



Research Article

Double Burden of Obesity and Hypertension in the Elderly: Cross-Sectional Study of Prevalence and Risk Factors in Fouban, West Region, Cameroon

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Abstract

Objective: To identify the factors contributing to the double burden of obesity and hypertension in the elderly Cameroonians.

Methodology: A total of 172 participants aged over 60 were enrolled in a cross-sectional study carried out in households in the city of Fouban. The socio-demographic and nutritional data of each participant were collected using a questionnaire adapted from the WHO STEP wise approach while anthropometric and hemodynamic measurements were recorded. Based on the WHO guidelines and ACC/AHA definitions, three patterns of the double burden of obesity and hypertension were investigated: i) generalized obesity/hypertension (GO/H), ii) abdominal obesity/hypertension (AO/H) and iii) combined generalized and abdominal obesity/hypertension (CO/H).

Results: Prevalence of the different patterns of the double burden of obesity and hypertension were: 29.7% (CO/H), 37.8% (GO/H), and 46.5% (AO/H). Type of marriage, source of income, consumption of fat and starchy recipes, consumption of refined sugars and family history were significantly linked to the AO/H pattern while consumption of refined sugars and irregular consumption of fruits were associated with the GO/H pattern.

Conclusion: Abdominal obesity appears to be the most frequent pattern of the double burden of obesity and hypertension in the elderly. Key risk factors are mainly diet-based, suggesting the importance of nutritional education of the elderly in Cameroon. Yet, large scale studies are needed to refine the nutritional education strategies for the elderly in Cameroon.

Keywords: Double burden; Elderly; Hypertension; Obesity; Risk factors

Introduction

Cardiovascular diseases (CVDs) are one of the leading causes of death today. CVDs incidence results partially from a significant increase in the prevalence of various pathological conditions such as obesity, insulin resistance, dyslipidemia, sympathetic overactivity, arterial hypertension, etc. in adults and adolescents [1]. Several studies around the world have shown that an increase in human body weight is the cause of several pathologies. Indeed, Framingham's studies have shown that body weight gain is a predictor of an increase in blood pressure due to the accumulation of LDL-cholesterol [2]. In addition, high blood pressure is three times more common in obese people than people of normal weight [3]. The concomitant occurrence of obesity and hypertension in the same person actually constitutes a double burden that is critical in terms of quality of life and budget. The risk factors of this double burden are as numerous as diverse and include eating habits, lifestyle, psychosocial stress, family history, alcohol consumption, tobacco consumption [4,5]. Such factors are present in the environment and all age groups are thus exposed. The vast majority of obese people—predominantly of android type—over 50 years old are hypertensive [3]. The elderly are the most vulnerable to the occurrence of the combination of obesity and arterial hypertension because of the weakening of their immune system caused by human aging, a normal inevitable

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phenomenon, causing several biological, psychological and sociological changes that can generate potentially harmful effects. With life expectancy increasing worldwide, the number of elderly people is expected to rise especially in the developing countries. Cameroon is no exception as from the country's independence in 1960 to 2018 life expectancy has been increased by 18 years [6]. However, no published data are available to date regarding prevalence and risk factors of the concomitant occurrence of obesity and hypertension in the elderly in Cameroon. The main objective of the study was to assess the prevalence of the double burden of obesity and hypertension in the elderly in Cameroon and to identify its risk factors.

Methodology

The study population consisted of Cameroonians of both genders, aged 60 and above from various regions of the country and living in Foumban. The study included elderly people who had been residing in Foumban for at least 6 months and had freely consented to participate in the study. Elderly people with serious illness and those who were not fully mentally able were excluded from the study. The study was descriptive and cross-sectional. It took place during the period from July to August 2019 and was carried out in various neighbourhoods of the city of Foumban, Western Region of Cameroon. A total of 172 elderly apparently healthy aged 60 and over randomly recruited during household survey organized by Koukouet Medical Center.

Questionnaire

Under assistance of well-trained and qualified technicians, participants filled out a questionnaire conceived from "WHO steps instrument for chronic diseases" related to their socio-demographic, lifestyle, eating habits, food security, perceived stress scale. During the survey, participants spent 20 to 30 minutes in answering the questions and some of them were helped by investigators to complete the questionnaire. In this study, food security and perceived stress scale were not used. Marital status and the source of income help to determine the socio-economic conditions. In our study the marital status was collected. Three levels of marital status were thus coded: "0": marriage, "1": widowhood/divorce and "2": bachelorhood/engagement.

