2000). However, men have higher prevalence rates of overweight than women in this age group (Arroyo et al 2000). Among those aged 70 and over, obesity prevalence rates are estimated in 20% for both sexes (Aguilar-Salinas et al 2001). For Mexican Americans, the figures are 23% of elderly men and 35% of women were obese (Ostir et al 2000). Most impressive is the fact that over $\frac{3}{4}$ those aged 60 and over in Mexico have excess weight (Velázquez-Alva et al 1996, Aguilar-Salinas et al 2001). Gutierrez et al (2001) show that elderly women living in urban areas have higher BMI than those living in rural areas. Those living in marginal areas have even higher mean BMI and a much higher prevalence of obesity and overweight (Gutierrez et al 2001). There is also evidence that obesity prevalence declines with advanced age (Velázquez-Alva et al 1996, Lerman-Garber et al 1999).

Uruguay

Over half of the adult population in Uruguay is obese or overweight (FAO 1999, Curto et al 2004). Approximately 18% of the population aged 18 and older is obese and almost 36% overweight (Curto et al 2004). In some studies, prevalence rates among women were lower than among men (Curto et al 2004), but in most studies the reverse is found. Obesity and overweight rates increase until the age groups 50-59 and 60-69, respectively (Curto et al 2004). Curto et al (2004) estimated in 26% the prevalence of obesity in the age

group 50-59, approximately 20% in the age group 60-69, and near 11% in the age group 70-79. There is some evidence that obesity is negatively associated with socioeconomic conditions among women, but among men obesity is more prevalent among those more affluent, even though the association is weaker (PAHO 1998).

Data

SABE (Salud, Bienestar y Envejecimiento en América Latina y el Caribe Proyecto) is a multicenter survey that investigates the health and well being of noninstitutionalized population of older people (aged 60 and over) and, in some cases, of their surviving spouse in principal urban areas of Argentina (Buenos Aires), Barbados (Bridgetown), Brazil (São Paulo), Chile (Santiago), Cuba (Havana), Mexico (Mexico City) and Uruguay (Montevideo) (Palloni et al 2002).

Information was collected through personal interviews using a structured questionnaire, followed by physical examination to measure anthropometric characteristics. Data contain the details of demography, medical history, physical activity, educational and social status information. Anthropometric measures were obtained by paramedical personnel specially trained for this study. Measurements of body height, knee height, weight, waist, hip, triceps skinfold thickness and mid arm circumference were made. Argentina does not collect anthropometric measures and it will not be analyzed here.

Sample

A total of 10,537 individuals completed the interview and from those 9,859 were aged 60 and over. Complete anthropometric measures were obtained from 8,671 elderly individuals, 5353 women (62%) and 3280 men (38%) (Table 1). Those who didn't have complete information on anthropometric measures were older (mean 73.8 years) than those

who completed (average 71.6 years) ($p < 0.001$). There were no differences among men and women in completing the anthropometric section.

Table 1: Sample size by age group and sex, all countries

	Barbados	Brazil	Chile	Cuba	Mexico	Uruguay	Total
<i>Females</i>	1019	1057	808	1044	626	799	5353
60-69	447	425	366	451	349	378	2416
70-79	377	409	282	369	206	313	1956
80-84	105	142	87	113	42	65	554
85+	90	81	73	111	29	43	427
<i>Males</i>	689	689	406	630	411	455	3280
60-69	280	280	213	342	242	218	1575
70-79	282	282	142	180	114	183	1183
80-84	80	80	29	57	36	40	322
85+	47	47	22	51	19	14	200
<i>Total</i>	1708	1784	1214	1674	1037	1254	8671
60-69	727	684	579	793	591	596	3970
70-79	659	694	424	549	320	496	3142
80-84	185	251	116	170	78	105	905
85+	137	155	95	162	48	57	654

Source: SABE

Measures and Methods

For each individual, body height was measured with the individual standing without shoes, legs straight, shoulders relaxed, and head in the Frankfort horizontal plane, lying against a wall. Height was recorded to the nearest centimeter. Weight was obtained with the subjects wearing light clothing and standing on the platform barefoot. Weight was assessed with a SECA platform scale (Madison, WI, USA) graduated to the nearest 0.1 kg. BMI was calculated from the resulting height and weight measures with the formula $BMI = \text{weight}/\text{height}^2$.

