

# Prevalence of prehypertension, hypertension and high body mass index in newly presenting diabetics in sub-Saharan Africa

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## Abstract

Hyperinsulinaemia has been hypothesized to underlie the pathophysiology of diabetes and hypertension especially as they relate to the deadly quartet or metabolic syndrome. Our aim in embarking on this study was to determine the proportion of individuals whose primary diagnosis was diabetes that also had hypertension in the Northeast zone of Nigeria. In this study we analysed the clinic records of 100 newly presenting diabetic patients and reported on their demographic characteristics, anthropometric measurements, blood pressures and urinalysis results. Our study population was made up of 53 male and 47 female diabetic patients whose ages ranged between 19 and 78 years old with a mean and standard deviation of 46.2 +/-13.2 years. Twenty percent of the male and 72.7 % of the female had greater than 102 and 88 cm waist circumferences respectively. The mean body mass index (BMI) for the group was 26.35 +/- 5.45 kg/m<sup>2</sup> but 58.6% of the study population was either overweight or obese. Prehypertension was present in 36 % of the group but only 37% of the diabetic patients achieved the recommended BP goal of < 130/80 mmHg while hypertension stages 1&2 was seen in 37 % of the group at the first visit and 43 % at the second visit. Prehypertension, hypertension, overweight and obesity are common in the newly presenting diabetic patients in the sub-Sahara Africa. The study findings call for action at the primary health care level to reduce the burden of modifiable cardiovascular risk factors at the community level.

## INTRODUCTION

There is a global epidemic of vascular diseases that is fuelled mainly by hypertension and diabetes which some postulate have a common pathophysiologic root in hyperinsulinaemia. The global disease burden of diabetes mellitus has been on the increase in recent times with the total number of diabetics being put at 185 million, a figure which is expected to double by 2025 mainly as a result of the increase in the number of type 2 diabetics globally. Among the World Health Organisation (WHO) global regions that are expected to experience a disproportionate increase in prevalence of diabetes are the middle and low income countries of Asia and sub-Saharan Africa. The common explanation for this epidemic of diabetes is the increasing adoption of the Western lifestyle which not only predisposes to diabetes, but also favours the development of hypertension and obesity. Reaven described the metabolic syndrome or syndrome X which is also regarded as the deadly quartet of upper body obesity, hyperinsulinaemia / insulin resistance and hypertension (1). In order to curtail the risk of developing of vascular complications in the individuals with diabetes the

Seventh report of the Joint National Committee (JNC 7) guideline has recommended the attainment of a blood pressure goal of less than 130/ 80 mmHg (2). A high body mass index is a modifiable component of the syndrome X, that predisposes the individual to diabetes mellitus, hypertension and is also a risk factor for coronary heart disease and chronic kidney disease independent of ethnic origin (3). Whereas hypertension may affect about 15% of the general population in Nigeria,(4) the prevalence of hypertension in diabetic patients in the Northeast of Nigeria is unknown. Our aim in embarking on this cross sectional study was to determine the frequency of pre-hypertension, hypertension and obesity in a cohort of diabetics attending the medical out-patient clinic of the Teaching Hospital at Maiduguri, Nigeria.

## METHODS

The setting for this study was the Medical out-patient clinic of the Maiduguri University Teaching Hospital at Maiduguri. The study population was made up of adult patients 18 years and older with a diagnosis of diabetes

mellitus according to the American Diabetes Association criteria (3). In this retrospective study we analysed the records from the first two clinic visits of the diabetics and reported on the demographic characteristics, anthropometric measurements, blood pressure and urine protein estimation by dipstick test. We determined the body mass index (BMI) of the patients by dividing the individual's weight in kilograms by the square of the height in meters. The study population was categorized into the BMI groups which were constituted by those patients whose measurements fell within the less than 20, 20-24.9, 25-29.9 and the 30 kg/m<sup>2</sup> and above BMI categories. The blood pressure readings which were used in this study were those ones taken at the first two clinic visits. The majority of the hypertensive patients were aware that they had elevated blood pressures and they self reported compliance to prescribed drugs. The blood pressure findings were grouped according to the JNC 7 report staging of hypertension in which the systolic and diastolic pressures were equally weighted and either of them qualified the patient for a BP group. The JNC 7 guideline described the optimal blood pressure as those measurements that are less than 120/80mmHg. The next category of blood pressure measurements comes under the term prehypertension which includes the range of systolic blood pressure of 120 to 139 or diastolic pressure of 80 to 89 mmHg; either of which qualified the individual as having prehypertension. Blood pressure readings equal or greater than a systolic of 140 mmHg and/or diastolic of 90 mmHg were classified as hypertension stage 1 (systolic BP 140 to 159 mmHg and / or diastolic BP 90 to 99 mmHg) or stage 2 for blood pressures equal or greater than 160mmHg systolic and /or 100 mmHg diastolic.