Source of incomes has been used as a determinant of socioeconomic status. The main source of incomes for our participants has been collected. Four income levels were coded as follows: "0" permanent salary, "1" temporary salary, "2" trade and "3" help/assistance.

Three level of education were obtained: none education, primary level, secondary level and university level. The dietary habits of the participants were explored using a questionnaire. For each participant, we documented over a seven-day period: frequency of consumption of "local" foods, foods specific to "urban" areas, "western" foods [7].

Anthropometric measurements

The following parameters: age, gender, weight, height, Knee

Height, blood pressure, waist circumference were measured on the first and only visit. The body weight of participants in light clothing and without shoes was measured with a precision of $\pm 100\text{g}$ using a portable electronic scale of 150kg capacity (TANITA™). Height was measured to the nearest 0.5 cm using a portable stadiometer specially design for the study, with the participants standing upright on a flat surface without shoes and with the back of their heels and the occiput against the stadiometer. To have the exact height of the elderly, knee height (KH) was measured and used in the [8] formula to calculate their height. Waist circumference (WC), strongly correlated to visceral adipose tissue and associated to several cardiometabolic risk factors, was measured [9]. It was measured to the nearest 0.1 cm with a flexible, non-stretchable and tension-regulated steel tape, at the midpoint between the lowest rib and the iliac crest, while participants were standing and breathing normally. Body mass index (BMI) was calculated as weight (in kilograms) divided by the square of height (in metres). Overweight and obesity profiles were categorised as follows [10,7]:

- Overweight was defined as $\text{BMI} \geq 25.0 \text{ kg/m}^2$ but $< 30.0 \text{ kg/m}^2$ for both genders with or without abdominal obesity;
- Generalized obesity (GO) was defined as $\text{BMI} \geq 30.0 \text{ kg/m}^2$ for both genders with or without abdominal obesity;
- Abdominal obesity (AO) was defined as $\text{WC} \geq 94 \text{ cm}$ for men and $\text{WC} \geq 80 \text{ cm}$ for women with or without generalized obesity;
- Combined obesity (CO): individuals with both GO and AO.

Blood pressure measurements

The measurement of systolic and diastolic blood pressures (SBP and DBP respectively) was performed using a blood pressure monitor (OMRON HEM 7124) based on oscillometric measurement method with Fuzzylogic technique [11]. Blood pressure records were made three times on the upper left arm. The first measurement was taken after a 5 min rest in a sitting position and was followed by two subsequent measurements in the middle and at the end of the interview. The average of the three measurements was used to assess the presence or absence of hypertension according to the 2017 American College of Cardiology/American Heart Association (ACC/AHA) guidelines: $\text{SBP} \geq 130 \text{ mmHg}$, or $\text{DBP} \geq 80 \text{ mmHg}$ [11]. A participant was considered to have isolated systolic hypertension (ISH) for a $\text{SBP} \geq 130 \text{ mmHg}$ and $\text{DBP} < 80 \text{ mmHg}$; isolated diastolic hypertension (IDH) for a $\text{SBP} < 130 \text{ mmHg}$ and $\text{DBP} \geq 80 \text{ mmHg}$ and the systo-diastolic hypertension (SDH) with a $\text{SBP} \geq 130 \text{ mmHg}$ and $\text{DBP} \geq 80 \text{ mmHg}$ [11].

Definition of double burden

Three patterns of the double burden of obesity and hypertension (SDH only) were defined:

- Generalized obesity/hypertension (GO/H) was defined as $\text{BMI} \geq 30.0 \text{ kg/m}^2$ for both genders with or without abdominal obesity and $\text{SBP} \geq 130 \text{ mmHg}$ and $\text{DBP} \geq 80 \text{ mmHg}$;

- Abdominal obesity/hypertension (AO/H) was defined as WC \geq 94 cm for men and WC \geq 80 cm for women with or without generalized obesity and SBP \geq 130mm Hg and DBP \geq 80 mm Hg;
- Combined generalized and abdominal obesity/hypertension (CO/H): individuals with both GO and AO and SBP \geq 130mm Hg and DBP \geq 80 mm Hg.

Ethical approvals

The study was approved by the following institutions:

- Cameroon National Ethics Committee through the ethical clearance N°2014/08/488/EC/CNERSH;
- First Deputy Mayor of the city of Foumban by validation of our request N° 780/UD/ ENSET/D/DA/ESF;

The names of the respondents were coded and anonymity of the information was respected. The data has been used for scientific purposes only and the results obtained are published with strict respect for the confidentiality and dignity of the respondents.

