

**TITLE****Association between socio-economic status and adiposity in urban  
Cameroon**

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## ABSTRACT

**Background:** This study assesses the relation between socio-economic status and adiposity in adults from urban Cameroon.

**Methods:** One thousand five hundred and thirty women and 1301 men aged 25 to 87 years, from 1897 households in the Biyem-Assi health area in the capital of Cameroon, Yaoundé, were interviewed about their household amenities, occupation, education, alcohol consumption and tobacco smoking. Weight, height, and waist circumference were measured and subjects were classified as obese if their BMI  $\geq 30$  kg/m<sup>2</sup> or overweight if BMI was between 25.0 and 29.9 kg/m<sup>2</sup>. Abdominal obesity was defined by a waist circumference  $\geq 80$  cm in women and  $\geq 94$  cm in men.

**Results:** Thirty three percent of women and 30% of men were overweight ( $p < 0.08$ ), whereas 22% of women and 7% of men were obese ( $p < 0.001$ ). Abdominal obesity was present in 67% of women and 18% of men ( $p < 0.001$ ). After adjusting for age, leisure time physical activity, alcohol consumption and tobacco smoking, the prevalence of obesity and abdominal obesity increased with quartiles of household amenities in both genders, while the prevalence of overweight, obesity and abdominal obesity increased with occupational level in men.

**Conclusion:** Socio-economic status is positively associated with adiposity in urban Cameroon after adjusting for confounding factors.

## INTRODUCTION

Cardiovascular diseases (CVD) are rapidly becoming an emerging public health priority in developing countries.<sup>1-3</sup> Excess weight has been identified as an important risk factor for many diseases including hypertension, diabetes, CVD and rheumatologic problems.<sup>4,5</sup> The World Health Organisation has declared that obesity is an epidemic on a global scale,<sup>6</sup> posing a major threat to human health and well-being.

Over the past few decades, several advances have been made in our understanding of the factors that contribute to obesity,<sup>7-11</sup> including the identification of some genetic polymorphisms<sup>9-11</sup> and the potential role of metabolic factors such as variations in energy expenditure and in patterns of fuel utilisation. However, the link between socio-economic status (SES) and obesity has been misleading as it is very dependent on the stage of industrial development of a country or region.<sup>12,13</sup>

In developed countries, there is evidence of a consistent, strong inverse association between different measures of SES, including education level and income, and the risk of obesity in women, whereas obesity in men is characterized by a weaker and more variable association with SES.<sup>12,14</sup> However, there is much less research on socioeconomic determinants of obesity in developing countries and data available are mainly from Latin America and Asia.<sup>15-18</sup> Although the review of the modest published literature on this topic point to a general positive association between SES and obesity in both men and women that may not be true for all developing societies. Also, most of the studies available do not take into account the variables which could be confounders in the relation between adiposity and SES.

The primary goal of this study is to examine the effects of SES on anthropometric parameters, taking into account other risks factors for obesity, in an urban population in Cameroon.

## RESEARCH DESIGN AND METHODS

This study is part of the Cameroon Non-Communicable Diseases Poverty Study, funded by the World Health Organisation and conducted in 2000 within an urban area of Cameroon to investigate the relations between the burden of diseases, specific causes and poverty.

### Study site and study population

The Biyem-Assi health area of Biyem-Assi health district was chosen as the study site. Biyem-Assi is an urban area of Yaoundé, the capital city of Cameroon. Its inhabitants are mainly civil servants, businessmen and students. Before the study, a household census was conducted in the health district. The sampling frame was all households of Cameroonian subjects who had been resident in the health area for at least one year. All inhabitants aged 25 years and over were selected for participation in the study. A map of the health area was drawn and the area divided into eight zones; each zone was further subdivided into blocks. A survey number was attributed to each household in each block. Two weeks prior to the survey each household received a leaflet explaining the purpose of the survey. All available mass media were used to inform the population.

