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MODIFIABLE CARDIOVASCULAR RISK FACTORS IN RURAL AND URBAN POPULATIONS OF SOUTH-SOUTH NIGERIA

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ABSTRACT

Aim: The extent of predisposition to cardiovascular diseases (CVDs) in the South-South, Nigeria, was assessed by a cross-sectional survey of two rural (Ikot Ekpene and Okorette) and one urban (Uyo) locations in Akwa Ibom State, Nigeria. **Method:** Five communities from each of the three locations were randomly selected; all the houses therein enumerated. The members of each household aged ≥15 years (except members with diabetes mellitus and sickle cell anaemia) were included in the study. Questionnaires designed to obtain information on age, sex, cigarette and alcohol consumption, and socioeconomic status were administered. Body weight and height (for calculation of BMI), and blood pressure measurements were taken. Overweight and obesity were defined as BMI ≥ 25.00 Kg/m^2 and BMI ≥ 30.00 Kg/m^2, respectively; subjects with systolic/ diastolic blood pressure (SBP/DBP) ≥ 140/90mmHg were considered hypertensive. The total number of respondents studied in each location were Ikot Ekpene (N=1313; male 609; female 704); Okorette (N=511; male, 139; female, 372); and Uyo (N= 480; male, 280; female, 200). **Results:** The level of hypertension in Uyo (10.6%) was significantly higher ($p<0.05$) than Ikot Ekpene (9.9%) and Okorette (6.3%). The trend in obesity prevalence was in tandem with hypertension thus: Uyo (26.5%), Ikot Ekpene (11.1%) and Okorette (8.4%), ($p<0.05$). Current cigarette smokers (%) were 15.7, 5.8, and 4.5, for Okorette, Uyo and Ikot Ekpene, respectively. **Conclusion:** The results of this study indicate that the urban dwellers are more at risk of CVDs than the rural populations with overweight/obesity contributing more to this than cigarette smoking.

KEYWORDS: Cardiovascular disease, Body mass index, Hypertension, Obesity, Cigarette smoking.

INTRODUCTION

Cardiovascular heart disease (CHD) is a major cause of disability and premature death globally.[1] In Nigeria, non-communicable diseases (NCDs) are estimated to account for 24% of total deaths.[2] The incidence of CHD among black Africans is on the increase[3] compared to the low incidences recorded in earlier studies.[4] This is attributable to the high incidence of smoking in developing countries,[3] central obesity,[5] and alcohol consumption.[6] The major risk factors of CHD found in men also apply to women although mortality is declining in many industrialized countries like USA, Australia, New Zealand, Belgium, and Finland.[4,7,8]

Various risk factors contribute to CVD in developing countries.[9] However, in more often, attention focuses on those classified under lifestyle, biochemical or physiological and personal factors. Lifestyle factors include tobacco smoking; dietary (high saturated fat and calories, low fruit and vegetables and high sugar); excess alcohol; stress; physical inactivity; and obesity. Under biochemical or physiological factors are elevated blood pressure, elevated plasma cholesterol, low plasma HDL-cholesterol; elevated plasma triglyceride; thrombogenic factors; and diabetes mellitus. Personal factors include age; gender; family history (first degree); and personal history of CHD. In clinical terms, risk factors are more conveniently classified either as modifiable or non-modifiable. Modifiable factors include elevated blood pressure, elevated plasma cholesterol, smoking, obesity, physical inactivity, excess alcohol and stress.[10]

Whereas, non-modifiable factors, include age, gender, personal history, and family history of CHD, and diabetes mellitus. Lifestyle modification is both therapeutic and cost-effective. It plays an important role in the prevention of non-communicable diseases.[1,3] Approximately 70% of Nigeria's population live in rural areas, resource-poor settings where lack of awareness and poor access to quality care increase diabetes-related complications.[11-14] This may well stem from a dearth of research data on the prevalence of these modifiable

factors among our rural communities. Although, there have been few well-designed studies in rural settings that have shown successful intervention in improving awareness and lifestyle.[14-18] To our knowledge, no such study has been carried out in the South-South Region of Nigeria with the ultimate aim of creating the needed awareness and informed policy decisions on avoidable CHD risk.

