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Full Length Research Paper

Effect of lifestyle options on the determinants of the Metabolic Syndrome in the urban and peri-urban Regions of Cameroon

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Metabolic syndrome (MS) has a high prevalence in many Western countries but relatively lower in sub-Saharan Africa. The prevalence of the key determinants of MS, like Hypertension, Diabetes, Elevated Body Mass Index (BMI), Dyslipidemias and central obesity, are on a steady rise in Africa. This study aims to assess the effect of lifestyle options on the determinants of the metabolic syndrome in the urban and peri-urban regions of Cameroon. 1974 males and females patients aged between 18 -80 years were recruited for this study between 2010 and 2011. Trained and forthrightly certified nurses obtained blood pressure and anthropometric measurements and collected a venous blood sample for measurement of glucose. Questionnaires on medical and medication history as well as lifestyle options were administered. Prevalence of the metabolic syndrome and its components were estimated using the International Diabetes Federation, (IDF) 2005, World Health Organization (WHO, 1999), NCEP-ATP III criteria. Associations between lifestyle options and determinants of the Metabolic syndrome was done using χ^2-test and Analysis of Variance (ANOVA) Multivariable analysis was conducted using the Binomial logistic regression models since MS is both a categorical and a dichotomous variable. The diabetic condition was significantly associated with the consumption of rapid sugars (χ2-test; $p<0.001$). BMI was significantly associated with occupation (χ^2-test; $p < 0.001$) WHR was significantly associated with sporting activities (χ^2-test; $p=0.002$) and consumption of rapid sugars (χ^2-test; $p=0.001$). The determinants of MS' had the highest explanatory power (EP=80.5%) toward Metabolic syndrome diabetes history ($p<0.001$). Hypertension was significantly associated with area of residence, occupation and consumption of rapid sugars ($p<0.001$). Sleep duration and sporting activities were not significantly associated with the determinants of the metabolic syndrome.

Key words: Metabolic syndrome, determinants, lifestyle options, hypertension, IDF 2004.

INTRODUCTION

The major risk factors or determinants of metabolic syndrome, often defined as a cluster of coronary risk factors include central obesity, glucose intolerance, high triglycerides level, low "High Density Lipoproteins" (HDL), and hypertension (Eckel et al., 2005).

Several organizations have suggested definitions for the Metabolic Syndrome. In 1998, the World Health Organization (WHO) provided a definition of the metabolic syndrome as association of glucose intolerance with three or more other components (Alberti and Zimmet, 1998). In response, the European Group for the Study of Insulin Resistance countered with a modification of the WHO definition having insulin resistance as its hallmark (Balkau et al., 2002). In 2001, the USA National Cholesterol Education Program (NCEP) released its own definition categorizing the risk factors as underlying, major and emerging (NCEP, 2001).

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Subsequently, the American Association of Clinical Endocrinologists considered the concept of insulin resistance as central (ACE, 2003). The proliferation of definitions suggested that a single unifying definition was desirable(Ford,2005). In the hope of accomplishing this, the International Diabetes Federation (IDF) proposed a further definition for metabolic syndrome for use in epidemiology studies and clinical practice, which would allow for comparison between different population groups and the assessment of its relationship with various health outcomes (Grundy, 2004). In 2009, an additional definition of metabolic syndrome-a Joint Interim Statement was proposed by several organizations in an attempt to harmonize the definition of the metabolic syndrome (Alberti et al., 2009). These determinants or components of metabolic syndrome occur together more frequently than expected by chance, and when grouped together they result in an increased risk for cardiovascular disease and diabetes mellitus (Eckel et al., 2005; Ford, 2005). The IDF definition of MS associates more strongly than the NCEP/ATP-III definition with the concept of sedentary lifestyle (Cabrera de León et al., 2007).

Consequently, the sedentary lifestyle is associated with worse quality of life Guallar-Castillón et al. (2004) and increased general mortality (Trolle-Lagerros et al., 2004). But, in spite of its intuitive simplicity, no consensus has been reached on the concept of sedentary lifestyle (Alberti et al., 2005). Positive lifestyle adjustments [physical activity, appropriate sleep patterns, appropriate diet, and low alcohol consumption, quitting smoking] are central in the prevention of some degenerative diseases and cancers. Physical inactivity as evidenced by a sedentary lifestyle is one of the main risk factors in chronic conditions like Type 2 diabetes(Bassuk and Manson, 2005), cardiovascular disease (Sherman et al.,1999) osteoporosis (Pang et al., 2005) and some cancers (Thune and Furberg, 2001). The association between sedentary lifestyle and obesity on one hand and metabolic syndrome on the other has been reported (WHO; 1998). Sedentary lifestyle has been associated with worse quality of life and increased morbidity and mortality (Trolle-Lagerros et al., 2005).