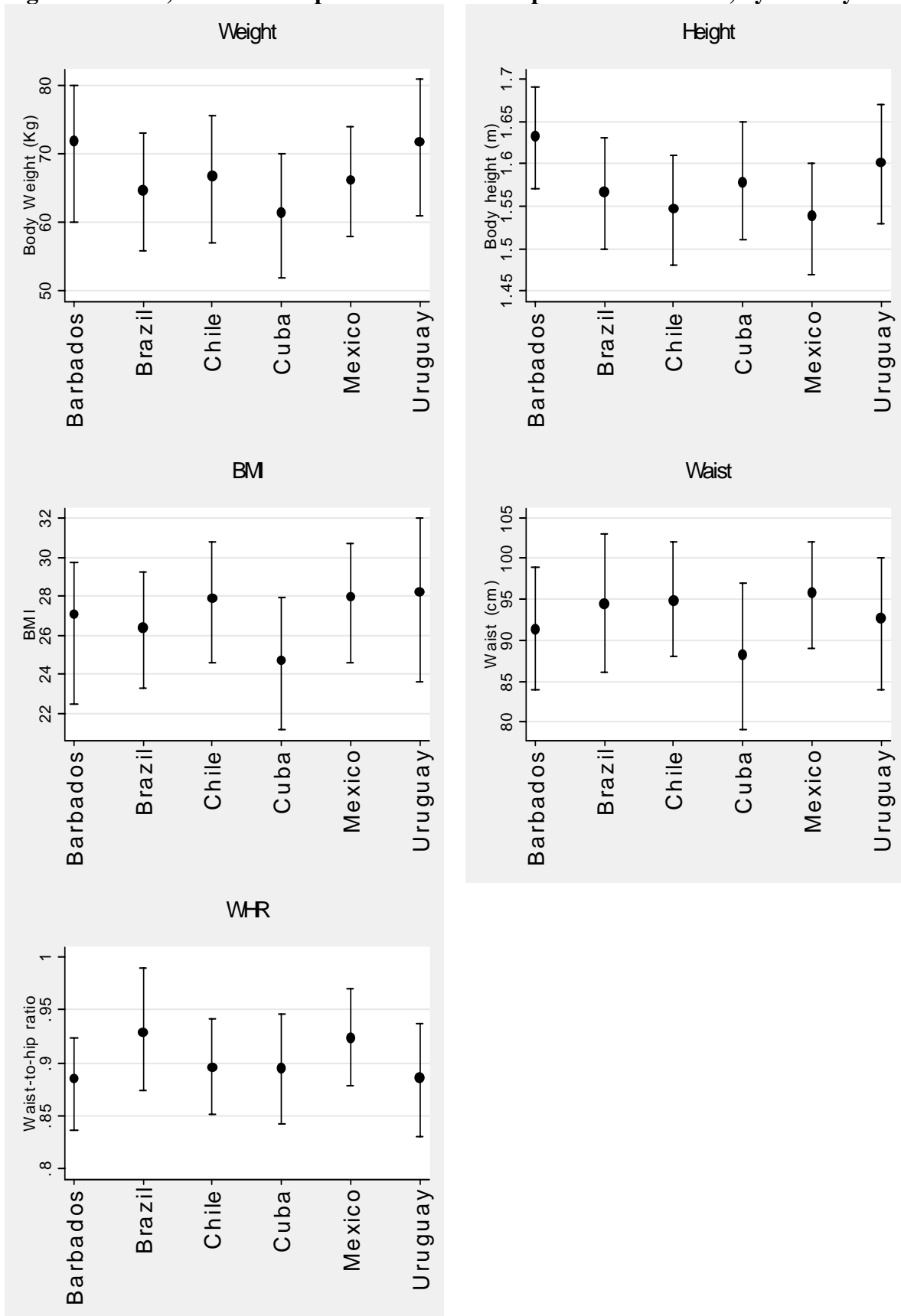
Waist circumference was measured with the subject standing up. A flexible steel tape was used to measure the waist circumference at the level of the umbilicus. Hip circumference was assessed at the point of maximum posterior protrusion of the buttocks. The waist-to-hip ratio (WHR) was calculated from the waist and hip circumferences.