Statistical analysis

IBM Statistical Package for Social Sciences (IBM SPSS) for Windows version 22.0 software was used to perform the statistical analyzes. The descriptive statistics made it possible to assess the distributions of each variable under study to determine its characteristics (frequency, mean, standard deviation). Student's t-test was used to compare men and women based on age, BMI, WC, SBP and DBP. The results were expressed as the mean \pm

standard error of the mean. Pearson's chi-square test was used to examine relation between sociodemographic parameters and double burden. Binary logistic regression was done to assess the influence of food consumed on the incidence of double burden and the risk to develop double burden. The significance level was $p < 0.05$.

Results

Our sample consisted of 172 people aged 60 and above. Table 1 below presents the socio-demographic parameters and shows that approximately 2/3 or 61.6% of respondents were of male gender, 3/4 (73.3%) were married, the vast majority of them have been in school at one time in their life (69.21%), 94.3% were living as part of a couple, 39.5% had a permanent salary and 96.5% of our respondents had an history with cardiometabolic risk.

Anthropometric and hemodynamic parameters of the study population

The results of the distribution of the study population according to anthropometric and hemodynamic parameters are given in table 2 below. We see from table 2 below that: age, BMI and waist circumference are significantly higher in senior women compared to men, on the other hand the DBP is significantly high in older men compared to older women.

Prevalence of obesity, hypertension and double burden

The results of the distribution of the study population according to overweight and arterial hypertension are shown in table 3 below. From this study we find that almost all of our

Table 1: Characteristics of the study population.

Sociodemographic parameters	Classification	Frequency (n=172)	Percentage (%)
Gender	Men	106	61.6
	Women	66	38.4
Marital status	Marriage or concubinage	126	73.3
	widowed/divorced	42	24.4
	single	4	2.3
Education level	Illiteracy	53	30.8
	Primary	34	19.8
	Secondary	41	23.8
	University	44	25.6
Regime of marriage	Monogamous	66	38.5
	Polygamous	96	55.8
	Single parent	10	5.8
Source of income	Permanent salary	68	39.5
	Temporary salary	11	6.4
	Trade	29	16.9
	Help/assistance	64	37.2
Family history	No antécédent	6	3.5
	Cardiovascular diseases (CVD)	12	7
	CVD+ hypertension	4	2.3
	CVD + hypertension+diabetes	7	4.1
	CVD+diabetes	4	2.3
	Hypertension	75	43.6
	Hypertension+diabetes	20	11.6
	Diabetes	44	25.6

Table 2: Distribution of study population based on mean of age, BMI, WC, SBP and DBP.

Variables	Total population (n=172)	Men (n=106)	Women (n=66)
Age (years)	72.5 ± 0.8	70.3 ± 1.0	76.1 ± 1.2*
BMI (kg/m ²)	31.6 ± 0.4	30.0 ± 0.6	34.3 ± 0.6*
WC (cm)	101.2 ± 1.5	95.7 ± 1.7	109.9 ± 2.3*
SBP (mm Hg)	139.5 ± 2.6	139.5 ± 3.7	139.5 ± 3.5
DBP (mm Hg)	94.5 ± 1.4	97.2 ± 1.4*	90.0 ± 2.91

*Significant difference between men and women at $P < 0.05$ with the t-test of Student. BMI=Body mass index; WC= waist circumference; SBP= systolic blood pressure; DBP= diastolic blood pressure.

Table 3: Prevalence of overweight, obesity, hypertension and double burden.

	Frequency	Percentage (%)
Overweight and subtypes of obesity		
Overweight	46	26.7
Generalized obesity (GO)	99	57.6
Abdominal obesity (AO)	123	71.5
Isolated generalized obesity (IGO)	15	8.7
Isolated abdominal obesity (IAO)	39	22.7
Combined obesity (CO= GO+AO)	84	48.8
Subtypes of arterial hypertension		
Isolated systolic hypertension (ISH)	6	3.5
Isolated diastolic hypertension (IDH)	17	9.9
Generalized hypertension (GH)	114	66.3
Double burden of obesity and hypertension		
GO/H	65	37.8
AO/H	80	46.5
CO/H	51	29.7

%= pourcentage. GO= Generalized obesity; H= Hypertension; AO= Abdominal obesity; CO= Combined obesity.

study population is overweight (26.7%). Abdominal obesity having the highest prevalence (71.5%). In addition, the results of the distribution of the study population according to the prevalence of arterial hypertension shows that in this study more than two thirds (2/3) (66.3%) of elderly people are in a situation of general hypertension. The results of the distribution of the study population according to the double burden of obesity and hypertension. In the present study, the prevalence of the AO/H pattern is highest (46.5%) followed by the GO/H pattern (37.8%) and finally the CO/H pattern (29.7%).

