

# Overweight, Obesity, Central Adiposity and Associated Chronic Diseases in Cuban Adults

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## ABSTRACT

**Introduction** Prevalence of overweight and obesity is increasing worldwide in parallel with the growing burden of noncommunicable chronic diseases. According to the World Health Organization, in 2005 approximately 1.6 billion individuals aged  $\geq 15$  years were overweight and at least 400 million were obese; by 2015 these figures will almost double. Central distribution of adiposity has also been associated with higher rates of cardiovascular diseases and other conditions.

**Objective** Determine the prevalence of overweight, obesity and central adiposity, and their association with noncommunicable chronic diseases and related lifestyle risk factors in Cuban adults.

**Methods** The Second National Survey on Risk Factors and Chronic Diseases (ENFRENT II), conducted in 2000–2001, surveyed a representative sample of males and females aged  $\geq 15$  years using a stratified, multi-stage cluster sampling design. Data from a sub-sample of 19,519 individuals aged  $\geq 20$  years were analyzed and prevalence calculated for diabetes, hypertension, cardiovascular and cerebrovascular diseases, and for each of these variables in association with overweight, obesity and central distribution of adiposity, and with the

presence of sedentary lifestyle, smoking, alcohol consumption, eating regular daily meals and daily breakfast.

**Results** Estimated prevalence of overweight and obesity in the adult population was 30.8% (CI: 30.1–31.5) and 11.8% (CI: 11.2–12.4), respectively. Obesity prevalence was twice as high in women (15.4%; CI: 14.5–16.3) as in men (7.9%; CI: 7.3–8.6). Obesity was significantly more frequent in diabetics, hypertensives and people with heart disease, while central adiposity was significantly associated with a higher prevalence of diabetes mellitus, cardiovascular and cerebrovascular diseases, hypertension, obesity and overweight. Smoking and alcohol consumption were low among overweight and obese subjects, who exhibited a higher prevalence of irregular and inadequate eating patterns.

**Conclusions** Prevalence of overweight, obesity and central adiposity, and comorbidity with diabetes mellitus, hypertension and heart disease, are growing public health problems in Cuba. A multi-sector strategy is needed to develop comprehensive food and nutrition policies and programs aimed at halting these trends, including interventions that encourage healthy eating patterns and regular physical activity in adults and children.

**Keywords:** Overweight, obesity, comorbidity, chronic disease, prevalence, nutrition disorders

## INTRODUCTION

Overweight and obesity constitute a looming public health problem affecting both industrialized and developing countries. According to the World Health Organization (WHO), in 2005, approximately 1.6 billion individuals aged  $\geq 15$  years were overweight and at least 400 million were obese; these figures are expected to almost double by 2015.[1]

As obesity prevalence has risen in most of the world, there has also been an overall increase in comorbidity from noncommunicable chronic diseases,[1] particularly cardiovascular disease, the world's number one cause of death, killing 17 million people each year, and the leading cause of mortality in obese individuals.[2]

At the same time, diabetes mellitus has rapidly become a global epidemic; WHO projects that diabetes deaths will increase by more than 50% in the next 10 years.[1] In the United States, a survey of 33 states in two periods showed a 90% increase in age-adjusted incidence of diabetes, from 4.8 per 1000 population in 1995–1997 to 9.1 per 1000 population in 2005–2007. The data indicated that diabetes risk may be attributed to overweight.[3] A recent cross-sectional study reported a 40% prevalence of hypertension in US adults.[4]

While moderate weight gain may lead to unfavorable health outcomes in an individual, the rise in obesity is shortening life expectancy in populations.[1] Most studies show an increase in mortality rates associated with obesity, primarily due to cardiovascular causes.[2] Obese individuals have a 50–100% higher risk for all

causes of morbidity and a life expectancy 2–5 years shorter than individuals with normal body weight.[1,5] There is also evidence that obesity-related morbidity may increase the longer an individual is obese.[2]

Central distribution of adiposity is a risk factor for chronic disease independent of excess body weight. Comorbidity is often manifested through vascular and metabolic complications typically associated with abdominal or central obesity.[6] Unlike subcutaneous fat, abdominal fat is more metabolically active, more susceptible to hormonal stimulation and changes in lipid metabolism. In addition, high levels of abdominal fat cause a large influx of non-esterified free fatty acids to the liver through the portal vein.[7] This adiposity pattern (also known as android obesity) is so important that even a slight abdominal accumulation of adipose tissue has been associated with higher rates of cardiovascular disease and other conditions, including diabetes, hypertension, atherosclerosis, dyslipidemia and cholelithiasis. Cardiovascular risk associated with gynoid obesity (peripheral, lower or gluteo-femoral obesity) is comparatively lower.[1,7–11]

The objective of this study was to determine the prevalence of overweight, obesity and central distribution of adiposity, and their association with noncommunicable chronic diseases and certain lifestyle risk factors in Cuban adults.