### Methods

A pilot study was undertaken to test the survey forms and procedures and these were adapted as necessary. All participants were interviewed and examined between 8 AM and 9 PM by trained nurses. They responded to a questionnaire on their socio-

demographic characteristics. Information on household amenities<sup>19</sup> and annual family income was obtained from the head of each household. Body weight and height were measured with subjects wearing light clothes, and waist circumference was measured midway between the lowest rib and the iliac crest. The Sub-Saharan Africa Activity Questionnaire (SSAAQ),<sup>20</sup> was used to assess the leisure time physical activity during the past month. Frequency and duration were computed for each reported activity, and the energy expenditure was calculated using Ainsworth et al's compendium.<sup>21, 22</sup> Energy expenditure related to leisure time physical activity was calculated by multiplying the ratio of the exercise to resting metabolic rate (MET) score by the number of hours spent in each activity.

A total of 2700 households with 3484 subjects were selected to participate in the study. The number of eligible subjects per household varied from one to six. Overall 2622 households were surveyed, with 1671 women and 1378 men; the response rate of individuals was 87.5 %. The main reasons for non-response were absence of subjects after three visits of the survey team, and refusal to participate in the study. Due to missing and inconsistent data, 1530 women and 1301 men were included in these analyses.

## **Definitions**

Overweight and obesity and abdominal obesity: Body Mass Index (BMI) was calculated for all subjects and the World Health Organisation criteria<sup>6</sup> was used: normal weight (BMI  $\geq$  18.5 kg/m<sup>2</sup> and BMI  $<$  25 kg/m<sup>2</sup>), overweight (BMI  $\geq$  25 kg/m<sup>2</sup> and  $<$  30

kg/m<sup>2</sup>) or obese (BMI  $\geq$  30 kg/m<sup>2</sup>). Abdominal obesity was defined<sup>6</sup> using waist  $\geq$  94 cm for men and  $\geq$  80 cm for women.

Household amenities and income: For each amenity available in the household (table 1) a score based on the HNP/Poverty Thematic Group of the World Bank<sup>19</sup> was given and their sum was the household amenities score. From the total household score, we calculated sex-specific quartiles and defined four wealth classes, from poorest (first quartile) to richest (fourth quartile). Each individual in the household was given the same household score. Annual family income was available only for 644 households. The Pearson correlation coefficient between household amenities and available annual family income was 0.51,  $p < 0.001$ .

Occupation: Three categories of occupations (low, middle and high) were defined based on the public service classification of occupations (respectively civil servants categories C, B and A). Subjects working for private firms or for themselves were allocated to these categories.

Education: The type of last educational institution attended was used, giving four categories: none (attended no educational institution), primary, secondary and university.

Leisure time physical activity: From the total MET of each subject, we calculated sex-specific quartiles and defined four classes of physical activity.

Smoking: The classification used was non-smoker (has never smoked + ex-smoker) and smokers (current smokers).

*Alcohol consumption* took into account the consumption of beer, wine, spirits and traditional spirits. The number of grams of pure alcohol in 100 cl of each of the following alcoholic drinks was taken to be: 3.17 g for beer; 9.07 g for wine; 27.39 g for spirits, including traditional spirits. The daily consumption of pure alcohol was divided into four categories: 0 g = non-drinkers, < 5 g/day, 5-30 g/day and > 30g/day.

### **Statistical methods**

Analyses used the statistical module for complex sample data from the STATA® 6.0 Software with the primary sample unit being the household;  $p < 0.05$  was taken to indicate statistical significance. The maximum design effect was for BMI in women, equal to 1.10. The prevalence of overweight, obesity and abdominal obesity were standardised according to the urban Cameroonian 2000 population<sup>23</sup> distribution. Data were stratified by sex and results are presented as means [standard deviation, (SD)], median (25<sup>th</sup> - 75<sup>th</sup> percentile) or percentages. Binomial distribution was used to calculate 95 % confidence intervals (CI). The logistic regression model was used in univariate analysis to estimate the odds ratios between adiposity (BMI  $\geq 25$  kg/m<sup>2</sup> and BMI  $\geq 30$  kg/m<sup>2</sup>) and possible confounding risk factors (age classes, leisure-time physical activity quartiles, tobacco smoking and alcohol consumption). Also, logistic regression model was used in multivariate analyses to quantify the association between socio-economic indicators and adiposity after adjusting for other risk factors of obesity.



## **Ethical issues**

Approvals for this study were obtained from the National Ethical Committee of the Ministry of Health, the Minister of Health and local administrative and traditional authorities prior to starting the study. Informed consent was obtained from all the study participants.

