ORIGINAL ARTICLE

# SYSTOLIC HYPERTENSION IN ADULT NIGERIANS WITH HYPERTENSION

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## ABSTRACT

**Objective:** To determine the prevalence of both systolic and diastolic hypertensions in relation to age and their impacts on target organ among adult Nigerians with hypertension.

**Design:** Observational study.

**Place and Duration of Study:** The Cardiovascular Clinic of the University of Ilorin Teaching Hospital, Nigeria, from July 2002 to June 2003.

**Patients and Methods:** Newly diagnosed adult hypertensives, with blood pressure Ž 140/90mmHg, taken twice with mercury column sphygmomanometer at 3 weeks interval, were studied. The total number of hypertensive patients treated over this period was also taken into consideration. The newly diagnosed hypertensives were classified using JNC VI classification. The frequency of occurrence of target organ damage such as Left Ventricular Hypertrophy (LVH), heart failure, renal impairment etc. was charted according to systolic and or diastolic pressures. The occurrence of systolic or diastolic blood pressure was also related with the age of the patients. Blood metabolic parameters were compared in both systolic and diastolic blood pressures for their possible contributory role.

**Results:** Two thousand seven hundred and ninety-two adult hypertensive patients were managed over the study period. Of them, 218 (7.8%) were newly diagnosed and studied. There were 94 males and 124 females. Seventy-seven (35.3%) were aged 60 years and above with equal frequency in the gender.

One hundred and seventy-eight (81.7%) cases had combined systolic and diastolic pressures. Twenty-nine (13.3%) patients had systolic hypertension. Twenty-five (86.2%) of these 29 were aged 50 years and above and 20 (69.0%) were aged 60 years and above. Eleven (5.0%) patients had isolated diastolic hypertension and they were all in the age bracket 40-49 years. Systolic blood pressure was found to be rising with advancing age while diastolic blood pressure peaked at mid 40's and declined. Target organ damage occurred more frequently with systolic hypertension and advancing age than with diastolic hypertension.

**Conclusion:** Systolic hypertension occurred more frequently in this series of adult Nigerians with hypertension. It was higher with advancing age and associated with more target organ damage than the diastolic hypertension.

**KEY WORDS:** *Hypertension. Systolic. Diastolic. Age. Target organ damage.*

## INTRODUCTION

Systemic hypertension is associated with target organ damage ,such as Chronic Kidney Disease (CKD), Heart Failure (HF), Coronary Heart Disease (CHD), stroke, cardiac arrhythmias and sudden death.[1] The risks of developing these complications even though depend on the level of blood pressure elevation, it also depends on certain associated risk factors.[2]

Approximately 10-20% of adult Nigerians have elevated blood pressure.[3] The urban prevalence is 15.3% while the prevalence in the rural setting is 10.6%. However, controlling the hypertension and achieving the blood pressure set goal has been a major problem facing physicians[4].

Numerous large-scale studies have demonstrated significantly, the efficacy and effectiveness of antihypertensive agents in reducing both the systolic and diastolic pressures with significant reduction in cardiovascular events.[5-7] Despite the effects of the antihypertensive agents, most hypertensive patients do not achieve the recommended blood pressure targets of • 140/90 mmHg.[4]

It has been observed that most hypertensive patients have elevation of both systolic and diastolic blood pressures. However, Systolic Blood Pressure (SBP) has been documented elsewhere to be associated with advancing age while the Diastolic Blood Pressure (DBP) peaks at a certain age and then declines.[8] Which of these blood pressures is the culprit for the cardiovascular events, has been a major concern in recent years.

The objective of this study was to determine the frequencies of the systolic and diastolic blood pressure in relation to age and impact on target organ, especially the heart, brain and the kidneys in newly diagnosed hypertensive patients.

## PATIENTS AND METHODS

Newly diagnosed adult hypertensive patients, who attended the cardiovascular clinic of University of Ilorin Teaching Hospital, from July 2002 to June 2003, were recruited consecutively into the study. The total number of hypertensive patients managed in the unit over the same period was taken into consideration.

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The blood pressures were measured in line with the recommended standard after the usual health talk by the clinic nurses using mercury (accoson) sphygmomanometer. Those patients with blood pressure Ž 140/90 mmHg or persistent systolic hypertension Ž 140 mmHg with persistent diastolic blood pressure of • 90 mmHg or with systolic blood pressure less than 140 mmHg but persistent diastolic hypertension Ž 90 mmHg taken thrice at 3 weeks interval in the sitting position after 30 minutes rest in the consulting clinic were considered for inclusion into the study. They were thoroughly evaluated clinically for evidence of stroke, heart failure as defined by Mckee et al. in Framingham study[9], renal involvement in line with National Kidney Foundation[10] and myocardial infarction as recently re-defined by Albert et al.[11] (chest pain, sweating, vomiting, ECG with repolarisation changes and serum markers excluding Tropolin) as target organ damage.

