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Research Article

Impact of Combined Hypertension and Diabetes on Dyslipidemia Prevalence Among Adults Aged 60 and Older: A retrospective study

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Abstract

Background and Aim: Dyslipidemia is a major modifiable risk factor for cardiovascular disease, particularly among older adults. Comorbidities such as diabetes mellitus and hypertension may exacerbate lipid abnormalities, compounding cardiovascular risk. This study aims to assess the impact of these comorbidities on lipid profiles among adults aged 60 years and above using a cross-sectional approach.

Method and Materials: A retrospective study was conducted on 579 participants aged 60 and above. Dyslipidemia was defined based on established lipid profile thresholds, including elevated total cholesterol (.>5.2 mmol/L), LDL-C (>3.4 mmol/L), triglycerides (≥1.7 mmol/L), or low HDL-C (<1.0 mmol/L in males and <1.3 mmol/L in females). Descriptive statistics were computed by gender to compare dyslipidemia prevalence and lipid profile characteristics.

Results: The prevalence of dyslipidemia was higher among females (60.2%) compared to males (44.6%). Gender differences in lipid profiles were evident, with females having higher levels of total cholesterol (5.19 mmol/L vs. 4.67 mmol/L) and LDL cholesterol (3.18 mmol/L vs. 2.84 mmol/L), while males exhibited higher HDL cholesterol (1.69 mmol/L vs. 1.38 mmol/L) and lower triglyceride levels (1.23 mmol/L vs. 1.48 mmol/L). Additionally, individuals with multiple comorbidities had the highest prevalence of dyslipidemia (65.8%), followed by those with no comorbidities (53.9%) and single comorbidities (44.9%). Hypertension was associated with lower total cholesterol and LDL cholesterol, but higher HDL cholesterol compared to non-hypertensive individuals, while diabetes showed no significant impact on lipid profiles compared to non-diabetics. Statin users had significantly higher total cholesterol, LDL-C, and cardiovascular risk scores, but lower HDL-C levels. Increasing age (OR = 1.030, 95% CI: 1.005-1.055, p = 0.018) was significantly associated with the increased odds of dyslipidemia, whereas hypertension, diabetes, statin use, and gender were not significant factors.

Conclusion: Older adult females exhibit a higher prevalence of dyslipidemia and less favorable lipid profiles compared to their male counterparts. These findings underscore the need for gender-specific screening and interventions in dyslipidemia management among the elderly.

Kew Words: dyslipidemia; diabetes; hypertension; cardiovascular risk; older adults; lipid profile; cross-sectional study

Introduction

As the global population continues to age, the occurrence of multiple comorbidities in older adults has significantly increased. Dyslipidemia, which is marked by abnormal lipid levels such as high total cholesterol, elevated low-density lipoprotein (LDL) cholesterol, reduced high-density lipoprotein (HDL) cholesterol, and high triglycerides, is a prevalent metabolic disorder in this demographic.[1] The presence of comorbid

conditions, including diabetes, hypertension, cardiovascular diseases, and obesity, has been found to profoundly impact lipid metabolism and heighten the risk of developing dyslipidemia in older adult.[2,3]

Dyslipidemia is widespread across all geopolitical zones of Nigeria, with prevalence rates ranging from 60% among healthy individuals to as high as 89% among diabetic patients.[4] In older populations, the prevalence of dyslipidemia is notably high, with patterns varying depending on the presence of comorbid conditions. Low HDL cholesterol (HDL-C) is the most common dyslipidemia pattern, affecting 37.6% to 59.3% of individuals.[3] Elevated LDL cholesterol (LDL-C) is observed in 25.7% to 60.9% of individuals, particularly among those with diabetes or hypertension.[4] Hypertriglyceridemia (high TG) is found in 15% to 34.8% of individuals, often associated with obesity and diabetes. [5]Additionally, studies suggest regional differences in dyslipidemia prevalence between rural and urban populations: rural dwellers tend to have higher rates of elevated LDL-C and hypertriglyceridemia, likely due to lifestyle factors such as lower physical activity levels and poor dietary habits.[4]

