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Prevalence and risk factors of dyslipidemia among hypertensive patients at Mukono General Hospital. Descriptive cross-sectional study.

Roy Nassaka*, Joel Philp Mwesigwa, Habert Mabonga.
University Of Kisubi

Abstract:

Background:

Cardiovascular disease is the leading cause of morbidity and mortality worldwide, and dyslipidemia is one of the major risk factors. Dyslipidemia may be classified as increased levels of serum total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG), and a decreased serum high-density lipoprotein cholesterol (HDL-C) concentration. The current study investigated the prevalence of dyslipidemia and associated risk factors among hypertensive patients at Mukono General Hospital.

Methodology:

A total of 184 participants enrolled in the study, 118 were women with a percentage of 64%, and 66 were men with a percentage of 36%. Results were analyzed at 95% confidence interval to check statistical significance from a chi-squared test.

Results:

As a result, the total prevalence of dyslipidemia was 65%, 45% more in women, with a p-value of 0.497. Further, the prevalence of dyslipidemia was higher in alcohol intake (58%) and those above 40 years (83%), with p values of 0.001 and <0.000. Thus, age and alcohol were the major predisposing factors to dyslipidemia in this study.
Additionally, the most prevalent type of dyslipidemia was triglycerides (37%) with p-value <0.000, followed by total cholesterol (36%) with p-value 0.314, LDL-C (33%) with p-value 0.152, and low HDL-C (28%) with p-value 0.003

Conclusions:

The total prevalence of dyslipidemias was 65%, with a higher prevalence of 45% from women and 20% from women. Furthermore, the prevalence of dyslipidemias was greatly affected by gender, alcohol intake, and age of the participants. However, FBG and BMI cannot be ruled out as factors not affecting the prevalence of dyslipidemias since a few of the participants were diabetic (around 18%) and obese (8%).

Recommendations:

It is also worth evaluating the prevalence of dyslipidemias and predisposing factors in school-going children because of the rampant rise in obesity among them.

***Keywords**: Prevalence, Risk Factors, Dyslipidemia, Hypertensive Patients, Mukono General Hospital.*
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***Corresponding author:** Roy Nassaka*
Email: roynassaka@gmail.com
University of Kisubi

Background of the study

Dyslipidemia is a state that occurs due to abnormalities in the plasma lipids. The prevalence of dyslipidemia varies geographically; however, it has been estimated that more than 50% of the adult population has dyslipidemia worldwide. (Newton, 2019; Obsa et al., 2022).
Dyslipidemia is characterized by an elevation of serum total cholesterol, low-density lipoprotein cholesterol, triglycerides, and reduced serum high-density lipoprotein cholesterol (HDL-C). Dyslipidemia is a major modifiable risk factor for CVD. (C. Thambiah & Lai, 2021; Yavuz, 2022a). It can be classified into hypercholesterolemia, hypertriglyceridemia, and mixed hyperlipidemia, characterized by elevated levels of either total cholesterol or triglycerides, or a combined pattern. (Bitencourt et al., 2023).
Dyslipidemia is a major independent modifiable risk factor for cardiovascular diseases. The prevalence of dyslipidemia is high and increasing in most developed countries as well as in many developing countries as a result of the westernization of diet, obesity, reduced physical activity, and other adverse lifestyle changes. Hypertriglyceridemia and low serum high –density lipoprotein cholesterol (LDL-C) are established, defining features of dyslipidemia.

(Dybiec et al., 2023). Dyslipidemia is increased by visceral adiposity, metabolic syndrome (MS), insulin resistance, and diabetes mellitus (DM). Dyslipidemia is a common public health problem in Africa. It has emerged as an important cardiovascular risk factor. It has been steadily increasing due to economic growth, urbanization, and unhealthy dietary patterns. (Costa-Urrutia et al., 2021; Mansfield et al., 2022). Therefore, it is essential to identify determinants of dyslipidemia to prevent the condition and reduce its long term sequel.