Overweight, obesity and hypertension based on gender

The study population was grouped according to the gender. Table 4 below shows us that our male seniors are generally obese (50.5%), while our female seniors have high prevalence of abdominal obesity (57.7%) and combined obesity (58.3%). In addition, older men are more exposed to the all subtypes of hypertension compared to older women. The results of the distribution of the study population according to the double burden of obesity- hypertension according to gender have

shown that older women are more exposed to all three types of combinations compared to older men.

Overweight, obesity and hypertension based on age

The results of the distribution of the study population according to overweight, obesity, hypertension and age are shown in table 5 below. It appears that people aged 60-69 years are much more exposed to all types of obesity and hypertension compared to other age groups.

The results of the distribution of patterns of the double burden of obesity and hypertension based on age shows that the 60-69 years age group was the most exposed to all patterns of double burden (prevalence 50-60%) as compared to other age groups.

Relationship between double burden obesity - hypertension with some cardiometabolic risk factors

Table 6 below shows the relationship between socio-demographic factors and the double burden obesity-hypertension. It appears that our study population is mainly made up of elderly males (61.6%). Both genders are affected by the double

Table 4: Prevalence of overweight, obesity; hypertension and double burden based on gender

	Total population n=172	Men n=106	Women n= 66
	n (%)	n (%)	n (%)
Overweight and subtypes of obesity			
Overweight	46 (26.7)	29 (63.0)**	17 (37.0)
Generalized obesity (GO)	99 (57.6)	50 (50.5)**	49 (49.5)
Abdominal obesity (AO)	123 (71.5)	57 (46.3)	66 (53.7)**
Combined obesity (CO= GO + AO)	84 (48.8)	35 (42.0)	49 (58.3)
Subtypes of arterial hypertension			
Isolated systolic hypertension (ISH)	120 (69.8)	76 (63.3)	44 (36.7)
Isolated diastolic hypertension (IDH)	131 (76.2)	90 (68.7)**	41 (31.3)
Systo – diastolo hypertension (SDH)	114 (66.3)	74 (64.9)	40 (35.1)
Double burden of obesity and hypertension			
GO/H	65 (37.8)	31 (47.7)	34 (52.3)*
AO/H	80 (46.5)	40 (50)**	40 (50)**
CO/H	51 (29.7)	20 (39.2)	31 (60.8)**

GO= Generalized obesity; H= Hypertension; AO= Abdominal obesity; CO= Combined obesity; n= frequency; %= percentage. **= $p < 0.01$; *= $p < 0.05$

Table 5: Prevalence of overweight, obesity, hypertension and double burden based on age

	Total population n=172	60-69years n=100	70-79years n=25	80-89years n=31	90-99years n=16
	n (%)	n (%)	n (%)	n (%)	n (%)
Overweight and subtypes of obesity					
Overweight	46 (26.7)	24 (52.2)**	2 (4.3)	17 (37.0)	3 (6.5)
Generalized obesity (GO)	99 (57.6)	55 (55.6)**	17 (17.2)	14 (14.1)	13 (13.1)
Abdominal obesity (AO)	123 (71.5)	61 (49.6)**	18 (14.6)	31 (25.2)	13 (10.6)
Combined obesity (CO= GO + AO)	84 (48.8)	41 (48.8)**	16 (19.1)	14 (17)	13 (15.5)
Subtypes of arterial hypertension					
Isolated systolic hypertension (ISH)	120 (69.8)	77 (64.2)**	13 (10.8)	20 (16.7)	10 (8.3)
Isolated diastolic hypertension (IDH)	131 (76.2)	85 (64.9)**	10 (7.6)	10 (7.6)	6 (4.6)
Systo – diastolo hypertension (SDH)	114 (66.3)	71 (62.3)**	13 (11.4)	20 (17.5)	10 (8.8)
Double burden of obesity and hypertension					
GO/H	65 (37.8)	40 (62.0)	7 (10.8)	11 (16.9)	7 (11.0)
AO/H	80 (46.5)	46 (57.5)	7 (8.8)	20 (25.0)	7 (8.8)
CO/H	51 (29.7)	26 (51.0)	7 (14.0)	11 (21.6)	7 (13.7)

GO= Generalized obesity; H= Hypertension; AO= Abdominal obesity; CO= Combined obesity; n= frequency; %= percentage. **= $p < 0.01$.

