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Dyslipidemia and associated factors among hypertensive patients in Ethiopia: a systematic review and meta-analysis

Worku Chekol Tassew[1*], Samson Sisay Woldie[2], Yeshiwas Ayale Ferede[2], Agerie Mengistie Zeleke[3] and Adane Nigussie[4]

Abstract

Introduction Dyslipidemia and other CVD risk factors in cardiac patients can lead to accelerated atherosclerosis, morbidity, and significant mortality. Identifying the potential contributory factors of dyslipidemia in hypertensive patients is crucial in order to manage the disease condition and reduce further complications. Although dyslipidemia has been studied in many countries, evidence of pooled prevalence and its risk factors in Ethiopia remains scarce. Thus, this meta-analysis aimed to estimate the pooled prevalence of dyslipidemia (high TG, low HDL-C, high LDL-C, and high TC) and associated factors among adults with hypertension in Ethiopia.

Methods The reporting system adhered to the Preferred Reporting Items for Systematic Review and Meta-analysis guidelines. Articles were searched using electronic databases such as PubMed, Cochrane Library, Science Direct, African Journals Online, and Google Scholar from April 1 to April 21, 2024 to find relevant studies. We utilized Endnote X7 and STATA 11 for bibliographical management and statistical analysis, respectively. The heterogeneity of the included studies was analyzed using forest plots, Cochran's Q statistics, I^2 test, and P-values.

Results The electronic searches yielded 10,629 articles. Based on the quality assessment, all the included studies had high quality. The overall pooled prevalence of dyslipidemia among hypertensive patients in Ethiopia was 37.12% (95% CI: 31.79–42.44%; I^2=98.4%). The pooled point estimates for high TC were (33.39%, 95% CI: 23.92–42.85; I^2=97.9%), TG (38.89%, 95% CI: 32.90–44.88; I^2=93.6%), high LDL-c (33.98%, 95% CI: 21.46–46.49; I^2=98.4%), and low HDL-c (42.23%, 95% CI: 28.76–55.71; I^2=98.9%). Based on this meta-analysis, dyslipidemia was associated with age ≥ 40 years and sedentary lifestyle.

Conclusion This study suggests that dyslipidemia was high among the study participants, which underlines urgent need for early detection and public health interventions through the integrated involvement of public, governmental, and non-governmental organizations. Dyslipidemia was associated with, age ≥ 40 years, and sedentary lifestyle. This alarms the need for lipid profile assessment for patients periodically, with treatment follow-up to monitor any rising patterns and cardiovascular related risks.

Keywords Dyslipidemia, Hypertension, Systematic review, Meta-analysis, Ethiopia

*Correspondence:
Worku Chekol Tassew
workukid16@gmail.com

Full list of author information is available at the end of the article

Introduction

Cardiovascular diseases (CVDs) are the leading cause of death globally. Hypertension, or high blood pressure, is a major risk factor for different CVDs. Hypertension is a growing problem, especially in low- and middle-income countries such as Ethiopia [1]. Hypertension, is a serious public health concern and the main cause of mortality and disability from CVDs worldwide. Hypertension affects approximately one billion people worldwide and is expected to increase to more than 1.5 billion by 2025. Hypertension is responsible for at least 45% of fatal heart disease and 51% of stroke deaths [2].

Over half of the global deaths (over 17.4 million annually) are due to CVDs [3]. Evidences shows a strong association between hypertension and dyslipidemia, which often occur together and significantly increase the risk of CVD [4]. Dyslipidemia is one of the leading causes of atherosclerosis. As atherosclerosis has advanced, the incidence of CVDs has risen. Thus, it is obvious that the frequent co-occurrence of hypertension, dyslipidemia, and other metabolic abnormalities in patients increases the risk of heart failure as well as CVD-related morbidity and mortality [5]. Dyslipidemia is a lipoprotein metabolism disorder characterized by elevated levels of serum triglycerides (TGs), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C) and decreased level of high-density lipoprotein cholesterol (HDL-C) [6]. Patients with coexisting cardiovascular risk factors, such as hypertension, have a substantially greater prevalence of dyslipidemia [7, 8]. A number of risk factors were linked to dyslipidemia among hypertension patients, according to empirical data from earlier literature. These risk variables included sedentary behavior, age, gender, obesity, smoking, diabetes, and a poor diet of fruits and vegetables [9]. Although non-healthy food and people's behaviors are linked to roughly 80% of dyslipidemia [10], this percentage is still high. The overall prevalence of dyslipidemia was 25.5% in African general adult population. The individual prevalence of TC, TG, HDL-c, and LDL-c was 25.5%, 17.0%, 19.5%, and 21.4%, respectively [8]. In 2017, the report indicated that about three hundred thousand people were affected by CVD in Ethiopia [11]. Hypercholesterolemia and hypertriglyceridemia were found almost in one-third of the CVD patients, 34% of patients with hypertensive heart disease had a lipid abnormality and 63% of patients with CAD had dyslipidemia in Ethiopia [12, 13].

Dyslipidemia is a major risk factor for CVDs, such as heart attack and stroke. There are two main types of dyslipidemia: primary (genetic) and secondary (acquired). Acquired dyslipidemia, caused by lack of physical activity, diet high in saturated and trans fats, cholesterol, and sugar, can worsen lipid levels and cause chronic problems such as obesity, chronic kidney disease, liver disease (hepatic diseases), and hypertension [14]. It is the leading risk factor for chronic non-communicable illnesses, leading to increased morbidity, mortality, and medical expenses worldwide. Currently, the prevalence of atherosclerotic cardiovascular illnesses has increased, making them the main cause of death [15, 16]. Increased blood TGs levels were found to be a strong predictor of coronary problems. As a result, preventing and controlling dyslipidemia, especially in adult populations, has an important role in reducing coronary problems. While the advantages of lipid-lowering medication have been most clearly established in individuals with CVDs, such therapy is also beneficial for those without clinically evident CVDs [17].

