

ORIGINAL RESEARCH

Overweight and obesity among women living in peri-urban areas in West Africa

Koussoh Simone Malik¹, Anicet Adoubi², Kouamé Kouadio³, Jérôme Kouamé⁴, Annita Hounsa⁴, Julie Sackou⁴

¹ Cardiology Unit, National Institute of Public Health, Abidjan, Côte d'Ivoire;

² Medical Sciences Training and Research Unit, Cardiology Department, University of Bouaké, Bouaké, Côte d'Ivoire;

³ Eco epidemiology Unit, Department of Environmental health, Institut Pasteur of Côte d'Ivoire, Abidjan, Côte d'Ivoire;

⁴ Department of Public Health, Hydrology and Toxicology, Training and Research Unit of Pharmaceutical and Biological Sciences, Félix Houphouët Boigny University, Abidjan, Côte d'Ivoire.

Corresponding author: Malik Koussoh Simone;

Address: Cardiology Unit, National Institute of Public Health of Côte d'Ivoire, BP V 47 Abidjan, Côte d'Ivoire.

Telephone: +225-01-24-61-25; E-mail: simone.malik@medecins.ci

Abstract

Aim: This study assessed selected correlates of overweight and obesity among women in a sub-urban population of Abidjan, Côte d'Ivoire.

Methods: A cross-sectional study was conducted during April-May, 2014 in Abobo-Anonkoi 3, a peri-urban city of Abidjan in Côte d'Ivoire. Women of 18 years and older healthy in appearance were randomly recruited from households. Overweight and obesity were measured by BMI respectively greater or equal to 25 and 30 kg/m². Abdominal obesity was defined by waist to hip ratio greater or equal to 0.80. The level of physical activity was evaluated by the IPAQ questionnaire and the blood pressure according to the criteria of the JNC7 report. A regression analysis of the associated factors with overweight and obesity (age, marital status, level of study, level of physical activity, blood pressure, and socioeconomic status) was carried out.

Results: We visited 486 households in which 398 women were approached and 327 agreed to participate in the survey. The average age was 35.25 ± 12.4 years. The prevalence of overweight was 27.2% and that of obesity was 19.6%; 72.2% of women had abdominal obesity. The prevalence of abdominal obesity was 90.6% among obese people. Age (p=0.006), marital status (p=0.002) and blood pressure (p=0.004) were significantly associated with obesity. With regard to abdominal obesity, there was a significant association of educational level in addition to the above factors.

Conclusion: Overweight and obesity are a reality in this population of Côte d'Ivoire and about one in five people are affected by the scourge of obesity.

Keywords: abdominal obesity, Africa, central obesity, overweight, women.

Introduction

In 2016, more than 1.9 billion adults, 18 years and older, were overweight and these over 650 million were obese (1). Projections show that by 2030, about 2.16 billion adults will be overweight and 1.12 billion adults will be obese (2). The global prevalence estimate showed that the proportion of obese adults rose from 28.8% in 1980 to 36.9% in 2013 among men and from 29.8% to 38% among women (3). These increases have been observed in both developed and developing countries (3).

In Africa, in 2008, 26.9% of the adult population was overweight or obese (4). Overweight and obesity are risk factors for chronic diseases such as cardiovascular disease, diabetes and some cancers (5).

Certain events in women's lives (childbirth, menopause) could promote the development of obesity (6). Thus, several studies on obesity conducted both in developed countries and in Africa, particularly in urban areas, have established that the prevalence of obesity was often higher among women (7-10). Obesity affects women more often than men (11).

In Côte d'Ivoire, the World Health Organization STEPS survey (measures of risk factors for chronic diseases) revealed a prevalence of overweight and obesity of 32.2% among the adult population in 2005 in the Lagoon region, in the south of the country, which includes the city of Abidjan (8). The same study confirmed a higher prevalence of overweight and obesity among women of 37.6% compared to 24.6% among men. The 2011 - 2012 Demographic and Health Survey in Côte d'Ivoire reported an overweight prevalence of 19% and obesity of 6.6% among women of reproductive age (10).