Comorbidities such as diabetes, hypertension, cardiovascular diseases, obesity, chronic kidney disease (CKD), and thyroid disorders significantly contribute to the development of dyslipidemia in older adults. These conditions often interact with each other, amplifying the risk of dyslipidemia and its associated cardiovascular complications.[6] Diabetes is strongly linked to dyslipidemia, particularly elevated triglycerides (TG) and low-density lipoprotein cholesterol (LDL-C 4,5] A study revealed that diabetic individuals aged 60 and older had a notably higher prevalence of dyslipidemia compared to their non-diabetic counterparts in the same age group. [7-8]The altered lipid profile in diabetes is thought to play a key role in the increased cardiovascular risk observed in this patients.[7, 8]

Hypertension, another common comorbidity in older adults, is closely associated with dyslipidemia. Both conditions frequently coexist due to age-related mechanisms, including endothelial dysfunction and increased arterial stiffness. In elderly individuals, hypertension can lead to elevated LDL cholesterol and triglycerides while simultaneously lowering HDL cholesterol levels.[9,10] Studies also demonstrated that hypertensive patients aged 60 and above had significantly higher levels of total cholesterol and LDL cholesterol compared to normotensive individuals. The combination of high blood pressure and dyslipidemia accelerates atherosclerosis, increasing the risk of cardiovascular events in this population.[11, 12]

Older adults with pre-existing cardiovascular diseases (CVD), such as coronary artery disease or heart failure, often exhibit dyslipidemia as part of their disease process. Dyslipidemia in individuals with CVD is typically characterized by high LDL cholesterol and triglyceride levels, and low HDL cholesterol.[2]People with heart disease are more likely to have lipid imbalances that contribute to plaque formation in the arteries, elevating the risk of myocardial infarction and stroke. [12, 13]The relationship between CVD and dyslipidemia is complex, involving genetic, inflammatory, and metabolic factors. Additionally, older adults with CVD are often prescribed statins or other lipid-lowering drugs, which can alter their lipid profiles and affect the relationship between CVD and dyslipidemia.[14, 15]

Obesity, particularly visceral obesity, is closely associated with dyslipidemia in older adults. The accumulation of excess adipose tissue leads to an increase in free fatty acid production, which disrupts lipid metabolism by raising triglyceride levels and lowering HDL cholesterol. [16, 17] Studies reviewed older adults with obesity were at a significantly higher risk of developing dyslipidemia, even after accounting for comorbidities like diabetes and hypertension. Furthermore, obesity is often linked to insulin resistance in older adults, which exacerbates dyslipidemia by increasing triglycerides and decreasing HDL cholesterol levels. The combination of obesity and comorbidities like diabetes further elevates the cardiovascular risks associated with dyslipidemia.[2,18,19]

Chronic kidney disease (CKD) is another common comorbidity in older adults that is frequently associated with dyslipidemia. CKD leads to alterations in lipid metabolism, often resulting in elevated triglyceride levels, increased LDL cholesterol, and decreased HDL cholesterol. Studies have shown that dyslipidemia in CKD patients contributes to the accelerated progression of atherosclerosis, increasing the risk of cardiovascular morbidity and mortality.[20, 21] In the general population, CKD is strongly associated with an unfavorable lipid profile, characterized by elevated triglycerides and a higher concentration of small, dense LDL particles, which are considered more atherogenic. The interplay between renal dysfunction, dyslipidemia, and cardiovascular disease is a critical concern for older adults with CKD.[20, 21]