## RESULTS

### Characteristics of the study population

The age range was the same for women and men, 25 – 87 years. There was no statistically significant difference ( $p=0.2$ ) between the mean age of women: 38.4 (sd = 10.3) years and men: 39.0 (10.9) years (table 2). Women had higher mean BMI (26.7 kg/m<sup>2</sup> vs 24.7 kg/m<sup>2</sup>,  $p < 0.001$ ) and waist circumference (84.8 cm vs 83.6 cm,  $p < 0.003$ ) than men. While the median leisure time physical activity was not significantly different between the genders (11.6 MET/day for women vs 10.4 MET/day for men,  $p = 0.3$ ), more men had a high occupational level (21.5 % vs 11.9 %), a university education (26.7 % vs 17.3 %), smoked (7.9 % vs 2.8 %) and they drank alcohol more frequently (37.5 % vs 28.6 %, table 2).

### Prevalence of overweight, obesity and abdominal obesity

The age standardised prevalence of overweight was 32.9 % (95 % CI: 30.5 – 35.3) for women and 29.8 % (27.3 – 32.4) for men ( $p < 0.08$ ), whereas 22.3 % (20.2 – 24.5) of women and 7.0 % (5.7 – 8.5) of men were obese ( $p < 0.001$ ). Abdominal obesity was present in 66.7 % (64.3 – 69.1) of the women and 18.2 % (16.2 – 20.4) of the men ( $p<0.001$ ).

### Univariate analyses

The prevalences of overweight + obesity, obesity and abdominal obesity increased with age in both genders (table 3). Quartiles of leisure time physical activity were negatively associated with overweight + obesity and obesity in men and with abdominal obesity in women. There was no significant association between educational

level and markers of adiposity in either gender. Alcohol consumption was positively associated with overweight + obesity in women and with abdominal obesity in men.

The age adjusted prevalences of overweight + obesity (BMI  $\geq$  25 kg/m<sup>2</sup>) increased significantly in women only with quartiles of household amenities (p for trend < 0.002), while it increased in men with quartiles of both household amenities (p for trend < 0.001) and occupational level (p for trend < 0.001, figure 1). The same trend was seen with the prevalence of abdominal obesity. Also, in men, the prevalences of overweight and obesity and of abdominal obesity were two times higher in the fourth quartile of the household amenities score than in the first quartile.

#### **Multivariate analyses:**

After adjusting for age classes, quartiles of leisure time physical activity, alcohol consumption and smoking, the prevalences of obesity and abdominal obesity were higher in the third (odds ratios, 2.0, 95% CI: 1.3-3.0 and 1.3, 1.0-1.8) and fourth (1.3, 1.0-1.8 and 1.7, 1.2-2.4) quartiles of household amenities compared to the first quartile in women. In men, the prevalences of overweight, obesity and abdominal obesity were higher in the third (1.8, 1.2-2.6; 2.1, 1.1-4.2 and 3.3, 1.8-5.8 respectively) and fourth (odds ratios, 2.4, 1.7-3.6; 2.4, 1.5-6.0 and 4.1, 2.3-7.3 respectively) quartiles of household amenities compared to the first quartile (table 4). Also, in men, after adjusting for confounding variables, the odds of overweight (1.8, 1.2-2.6), obesity (3.8, 1.8-7.8) and abdominal obesity (2.2, 1.3-3.6) were significantly higher for those in the high compared to the low occupational level.

## DISCUSSION

The aim of this study was to describe the association between socio-economic indicators and adiposity in an urban Cameroonian population after adjusting for the main confounding factors. Household amenities were the most important socio-economic indicator for overweight, obesity and abdominal obesity in both genders. Occupational level was positively associated with obesity and abdominal obesity only in men, while there was no association between any marker of adiposity and educational level.

The household amenities score developed by the World Bank<sup>19</sup> is probably a better indicator of poverty than family income in developing countries. Family income was difficult to obtain in our study, due to suspicion and fear of responders as to the use of these data. Most families in Cameroon have various sources of income, and the exact amount of income varies from month to month. The main occupation was used to define the occupational level, although it is not always the occupation giving the higher wages. The proposed World Health Organization definition of abdominal obesity<sup>6</sup> was used, as there is not yet a specific definition for African populations. This definition uses a higher cut point for waist circumference for men than for women, and is probably not suitable in our population where the mean waist circumference of women is greater than that of men. This may explain the higher prevalence of abdominal obesity in women compared to men.