Accordingly, in this study, we estimated the prevalence of modifiable CHD risk factors (hypertension, alcohol consumption, overweight/ obesity, and cigarette smoking) in three population groups: namely rural farming (Ikot Ekpene); rural fishing (Okorette); and urban (Uyo) populations in Akwa Ibom State, Nigeria. These communities belong to the South-South, coastal region of the country and are characterized by similar socio-cultural values. However, the predominant occupation, access to certain diets, and other environmental factors unique to each community may influence their levels of cardiovascular risk. Such data which hitherto was scarce will find usefulness in policy formulation and intervention programmes aimed at stemming the tide of non-communicable diseases in the face of poverty and poor health facilities in the area.

MATERIALS AND METHODS

Selection of subjects and questionnaire administration: The study was conducted on participants drawn from rural farming (Ikot Ekpene); rural fishing (Okorette); and urban civil service (Uyo) communities in Akwa Ibom State, South-South Nigeria. Five villages within each location were randomly selected from a list of numbered villages using a table of random numbers. This was followed by the enumeration of households in each of the randomly selected villages. All subjects (male and female aged 15 years and above) were included in the study. People with known illnesses such as diabetes mellitus and sickle cell anaemia were excluded. The study protocol conformed to the ethical guidelines of the 1975 declaration of Helsinki as reflected in a priori approval by the University of Calabar human research committee; free and voluntary informed consent was also obtained from participants at each location before the beginning of the study. The total number of participants was 2304 (with 1313, 511, and 480 from Ikot Ekpene, Okorette and Uyo, respectively).

The respondents completed questionnaires which provided information on age, sex, marital status, level of education, alcohol consumption, cigarette smoking, personal and family history of hypertension, overweight and obesity.

Physical Measurements: Physical measurements of blood pressure, body weight and height were taken using standard methods.[14] Body mass index (BMI) was calculated as (body weight in Kg)/ (height in M)^2. The subjects were categorized[13] into: (a) Underweight (BMI< 19.5 Kg/m^2); (b) Acceptable weight (BMI 19.5 - 24.9 Kg/m^2); (c) Overweight (BMI 25.0 - 29.9 Kg/m^2); and (d) Obese (BMI ≥ 30 Kg/m^2). Hypertension was defined as systolic/diastolic blood pressure, SBP/DBP ≥ 140/90 mmHg.[1]

Statistical methods

Data analysis was done using SPSS, 2008 version 16 for Windows. One way analysis of variance (F-test), Chi-square and unpaired Student's t-test were used to compare parameters between the different groups. Statistical significance was determined at $p< 0.05$.

RESULTS

Prevalence of hypertension: The level of hypertension (%) (male, female and sum) in Uyo (13.9, 6.0, 10.06); Ikot Ekpene (10.8, 9.1, 9.9) and Okorette (8.6, 5.4, 6.3) respectively, shows that hypertension was significantly more prevalent ($p<0.05$) among the urban dwellers than rural farmers and rural fishermen (Table1). In the three locations, the males had significantly higher ($p< 0.05$) levels of hypertension than the females. The prevalence of hypertension (%) was influenced by marital status (Table2): the singles, married, widowed/divorced in Uyo (4.5, 12.0, 11.1); Ikot Ekpene (3.5, 10.3, 19.3) and Okorette (1.1, 6.5, 9.4) respectively, were significantly different in their values at all locations. The distribution of hypertension (%) by levels of education (low, medium and high) in Uyo (12.7, 9.9, 9.7); Ikot Ekpene (11.4, 5.7, 6.5) and Okorette (6.7, 3.1, 14.3) respectively, showed more concentration among those with low levels of education in two out of the three locations (Table3). At Ikot Ekpene the blood pressure of those with medium was significantly lower than those with low and high levels of education. Among the hypertensive subjects, only 11.8% and 2.3% of Uyo and Ikot Ekpene respectively, had a family history of hypertension but as many as 72.5% in Uyo, 40.8% in Ikot Ekpene and 65.6% in Okorette had a family history of obesity (Table 4.).