In these studies conducted in Côte d'Ivoire, the factors associated with overweight and obesity in women have been under-researched in the peri-urban environment.

This environment is at the junction of urban and rural areas, it is distinct from these two areas in relation to eating habits (12). It is also an important place for epidemiological, demographic, social and nutritional transition (2). However, demographic, social, epidemiological and nutritional transitions are inseparable (11,13). The corollary of this transition in the field of nutrition is the substitution of problems of overweight and obesity for problems of nutritional deficiencies (13). Thus, one marker of the ongoing nutritional transition is the increase in obesity (11). Diet is the leading cause of overweight and obesity (11). What factors other than diet are associated with overweight and obesity in women in this particular space that is the peri-urban environment?

To answer this question, we conducted a study to determine the prevalence and factors associated with overweight and obesity in women.

Methods

Framework of the study

This survey was conducted in the Autonomous District of Abidjan. It was carried out in households in the Anonkoi 3 district located in the municipality of Abobo, which is the second most populated municipality in the Autonomous District of Abidjan after Yopougon, with a density of 167 inhabitants per square kilometre (14). The Autonomous District of Abidjan is located in the Lagoons region in the south of Côte d'Ivoire (15).

Type and period of study

This was a cross-sectional study conducted from 24 April to 23 May 2014. The sample size was calculated using the formula:

$n = p(1-p) Z^2/i^2$ with n: sample size; p: prevalence of overweight and obesity 32.2%; Z=1.96 for a 5% risk of error and i: accuracy (5%).

The sample size calculated was 336. Considering a response rate of 80%, the minimum sample size was 420.

Sampling strategy

The neighbourhood of Anonkoi 3 is a village in the commune of Abidjan. In this neighbourhood households are not numbered. In the general census of the population in 1998, the neighbourhood had 474 households (16). However during a comprehensive study in this area, Sackou Kouakou et al. identified 668 households (14). Therefore, we conducted a random sample, we calculated a sampling interval of two ($668/336 = 1.98$). We considered household No. 1 the first household found when we had access to the area, and we visited one in two households.

Population

The study included all women 18 years of age and older who were not in bed and were present at the time of the survey. Women who were pregnant or breastfeeding were not included.

In each household visited, the woman aged 18 and over present was selected. In the presence of more than one woman 18 years of age or older, only one was randomly selected.

Data collection

Data collection was based on a pre-tested questionnaire with the free and informed consent of the person selected (written or oral consent). Overweight and obesity were defined from the Quételet Body Mass Index (17). Overweight is defined as having a BMI greater than or equal to 25 and lower than 30 kg/m^2 ; obesity is defined as having a BMI greater than or equal to 30. Height was measured by a tape measure and weight by a Camry® brand scale model scal160 that can support up to 160 kg. Abdominal obesity was measured by a tape measure and defined as a waist circumference (WC) to hip circumference (TH) ratio greater than 0.80 (18).

The level of physical activity was assessed by the IPAQ questionnaire which defined 3 categories of persons: category 1 (inactive or insufficiently active) category 2 (sufficiently active) category 3 (very active). Blood pressure (BP) was measured with an OMRON electronic blood pressure monitor with an arm cuff after five minutes rest. Women with systolic blood pressure greater or equal to 140 mmHg and/or diastolic blood pressure greater or equal to 90 mmHg with or without treatment were considered to have high blood pressure. Systolic blood pressure below 90 mmHg and/or diastolic blood pressure below 60 mmHg were considered low blood pressure. The level of education was categorized into four (no education, primary level, secondary level and higher level) (19). The socioeconomic level was assessed by the poverty score or wealth index calculated on the basis of asset ownership. The wealth index was calculated using data on the ownership of assets selected by a household (e.g. televisions, bicycles, cars, materials used for housing construction, types of access to water and sanitation). The relative wealth scale was then classified into five categories (poorest, poor, middle, rich and richest) according to the quintile of the sample (19).