Statistical programs available in STATA version 8.0 S.E. were utilized for these analyses. Age and gender specific means and standard deviations were computed and compared across sites. Analysis of variance was performed. For multiple comparison tests, Bonferroni tests were used (results not shown). Linear regression analysis was also executed in order to examine age trends (results not shown).

Results

Elderly people in Barbados and Uruguay have the highest mean body weight, while Cubans has the lowest average weight (Figure 1). ANOVA results show that there are significant differences among body weight in these countries ($p < 0.0001$), but Bonferroni statistics show that there are no significant differences between Barbados and Uruguay, Mexico and Chile, and Mexico and Brazil (results upon request). Those residing in Barbados are tallest, followed by those in Uruguay and Cuba. Mexican elderly have the lowest average height. As a result, BMI reaches the highest values in Uruguay, Mexico and Chile – with no statistical significant difference among them. The lowest BMI is found among Cuban elderly. In terms of central obesity measures, Brazilian, Chilean and Mexican elderly have the largest waist circumferences. Bonferroni analysis show that there are no statistical significant differences among these three countries, but all other comparisons are statistically significant ($p < 0.05$). Again, Brazil and Mexico are the leaders of the ranking of WHR.

Figure 1: Mean, 25th and 75th percentiles of anthropometric measures, by country



Source: SABE

Table 2 shows that average weight declines with age for both men and women. ANOVA results indicate that for all countries and for both sexes those age differences in weight are significant. Moreover, regression results show statistically significant negative coefficients associated with age. Among women, mean weight in the youngest age group is 68.2 kilograms and it declines to 55.6% among the oldest – 12.6 kilograms of difference. Among men, the difference between extreme age groups is near 10 kilograms. Women have lower average weight than men in all age groups ($p < 0.0001$), and all countries ($p < 0.05$) except in Barbados ($p = 0.138$). Women in Barbados and Uruguay have the highest mean weight, while Cuban elderly women have the lowest. Among men, Chileans and Uruguayans are the heaviest and Cubans the lightest. There are significant declines in weight with increases in age.

Table 2: Mean weight by age groups and sex, all countries

	Barbados	Brazil	Chile	Cuba	Mexico	Uruguay	Total
<i>Females</i>	***	***	***	***	***	*	***
60-69	75.0	65.0	67.3	64.0	65.5	72.4	68.2
70-79	71.9	62.6	63.3	58.3	62.0	70.7	64.9
80-84	65.2	59.0	58.5	54.3	57.7	68.7	60.2
85+	57.5	54.9	53.3	52.6	52.3	66.5	55.6
60+	71.3	62.5	63.7	59.7	63.2	71.1	65.2
<i>Males</i>	***	***	***	***	*	*	***
60-69	76.1	71.0	75.3	67.1	72.0	74.3	72.3
70-79	72.4	68.0	71.9	62.5	70.4	73.0	69.7
80-84	66.4	64.8	68.8	59.1	65.9	69.7	65.2
85+	65.3	60.5	64.6	58.8	67.6	64.8	62.4
60+	72.7	67.8	73.1	64.4	70.8	73.1	69.9
<i>Total</i>	***	***	***	***	***	*	***
60-69	75.4	67.3	70.3	65.3	68.2	73.1	69.8
70-79	72.1	64.8	66.2	59.7	65.0	71.5	66.7
80-84	65.8	61.5	61.1	55.9	61.5	69.1	62.1
85+	60.2	57.6	55.9	54.6	58.3	66.1	57.9
60+	71.9	64.7	66.8	61.5	66.2	71.8	67.0

Source: SABE

Note: *** $p < 0.001$, ** $p < 0.01$ and * $p < 0.05$

There is evidence that younger cohorts have higher height than older cohorts (Table 3). Results from linear regression show a negative and significant coefficient for age. Analysis of variance also indicates that there are significant age differences. Older individuals are 3-4 centimeters shorter than younger ones. Elderly men are taller than women in all countries ($p < 0.0001$) and in all age groups ($p < 0.0001$). Elderly from Mexico and Chile are the lowest, while those from Barbados are the tallest.