Cardiovascular disease is the leading cause of morbidity and mortality worldwide, and dyslipidemia is one of the major risk factors. Hypercholesterolemia is the most common form of dyslipidemia. Low-density lipoprotein, as the most abundant apolipoprotein B (ApoB)-containing lipoprotein in human plasma, is a key transmitter of cholesterol to the vascular wall. (Fiorentino & Chiarelli, 2021). The elevation of LDL cholesterol is the principal aspect of dyslipidemia and is associated with an increased cardiovascular risk, particularly in atherosclerotic cardiovascular disease.(Jang et al., 2021)

Dyslipidemia is responsible for more than half of the global IHD and more than 4 million deaths annually. (Yang et al., 2021). It remains a common public health problem, as abnormal serum lipid profiles have been steadily increasing due to economic growth, urbanization, and unhealthy lifestyles. (Atmosudigdo et al., 2021). In Africa, the prevalence of dyslipidemia ranges from 5.3 to 89.9%. The presentation of an abnormal lipid profile is common in individuals with central obesity, anti-retroviral therapy ART, metabolic syndrome, insulin resistance, and type 2 diabetes mellitus (DM) (Chang & Wu, 2013). The duration of HIV treatment, advanced age, sex, low CD4 counts, smoking, alcohol consumption, depression, and adiet high in saturated fat, a sedentary lifestyle, and obesogenic factors are the major risk factors of dyslipidemia. (Pirillo et al., 2021; Yavuz, 2022b).

Although the measurement of plasma lipid and lipoprotein levels in different parts of the world was examined in previous studies, the prevalence of dyslipidemia and its risk factors in hypertensive patients in Uganda has been inadequately documented. It has been shown that the effective treatment of dyslipidemia reduces the rate of cardiovascular morbidity and mortality. Therefore, estimation of the prevalence of dyslipidemia ensures proper planning of health actions for both the primary and secondary prevention of cardiovascular events. In this study. We present the findings of a study that evaluated the prevalence of dyslipidemia and its associated risk factors in hypertensive patients at Mukono General Hospital.

Methodology

Study subjects

The study involved hypertensive patients at Mukono General Hospital, both male and female.

study design

This was a cross-sectional study design because the exposure and outcome would be measured at the same time; the prevalence of dyslipidemia, associated risk factors(age, sex, diabetes, and BMI), and the most common type of dyslipidemia were assessed using this study design.

Study area

The samples for this research were collected from Mukono General Hospital, located on the Kampala Jinja Highway, in the town of Mukono, approximately 20 kilometers east of Kampala, the capital and largest city in the country. The coordinates of the hospital are: 021’40.0” N, $32^0$44’49.0” E (latitude: 0.361123; longitude: 32.746941).

Sample population

Blood samples were drawn from patients above 18 years of age, irrespective of their gender, tribe, or background.

Sample size determination

The sample size for this study was calculated from the formula below:

$n = z^2P(1-P)/d^2$

Where;

n is the sample size

, z is the statistic corresponding to the level of confidence (a 95% confidence interval will be used)

P is expected prevalence (taken as 13.9%)

d is precision (corresponding effect size)

$n = 1.96^2 \text{ X } 0.139 \text{ X } (1-0.139) /0.05^2$

$= 184$

Therefore, 184 samples were used in this study.

Exclusion and Inclusion criteria

Patients aged 18 and above were used in this study.

Patients undergoing statin treatment were excluded from the study.

Only patients with systolic blood pressures above 140mmHg and diastolic pressures above 90mmHg were used in this study.

Sampling techniques and procedure

A probabilistic stratified random sampling, where the population was divided into homogenous strata or subgroups according to a demographic factor (age, gender, BMI, and diabetic status), because the current study is quantitative in nature, was employed in this study. The samples were then withdrawn from the different strata.

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Additionally, a non-probabilistic convenience sampling method was equally employed because of the availability, proximity, and accessibility of the hypertensive patients at Mukono General Hospital.

Data collection methods

Interviews were used to gather information from individuals 1-on-1, using a series of predetermined questions or a set of interest areas. These were performed through the use of a well-formulated and structured questionnaire to probe and prompt patients to collect richer data. This was prudent in assessing the risk factors of dyslipidemia in hypertensive patients.

Experimental data obtained from samples run in a chemistry analyzer (CoBas c111) were used to assess the prevalence of dyslipidemia and the common type of dyslipidemia in patients.

Data collection instruments

A research question was used in this study. It briefly entailed an introduction, stating the aims of the study and providing information about the investigator. The arrangement of the questions was in a logical and structured sequence, with general questions preceding the specific, in order to obtain better responses from the participants.

Other collection tools, such as laboratory manuals, online research articles, and a notebook, were used to gather experimental data.

Validity and reliability.

