A Comparative Study of Dyslipidaemias among Hypertensives and Normotensives in a Tertiary Health Facility in North Central, Nigeria

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Abstract

Background: Dyslipidaemia and hypertension are major risk factors for cardiovascular diseases (CVDs), with evidence suggesting a strong interrelationship between both conditions. Understanding the pattern of dyslipidaemia among hypertensives and normotensives is critical for effective risk assessment and management.

Aim: To determine and compare the prevalence and pattern of dyslipidaemia among hypertensive and normotensive adults in a tertiary healthcare facility in North Central Nigeria.

Methodology: A comparative cross-sectional study was conducted among 176 participants (88 hypertensives and 88 age- and sex-matched normotensives) recruited from the General Outpatient Clinic of Federal Medical Centre, Bida, between August and October 2022. Data were collected using structured questionnaires, anthropometric measurements, and fasting blood samples for lipid profiling. Statistical analysis was performed using SPSS version 23. Independent t-tests and Chi-square tests were used to compare mean values and assess associations, respectively. A p-value < 0.05 was considered statistically significant.

Result: The prevalence of dyslipidaemia was significantly higher among hypertensives (78.4%) compared to normotensives (52.3%). Hypertensives had significantly higher mean values of LDL-C and triglycerides, while HDL-C was significantly lower ($p < 0.001$). Total cholesterol and atherogenic index were higher among normotensives, though not statistically significant. LDL-C, HDL-C, total cholesterol, and atherogenic index showed significant associations with hypertension status.

Conclusion: Dyslipidaemia is highly prevalent among hypertensive patients compared to normotensives. Routine lipid screening and lifestyle modification are recommended as part of integrated hypertension management to reduce cardiovascular risk

Keywords: Dyslipidaemia, Hypertension, Prevalence, Lipid Profile, Cardiovascular Risk

Introduction:

Dyslipidaemia, which is defined by abnormal blood lipid concentrations, including elevated levels of total cholesterol, low-density lipoprotein cholesterol (LDL-C), triglycerides, and reduced levels of high-density lipoprotein cholesterol (HDL-C), is a recognized risk factor for cardiovascular diseases (CVDs).[1] With an anticipated 17.9 million deaths per year, cardiovascular illnesses continue to be the world's leading cause of mortality.[2] Dyslipidaemia's contribution to the pathophysiology of CVDs, including the promotion of atherosclerosis, emphasises the vital need for efficient treatment and preventative measures.[3]

Approximately 1.13 billion individuals worldwide suffer from hypertension, a major risk factor for cardiovascular disease (CVD) that greatly increases the global burden of disease.[4] According to Weber et al., hypertension is defined as consistently high blood pressure and is linked to a higher risk of heart failure, myocardial infarction, stroke, and kidney disease.[5] Because the combined effects of dyslipidaemia and hypertension raise the risk of cardiovascular events more than each condition alone, their presence is especially alarming.[6]

Numerous investigations have revealed a significant incidence of dyslipidaemia in hypertensive patients, pointing to a possible connection between blood pressure management and lipid metabolism.[7] For example, lipid abnormalities, such as raised LDL-C and triglycerides and lower HDL-C levels, are frequently observed in hypertensive individuals.[8] Dyslipidaemia-related metabolic abnormalities may worsen arterial stiffness and endothelial dysfunction, which would increase hypertension and set off a dangerous cycle of cardiovascular risk.

However, dyslipidaemia can also occur in people with normotension, suggesting that lipid problems are influenced by a range of factors other than blood pressure. Dyslipidaemia development is significantly influenced by a person's genetic predisposition, food choices, degree of physical activity, and other lifestyle factors.[8] In addition, dyslipidaemia is closely associated with metabolic disorders, including diabetes and obesity, which raise its frequency in the general population.[10]

Developing focused therapies requires an understanding of the prevalence and distribution of dyslipidaemia in individuals with hypertension and those without it. Further detailed data on the frequency of dyslipidaemia in various blood pressure strata within particular populations is necessary, despite the condition's evident clinical significance. By researching the prevalence of dyslipidaemia among hypertensive and normotensive people visiting a tertiary hospital in Bida, Niger state, Nigeria, this study seeks

to close this knowledge gap and offer insights that may guide clinical practice and public health initiatives.