Other factors associated with overweight and obesity that were collected were age and marital status.

Ethical considerations

Survey participants were informed of the reasons for the study. They all have accepted to fill out a personal identification form and submit to taking the settings. Their free and informed consent was obtained before the investigation began. They were free to withdraw from the investigation at any time without prejudice. The data were collected anonymously.

Data analysis

The data were entered on the Epi data software (version 3.1) and analyzed with the SPSS software (version 22.0).

The quantitative variable BMI was transformed into a categorical variable with 4 modalities: Lean, BMI less than 18.5; Normal, BMI between 18.5 and 24.9; Overweight, BMI between 25 and 29.9 and Obese, BMI greater than or equal to 30.

The ratio TT/TH has been transformed into a binary variable (less than 0.80: no; greater or equal to 0.80: yes).

The search of factors associated with BMI was done in two stages. First, we performed a univariate analysis using the Pearson KHI two test at the 0.05 significance level. In this analysis, BMI was considered as a qualitative variable with four modalities (skinny, normal weight, overweight and obesity).

Then, the variables having a value less than 0.05 p were included in a logistic regression model. For regression model, BMI (the dependent variable) has been categorized into two modalities (obesity / non-obesity). The non-obesity modality resulted from the combination of skinny, normal and overweight modalities. The adjusted odds ratio and the confidence intervals at 95% were calculated.

Results

Four hundred and eighty-six (486) households were visited. In 88 households there was no woman and in 398 households there was at least one woman aged 18 and over whom we approached. Among them, 46 did not meet the

inclusion criteria (29 were pregnant and 17 were bedridden). Finally, 327 agreed to participate in the survey. The response rate was 93%. The average age was 35.25 years and the standard deviation was 12.40 years. The participation rate was 67.3%. The overall prevalence of overweight and obesity was 46.8%. The prevalence of overweight was 27.2% (89 women) and 64 women were obese (19.6%).

Table 1 presents the socio-demographic characteristics and association between women's BMI and the analyzed different factors. About 2 in 5 women had no education and just over 20% had only primary education. Almost 3 out of 5 women were married. The prevalence of high blood pressure was 26%. Very active women represented less than 2% of our study population. In this environment, the poor and the poorest represented nearly 60% of the population. The association between body mass index and age was significant. Indeed, overweight and obesity were observed mainly between 30 and 45 years of age (54.68% obese, $p=0.006$). A significant association was also found between body mass index and marital status. Married women were more overweight and obese ($p=0.002$). In addition, overweight and obese women had higher blood pressure ($p=0.004$).

The factors involved in obesity are presented in Table 2. According to our study, the factor involved in the onset of obesity is age. The 30-45 age group is three times more likely to be obese than other age groups.

Table 1. Socio-demographic characteristics and association between women's BMI and the analyzed different factors in Anonkoi 3