Validity encompasses the entire experiment concept and establishes whether the results obtained meet all of the requirements of the scientific research method. It means appropriateness of the tools, processes, and data. Reliability refers to how consistently a method measures something. It was emphasized that the concept of data reproducibility is under the same conditions. It addresses the consistency of the data generated.

Procedure of data collection.

Primary data was collected from hypertensive patients at Mukono General Hospital through questionnaires, and experimental data was generated from the chemistry analyzer (coBas c111). Secondary data was downloaded from the internet and from laboratory manuals to obtain references.

Data analysis

The raw data obtained from the lab and questionnaires were recorded in a notebook. Data was then entered into Microsoft Word and Excel, where descriptive statistics were obtained, and further exported to Statistical Package for Social Sciences (SPSS) for a detailed analysis.

In SPSS, the odds ratios between the exposed and non-exposed were computed from a chi-squared test. Also, the p-values were computed at a 95% confidence interval to determine the significance or non-significance of a variable(s).

Ethical considerations

Formal permission was sought from the school's Research Ethics Committee (REC) for the initial approval of the research proposal. Further, permissions were obtained from the REC of Mukono General Hospital for access to the facility and the patients. Also, patients were allowed to enroll in the study voluntarily and consented by filling out an acceptance form.

Results

The study comprised 184 participants, 118 being women, with a percentage of 64%, and 66 being men, with a percentage of 36%. Five parameters (sex, age, alcohol, BMI, and FBG were assessed, and their impact on dyslipidemias (total cholesterol, triglycerides, LDL-C, and HDL-C) was evaluated. A chi-squared test χ^2 was performed to determine the statistical significance between the different factors, as illustrated in the table one.

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		PREVALENCE			
VARIABLES	CATEGORIES	TOTAL	MEN	WOMEN	P-VALUE
Dyslipidemias	YES	119 (65%)	37 (20%)	82 (45%)	0.497
	NO	65 (35%)	29 (16%)	36 (20%)	
Alcohol	YES	106 (58%)	55 (30%)	51(28%)	0.001
	NO	78 (42%)	11 (6%)	67 (36%)	
AGE (YRS)	18-39	31 (17%)	13 (7%)	18 (10%)	0.000
	40-59	73 (40%)	37 (20%)	36 (20%)	
	>60	80 (43%)	35 (19%)	45 (24%)	
Total cholesterol	<200mg/dl	117 (64%)	41 (22%)	76 (41%)	0.314
	>200mg/dl	67 (36%)	25 (14%)	42 (3%)	
Triglyceride	<150mg/dl	116 (63%)	36 (20%)	80 (43%)	0.000
	>150mg/dl	68 (37%)	30 (16%)	38 (21%)	
LDL-C	<100mg/dl	124 (67%)	39 (21%)	85 (46%)	0.152
	>100mg/dl	60 (33%)	27 (15%)	33 (20%)	
HDL-C	<40mg/dl	51 (28%)	11 (60%)	40 (22%)	0.003
	>40mg/dl	133 (72%)	55 (30%)	78 (42%)	
FBG	Normal	151 (82%)	52 (28%)	99 (54%)	0.445
	Pre-diabetic	21 (11%)	9 (5%)	12 (7%)	
	diabetic	12 (7%)	5 (3%)	7 (4%)	
BMI	Underweight	10 (5%)	3 (2%)	7 (38%)	0.217
	Normal	114 (62%)	46 (5%)	68 (37%)	
	Overweight	45 (24%)	12 (7%)	33 (18%)	
	Obese	15 (8%)	5 (3%)	10 (5%)	

Moreover, the prevalence of dyslipidemias in hypertensive patients (n = 184) was 65% in the total population, 20% of dyslipidemias being in men and 45% in women, as elaborated in the graph one.