This study has the main goals of first, finding out how common dyslipidaemia is in the two study populations, and second, comparing the prevalence of dyslipidaemia in hypertensive and normotensive people. By fulfilling these goals, the study hopes to advance knowledge of the relationship between lipid abnormalities and blood pressure as well as emphasise the importance of integrated treatment plans for individuals at risk of CVD.

Methods

Research design

The study was hospital-based comparative cross-sectional research conducted from August 2022 to October 2022.

Study area

The study was conducted at the General Outpatient Clinic of Federal Medical Centre, Bida, located in the ancient town of Bida, the headquarters of Bida Local Government Area. Bida is the second-largest city in Niger State and is home to the Nupe-speaking ethnic group, with brass works, trading, and farming being the major occupations. The Federal Medical Centre, Bida, is the largest health facility in Niger State, offering a wide variety of services covering primary, secondary, and tertiary medical and surgical specialties. The centre provides clinical, laboratory, and specialist services in various fields, including surgery, community medicine, obstetrics and gynaecology, family medicine, internal medicine, ear, nose and throat, ophthalmology, mental health, maxillofacial, haematology & blood transfusion, pharmaceutical, nursing, radiological, and paediatrics. The Family Medicine department of the Federal Medical Centre, Bida, is currently run by eight consultant Family Physicians, offering comprehensive, coordinated, integrative, and undifferentiated healthcare services to the host community and its surrounding communities. The department runs the Antiretroviral Therapy Clinic (ART), General Outpatient Clinic (GOPC), Tuberculosis clinic, Skin clinic, National Health Insurance Scheme clinic (NHIS), and Non-communicable disease clinics (NCD clinic).

Sample size:

The study used a comparative cross-sectional formula to calculate the sample size for a comparative study. [11]

$$n = \frac{(u + v)^2 \{p_1 (100 - p_1) + p_2 (100 - p_2)\}}{(p_1 - p_2)^2}$$

Based on previous studies in the same centre, the study used a prevalence of 64% and 39%.[12] The power was set at 90%. The minimum sample size was 87.777, with a 10% non-response rate. This study recruited 176 respondents, with 88 consenting to participate.

Sampling method:

The study employed a systematic random sampling method to select hypertensive and normotensive adults aged 18 years or older from the General Outpatient Clinic of Federal Medical Centre Bida. Five hypertensive subjects were recruited weekly, and every fifth eligible patient was recruited until the desired sample size was reached. This was determined from the hospital record; the average number of hypertensive adults >18 years seen in the GOPC per month was 140.

Hence, the population frame (N) over the 3-month period was 420. The sampling interval (K) was sample frame/sample size = 420/88 = 4.8 ≈5

A simple random sampling was used to select the first patient from the first five eligible clients. A control group was also recruited for each hypertensive selected. An identification mark was placed on all selected patients' record cards to avoid repeat selection.

Inclusion and exclusion criteria

The study included hypertensive and normotensive adults aged 18 and above, who consented to participate and could fast for 10-12 hours overnight. Exclusion criteria included hypertensive patients with comorbid conditions, hypertensives on lipid-lowering agents, and those too ill to participate.

Study protocol:

This study involved two trained research assistants who assisted with anthropometric measurements and sample collection. A pre-test was conducted to assess acceptability and logistical issues. A questionnaire was administered to respondents to obtain socio-demographic data, including age, gender, tribe, religion, and occupation. Height and weight were measured using a standardised stadiometer and a weighing scale. The Body Mass Index (BMI) was calculated by dividing weight in kilograms by height in meters squared, according to WHO guidelines.[13]

Blood pressure was measured using an Accoson Mercury Sphygmomanometer after 5 minutes of rest, using the 7th Joint National Committee on Prevention of Hypertension cut-off point of 140/90mmHg. Participants were instructed to fast overnight for 10–12 hours before blood sample collection. Fasting status was confirmed verbally on the morning of sample collection before phlebotomy and analyzed for fasting lipid profile. This procedure was followed consistently across all participants to ensure data integrity for the lipid profile assessments.