## METHODS

Data from the Second National Survey on Risk Factors and Chronic Diseases (ENFRENT II, its Spanish acronym) was used to calculate the prevalence of overweight, obesity and

regional distribution of adipose tissue and their association with morbidity due to noncommunicable chronic diseases and lifestyle determinants.

The ENFRENT II study was conducted November 2000–March 2001 by the National Institute of Hygiene, Epidemiology and Microbiology (INHEM, its Spanish acronym), the National Statistics Bureau (ONE, its Spanish acronym), and the Nutrition and Food Hygiene Institute (INHA, its Spanish acronym).[12] All urban areas of the country were surveyed, and the results are representative nationally and by province. A complex, stratified, multi-stage cluster sampling design was used, based on the general sampling design developed by ONE in 1995 for the household survey system and updated in 1999.[13] Cuba's 14 provinces and the Isle of Youth Special Municipality served as the strata, while the clusters consisted of sampled geographic areas (SGA), blocks and sectors. A representative sample size was calculated for each stratum and provincial estimates were obtained. Prevalence was estimated for the national sample, the latter formed by aggregating the provincial samples and was therefore not equiprobable.

To compensate for differences in selection probability in the different subgroups, reduce bias due to reductions in sample size, obtain estimates of population totals and minimize shortcomings of the sampling frame (due to omitting households on the lists, for example), samples were weighted in inverse proportion to the probability of individual selection, considering sex and age.[13] Ultimately, 22,851 individuals aged  $\geq 15$  years were surveyed. For the present study, data from the 19,519 respondents aged  $\geq 20$  years, excluding pregnant women, were analyzed.

Informed consent was obtained from all ENFRENT II participants. Each person selected for the sample was given the option to refuse to participate or to interrupt the survey at any time. Participants found to have abnormal blood pressure or body mass index or any other abnormality were referred to their family doctor for care.

Overweight and obesity were defined and evaluated using Body Mass Index [BMI = weight in kg/(height in m)<sup>2</sup>] and WHO cutoff points (BMI 25–29.9 kg/m<sup>2</sup> for overweight; BMI  $\geq 30$  kg/m<sup>2</sup> for obesity).[14] Regional distribution of adipose tissue was determined by waist-to-hip ratio and risk levels for chronic disease set according to Seidell et al: low (men:  $\leq 0.94$ ; women:  $\leq 0.78$ ), intermediate (men: 0.95–0.99; women: 0.79–0.84) and high (men:  $\geq 1.00$ ; women:  $\geq 0.85$ ).[8]

Self-reported data on morbidity and lifestyle determinants were obtained in structured interviews conducted in respondents' homes by professional interviewers trained by the research team. This information was used to develop survey variables[12] according to the following criteria:

- Diabetes mellitus—WHO International Diabetes Program criteria.[15]
- Heart disease—Rose and Blackburn's Cardiovascular Survey Methods:[16]
  1. Known = existing heart disease
  2. Rose + = possible angina or infarction
- Hypertension—Rose and Blackburn:[16]
  1. Known = hypertension diagnosed by a doctor and in treatment
  2. New =  $\geq 140$  mm Hg systolic pressure or  $\geq 90$  mm Hg diastolic pressure, or both. A previously calibrated mercury

sphygmomanometer was used, and two readings were taken.

- Cerebrovascular diseases—questions developed by the Cuban Neurology and Neurosurgery Institute to elicit self-reported morbidity and possible sequelae.