Table. 1: Blood pressure and prevalence of hypertension by gender and location.

Location	Sex	N	SBP (mmHg)	DBP (mmHg)	Hypertensives	
					n	%
Ikot Ekpene	M	609	126 ±25	72 ±15	66	10.8
	F	704	120 ±23*	69 ±15*	64	9.1
	All	1313	123 ±23	71 ±15	130	9.9
Okorette	M	139	121 ±20	70 ±13	12	8.6
	F	372	117 ±20*	65 ±13*	20	5.4
	All	511	118 ±20[a]	66 ±13[a]	32	6.3
Uyo	M	280	129 ±20	79 ±17	39	13.9
	F	200	120 ±14*	76 ±13*	12	6.0
	All	480	125 ±18[b]	78 ±15[a,b]	51	10.6

Values expressed as mean ±SD
* = significantly different from male (within location) at p<0.05
a = significantly different from Ikot Ekpene (All) at p<0.05
b = significantly different from Okorete (All) at p<0.05
(Prevalence of hypertension in the different sexes varied significantly in the different locations: chi cal. = 14.394; df = 2; p<0.001)

Table. 2: Blood pressure and prevalence of hypertension by marital status and location.

Location	Marital status	N	SBP (mmHg)	DBP (mmHg)	Hypertensives	
					n	%
Ikot Ekpene	Single	342	118 ±18	67 ±15	12	3.5
	Married	774	123 ±24*	72 ±14*	80	10.3
	Widow/divorced	197	131 ±26*, [a]	72 ±16*	38	19.3
Okorette	Single	91	113 ±17	61 ±9	1	1.1
	Married	293	117 ±20	66 ±13*	19	6.5
	Widow/divorced	127	124 ±26*, [a]	70 ±14*, [a]	12	9.4
Uyo	Single	89	120 ±13	75 ±11	4	4.5
	Married	373	126 ±17*	80 ±13*	45	12.0
	Widow/divorced	18	129 ±24*	81 ±12*	2	11.1

Values expressed as mean ±SD
* = significantly different from male single at p<0.05
a = significantly different from married at p<0.05
(No significant variation in the prevalence of hypertension in the different location: chi cal. = 1.554; df = 2; p = 0.460)

Table. 3: Blood pressure and prevalence of hypertension by level of education and location.

Location	Level of education	N (%)	SBP (mmHg)	SBP (mmHg)	Hypertensives	
					n	%
Ikot Ekpene	Low	968 (73.7)	124 ±25	71 ±18	110	11.4
	Medium	299 (22.8)	119 ±18*	69 ±16	17	5.7
	High	46 (3.5)	125 ±18[a]	75 ±12[a]	3	6.5
Okorette	Low	416 (81.4)	118 ±22	66 ±13	28	6.7
	Medium	88 (17.2)	114 ±21	64 ±13	3	3.1
	High	7 (1.4)	127 ±17	74 ±14	1	14.3
Uyo	Low	134 (27.9)	124 ±17	78 ±13	17	12.7
	Medium	234 (50.6)	124 ±17	79 ±13	24	9.9
	High	103 (21.5)	127 ±16	80 ±12	10	9.7

Values expressed as mean ±SD
* = significantly different from low at p<0.05
a = significantly different medium at p<0.05
(Prevalence of hypertension in the different sexes varied significantly in the different locations: chi cal. = 39.985: df = 2; p<0.001)

Table. 4: Family history of hypertension and obesity among the hypertensive subjects at various locations.