Table 3: Mean height by age groups and sex, all countries

	Barbados	Brazil	Chile	Cuba	Mexico	Uruguay	Total
<i>Females</i>	***	***	***	***	***	***	***
60-69	1.60	1.53	1.51	1.54	1.49	1.56	1.54
70-79	1.58	1.51	1.50	1.53	1.48	1.55	1.53
80-84	1.56	1.49	1.48	1.51	1.46	1.51	1.51
85+	1.55	1.47	1.46	1.49	1.42	1.51	1.49
60+	1.59	1.51	1.50	1.53	1.48	1.55	1.53
<i>Males</i>	*	*	*	***	**	***	***
60-69	1.71	1.66	1.65	1.67	1.63	1.70	1.67
70-79	1.70	1.64	1.64	1.66	1.63	1.69	1.66
80-84	1.69	1.64	1.62	1.63	1.59	1.68	1.65
85+	1.67	1.62	1.62	1.63	1.59	1.63	1.63
60+	1.70	1.64	1.64	1.66	1.62	1.69	1.66
<i>Total</i>	***	***	***	***	***	***	***
60-69	1.64	1.58	1.56	1.60	1.55	1.62	1.59
70-79	1.63	1.57	1.55	1.57	1.53	1.60	1.58
80-84	1.62	1.55	1.51	1.55	1.52	1.58	1.56
85+	1.59	1.54	1.49	1.54	1.49	1.54	1.54
60+	1.63	1.57	1.55	1.58	1.54	1.60	1.58

Source: SABE

Note: *** $p < 0.001$, ** $p < 0.01$ and * $p < 0.05$

BMI values also tend to get smaller as age increases (Table 4 and Table 6). Table 4 shows that, for most countries, there are statistically significant differences among age groups regarding to body mass index. The only exceptions are for both men and women in Uruguay and for men in Mexico. Women have higher values of BMI than men in all countries in the region. As a consequence, there is a higher prevalence of obesity among

women in the region (Table 5). Over 40% of elderly women in Uruguay are obese and over 1/3 in Mexico and Chile. The lowest prevalence of obesity is in Cuba, for both men and women. In Barbados, Brazil and Cuba, there are near 3 obese women for 1 obese man. Rates do not change much when they are standardized (Table 5).

Table 4: Mean BMI by age groups and sex, all countries

	Barbados	Brazil	Chile	Cuba	Mexico	Uruguay	Total
<i>Females</i>	***	***	***	***	***		***
60-69	29.2	27.9	29.4	27.0	29.4	29.7	28.7
70-79	28.7	27.4	28.2	25.0	28.2	29.7	27.8
80-84	26.9	26.5	26.8	23.8	27.0	30.2	26.5
85+	24.0	25.4	25.2	23.6	25.7	29.4	25.0
60+	28.3	27.3	28.3	25.6	28.7	29.7	27.8
<i>Males</i>	*	***	**	***			***
60-69	26.2	25.9	27.5	24.0	27.2	25.7	25.9
70-79	25.2	25.2	26.7	22.7	26.6	25.8	25.2
80-84	23.3	24.1	25.9	22.2	26.0	24.7	24.0
85+	23.4	22.9	24.7	22.0	26.8	24.5	23.4
60+	25.3	25.0	26.9	23.3	26.9	25.6	25.3
<i>Total</i>	***	***	***	***	***		***
60-69	28.0	27.1	28.7	25.7	28.5	28.2	27.6
70-79	27.2	26.5	27.7	24.3	27.6	28.2	26.8
80-84	25.3	25.4	26.6	23.3	26.5	28.1	25.6
85+	23.8	24.2	25.1	23.1	26.2	28.2	24.5
60+	27.1	26.4	27.9	24.7	28.0	28.2	26.9

Source: SABE

Note: *** p<0.001, ** p<0.01 and * p<0.05

Table 5: Prevalence of obesity by sex and country, crude rates and standardized

Countries	Total		Females		Males	
	Crude Rate	Standardized	Crude Rate	Standardized	Crude Rate	Standardized
Barbados	23.9	24.2	32.3	32.6	11.5	11.8
Brazil	20.6	21.2	28.3	28.6	9.5	10.0
Chile	30.6	30.5	34.5	34.7	22.9	22.4
Cuba	14.5	14.4	19.3	19.7	6.3	6.2
Mexico	30.4	29.2	37.1	35.2	20.2	20.0
Uruguay	34.4	34.5	43.3	43.4	18.7	18.7

Source: SABE

Note: The standard was obtained using the age and sex distribution of the six countries.