Metabolic syndrome (MS), characterized by central obesity, dyslipidemia, hyperglycemia and hypertension is currently a major global public health challenge because it involves a serious risk of cardiovascular disease and type 2 diabetes(.Alberti et al., 2005). According to the World Health Organization, since 1990 coronary heart disease has been the highest cause of death and this tendency has not yet been observed only in countries with very low life expectancy (Sherman et al., 1999).

It has been reported that technology, automation and a more comfortable lifestyle encourage sedentary behavior, especially in urban populations. The diseases associated with inactivity are now an important global public health problem, with 11.7% of deaths in developed countries being linked to increased obesity. (Bassuk and Manson, 2005; Sherman et al., 1999; Pang et al., 2005).

The fact that the lack of physical activity and MS are cardiovascular risk factors that increase overall morbidity makes the study of their interrelationships extremely important. This is becoming even more significant considering that the prevalence of physical inactivity, obesity and MS increases with age(WHO, 1998) and the world-wide number of elderly people is increasing, especially in newly-industrialized countries such as Brazil (Ekelund et al., 2005) and hopefully, in developing countries such as Cameroon.

In recent decades, the importance of physical activity for the maintenance of a healthy weight and the prevention of cardiovascular events and death has been widely reported in the scientific literature and the mass media. Clinical studies have been conducted to determine the influence of primary care counseling on the level of physical activity and the maintenance of changes in behavior regarding physical activity. Most of them have shown that recommending physical activity can cause an increase in weekly energy expenditure, even in the elderly(Guallar-Castillón et al., 2004: Trolle-Lagerros et al., 2005, Alberti et al., 2005).

Till date, research on the association of MS or its determinants with cardiovascular diseases in developing countries is limited despite the reported surge in the prevalence of the latter (Yusuf et al., 2004). This study targets the impact of lifestyle options on the prevalence of MS and its determinants in the urban and peri-urban settings of the Littoral Region of Cameroon.

METHODS

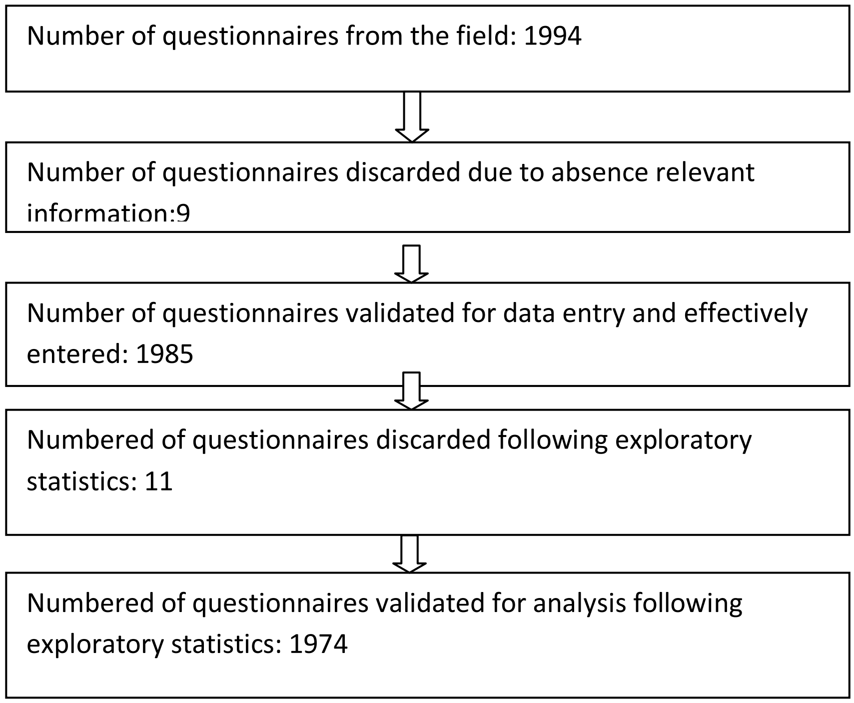
Participants and recruitment

The authors conducted a cross-sectional study using a sub-set of patients consulting at the district hospitals in the urban (District hospitals of Deido, New Bell, Nylon, Cite des palmiers, Bonassama, and Polyclinic Bonanjo) and peri-urban zones (District hospitals of Loum, Mbanga, Dibombari and Edea) of the Littoral region of Cameroon. The participants comprised 1974 patients down from 1994 (Figure 1). All participants provided informed consent by signing the consent form which was actually the last page of the questionnaire they completed. The exact inclusion criteria included: Age-18 to 80 years, overnight fast, both male and females. Excluded from this study were pregnant women, patients who were not fasted or those refusing to sign the consent form. Those arriving the hospitals after 12:30 noon were advised to report the next morning after an overnight fast.

