

Original Research Article

Hypertension and Associated Risk Factors among Diabetic Patients in Ogbomoso, Nigeria.

ABSTRACT

Aims: To determine the prevalence of hypertension among the diabetes and the associated risk factors.

Study Design: The study was a descriptive cross-sectional study.

Place and Duration of Study: The study was conducted at Bowen University Teaching Hospital, Ogbomoso and the data was collection between March and June 2018.

Methodology: Systematic sampling technique was used for the selection of participants and a total of 290 participants were recruited for the study. The participants were administered a standardized questionnaire. The questionnaire was then used to obtain the socio-demographic and medical history of the participants. The blood pressure was measured using Accoson[®] mercury sphygmomanometer manufactured by Dekamet Accoson, England and a Littmann stethoscope.

Results: A total of 290 participants were recruited for this study. Their age ranges from 28 years to 85years with the mean age of 59.17 ± 11.41 years. The prevalence of hypertension was higher among the female (131, 73.6%) than the male (68, 60.7%) and this finding was statistically significant ($p=0.02$). The association between the high prevalence of hypertension found in our study and marital status, level of education and duration of been diabetic was statistically significant.

Conclusion: The prevalence of hypertension among our participants was very high and it is much higher among the female than male. The high prevalence of hypertension was found to be associated with marital status, level of education and duration of been diabetic

Comment [S1]: There are spelling error as well as grammar error in the manuscript

Keywords: *Diabetes; Hypertension; Nigeria; Ogbomoso.*

1. INTRODUCTION

Diabetes is a chronic, metabolic disorder characterized by elevated levels of blood glucose. The most common form of diabetes is type 2 diabetes which occurs when there is body resistant to insulin or when the insulin produced is not enough. In the past three decades the prevalence of type 2 diabetes has risen dramatically in low-, middle- and high-income countries [1]. The number of individuals with diabetes rose significantly from 108 million in 1980 to 422 million in 2014. The rate of increase in type 2 diabetes prevalence is more rapid in low- and middle-income countries than in high-income countries [2]. About 1.5 million deaths were recorded yearly as a result of diabetes mellitus. Both the number of cases and the prevalence of diabetes have been steadily increasing over the past few decades. There is an agreement worldwide to halt the rise in diabetes and obesity by 2025 [1].

Hypertension is defined as a sustained elevation of blood pressure above 140mmHg systolic and or above 90mmHg diastolic. About 1.28 billion adults whose age ranged from 30 years to 79 years have hypertension worldwide. About two-thirds of them are living in low- and middle-income countries [3].

A person with diabetes is more likely to develop hypertension than a person without diabetes. When hypertension is left untreated, it can lead to heart disease and cerebrovascular accident. In fact, an individual with diabetes and hypertension is four times more likely to develop heart disease than an individual who is not diabetic or hypertensive. About two-thirds of adults with diabetes have blood pressure greater than 130/80 mm Hg or are on medications for hypertension [4].

Hypertension and type 2 diabetes are common comorbidities. Moreover, patients with hypertension have tendency to develop insulin resistance and are at greater risk of developing diabetes than individuals who are normotensive. Cardiovascular disease is the major cause of morbidity and mortality in diabetes and it is exacerbated by hypertension. Diabetes and hypertension are closely interlinked because of similar risk factors, such as endothelial dysfunction, vascular inflammation, arterial remodelling, atherosclerosis, dyslipidemia, and obesity. There is also overlap in the cardiovascular complications arising from diabetes and hypertension and they are primarily due to microvascular and macrovascular disease. Common mechanisms, such as upregulation of the renin-angiotensin-aldosterone system, oxidative stress, inflammation, and activation of the immune system likely contribute to the close relationship between diabetes and hypertension.

We aimed to determine the prevalence of hypertension among the diabetes and the associated risk factors.

Study Area

The study area was Ogbomoso. It is a city in Oyo state, South-west of Nigeria. It is located 104 km North-east of Ibadan, 58 km North-west of Osogbo, 57 km South-west of Ilorin and 53 km North-east of Oyo. The indigenous people are from the Yoruba ethnic group. Farming is the main vocation of the people of Ogbomoso and a few are traders, artisans or civil and the Nigerian Baptist Theological Seminary which attracts people of diverse ethnic groups to the town.

