International Journal of Medicine and Biomedical Research
Volume 1 Issue 2 May – August 2012
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Original Article

Prevalence of metabolic syndrome using weight and weight indices in an apparently healthy Nigerian population

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Received: 24.04.12; Accepted: 20.06.12

ABSTRACT

Background: Notions about the metabolic syndrome (MS) emphasized the importance of obesity. This may prevent the early diagnosis of the condition in normal weight individuals. **Aim:** To determine variations in prevalence of MS according to different weight and weight indices. **Materials and Methods:** 342 apparently healthy subjects (men 164; women 178), aged 35 to 85 years were randomly selected for the study. 240 were urban residents while 102 were rural dwellers. Anthropometric measurements and fasting blood samples were collected between 8 am and 11 am. Body mass index (BMI) and waist-hip ratio (WHR) were calculated and fasting plasma glucose (FBG), triglycerides (TG) and high density lipoprotein cholesterol (HDL-C) determined. **Results:** A total of 80 subjects had three or more of predictors of the MS giving prevalence of 23.4%. Prevalence increased with BMI: 6.6%, 27% and 38.7% at BMI 18.5 – 24.9, 25 – 29.9 and ≥30 kg/m^2 respectively. Similar trends were observed with waist circumference (WC) and waist–hip ratio (WHR): 5.8%, 22.1% and 58.6% at WC ≤82cm, 83 – 100cm and >100cm and 7.5%, 28% and 60% at WHR ≤0.85, 0.86 – 1.00, and >1.00 respectively. MS was most prevalent at the extreme ranges of weight measures. An appreciable percentage of normal weight individuals, 6.6%, 5.8% and 7.5% for BMI, WC and WHR had the MS. **Conclusions:** MS was present in normal weight individuals and screening for the condition should be considered in this group. Prevalence of MS increased with weight irrespective of the weight index considered. WC and WHR appear to be better index of MS than BMI. Urban residence is a risk factor and this may be due to unhealthy lifestyle.

Key words: Weight, BMI, waist circumference, waist-hip ratio, obesity,

INTRODUCTION

Metabolic syndrome (MS) is a cluster of cardiovascular risk factors.[1,2] Insulin resistance and obesity were reported to be the underlying factors of the syndrome.[3,4,5] It is affecting the general population in epidemic proportions.[6,7,8] Notions about the MS emphasized the importance of obesity and MS is been found to increase with

rise in BMI.[9,10] However, there are many individuals who are not obese on the basis of body mass index (BMI), but have the MS; the metabolically obese normal-weight (MONW) individuals.[11,12] MS has been reported in an individual with BMI <18.5 kg/m.[2.13] The emphasis on weight as a risk factor of the syndrome may prevent the early diagnosis of MS in normal weight individuals. Weight is expressed either as BMI, WC or WHR and individuals are classified as either normal, overweight or obese based on the values of these parameters. BMI is classified into three: normal, 18.5 – 24.9kg/m^2; overweight, 25 – 29.9 kg/m^2 and obese, >30 kg/m.[2,14] As for WC, values below 88cm are said to be normal for women while 102cm are normal for men.[15] Values above these figures are therefore abnormal. Men and women whose WHR are >0.9 >0.85 respectively are also said to be obese.[16] There is yet no report on the distribution of the MS among apparently healthy Nigerians according to these classifications.

The study thus highlighted the significance of weight classifications in the prevalence of MS and the need for screening for the MS in apparently healthy subjects without regard to weight index.

MATERIALS AND METHODS

Three hundred and forty two individuals (men 164, women 178) within the age range 35-85 years (mean 56; median 54.5) were randomly recruited for the study. 240 were urban dwellers while 102 were rural dwellers. The Ethics Committee of the University of Nigeria Teaching Hospital approved the study protocol and informed consent was obtained before data and sample collections. The work was done between March and September, 2006. Subjects must be within the age bracket, apparently healthy with no history medication in the preceding 3 months. They must have been living in their respective localities for upwards of 2 years.