Measurements

Trained research nurses assisted the investigators in ob-

Figure 1. Sample flow chart



taining measurements of blood pressure and anthropometry (weight, height, waist and hip circumference). Blood pressure was measured using a mercury sphygmomanometer following standardized procedures. Waist and hip circumferences were measured using a non-stretchable nylon tape. The means of three standard measurements of waist and hip circumferences were recorded, and the waist-hip ratio (WHR) calculated. Three consecutive diastolic and systolic blood pressures (SBP and DBF) were taken on the right arm using a standard mercury sphygmomanometer with appropriate cuff. Height was measured using a portable stadiometer and weight was measured using a portable digital scale which was calibrated daily using standard weights. Questionnaires were administered by trained research nurses during face to face interviews.

Data on personal and family medical history, socioeconomic status, physical activity and habits and other lifestyle options were collected. A fasting blood sample was obtained by venipuncture at the finger-tip to measure fasting glucose. Glucose was measured using the glucose oxidase method. Physical activity levels were derived based on time spent playing sports or engaged in exercise (such a brisk walking) during leisure time. Participants reporting no leisure time physical activity were classified as having low physical activity level or sedentary, participants reporting engagement in physical activity of 3 to 5 hours a week were classified as physically active.

Metabolic syndrome designation

Prevalence of the Metabolic Syndrome and its components were estimated using the Joint Initiative Statement (JIS) 2009, International Diabetes Federation, (IDF, 2005), NCEP-ATP III (2002) and World Health Organization 1999 criteria. The determinants or components of Metabolic Syndrome considered in this study were: Body Mass Index (BMI), Waist/Hip Ratio (WHR), Elevated Blood sugar, Waist Circumference (WC) and Hypertension (HT).

Statistical Methods

Data from the questionnaires and laboratory reports were entered into an electronic data base Epi-Info 6.04d (CDC, 2001). Range and consistency checks were used to minimize data entry errors. Data were merged and exported from Epi-Info to SPSS.

Generating computed variables: to answer specific indicators, some variables were derived from ‘raw variables’ using direct compute command or command syntax.

Development of syntax journal: a syntax journal was developed for each major steps of the analysis. Syntax was also indispensable to solve specific problems that could not be done using direct interactive-window analysis.

Table 1. Distribution of lifestyle option's indicators.

Life style option's indicators	Categories	N	%	N
Physical activity	Inactive	1165	59.0	
	Active	869	41.0	1974
Dietary recall	Healthy	1283	65.0	
	Unhealthy	691	35.0	1974
Nature of Occupation	Active	282	14.3	
	Sedentary	1692	85.7	1974
Alcohol consumption	Heavy drinker	1284	65.0	
	Moderate or occasional drinkers	690	35.0	1824
Consumption of Rapid sugars	Yes	1567	79.4	
	No	407	20.6	1974
Preferred sources of protein	Healthy	880	44.6	
	Unhealthy	1094	55.4	1974
Sleeping Duration	Healthy	601	30.4	
	Unhealthy	1094	69.6	1974

Data was later analyzed using the following approaches: The case summaries procedures were used to calculated values of central tendencies and dispersion. Continuous variables were then screened for normality and homogeneity of variance using Kolmogorov-Smirnov and Shapiro-Wilk tests, the means, the median and the kurtosis values. The variables were approximately normally distributed and parametric tests were then used to compare groups for the significant difference. Independent Sampled T test was used to compare two independent samples for significant difference whilst ANOVA helps in comparing more than two subsets. For categorical variables, descriptive statistics was used to present the distribution of subjects between and within subsets using frequencies and proportions. Associations between lifestyle options and determinants of the Metabolic syndrome was done using χ^2-test and Analysis of Variance (ANOVA) Multivariable analysis was conducted using the Binomial logistic regression models since Metabolic Syndrome is both a categorical and a dichotomous variable.

Two modeling approaches were used-the Binomial Logistic Regression Model (used to appraise the explanatory power of the various components of the metabolic syndrome) and the Multiple linear Regression Model (applied to continuous variables which were the Biochemical indicators).

Ethical considerations

The study protocol was approved by the National Ethics Committee of the Ministry of Public Health, Cameroon. All subjects gave informed consent to participate and the authors followed the Declaration of Helsinki on biomedical research involving human subjects.

RESULTS

From the distribution pattern of the lifestyle options indicators below, it was apparent that the majority of the subjects in this study had inactive lifestyles (that is sedentary and physically inactive). Most had unhealthy eating habits, were heavy drinkers, had unhealthy sleep pattern ([having less than 5hours of sleep per night) and had a sweet tongue (high consumption of rapid sugars) [see Table 1].

Multilinear Regression Model could not apply if prevalence of MS was to be used as dependent variable. This is because MS is categorical and not continuous (scale level). The appropriate model to apply when MS is used as dependent variable is Binomial Logistic Regression Model moreover as MS is a dichotomous variable. Table 2 shows the model summary indicating the different components and their explanatory power. It

Table 2. Model Summary.