There seems to be a positive relationship between SES and BMI in urban Cameroon. In the present study, obesity increased with household amenities in women

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and was positively associated with household amenities and occupation in men even after adjusting for age, physical activity, education, alcohol and smoking. A positive SES to adiposity relation is consistent with findings in some<sup>24-26</sup> but not in all developing countries.<sup>15</sup> Kruger et al<sup>27</sup> found in univariate analysis no association between BMI and educational level and a positive association between income and BMI in women from South-Africa. BMI related more to education than to wealth, in urban Tanzania.<sup>24</sup> However, for almost all of these studies, when adjustments were made for age and other studied SES factors,<sup>15, 27</sup> the relation was no longer statistically significant.<sup>15, 24, 27</sup> In contrast, BMI is inversely and significantly related to almost all socio-economic indicators in developed countries.<sup>28-31</sup>

A higher BMI in individuals with lower SES in developed countries has been shown to be related to restricted knowledge and access to healthy foods and to safe exercise, less interest in weight control, discrimination against socio-economic advancement and cultural standards of physical effectiveness.<sup>12, 28</sup> Cultural factors and health beliefs differ in Cameroon, and probably in Sub-Saharan Africa, where undernutrition and opulence co-exist, food availability remains a daily challenge and overweight is subsequently perceived as a sign of wealth.<sup>32</sup> Moreover, being obese is still a deeply rooted status symbol in some developing countries, and it will be a challenge for health services to try to change that health belief. Also, prevention programmes warning the population about harmful effects of weight gain on health are still rare.

Socio-economic inequalities in health have been attributed to a number of different mechanisms, including unhealthy behaviours, inadequate access to health care, nutritional inadequacies and other inequalities in material circumstances, and psychologic stress.<sup>33, 34</sup> Socio-economic indicators usually describe different aspects of socio-economic position. Education indicates skills required for acquiring social, psychosocial and economic resources; occupation measures prestige, responsibility, physical activity and work exposure; income reflects spending power, diet and medical care.<sup>14, 35</sup> The socio-economic indicator associated with adiposity is mainly income in developing countries and education in developed countries.

In our study, educational level was not significantly related to adiposity, even in univariate analyses. Being educated in Cameroon is not necessarily associated with a better remuneration in the job market. In fact, those involved in economic or commercial activities are mainly the less educated but most financially rewarded. With the expected increase in the standard of living in Cameroon, an adequate food supply will be available even for the poorest subjects in the society, and adoption of unhealthy behaviour related to eating habits and energy expenditure patterns will be one of the major determinants for obesity.

Neither eating behaviour nor energy intake was taken into account when adjusting for confounding variables in the present study. Due to economic problems in Cameroon, energy intake is probably positively associated with income, and also to household amenities. In developing countries, income has been found to be positively associated with intake of fat and animal-protein.<sup>36</sup> Although adjusting for energy intake

may have permitted the assessment of the real effect of wealth and occupation on markers of adiposity, it could, to some extent, be an over adjustment if the relation between these socio-economic indicators and obesity is partly mediated by the accessibility to food.

Monteiro et al,<sup>18</sup> in a cross sectional study including 148 579 nonpregnant women from 37 developing countries with Gross National Product (GNP) varying from US \$ 190 to US \$ 44 440 per capi ta, identified a cut point from which there was a shift of the effects of income on obesity, with a positive association between BMI and income under \$ US 2500 and a negative association above \$ US 2500. It is likely that economic growth in Cameroon will be associated with an increase in the prevalence of obesity, particularly in the poorest populations.

Programmes emphasising the harmful effects of excess weight on health have to be delivered more frequently in Cameroon. Moreover, public actions to prevent the development of obesity in Cameroon should include population education strategies, not restricted to the richest, on the determinants and consequences of obesity as a risk factor of several fatal and non fatal but highly debilitating non-communicable diseases, particularly cardiovascular diseases, type 2 diabetes, other endocrine and metabolic disturbances, and some forms of cancers.

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