burden obesity- hypertension, with the prevalence of all three combinations being high with the male gender. The majority of our study population is married (94.2%). Among these married couples, we find that those who are in the monogamous marriage are more exposed to the three types of combination. The prevalence of AO/H is higher among elderly married people (47.6%) compared to other marital status. In terms of education level, it is clear that, two thirds (2/3) of our respondents are educated, the prevalence of all three combinations of double burden obesity-hypertension is low among university-level seniors. The results of the relation between the source of incomes and the obesity-hypertension combination show that the prevalence of the three combinations of double burden obesity-hypertension is high

among the elderly receiving assistance, followed by the elderly who trade and finally those who receive a permanent salary. Regarding family health history, the prevalence of the- double burden obesity-hypertension is high in older people with a family history of hypertension.

Contributing factors to double burden obesity-hypertension

Sociodemographic factors

In this part, it will be a question to establish the influence of some socio-demographic factors on the different combinations. Table 10 below shows that, type of marriage, source of income and

Table 6: Relation between the double burden obesity - hypertension with sociodemographic factors

Sociodemographic factors	Variables	Total population n (%)	GO/H n (%)	AO/H n (%)	CO/H n (%)
Gender	Male	106 (61.6)	34 (32.1)	40 (37.7)	20 (18.9)
	Female	66 (38.4)	31 (47.0)	40 (60.6)	31 (47.0)
Type of marriage	Monogamous	66 (38.4)	31 (47.0)	39 (59.1)	25 (37.9)
	Polygamous	96 (55.8)	30 (31.3)	35 (36.5)	22 (22.9)
	Single parent	10 (5.8)	4 (40.0)	6 (60.0)	4 (40.0)
Marital status	Married	126 (73.3)	52 (41.3)	60 (47.6)	40 (31.7)
	Widowed/ Divorced/ Separated	42 (24.4)	13 (31.0)	20 (47.6)	11 (26.2)
	Single or fianced	4 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)
Level of education	No education	53 (30.8)	11 (21.0)	27 (51.0)	11 (20.8)
	Primary	34 (19.8)	21 (61.8)	22 (64.7)	15 (44.1)
	Secondary	41 (23.8)	26 (63.4)	18 (43.9)	18 (43.9)
	University	44 (25.6)	7 (15.9)	13 (29.5)	7 (15.9)
Source of income	Permanent salary	68 (39.5)	25 (36.8)	25 (36.7)	19 (27.9)
	Temporary salary	11 (6.4)	4 (36.4)	0 (0.0)	0 (0.0)
	Trade	29 (16.9)	9 (31.0)	13 (44.8)	7 (29.1)
	Help/assistance	64 (37.2)	27 (42.3)	42 (65.6)**	25 (39.1)
Family history	None	6 (3.5)	0 (0.0)	0 (0.0)	0 (0.0)
	Cardiovascular diseases (CVD)	12 (7.0)	2 (16.7)	2 (16.7)	2 (16.7)
	CVD + hypertension	4 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)
	CVD + hypertension + diabetes	7 (4.1)	2 (28.6)	7 (100.0)	2 (28.6)
	CVD + diabetes	4 (2.3)	1 (25.0)	4 (100.0)	1 (25.0)
	Hypertension	75 (43.6)	40 (53.3)	39 (52.0)**	28 (37.3)
	Hypertension + diabetes	20 (11.6)	8 (40.0)	8 (40.0)	8 (40.0)
	Diabetes	44 (25.6)	12 (27.3)	20 (45.5)	10 (22.7)

GO= Generalized obesity; H= Hypertension; AO= Abdominal obesity; CO= Combined obesity. **= $p < 0.01$; *= $p < 0.05$

family history influence the combination AO/H, and education level influences combination CO/H (Table 7).

Dietary habits associated to double burden obesity-hypertension

The results of the influence of eating habits on the three obesity-hypertension patterns inform us that the consumption of lettuce-based dishes has a protective effect of the GO/H patterns ([0.33 (95% CI: 0.15-0.73)]) and CO/H ([0.38 (95% CI: 0.16-0.91)]) (Table 11). The consumption of fat and starchy recipes and refined sugars exposes 4.49 (95% CI: 1.30-15.48) times and 2.45 (95% CI: 1.04-5.77) times respectively to the AO/H pattern while the consumption of refined sugars and the irregular fruit consumption exposes 2.52 (95% CI: 1.03-6.17) times and 5.18 (95% CI: 1.36-19.69) times respectively to the combination of GO/H (Table 8). The consumption of local meals has a protective effect on the different combinations. Indeed our study tells us that the most consumed local meals are based on fufu corn and vegetable sauces such as oka soup, “kekekelen” soup, “folere” soup, cassava leaves and “Djapche” (Table 9).