Components	Metabolic Syndrome Chi-square statistics	Explanatory Power (Nagelkerke R Square)	n
1-Background indicators	<0.001	16.6%	1625
2-Life style options	<0.001	6.5%	1824
3-Family history	<0.001	4.6%	1109
4-Determinants of MS	<0.001	80.5%	1750
IVM (1 & 2)	<0.001	14.7%	1752
IVM (1 & 2 & 3)	<0.001	20.1%	989
IVM (1 & 2 & 4)	<0.001	82.1%	1579
IVM (1 & 2 & 3 & 4)	<0.001	86.7	904

can be seen that while lifestyle options have an explanatory power of 6.5%, the determinants of MS offer an 80.5% explanatory power.

Association between life style option's indicators and Sex

Females were more physically inactive than males ($p<0.001$) while males had more unhealthy sleep patterns than females ($p=0.001$). But for dietary habits, nature of occupation, consumption of rapid sugars, and consumption of unhealthy proteins (consumption of mostly animal proteins with dairy products) there was no significant difference between males and females. Alcohol consumption suggested an interesting pattern: while more males were heavy drinkers, more women were moderate drinkers. The difference between males and females for this drinking habit was significant ($p=0.001$) See Table 3.

Association between lifestyle option's indicators and age groups

The proportion of physically inactive subjects increased age and there was a significant difference ($p<0.001$) between the different age groups with respect to this lifestyle option. The same trend was recorded for sedentary occupation. As far as alcohol consumption is concerned, the proportion of heavy drinkers appeared to decrease with age although this decrease was not significant but there was a steady rise in the proportion of moderate drinkers with increasing age.

The proportion of those consuming rapid sugars decreased with increasing age of the subjects and the difference between the age groups was significant ($p<0.001$). Most of the subjects in all the three age groups had unhealthy sleep patterns, that is having less than 5-7 hours of sleep per day.

The diabetic condition was significantly associated with the consumption of rapid sugars (χ^2-test: $p<0.001$). BMI was significantly associated with occupation (χ^2-test $p<0.001$).WHR was significantly associated with sporting activities (χ^2-test $p=0.002$) and consumption of rapid sugars (χ^2-test: $p=0.001$) .Waist Circumference, the main indicator of central obesity was significantly associated with area of residence ($p=0.001$), occupation ($p<0.001$) and alcohol consumption ($p<0.001$.

Hypertension defined by both the WHO 1999 definition (systole/diastole >140/90) or the IDF 2005 definition (systole /diastole >130/85) was significantly associated with setting type or place of residence ($p<0.001$), occupation ($p<0.001$) consumption of rapid sugars ($p=0.003$).

Lifestyle options that were not significantly associated with any of the determinants of M S include sleep duration (healthy/unhealthy), preferred protein source and indulgence in sporting activities. As for as the other lifestyle options are concerned, sedentary lifestyle (χ^2 $P=0.11$), drinking of less than 1 litre of water a day ($P= 0.04$), diabetes history ($p<0.001$) and the consumption of rapid sugars ($p<0.015$) were the only four lifestyle options that showed a significant χ^2 difference. This suggests that

Table 3. Association between lifestyle option's indicators and Sex

Life style option' indicators	Category	Sex Male	Female	Chi-square
Physical activity	Inactive	228(31.1%)	581(46.8%)	χ^2=47.034 p<0.001
Dietary habits	Unhealthy	482(65.8%)	801(64.5%)	χ^2=0.298 p=0.585
Nature of Occupation	Sedentary	627(85.5%)	1065(%)	χ^2=0.029 p=0.864
Alcohol consumption	Heavy drinker	505(68.9%)	779 (62.8%)	
	Moderate or occasional drinkers	228(31.1%)	462(37.2%)	χ^2=7.599 p=0.006
Consumption of sweet, cakes	Yes	569(77.6%)	998(80.4%)	χ^2=2.196 p=0.138
Preferred sources of protein	Unhealthy	419(57.2%)	657(54.4%)	χ^2=1.432 p=0.231
Sleeping duration	Unhealthy	543(74.1%)	830(66.9%)	χ^2=11.273 p=0.001
	N	733	1241	