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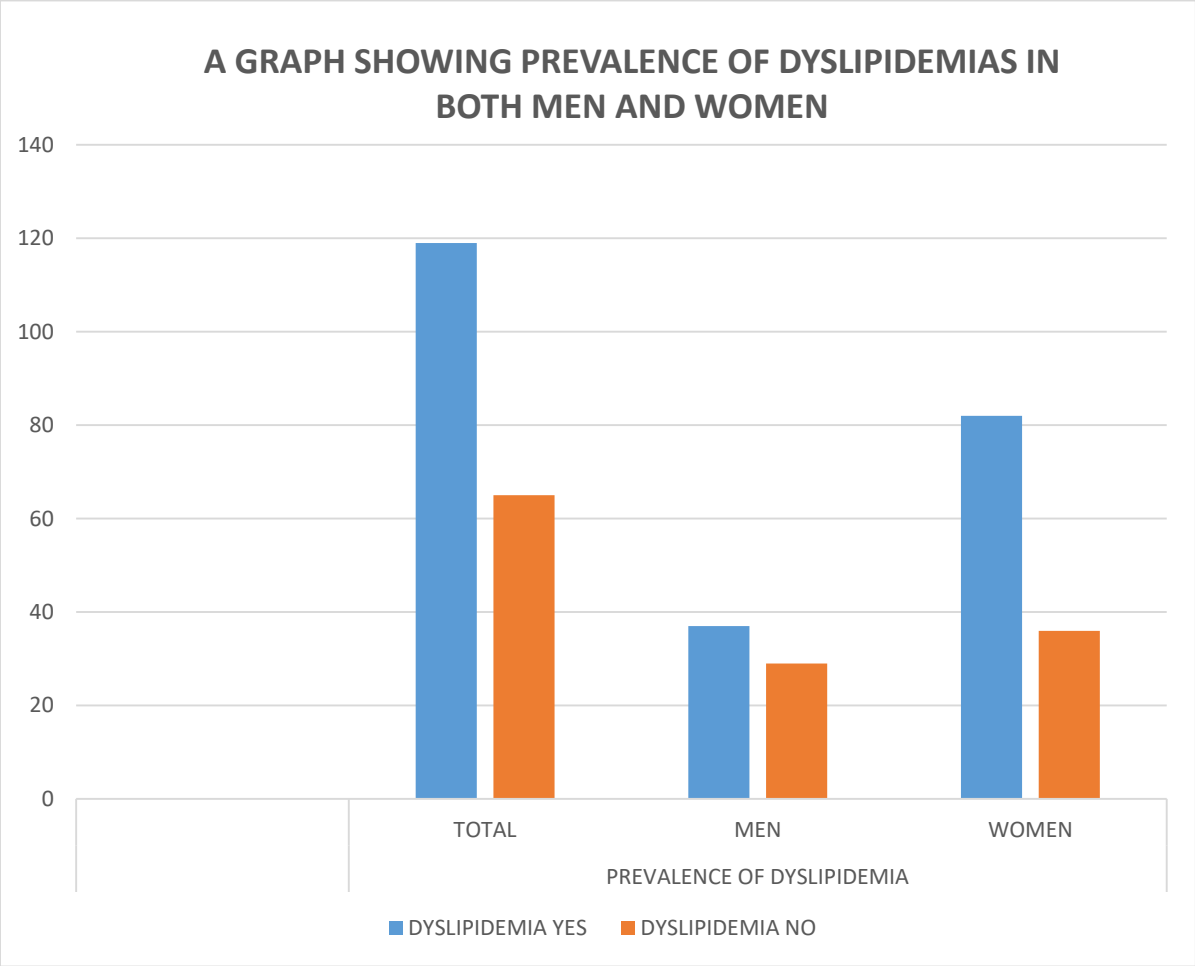

Prevalence = total number of diseased/total population
= 119/184
= 65%

Similarly, the prevalence of dyslipidemias was more prevalent in alcohol users (58%) and was also more prevalent in the elderly (50 years and above), with a prevalence of 83%, as illustrated in graph two.