People with high levels of serum lipid ("bad" cholesterol) and TGs are more likely to develop hypertension. Conversely, low level of HDL ("good" cholesterol) is also risk factor for HTN [18]. The co-occurrence of dyslipidemia (abnormal cholesterol levels) and hypertension significantly worsens a patient's health. Unfortunately, CVD and hypertension are becoming major public health problems in developing nations, including Ethiopia [19]. The prevalence of dyslipidemia varies based on factors such as age, disease, environment, and lifestyle. Dyslipidemia and other CVD risk factors in cardiac patients can lead to accelerated atherosclerosis, morbidity, and significant mortality. Identifying the potential contributory factors of dyslipidemia in hypertensive patients is crucial in order to manage the disease condition and reduce further complications. Although dyslipidemia has been studied in many countries, evidence of pooled prevalence and its risk factors in Ethiopia remains scarce. For instance, even though cardiovascular disease is a common problem, there are inadequate understanding of the associated factors for dyslipidemia and CVDs risks. In addition, Enhanced comprehension of the factors influencing dyslipidemia provides valuable opportunities to implement impactful secondary prevention strategies, leading to a notable reduction in dyslipidemia and, consequently, a decline in atherosclerotic CVDs. Thus, this meta-analysis aimed to estimate the pooled prevalence of dyslipidemia (high TG, low HDL-C, high LDL-C, and high TC) and associated factors among adults with hypertension in Ethiopia.

Materials and methods

The reporting system adhered to the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA-2020) guidelines [20] (Supplementary file S1). We followed the PRISMA guideline recommendation flowchart to show the selection approach, from first identified records to studies that were eventually included. This systematic review and meta-analysis was conducted following the protocol that was registered with

Table 1 Example of pubmed search history for dyslipidemia and associated factors among hypertensive patients in Ethiopia: A systematic review and meta-analysis

Search	Search terms	Hits
1	"dyslipidemia" OR "lipid profile alteration" OR "hyperlipidemia" OR "lipid profile abnormalities" OR "high triglycerides" "high total cholesterol" "low 'high-density lipoprotein cholesterol' "elevated low-density lipoprotein cholesterol"	247
2	"hypertension" OR "elevated blood pressure" OR "elevated BP"	134
3	"associated factors" OR "determinants" OR "risk factors"	87
4	#1, #2 and #3	45
5	Limits; articles done in humans, published in English language, and free full text	34

Table 2 Framework for determining the eligibility of studies

Criteria	Description
Co-condition	Dyslipidemia
Co-context	Ethiopia
Population	Adults
Exposure	Hypertensive patients
Outcome	Dyslipidemia

International Prospective Register of Systematic Reviews (PROSPERO) (CRD420251002919).

Search strategy and data sources

This review focused on pocket/primary studies that reported the prevalence of dyslipidemia and other plasma lipid abnormalities (abnormally high TC, high LDL-C, and low HDL-C) and associated factors among hypertensive patients in Ethiopia. Articles were searched using electronic databases such as PubMed, Cochrane Library, Science Direct, African Journals Online, and Google Scholar from April 1 to April 21, 2024 to find relevant studies. EndNote X7 reference manager software was used to collect, organize search results, and remove duplicate articles. In the search process, both Medical Subject Headings (MeSH) and plain text terms were utilized for the following keywords: "dyslipidemia" OR "lipid profile alteration" OR "hyperlipidemia" OR "lipid profile abnormalities" OR "high triglycerides" "high total cholesterol" "low 'high-density lipoprotein cholesterol' "elevated low-density lipoprotein cholesterol" AND "hypertension" OR "elevated blood pressure" OR "elevated BP" AND "associated factors" OR "determinants" OR "risk factors" AND "Ethiopia". The search process was performed by two authors (WCT and SSW). Search results from databases provided in (Supplementary file S2) (Table 1).

The qualifying standards for this study were developed using the CoCoPop and PEO framework (Table 2).

Eligibility criteria

This meta-analysis and systematic review included cross-sectional and case–control studies conducted in Ethiopia among individuals with hypertension. Full-text studies reporting the prevalence of dyslipidemia and associated factors or with the potential to identify the prevalence of dyslipidemia among hypertensive individuals were included. All pertinent studies published in English before our search cutoff date of April 21, 2024, were included. Studies that failed to describe the prevalence of dyslipidemia or studies with incomplete data on key variables (such as lipid profile measurements) were excluded from the review. In addition, articles lacking full text, unpublished studies, low-quality studies, case reports, qualitative studies, conference papers, as well as systematic reviews and meta-analysis were excluded.

Outcome of the study

The main outcome of the study was the prevalence of dyslipidemia in hypertensive patients, which was characterized using the National Cholesterol Education Program (NCEP). The National Cholesterol Education Program (NCEP) guidelines likely serve as a benchmark for defining abnormal cholesterol levels. According to these guidelines, the outcome of the study (dyslipidemia) was defined as TC concentration ≥ 200 mg/dl, TG concentration ≥ 150 mg/dl, LDL-c concentration > 130 mg/dl, or HDL-c concentration < 40 mg/dl for men and < 50 mg/dl for women [21].

Article selection and data extraction

All studies were exported to Endnote X7 and duplicate articles were removed. After identifying articles for inclusion, two independent authors (YAF and WCT) conducted data extraction, using a standardized data abstraction template created in Microsoft Excel. The Joanna Briggs Institute (JBI) tool was used for the data extraction. Further discrepancies in the data extraction was resolved through discussion. The template of data extraction format included the following information: corresponding author name, publication year, study setting or region, study design, sample size, participants or response rate, and sampling technique. Lipid profile data were extracted. Two authors, WCT and YAF, independently extracted the pertinent data and compared the results. Disagreements during data extraction were resolved through conversation with the third author (YAF).