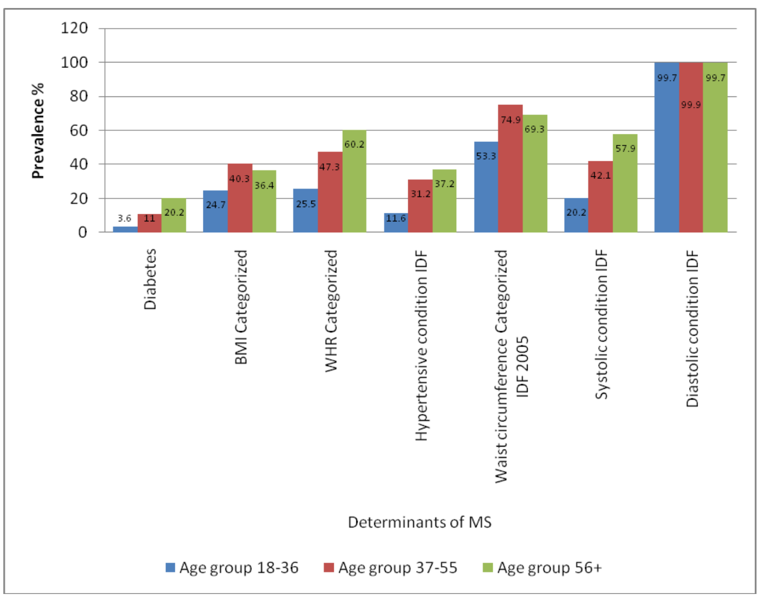


Figure 2. Age groups specific determinant of MS.

dehydration might predispose an individual to suffering from Metabolic Syndrome.

Having a body weight increase of more than 10 kg over the past 10 years was a criterion that was observed to be strongly associated with the patients suffering from the Metabolic Syndrome (P < 0.001).

Variation of MS indicators with Age

For most of the components or indicators (Elevated Blood sugar levels, Waist to Hip Ratio, Hypertensive condition according to the IDF 2005 criteria) there was a steady increase in the prevalence estimates with age. (See Figure 2). With the exception of the body mass index and waist circumference, there is a tendency for the prevalence estimate of these components to plateau out or decrease slightly in the elderly (Age >56 years). Dissecting the components of elevated Blood pressure into systolic and diastolic values gave different prevalent trends with age: while the systolic value increased with age,

Table 4a. Cross Tabulation of sex, age and lifestyle options with different determinants/components of MS.

	Category	Diabetes Condition				BMI				WHR			
		n (%)	95% C.I	N	x^2 (p value)	n (%)	95% C.I	N	x^2 (p value)	n (%)	95% C.I	N	x^2 (p value)
Sex	Male	69(10.6%)	8.4-13.2	650	P=0.365	183(25.3%)	22.2-28.6	723	P<0.001	298(40.8%)	37.2-44.5	730	P=0.846
	Female	105(9.3%)	7.7-11.1	1130		470(38.4%)	35.7-41.2	1224		508(41.3%)	38.5-44.1	1231	
Age	<41	40(4.7%)	3.4-6.3	856	P<0.001	251(26.5%)	23.7-29.5	946	P<0.001	275(28.9%)	26.0-31.8	953	P<0.001
	41+	132(14.4%)	12.2-16.9	914		401(40.5%)	37.4-43.6	990		526(52.8%)	49.6-55.9	997	
Residence	Urban	116(9.5%)	7.9-11.3	1215	P=0.635	394(32.5%)	29.8-35.2	1214	P=0.192	509(41.9%)	39.1-44.7	1216	P=0.384
	Peri urban	58(10.3%)	7.9-13.1	565		259(35.5%)	31.9-38.9	733		297(39.9%)	36.3-43.5	745	
Dietary habits	Healthy	110(9.4%)	7.8-11.2	1167	P=0.493	415(32.8%)	30.2-35.4	1266	P=0.334	538(42.2%)	39.4-44.9	1276	P=0.192
	Unhealthy	64(10.4%)	8.1-13.1	613		238(34.9%)	31.4-38.7	681		268(39.1%)	35.5-42.9	685	
Sporting activities	Inactive	134(10.0%)	8.5-11.8	1334	P=0.508	498(34.0%)	31.6-36.5	1465	P=0.459	623(42.2%)	39.6-44.7	1477	P=0.090
	Active	40(9.0%)	6.5-12.0	446		155(32.2%)	28.0-36.5	482		183(37.8%)	33.5-42.3	484	
Occupation	Active	19(7.9%)	4.8-12.1	240	P=0.297	64(23.4%)	18.5-28.8	274	P<0.001	91(32.6%)	27.1-38.5	279	P=0.002
	Sedentary	155(10.1%)	8.6-11.7	1540		589(35.2%)	32.9-37.5	1673		715(42.5%)	40.1-44.9	1682	
Alcohol consumption	Heavy	116(10.2%)	8.5-12.2	1133	P=0.384	405(32.0%)	29.5-34.7	1264	P=0.057	526(41.3%)	38.6-44.1	1273	P=0.789
	Moderate	58(9.0%)	6.9-11.4	647		248(36.3%)	32.7-40.0	683		280(40.7%)	37.0-44.5	688	
Protein source	Healthy	85(10.5%)	8.5-12.8	808	P=0.335	281(32.4%)	29.3-35.6	867	P=0.345	380(43.4%)	40.1-46.8	875	P=0.060
	Less healthy	89(9.2%)	7.4-11.1	972		372(34.4%)	31.6-37.4	1080		426(39.2%)	36.3-42.2	1086	
Sleep duration	Healthy	52(9.4%)	7.1-12.2	552	P=0.735	208(35.0%)	31.2-39.0	594	P=0.360	242(40.6%)	36.6-44.7	596	P=0.767
	Less healthy	122(9.9%)	8.3-11.7	1228		445(32.9%)	30.4-35.5	1353		564(41.3%)	38.7-44.0	1365	
Consumption of rapid sugar	Yes	101(7.2%)	5.9-8.6	1410	P<0.001	508(32.8%)	30.5-35.2	1548	P=0.184	612(39.3%)	36.8-41.7	1559	P=0.001