## RESULTS

We studied 100 diabetic patients who were made up of 53 males and 47 females whose ages ranged between 19 to 78 years with an average age of 46.2 years for the study population. Weight measurements were carried out in 92 individuals whose mean weight was 69.9 kilograms. The typical diabetic member of the study population was in the overweight category with a mean body mass index of 26.3 kg/m<sup>2</sup> (Table I).

**Figure 1**

Table 1: Characteristics of the study population

Variable	Number	Mean	Range	+/-SD
Age (years)	100	46.25	19-78	13.23
Weight (kg)	92	69.96	43.5-110	15.18
Height (cm)	50	164.4	166-180	10.78
BMI (kg/m <sup>2</sup> )	50	26.35	17.3-38.9	5.45
Waist (cm)	44	91.62	64-135	13.75
Hip (cm)	44	97.11	72-124	11.66
W/H	44	0.94	0.74-1.37	0.101
T Chol	41	5.15	3.4-7.5	0.70
HDL Chol	41	1.395	0.4-2.7	0.49
LDL Chol	41	3.10	1.3-5	0.98
Trigly	41	1.43	0.6-3.6	0.67

BMI; body mass index, W/H waist : hip ratio, T chol; total cholesterol, HDL chol; High Density Lipoprotein cholesterol, LDL chol; Low Density Lipoprotein, Trigly; Triglycerides

The overall prevalence of BMI greater than 25 kg/m<sup>2</sup> was 58.6% which was made up of the overweight category or BMI 25-29.9 kg/m<sup>2</sup> (36.9%) and the obese group who had body mass indices of 30 or greater and they constituted 21.7 % of the study population. The average waist circumference for the study group was 91.62 +/-13.75cm but 20 % of the males versus 72.7% of the females had circumferences greater than 102 cm and 88 cm respectively. Among the evaluated vascular risk factors, the BMI had the most noticeable correlation with the blood pressure when we compared its contribution to those of weight and age (r = 0.32 versus 0.26 and 0.17 for weight and age respectively). The mean systolic blood for the study population was 133 mmHg at the visit 1 and 131 mmHg at the clinic visit 2 (Table II).

**Figure 2**

Table 2: Blood pressure measurements at two clinic visits

Measurement	Visit 1	Visit 2
SBP		
• Mean	133.0	131.0
• Range	80-240	80-210
• SD	26.0	23.9
DBP		
• Mean	83.5	81.4
• Range	50-140	40-140
• SD	16.23	15.4

SBP; systolic blood pressure, DBP; diastolic blood pressure, SD standard deviation of mean

Prehypertension was present in 36% of the study population at the first of the 2 initial visits while hypertension stages 1 or 2 was recorded in about 37 % of the patients at the first visit and 43 % at the second visit (Table III & IV) .

**Figure 3**

Table 3: Blood pressure groups at visit 1

Systolic Blood Pressure			
Range	Male	Female	Total (%)
< 120	14	11	25 (25.5)
120-139	13	23	36 (36.7)
140-159	16	8	24 (24.5)
> 160	8	5	13 (13.3)
Total	51	47	98 (100)

Diastolic Blood Pressure			
Range	Male	Female	Total (%)
< 80	16	21	37 (37.8)
80-89	13	12	26 (26.5)
90-99	9	5	24 (24.5)
100+	12	9	11 (11.2)
Total	51	47	98 (100)

Thirty-seven percent of the study group had the JNC 7 recommended blood pressure goal of less than 130/80 mmHg. The majority of the patients with BMI less than 25 kg/m<sup>2</sup> had optimal blood pressures whereas the majority of the overweight and obese had prehypertension or higher levels of blood pressure (Table V). Twenty-six percent of the study population had dipstick positive proteinuria of at least 1+ (Table VI).

**Figure 4**

Table 4: Blood pressure groups at visit 2

Systolic Blood Pressure			
Range	Male	Female	Total (%)
< 120	12	8	20 (22.7)
120-139	13	22	35 (39.8)
140-159	15	5	20 (22.7)
> 160	7	6	13 (14.8)
Total	47	41	88 (100)

Diastolic Blood Pressure			
Range	Male	Female	Total (%)
< 80	19	15	34 (38.6)
80-89	6	10	16 (18.2)
90-99	12	7	19 (21.6)
100+	10	9	19 (21.6)
Total	47	41	88(100)

**Figure 5**

Table 5: Blood pressure groups versus BMI

Blood pressure (mmHg)	Body mass index groups (%)			
	< 20	20-24.9	25-29.9	>30
< 120/80	63.6	42.3	27.5	29.4
120-139/80-89	27.3	26.9	17.2	35.3
140-159/90-99	9	15.4	27.5	23.5
> 160/100	0	15.4	27.5	11.7