Variable	Number (%) n=327 (100 %)	Skinny n=18 (5.50%)	Normal n=156 (47.71%)	Overweight n=89 (2.21%)	Obese n=64 (19.57%)	P
Age (years)						
15-30	128 (39.14)	8(44.45)	76 (48.72)	29 (32.58)	15 (23.44)	0.006
31-45	129 (39.45)	4(22.23)	52 (33.33)	38 (42.70)	35 (54.68)	
>45	70 (21.41)	6(33.33)	28(17.95)	22 (24.72)	14 (21.88)	
Marital status						
Married	184 (56.27)	8(44.45)	73 (46.79)	61 (68.54)	42 (65.63)	0.002
Single and widows	143 (43.73)	10(55.55)	83 (53.21)	28 (31.46)	22 (34.37)	
Level of study						
none	127 (38.84)	12 (66.67)	51 (32.69)	39 (43.82)	25 (39.06)	0.106
primary	68 (20.8)	2 (11.11)	30 (19.23)	22 (24.72)	14 (21.88)	
secondary	106 (32.41)	3 (16.67)	59 (37.82)	25 (28.09)	19 (29.68)	
higher	26 (7.95)	1 (5.55)	16 (10.26)	3 (3.37)	6 (9.38)	
Level of physical activity						
Inactive	170 (51.99)	10 (55.56)	77 (49.36)	46 (51.68)	37 (57.81)	0.761
Active	151 (46.18)	7 (38.88)	77 (49.36)	41 (46.07)	26 (40.63)	
Very active	6 (1.83)	1 (5.56)	2 (1.28)	2 (2.25)	1 (1.56)	
Blood Pressure						
High	85 (26.0)	4 (22.23)	33 (21.15)	23 (25.84)	25 (39.06)	0.004
Normal	188 (57.49)	6 (33.33)	96 (61.54)	55 (61.80)	31 (48.44)	
Low	54 (16.51)	8 (44.44)	27 (17.31)	11 (12.36)	8 (12.50)	
Socioeconomic situation						
Very poor	61 (18.65)	6 (33.33)	28 (17.95)	15 (16.85)	12 (18.75)	0.51
Poor	127 (38.84)	8 (44.44)	62 (39.74)	31 (34.83)	26 (40.62)	
Middle income	88 (26.91)	3 (16.67)	42 (26.92)	28 (31.46)	15 (23.44)	
Rich	33 (10.10)	1 (5.56)	19 (12.18)	8 (9.00)	5 (7.81)	
Very rich	18 (5.5)	0 (0.0)	5 (3.21)	7 (7.86)	6 (9.38)	

Table 2. Relationship between the analyzed factors and the risk of being obese in Anonkoi 3

Independent variables	N	Obesity (%)	No obesity (%)	Adjusted OR	95%CI
Age group					
15 – 30	128	15 (23.44)	113 (42.97)	1.00	reference
30 – 45	129	35 (54.68)	94 (35.74)	2.80	1.44-5.44
45 – 60	70	14 (21.88)	56 (21.29)	1.88	0.84-4.16
Marital Status					
Married	184	42 (65.63)	142(54.00)	1.62	0.91-2.87
Single and widow	143	22 (34.37)	121(46.00)	1.00	reference
Blood Pressure					
High BP	85	25 (39.06)	60(22.81)	2.39	0.98-5.79
Normal BP	188	31 (48.44)	157(59.70)	1.13	0.48-2.64
Low BP	54	8 (12.50)	46 (17.49)	1.00	reference

OR: Odds Ratio; CI: Confidence Interval; 1: Reference category.

The prevalence of abdominal obesity was 90.6% among obese people. The different associations between abdominal obesity and factors are presented in Table 3. The association between abdominal obesity and age was significant. Indeed, abdominal obesity was observed in the 30-45 and 45-60 age groups ($p=0.001$). The 30-45 age group is three times more likely to have abdominal obesity than the 15-30 age group. Similarly, the 45-60 age group is four and a half times more likely to have abdominal obesity than the 15-30 age group. This abdominal obesity was also higher among women with no education

and those with only primary education ($p=0.004$). Thus, women with no education and those with primary education are three times more likely to have abdominal obesity than those with higher education. Abdominal obesity was also higher in married women ($p=0.002$) and those with high blood pressure ($p<10^{-3}$). Married women are twice as likely to have abdominal obesity as those without a partner. Women with high blood pressure are five times more likely to have abdominal obesity than women without high blood pressure.