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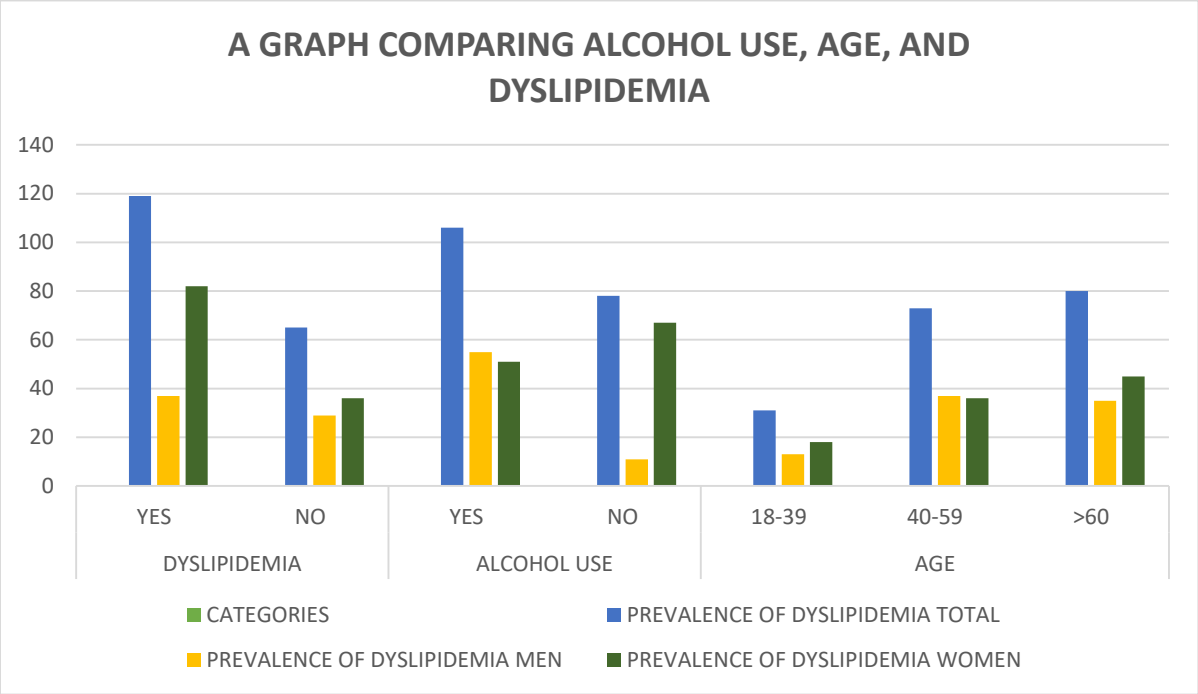
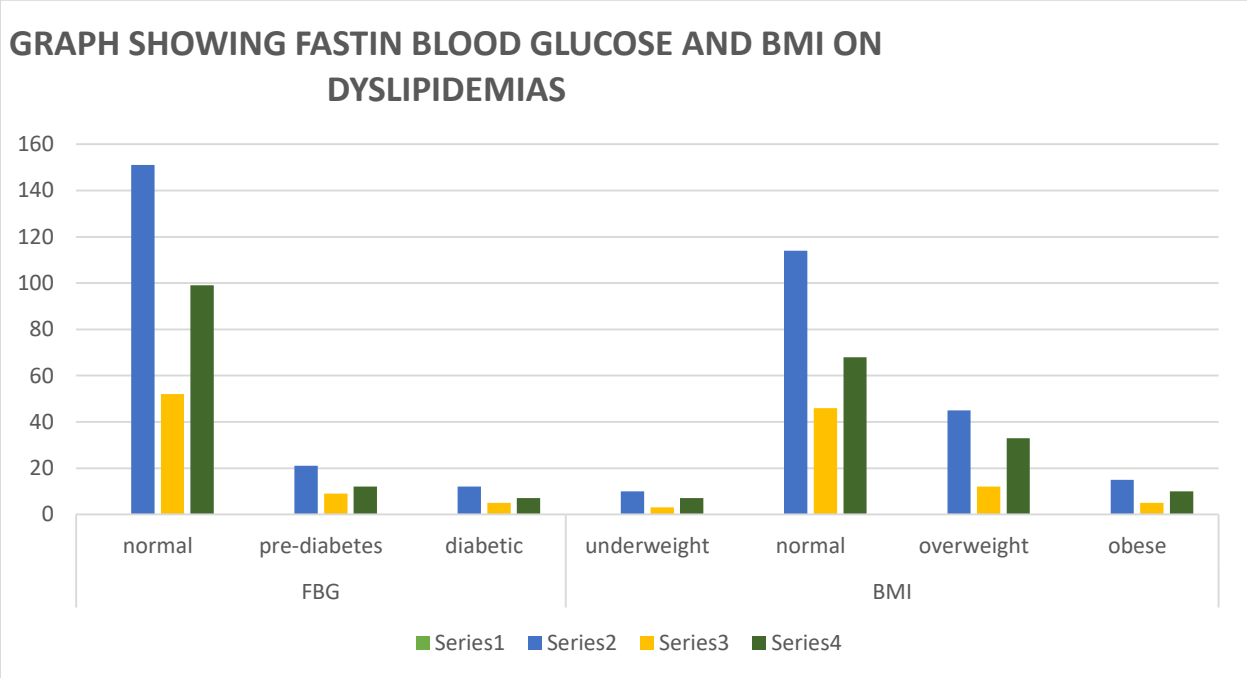


The prevalence of dyslipidemias is high in patients with normal fasting blood glucose and normal BMI, with a prevalence of 82% and 62%, as shown in graph three.