Study Centre

The study centre was Bowen University Teaching Hospital (BUTH), Ogbomoso. It was formerly called Baptist Medical Centre and was established in 1907 and upgraded to a teaching hospital in 2009. The centre also provides training in basic nursing, undergraduate medical and physiotherapy training, internship training and postgraduate Family Medicine residency.

2. MATERIAL AND METHODS

The study was a descriptive cross-sectional study. The data collection lasted 4 months between March and June 2018. The study population consisted of adult out-patients with diabetes mellitus accessing care in Bowen University Teaching Hospital, Ogbomoso. The consenting patients aged 18 years and above with diabetes mellitus who have been on treatment for at least 6 months were recruited for the study. The cognitively impaired patients were excluded because they may not be able to follow the instructions. Systematic sampling technique was used for the selection of participants and a total of 290 participants were recruited for the study. The participants were administered a standardized questionnaire. The questionnaire was then used to obtain the socio-demographic and medical history of the participants.

The blood pressure was measured using Accoson® mercury sphygmomanometer manufactured by Dekamet Accoson, England and a Littmann stethoscope. The blood pressure measurement was done after at least 10 minutes of rest with subjects in a sitting position and using the right arm. Blood pressure measurement was used to classify participants into

Comment [S2]: Should be under material and methods title

Comment [S3]: Please clarify in more details about medical history of diseases among Ogbomoso indigenous people, their life style and also their ethnic habits that may contribute to the prevalence of diabetes and hypertension among them

Comment [S4]: Should be under material and methods title

Comment [S5]: Please mention how glycemic control have been evaluated in this study

Comment [S6]: Dear author you mentioned in abstract that participants age ranges from 28 years to 85years with the mean age of 59.17±11.41years.??

Comment [S7]: Please clarify the included and excluded criteria in selecting patient included in this study in more details

hypertensive or normotensive. Participants with blood pressure $\geq 140/90$ mmHg or with history of antihypertensive drug use were considered hypertensive while participants with blood pressure $< 140/90$ mmHg were considered normotensive.

| VARIABLE | FREQUENCY, N=121 | PERCENTAGE (%) |
|----------|---------------------|----------------|
|----------|---------------------|----------------|

Data Analysis

The completed copies of the questionnaire and measurements were collected, coded, and serially entered into a computer. The data was analyzed using the statistical package for social sciences (SPSS) version 17.0. All descriptive statistics such as frequencies, percentages, means and standard deviations were generated for quantitative variables, while for categorical variables; tables were used for data presentation. The Chi-square and Fischer's exact test were used to test associations. The p-value was set at 0.05 (p-value < 0.05 was regarded as statistically significant) at 95% confidence interval.

3. RESULTS AND DISCUSSION

Comment [S8]: Please change it to results

A total of 290 participants were recruited for this study. Their age ranges from 28 years to 85years with the mean age of 59.17 ± 11.41 years. The age group 61 and above had the highest proportion of the participants. More than one-half of the participants were female 178(61.4%) while 38.6% (112) were male. Overwhelming majority of the participants were married 264(91.0%) while 1.0% (3) were single. Majority of the participants were Christian 221 (76.2%) and almost equal percentage of the participants had no formal education 87 (30.0%) and primary education 88 (30.3%). More than one-half of the participants belonged to social class 2 (197, 67.9%) and 71.4% (208) of the participants reside in Urban area. Almost all the participants were from the Yoruba ethnic 275 (97.8%) group. Two-third of the participants (194 66.9%) had been diagnosed to be diabetic for less or five years and 62.1% (180) of the participants were on oral hypoglycemic agents. More than one-third of the participants were overweight (112 38.6%) and 68.6% (199) of the participants were hypertensive. Only 48 (16.6%) of our participants had good glycemc control.