Table 3. Association between abdominal obesity among women (n=327) and the analyzed different factors in Anonkoi 3

	Abdominal obesity		OR	95%CI	P
	no n=91 n (%)	yes n=236 n (%)			
Age group					
15 – 30	55(60.44)	73(30.93)	1.00	reference	
30 – 45	26(28.57)	103(43.65)	2.98	1.71-5.19	<0.001
45 – 60	10(10.99)	60(25.42)	4.52	2.12-9.62	
Level of study					
None	27(29.67)	100(42.37)	2.72	1.11-6.59	
Primary	13(14.29)	55(23.31)	3.10	1.15-8.31	0.004
Secondary	40(43.95)	66(27.96)	1.21	0.50-2.89	
Higher	11(12.09)	15(6.36)	1.00	reference	
Marital status					
Married	39(42.86)	145(61.44)	2.12	1.30-3.47	0.002
Single and widows	52(57.14)	91(38.56)	1.00	reference	
Blood Pressure (BP)					
High BP	10(10.99)	75(31.78)	5.15	2.19-12.11	
Normal BP	59(64.84)	129(54.66)	1.50	0.80- 2.80	<0.001
Low BP	22(24.17)	32(13.56)	1.00	reference	

OR: Odds Ratio; CI: confidence interval; 1: Reference category.

Discussion

In our study, almost half of the women were overweight, about 20% of whom were obese. This prevalence shows that one in five women is at risk of developing a cardiovascular pathology, as some authors confirm. These reported that women are becoming increasingly at risk

for non-communicable diseases or associated comorbidities including hypertension, diabetes, cancer and stroke (20).

This obesity was related to various factors including age (between 30 and 45 years), marriage and high blood pressure. The active 30-45 age group is the obese age

group. These young adults are thus at higher risk of developing cardiovascular disease and dying prematurely, posing a serious threat to the economies of countries in sub-Saharan Africa (21,22).

The prevalence of overweight and obesity increases steadily with age in developing countries (9,23). Some studies in Nigeria, Cameroon and Togo found an association between age and obesity later (after 40 years) than found in our study (9,23,24).

The association between marital status and obesity can be explained by the fact that people after marriage have less physical activity, change their diet and may be less concerned about their weight (25). This is the observation in African society where culture considers that being overweight is a sign of material ease (19).

The prevalence of overweight and obesity is high in peri-urban areas, in the middle of the epidemiological transition. This high prevalence could be explained by the culture and lifestyles of our population. Indeed, in developing countries there is a shift from a low-fat diet and a physically active life to a diet richer in saturated animal fat and a sedentary lifestyle (2). Overweight and obesity are no longer only predominant in high socioeconomic backgrounds, but this burden in developing countries is shifting to low socioeconomic groups and particularly to women (26).

Our work confirms the relationship between obesity and high blood pressure (27). High blood pressure is more frequent in obese subjects and hypertensive subjects develop overweight more easily. This epidemiological observation explains the link between high blood pressure and obesity. In addition, obesity potentiates the presence and severity of other cardiovascular risk factors (28). An excess weight of 10 kg is associated with an increase of 3 mmHg in systolic blood pressure and 2.3 mmHg in diastolic blood pressure.

In Anonkoi 3, the prevalence of abdominal obesity was also high (near $\frac{3}{4}$ of our total population and almost all obese women). Waist circumference is a simple indicator of excess abdominal fat in adults. Excess abdominal fat is associated, independently of BMI, with the development of metabolic and vascular complications of obesity (24,27). Indeed, abdominal obesity, a toxic form of obesity, is a complex dysmetabolic state at the origin of a profound disorder of blood pressure, vascular endothelium and energy homeostasis. Thus, at equivalent BMI, subjects with abdominal obesity develop more cardiovascular complications. Beyond weight, the type of obesity has an even greater influence on the prognosis of patients (28).