The resting electrocardiogram (ECG) was recorded on all the patients, using portable Schiller (Cardovit-AT10) machine with paper speed of 25 metre per second to 50 metre per second and sensitivity of 10 milli volts to 20 milli volts. The ECG was read by one of the authors (O.G.O.). Their fasting blood samples were also collected for serum sugar estimation, using colorimetric method. Blood samples were also analyzed in the laboratory for fasting lipids profile, such as total cholesterol (Tc) and triglyceride (TRG) and serum electrolytes, urea and creatinine, using R-A 50 machine.

They were then classified into appropriate grade according to the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure (JNC VI) of 1999. Target organ damage was related to the systolic and diastolic blood pressure in line with the JNC VI classification.

Excluded from the study were hypertensive patients with diabetes mellitus. Data analysis was done using Chi-square test and Student's t-test for means of variables where necessary. A Fisher's exact p-value • 0.05 was taken as a measure of statistical significance.

## RESULTS

A total of 2792 adult hypertensive patients were managed over the study period. Two hundred and eighteen (7.8%) cases were newly diagnosed and this number formed the study population.

Of these 218 cases, 94 (43.1%) were males while 124 (56.9%) were females; ($x^2$ = 4.8 and p = 0.01). Their ages ranged between 20 years and 85 years with a mean age of 51.5 $\pm$ 4.7 years. One hundred and three (47.2%, M/F = 56/47) were aged 50 years and above while 77 (35.3%) (M/F= 38/39) were aged 60 years and above. Twenty (26.0%) (M: F 14:6) of these 77 patients had Isolated Systolic Hypertension (ISH). Ninety-two (42.1%) of the 218 patients were in the age bracket 40-59 years. Five of these 92 had ISH, 9 with Isolated Diastolic Hypertension (IDH) and the rest 78 (84.8%) had combined hypertension.

Majority, 178 (81.7%) cases had combined elevation of both systolic and diastolic blood pressures. Forty-five (25.3%) of 178 cases of combined hypertension were in the age bracket 40-49 years. Forty (22.5%) belonged to grade 1, 51 (28.7%) to grade 2 and 87 (48.9%) to grade 3 JNC – VI. Twenty-two and 13 cases were elevated to grade 2 on the basis of systolic and diastolic blood pressures respectively, while 13 and 34 cases were elevated to grade 3 on the basis of their systolic and diastolic blood pressures respectively. Twenty-nine (13.3%) had ISH whereas only 11 (5.0%) cases had IDH ($x^2$ = 5.0, p = 0.01).

Of the 29 cases with ISH, 20 (69.0%) were males and 9 (31.0%) were females ($x^2$ = 8.3 and p = 0.001). Their ages ranged between 25 years and 85 years with a mean age of 61.4 $\pm$ 15.4 years.

Four (36.4%) out of 11 cases of IDH were males as opposed to 7 (63.6%) females. Their ages ranged between 40 years and 49 years with a mean age of 43.5 $\pm$ 18.1 years. Comparing the mean age of cases with ISH with the mean age of cases with IDH, it showed values of t = 6.6 and p = 0.0001 in favour of ISH.

The range of isolated systolic blood pressure (ISBP) was 140mmHg and 220 mmHg with a mean of 156.9 $\pm$ 39.2 mmHg. The diastolic blood pressure range of ISH cases was between 76 mmHg to 85 mmHg with a mean of 74.7 $\pm$ 18.1 mmHg. Whereas diastolic blood pressure (DBP) range of IDH cases was between 90 mmHg and 100 mmHg with a mean of 94.0 $\pm$ 39.2 mmHg; their corresponding mean systolic pressure was 124.2 $\pm$ 51.7 mmHg (range 120 – 135 mmHg).

Of the ISH, only 2 (6.92) cases were less than 30 years of age, 2 (6.9%) less than 40 years, 5 (17.2%) were between age bracket 50-59 years, 11 (37.9%) cases between 60-69 years and the remaining 9 (31.0%) were above age 70 years. All cases (100%) of IDH were between (40-49 years) age bracket.