Statistical analysis

Heterogeneity test

We utilized Endnote X7 and STATA 11 for bibliographical management and statistical analysis, respectively. The heterogeneity of the included studies was analyzed using

forest plots, Cochran's Q statistics, I^2 test, and P-values. In the pooled analysis, an I^2 statistic less than 25% indicated no heterogeneity, 25 to 50% indicated low heterogeneity, more than 50% indicated moderate heterogeneity, and more than 75% indicated high heterogeneity [22, 23]. Forest plots were constructed to represent the pooled prevalence and 95% confidence intervals. Because of the presence of high heterogeneity, the pooled prevalence of dyslipidemia was computed using a random effect model, specifically the DerSimonian and Laird random effects model [24]. Subgroup analysis was done to account for any heterogeneity. The impact of one study on the pooled estimates was also investigated using leave-one-out sensitivity analysis.

Publication bias

The symmetry of the funnel plot was visually checked, and Egger's test was used to assess publication bias among the included studies. The presence of publication bias was declared when the P value was less than 0.05 [25].

Results

Study selection

The electronic searches yielded 10,629 articles. Of these, 10,200 were from Google Scholar, 34 from PubMed, 270 from Science Direct, and 125 from African Journal Online. After reviewing the titles, we removed 9342 items due to duplication. In evaluating the remaining 1287 articles, we removed 1242 because they were not focused on the outcome of interest and were not conducted on patients with hypertension. The full texts of the remaining 45 papers were reviewed for inclusion criteria and quality using the JBI checklist. Additional studies were removed because it is difficult to assess the prevalence of dyslipidemia, and they were not conducted in Ethiopia. Finally, the analysis included ten pocket studies (Fig. 1).

Baseline study characteristics

In the present study, 10 original published studies were included. The number of participants in each study ranged from 100 to 1200. In terms of study design, eight of the included studies used an institutional-based cross-sectional design, one used a community-based

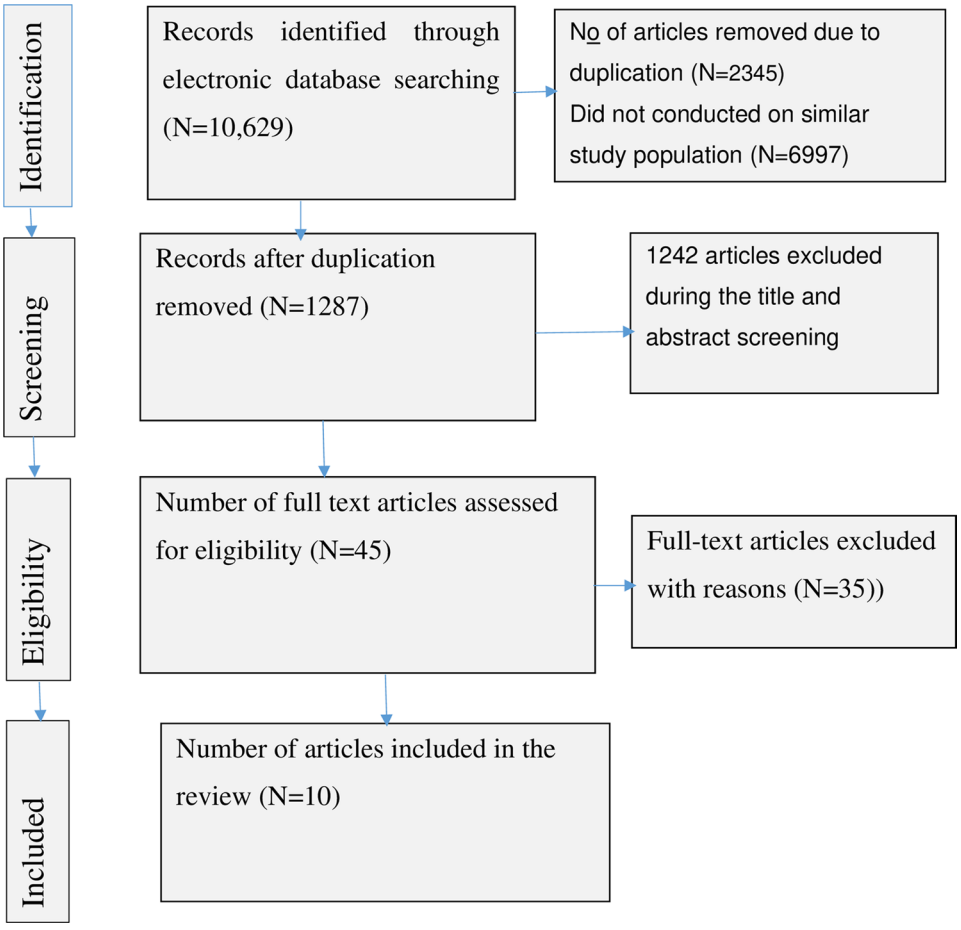

Fig. 1 PRISMA flow diagram for a systematic review and meta-analysis of prevalence and associated factors of dyslipidemia among hypertensive patients in Ethiopia (N=10)

cross-sectional design, and one used a case–control design. The articles were published between 2018 and 2024. Regarding the regional setting where the included studies were conducted, 3 studies were from the Amhara region [26–28], 4 were from the Oromia region [12, 29–31], and the remaining studies were from the Addis Ababa, Tigray and South regions [32–34]. In terms of the sample techniques, seven studies utilized probability sampling, while the others employed non-probability sampling (Table 3).

Pooled prevalence of dyslipidemia among hypertensive patients

According to the current meta-analysis and systematic review, a moderate level of heterogeneity was detected (I^2=74.5%, p value ≤ 0.05). Therefore, we performed the main meta-analysis using a random-effects model, specifically the DerSimonian and Laird random-effects model, to determine the pooled prevalence of dyslipidemia. The overall pooled prevalence of dyslipidemia among hypertensive patients in Ethiopia was 37.12% (95% CI: 31.79–42.44%; I^2=98.4%). The pooled point estimates for high TC were (33.39%, 95% CI: 23.92–42.85; I^2=97.9%), TG (38.89%, 95% CI: 32.90–44.88; I^2=93.6%), high LDL-c (33.98%, 95% CI: 21.46–46.49; I^2=98.4%), and low HDL-c (42.23%, 95% CI: 28.76–55.71; I^2=98.9%) (Fig. 2).