Lifestyle factors assessed were alcohol use, smoking, sedentary lifestyle, and eating pattern, defined as follows:

- Alcohol use = consumed alcoholic beverages more than five times in the last 12 months.
- Alcoholic = drinks regularly and responded positively to 3–4 CAGE test questions.[17]
- Smoker = smoking at time of survey and regularly consumed a tobacco product during at least the previous month (Cuban Consumer Research Institute criteria).[18]
- Sedentary lifestyle = primary physical activity of light intensity and ineffective additional physical activity less than four times per week, for less than 30 minutes each time (American College of Sports Medicine and FAO/WHO physical activity level criteria).[19,20]
- Eating pattern = 24-hour recall of food consumption, adapted by the Nutrition and Food Hygiene Institute.[21,22]

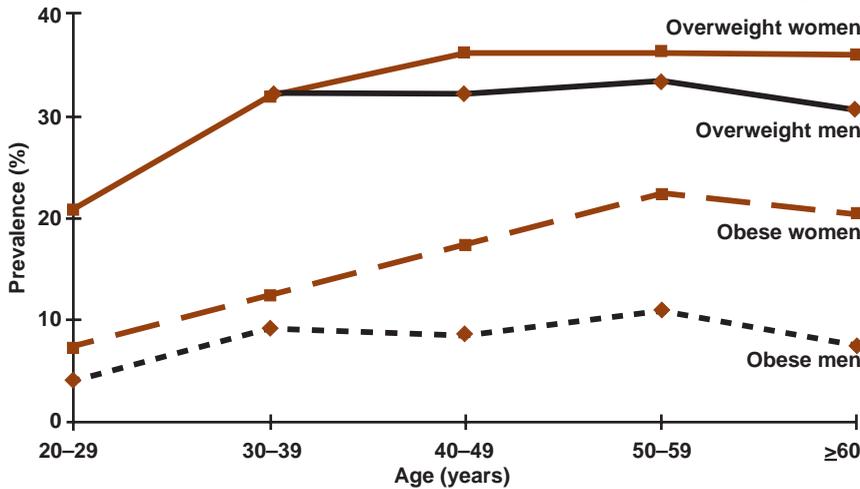
In the present study, prevalence was calculated for overweight, obesity and central adiposity, and for each of these variables in association with morbidity from diabetes, hypertension, cardiovascular and cerebrovascular diseases; and with alcohol use, smoking, sedentary lifestyle, overall eating pattern and eating daily breakfast. Confidence intervals (95% CI) were used to make the population inferences,[23] and standard CI errors were obtained using Taylor series approximations. Differences in variables compared were considered significant if there was no overlap in their respective CIs; overlapping CIs indicated the difference was not significant. Results were processed using Statistical Analysis Software (SAS) version 8.02, and were presented in tables and figures.

## RESULTS

Estimated prevalence of overweight and obesity in the adult population was 30.8% (CI: 30.1–31.5) and 11.8% (CI: 11.2–12.4), respectively, for a total of 42.6% with excess weight. Overweight prevalence was statistically similar in men (29.7%; CI: 29.1–30.3) and women (31.5%; CI: 31.0–32.2), but obesity prevalence was significantly different and twice as high in women (15.4%; CI: 14.5–16.3) as in men (7.9%; CI: 7.3–8.6). Prevalence of overweight and obesity varied by age in both sexes. Overweight prevalence rose steadily in both men and women until age 39. In women it continued to rise, peaking in middle age and then remaining at a plateau. In men, continued increase was barely perceptible until age 50–59 years, after which it declined. Obesity was more prevalent in women in all age groups and gradually increased until age 59, after which it declined. Prevalence in men varied less by age but also declined after age 59 (Figure 1).

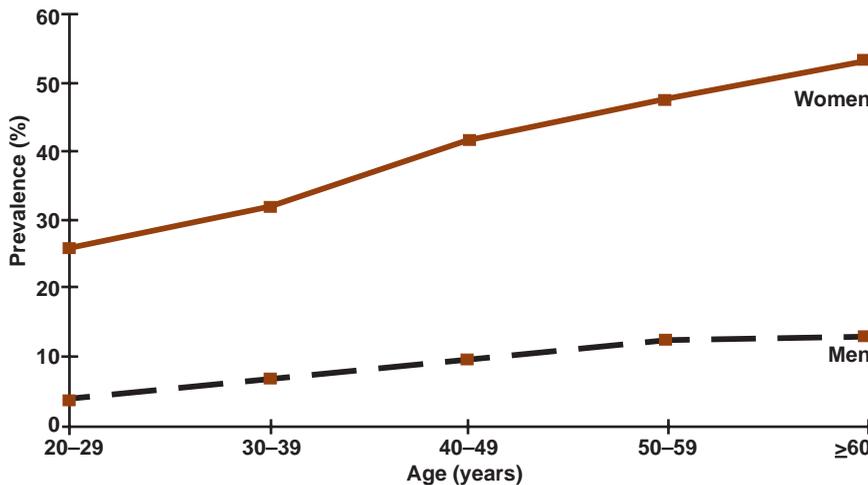
According to the ENFRENT II data analyzed, overweight was not significantly associated with diabetes mellitus, cardiovascular diseases or cerebrovascular diseases. Obesity, however, was significantly more prevalent among diabetics and among people with a known history of heart disease. Neither overweight nor obesity was significantly associated with cerebrovascular diseases. However, both overweight and obesity were significantly more preva-