Thyroid dysfunction, especially hypothyroidism, is prevalent in older adults and can significantly impact lipid metabolism. Hypothyroidism is typically associated with elevated total cholesterol and LDL cholesterol levels, while hyperthyroidism generally lowers cholesterol levels.[22-24] A study found that older adults with subclinical hypothyroidism had a higher incidence of dyslipidemia, primarily elevated LDL cholesterol levels. The effects of thyroid dysfunction on lipid metabolism may be further exacerbated by the presence of other comorbidities such as diabetes and hypertension, making the management of lipid levels more challenging in this population.The relationship between comorbidities and dyslipidemia in older adults is complex and involves several key mechanisms, including insulin resistance, endothelial dysfunction, and inflammation.[25-27]

While individual comorbidities such as diabetes, hypertension, and obesity have been associated with dyslipidemia, there is limited research that systematically examines the combined effect of multiple comorbidities on dyslipidemia in older adults. Additionally, although the relationship between dyslipidemia and cardiovascular risk is well-established, the impact of the cumulative burden of multiple comorbidities on cardiovascular risk through dyslipidemia in older adults remains insufficiently understood.[6, 28] Therefore, this study aims to explore the relationship between specific comorbidities (diabetes, hypertension, cardiovascular diseases) and dyslipidemia in adults aged 60 and above. It will assess the prevalence of dyslipidemia in older adults with different comorbidities and investigate whether the presence of multiple comorbidities increases the risk of dyslipidemia more than a single comorbidity. The study will offer valuable insights into whether multiple comorbidities amplify the risk of dyslipidemia, as compared to the effect of each comorbidity individually, and evaluate the overall cardiovascular risk in older adults.

Material &Methods

- Data Source:
    - The study employed secondary data obtained from the electronic health records (EHR) of Nisa-Garki Hospital from January 2020 to January 2025.
    - This EHR dataset includes comprehensive health information for all patients who received care at the hospital, encompassing medical histories, laboratory results, and demographic details.
- Study Population:
    - The focus was on adults aged 60 years and older, specifically to assess the risk of dyslipidemia and the impact of comorbidities in this age group.
    - Only individuals with complete data on lipid profiles (total cholesterol, LDL-C, HDL-C, triglycerides) and comorbidities (diabetes, hypertension, cardiovascular disease) were included in the study.
- Variables Collected:

- Demographics: Information on age, sex, and socioeconomic status.
- Comorbidities: Data on diagnoses of diabetes, hypertension, and cardiovascular diseases as recorded in the EHR.
- Lipid Profile: Measurements for total cholesterol, LDL-C, HDL-C, and triglycerides.
- Other Variables: Data on medications (e.g., statins, antihypertensive drugs), smoking status, and other lifestyle factors.

- Inclusion Criteria:
  - Adults aged 60 years and older.
  - Individuals with complete data on comorbidities and lipid profiles.
- Exclusion Criteria:
  - Adults younger than 60 years.
  - Incomplete or missing data for essential variables, such as lipid profiles or comorbidity information.
  - Pregnant or breastfeeding women.

Definition of Term; For the purpose of this study, dyslipidemia was defined using guidelines from National Cholesterol Education Program (NCEP ATP III)**:** [29-31]

- High Total Cholesterol (>5.2mmol/L)
- High LDL-C (>3.4 mmol/L)
- Low HDL-C (<1.0 mmol/L)
- High Triglycerides (>1.7 mmol/L)

Data Management

Ethical clearance was obtained from Federal Capital Territory Health Research Ethical Review Committee. The study adhered to ethical guidelines, ensuring patient confidentiality and privacy. The collected data were processed and analyzed using statistical software MS-Excel 2013 and SPSS version 24. First data was entered in excel and then transferred to SPSS for analysis.

Statistical analysis was performed with SPSS software version 24. Data was expressed as the mean ± SD for continuous variables while categorical variables were expressed as frequencies and percentages. Categorical variables were compared with chi-square while means was compared using independent t test between 2 groups. Of more than 2 groups and with a continuous outcome was tested with one way analysis of variance ANOVA. Association between variables was determined using Pearson's or Spearman's coefficient of association if the data was normally distributed or skewed respectively. Multiple logistic regression was used to determine the association between multiple variables. Significant P value was taken to be <0.05.