Our study found that women with no education and those with only primary education are more overweight or obese. The lower the level of education, the higher the prevalence of obesity. In recent years, obesity rates have increased in all education groups, but more rapidly among less educated women (29). According to the Centre de recherche pour l'étude et l'observation des conditions de vie (Crédoc), those who have a healthy diet (more fruits and vegetables, higher nutrient intakes, better food indices) are those who have higher degrees. They are more interested in the links between nutrition and health (30). However, some studies have reported that women with a high level of education were more overweight or obese (25).

Study limitations

However, we noted some limitations in our study. The number of study participants was lower than the anticipated sample size. This is partly due to the fact that in more than 10% of households, there were no women. Moreover, we considered as married women, all women legally married or living in a couple. As far as parity is

concerned, it has not been sought. We considered snacking as diet data.

In addition, it is a cross-sectional study over a relatively short period and for which there could be bias in the design. These biases could be related to the non-representativeness of the sample, the mode of selection of households and women in households. We did not take into account the number of women eligible for the survey in each household visited, we limited ourselves to choosing a single woman. Also, information on socio-demographic characteristics, level of physical activity and snacking were assessed using self-reporting which is a source of information bias.

Conclusion

The prevalence of overweight and obesity is high among women in peri-urban areas. This obesity particularly affects young, married women with no education or

primary education. Our study shows the need for urgent intervention targeted at women with information, education and communication (IEC). It is important to fight against this obesity through awareness sessions for women on the consequences of obesity, education sessions and management of this scourge during home visits.

Conflicts of interest: None declared.

Acknowledgments: The authors would like to thank the NGO ASAPSU (Urban Health Self-Promotion Association) for its contribution during the investigation. We would like to thank also the staff member of the Department of Public Health, Hydrology and Toxicology, Training and Research Unit of Pharmaceutical and Biological Sciences.

References

1. World Health Organisation. Obesity and overweight. Available from: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight> (accessed: July 23, 2019).
2. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. *Nutr Rev* 2012;70:3-21.
3. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional and national prevalence of overweight and obesity in children and adults 1980-2013: A systematic analysis. *Lancet* 2014;384:766-81.
4. Yatsuya H, Li Y, Hilawe EH, Ota A, Wang C, Chiang C, et al. Global trend in overweight and obesity and its association with cardiovascular disease incidence. *Circ J* 2014;78:2807-18.
5. Correia J, Pataky Z, Golay A. Comprendrel'obésitéen Afrique: poids du développementet des représentations. *Rev Med Suisse* 2014;6 [in French].
6. Hauhouot-Attoungbré ML, Yayo ES, Konan JL, Koné F, Siara E, Monnet D. Fattening diet and metabolic syndrome in Ivory Coast. *Ann BiolClin (Paris)* 2013;71:207-10.
7. Inserm, Kantar Health, Roche. Enquêteépidémiologique nationale sur le surpoidsetl'obésité. Paris: Roche 2012:58. [in French].
8. Direction de coordination du programme STEPS/MNT. Enquête sur les facteurs de risque des maladies non transmissibles. Abidjan: Ministère de la Santé et de l'hygiène publique; 2005:165. [in French].
9. Desalu OO, Salami AK, Oluboyo PO, Olarinoye JK. Prevalence and Socio-Demographic Determinants of Obesity Among Adults In An Urban Nigerian Population. *Sahel Med J* 2008;11:61-4.