Table 4b. Cross Tabulation of sex, age and lifestyle options with different determinants/components of MS[cont'd] .

	Category	W.C				H.T (WHO)				H.T (IDF 2005)			
		n (%)	95% C.I	N	x^2 (p value)	n (%)	95% C.I	N	x^2 (p value)	n (%)	95% C.I	N	x^2 (p value)
Sex	Male	304(41.6%)	38.0-45.2	731	P<0.001	123(16.8%)	14.1-19.7	733	P=0.030	218(29.7%)	26.5-33.2	733	P<0.001
	Female	985(79.9%)	77.5-82.1	1233		164(13.2%)	11.4-15.2	1241		267(21.5%)	19.3-23.9	1241	
Age	<41	541(56.7%)	53.5-59.9	954	P<0.001	67(7.0%)	5.5-8.8	957	P<0.001	135(14.1%)	12.0-16.5	957	P<0.001
	41+	742(74.3%)	71.4-77.0	999		220(21.9%)	19.4-24.6	1006		349(34.7%)	31.7-37.7	1006	
Residence	Urban	832(68.4%)	65.7-71.0	1217	P=0.001	234(19.1%)	17.0-21.5	1222	P<0.001	372(30.4%)	27.9-33.1	1222	P<0.001
	Peri urban	457(61.2%)	57.6-64.7	747		53(7.0%)	5.3-9.1	752		113(15.0%)	12.5-17.8	752	
Dietary habits	Healthy	821(64.2%)	61.5-66.9	1278	P=0.077	180(14.0%)	12.2-16.1	1283	P=0.382	314(24.5%)	22.1-27.0	1283	P=0.893
	Unhealthy	468(68.2%)	64.6-71.7	686		107(15.5%)	12.9-18.4	691		171(24.7%)	21.6-28.1	691	
Sporting activities	Inactive	993(67.1%)	64.7-69.5	1479	P=0.014	207(13.9%)	12.2-15.8	1486	P=0.180	351(23.6%)	21.5-25.9	1486	P=0.087
	Active	296(61.0%)	56.5-65.4	485		80(16.4%)	13.2-20.0	488		134(27.5%)	23.5-31.6	488	
Occupation	Active	137(49.1%)	43.1-55.1	279	P<0.001	16(5.7%)	3.3-9.1	282	P<0.001	34(12.1%)	8.5-16.4	282	P<0.001
	Sedentary	1152(68.4%)	66.1-70.6	1685		271(16.0%)	14.3-17.8	1692		451(26.7%)	24.6-28.8	1692	
Alcohol consumption	Heavy	800(62.7%)	60.0-65.4	1276	P<0.001	200(15.6%)	13.6-17.7	1284	P=0.074	325(25.3%)	22.9-27.8	1284	P=0.296
	Moderate	489(71.1%)	67.5-74.4	688		87(12.6%)	10.2-15.3	690		160(23.3%)	20.1-26.5	690	
Protein source	Healthy	586(66.9%)	63.7-70.0	876	P=0.290	143(16.3%)	13.9-18.6	880	P=0.053	229(26.0%)	23.2-29.1	880	P=0.179
	Less healthy	703(64.4%)	61.7-67.5	1088		144(13.2%)	11.2-15.3	1094		256(23.4%)	20.9-26.0	1094	
Sleep duration	Healthy	396(66.4%)	76.0-83.3	596	P=0.617	82(13.6%)	11.0-16.7	601	P=0.455	136(22.6%)	19.3-26.2	601	P=0.185
	Less healthy	893(65.3%)	62.7-67.8	1368		205(14.9%)	13.1-17.0	1373		349(25.4%)	23.1-27.8	1373	
Consumption of rapid sugar	Yes	1047(67.0%)	64.6-69.4	1562	P=0.010	209(13.3%)	11.7-15.1	1567	P=0.003	362(23.1%)	21.0-25.3	1567	P=0.003
	Not at all	242(60.2%)	55.2-65.0	402		78(19.2%)	15.5-23.3	407		123(30.2%)	25.8-34.9	407	

the diastolic value showed the same elevated value for all the three groups. It is worth mentioning that diastolic value had the highest prevalent rates as compared with all the other components of the MS in this study.