Serum lipid concentrations (total cholesterol, HDL-cholesterol, and triglycerides) were measured using enzymatic colorimetric methods with commercially available reagent kits containing cholesterol esterase, cholesterol oxidase, lipoprotein lipase, glycerol kinase, and peroxidase, as appropriate. LDL-cholesterol was calculated using the Friedewald formula.[14] The researcher kept a confidential identification code to track the respondent's hospital records,

only known to the researcher for future reference.

Statistical analysis:

Data were analyzed using SPSS version 23. Descriptive and inferential statistics were applied to assess the prevalence of dyslipidaemia among hypertensive and normotensive participants. Results were presented using frequency tables and figures. Independent t-tests compared mean lipid and anthropometric parameters between groups, while Chi-square tests evaluated associations between categorical lipid abnormalities and blood pressure status. A p-value of < 0.05 was considered statistically significant.

Ethical consideration:

The study was approved by the Federal Medical Centre, Bida's ethical committee, and selected patients were screened and recruited after giving written consent. Participants were informed about the study's purpose and potential benefits and were assured that records would be kept private. They were also given a consent form and informed they could withdraw or opt out at any time without affecting their clinical care.

Table 1: WHO Classification of Body Mass Index (BMI)[13]

Group	Value (kg/m^2)
Under Weight	<18.5
Normal	18.5 – 24.9
Over Weight	25.0 – 29.9
Class I Obesity	30.0 – 34.9
Class II Obesity	35.0 – 39.9
Class III Obesity	> 40

Table 2: Interpretation of Serum Lipid Profile.[8,10]

Parameter	Normal (mg/dl)	Borderline (mg/dl)	High (mg/dl)
TC	<200	201 – 239	>240
TG	<150	150 – 199	>200
LDL–C	<100	101 – 159	>160
HDL–C	> 40	-	< 40

World Health Organization. Obesity and overweight. WHO fact sheet. Updated 7 May 2025. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Results

The study surveyed respondents aged 30-75 years, with the majority in the 41-50 age group (35.2%), followed by the 51-60 age group (27.2%). There were (43.2%) males and (54.8%) females in each group, with a male-to-female ratio of 1:1.3. The predominant tribe was Nupe (73.3%), while (79.5%) were of the Islamic religion. Most were married (88.1%), with trading (36.4%) as the predominant occupation, and most (55.1%) lived below the national minimum wage of N30,000. The hypertensive and normotensive groups shared similar sociodemographic characteristics, except in religion, where there were statistically significant differences between them ($P = 0.039$).

Table 3 Respondents Sociodemographic Characteristics with being Hypertensive/Normotensive

Variable	Hypertensive		Normotensives		X^2	P – value
	Frequency n = 88	Percentage (%)	Frequency n = 88	Percentage (%)		
Age group (years)						
21-30	1	1.1	1	1.1	0.354	0.997
31-40	10	11.4	10	11.4		
41-50	31	35.3	31	35.3		
51-60	25	28.4	25	28.4		
61-70	20	22.7	20	22.7		
≥71	1	1.1	1	1.1		
Gender						
Male	38	43.2	38	43.2	0.000	1.000
Female	50	56.8	50	56.8		
Tribe						
Nupe	62	70.5	67	76.1	3.762	0.439
Hausa	4	4.5	7	8.0		
Yoruba	6	6.8	6	6.8		
Igbo	11	12.5	5	5.7		
Others	5	5.7	3	3.4		
Religion						
Islam	64	72.7	76	86.4	5.029	*0.039
Christianity	24	27.3	12	13.6		
Marital status						
Single	1	1.1	2	2.3	6.427	0.093
Married	73	83.0	82	93.2		
Widowed	11	12.5	3	3.4		
Separated/divorced	3	3.4	1	1.1		
Occupation						
Civil servant	15	17.0	22	25.0	3.264	0.515
Trading	33	37.5	31	35.2		
Artisan	4	4.5	4	4.6		
Farming	5	5.7	8	9.1		
Unemployed	31	35.3	23	26.1		
Educational status						
Completed Primary	13	14.8	8	9.1	1.867	0.760
Completed Secondary	27	30.7	29	33.0		
Completed Tertiary	22	25.0	27	30.7		
Islamic education	22	25.0	20	22.7		
None	4	4.5	4	4.5		
Average monthly income						
N30,000 & below	48	54.5	49	55.7	0.023	1.000
N30,000 & above	40	45.5	39	44.3		