10. Institut National de la Statistique, ICF International. Enquête Démographique et de Santé et à Indicateurs Multiples de Côte d'Ivoire 2011-2012. Calverton, Maryland, USA;2012 [in French].
11. Maire B, Lioret S, Gartner A, Delpeuch F. Transition nutritionnelle et maladies chroniques non transmissibles liées à l'alimentation dans les pays en développement. *Santé* 2002;12:45-55 [in French].
12. Ntandou G, Delisle H, Agueh V, Fayomi B. Abdominal obesity explains the positive rural-urban gradient in the prevalence of the metabolic syndrome in Benin, West Africa. *Nutr Res* 2009;29:180-9.
13. Popkin BM. The Nutrition Transition in Low-Income Countries: An Emerging Crisis. *Nutr Rev* 1994;52:285-98.
14. Sackou-Kouakou JG, Aka BS, Hounsa AE, Attia R, Wilson R, Ake O, et al. Malnutrition: prévalence et facteurs de risque chez les enfants de 0 à 59 mois dans un quartier périurbain de la ville d'Abidjan. *Médecine Santé Trop* 2016;26:312-7 [in French].
15. Département d'Abidjan. In: Wikipédia [Internet]. 2017. Available from: https://fr.wikipedia.org/w/index.php?title=D%C3%A9partement_d%27Abidjan&oldid=137521318 (accessed: May 4, 2018). [in French].
16. INS-CIV: COTE D'IVOIRE - Recensement Générale de la Population et de l'Habitat (1998). Available from: <http://www.ins.ci/n/nada/index.php/catalog/51> (accessed: July 23, 2019) [in French].
17. World Health Organization. Obesity: preventing and managing the global epidemic. World Health Organization; 2000:252.
18. Krotkiewski M, Björntorp P, Sjöström L, Smith U. Impact of obesity on metabolism in men and women. Importance of regional adipose tissue distribution. *J Clin Invest* 1983;72:1150-62.
19. Neupane S, Prakash KC, Doku DT. Overweight and obesity among women: analysis of demographic and health survey data from 32 Sub-Saharan African Countries. *BMC Public Health* 2016;16:30.
20. Paul E, Mtumwa AH, Ntwenya JE, Vuai SAH. Disparities in Risk Factors Associated with Obesity between Zanzibar and Tanzania Mainland among Women of Reproductive Age Based on the 2010 TDHS. *J Obes* 2016;2016:10.
21. Murray CJL, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380:2197-223.
22. Abegunde DO, Mathers CD, Adam T, Ortegon M, Strong K. The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet* 2007;370:1929-38.
23. Fouda A, Lemogoum D, Owona Manga J, Il Dissongo J, Tobbit R, Ngounou Moyo DF, et al. Epidémiologie de l'obésité en milieu du travail à Douala, Cameroun. *Rev Med Brux* 2012;33:131-7 [in French].
24. Pessinaba S, Yayehd K, Pio M, Baragou R, Afassinou Y, Tchérou T, et al. L'obésité en consultation cardiologique à Lomé: prévalence et facteurs de risque cardiovasculaire associés - étude chez 1200 patients. *Pan Afr Med J* 2012;12:99 [in French].
25. Tzotzas T, Vlahavas G, Papadopoulou SK, Kapantais E, Kaklamanou D, Hassapidou M. Marital status and educational level associated to obesity in Greek adults: data from the National

- Epidemiological Survey. BMC Public Health 2010;10:732.
26. Monteiro CA, Conde WL, Popkin BM. The Burden of Disease From Undernutrition and Overnutrition in Countries Undergoing Rapid Nutrition Transition: A View From Brazil. Am J Public Health 2004;94:433-4.
27. Ahaneku GI, Osuji CU, Anisiuba BC, Ikeh VO, Oguejiofor OC, Ahaneku JE. Evaluation of blood pressure and indices of obesity in a typical rural community in eastern Nigeria. Ann Afr Med 2011;10:120-6.
28. Pathak A, Galinier M, Senard J-M. Obésité et maladies cardiovasculaires: physiopathologie, comorbidités et effet de l'aperte de poids. MT Cardio 2007;3:187-92 [in French].
29. Ogden CL, Carroll MD, McDowell MA, Flegal KM. Obesity and socioeconomic status in adults: United States, 2005-2008. NCHS Data Brief 2010;51:1-8.
30. Recours F, Hébel P, Chamaret C. Les populations modestes ont-elles une alimentation déséquilibrée? Paris: Credoc (Cahiers de Recherche); 2006:113 [in French].

©2019 Malik et al; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.