Table 6: Prevalence of obesity by age-groups, sex and country – crude rates

	Barbados	Brazil	Chile	Cuba	Mexico	Uruguay
Females	32.3	28.3	34.5	19.4	37.1	43.3
60-69	39.6	31.8	42.1	27.7	43.8	42.9
70-79	33.4	28.4	32.6	14.6	30.1	42.8
80-84	16.2	23.2	25.3	8.9	23.8	47.7
85+	10.0	18.5	15.1	11.7	24.1	44.2
Males	11.5	9.5	22.9	6.4	20.2	18.7
60-69	14.6	11.2	28.2	7.9	21.1	20.6
70-79	10.6	11.6	16.9	5.6	18.4	17.5
80-84	6.3	3.7	20.7	3.5	16.7	12.5
85+	6.4	4.1	13.6	2.0	26.3	21.4
Total	23.9	20.6	30.6	14.5	30.4	34.4
60-69	30.0	24.0	37.0	19.2	34.5	34.7
70-79	23.7	21.5	27.4	11.7	25.9	33.5
80-84	11.9	14.7	24.1	7.1	20.5	34.3
85+	8.8	11.6	14.7	8.6	25.0	38.6

Source: SABE

Table 7 shows the mean waist circumference by age and country. Waist circumference among women is particularly large in Latin America and Caribbean. According to Han et al (1995), $WC \geq 80$ centimeters (action level I) require some changes in lifestyle as a way to reduce body weight. In all countries, mean values are above this cutoff. Values of $WC \geq 88$ centimeters (action level II) for women are an important risk factor for some diseases and require professional help (Han et al 1995). For most part, elderly women in Latin America and the Caribbean are also above this threshold, which is a serious public health concern. Among men, the threshold for the action level I is $WC \geq 94$ centimeters. With exception of elderly men from Barbados and Cuba, all other countries have mean values above this cutoff point, but in none of the cases the mean WC is above action level II ($WC \geq 102$ cm). As for weight, height and BMI, waist circumference tends to decline with increases in age in many countries. Mexico is probably the main exception. Mean values of waist-to-hip ratio do not vary considerably across age groups (Table 8). Elderly men and

women in Brazil and Mexico have the highest waist circumferences as well as the highest waist-to-hip ratios.

Table 7: Mean waist circumference by age groups and sex, all countries

	Barbados	Brazil	Chile	Cuba	Mexico	Uruguay	Total
<i>Females</i>	***		**	***		*	***
60-69	92.8	93.1	93.9	89.8	94.9	92.1	92.6
70-79	92.0	95.0	93.9	86.5	95.7	90.1	91.9
80-84	88.9	94.6	91.0	83.5	93.8	86.8	89.7
85+	85.3	91.3	88.6	84.4	92.9	87.2	87.5
60+	91.4	93.9	93.1	87.4	95.0	90.6	91.7
<i>Males</i>		***	**	**			***
60-69	92.4	96.9	99.1	91.1	96.7	96.9	95.1
70-79	90.4	95.3	98.1	88.5	97.1	96.7	93.8
80-84	87.8	93.9	98.4	86.5	95.7	95.2	92.0
85+	92.7	90.3	93.7	87.0	100.1	88.7	91.1
60+	91.1	95.2	98.4	89.6	96.9	96.4	94.0
<i>Total</i>	***	**	***	***		***	***
60-69	92.6	94.5	95.8	90.4	95.7	93.8	93.6
70-79	91.4	95.1	95.3	87.1	96.2	92.5	92.7
80-84	88.4	94.3	92.9	84.5	94.7	90.0	90.6
85+	87.8	90.8	89.8	85.2	95.7	87.6	88.7
60+	91.3	94.4	94.9	88.2	95.8	92.7	92.6