History	Ikot Ekpene		Okorette		Uyo	
	*nHT	#%HT	nHT	%HT	nHT	%HT
Father/ or mother hypertensive	3	2.3	0	0	6	11.8
Father/ or mother not hypertensive	97	74.6	20	62.5	44	86.3
No knowledge/ response	30	23.1	12	37.5	1	2.0
	Chi Cal. = 24.538; df = 4; p<0.05					
Father/ or mother overweight or obese	53	40.8	21	65.6	37	72.5
Father/ or mother not overweight or obese	77	59.2	11	34.4	14	27.5
No knowledge/ response	0	0	0	0	0	0
	Chi Cal. = 17.579; df = 2; p<0.05					
*nHT= number of hypertensive subjects; #%HT= percentage of hypertensive subjects.						

Alcohol consumption

As depicted in Figure 1, alcohol was consumed by 82.3%, 74.7% and 78.2% of subjects (male, female and all, respectively) from Ikot Ekpene (Figure1). Corresponding values for Okorette were 59.0, 41.4, and 46.2 and Uyo 67.3, 48.7 and 59.8.

BMI distribution and prevalence of overweight/ obesity: The highest prevalence of underweight (%) was found among the rural farming community, Ikot Ekpene (34.3), followed by Okorette and Uyo (23.1 and 14.6, respectively) (Table 5). Those with acceptable weight (%) were Okorette (67.9); Uyo (60.4) and Ikot Ekpene (54.6). Overweight and obesity (%) were Uyo (19.2 and 5.8); Ikot Ekpene (8.1 and 3.0); and Okorette (7.6 and 1.4) respectively. The distribution of overweight/obesity among the sexes shows the highest prevalence (%) in Uyo (17.4, 39.2, and 26.5)); followed by Ikot Ekpene (9.2, 12.7, and 11.1) and Okorette (7.9, 8.6, and 8.4) for male, female and all, respectively (Figure 2).

Cigarette smoking

The level of cigarette smoking (current and past smokers) by gender and location is as presented in Table 6. Current cigarette smokers (%) were highest in Okorette (26.6, 11.6, and 15.7) followed by Uyo (7.8, 3.0, and 5.8 1) and Ikot Ekpene (8.5, 0.6, and 4.3) for male, female and all, respectively. Corresponding values (%) for those who had quit smoking were Uyo (18.6, 2.0 and 11.7); Ikot Ekpene (8.9, 1.4, and 4.9); and Okorette (1.4, 0.3 and 0.6), for male, female and all respectively. This shows that more urban dwellers quitted smoking while the fishermen had the least quitters.

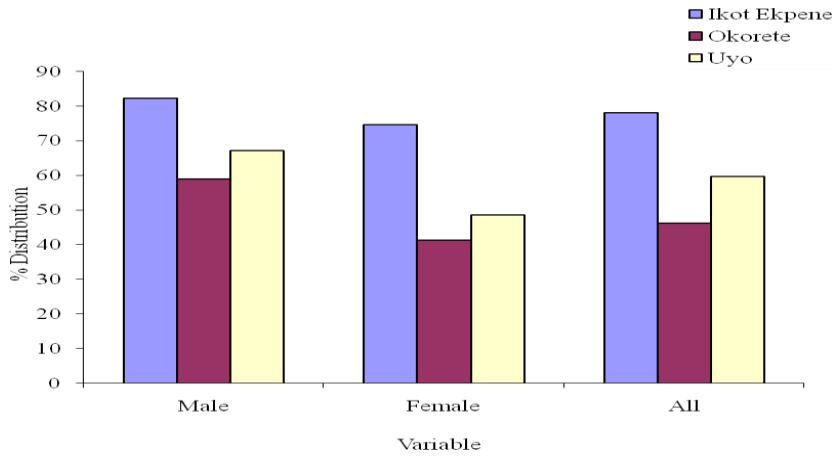

Figure 1: Percentage distribution of alcohol consumption by male and female subjects at different locations.