| | | |
|-----------------------------|-------------|------|
| Sex | | |
| Male | 112 | 38.6 |
| Female | 178 | 61.4 |
| Age (years) | | |
| Less than 30 | 4 | 1.4 |
| 30-39 | 15 | 5.2 |
| 40-49 | 62 | 21.4 |
| 50-59 | 89 | 30.7 |
| 60 and above | 120 | 41.4 |
| Mean age | 59.17±11.41 | |
| Education | | |
| No formal education | 87 | 30.0 |
| Primary | 88 | 30.3 |
| Secondary | 51 | 17.6 |
| Tertiary | 64 | 22.1 |
| Ethnicity | | |
| Yoruba | 275 | 94.8 |
| Igbo | 12 | 4.1 |
| Hausa | 3 | 1.1 |
| Marital Status | | |
| Single | 3 | 1.0 |
| Married | 264 | 91.0 |
| Separated | 4 | 1.4 |
| Widow | 19 | 6.6 |
| Religion | | |
| Christianity | 221 | 76.2 |
| Islam | 68 | 23.4 |
| Others | 1 | 0.3 |
| Social class | | |
| Class 1 | 73 | 25.2 |
| Class 2 | 197 | 67.9 |
| Class 3 | 20 | 6.9 |
| Residential location | | |
| Rural | 82 | 28.3 |
| Urban | 208 | 71.7 |

**TABLE 1:
SOCIODEMOG
RAPHIC
CHARACTERIS
TICS OF THE
PARTICIPANTS**

TABLE 2: PREVALENCE OF SOME VARIABLES

| VARIABLE | FREQUENCY, N=121 | PERCENTAGE (%) |
|----------------------------|------------------|----------------|
| MEDICATION | | |
| Oral | 180 | 62.1 |
| Insulin | 11 | 3.8 |
| Both | 99 | 34.1 |
| DIABETES PERIOD | | |
| ≤5 years | 194 | 66.9 |
| 6-10 years | 48 | 16.6 |
| Above 10 years | 48 | 16.6 |
| GLYCEMIC CONTROL | | |
| Good | 48 | 16.6 |
| Poor | 242 | 83.4 |
| BMI STATUS | | |
| Normal | 78 | 26.9 |
| Overweight | 112 | 38.6 |
| Obese | 87 | 30.0 |
| Underweight | 13 | 4.5 |
| HYPERTENSIVE STATUS | | |
| Hypertensive | 199 | 68.6 |
| Normotensive | 91 | 31.4 |

The prevalence of hypertension was 68.6% (199). The prevalence of hypertension was higher among the female (131, 73.6%) than the male (68, 60.7%) and this finding was statistically significant ($p=0.02$). All the participants who were single (3, 100.0%) or separated (4, 100.0%) had hypertension ($p=0.06$). The participants who had primary level of education (71, 80.7%) had the highest prevalence of hypertension while those who had secondary level (27, 52.9%) of education had least prevalence ($p=0.01$). The prevalence among the participants who belong to social class 3 (14, 70.0%) is slightly higher than those of class 1 (51, 69.9%) and class 2 (134, 68.0%) ($p=0.95$). The participants who were using both oral hypoglycemic drug and insulin had the highest prevalence of hypertension (73, 73.7%). The prevalence of hypertension among the participants who had been diagnosed to be diabetic for more than ten years was (41, 85.4%) while it was 63.9% (124). ($p=0.02$). The prevalence of hypertension among the participants who had good glycemic control was 83.3% (40) while it was 65.7% (159) among the participants who had poor glycemic control.

TABLE 3: ASSOCIATION BETWEEN HYPERTENSION AND SOCIODEMOGRAPHIC CHARACTERISTICS.