Source: SABE

Note: *** p<0.001, ** p<0.01 and * p<0.05

Table 8: Mean WHR by age groups and sex, all countries

	Barbados	Brazil	Chile	Cuba	Mexico	Uruguay	Total
<i>Females</i>		***	*		**		***
60-69	0.86	0.89	0.86	0.87	0.89	0.85	0.87
70-79	0.87	0.91	0.87	0.86	0.90	0.86	0.88
80-84	0.87	0.93	0.87	0.86	0.91	0.87	0.89
85+	0.86	0.91	0.87	0.87	0.92	0.87	0.88
60+	0.87	0.91	0.87	0.87	0.90	0.85	0.88
<i>Males</i>		*		**			***
60-69	0.92	0.97	0.96	0.95	0.96	0.95	0.95
70-79	0.91	0.96	0.95	0.94	0.97	0.94	0.94
80-84	0.90	0.96	0.95	0.91	0.97	0.93	0.93
85+	0.94	0.94	0.92	0.93	0.97	0.93	0.94
60+	0.91	0.96	0.95	0.94	0.97	0.94	0.94
<i>Total</i>		**		***			
60-69	0.88	0.92	0.90	0.90	0.92	0.89	0.90
70-79	0.89	0.93	0.90	0.89	0.93	0.89	0.90
80-84	0.88	0.94	0.89	0.88	0.94	0.89	0.90
85+	0.89	0.92	0.88	0.89	0.94	0.88	0.90
60+	0.89	0.93	0.90	0.89	0.92	0.89	0.90

Source: SABE

Note: *** p<0.001, ** p<0.01 and * p<0.05

Discussion

Latin America and Caribbean countries have experienced dramatic changes on food availability and physical activity in the last decades. However, there are important differences among countries in the region, across age and sex groups.

Estimates show that elderly men and women from Cuba have the lowest mean weight and the lowest prevalence of obesity. In contrast, elders from Uruguay have the highest rate followed by Chile and Mexico. The lower weight and lower BMI of Cubans might be a consequence of limited food availability due to the economic situation in recent years.

Obesity prevalence among women in the age group 60-69 reaches 29.8% of women in the United States (Flegal et al 1998). This prevalence is lower than the ones found in this study.

Therefore, women in Latin America and the Caribbean are usually fatter than their counterparts in the United States, with exception of those from Cuba. Part of the problem

may have to be with the tradition that fat women are preferred and that obesity is healthy. Among men, near ¼ of residents in the United States are obese - this is a higher prevalence than in most countries studied here, except for Chileans. The elderly women aged 75 and over in this study, except Cubans, have higher mean BMI than Europeans from Sweden, Norway, and Denmark (de Groot et al, 1991; Dey et al, 1999; Gause-Nilsson et al, 1997). Among men, residents in Chile, Mexico and Uruguay have mean BMI higher than the ones in Sweden, Norway, Denmark and Finland (de Groot et al, 1991; Dey et al, 1999; Gause-Nilsson et al, 1997). Elderly in this study are considerably shorter than the ones in those European countries. Mean weight in Latin America and the Caribbean countries is also lower, with exception of women in Uruguay that are heavier than the Europeans in those studies.

In terms of central obesity, Brazilians and Mexicans have highest values of waist and WHR, which implies that elderly in these two countries are at higher risk of developing diabetes and cardiovascular disease. Elderly women in the SABE sample have waist circumferences that require changes in lifestyle and in many cases professional help to reduce the central adiposity levels in their bodies. Among men, the situation is not as critical, but in Brazil, Chile, Mexico and Uruguay changes in lifestyle are necessary.

Obesity rates in Barbados reached 24% of the elderly population – 11.5% of men and 32.3% of women. These rates are comparable to the ones found by Foster et al (2003) in a sample of individuals aged 40-74. The prevalence of overweight reaches 1/3 of the population using SABE. This figure is smaller than the one reported by Foster et al (2003), but their sample is younger and there is evidence that prevalence of overweight in Barbados increase with age until the eighth decade of life and then declines. Therefore, the SABE sample has a higher percentage of older people in which prevalence of overweight is lower.

Cooper et al (1997) and Okosun et al (2000) analyzed a sample of adults aged 25-74 and estimated in 25.9 the mean BMI among men and 29.4 among women. These results are comparable with the ones found in SABE, even though SABE sample is older. Values for height and weight are also similar. Okosun et al (2000) identified values of waist circumference in Barbados associated with hypertension. The cutoff points were 91.3 cm for men and 90.3 cm for women. The values estimated in this study show that elderly women in Barbados have mean values that are above this threshold ($p < 0.01$), which implies that they are facing increased risk of having hypertension.