Discussion

Our study population consisted of 172 elderly aged 60 and above. The male gender was the most dominant. This could be explained by the fact that men are more available and more accessible than women. The prevalences of abdominal obesity, generalized hypertension, and the AO/H pattern were highest. [10] and [7] have shown that the prevalence of abdominal obesity is high in urban areas of Cameroon. This high prevalence could be due to socioeconomic changes and changes in lifestyle in Cameroon (less leisure-time physical activity, increase of educational level, weight gain during youth particularly in married couple...) [10]. Visceral obesity is also believed to be implicated in the etiology of arterial hypertension in the elderly by several mechanisms. Among other things, an increased vasoconstrictive response in response to angiotensin II has been observed in obese normotensive men [12]. This could be explained by the stimulation of the sympathetic nervous system, which inhibits vasorelaxation induced by nitrite oxide (NO) and promotes endothelial dysfunction [13]. Otherwise, a high weight could have beneficial effects in the elderly. Bone mass is increased in

Table 7: Influence of sociodemographic factors with double burden obesity - hypertension

Sociodemographic factors	Variables	GO/H Chi square P value	AO/H Chi square P value	CO/H Chi square P value
Age strata	60-69	1.5 ^a P>0.05	7.5 ^a P>0.05	2.7 ^a P>0.05
	70-79			
	80-89			
	90-99			
Marital status	Marriage	3.9 ^a P>0.05	3.6 ^a P>0.05	2.2 ^a P>0.05
	widowed/divorced/ separated			
	Single or fianced			
Level of education	No education	10.1 ^a P>0.05	10.1 ^a P>0.05	13.4^a P=0.04 (P<0.05)
	Primary			
	Secondary			
	University			
Type of marriage	Monogamous	4.1 ^a P>0.05	8.8^a P=0.012 (P<0.05)	4.7 ^a P>0.05
	Polygamous			
	Single parent			
Source of incomes	Permanent salary	1.1 ^a P>0.05	21.6^a P=0.00 (P<0.01)	9.4 ^a P>0.05
	Temporary salary			
	Trade			
	Help/ assistance			
Family history	None	18.7 ^a P>0.05	26.9^a P=0.00 (P<0.01)	9.4 ^a P>0.05
	Cardiovascular diseases (CVD)			
	CVD+Hypertension			
	CVD+ Hypertension+ Diabete			
	CVD + Diabete			
	Hypertension			
	Hypertension + Diabete			
Diabete				

GO= Generalized obesity; H= Hypertension; AO= Abdominal obesity; CO= Combined obesity

Table 8: Binary logistic regression of double burden obesity - hypertension with food consumed

Types of foods consumed	GO/H Odds ratio (95% IC) p value	AO/H Odds ratio (95% IC) p value	CO/H Odds ratio (95% IC) p value	
Foods specific to urban environment	Pastas (yes)	0.59 (0.19-1.79) P>0.05	0.40 (0.14-1.17) P>0.05	0.85 (0.26-2.81) P>0.05
	Canned fishes (yes)	0.96 (0.19-1.79) P>0.05	1.85 (0.47-2.99) P>0.05	0.77 (0.27 -2.20) P>0.05
	Canned vegetables (yes)	1.86 (0.62-5.62) P>0.05	2.89 (0.96-8.71) P>0.05	1.41 (0.39-5.06) P>0.05
	Lettuce dishes (yes)	0.33 (0.15-0.73) P<0.05	0.70 (0.32-1.51) P>0.05	0.38 (0.16-0.91) P<0.05
	Rice-soup (yes)	1.84 (0.58-5.88) P>0.05	4.49 (1.30- 15.48) P<0.05	2.76 (0.82-9.24) P>0.05
Western foods	Soft drinks (yes)	0.96 (0.42-2.22) P>0.05	1.48 (0.65-3.37) P>0.05	1.76 (0.67-4.65) P>0.05
	Candies (yes)	2.52 (1.03-6.17) P<0.05	2.45 (1.04-5.77) P<0.05	1.57 (0.59-4.20) P>0.05
	Fried irish potatoes (yes)	2.14 (0.78-5.84) P>0.05	1.27 (0.48-3.39) P>0.05	1.35 (0.44-4.17) P>0.05
	Pop corn (yes)	0.36 (0.13-1.00) P>0.05	0.91 (0.36-2.27) P>0.05	2.61 (0.90-7.56) P>0.05
	Pastries (yes)	1.45 (0.58-3.64) P>0.05	0.91 (0.36-2.27) P>0.05	2.61 (0.90-7.56) P>0.05
	Milk and diary products (no)	1.08 (0.47-2.51) P>0.05	0.61 (0.27-1.42) P>0.05	0.60 (0.24-1.52) P>0.05
Local meals and fruits	Local meals (regular)	0.42 (0.17-1.02) P>0.05	0.66 (0.28-1.57) P>0.05	0.42 (0.16-1.14) P>0.05
	Fruits (irregular)	5.18 (1.36-19.69) P<0.05	1.00 (0.26-3.84) P>0.05	4.93 (0.88-27.60) P>0.05