Publication bias

Publication bias was assessed using funnel plots and Egger's test at the 5% significance level. There was statistically significant evidence of publication bias in the pooled estimates of dyslipidemia. Egger's test was significant (p = 0.008), and the funnel plot was nearly asymmetric This bias may indicate that only studies which have statistically significant positive results get published and the statistically insignificant or negative studies does not get published. Of the several reasons of this bias the important ones are rejection (by editors, reviewers), lack of interest to revise, competing interests, lack of motivation to write in spite of conducting the study. Many researchers do not publish research with negative results because they consider it as a failed research which is not true. If the hypothesis made by them is rejected based on results of a study with sound methodology, it does not mean it is a failed research (Fig. 3).

Meta-regression

We further fitted meta-regression using the random effects model on the aggregated study level variables to address the above heterogeneity. According to the univariable meta-regression analysis, the number of participants, sample size, and publication year were not significant indicating the heterogeneity was not result from these variables (Table 4).

Quality assessment

The Johanna Briggs Institute (JBI) quality evaluation checklist and the methodological quality and bias risk were evaluated using a scale intended for cross-sectional studies assessment [35]. Two authors, WCT and AN, independently evaluated the quality of each article. All eligible studies were assessed, but only those of good quality or higher were included in the final analysis. Any disagreement during quality appraisal were resolved with discussion with another author (WCT).

Based on the quality assessment, all the included studies had high quality. The quality of each of the included studies was evaluated using the Joanna Briggs Institute (JBI) critical assessment checklist, which consists of nine items. The JBI quality assessment checklist consists of the following components: (1) was the sample frame appropriate for reaching the target population? (2) Were study participants properly sampled? (3) Was the sample size appropriate? (4) Were the study participants and setting described in detail? (5) Did the data analysis provide adequate coverage of the identified sample? (6) Were appropriate procedures employed to identify the condition? (7) Was the condition assessed in a consistent, reliable

Table 3 Overview of included studies on the incidence of dyslipidemia and associated factors among hypertensive patients in Ethiopia (N = 10)

Primary Author	Pub Year	Setting	Study Design	Study subjects	SS	Dyslipidemia (%)	Sampling procedure
Z.D. Kifle et al. [26]	2021	Amhara	IBCS	Hypertensive Patients	372	24.5	simple random
Mohammed et al. [27]	2023	Amhara	IBCS	Hypertensive Patients	384	50.3	systematic random
Addisu et al. [12]	2023	Oromia	IBCS	Cardiac Patients	269	44.6	consecutive sampling
Gebremedhin et al. [29]	2021	Oromia	Case–control	Hypertensive Patients	406	53.7	consecutive sampling
Abera et al. [32]	2024	South	IBCS	Cardiac Patients	328	30.1	systematic random
Gebrie et al. [28]	2018	Amhara	IBCS	Hypertensive Patients	100	35	simple random
Haile et al. [30]	2021	Oromia	IBCS	Hypertensive Patients	381	44.6	consecutive sampling
Motuma et al. [31]	2023	Oromia	IBCS	Adult workers	1200	32.6	simple random
Gebreegziabiher et al. [33]	2021	Tigray	CBCS	Adult workers	321	40.2	simple random
Angassa et al. [34]	2022	Addis Ababa	IBCS	Adult workers	335	33.4	simple random

*IBCS, Institutional-Based Cross-sectional Study, SS, Sample Size, CBCS, Community-Based Cross-sectional Study