Subject stood on a firm and level surface without shoes at a right angle to the vertical board of the height measurement device to determine the height and readings were taken to the nearest 0.5cm.[17] Body weight in light clothing was measured to the nearest 0.1kg using electronic scale balance. An average of two readings (in kg) was taken and body mass index (BMI, kg/m^2) was calculated as weight divided by the square of height in meters (m^2).[17] Waist circumference was measured at the umbilicus. This and hip circumference were measured using ordinary tailor's tape and waist-hip ratio calculated. The blood pressure measurements were taken three times in the left arm with the participants sitting and after 10 minutes rest using Accusson's mercury sphygmomanometer with appropriate cuff sizes.[17]

Fasting blood samples, (5ml), were collected from subjects between 8 am and 11 am each day using standard methods.[18] 1ml of blood sample was put into heparinized tube and spun at 3000 revolutions per minute for 5 minutes and the plasma was used for glucose estimation within three hours to avoid loss of glucose. The rest of the sample was put into a plain sample tube and allowed to clot at room temperature. They were similarly spun and the serum harvested and used for the determination of triglycerides and HDLC.

PG was determined by the method of Trinder,[19] serum TG by the method of Buccolo and David.[20] HDLC was estimated in the serum supernatant after precipitating β-apoprotein containing lipoproteins using the method of Allain *et al*.[21] Cromatest(R) mono-reagent test kits manufactured by Linear Chemicals, Spain, 2005, were used for biochemical determinations.

Metabolic syndrome was diagnosed in the presence of any three of the following factors: excess WC (men >102cm, women >88cm), raised TG (1.70mmol/l), raised blood pressure (≥85mmHg diastolic and/or ≥130mmHg systolic), low HDL-C (men ≤ 1.0mmol/l, women ≤ 1.3mmol/l), and raised PG (≥ 5.6mmol/l).[22]

For analyses, subjects were grouped according to residence (urban or rural), sex (men and women) weight indices and weight class and prevalence of MS determined. Normal weight is BMI 18.5-24.9kg/m^2, WC <82cm, WHR <0.85; overweight is BMI 25 – 29.9kg/m^2, WC 83 -100cm and WHR 0.86 -1.0 and obesity is BMI ≥30kg/m^2, WC >100cm and WHR >1.0.

RESULTS

A total of 80 subjects had three or more of predictors of the MS giving prevalence of 23.4%. Prevalence increased with BMI: 6.6%, 27% and 38.7% at normal, overweight and obese BMI respectively. Six subjects (1.8%) all with BMI >40kg/m^2 had not the MS. Similarly prevalence rose with increase in WC: 5.8%, 22.1% and 58.6% and WHR: 7.5%, 28% and 60% respectively (Table1).

The study population was near evenly distributed among the three classes of BMI, normal, overweight and obese as follows: 35.3% (121), 33.6% (115) and 31% (106) respectively. Most of the subjects were found in the class 2 (overweight) ranges of WC 52.6% (181) and WHR 69.9% (239) (Table 1).

Normal weight BMI, WC and WHR recorded prevalence of 6.6%, 5.8% and 7.5% respectively. In overweight ranges the following prevalence values were obtained: 27%, 22.1% and 28% respectively.

In the obesity ranges prevalence values stood at 38.7%, 58.6% and 60% respectively (Table 1). Most of the rural dwellers were found in the normal weight range while urban residents dominate the overweight and obesity ranges (Table 1).