Results

The study cohort consists of older adults, with a mean age of 67.6 years, ranging from 60 to 92 years. The average age was comparable between genders, with females having a mean age of 68.5 years and males 67.6 years. A significant proportion of participants are hypertensive (82.47%), and many also have diabetes (64.18%). Statin use is prevalent, with 55.93% of participants being prescribed statins. Table1

Dyslipidemia was more common among females, with 60.2% of females affected compared to 44.6% of males. Gender differences in lipid profiles were observed, with females exhibiting higher mean levels of total cholesterol (5.19 mmol/L vs. 4.67 mmol/L) and LDL cholesterol (3.18 mmol/L vs. 2.84 mmol/L), while males had higher HDL cholesterol levels (1.69 mmol/L vs. 1.38 mmol/L) and lower triglyceride levels (1.23 mmol/L vs. 1.48 mmol/L)-Table 1. A higher prevalence of elevated total cholesterol (TC) was noted in females (15.3% higher than males), while males had a higher prevalence of elevated triglycerides (3.4% higher than females). Additionally, low HDL cholesterol (HDL-C) was more common in males (22.0% vs. 18.6%) (Table 2).

The prevalence of dyslipidemia varied across different comorbidity groups. Participants with multiple comorbidities exhibited the highest prevalence of dyslipidemia (65.8%), followed by those without comorbidities (53.9%), and those with a single comorbidity (44.9%) - (Table 3). Hypertensive individuals had significantly lower levels of total cholesterol and LDL cholesterol, but higher levels of HDL cholesterol compared to their non-hypertensive counterparts. No significant differences in lipid levels or cardiovascular risk scores were found between diabetic and non-diabetic individuals.

Statin users displayed significantly different lipid profiles and cardiovascular risk scores compared to non-users. Statin use was associated with significantly higher levels of total cholesterol, LDL-C, and cardiovascular risk scores, but lower levels of HDL-C, when compared to non-users (Tables 4a-c).

Multivariate logistic regression analysis was conducted to determine the independent effects of various risk factors on the likelihood of dyslipidemia in older adults. After adjusting for age, the only factor significantly associated with an increased odds of dyslipidemia was age itself (Odds Ratio = 1.030, 95% Confidence Interval: 1.005 - 1.055, p = 0.018). Neither hypertension, diabetes, statin use, nor gender showed a significant association with dyslipidemia in this model.

Variable	N= 579 Mean	Female n= 294	Male n =285
Age	67.56 ± 6.79	68.5 ± 7.1	67.6 ± 7.5
Total Cholesterol (mmol/L)	4.94 ± 1.24	5.19 ± 1.2	4.64 ± 1.1
LDL-C (mmol/L)	3.04±1.13	3.18±1.1	2.84±0.9
HDL-C (mmol/L)	1.32±0.45	1.38±0.5	1.69±0.4
Triglyceride (mmol/L)	1.52±3.08	1.48±0.6	1.23±0.7
Systolic BP (mmHg)	134.43 ±3.08	136.7± 20.8	133.0±25.6
CV score %	20.89 ± 13.12	16.9±8.6	25.7± 16.5
Dyslipidemia n (%)	304 (52.50)	177(60.20)	127 (44.56)
Diabetes n (%)	291 (50.25)	168(57.14)	123 (43.16)
Hypertension n (%)	501 (86.52)	241 (81.97)	260(91.55)
Smoking n (%)	2(0.35)	1(0.34)	1(0.35)
On statin n (%)	324 (55.93)	159 (54.08)	165 (57.89)

HDL – high density lipoprotein, LDL-low density lipoprotein, CV cardiovascular risk score