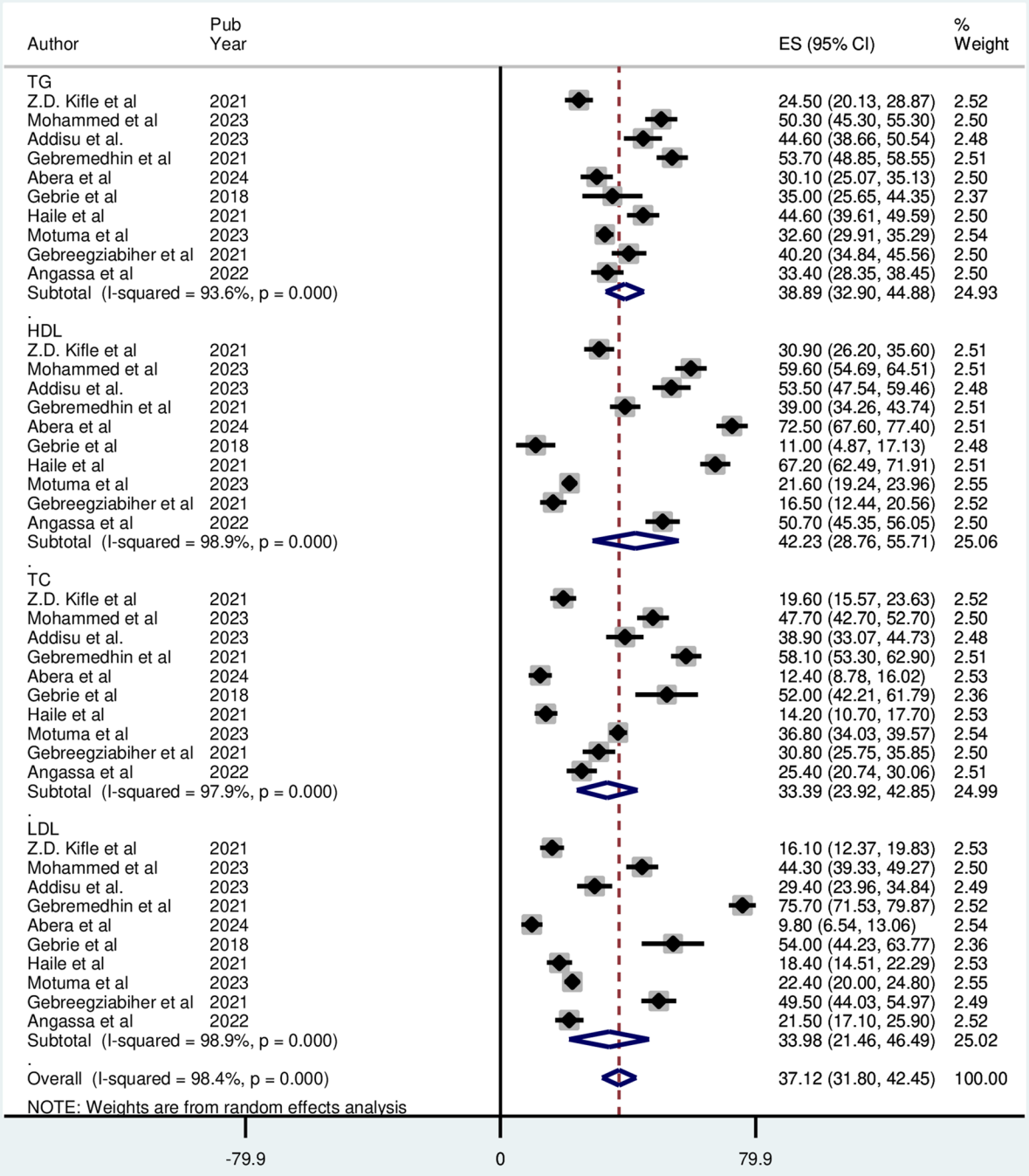

Fig. 2 Forest plot indicating pooled prevalence of dyslipidemia among hypertensive patients in Ethiopia (N=10)

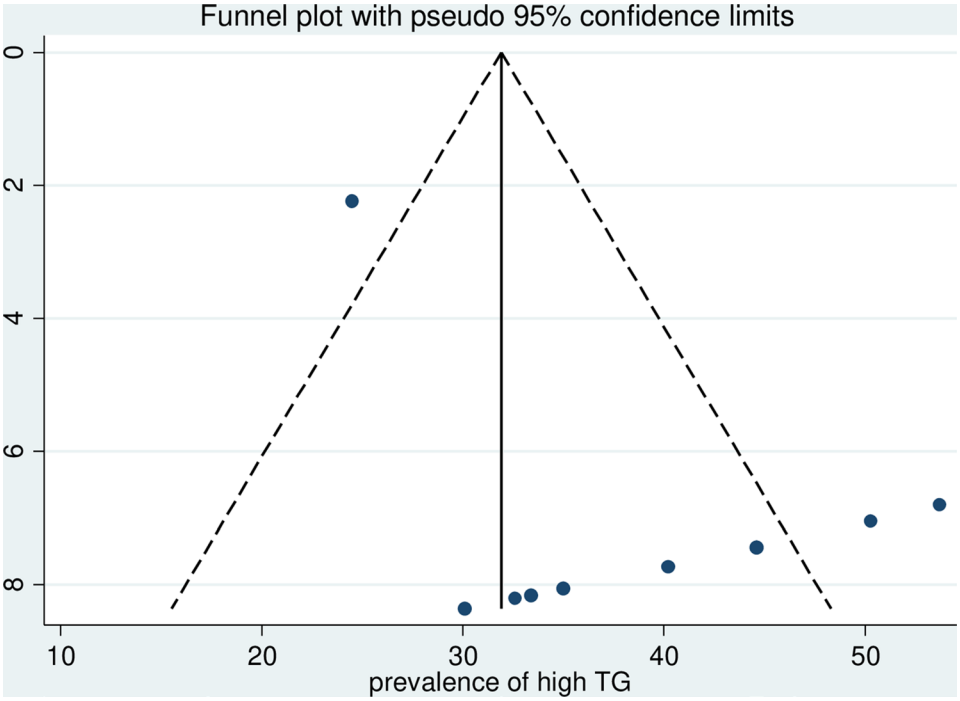

Fig. 3 Funnel plot of prevalence of dyslipidemia among hypertensive patients in Ethiopia assessing for publication bias in 10 studies, 2024

Table 4 Univariable meta-regression analysis results for the pooled prevalence of dyslipidemia among hypertensive patients in Ethiopia

Study level variables	Coefficients	Standard error	*P*>|t|	[95% CI]
Participants	0.028	0.10	0.80	(-0.23 – 0.29)
Pub year	0.01	0.30	0.97	(-0.73– 0.75)
Sample size	-0.027	0.10	0.80	(-0.28– 0.23)

manner for all participants? (8) Was there a proper statistical analysis? (9) Was the response rate adequate? For each question, a score was assigned (0 for 'not reported or not acceptable' and 1 for 'yes'); the scores were then summed in the range of 0 to 9. When the summary scores reached 0–4, 5–6, or 7–9, the studies were classified as low, medium, or high quality, respectively. The supplementary file contains detailed results from the quality assessment of the studies (Supplementary file S3).

Subgroup analysis

As one of the handling mechanisms of heterogeneity, we conducted subgroup analysis using sampling technique and region. The pooled prevalence of dyslipidemia among hypertensive patients ranged from 30.10% (95% CI: 13.71– 46.49) in southern region to 44.63% (95% CI: 36.29–52.97) in Oromia region of Ethiopia. The prevalence estimates between studies by region revealed significant heterogeneity in the Amhara region (heterogeneity, $p = 0.001$) but no heterogeneity in the Oromia region (Fig. 4).

The results of subgroup analysis based on sample procedure revealed that articles using non-probability sampling had high prevalence of dyslipidemia (48.01%; CI: 39.85, 56.17) (Fig. 5).

Sensitivity analysis

A sensitivity analysis was applied to assess the effect of a single study on the total effect size. The sensitivity analysis showed that no single study had an effect on the overall prevalence of dyslipidemia among hypertensive patients (Fig. 6).