Figure 1: Prevalence of Overweight and Obesity in Cuban Adults, by Sex and Age



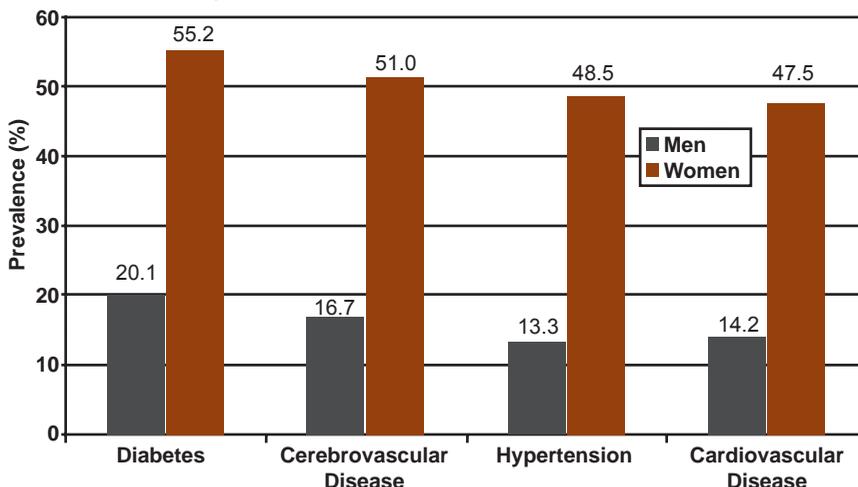
Source: Study data

Figure 2: Prevalence of Central Adiposity in Cuban Adults, by Sex and Age



Source: Study data

Figure 3: Prevalence of Central Adiposity in Cuban Adults with Noncommunicable Chronic Diseases, by Sex



Source: Study data

lent in people with known and new hypertension, compared to those with normal blood pressure (Table 1). Comorbidity with the chronic diseases analyzed was more predominant among overweight men than among overweight women but significantly more predominant in obese women than in obese men (Table 2).

With regard to the lifestyle determinants surveyed, no association was found between overweight and alcohol use, and obesity prevalence was lower among regular drinkers. Smokers were significantly less overweight and less obese than non-smokers, and a sedentary lifestyle was significantly more common in the obese (Table 3).

Analysis of eating patterns found that eating three regular meals a day was less frequent in overweight subjects (28.5%; CI: 27.6–29.4) than in the general population and even lower among the obese (10.5%; CI: 9.8–11.0). Frequency of daily breakfast was the same in relation to both overweight and obesity (28.8%; CI: 27.9–29.6); however, overweight and obese women (31.1%; CI: 29.9–32.3 and 14.9%; CI: 13.9–16.0, respectively) reported skipping breakfast more frequently than overweight and obese men: (30.2%; CI: 28.9–31.4 and 7.9%; CI: 7.1–8.7, respectively).

Prevalence of central adiposity varied by sex and age, was more predominant in women than in men in all groups, and also showed greater increase with age in women (Figure 2). Prevalence of diabetes mellitus, cardiovascular and cerebrovascular diseases, hypertension, obesity and overweight were significantly higher in both men and women with abdominal adiposity (Table 4), but comorbidity was nearly twice as high in women as in men. This means that women with diabetes, hypertension or cerebrovascular or cardiovascular diseases were much more likely to have a body shape showing predominance of central adiposity (Figure 3). Central adiposity was significantly higher in non-drinkers, non-smokers and people with a sedentary lifestyle, and was also more predominant in women with these characteristics than in men (Table 5).

**DISCUSSION**

One limitation of the present study is the use of data obtained in 2001; these are, however, the most recent representative data on a national scale and therefore indicative of the severity of overweight, obesity and central adiposity associated with the prevalence of chronic diseases and certain lifestyle factors in the Cuban adult population. In addition to providing important input for public health strategies and actions, this information serves as a reference for the Third National

Survey on Risk Factors and Chronic Diseases, currently underway.

