

Research Article

Ethnic Variation in Normal Blood Pressure Among Rural and Urban Dwellers in Borno State, Nigeria

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Abstract

Normal arterial blood pressure was studied in urban and rural areas of Borno State, Nigeria, involving four major indigenous groups. A total of 816 subjects were recruited for the exercise. The subjects were randomly selected, comprising of 50% males and 50% females in both the urban and rural communities. The mean systolic blood pressure (MSBP) and mean diastolic blood pressure (MDBP) were significantly lower ($p < 0.5$) in individuals below 30 years compared to those subjects above 30 years of age. The mean arterial blood pressure (MABP) levels were significantly lower ($p < 0.5$) in women than in men and in rural than urban dwellers. The mean blood pressure levels (MSBP, MDBP and MABP) were significantly lower in the rural compared with the urban at all ages and in both sexes. However, two extremes were recorded in the results. The Margis showed the highest MSBP and MDBP, while the Kanuris had the least in all the parameters. The other ethnic groups living in these communities presented blood pressure levels falling within these two extremes.

Key Words: Normal blood pressure, ethnic variation, Kanuri, Babur, Gwoza, Marghi, Bomo State, Nigeria

INTRODUCTION

In previous studies, incidence of high blood pressure in pregnant women attending antenatal clinic at University of Maiduguri Teaching Hospital Maiduguri, Bomo State of Nigeria were reported to show different patterns among the major ethnic groups (Bobzom, 1998). Though the diagnosis of hypertension is based on the WHO criteria, it appears that the prevalence of hypertension in a community would be related well with the frequency distribution of normal blood pressure readings around mean blood pressure values. Thus, the WHO committee on hypertension recommended that studies be carried out all over the world to determine the distribution, and possible differences in normal blood pressure values in a given community (WHO, 2007). In view of this mandate, it is therefore rational to consider normal blood pressure levels in our communities.

This study was aimed at providing reliable reference on the range of normal blood pressure in four major ethnic and indigenous communities of Borno State, Northeast of Nigeria, resident in urban and rural communities (Plate 1). Three of the rural communities (Babur, Gwoza and Marghi) are living in the Savannah region of southern Borno State, with distance of between 100 to 250 Km south of Maiduguri, the State capital, while the fourth ethnic group (Kanuris) are located in the Arid Zone of northern Borno State, 50 to 100Km north of Maiduguri. The main occupation of the rural populace is subsistent farming while those in the cities are either petty traders or government employees.

In most reported cases in our society, hypertension is always diagnosed when the complications have set in. Thus, a second need would be to determine the normal range in order to employ preventive approach in terms of early detection to reduce the risk of such complications.



Plate 1
Map of Borno State in Nigeria, showing its borders with Niger republic, Chad and Cameroun. (Source: Google image 2017)

MATERIALS AND METHODS

Two sets of sample population from rural and urban settings in Borno State, Nigeria, comprising of four ethnic groups (Babur, Marghi, Kanuri and Gwoza) were recruited for the study. A total of 816 subjects consisting of males and females within the age range of 18 and 70 years were investigated for their blood pressure profile.

The investigation was carried out in major cities and villages of the state consisting of 50% of subjects (408) taken from the urban settings while the rest 50% were examined in the villages. Equal number of males and females were recruited for this study and they were randomly allocated in strata defined by size, age and ethnic group.

The purpose of the study was explained to the subject by a Community Health Officer in the language they understood. A structured questionnaire was also administered in which detailed history regarding gender, age, occupation, stable food, marital status, debilitating disease and history of hypertension in the family were recorded.

The main occupation of these rural dwellers is farming while the urban residents comprised of persons belonging to diverse occupations, such as school teachers, lawyers, health personnel, civil servants, professional drivers and housewives. Ethical clearance was obtained from the University of Maiduguri Teaching Hospital Ethical committee. People with history of hypertension or on hypertensive drugs were excluded.

Measurements of Arterial Blood Pressure

Blood pressure was measured in a quiet room in a sitting position with the arm resting on a table after 15 minutes of rest. The first and fifth phases of Korotkoff sound were taken as systolic blood pressure and diastolic blood pressure, respectively. The measurements were taken with a mercury sphygmomanometer using cuffs of different widths in order to surround at least two-thirds of the upper arm. The measurements were taken twice, with a five-minute interval, and the mean of the two determinations was used. The mean blood pressure levels were also determined.