Lifestyle parameters

The respondents' lifestyle pattern reveals that they were identical in practically every way, except the frequency of consumption of maize and wheat, which is statistically significant at $P = 0.039$ and 0.050, respectively.

Table 4: Comparative Lifestyle Characteristics (Diet And Exercise) of Hypertensive and Normotensive Respondents

Variable	Hypertensive		Normotensives		X^2	P – value
	Frequency n = 88	Percentage (%)	Frequency n = 88	Percentage (%)		
Exercise						
Always	2	2.3	0	0.0	4.504	0.212
Sometimes	45	51.1	41	46.6		
Rarely	30	34.1	40	45.4		
Never	11	12.5	7	8.0		
Rice consumption (frequently)						
Yes	67	76.1	70	79.5	0.297	0.586
No	21	23.9	18	20.5		
Millet consumption (frequently)						
Yes	29	33.0	33	37.5	0.398	0.528
No	59	67.0	55	62.5		
Maize consumption (frequently)						
Yes	51	58.0	64	72.7	4.240	*0.039
No	37	42.0	24	27.3		
Wheat consumption (frequently)						
Yes	21	23.9	11	12.5	3.819	*0.050
No	67	76.1	77	87.5		

Clinical profile of the hypertensive group

Hypertensive patients, mostly diagnosed within 5 years, primarily use pharmacological management (77.3%), calcium channel blockers, and diuretics (81.8%; 77.3% respectively).

Table 5: Clinical Profile of the Hypertensive Group

Variable	Hypertensive	
	Frequency n = 88	Percentage (%)
Duration of hypertension (years)		
0.5	48	545
6-10	27	30.7
11-15	12	13.6
16-20	1	1.1
Modalities of treatment		
Pharmacological alone	68	77.3
Pharmacological and lifestyle modification	20	22.7
Drugs used: CCB		
Yes	72	81.8
No	16	18.2
Drugs used: Diuretics		
Yes	68	77.3
No	20	22.7
Drugs used: ACEI		
Yes	38	43.2
No	50	56.8
Drugs used: ARBs		
Yes	8	9.1
No	80	90.9
Drugs used: β-blockers		
Yes	0	0.0
No	88	100.0
Drugs used: α-blockers		
Yes	0	0.0
No	88	100.0

The study found that hypertensive individuals have higher mean BMI, Systolic BP, and Diastolic BP compared to normotensives, and higher LDL-C compared to normotensives. Total cholesterol, HDL-C, and atherogenic index were higher in normotensives, while Triglycerides were higher in hypertensives. However, these differences are not statistically significant, except in HDL-C.