The strongest association (p=0.001) was between diabetes condition and cardiovascular history. The hypertensive condition according to WHO 1999 elevated BMI and WHR were all significantly associated with cardiovascular diseases history ($p<0.05$). High BMI and WHR were very significantly associated with history of diabetes. Metabolic Syndrome (WHO 1999, IDF 2005) was very significantly associated with family history of diabetes. [Table 4a and b]

Family history of obesity was most strongly associated with elevated BMI ($p<0.001$). The association between family history of obesity and metabolic syndrome (all three definitions) was significant ($p<0.05$) for all definitions of metabolic syndrome rate increases with age. There is no significant difference between prevalence rate males and females. 85% of those surveyed had sedentary job, 65% heavy drinkers, 79.4% having a sweet tongue while 69% sleep for less than 7-9 hours daily thus unhealthy sleep pattern. Only 41% were physically active.

With respect to physical activity, the elderly group had highest proportion of inactive while youths had unhealthy eating habit. Youths had highest proportion of heavy drinkers and rapid sugars consumption unit significant difference between age groups ($p<0.001$). For sleeping pattern, most surveyed within all age groups had unhealthy sleeping pattern with no significant difference between the age groups.

The urban dwellers had a higher proportion of physically inactivity, unhealthy eating habit and sedentary jobs. Peri-urban dwellers not only slept for longer hours daily than their urban counterparts but had a higher proportion of heavy drinkers.-More females were inactive physically ($p<0.001$) and sedentary-job wise, and had unhealthy eating habit. More males were heavy drinkers though the different was not very significant (p=0.006). There was no significant association between patients having a history of gout and the determinants of the metabolic syndrome.

DISCUSSION

The lifestyle options considered in this study include: physical activity, dietary habits, nature of occupation, alcohol consumption, sleep patterns, consumption of rapid sugars and preferred protein source. The IDF definition gave the highest prevalence rate for the metabolic syndrome (Figure 2). Lifestyle options showed significant associations with the determinants of the metabolic syndrome. Hypertension was significantly associated with area of residence, occupation and consumption of rapid sugars ($p<0.001$). Sleep duration and sporting activities were not significantly associated with the determinants of the metabolic syndrome. Sedentary lifestyle (χ^2 P=0.11), drinking of less than 1 liter of water a day (P= 0.04), diabetes history ($p<0.001$) and the consumption of rapid sugars ($p<0.015$) were the only four lifestyle options that showed a significant association with the determinants of MS.

Any association between determinants of MS and lifestyle options should provide an opportunity to encourage radical lifestyle changes in view of lowering the risk of cardiovascular disease and diabetes. Another study Sharma et al. (2011) reported that the prevalence of the MS was higher in the less educated, people working at home, and females. The amount of physical activity involved in home workers is unknown, but the results suggest it is less than that undertaken by other workers. In our study, more females were inactive physically ($p<0.001$) and sedentary-job wise, and had unhealthy eating habit than their male counterparts. Other investigators Ferguson et al. (2010) reported that in females, central obesity was inversely associated with occupation and educational level.

Diet choice and portion control are key to the prevention and treatment of the MS. The Mediterranean diet is without doubt one of the best options for strong metabolic syndrome prevention, while the low glycemic index [GI-] foods for its treatment (Antoaneter, 2010). Thus the high consumption of rapid sugars observed more in the urban setting would only exacerbate the metabolic syndrome since urban dwellers have a more sedentary lifestyle than their peri-urban counterparts. In our study the consumption of rapid sugars was associated with the diabetic condition. Moreover, the level of obesity and fasting glucose level had positive correlation with the intensity of vascular changes in the fundus of the eye (Irzmański, 2011) thus determinants of metabolic syndrome have high impact on advancing vascular complications in these MS patients. Hypertension defined by both the WHO 1999 definition (systole/diastole >140/90) or the IDF 2005 definition (systole/diastole >130/85) was significantly associated with setting type or place of residence ($p<0.001$), occupation ($p<0.001$) consumption of rapid sugars (p=0.003).

The urban dwellers had a higher proportion of physically inactivity, unhealthy eating habit and sedentary jobs. Peri-urban dwellers not only slept for longer hours daily than their urban counterparts but had a higher proportion of heavy drinkers. Reducing the amount of alcohol to much less than two standard drinks a day is imperative as this might aid to lower triglyceride levels(Sanjib et al,2011) Moreover this would go a long way to prevent alcohol related liver diseases.