Table. 5: Categorization of body mass index across the locations.

Body Mass Index (BMI) (Kg/m^2)	Ikot Ekpene		Okorette		Uyo	
	n	%	n	%	N	%
Under weight (< 19.5)	541	34.3	118	23.1	70	14.6
Acceptable weight (19.5-24.9)	717	54.6	347	67.9	290	60.4
Over weight (2.5 -29.9)	106	8.1	39	7.6	92	19.2
Obese (≥ 30.0)	39	3.0	7	1.4	28	5.8
Chi Cal. = 168.447; df = 6; p<0.05						

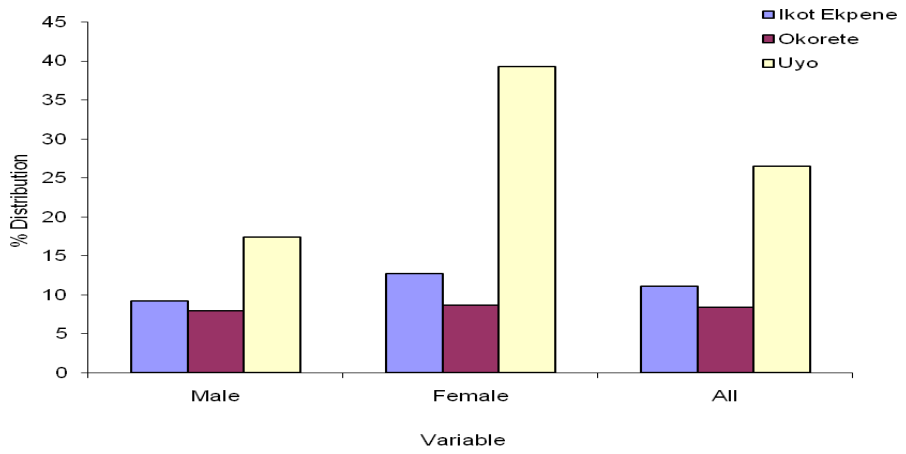

Figure 2: Percentage total prevalence of overweight / obesity among male and female subjects at different locations.

Table. 6: Current and past cigarette smokers by gender and location.

Location	Current smokers		Past smokers		Past/current smokers	
	n	%	n	%	n	%
Ikot Ekpene						
Male (N=609)	53	8.7	54	8.9	107	17.6
Female (N=704)	6	1.0	10	1.4	16	2.3
All (N=1313)	59	4.5	64	4.9	123	9.4
	Chi Cal. = 90.362; df = 2; p<0.05					
Okorette						
Male (N=139)	37	26.6	2	1.4	39	28.1
Female (N=372)	43	11.6	1	0.3	44	11.8
All (N=511)	80	15.7	3	0.6	83	16.2
	Chi Cal. = 20.200; df = 2; p<0.05					
Uyo						
Male (N=280)	27	9.6	52	18.6	79	28.2
Female (N=200)	1	0.5	4	2.0	5	2.5
All (N=480)	28	5.8	56	11.7	84	17.5
	Chi Cal. = 53.530; df = 2; p<0.05					

DISCUSSION

Prevalence of hypertension

The prevalence of hypertension reported in this study (6.3-10.6%) is similar to the range reported earlier for the South-East Region, Nigeria (8.1%) by Ekpo *et. al.*,[19] but lower than communities in Cross River State (23.6%);[20] Ibadan-North (33.1%);[18] Ndokwa West, Delta State (35.7%);[14] all in Nigeria, and Nepal (34.4%).[21]

Prevalence of hypertension among the study groups was in the order of Uyo > Ikot Ekpene > Okorette. The same order is also reported for overweight/ obesity, confirming the positive correlation between BMI and blood pressure for these groups[22] and in other studies.[19,20] The urban dwellers being predominantly civil servants are likely to be more prone to sedentary lifestyles that promotes weight gain.[7,11,23] Regular physical exercise including brisk walks, interruption of long sitting hours with intermittent at-work exercises have been recommended and proven successful in reducing the twin risks of hypertension and overweight / obesity) among office workers.[1,3,7] The rural farming group (Ikot Ekpene) ranked second in hypertension prevalence (9.9%) showed apparent under-nutrition as they had the highest prevalence of underweight and the least number of people with ideal body weight. This suggests that being underweight may also be a risk factor.