Table 1: Baseline Clinical Profiles of the Subjects

Parameter	Female Prevalence	Male Prevalence
High Total Cholesterol (>5.2)	44.1%	28.8%
High LDL-C (>3.4)	32.2%	25.4%
Low HDL-C (<1.0)	18.6%	22.0%
High Triglycerides (>1.7)	27.1%	30.5%

HDL – high density lipoprotein, LDL-low density lipoprotein

Table 2: Gender-based prevalence of Dyslipidemia

Comorbidity Group	**No Dyslipidemia**	**With Dyslipidemia**	**Total Participants**	**Prevalence (%)**
None	12	14	26	53.85%
Single	195	159	354	44.92%
Multiple	68	131	199	**65.83%**

Table 3: Prevalence **o**f dyslipidemia by comorbidity group

Lipid Level	T-statistic	P-value
Total Cholesterol	-2.589	0.010
LDL-C	-2.199	0.029
HDL-C	2.222	0.027
Triglyceride (Tg)	-0.534	0.594
CV Score %	-0.437	0.662

HDL – high density lipoprotein, LDL-low density lipoprotein, CV cardiovascular risk score

Table 4a: Comparison of lipid levels and CV risk between different groups (Hypertensive vs. Non-Hypertensive)

Lipid Level	T-statistic	P-value
Total Cholesterol	0.317	0.751
LDL-C	0.382	0.703
HDL-C	-1.268	0.206
Triglyceride (Tg)	0.315	0.753
CV Score %	1.590	0.113

HDL – high density lipoprotein, LDL-low density lipoprotein, CV cardiovascular risk score

Table 4b: Comparison of lipid levels and CV risk between different groups (Diabetic Vs. Non –Diabetic)

Lipid Level	T-statistic	P-value
Total Cholesterol	6.951	0.000
LDL-C	6.963	0.000
HDL-C	-2.889	0.004
Triglyceride (Tg)	1.713	0.087
CV Score %	5.081	0.000

HDL – high density lipoprotein, LDL-low density lipoprotein, CV cardiovascular risk score

Table 4c: Comparison of lipid levels and CV risk between different groups (Statin Users Vs Non Statin-Users)

Variable	OR	95% CI	P-Value
Age	1.030	(1.005, 1.055)	0.018
Gender	1.075	(0.379, 0.524)	0.753
Hypertension	1.672	(-0.060, 1.089)	0.079
Diabetes	1.163	(-0.338, 0.640)	0.544
Statin Use	0.995	(-0.467, 0.457)	0.983
Constant	0.204	(-2.730, -0.447)	0.006

Table 5: Multivariable logistic regression-(assessing independent effects on dyslipidemia)

Discussion

The higher prevalence of dyslipidemia observed in females in this age group reflects well-established patterns in cardiovascular risk factors, underscoring the importance of gender-specific strategies for managing dyslipidemia and cardiovascular risk in older adults. The findings of this study are consistent with numerous others, which show that older women tend to have higher levels of LDL cholesterol and total cholesterol, while men typically exhibit higher HDL cholesterol and lower triglyceride levels. These differences are likely attributed to hormonal, metabolic, and body composition factors that change with age, particularly after menopause. [32-33]

In postmenopausal women, the decline in estrogen levels can lead to an increase in LDL cholesterol and a decrease in HDL cholesterol. Estrogen is known to have a protective effect on lipid profiles, and its reduction after menopause may contribute to the rise in cholesterol levels observed in older women. [34-35] Multiple studies found that women over the age

of 50 were more likely to have high cholesterol compared to men, whereas younger adults typically show higher cholesterol levels in males. This age-related increase in gender differences in lipid profiles aligns with broader trends in the literature, suggesting that aging and hormonal changes play a significant role in this variations.[32, 36]