Obesity rates among elderly people in Brazil were estimated in about 20% - 28% among women and 9.5% among men. These prevalence rates are very close to the ones found by Cabrera and Jacob Filho (2003), but higher than the ones found by Barreto et al (2003). Abranches et al (2003) found that 6.4% of men and 19.2% of women aged 60-69 were obese. In the SABE sample, these percentages were 11.2 and 31.8, respectively. This difference may be due to the fact that SABE sample focus on elderly in a large urban area, while Abranches et al (2003) combines samples urban and rural samples of the most developed (Southeast) and one of least developed regions (Northeast) in Brazil.

Chilean men have the highest prevalence of obesity among the countries studied here – near 23%. This rate is similar to the one reported by Rozowski and Arteaga (1997). Chilean men also have the highest prevalence of overweight – 44.8%. If obesity and overweight are considered altogether, over 2/3 of males in Chile have excess weight. Chilean women also have high prevalence of obesity and overweight. This nutritional problem by excess are associated with economic improvements in Chile that increased the availability of food.

Even though there are not many comparable studies made in Cuba focusing on elderly individuals, there is some evidence that obesity is not as prevalent in Cuba as in other

countries in the region. For instance, Rodrigues-Ojea et al (2002) find that near 10% of adult females and 7% of adult males are obese. Prevalence rates found in this study indicate that about 20% of elderly women and 6% of elderly men are obese. Valencia et al (2003) estimated the mean BMI of females aged 60 and over living in rural areas in 23.2 (s.d 0.9), which contrasts with 25.5 (s.d. 5.5) in SABE urban sample. Among men, they found 22.5 (s.d. 0.7) and in SABE the estimated value is 23.2 (s.d. 4.3). Measures of central obesity reported by Valencia et al (2003) were almost identical of the ones obtained from SABE.

Mexico has one of the highest prevalence rates of obesity among elderly. About 30% of residents in Mexico City are obese – over 1/3 of females and about 1/5 of males. These rates are higher than the ones found by Lerman-Garbel et al (1999). They analyzed three communities and estimated that 15.6% of men and 19.7% of elderly women were obese. Figures from SABE are also higher than the ones reported by Castro et al (1996) who analyzed urban areas. They estimated that near 25% of the elderly aged 60-60 were obese, while SABE shows that over 1/3 were obese in this age group in Mexico City. In this study, over 70% of the elderly in Mexico City face excess weight – this percentage is close to the one reported by Velázquez-Alva et al (1996) and Aguilar-Salinas et al (2001). Velázquez-Alva et al (1996) also analyze a sample of elderly in Mexico City in 1995. The estimates of elderly women regarding their weight, BMI and waist circumference are statistically higher using SABE than the ones estimated by Velázquez-Alva et al (1996). Height, on the other hand, was considerably lower in SABE sample. Among men, estimates from weight and BMI were comparable, but waist circumference in the SABE sample was significantly larger. Differences in sampling may explain some of these differences, but it is also possible that in the period between these two surveys, elderly Mexicans became fatter, particularly in the abdominal area. There is also evidence that obesity in urban areas is of greater concern than

in rural areas. For instance, Valencia et al (2003) analyzed a small sample of elderly (N=50) in rural areas and estimated in 23.9 the mean BMI for elderly men, while this study found a higher mean BMI 26.9 (s.d. 3.9) ($p < 0.0001$). For women, their estimate was 26.5. This study estimated a higher BMI - 28.7 (s.d. 5.1) ($p < 0.0001$).

Obesity rates in Uruguay were higher than in any other country analyzed in this study. Over 1/3 of the elderly in Montevideo are obese and other 32% overweight. Rates presented here are higher than the ones described by Curto et al (2004). They found that about 20% of those aged 60-69 and near 11% of those aged 70 and over were obese. In the SABE sample over 1/3 of individuals in these age groups were obese.

This study shows that current levels of obesity and central obesity are high and require changes in lifestyle, mainly changes on their diets and increases in physical activity, but in many cases professional help is already necessary to reduce body weight. There are also important declines in weight, height and BMI as age increases and this may indicate historical trends or nutritional differences among these cohorts.

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