| VARIABLE | HYPERTENSION | | χ^2 | P-VALUE |
|------------------|--------------|--------------|----------|---------|
| | NORMOTENSIVE | HYPERTENSIVE | | |
| AGE RANGE | | | | |
| Less than 30 | 0(0.0) | 4(100.0) | | |
| 31-40 | 5(33.3) | 10(66.7) | | |
| 41-50 | 25(40.3) | 37(59.7) | | |
| 51-60 | 29(32.6) | 60(67.4) | F= 5.014 | 0.27 |

| | | | | |
|---------------------------------|----------|-----------|----------|------|
| Above 60 | 32(26.7) | 88(73.3) | | |
| SEX | | | | |
| Male | 47(26.4) | 131(73.6) | | |
| Female | 44(39.3) | 68(60.7) | 5.297 | 0.02 |
| MARITAL STATUS | | | | |
| Single | 0(0.0) | 3(100.0) | | |
| Married | 89(33.7) | 175(66.3) | | |
| Separated | 0(0.0) | 4(100.0) | F=6.788 | 0.06 |
| Widowed | 2(10.5) | 17(89.5) | | |
| LEVEL OF EDUCATION | | | | |
| No Formal Education | 29(33.3) | 58(66.7) | | |
| Primary | 17(19.3) | 71(80.7) | | |
| Secondary | 24(47.1) | 27(52.9) | 11.963 | 0.01 |
| Tertiary | 21(32.8) | 43(67.2) | | |
| RELIGION | | | | |
| Christianity | 75(33.9) | 146(66.1) | | |
| Islam | 16(23.5) | 52(76.6) | F=3.037 | 0.19 |
| others | 47(38.8) | 49(40.5) | | |
| SOCIAL OCCUPATION SYSTEM | | | | |
| Class 1 | 22(30.1) | 51(69.9) | | |
| Class 2 | 63(32.0) | 134(68.0) | | |
| Class 3 | 6(30.0) | 14(70.0) | 0.103 | 0.95 |
| RESIDENTIAL LOCATION | | | | |
| Rural | 25(30.5) | 57(69.5) | | |
| Urban | 66(31.9) | 142(68.1) | F=0.507 | 0.92 |
| ETHNICITY | | | | |
| YORUBA | 87(31.6) | 188(68.4) | | |
| IGBO | 4(33.3) | 8(66.7) | | |
| HAUSA | 0(0.0) | 3(100.0) | F=0.973 | 0.71 |
| MEDICATION | | | | |
| Oral | 62(34.4) | 118(65.5) | | |
| Insulin | 3(27.3) | 8(72.7) | | |
| Both | 26(26.3) | 73(73.7) | F= 2.033 | 0.38 |
| DIABETES PERIOD | | | | |
| ≤ 5 years | 70(36.1) | 124(63.9) | | |
| 6-10 years | 14(29.2) | 34(70.8) | | |
| >10 years | 7(14.6) | 41(85.4) | 8.391 | 0.02 |
| GLYCEMIC CONTROL STATUS | | | | |
| Good GC | 8(16.7) | 40(83.3) | | |
| Poor GC | 83(34.3) | 159(65.7) | 5.782 | 0.02 |
| BMI STATUS | | | | |
| Normal | 19(24.4) | 59(75.6) | | |
| Underweight | 0(0.0) | 13(100.0) | | |
| Overweight | 39(34.8) | 73(65.2) | F=11.081 | 0.01 |
| Obese | 33(37.9) | 54(62.1) | | |

Discussion

Comment [S9]: Please change it to **4. Discussion**

Comment [S10]: The discussion should not repeat the results, but provide detailed interpretation of data. This should interpret the significance of the findings of the work