Statistical Analysis: All results were expressed as mean \pm SD. The statistical package for the social sciences (SPSS) program, version 22 was used to compare significance between groups using the Student's t-test. Differences were considered significance when $P < 0.05$.

RESULTS

Normal Blood Pressure: Table 1 shows the normal range of blood pressure values recorded in different age groups from both the rural and urban populations. Generally, the range of normal blood pressure distribution fluctuated in both males and females in the urban settings.

The normal ranges of systolic blood pressure (SBP) within the age range 18-30 years were 100-130 mmHg and 90-130 mmHg in males and females, respectively. The diastolic blood pressure (DBP) was from 60-80 mmHg in both sexes of the same age bracket. With advancing age (31 - 40 years) the systolic blood pressure recorded in males and females were 110-135 mmHg and 90-130 mm Hg, while the DBP were 70-90 mmHg and 60-90 mmHg. Above 40 years the systolic blood pressure ranges recorded were the same (110-140 mmHg) in males and females in the cities while DBP were 70-90 mmHg and 70-100 mmHg in the corresponding sexes.

Among the rural dwellers examined the blood pressure was relatively stable in both men and women, showing no difference in the SBP, which ranged from 90-130 mmHg of subjects within the age range of 18-30 years. However, the DBP showed a slight difference between the two sexes, 60-90 mmHg in males and 60-80mmHg in females. It was also observed that the lower limits of the DBP were equal in both sexes. The systolic blood pressure recorded in the age group 31-40 years showed a higher upper limit in females than males while the lower limits were equal (100-140 mmHg in females and 100-130 mmHg in males). However, the diastolic blood pressure was 70-90 mmHg and 60-80 mmHg in males and females, respectively.

Above 40 years, the range of SBP recorded among the rural males and females were found to be 100-135 mmHg and 110-140 mmHg. The DBP, on the other hand, were 70-90 mmHg and 70-100 mmHg in males and females, respectively.

Mean Blood Pressure in the Rural Groups: The males in the rural settings (Table 2) had the highest mean systolic blood pressure (MSBP) of 119.7 ± 11 mm Hg from the Babur community and from within the age range of 18- 30 years. A significantly high mean of mean arterial blood pressure (MMABP) was recorded among the Gwoza and Babur men ($p < 0.05$), while the Kanuris resident in villages showed significant lowest MSBP of 107.88 ± 10 mmHg; mean diastolic blood pressure (MDBP) of 65.60 ± 8 mmHg and MMABP of 80.35 ± 5 mmHg, all at $p < 0.5$, when compared with other male, indigenous groups living in the same environment.

The highest MSBP of 123.82 ± 8 mmHg was calculated from the Babur men while the highest MDBP and MMABP were from the Gwoza men aged 31-40 years. These findings showed that the Babur and the Gwoza males have similar pattern of blood pressure distribution, since the highest mean blood pressure levels were recorded in these two ethnic groups from two generations of 18-30 years and 31- 40 years.

The mean blood pressure level calculated from the Babur males that were above 40 years showed similar high MSBP as obtained at earlier age groups. On the other hand, the Kanuris still showed a significantly low MSBP of 125.24 ± 13 mmHg at $p < 0.5$.

Table 1:
The Normal Range in Blood Pressure Values in Relation to Age in Urban and Rural Residents.

Age in years	MALES				FEMALE			
	SBP (mmHg)		DBP (mm Hg)		SBP (mm Hg)		DBP (mm Hg)	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
18-30	100-130	90-130	60-80	60-90	90-130	90-130	60-80	60-80
31-40	110-135	100-130	70-90	70-90	90-130	100-140	60-90	60-80
40 and above	110-140	100-135	70-90	70-90	110-140	100-140	70-100	70-100

Blood pressure in millimeter of mercury (mmHg); SBP- Systolic Blood Pressure; DBP- Diastolic Blood Pressure

Table 2:

Mean Systolic Blood Pressure (MSBP), Mean Diastolic Blood Pressure (MDBP), and Mean of Mean Arterial Blood Pressure (MMABP) among Males from the Ethnic groups in Borno State, Nigeria