Men in the normal weight ranges had minimal prevalence of MS, (0.6%) while the women recorded an average of 3.3% (Table 2). Urban residents had moderate prevalence in the normal weight ranges (average 13%) while rural dwellers had minimal prevalence (average 1.6%) (Table 2)

Table 1: Distribution of urban and rural dwellers with metabolic syndrome and prevalence according to weight and weight indices

	BMI(kg/m2)			WC(cm)			WHR		
	18.5-24.9	25-29.9	≥30	<82	83-100	>100	<.85	.86-1.0	>1.0
Urban Men	31	50	36	22	75	20	24	90	3.0
Urban Women	19	40	64	27	66	30	47	71	5.0
Rural Men	35	11	1.0	28	18	1.0	5.0	42	0.0
Rural Women	36	14	5	26	22	7.0	17	36	2.0
Total	121	115	106	103	181	58	93	239	10
% of Total	35.3	33.6	31	30.1	52.6	16.9	27.2	69.9	3.0
No with MS.	8.0	31	41	6.0	40	34	7.0	67	6.0
Prevalence %	6.6	27	38.7	5.8	22.1	58.6	7.5	28	60

Table 2: Differences in the prevalence of metabolic syndrome (%) between urban and rural residents; men and women according to weight and weight indices

	BMI (kg/m^2)			WC(cm).			WHR		
	18.5-24.9	25-29.9	≥30	<82	83-100	>100	<0.85	.86-1.0	>1.0
Urban Residents	22	24.4	38	10	23.4	58	9.9	32.9	75
Rural Residents	2.8	36	13.3	1.9	17.5	62.5	0.0	16.7	0.0
Men	0.6	6.1	7.3	0.6	4.9	8.5	0.6	12.2	1.2
Women	3,9	11.8	15.7	2.8	18	11.2	3.3	25.8	2.2

DISCUSSION

MS prevalence of 23.4% obtained in this study agrees with the reports.[9,23,24,25,26] The subjects were evenly distributed in the three classes of BMI and prevalence increased proportionally. It has been reported that prevalence of MS increased with increase in BMI.[9,10] The number of the subjects found in the overweight ranges of WC and WHR 52.6% and 69.9% respectively correspond roughly to the number in the overweight-obesity range of BMI, 64.6%.

These ranges, therefore, may be equivalent to the overweight-obese class. Although prevalence rates were not high in these WC and WHR ranges, it was highest after and lowest before them. These, therefore, may be defining ranges above which it might become necessary to screen for the MS in an individual. Since these are the most populous weight classes they may easily be mistaken for evidence of good living and screening overlooked. Besides, the use of measures of visceral adiposity, WC and WHR, in the diagnosis of MS may be preferred to BMI for the above reason and for the fact that in elderly subjects, >50 years, muscle mass is to a varying degree replaced by fat, much of it within the abdomen leading to increasing WC and higher WHR.[27]

An appreciable percentage of the normal weight individuals also had the MS. These are the metabolically obese normal-weight (MONW) individuals.[11,12] These people may be missed in the diagnosis of MS if obesity or overweight is emphasized. In the normal weight ranges, MS is rare especially among rural men. Urban women in this class recorded minimal prevalence thus making urban residence a risk factor for the MS in the study population, more so as the few men with the syndrome in this weight class were all urban dwellers as well.

The case in this study, of six subjects (1.8%) with BMI >40kg/m^2 and without MS requires further explanation. Visceral fat is implicated in the pathogenesis of MS.[28] It may be speculated therefore, that visceral adiposity develops early in obesity and does not continue to do so after a stage which may correspond to the BMI 39.9kg/m^2 and WHR 1.00 when fat begins to be deposited in areas that may not be critical to the development of MS. Most of the urban dwellers were in the overweight/obese BMI class while most of the rural dwellers were in the normal BMI class. This is

associated with differences in lifestyles. Exercise and dietary habits have been implicated as causative factors of obesity and therefore the MS.[29,30,31]

CONCLUSION

MS was present in normal weight individuals and screening for the condition should be considered in this group. Prevalence of MS increased with weight irrespective of the weight index considered. WC and WHR appear to be better index of MS than BMI. Urban residence is a risk factor and this may be due to unhealthy lifestyle.

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doi: http://dx.doi.org/10.14194/ijmbr.129

How to cite this article: Ogbu I.S.I, Chukwukelu E.E. Prevalence of metabolic syndrome using weight and weight indices in an apparently healthy Nigerian population. Int J Med Biomed Res 2012;1(2):141-146.

Conflict of Interest: None declared