The highest systolic blood pressure (SBP) 230 mmHg in the overall study population was reached twice–first between the age brackets 50-60 years and second between 60-70 years. Whereas the highest Diastolic Blood Pressure (DBP) of 150 mmHg was obtained in the age brackets 40-49 years. This indicates progressive rise of SBP with age and stabilization of diastolic pressure by mid 40s.

The effect of age on both the systolic and diastolic blood pressures is shown in Figure 1.

Eighteen cases of ISH with various cardiac abnormalities were found compared to 7 of IDH ($X^2$ = 2.25 and p = 0.0001). Various types of cardiac abnormalities noted are shown in Table I. Fifteen cases of combined (systolic and diastolic) hypertension had various types of cardiac arrhythmias, 4 (26.7%) of these had Premature Atrial Contraction (PAC)

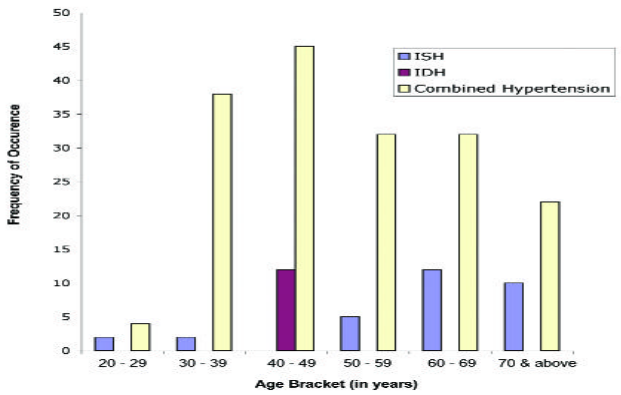


**Figure 1:** Effect of age on systolic, diastolic and combined hypertension.

**Table I**: Types of cardiac abnormalities.

| | Combined hypertension (A) | ISH (B) | IDH (C) | P-value BVSC |
|---|---|---|---|---|
| | n = 178 | n = 29 | | n = 11 |
| ECG-LVH | 152 | 16 | 7 | 0.01 |
| Conduction | 26 | 7 | 0 | 0.001 |
| Abnormality | | | | |
| Cardiac arrhythmia | 15 | 2 | 2 | 0.001 |
| Myocardial infarction | 6 | 4 | 2 | 0.01 |
| Heart Failure (HF) | 97 | 10 | 0 | 0.01 |

ISH = Isolated Systolic Hypertension; IDH = Isolated Hypertension; Combined = (Systolic and Diastolic Hypertension occurring together. P Value of BvsC.

while the remaining 11 (73.3%) had Premature Ventricular Contraction (PVC); 2 cases each of ISH and IDH had arrhythmias of PVC type. In the same vein, 5 cases of stroke and 5 cases of kidney impairment with very high serum creatinine, 120 umol per litre, and urea, 15 mmol per litre, were found with ISH as opposed to none case of stroke with 2 cases of renal failure found with IDH ( p = 0.001).

The mean total serum creatinine for ISH was 137 ± 5.6 umol per litre as against 117 ± 4.5 umol per litre for IDH.

The mean total serum cholesterol (Tc) for all the newly diagnosed hypertensives was 5.3 ± 0.9 mmol/L. The mean total cholesterol (Tc) for those with isolated systolic hypertension was 4.4 ± 1.8 mmol/L whereas that of the isolated diastolic hypertension was 4.7 ± 1.9 mmol/L. (t = 0.67 and p = 0.20). The mean ± (SD) total fasting blood sugar (FBS) for the study population was 4.6 ± 0.5 mmol/L.

The mean FBS for the isolated systolic hypertension was 4.3 ± 1.5 mmol/L as against 4.9 ± 1.8 mmol/L for the isolated diastolic hypertension (t = 0.67 and p = 0.2).

The mean triglyceride (TRG) for all the newly diagnosed hypertensives was 1.25 ± 0.2 mmol/L. The mean TRG for those with isolated systolic hypertension was 0.93 ± 0.4 mmol/L; whereas the mean TRG for the isolated diastolic hypertension was 1.3 5 ± 0.6 mmol/L (t = 0.75 and p = 0.2).