Level of hypertension is influenced by sex as it was found to be more prevalent in males than females in the three study locations. This is similar to findings from previous studies.[18,19,20]

In this study marital status influenced the prevalence of hypertension as more hypertensive subjects were found among the widows/divorced than the married, and among the married than the singles. There is considerable evidence that marriage has a beneficial role in health. Those who are married generally show lower prevalence and incidence of mental and physical disorders than the unmarried.[24,25] Marriage is also said to be protective of the most serious health consequences and death since the unmarried have been found to experience higher mortality rates.[26] Widowhood also is

associated with elevated risk of mortality, in particular, death due to CHD.[27,28] Divorce, too, has been found to increase the risk for total mortality and CHD mortality.[26,28] In contrast to these claims, the urban subjects in this study who recorded the higher prevalence of hypertension also had the lowest prevalence of widowhood/divorce. This shows that marriage alone would not be the only contributing factor to the above claims.

Level of education is an indicator of socioeconomic status.[14,19] The results of this study show that the two rural communities were severely disadvantaged educationally in comparison to the urban community. In this study, no attempt was made to relate the level of education with knowledge/ awareness of cardiovascular risk factors among the respondents. However, hypertension was found to cluster more at the extremes; a much higher prevalence among the poorly educated in both the urban and rural communities. Some studies[29,30] had indicated a tendency of some cardiovascular risk factors to aggregate in the lower socioeconomic status. Others[10,14,31] have demonstrated these to be highest at the lowest and highest socioeconomic strata. In this study, among the rural populations, the farmers which showed evidence of relative under-nutrition in addition to a low level of educational achievement had a higher prevalence of hypertension. The highest prevalence of hypertension was however found among the urban group in which more people had attained high levels of education. This observation cannot be fully attributed to educational achievement as data shows that other factors had a tremendous influence on hypertension as well. Family history, for instance, showed that in this study hypertension prevalence was more closely related with overweight/ obesity than the history of hypertension itself. This observation is not out of place as obesity in parents is known to predispose the offspring to hypertension.[9] This observation which had already been made in other communities in sub-Saharan African populations,[3,18,20,32] indicate that hypertension is an emerging public health problem in the populations under study.

Alcohol Consumption

The results of this study show that a great majority of the people in the communities do take alcohol. The level of alcohol intake was however not estimated. Our data shows that 78% of the rural farming population is currently consuming alcohol. This was the highest prevalence among the three studies with the rural fishing and urban dwellers having 46% and 60% respectively.

Considering the resource-poor setting of the rural dwellers, it is doubtful that a majority of the respondents can afford to be successful heavy drinkers. Although in all locations men recorded higher prevalence than their female counterparts, the level of alcohol consumption among the women folk is considered appreciably high. A study by Karjane *et. al.*,[33] concluded that the emotional ups and downs associated with infertility and infertility treatment among women may increase subsequent risk for depression, anxiety, or other psychiatric illnesses. These may, in turn, be associated with higher rates of problem drinking. It is most likely that in traditional communities such as the ones under study, medication for infertility and other ailments that affect both genders may be alcohol based. Taking a few shots of malaria decoction first thing in the morning even without breakfast is both common and widespread. Although heavy alcohol consumption is reported to promote hypertension and to generate other risk factors of CHD, moderate alcohol consumption has been said to be beneficial[34] because it increases HDL-c and reduces LDL-c. Alcohol consumption and CHD have a J-shaped relationship.[34,35] High levels of alcohol promote hypertension and CHD[35] but moderate consumption (two drinks a day or less) may offer protection.[36]