Age in years	Ethnic Group	URBAN MALES			RURAL MALES		
		MSBP±SD (mm Hg)	MDBP±SD (mmHg)	MMABP±SD (mmHg)	MSBP±SD (mmHg)	MDBP±SD (mmHg)	MMABP±SD (mmHg)
18-30	Babur	117.53±10	75.88±8	89.76±8	119.7±11	77.12±8	89.31±7
	Gwoza	118.53±9	73.53±7	88.86±3	117.06±11	76.47±8	89.50±7
	Kanuri	*116.76±10	72.94±11	**87.55±10	***107.88±10	65.60±8	*80.35±5
	Marghi	119.88±6	77.06±5	91.33±5	108.35±12	69.41±8	82.35±9
31-40	Babur	123.76±9	78.06±6	92.96±6	123.82±8	78.24±7	93.43±5
	Gwoza	125.59±9	79.12±5	94.61±3	121.76±11	80.59±8	94.31±7
	Kanuri	126.65±8	80.00±5	95.55±4	120.59±12	74.70±6	90.00±9
	Marghi	126.82±4	77.65±8	94.71±5	118.59±11	75.47±11	89.84±10
40 & above	Babur	137.05±6	86.00±3	102.69±4	136.00±13	82.35±10	100.23±9
	Gwoza	**135.88±4	84.12±9	*101.37±6	127.06±10	83.24±10	97.84±8
	Kanuri	140.00±9	90.88±9	107.25±8	125.24±13	82.40±11	**96.6510
	Marghi	138.12±10	88.82±11	104.59±9	125.29±14	82.35±13	96.67±12

MSBP lowest in Kanuri *p<0.3212; MSBP Lowest in Kanuri ***p<0.4321; MSBP lowest in Gwoza in **p<0.4851
 MMABP Lowest in Kanuri **p<0.4212; MMABP Lowest in Kanuri *p<0.2130; MMABP Lowest in Gwoza *p<0.334
 MMABP Lowest in Kanuri **p<0.4225

Table 3:

The Mean Systolic Blood Pressure (MSBP), Mean Diastolic Blood Pressure (MDBP), and Mean of Arterial Blood Pressure (MMABP) Among Females from the Ethnic Groups in Borno State, Nigeria

Age in years	Ethnic Group	URBAN FEMALES			RURAL FEMALES		
		MSBP±SD (mm Hg)	MDBP±SD (mm Hg)	MMABP±SD (mm Hg)	MSBP±SD (mm Hg)	MDBP±SD (mm Hg)	MMABP±SD (mm Hg)
18-30	Babur	113.5±7	72.94±4	**86.47±4	110.00±8	72.82±6	85.22±6
	Gwaza	*112.06±11	69.41±7	86.86±6	111.76±12	74.71±9	87.06±8
	Kanuri	121.06±11	75.88±7	91.18±7	*109.00±10	66.47±7	**80.65±17
	Marghi	124.41±9	80.59±7	95.20±7	112.94±14	71.18±11	85.10±11
31-40	Babur	115.88±13	70.59±8	85.69±6	116.24±10	74.12±6	88.16±5
	Gwaza	110.94±9	73.53±7	86.00±7	109.41±12	71.18±6	*83.92±6
	Kanuri	**107.12±12	70.30±7	*82.57±9	113.54±12	75.88±6	88.43±8
	Marghi	110.94±12	73.53±6	86.00±6	112.35±13	75.88±8	85.69±7
40 & above	Babur	123.22±9	77.65±8	92.84±6	126.12±10	78.59±8	94.43±7
	Gwaza	128.82±13	84.12±7	99.02±7	**122.35±12	77.65±5	**92.55±6
	Kanuri	***122.06±12	75.88±5	91.27±5	126.47±12	84.71±8	98.63±7
	Marghi	135.24±7	87.06±10	103.12±8	127.35±10	84.11±10	98.53±9

MSBP lowest in Gwoza *p<0.4115; MSBP Lowest in Kanuri *p<0.4123; MSBP lowest in Kanuri **p<0.3221
 MSBP Lowest in Gwoza **p<0.3426; MSBP Lowest in Kanuri ***p<0.2845; MMABP Lowest in Kanuri **p<0.3522
 MMABP Lowest in Gwoza *p<0.4461; MMABP Lowest in Babur **p<0.3011; MMABP Lowest in Kanuri *p<0.4421

There was no significant difference in the MDBP among the different ethnic groups at the age of 40 years, though a significantly high MMABP of 100.23 ± 9 mmHg was recorded from the Babur and the lowest was from the Kanuris at 96.65 ± 10 mmHg.