Factors associated with dyslipidemia

Based on this meta-analysis, dyslipidemia was associated with, age ≥ 40 years, and sedentary lifestyle. In the present study, participants who had sedentary physical activity were at higher risk for having high chance of dyslipidemia (POR = 1.14, 95% CI: 0.11–11.84, P-value < 0.001) than participants who had vigorous physical activity. Participants whose age > 40 years were at higher risk for having elevated levels of TC, LDL-c and TG with a value of (POR = 3.54, 95% CI = 1.72–7.28, P-value < 0.001) than those who were below 40 years of age (Fig. 7).

Discussion

Dyslipidemia is a primary cause of cardiovascular disease. Given its public health importance, researchers have performed several pocket studies in various groups.

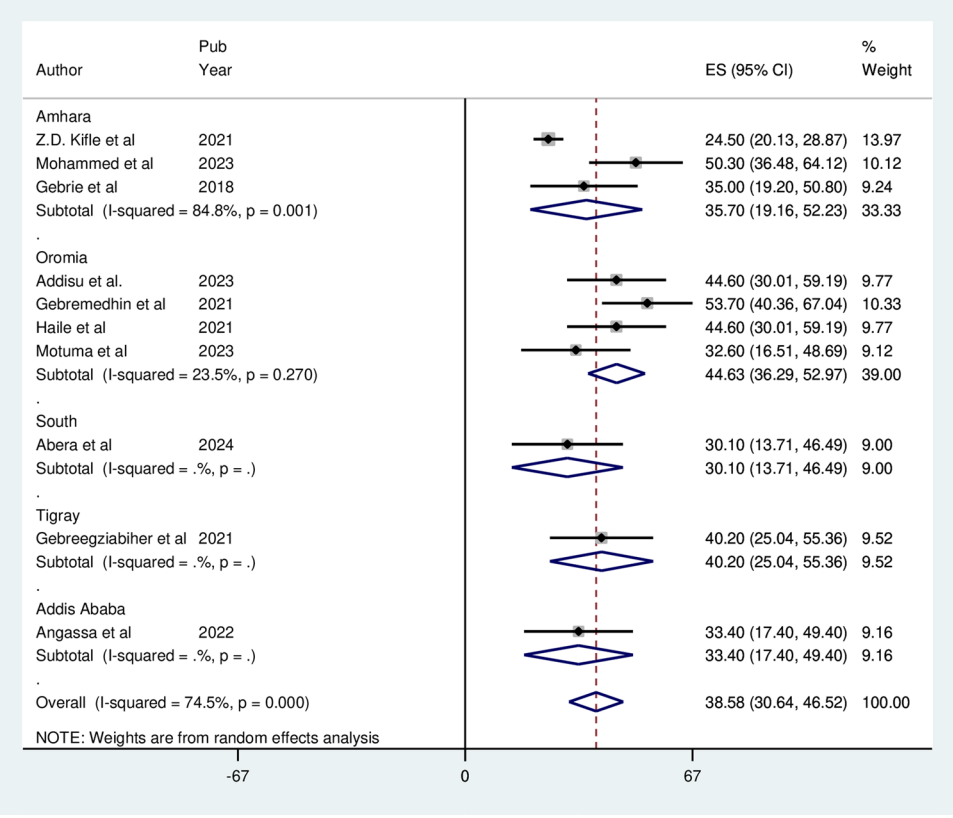

Fig. 4 Result of sub-group based on region (N=1 0)

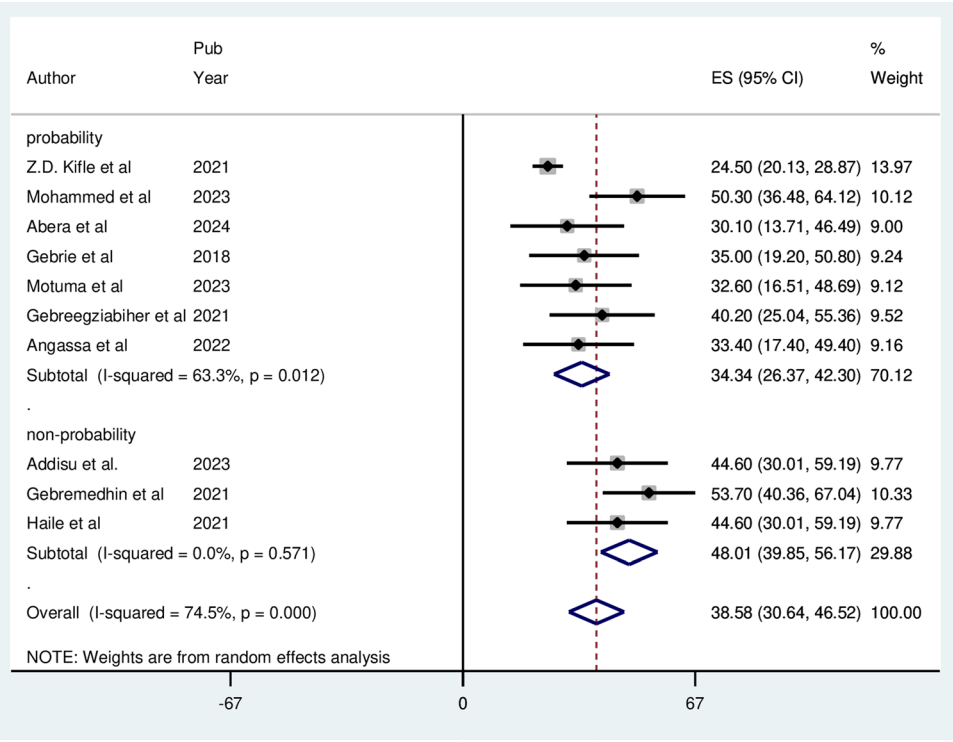

Fig. 5 Result of sub-group based on sampling procedure (N=10)