Table 6: Comparison of Mean Anthropometric and Biochemical Parameters of Hypertensive/normotensive Group

Variable	Hypertensives n = 88 Mean (±SD)	Normotensives n = 88 Mean (±SD)	P – value
BMI	29.3 (7.75)	24.4 (4.70)	0.000
Systolic BP	150 (17.32)	113 (11.40)	0.000
Diastolic BP	95 (10.75)	72 (7.42)	0.000
Total Cholesterol	5.36 (1.53)	8.97 (1.42)	0.415
Triglyceride	1.57 (1.24)	1.38 (0.62)	0.201
HDL – C	1.47 (0.97)	2.02 (1.04)	0.000
LDL – C	3.38 (1.41)	2.30 (0.98)	0.000
AI	4.8 (2.48)	6.64 (3. 61)	0.636

Prevalence of dyslipidaemia

The study found that 78.4% of hypertensive participants and 52.3% of controls had at least one lipid abnormality, with increased Total Cholesterol being the most common abnormality, compared to 27.3% in normotensive controls.

Figure 1: Prevalence of Dyslipidaemia in Hypertensive/Normotensive groups

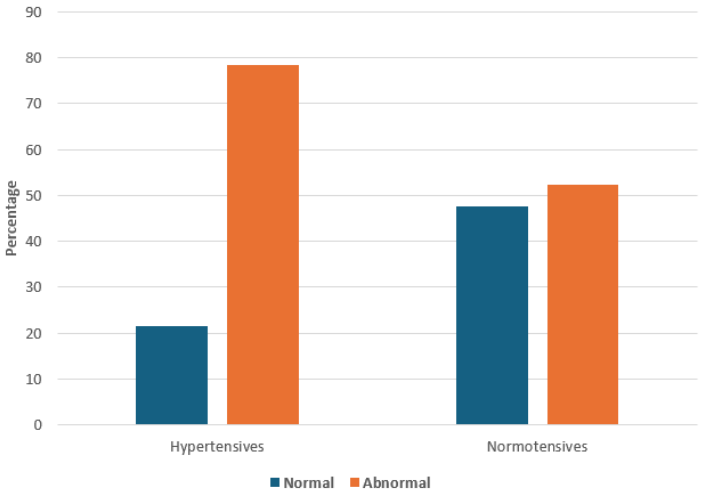

Table 7: Breakdown of Dyslipidaemia in Hypertensive/ Normotensive Groups

Variable	Hypertensive		Normotensives		χ^2	P – value
	Frequency n = 88	Percentage (%)	Frequency n = 88	Percentage (%)		
Total Cholesterol						
Normal	39	44.3	64	72.7	14.630	<0.001
Abnormal	49	55.7	24	27.3		
Triglyceride						
Normal	59	67.0	66	75.0	1.353	0.319
Abnormal	29	33.0	22	25.0		
HDL – C						
Normal	50	56.8	78	88.6	22.458	<0.001
Abnormal	38	43.2	10	11.4		
LDL – C						
Normal	45	51.1	76	86.4	25.415	<0.001
Abnormal	43	48.9	12	13.6		
Atherogenic index						
Normal	52	59.1	84	95.5	33.129	<0.001
Abnormal	36	40.9	4	4.5		

Discussion

Hypertension and dyslipidemia are major public health issues in developing nations, leading to morbidity and mortality.[12] These conditions are modifiable risk factors for cardiovascular disease, and their coexistence can exacerbate an individual's atherogenic index.[13] In Nigeria, the increasing prevalence of these risk factors adds to the burden of infectious diseases. Increased serum lipid levels predict coronary events, and atherosclerotic indices may also predict hypertension prevalence.[15] Preventing and controlling dyslipidemia is crucial for reducing coronary events.

The majority of the participants were in their fifth and sixth decades of life, with a mean age of 53±10 years. Hypertension prevalence increases with age, with the highest prevalence in the fifth and sixth decades. Females were more prevalent (56.8%) than males (43.2%), indicating better health-seeking behaviour. The predominant tribe and religion were Nupe and Islam, consistent with the study population's characteristics. The majority of respondents use calcium channel blockers as their primary anti-hypertensive, a trend similar to a study by

Ohishi et al in China,[16,] possibly due to JNC 8 guidelines for hypertension management [17]