The most prevalent type of dyslipidemia was triglycerides, followed by total cholesterol, LDL-C, and lastly HDL-C, with prevalences of 37%, 36%, 33%, and 28%, respectively, as illustrated in graph four.

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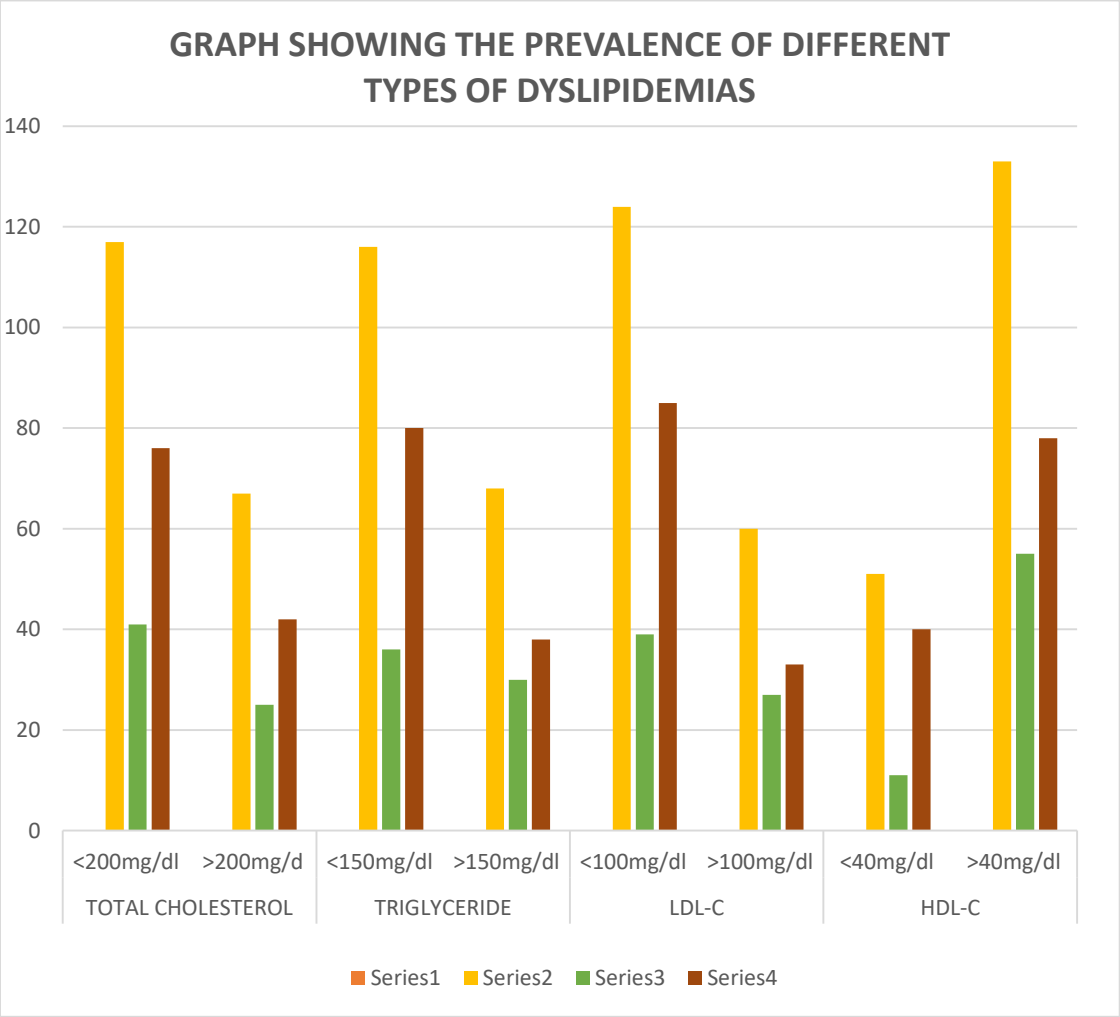

DISCUSSION

Dyslipidemia is a collection of metabolically interrelated plasma lipid and lipoprotein abnormalities involving low HDL-C, high LDL-C, high total cholesterol, and triglyceride levels. (Nie et al., 2021; Ortiz Galeano et al., 2020). More importantly, the prevalence of dyslipidemia has been on the horizon over the past decades and has become a worldwide public health concern, as noted by (Moreira et al., 2019; Shu et al., 2017). Besides, studies by (Kebede et al., 2021; Li et al., 2018) showed it varies significantly according to ethnicity, socioeconomic status, lifestyle, and dietary habits. The current study determined the prevalence of dyslipidemia and associated risk factors in hypertensive patients at Mukono General Hospital.