Additionally, differences in body fat distribution between males and females may contribute to the higher triglyceride levels observed in women in this study. Women generally have more body fat, which can lead to higher triglyceride levels, as fat cells produce adipokines that influence lipid metabolism, promoting increased triglyceride production.[37-39] Furthermore, higher triglycerides and lower HDL cholesterol levels in women are associated with a greater prevalence of metabolic syndrome, a condition that increases the risk of cardiovascular disease. Some studies indicate that older women with metabolic syndrome tend to have significantly higher triglyceride levels than men, which may help explain the gender differences observed in this study.[37-38]

Hypertensive patients in our study exhibited significantly lower total cholesterol and LDL-C levels but higher HDL-C levels compared to non-hypertensive individuals. While some studies suggest that hypertension is commonly associated with dyslipidemia, characterized by elevated total cholesterol, LDL-C, and triglycerides, along with decreased HDL-C, other research, including findings similar to ours, particularly in treated hypertensive patients, shows mixed results.[40-43] It is possible that the hypertensive group in our study is well-managed with medications that influence lipid profiles, contributing to the observed differences.

In contrast, no significant differences in lipid levels or cardiovascular (CV) scores were found between diabetic and non-diabetic individuals in our study. Many studies have consistently shown that diabetes is linked to a higher risk of dyslipidemia, characterized by increased triglycerides, lower HDL-C, and a higher proportion of small dense LDL particles.[44-45] The absence of significant differences in our dataset could be due to several factors: the inclusion of well-managed diabetic patients with optimized lipid profiles through medication and lifestyle interventions, a sample size too small to detect significant differences, or other unaccounted factors influencing the results.[45-46]

Additionally, statin users in our study displayed significantly different lipid profiles and CV risk scores compared to non-users. Specifically, statin users had higher total cholesterol, LDL-C, and CV scores, but lower HDL-C levels. While this finding may seem counter-intuitive, it aligns with clinical practice. Statins are prescribed to individuals with higher cholesterol levels, so the observed higher cholesterol levels likely reflect pre-treatment conditions. Statin therapy is known to lower LDL-C and total cholesterol, while modestly increasing HDL-C and reducing triglycerides, explaining the lipid profile changes in this group.[47-48]

Lastly, individuals with both hypertension and diabetes showed a significantly higher risk of dyslipidemia compared to those with only one or neither condition. This supports existing literature on the synergistic effect of multiple metabolic disorders on lipid metabolism. Our findings highlight the importance of integrated screening and management strategies for older adults with multiple comorbidities, to reduce the cardiovascular risks associated with this conditions.[49-51]

Conclusion

This analysis provides important insights into the lipid profiles and cardiovascular risk factors in an elderly population with a high prevalence of comorbidities. It revealed that hypertension is significantly associated with altered lipid profiles among the study population. In contrast, diabetes mellitus did not demonstrate a statistically significant association with lipid levels within this dataset. Furthermore, statin therapy was linked to marked differences in both lipid profiles and cardiovascular risk scores, likely reflecting its prescription in individuals with elevated cholesterol levels. These findings have important clinical implications and may contribute to more targeted risk stratification and management strategies in elderly patients presenting with dyslipidemia and associated comorbidities.

Limitations

Since this study relies on secondary data from the electronic health records (EHR) of Garki Hospital, the accuracy and completeness of the findings depend on the quality of the original records. Additionally, because the study used a cross-sectional design, it can only establish associations between comorbidities and dyslipidemia in older adults, rather than determining causal relationships. Consequently, the temporal dynamics between comorbidities and changes in lipid profiles cannot be assessed. Furthermore, the study sample is limited to patients who visit Garki Hospital, which may not fully represent the broader older adult population, especially those who do not seek medical care or those from different regions or socioeconomic backgrounds. This limits the generalizability of the findings to other areas of Nigeria. While the dataset includes information on medications like statins or antihypertensive drugs, variations in medication dosage, adherence, and potential drug interactions may not be fully captured, which could affect the lipid profiles observed in the study.

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Reference

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