Overweight and Obesity

Among the urban group, as much as 25% were overweight or obese. Excessive consumption of fast foods and beverages which are known to be fattening and very little or no physical exercise among urban dwellers has been reported.[7,23,30,37] In some studies decreased physical activity has been associated with CHD.[3] This may be responsible for the high prevalence of overweight/obesity among our urban dwellers. This calls for leisure time physical activity which has been recommended as a primordial intervention measure.[7,38] In the present study, no attempt was made to quantify physical activity. However, among the rural populations, public transport was limited as people trekked long distances, rode bicycles or roared boats. The level of physical activity was high as per their manual occupation of farming and fishing. This may account for the lower prevalence of overweight/obesity recorded among them. At all locations women were fatter than men; a fact attributable to female hormones, pregnancy and childbirth, bad eating habits and lack of physical activity, among other factors.[39]

The results of this study show that obesity, which is a CHD risk factor, is not a significant problem among the rural populations. Centripetal fat distribution is associated with metabolic changes that confer a greater risk of CHD than peripheral fat distribution.[40,41] As BMI takes no account of body fat distribution, in a study such as this, the combined measurements of BMI and waist to hip ratio (WHR) are more likely to identify overweight individuals most at risk of CHD more than the use of BMI alone.[30] Recently a new simply calculated index of body composition, A Body Shape Index (ABSI) is being considered as an index more reliable than BMI in associating between body composition and lipoproteins, circulating insulin and all-cause mortality.[5] Earlier introduced by Krakauer and Krakauer,[42] it is calculated from a combination of waist circumference (WC), BMI and height according to the following formula: ABSI = WC (m) /[BMI $^{2/3}$ X height (m) ^{½}].

Cigarette Smoking: The prevalence of cigarette smoking recorded among the three populations in this study (4.3-15.7%) is higher than the Nigerian national average (6%) reported for the year 2011[2] but considered very low compared to findings in other populations elsewhere.[21,43] The comparatively higher prevalence of cigarette smoking among the rural fishing community (overall, 15.7%; males, 26.6%; females 11.6%) may be occupationally related;[44] as much as 18.5% has been reported for those in agriculture, forestry, fishing, and hunting the United States of America.[45] Fishermen may take to smoking as an antidote to frequent exposure to cold and the nauseating odour of fish.[44] The danger here is that a combination of heavy cigarette smoking and alcohol is known to heighten the risk of liver cancer.[46] Cigarette smoking produces an immediate and transient elevation of blood pressure,[43,47] which may not be sustained. Studies on other populations have however associated cigarette smoking with lower blood pressure.[43] Williams *et. al.,*[48] found that an increase in blood pressure especially systolic occurred after cessation of cigarette smoking in one cohort study while in a randomized controlled trial,[49] no change was found. In another study, Gerace *et al,*[50] found that stopping smoking did not affect DBP in some men but did lead to hypertension in others; weight gain was considered to have contributed to hypertension. Our results also show that as much as 11.7% of urban dwellers quitted cigarette smoking compared to 0.6% in Okorette and, 4.9% in Ikot Ekpene. It is likely that this could also have contributed to the high prevalence of overweight/ obesity and hypertension reported among the urban group. However, persuasion to stop smoking among the urban group could be the impact of higher educational attainment and public enlightenment. This calls for a serious and committed campaign to discourage smoking among the rural populations.[12]

CONCLUSION

Except for high prevalence of cigarette smoking among the male fishermen, the urban dwellers may , have greater risks of cardiovascular disease because of the high prevalence of overweight/ obesity among them. On the whole, the strong positive family history of overweight/ obesity among hypertensive subjects indicate that hypertension may be a recurring public health concern in these populations. Primordial intervention measures are needed to reduce some cardiovascular disease risk factors.

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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