According to the current study, the prevalence of dyslipidemia was 65%, 20 % being men and 45% being women. A similar study by (Mohammed et al., 2024) The dyslipidemia among adult people living with HIV on dolutegravir showed a prevalence of 78%, and a higher prevalence was noted by the same. In contrast, a study by (Gebreegziabiher et al., 2021) showed an overall prevalence of 48.4%, with a higher prevalence in females. The high prevalence of dyslipidemia in this study could be due to sedentary physical activity, better socioeconomic status, and alteration in the intensity of work, especially in the elderly, hastened urbanization, and alteration in dietary lifestyles or habits. Likewise, the disparities in the prevalence from those observed elsewhere could be attributed to the stage of urbanization, lifestyles of the participants, cutoffs, study period, and socioeconomic status.

Furthermore, the prevalence of dyslipidemia was higher in alcohol use (prevalence of 58%), with men having a higher percentage of 30% compared to the 28% of women. A study by Valença et al. (2021) showed the impact of alcohol intake to be a great factor in the predisposition of dyslipidemias. Similarly, many epidemiological studies by (Ali et al., 2023; Mohammed et al., 2024; Xi et al., 2020) have demonstrated

that high alcohol intake is associated with an increased risk of mortality, various types of cancer, and CVD. Further, alcohol intake has also been associated with increased LDL-C and triglycerides (Kim et al., 2021; Tanisawa et al., 2022). Notwithstanding, alcohol intake is potentially one of the most important determinants of dietary habits, and men have been depicted as habitual alcohol drinkers, accounting for a higher prevalence of dyslipidemia in men compared to women. A classic example is the high correlation of alcohol intake at pork joints, with alcohol influencing the amount of meat consumed, which is a big contributor to dyslipidemias. Further, dyslipidemias were highly more prevalent in those 40 years and above, with a prevalence of a round 80%. Prior studies by (Ahmad et al., 2022; Ahmmed et al., 2021) have shown plasma cholesterol to increase with age, as does the incidence of CAD. However, the mechanisms responsible for hypercholesterolemia have not been fully exploited. Nevertheless, current evidence suggests that the aging process is associated with reduced lipid absorption and increased cholesterol absorption. In addition, reduced lipid degradation has been observed with increased age. Thus, impaired mitochondrial fatty acid beta-oxidation is primarily responsible for reduced fatty acid degradation, which disrupts energy balance and lipid homeostasis in the body. Furthermore, like with triglycerides, cholesterol biosynthesis in the liver increases with age. Previous studies by (Cho et al., 2020; Li et al., 2024) have shown that the reduced hepatic expression of LDL-C receptors is responsible for reduced clearance of LDL-C from circulation. Moreover, age-related reductions in the bile acid synthesis reduced the utilization of cholesterol. These changes are collectively associated with excessive accumulation of cholesterol in the body.

Conversely, the most prevalent dyslipidemia was triglycerides (37%), followed by total cholesterol (36%), then LDL-C (33%), and finally low HDL (28%). This was similar to a study by (Ali et al., 2023) and (Mohamed-Yassin et al., 2023) Although with hypertriglyceridemia prevalence at 49.7%, hypercholesterolemia at 5.6%, high LDL-C at 24.7, and low HDL-C of 77.3% from the former study. However, slight deviations were from a study by (Purva et al., 2020) highlighting TG (62.21%), followed by TC (55.20%), low HDL-C (43.95%), and high LDL-C (28.28%), with a woman showing the highest prevalence across all categories.