We discovered from our study that the female participants constituted more than one-half (178, 61.4%) of the study population. This is not unexpected because our study is a hospital-based study and women tend to visit the hospital more than their male counterparts. This finding is similar to what was found in Umuguma[6], Nigeria and Yaounde[7], Cameroon. Almost one-half of our participants belong to the age group 61 and above. This may not be unconnected to the fact that type 2 diabetes tends to occur in older age groups. This finding is in line with what was found in a multicenter study conducted in Nigeria by Akhuemokhan et al[8]. Two-third of the participants (194, 66.9%) had been diagnosed to be diabetic for less or five years. This may not be unconnected to poor health seeking behaviour of our people. Many of them will not present in the hospital until they develop a complication that makes it impossible for them to carry on with their day-to-day activities. Majority 62.1% (180) of our participants were on oral hypoglycemic agents and this may not be far from the fact that majority of our participants belongs to the age group 61 and above and are likely to have type 2 diabetes. More than one-third of our participants were overweight (112, 38.6%) and this is not out of place because it has been established that there is a strong association between obesity and diabetes. The prevalence of hypertension (68.6%, 199) among our participants was very high and it is much higher among the female (131, 73.6%) than male (68, 60.7%) and this finding was statistically significant ($p=0.02$). This high prevalence is similar to what Ugonma et al[6] found in Umuguma, Nigeria. They found a prevalence 70.0% among their study participant. Beryl et al[7] in their own study found a prevalence of 86.2% in Yaoundé, Cameroon. However Akhuemokhan et al[8] found a prevalence of 58.0% in a multicenter study carried out in Nigeria. Unlike higher prevalence of hypertension found among the female in our study, Unadike et al[9], Anizor et al[10] and Abdelbagi et al[11] found a higher prevalence among male than female. The association between the high prevalence of hypertension found in our study and marital status, level of education and duration of been diabetic was statistically significant.

4. CONCLUSION

The prevalence of hypertension among our participants was very high and it is much higher among the female than male. The high prevalence of hypertension was found to be associated with marital status, level of education and duration of been diabetic

Comment [S11]: Please change it to
5. CONCLUSION

ETHICAL APPROVAL

The study protocol was reviewed by the ethical committee of Bowen University Teaching Hospital, Ogbomosho and ethical approval was obtained on 18th July, 2017 (NHREC/12/04). All the participants gave informed consent to the research work.

REFERENCES

1. Diabetes, World Health Organization. https://www.who.int/health-topics/diabetes#tab=tab_1 accessed 24th July, 2022.
2. Diabetes, World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/diabetes>. accessed 24th July, 2022.
3. Hypertension, World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/hypertension>. accessed 24th July, 2022.
4. Diabetes and High Blood Pressure. Health. Johns Hopkins Medicine. <https://www.hopkinsmedicine.org/health/conditions-and-diseases/diabetes/diabetes-and-high-blood-pressure#:~:text=High%20blood%20pressure%20is%20twice,to%20heart%>. accessed 24th July, 2022.
5. John RP, Tomasz JG, Rhian MT. Diabetes, Hypertension, and Cardiovascular Disease: Clinical Insights and Vascular Mechanisms. *Can J Cardiol* 2018;34(5):575-584. doi:10.1016/j.cjca.2017.12.005.
6. Ugonma WD, Nnenna VO, Okwuchi BN, Somtochukwu MO, Chidozie JN, Ikechukwu NSD. Risk Factors of Hypertension among Type 2 Diabetic Patients in Imo state, South East of Nigeria. *Asian Journal of Medicine and Health*. 2020, 18(10): 65-72.
7. Beryl K, Brice US, Elie F. Risk Factors of Hypertension among Diabetic Patients from Yaoundé Central Hospital and Etoug-Ebe Baptist Health Centre, Cameroon. *Journal of Diabetes Research* 2020, <https://doi.org/10.1155/2020/1853516>
8. Akhuemokhan IK, Ehusani-Anumah FO, Ogbera AO, Ikem RT, Puepet F, Adeyemi-Doro AO et al. Hypertension in Nigerians with type 2 diabetes: a multicentre survey. *Mera: Diabetes International*. 2008.

9. Unadike BC, Eregie A, Ohwovoriole AE. Prevalence of hypertension amongst persons with diabetes mellitus in Benin City, Nigeria. *Nigerian Journal of Clinical Practice*. 2011,14(3):300-2
10. Anizor C, Azinge N. Hypertension Prevalence and Body Mass Index Correlates among Patients with Diabetes Mellitus in Oghara, Nigeria. *Nigerian Journal of General Practice*. 2015,13(1):12-15.
11. Omer A , Imad RM, Shaza MM, Salim AA, Ishag A. Prevalence and associated factors of hypertension among adults with diabetes mellitus in northern Sudan: a cross-sectional study. *BMC Cardiovasc Disord* 2021,21:168 <https://doi.org/10.1186/s12872-021-01983-x>

UNDER PEER REVIEW