This study found a significant prevalence of dyslipidaemia among hypertensive patients and controls, with a prevalence of 78.4% and 52.3%, respectively. This is consistent with previous studies conducted in Nigeria and around the world.[12,15,18,19] Previous studies have found high prevalence rates of dyslipidaemia in hypertensive patients, but this study was limited to a cardiology clinic with highly selected patients. Ayoade et al. also reported a high prevalence rate of dyslipidaemia in hypertensive patients, but not as high as in the current study.[20] Michael et al. found a high prevalence rate of 74.9% in hypertensive patients.[19] This high prevalence could be due to the increasing adoption of Western lifestyles, industrialization, and consumption of refined foods, high starch diets, and saturated fatty acids. Iloh et al. reported a high prevalence (44.3%) of dyslipidaemia in hypertension, but this was well below the current study's findings.[21] Meka et al. reported a high prevalence (44.0%) of dyslipidaemia in hypertension, but this was much lower than the current study's findings.[22] The observed differences may be due to different socio-cultural characteristics and the study population's age group.

A cross-sectional study by Kifle et al found a high prevalence (48.4%) of dyslipidaemia among hypertensive patients in Lumame, Ethiopia, but a lower prevalence (40.0%) in a case-control study by Lepira et al.[15,23] The difference could be due to different sociocultural practices and economic conditions in the two studies. Sociocultural practices can influence diet and lifestyle, which are risk factors for dyslipidaemia and hypertension. The study was conducted in Congo, East Africa, with different sociocultural practices, which could have accounted for the low prevalence. The Framingham Heart Study also reported that over 80% of hypertensive patients had at least one additional cardiovascular disease risk factor, predominantly atherogenic.[24]

This study found that serum lipid parameters, especially TC, HDL-C, and atherogenic index, were higher in normotensive groups than in hypertensive groups, while LDL-C and TG were higher in hypertensive groups. However, serum LDL-C concentration was significantly higher in the hypertensive group, while serum HDL-C concentration and AI were higher in the control group. This finding is consistent with previous studies, such as those by Onwubuya et al, Choudhury et al, Nayak et al, and Pooja et al., which found similar findings, except for serum TC and TG in the hypertensive group.[25-28] The findings are consistent with previous research. A study by Cheng et al found that serum TC, TG, and LDL-C concentrations were higher in hypertensive individuals than in the control group, while serum HDL-C concentration was higher in the control group.[29] However, only serum LDL-C concentration was significantly higher in the hypertensive group, and serum HDL-C concentration was statistically significantly higher in the control group. This difference could be due to the different sociodemographic characteristics of the study population.

Adamu et al found that serum lipid parameters were higher in the hypertensive group, but only serum TC concentration was significantly higher in the hypertensive group.[12] In both studies, HDL-C was significantly higher in the control group than in the hypertensive group, but AI was also significant in this study. These differences could be due to the different sociodemographic and economic characteristics of the different study populations, which have direct effects on diets, lifestyle, and physical activity. Kumar et al reported that all lipid parameters were higher among the hypertensive groups than in the control group.[30] Mahapatro et al reported that the mean values of serum TC, TG, and LDL-C were significantly higher in the hypertensive group than in the control group.[3] Akinlua et al found that serum TC and LDL-C were significantly higher in the hypertensive groups than in the control group.[31] The higher LDL-C and low HDL-C observed among hypertensives in these studies and other studies could be due to the association between dyslipidaemia and hypertension, primarily caused by endothelial damage and loss of physiological vasomotor activity due to atherosclerosis [32]

Conclusion

Based on the findings of this study, there is a significant difference in serum lipid levels between hypertensive and normotensive adults.

The prevalence of dyslipidaemia in the hypertensive group and normotensive group is 78.4% and 52.3% respectively.

Recommendation

The findings highlight the need for a comprehensive strategy for cardiovascular risk reduction and may influence guidelines for cholesterol screening and therapy in patients with different blood pressure levels. For example, more severe lipid-lowering therapies may be beneficial for hypertension patients, whereas specific lifestyle adjustments and medicines may be necessary for normotensive persons with dyslipidaemia, depending on their unique risk profiles.

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