Hypertension defined by both the WHO 1999 definition (systole/diastole >140/90) or the IDF 2005 definition (systole /diastole >130/85) was significantly associated with setting type or place of residence ($p<0.001$), occupapation (p<0.001) consumption of rapid sugars (p=0.003).

Lifestyle options that were not significantly associated with any of the determinants of M S include sleep duration [healthy/unhealthy], preferred protein source or indulgence in sporting activities. As for as the lifestyle options are concerned, sedentary lifestyle (χ^2 P=0.11), Drinking of less than 1 liter of water a day (P= 0.04), diabetes history (p<0.001) and the consumption of rapid sugars (p<0.015) were the only four lifestyle options that showed a significant χ^2 difference (Table 2). This suggests that dehydration might predispose on individual to suffering from Metabolic Syndrome. All these findings seem to be contrary to a recent finding by some investigators Sharma et al. (2011) who reported that there was no significant correlation between the participants' lifestyle factors and the prevalence of MS.

Having a body weight increase of more than 10 kg over the past 10 years was a criterion that was observed to be strongly associated with the patients suffering from the Metabolic Syndrome (P < 0.001).

Fezeu et al. (2007) reported that there were direct associations between a sedentary lifestyle and MS, body mass index, abdominal and pelvic circumferences, systolic blood pressure, heart rate, apolipoprotein B, and triglycerides, and inverse associations with high-density lipoprotein cholesterol. In our study we observed that BMI was associated with the nature of the occupation. Cabrera de Leónetal,2007 reported that both definitions of a sedentary lifestyle (that is based on physical activity duration and on energy expenditure) were more strongly associated with the metabolic syndrome as defined by International Diabetes Federation criteria than by Adult Treatment Panel III criteria but in our study, physical activity was evaluated based on physical activity duration .We found out that sporting activities was associated with waist to Hip ratio (WHR) while Waist Circumference, the main indicator of central obesity was significantly associated with area of residence (p=0.001),occupation (p<0.001) and alcohol consumption (p<0.001). The prevalence of total and abdominal obesity was high in rural and urban areas; the prevalence of the metabolic syndrome was low. High physical activity, even without reduced body fat mass, greatly improves all metabolic profiles (lipids, insulin resistance, and blood pressure.

The urban-rural difference in the prevalence of metabolic syndrome is possibly partly explained by the differences in the levels of physical activity. Therefore, any decrease in the level of physical activity would lead to a dramatic increase in the prevalence of the metabolic syndrome. Thus government Intervention should be geared at increasing the physical activity along with healthier food patterns and health education through awareness campaigns .Successful community-based intervention programs have been reported in developed countries, and a similar approach is required in developing countries. Reports of interventional programs in China and India, especially directed toward children, have shown encouraging results, but large-scale programs involving adults/children are required. Various other health strategies consisting of individual and community initiatives, backed up by governmental and legislative efforts, would also help in minimizing the increasing prevalence of obesity and the metabolic syndrome in developing countries (Mortala et al., 2011).

In developed countries the CVD burden is inversely related to the socioeconomic status (Kaplan and Keil, 1993; Gulliford, 2003) while a positive association may instead be seen in developing countries still emphasizing the need for health education and campaigns targeting all sectors of society. All modifiable risk factors should be the focus point in the management of patients with type 2 diabetes and metabolic syndrome (Ogbera, 2010).

Strength and Limitation of the study

This study was done using a hospital based sample and should therefore be representative of the urban and peri-urban population as the purposive-clustered randomized sampling technique was used. This study however represents the best estimates of prevalence of metabolic syndrome in the littoral Region as there are no other published studies on the subject.

Measurements made during the study followed standardized procedures thus limiting the likelihood of measurement error and misclassification. However since determination of lifestyle options was based on questionnaire data, some participants may have had inaccurate information on these questions, and thus could result in misclassification.

Participants with missing values were excluded from the analysis to ensure that all analyses were done on the same data. The proportion with missing values were relatively small (7%) and there were no differences in baseline characteristics for those excluded compared to those included in the analysis. It is therefore unlikely that any bias resulted from the exclusion of persons with missing data.

The major limitation of the study is it was a hospital –based and not population based.

Being a cross sectional study it makes it difficult to establish causal associations, which are easier to establish with prospective or longitudinal studies.

CONCLUSION

Lifestyle options have significant associations with the determinants of the Metabolic Syndrome. Hypertension was significantly associated with area of residence, occupation and consumption of rapid sugars (p<0.001).This study suggests that sleep duration and sporting activities were not significantly associated with the determinants of the metabolic syndrome.

Dehydration (caused by drinking less than a liter of water a day) and weight gain (having put on more than 10kg during the past 10 years) could predispose to metabolic syndrome.

COMPETING INTERESTS

The authors declare that they have no competing interests

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