## Discussion

Hypertension is a common non-communicable disease in Nigeria. Its prevalence is similar to that seen elsewhere in the world.[1] The prevalence in the urban centres is approximately 15.6%, a figure that is less than that of Manu et al.[12] The rural prevalence of 10.3% is again at variance with that of Safdar et al.[14] It is obvious from the study that systolic hypertension as defined by JNC and Chaudhry et al.[14] Occurs more frequently and significantly than diastolic hypertension among adult hypertensive Nigerians (p = 0.001). It is also evident from the study that systolic hypertension increases with advancing age of the population in keeping with Aziz et al.[15] (Figure 1). Also the mean age of cases with Isolated Systolic Hypertension (ISH) (61.4 ± 15.4 years) was significantly higher than that of the isolated diastolic hypertension of 43.5 ± 18.1 years (p = 0.001). This is compatible with the previous documentation among Americans[16] and it is due to age related arterial stiffness as a result of increased vascular and cardiac collagen and glycosaminoglycan with reduced elastin. Arterial stiffness leads to reduced vascular and cardiac compliance. Seventy-seven (35.3%) of all newly diagnosed hypertensive patients in this study were aged 60 years and above with equal frequency in both genders in agreement with the American experience.[16] This study has also shown that combined systolic and diastolic hypertension cases dominate the picture in Nigerians as seen in this centre and this is compatible with Aziz et al.[15] This is particularly so in the age range of 40-49 years.

It was observed that while the frequency of systolic hypertension rose with advancing age, the diastolic blood pressure peaked in the age bracket 40 years with subsequent decline. This is at variance with documented experience elsewhere where the diastolic blood pressure peaks at age bracket 50-59 years [8]. The difference may be as a result of the more devastating effect of hypertension in Blacks than Caucasians. Thus, a majority of the patients presented within this age bracket due possibly to the combined effect of both the systolic and diastolic hypertension since most cases (25.3%) of combined hypertension (systolic and diastolic) were crowded in this age bracket.

It appears from the study that the frequency of cardiac damage is higher with systolic hypertension than with the diastolic hypertension. The various cardiac abnormalities, as shown in Table I, indicates that the left ventricular hypertrophy is the most common as previously noted by Katibi et al.[17] and Araoye et al.[18] Worthy of note is the frequency of cardiac events with ISH where there were more cases of wall hyperthrophy, conduction abnormality such as Atrioventricular Nodal Block (AVNB) and Intraventricular Conduction Block (IVCB) [19-20] and myocardial infarction in keeping with previous documentation.[21] This is due to reduced vascular compliance and associated increased pulse pressure. There was no case of junctional cardiac arrhythmia in the study indicating its rarity as previously noted by Omotoso et al.[22]

There were more cases of stroke and renal impairment with systolic hypertension (ISH) than with diastolic hypertension. This evidence indicates and implicates systolic hypertension as a predictor of stroke and end-stage renal disease in adult hypertensive Nigerians compatible with previous study elsewhere; [24] the magnitude of which is very alarming.[24] The fasting serum Tc concentration and blood sugar level (FBS) for the systolic hypertension, even though slightly but not significantly lower than that of diastolic hypertension, indicate that serum metabolic parameters play a very little role in the target organ damage by the systolic hypertension over the diastolic hypertension in adult hypertensive Nigerians. The serum levels of these metabolic parameters do not discriminate between systolic and diastolic hypertension in adult Nigerians. Once there is hypertension, the levels tend to rise irrespective of the type of pressure elevation. However, elevated serum levels of these metabolic parameters may make the treatment of hypertension difficult generally and possibly prevent or delay the achievement of JNC-VI recommended goal for the systolic blood pressure and also these metabolic parameters had earlier been found to be associated with morbidity and mortality in adult hypertensive Nigerians[2] and this finding is similar to observation by Akatsu et al.[25] and Zachariah et al.[12]

It is of interest to note that the prevalence of ISH in the study is high (13.3%). The occurrence of ISH also increases with

advancing age since about 20 (69.0% of all cases of ISH were aged 60 years and above with only 4 (13.8%) cases below age 40 years. Isolated systolic hypertension was also found to be commoner in males than in females and more significantly so than with IDH.

The frequency of occurrence of cardiovascular events was equally high in ISH (see Table I) reinforcing the finding of systolic hypertension as the culprit in target organ damage especially after the age of 50 years in keeping with ALLHAT study.[26]

The prevalence of IDH in this study (5.0%) appears to be slightly higher compared to the American experience (3.8%).[27]

## CONCLUSION

Systolic hypertension (ISH) was a common occurrence in adult hypertensive Nigerians as noted in the study. Systolic hypertension and advancing age were the most significant factors in the development of target organ damage. While the systolic blood pressure continued to rise with age, diastolic blood pressure peaked at mid 40's. Combined systolic and diastolic hypertension exhibit additive effect which may become maximal in the age bracket 40-49 years in adult hypertensive Nigerians.

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