Another possible limitation is that ENFRENT II only covered urban areas; this does not invalidate use of the data to demonstrate the scope of the conditions analyzed, however, since 75.3% of the Cuban population is urban.[24]

Results of the present study indicate that obesity is a significant factor in increasing comorbidity from diabetes, hypertension and cardiovascular diseases, particularly in women. It has been estimated that >30% of obese subjects have diabetes and that 50–80% of diabetic subjects are obese.[25,26]

Obesity is associated with increased insulin resistance that can develop into type 2 diabetes. BMI, however, explains only one-third of the total variation in insulin sensitivity, which is more strongly correlated with central obesity. As BMI increases, systolic and diastolic blood pressure also rise. Although the causes are unknown, this is probably due to elevated insulin concentrations (resulting from insulin resistance), which are conducive to renal sodium retention, higher plasma renin concentrations and an increase in catecholamine activity.[27]

Observational studies have shown a direct association between excess weight and blood pressure, underscoring the heightened risk for hypertension in obese subjects compared to non-obese individuals.[16,26]

In the past two decades, studying the regional distribution of adiposity in the body has become very important in assessing risk for chronic disease. [2,7,10,11] Prevalence of comorbidity in association with central distribution of adiposity is higher than prevalence of comorbidity in association with overweight only and obesity only, indicating that abdominal fat is an independent risk factor for some chronic diseases.[6] The relationship between obesity and cardiovascular and metabolic diseases is very high when there is an accumulation of adiposity in the central region of the body, indicative of elevated lipolytic activity corresponding to a greater presence of fatty acids in the liver.[7]

The proportion of fat deposited in the abdomen increases as body shape becomes more android with age, due to decreasing height and increasing slackness of abdominal wall muscles. During adulthood, weight gain occurs in the abdominal region, emphasizing the importance of hypertrophic obesity, which is generally android.[28] This change in the adult figure may influence the positive association between age and excess abdominal adiposity, measured by waist-to-hip ratio[29] and exemplified in this study by the greater prevalence of overweight and obesity in individuals with central adiposity. At the same time, as upper-body obesity increases with morphological changes during the lifecycle, so does the burden of chronic diseases associated with this body type.[30] In this study, the greater prevalence of central obesity in women may be partly explained by the large

**Table 1: Prevalence of Noncommunicable Chronic Diseases Associated with Overweight and Obesity in Cuban Adults**

Comorbidity	Overweight Prevalence % (95% CI)	Obesity Prevalence % (95% CI)
<b>Diabetes Mellitus</b>		
Yes	31.9 (27.6–36.1)	19.9 (16.3–23.4)*
No	28.7 (27.9–29.5)	10.7 (10.2–11.3)
<b>Cardiovascular Diseases</b>		
Known	30.7 (27.5–33.9)	19.0 (16.1–21.9)*
Rose +	27.0 (24.2–29.9)	12.7 (10.3–15.2)
No	28.7 (27.9–29.6)	10.6 (10.0–11.2)
<b>Cerebrovascular Disease</b>		
Yes	29.7 (24.9–34.5)	11.8 (8.7–14.8)
No	28.7 (27.9–29.5)	11.1 (10.5–11.7)
<b>Hypertension</b>		
Known	35.0 (33.4–36.7)*	19.9 (18.5–21.3)*
New	31.3 (29.2–33.3)*	13.4 (11.9–14.9)*
No	25.9 (24.9–26.9)	7.3 (6.7–7.9)

\* p<0.05  
Source: Study data

**Table 2: Prevalence of Noncommunicable Chronic Diseases Associated with Obesity in Cuban Adults, by Sex**

Comorbidity	Men Prevalence % (95% CI)	Women Prevalence % (95% CI)
Diabetes Mellitus	13.1 (CI: 8.7–17.6)	26.5 (CI: 21.5–31.5)*
Cardiovascular Diseases	14.1 (CI: 9.3–18.9)	25.1 (CI: 21.0–29.3)*
Cerebrovascular Disease	6.6 (CI: 3.2–10.1)	20.5 (CI: 14.4–26.5)*
Hypertension	16.1 (CI: 14.0–18.1)	24.5 (CI: 22.5–26.3)*