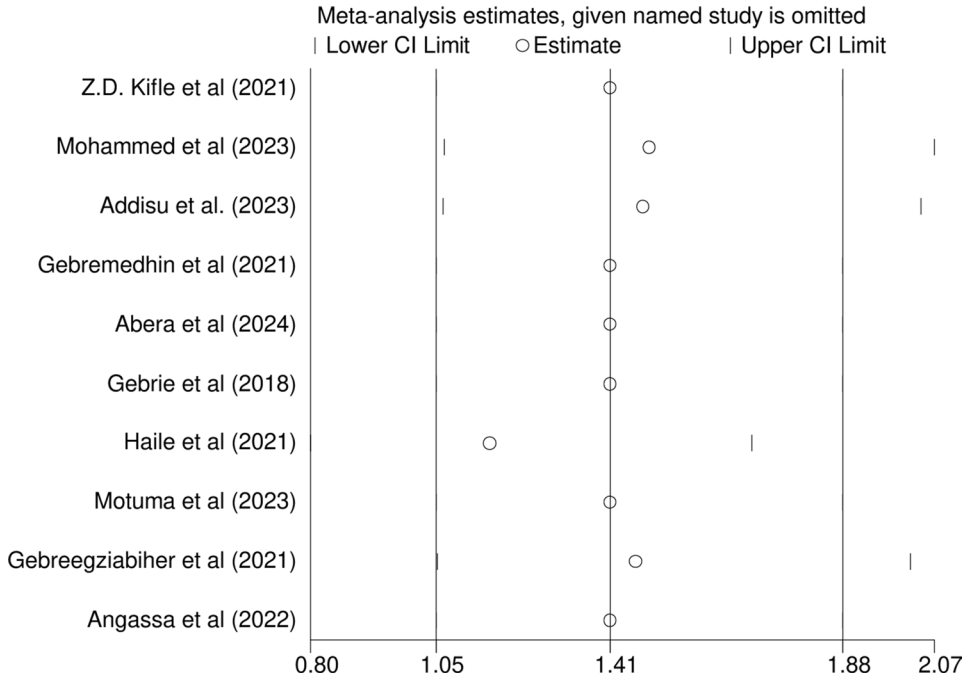

Fig. 6 Sensitivity analysis result (N=10)

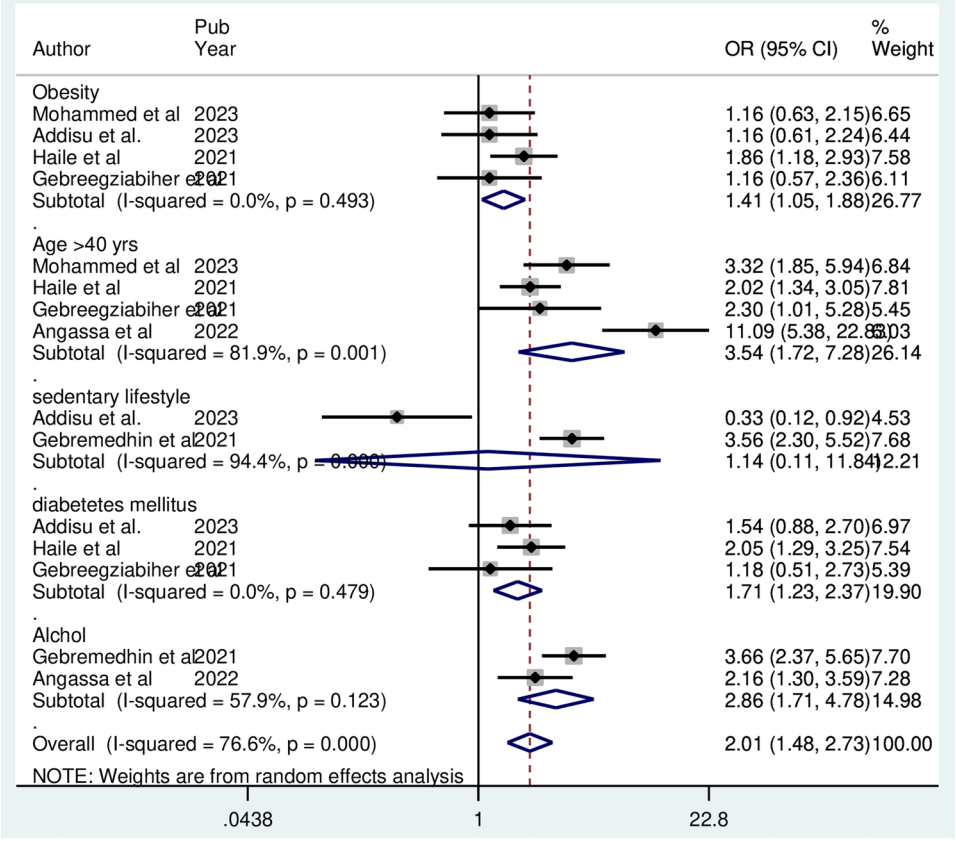

Fig. 7 Factors associated with dyslipdemia (N=10)

However, there has been no comprehensive study in Ethiopia. The current systematic review and meta-analysis sought to investigate the pooled prevalence of plasma lipid abnormalities (TG, TC, LDL-C, and HDL-C) among hypertensive patients in Ethiopia. The total pooled prevalence of dyslipidemia among hypertensive patients in Ethiopia was 37.12% (95% CI: 31.79–42.44%; I^2=98.4%). This indicates the presence of a large number of individuals with dyslipidemia in Ethiopia, necessitating health sector stakeholders to design and implement preventive strategies for plasma lipid abnormalities, thereby minimizing dyslipidemia-associated complications of hypertension and improving quality of life.