GO= Generalized obesity; H= Hypertension; AO= Abdominal obesity; CO= Combined obesity; OR= odds ratio; P= P value

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Table 9: Prevalence of consumption local meals based on double burden obesity-hypertension

Local meals	Consumption	Total population n(%)	GO/ H n(%)	AO/H n(%)	CO/H n(%)
Fufu corn +okra soup	Regular	159 (92.4)	62 (39.0)	74 (46.5)	49 (31.0)
	Irregular	13 (7.6)	3 (23.0)	6 (46.2)	2 (15.4)
Fufu corn + « kelenkelen » soup	Regular	115 (66.9)	46 (40.0)	54 (47.0)	37 (32.2)
	Irregular	57 (33.1)	19 (40.4)	14 (24.6)	14 (24.6)
Fufu corn + melon leaves	Regular	71 (41.3)	22 (31.0)	32 (45.1)	16 (22.5)
	Irregular	101 (58.7)	43 (42.6)	48 (47.5)	48 (47.5)
Fufu corn + folere leaves	Regular	145 (84.3)	58 (40.0)	66 (45.5)	45 (68.2)
	Irregular	27 (15.7)	7 (26.0)	14 (51.9)	6 (22.2)
Fufu corn + « djapche »	Regular	162 (94.2)	61 (37.7)	73 (45.1)	48 (29.6)
	Irregular	10 (5.8)	4 (40.0)	7 (70.0)	3 (30.0)
Fufu corn +cassava leaves	Regular	120 (69.8)	50 (41.7)	58 (48.3)	40 (33.3)
	Irregular	50 (29.1)	14 (28.0)	20 (40.0)	10 (20.0)

GO= generalized obesity; GH= general hypertension; AO= abdominal obesity; CO= combined obesity.

older obese people. There is less osteoporosis and less frequent hip fractures in obese men and women. This is due to a mechanical factor of course but also a hormonal one. Estrogen, insulin, and leptin can stimulate bone turnover and bone growth [14]. The prevalence of the three patterns of the double burden was high among women. This result could be explained by menopause. The transition to menopause is a period of life associated with a number of hormonal, morphological and metabolic changes. A redistribution of adipose tissue [15], and this preferentially at the level of abdominal adipose tissue [16], has been observed in postmenopausal women. The change in body composition in these women can lead to deterioration in the metabolic profile. Indeed, it has been shown that postmenopausal women have high plasma triglyceride concentrations [17], low plasma high density lipoprotein cholesterol (HDL) concentrations [18] as well as high prevalence of metabolic syndrome [19] compared to premenopausal women. The high prevalence of the three patterns of double burden among women could also explain by sedentary lifestyle. In fact in the West region - Cameroon and particularly in Fouban, the elderly female are sedentary. In sedentary people, energy expenditure is reduced or even close to that of rest and when intake is not reduced, there is energy storage leading to the phenomenon of obesity. This obesity in turn leads to increased vascular lipid peroxidation, the production of superoxide ion which promotes endothelial dysfunction and subsequently atherosclerosis [20]. In our study, the prevalence of all three types of combinations was high with people aged between 60 - 69 years. In a general population, the weight increases gradually until the age of 50-59 years in both men and women, from there the weight tends to decrease, knowing that there is a bias due to the high mortality rate in obese people [14]. After 20-30 years, the lean mass decreases. There is a decrease in muscle mass of 40% between 20 and 70 years while fat mass increases. The maximum lean mass is reached at age twenty and the maximum fat mass at 60-70 years. Beyond 70 years, the fat mass and the lean mass further decrease and there is also a redistribution of these masses