**Figure 6**

Table 6: Urinalysis for protein classified according to the gender

Test	Number (%)	Male	Female
- ve	74(74)	41 (41)	33 (33)
+ ve	26 (26)	13 (13)	13 (13)
Total	100 (100)	54 (54)	46 (46)

## DISCUSSION

In this study we found high prevalence rates for hypertension, prehypertension and high body mass index in a cohort of diabetic patients at the University of Maiduguri Teaching Hospital, Nigeria. Interestingly the overweight and obesity rates in our outpatient diabetic patient resembled those of the American general population. In the National Health and Nutrition Examination Surveys (NHANES) 1999-2004, Coresh et al reported prevalence rates of 34% for overweight, and 30 % for obese compared to 33% versus 22% for overweight and obese for 1988-94 period in the general American population (6). We found in this study that the diabetic patients in the overweight and obese categories constituted 36% and 22% of the study population respectively. As the obesity rates increased in the NHANES from 22 to 30% for the periods 1988-94 and 1998-2004 the self reported diabetes rates also jumped from 5.4 to 6.8%. It may well be that without drastic changes in the lifestyles patterns at the community level, diabetes rates will increase in the near future as more people are expected to increase in weights in the sub-Saharan countries. In this study the prevalence rate of hypertension in the patients with diabetes recorded on two different hospital visits ranged between 37 to 43% when the criterion for diagnosis of hypertension was a blood pressure equal or greater than 140/90 mmHg. Cooper et al applied a cut-off blood pressure level of 140/90mmHg and reported a prevalence rate of hypertension of approximately 15 % among Nigerians in a multinational study that involved seven different populations of West African origin (7). The much higher prevalence rate of hypertension in diabetics shown in this study can be attributed to the fact that the diabetic population is associated with an increased risk of developing

hypertension. Drawing from the data of the United Kingdom Prospective Diabetes Study (UKPDS) the authors of Hypertension in Diabetes Study I, reported a prevalence rate of 39% for hypertension in diabetes when the blood pressure level for diagnosis was 160/90mmHg (7). They concluded that hypertension was a common problem in the newly presenting diabetic patients in the UK. Among previously diagnosed diabetics the attainment of the recommend blood pressure goal of 130/80mmHg is not often achieved even in Western industrialized countries like the US. In the Kidney Early Evaluation Program (KEEP) only 18% of the diabetic participants of that programme had blood pressure readings which were less than 130/80 (8). In our study 37 % of the members of the study population had blood pressure measurements less than 130/80 mmHg indicating a comparable result with that report by Saydah et al from their analysis of the NHANES 1999-2000 (9). From the findings of our study we can safely conclude that uncontrolled hypertension remains a common problem in a cohort of newly presenting diabetics attending a tertiary health facility in sub-Saharan Africa. In the US it has been reported that undiagnosed diabetes, some of whom had developed chronic complications of diabetes may account for up to one third of the total diabetic population (10). In sub-Sahara Africa with the poorly developed primary healthcare systems, the health burden imposed upon the communities by undetected and undiagnosed non communicable diseases such as hypertension, diabetes and chronic kidney disease are expected to be greater than the reported situation in the developed economies of Europe and North America. Lin and Pi-Sunyer reported a prevalence rate of hypertension in diabetics of 73% in African Americans, but noted that the rates were lower for the Whites and Mexican Americans thereby suggesting an ethnic disparity in rates of hypertension in diabetics (11). About 35 % of our study population were in the prehypertension blood pressure category. In recent times the importance of this blood pressure range as a cardiovascular risk factor has become recognized. Not only is there a tendency for prehypertension to progress to more severe forms of hypertension but on its own prehypertension imposes an increased risk of vascular diseases like stroke, coronary heart disease, heart failure and kidney disease (12). Prehypertension was reported to be present in 48 % of young Israeli adults indicating a higher prevalence than the 35% we found among our diabetic patients and the NHANES 1999-2000 cohort for which a rate of 31 % was reported (13,14). Among the Israelis with prehypertension there was an elevated cardiovascular risk

status as was shown by the higher blood glucose, body mass index, total cholesterol and low density lipoproteins levels. Some now consider prehypertension a pro-inflammatory condition demonstrating elevated C-reactive protein (15), homocysteine, tumor necrosis (16) factor levels whose deleterious effect may add on to other cardiovascular risk factors.

## CONCLUSION

Hypertension, prehypertension, overweight and obesity are common cardiovascular risk factors seen in newly presenting diabetics resident in sub-Sahara Africa. In line with current guidelines efforts, should be directed at reducing the current heavy disease burden by all shareholders including physicians, other healthcare workers and non governmental organisations. Health intervention strategies that are directed at weight and blood pressure reductions are urgently needed at the community level in sub-Sahara Africa.

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