The prevalence of dyslipidemia among patients with hypertension is similar to that reported in studies in Botswana (38.9%) [36], Yemen (39.2%) [37], China (32.2%) [38], and Brazil (34.9%) [39]. However, the prevalence was lower than that reported in previous studies conducted in Uganda (42.1%) [40], Jordan (41.9%) [41], India (56.1%) [42], and Senegal (7.1%) [43]. On the other hand, this finding is higher than that of previous studies conducted in Nigeria (9.9%) [44] and Cameroon (18.9%) [45]. These discrepancies could be attributed to differences in lipid abnormalities cutoffs, methodology of diagnosis, lifestyles of patients, and genetic race. Differences in the study population, duration of hypertension, and experience with antihypertensive medications, may also contribute to variations in dyslipidemia prevalence. The other justification for the above variation could be due to saturated fat intake and high carbohydrate intake associated with rapid urbanization.

The pooled point estimates of high TC were 33.39% (95% CI: 23.92–42.85; I^2=97.9%). Which is higher than the study findings reported in Venezuela, 22.2% [46], Nigeria, 23% [47], and Africa, 25.5% [8]. Whereas, higher prevalence of elevated TC was reported in studies conducted in Togo, 64% [48], Malaysia, 51% [49] and Egypt, 60.6% [50]. The difference could be attributed to anti-cholesterol medicine use among the study subjects in countries with low prevalence of dyslipidemia, and lifestyle.

The pooled point estimates of elevated LDL-c were 33.98% (95% CI: 21.46–46.49; I^2=98.4%), which was lower than earlier studies done India (47.8%) [51], Iran (50.0%) [52], Ghana (61.0%) [53], Senegal (66.3%) [54] and Jordan (74.9%) [41]. However, this finding is higher than previous studies done in Korea (14.8%) [55], Africa 21.4% [8], India, 23% [56], and Venezuela, 23.3% [46]. The variation in the prevalence of high LDL-c could be attributed to difference in study populations, methodology, genetic races, and socioeconomic status. The pooled point estimates for low HDL-c were 42.23% (95% CI: 28.76–55.71; I^2=98.9%). The prevalence of reduced HDL-C in this study, is higher than the findings reported in Togo, 16.4% [48], China, 20.8% [57], and Turkey 21.1% [58]. Whereas, it is lower than the findings from India, 62% [56], and Nepal (56.70%) [59]. These discrepancies may be attributable to differences in cut-off values, risk factor distribution, study setting, and participant socioeconomic status. The other reason for the discrepancy in reports could be due to differences in lifestyles such as unhealthy diet and physical inactivity, mental stress caused by economic, social, and cultural factors, coronary-prone behavior, genetics, pro-inflammatory conditions, and diagnostic criteria or differences in cutoff values.

Within the study population 38.58% had high TG concentrations. The result of this study is lower than the finding of studies done in China 30.7% [60], and Turkey 35.7% [61]. In the current study, we recruited only hypertensive patients who were at higher risk for dyslipidemia than general populations. Moreover, this difference might be due to variation in the lifestyles and behavioral characteristics of respondents, sample size, method, stage of urbanization, cut-off values, and socioeconomic status.

Regarding risk factors, the present study showed that dyslipidemia is significantly and positively associated with age > 54 years. This finding is consistent with previous studies [60, 62] This could be due to an age-related increase in postprandial dyslipidemia, insulin resistance, and age-related decline in ApoB/E receptor and sex hormones (estrogen and androgen) [63]. In this study, a sedentary lifestyle was significantly associated with TC dyslipidemia. Physical exercise influences the lipid profile by increasing the level of HDL-c on account of increased HDL2 sub-fractions trailer and reduce the level of masculine triglyceride. Several studies have verified that physical exercise (walking about 5 miles a week without strain) accompanied by music helps increase energy, and optimizing body [64, 65].

Limitations

This was the first review of its kind on this topic, and it was conducted with significant contributions from several disciplines. However, the study's findings should be considered in light of the limitations listed below. First, the total sample size included did not represent the national population, making generalization problematic. Second, there was significant heterogeneity. We used random effects and subgroup analysis to identify the true reason of the fluctuation. Third, there were fewer studies in specific regions of the country, making it impossible to use the findings as a baseline in certain areas. Finally, it solely considered articles published in English, potentially excluded relevant studies in other languages which could provide unique insights into dyslipidemia among hypertensive patients.

Conclusion and recommendations

This study suggests that dyslipidemia was high among the study participants, which underlines an urgent need for early detection and public health interventions through the integrated involvement of public, governmental, and non-governmental organizations. Dyslipidemia was associated with, age ≥ 40 years, and sedentary lifestyle. This alarms the need for lipid profile assessment for patients periodically, with treatment follow-up to monitor any rising patterns and cardiovascular related risks. Based on these findings, we recommend an urgent need for early detection and public health interventions through the integrated involvement of public, governmental, and non-governmental organizations. Periodic screening of high-risk groups along with effective health promotion and education which encourages a healthy lifestyle is essential.

Abbreviations

CVD	Cardiovascular disorder
HTN	Hypertension
IBCS	Institutional-Based Cross-Sectional Study
OR	Odds ratio

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12872-025-04808-3.

Supplementary Material 1: PRISMA checklist of the included papers using the Joanna Briggs Institute (JBI) critical appraisal checklis

Supplementary Material 2: Search results of the included studies

Supplementary Material 3: Quality assessment of the included papers using the Joanna Briggs Institute (JBI) critical appraisal checklist

Supplementary Material 4

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Author contributions

WCT: Writing– review & editing, Writing– original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. SSW, AMZ, AN and YAF conceived the idea and participated in the data extraction, analysis, and draft writing. WCT, and YAF participated in the analysis, manuscript preparation, and manuscript revision. All the authors have read and approved the final version of the manuscript to be considered for publication.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Not applicable since the studies used were systematic reviews and meta-analyses.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Department of Medical Nursing, Teda Health Science College, Gondar, Ethiopia
[2]Department of Reproductive Health, Teda Health Science College, Gondar, Ethiopia
[3]Department of Clinical Midwifery, Teda Health Science College, Gondar, Ethiopia
[4]Department of Public Health and Health Promotion, University of Gondar, Gondar, Ethiopia

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