The mean blood pressure from the rural females within the age of 18-30 years (Table 3) showed the MSBP to be 109.00 ± 10 mmHg; MDBP 66.47 ± 7 mmHg, and MMABP to be 80.65 ± 17 mmHg among the Kanuris. These values were the lowest when compared to the blood pressure readings obtained from the other indigenous groups living in Borno State. The Marghi women had a significant highest MSBP of 112.94 ± 14 mmHg (p<0.5) while the Gwoza females showed the highest MDBP of 74.71 ± 9 mmHg and MMABP of 87.06 ± 8 mmHg.

The mean blood pressure values in the rural women from the 31-40 year age range indicated the least MSBP of 109.41 ± 12 mmHg; MDBP of 71.18 ± 6 mmHg and MMABP of 83.92 ± 6 mmHg, all from the Gwoza community. The Kanuris had the highest MDBP of 75.88 ± 8 mmHg and MMABP of 88.43 ± 8 mmHg from the same age range. But the Babur

females had a significantly high MSBP of 116.24 ± 10 mmHg (p<0.5).

The mean blood pressure levels of rural women 40 years and above showed that the Marghis still had the highest MSBP at 127.35 ± 10 mmHg while the lowest MSBP of 122.35 ± 12 mmHg; MDBP of 77.65 ± 5 mmHg; and MMABP of 92.55 ± 6 mmHg were recorded among the Gwoza indigenes. The Kanuris within this age range showed a significantly high MDBP of 84.71 ± 8 mmHg and MMABP of 98.63 ± 7 mmHg at p<0.5.

Mean Blood Pressure in the Urban Groups: The Marghi males, aged 18-30 years from the urban setting, showed significantly high mean SBP of 119.88 ± 6 mmHg; MDBP of 77.06 ± 5 mmHg and MMABP of 91.33 ± 5 mmHg all at p<0.5 (Table 2). The lowest MSBP of 116.76 ± 10 mmHg; MDBP of 72.94 ± 11 mmHg, and MMABP of 87.55 ± 10 mmHg (p < 0.5) were seen in the Kanuris. The mean blood pressure levels of the urban Babur and Gwoza men aged 18-30 years fell between those of the Kanuris and Marghis.

The blood pressure parameters recorded in males aged 31-40 years showed no significant difference among these four ethnic groups. But above 40 years the Kanuris had the highest values of mean blood pressure, with MSBP of 140.00 ± 9 mmHg; MDBP of 90.88 ± 9 mmHg; and MMABP of 107.25 ± 8 mmHg. The lowest, on the other hand, were derived from the Gwoza males with MSBP of 135.88 ± 4 mmHg; MDBP 84.12 ± 9 mmHg, and MMABP of 101.37 ± 6 mmHg.

Among the females in urban settings the Marghi women aged 18-30 years still had significantly highest mean blood pressure levels (MSBP of 124.41 ± 9 mmHg; MDBP of 80.59 ± 7 mmHg and MMABP of 95.20 ± 7 mmHg) when compared to the other ethnic groups in Maiduguri metropolis. But contrary to what obtained in the Gwoza men, the females showed the lowest mean blood pressure levels (MSBP of 112.06 ± 11 mmHg and MDBP of 69.41 ± 7 mmHg).

The recorded blood pressure values among those aged 31-40 years gave the highest MSBP of 115.88 ± 13 mmHg to the Babur while the Kanuris had the lowest MSBP of 107.12 ± 12 mmHg. But no significant difference in MDBP was found among the four ethnic groups at $p < 0.5$. The lowest MMABP of 82.57 ± 9 mmHg was, however, registered from the female Kanuris.

Above 40 years, the mean blood pressure levels were highest in the Marghis while the lowest of the values (MDBP and MMABP) were from the Kanuri women.