\* p<0.05  
Source: Study data

**Table 3: Prevalence of Overweight and Obesity Associated with Lifestyle Risk Factors in Cuban Adults**

Risk Factor	Overweight Prevalence % (95% CI)	Obesity Prevalence % (95% CI)
<b>Alcohol Consumption</b>		
Current drinker	28.9 (27.7–30.2)	8.6 (7.8–9.5)*
Former drinker	28.7 (27.2–30.1)	10.7 (9.6–11.8)*
Non-drinker	28.8 (27.6–30.1)	13.5 (12.5–14.4)
<b>Smoking</b>		
Yes	24.4 (23.1–25.6)*	8.6 (7.8–9.5)*
No	31.0 (30.0–31.9)	12.3 (11.6–13.0)
<b>Sedentary Lifestyle</b>		
Yes	29.6 (28.3–30.9)	12.6 (11.7–13.4)*
No	28.5 (27.5–29.4)	10.2 (9.6–10.9)

\* p<0.05  
Source: Study data

number of menopausal-aged women surveyed. Changes in the female figure are reported during menopause, including higher frequency of android body type.[28,29]

Analysis of lifestyle factors associated with weight and fat distribution in this study coincide with reports in the literature suggesting that weight gain is associated with smoking cessation, smokers tend to be thinner than non-smokers.[31] and a sedentary lifestyle is a determining environmental factor in obesity.[32] Waist-to-hip ratio has also been negatively associated with physical activity and with alcohol consumption, and positively associated with smoking.[28] In both sexes in the Cuban population, smoking and alcoholism presented less risk in association with central adi-

**Table 4: Prevalence of Noncommunicable Chronic Diseases Associated with Central Adiposity in Cuban Adults**

Comorbidity	Central Adiposity Prevalence % (95% CI)
<b>Diabetes Mellitus</b>	
Yes	44.9 (40.5–49.0)*
No	24.3 (23.5–25.1)
<b>Cardiovascular Diseases</b>	
Known	40.2 (36.4–43.9)*
Rose +	31.8 (28.4–35.2)*
No	23.9 (23.1–24.7)
<b>Cerebrovascular Disease</b>	
Yes	33.9 (29.2–38.6)*
No	24.7 (23.9–25.5)
<b>Hypertension</b>	
Known	34.8 (33.–36.4)*
New	26.2 (24.1–28.2)*
No	21.3 (20.4–22.3)
<b>Overweight</b>	
Yes	29.0 (27.7–30.4)*
No	23.4 (22.5–24.3)
<b>Obesity</b>	
Yes	45.0 (42.4–47.6)*
No	22.5 (21.7–23.3)

\* p&lt;0.05

Source: Study data

posity, whereas physical activity—prevalence of a sedentary lifestyle—played a more predominant role. While the association between overweight and sedentary lifestyle in this study was not significant, prevalence of sedentary lifestyle was significantly higher in obese subjects and higher among obese women than in obese men.

Comparison of the results of the present study with an analysis of data from the First National Survey on Risk Factors and Chronic Diseases, conducted in 1995, found that overweight and

**Table 5: Prevalence of Central Adiposity Associated with Lifestyle Risk Factors in Cuban Adults**

Risk Factor	Central Adiposity Prevalence % (95% CI)
<b>Alcohol Consumption</b>	
Current Drinker	15.1 (14.2–16.1)*
Former Drinker	25.5 (23.9–27.1)*
Non-drinker	33.8 (32.5–35.1)
<b>Smoking</b>	
Yes	20.3 (19.1–21.6)*
No	27.4 (26.5–28.4)
<b>Sedentary Lifestyle</b>	
Yes	30.9 (29.5–32.4)*
No	21.7 (20.8–22.5)

\* p&lt;0.05

Source: Study data

obesity (33.1% and 42.6%, respectively) increased 9.5% in approximately five years, with a greater prevalence in women. In the same period, hypertension prevalence rose 2.9% and sedentary lifestyle prevalence increased 10.3%.[33,34] a pattern similar to that observed in some developed countries and in Latin America.[25,35–40] Based on these rates of increase and prevalence, we can conclude that the problem of excess body weight and central adiposity associated with noncommunicable chronic disease is growing worse in Cuba, calling for immediate intervention. Although this may be regarded as fundamentally a public health problem, a multi-sector strategy is needed to develop comprehensive food and nutrition policies and programs aimed at halting these trends.[41] Encouraging healthy eating patterns and regular physical activity should be prioritized, particularly among children, since many of the risk factors observed in adults can be detected in childhood and, if modified, can change the course of chronic diseases.[42] Given the greater prevalence of overweight and obesity found in women, strategies should be developed from a gender perspective. 

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