in the body, the lean mass decreases in the periphery and the fat mass predominates at the intra-abdominal, intramuscular and intrahepatic level. These changes are often associated with insulin resistance [14]. Type of marriage, source of income and family history contribute to the AO/H pattern ($p < 0.05$). In our study population, the prevalence of the AO/H pattern is high with the elderly married under a monogamous diet (59.1%), the elderly receiving aid or assistance as a source of income (65.6%) and people elderly with a history of hypertension (52.0%). Studies by Mata and Hertwig [21] have shown that married people unlike single people have a much higher body weight, due to a much healthier and more filling diet. In addition, married men settled into a more comfortable diet and exercised less. In addition, Meltzer et al [22] have shown that happy housewives tend to gain weight. This situation could have been the case for the elderly in our study population in both youth and senior years. Education level was associated with the CO/H pattern. In our study, people in primary and secondary levels had a high prevalence of the combination of CO/H. This result could be explained as the consequence of differences between social classes concerning: the type of diet, the practice of physical exercise and the knowledge of the risks associated with obesity. People from more popular social classes are less aware of the risks associated with weight, have a less balanced diet and exercise less than individuals from more affluent classes [23]. In addition, Macia et al [24] have shown that the lower classes consume, out of "necessity", rich and inexpensive foods that necessarily make you fat. Thus, the shape of the body, which seems natural to us, would only be the product of lifestyle habits, mainly linked to social class. The differences between men and women are mentioned by the author: according to him, the richest foods are traditionally considered to be "men's foods". Many studies have looked at nutritional risk factors for obesity, including simple carbohydrates. In our study, the consumption of refined sugars, in particular candies, is associated with the AO/H pattern. In fact, these refined sugars have a high GI causing blood sugar levels to rise sharply upon ingestion. The consumption of

these sugary foods is harmful because of their high sugar contents and their implication in the development of diabetes and obesity [25]. In our study, the irregularity of fruit consumption was associated with the AO/H pattern, while the consumption of lettuce salad had a protective effect against obesity-hypertension combinations. An inverse relationship between the consumption of fruits and vegetables and weight is reported by a few studies [26]. Different cross-sectional studies indicate a negative relationship between consumption and weight. Fiber consumption is the best predictor of body build with level of physical activity. It is the indigestible fraction of the diet. Fiber is essential for stimulating intestinal transit and facilitates the elimination of certain undesirable elements such as cholesterol [27]. Consumption of rice with sauces was associated with the AO/H pattern. This result is in agreement with studies by Nyangono et al. [7] which showed that fat and starchy recipes was associated with high obesity in urban areas.

Strengths and limitations of the study

The results of our study are difficult to generalize because the study was only carried out on a sample of the elderly of the Fouban. Very few studies are carried out on the elderly in Cameroon. This work makes it possible to challenge all the stakeholders involved in the health field that the double burden of obesity and hypertension should be carefully considered in elderly and general population. Moreover, it must be as an emerging disease influenced by several factors including unhealthy diet. This work also makes it possible to complete the policies for the control and prevention of non communicable diseases on elderly in Cameroon.

Conclusion

Our study showed that the double burden of obesity and hypertension is present in our study population, AO/H pattern being the most discriminating because its prevalence was the highest (46.5%). Regarding socio-demographic parameters, the level of education is associated with the CO/H pattern while the type of marriage, the source of income and the family history are associated with the AO/H pattern. Regarding eating habits, the consumption of lettuce salads has a protective effect of the combinations GO/H and CO/H. Consumption of fat and starchy recipes and refined sugars exposes to the AO/H pattern while consumption of refined sugars and irregular consumption of fruit exposes to the GO/H pattern.

Recommendations

It would be important for the elderly to favor the consumption of vegetables and fruits and also to reduce the consumption of dishes with a high content of refined sugars.

Ethical approvals

The study was approved by the following institutions:

Cameroon National Ethics Committee through the ethical clearance N°2014/08/488/EC/CNERSH;

First Deputy Mayor of the city of Fouban by validation of our request N° 780/UD/ ENSET/D/DA/ESF;

The names of the respondents were coded and anonymity of the information was respected. The data has been used for scientific purposes only and the results obtained are published with strict respect for the confidentiality and dignity of the respondents.

Availability of data and materials

SPSS data outputs are available for review from corresponding author, if requested. Official registration is required to access the database.

Author's contributions

CFNB and designed the study protocol and wrote the first manuscript draft. NBCF and WD led the statistical analyses and contributed to the manuscript drafting. CM contributed to data collection. NBCF, WD and PM critically contributed to the analysis, discussion and interpretation of the data and contributed to data interpretation and the writing of the manuscript. All authors reviewed and approved the final manuscript draft.

Consent for publication

Sign written consent was taken from all study participants.

Competing interests

The authors have declared any competing interests.

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