DISCUSSION

The normal range of blood pressure values were critically evaluated among four major indigenous communities in Borno State, Nigeria. The recorded range was considerably lower in the rural areas compared to the urban centres. This was in agreement with previous studies by Poulter *et al.* (1985) who observed high range of blood pressure among urban dwellers, which they attributed to socio-economic factors. Others believed high physical activity was a key factor (Masterson *et al.*, 2010). Salmond *et al.* (1985) while comparing blood pressure in the immigrants into New Zealand confirmed that the indigenous dwellers had higher blood pressure levels than the immigrants but that with time this difference was not observed. The disappearance in blood pressure was attributed to changes in diet and pattern of physical activity with a consequent increase obesity, type II diabetes and cardiovascular disease (Salmond *et al.*, 1989).

The patterns of blood pressure levels in the present studied communities have equally shown a gradual increase with age in both the rural and the urban residents. However, the trend was found to be relatively stable among the 30-40 year olds before a steady increase was observed after 40 years. The highest blood pressure recorded was among the 55 year olds. Thereafter, a slight fluctuation in blood pressure was recorded, followed by a slight decline at about 65 years of age. The blood pressure then became constant at 70 years and above, though only a very few subjects were examined within this advanced age. Mario *et al.* (1985) and Ezeoma *et al.* (2001) also observed the same pattern of blood pressure changes with age. In the study by Mario *et al.* (1985) which lasted for 20 years, they observed changes of blood pressure in the controlled subjects though there was no change in blood pressure of nuns. They attributed this observation to the effect of stress in the controlled group while the nuns were not exposed to such stressful conditions. In the present study the

lowest blood pressure range and values were recorded at lower age range among the Kanuris. This might probably be a reflection of their lifestyle because most of them participate in less stressful work. The Kanuris are mainly petty-traders and civil servants while their wives are mostly full-time housewives.

The incidence of pregnancy induced hypertension (eclampsia) had been reported to be commoner among the Kanuri women (Bobzom, 1998) compared to other indigenous groups in Borno State. The phenomenon was attributed to hyperactive state of less stressful vascular system to a sudden exposure to stress accompanying pregnancy. Alteration in vascular tone during pregnancy has been shown to be possibly attributed, in part, to changes in the synthesis of vasoactive substances derived from endothelium (Allen *et al.*, 1994; William *et al.*, 1997). This might be true because Kanuri women are not usually involved in physically exerting duties as house-wives and are not exposed to physical exercise that could modify their biological stress responses prior to pregnancy (Moreira *et al.*, 2014). The other stable finding was a high range of blood pressure values obtained among the Marghis. These people are mostly farmers or are mostly engaged in highly physical and stressful work.

Lower MSBP and MDBP were recorded in the women living in the urban and rural areas when compared with the men in the same environment. These values were much lower in the rural women. These findings were in agreement with the results of other workers (Gupta *et al.*, 1979; Salmond *et al.*, 1985), who reported that blood pressure rose by one mmHg per year and were faster in males than in females. The MABP levels were also comparatively lower in the rural than in the urban subjects in both men and women. It was also observed that the MSBP and MDBP values in the older age groups were higher than those in younger age groups. Such differences were seen in both sexes and in rural as well as urban subjects. The MMABP were comparatively lower in the rural than in the urban subjects, a finding consistent with previous works by Gupta *et al.* (1979), Seuer *et al.* (1980) and Chapman *et al.* (2001). Lower MABP was observed in the rural populace which led to the postulation that rise in MABP was related to age and that values recorded in the males were higher than in the females. The highest MABP was recorded in the Marghis living in the rural as well as in the urban centers.

The mean arterial blood pressure represents the average pressure that maintains the normal blood circulation and the main vessels that receive direct bearing are the arterioles (Ganong, 1992). The arterioles are mainly controlled by the sympathetic nervous system. It can therefore be postulated that the highest MABP recorded in the Marghis at the earlier age group might probably be due to increased sympathetic activity. This may be due in part to the nature of their occupation and in others it might help to explain why these people are slightly nervous. Conversely, the Kanuris whose mean arterial blood pressure was very significantly low at their early age had a high MABP at about 50 years. The other ethnic groups had their blood pressure levels fluctuating between the Kanuris and Marghis. This might further proof the effects of social activities on the values of the blood pressure.

The MABP was higher in the urban females than in the rural populace. Though the distribution was consistent with what was observed from their male counterparts, the Kanuri women resident in the cities had a lower MABP than their counterparts in the rural areas. Further study is therefore

recommended in these communities to evaluate the prevalence of high blood pressure.

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