On the other hand, a low prevalence of 8% was noted in obese patients, in contrast to findings from other studies. It is well known that dyslipidemia associated with obesity is characterized by an atherogenic lipid profile, including higher levels of TG, with a reduction in HDL-C, along with high LDL-C (Kwon et al., 2023). On the contrary, in clinical practice, there's a misleading association between overnight and altered lipid profiles, as shown by (H. S. Kim et al., 2021). As a result, (Gajurel et al., 2023; Sheth et al., 2015) showed that subjects with overweight and obesity were independently associated with lower levels of HDL-C compared to those with normal weight. These findings are suggestive that obesity exacerbates dyslipidemia and contributes significantly to cardiovascular risk. Moreover, obesity related dyslipidemia is conventionally linked to an unhealthy lifestyle and an imbalanced diet. (Gómez-Avellaneda, Gisela; Tarqui-Mamani, 2017). One reason why blood LDL-C levels may be substantially increased in patients with obesity is the capacity of expanding adipose tissue to store cholesterol, as depicted by (Alhyas et al., 2011; Camargo et al., 2021). Hence, the static storage of cholesterol in adipose tissue presents the net result of obesity's dynamic effects on cholesterol influx.

The prevalence of dyslipidemias in diabetics was 7%, lower than in the normal cohort. This is attributable to the low number of diabetic patients who subscribed to the study. Consequently, studies by (Filisa-Kaphamtengo et al., 2023; Pokharel et al., 2017) have shown the prevalence of dyslipidemias in patients with diabetes mellitus to be 84%, although the study was carried out exclusively in diabetic patients, explaining the reason for the high prevalence. Accordingly, the cause of hypertriglyceridemia in DM patients is related to insulin resistance and hyperglycemia, which can lead to excessive production of triglyceride lipoproteins in the liver, reduced triglyceride lipoprotein clearance, and, in some cases, postprandial lipoprotein metabolism is impaired. (Bhuiyan et al., 2021; Hyassat et al., 2022). Likewise, having TDM for longer than 10 years was significantly associated with higher prevalence rates of high LDL-C (73.0%), hypercholesterolemia (43.1%), and hypertriglyceridemia (53.5%), as shown by (Bin Saleh et al., 2022).

CONCLUSIONS

From the findings of this study, the total prevalence of dyslipidemias was 65%, with a higher prevalence of 45% from women and 20% from women. Furthermore, the prevalence of dyslipidemias was greatly affected by gender, alcohol intake, and age of the participants. However, FBG and BMI cannot be ruled out as factors not affecting the prevalence of dyslipidemias since a few of the participants were diabetic (around 18%) and obese (8%).

Conclusively, the most prevalent dyslipidemia was triglyceridemia (37%), followed by total cholesterol (36%), then high LDL-C (33%), and finally low HDL-C (28%).

RECOMMENDATIONS

Further studies need to be established to unravel the prevalence of dyslipidemias in non-hypertensive populations.

More factors relating to the socio-economic status need to be integrated and evaluated to offer a holistic view of dyslipidemias.

It is also worth evaluating the prevalence of dyslipidemias and predisposing factors in school-going children because of the rampant rise in obesity among them.

Acknowledgement
I extend my sincere gratitude to the almighty God for His provision of good health and sustenance of the breath of life. Further, I express my heartfelt appreciation to my friends, supervisors, and siblings for their academic, emotional, and economic support. May God reward you abundantly.

List of Abbreviations
%	Percentage
HDL	High-Density Lipoprotein
LDL	Low-Density Lipoprotein
VLDL	Very Low Density Lipoprotein
TG	Triglycerides
TC	Total Cholesterol
mg	milli grams
Et al	and others
DM	Diabetes Mellitus
FBG	Fasting Blood Glucose

Source of Funding
This research was conducted without external financial support. All costs related to data collection, laboratory analysis, and report preparation were met by the investigator.

Conflict of Interest
The author declares that there is no conflict of interest regarding the publication of this study.

Author Contributions
The author was solely responsible for the conception and design of the study, data collection, laboratory analysis, data entry, statistical analysis, interpretation of results, and preparation of the final manuscript.

Data Availability
The datasets generated and analyzed during this study are available from the corresponding author upon reasonable request.

Ethical Approval
Ethical approval for this study was obtained from the Research Ethics Committee (REC) of the University of Kisubi. Additional permission to conduct the study was granted by the administration of Mukono General Hospital prior to data collection.

Informed Consent
Written informed consent was obtained from all participants before enrollment into the study. Participation was voluntary, and confidentiality of personal information was strictly maintained throughout the research process.

Author Biography
Nassaka Roy is a graduate of the University of Kisubi with a background in biomedical sciences. Her research interests focus on cardiovascular risk factors, metabolic disorders, and public health challenges affecting vulnerable populations in Uganda. She is particularly interested in generating evidence that informs preventive strategies and improves clinical outcomes in resource-limited settings.

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