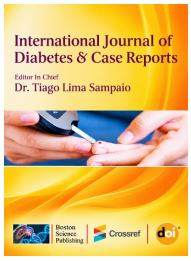
International Journal of Diabetes and Case Reports DOI: https://dx.doi.org/10.51521/IJDCR.2026.2105

Contents lists available at bostonsciencepublishing.com

International Journal of Diabetes and Case Reports




# Magnitude of Peripheral Arterial Disease Among Patients with Diabetes Mellitus in Ethiopia: A Systematic Review and Meta-Analysis (2026)

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ARTICLE INFO

*Article history*:
Received 28 October 2026
Revised 20 November 2026
Accepted 24 November 2026
Published : 26 November 2026

**KEYWORDS:**
PAD,
Diabetes,
Ethiopia,
Review,
Complication,
Prevalence

**To cite this article:**
Redeit Teferi Afework[1**], Rahma Abdulkadir Awol[2**], Mulualem Dawit Bekele[*3], Arsema Beshewa Teshome[*4], Adonay Hadgu Haile[*5], Jessica Zerihun Yilma[*6], Feven Gidey Gebre[*10], Napoleon Fekadesilassie Beza[9], Dawit Asmamaw Kifle[6], Yanit Tamirat Taddesse[*4], Zelalem Tegegn Fantaw[6], Rahel Yazie Tibebu[7], Akiya Turi Goshe[8], Bekalu Zewde Fetena[*9], Tewodros Kassahun Tarekegn[1] (2026) Magnitude of Peripheral Arterial Disease Among Patients with Diabetes Mellitus in Ethiopia: A Systematic Review and Meta-Analysis (2026). Int J Diabetes Case Rep, 2026,5(1), 1-7.

ABSTRACT

**Introduction:** Peripheral arterial disease is one of the major complications of diabetes mellitus, characterized by the partial or complete occlusion of peripheral blood vessels in the upper and lower extremities. It is particularly concerning in individuals with diabetes, as the disease accelerates atherosclerosis and is closely linked to endothelial dysfunction, chronic inflammation, and vascular injury. Therefore, this systematic review and meta-analysis aimed to estimate the pooled prevalence of peripheral arterial disease among patients with diabetes mellitus in Ethiopia.

**Methods and materials:** Studies were taken based Population, Outcome, condition, and Context (POCC) criteria for prevalence study. A comprehensive literature search was conducted in PubMed, Scopus, Web of Science, Google Scholar, and the Cochrane Library databases.

The methodological quality assessed using the Joanna Briggs Institute critical appraisal tool. A random-effects model meta-analysis was performed to estimate the pooled prevalence using Stata version 14 software. The $I^2$ test and the Egger's regression statistical test was used to check heterogeneity and publication bias respectively. A p-value of less than 0.05 used to declare statistical significance.

**Results:** Most of the included studies were cross-sectional studies with 4254 participants and mostly conducted in the central region. The prevalence of PAD ranges from 4.4 [26]–49% [34]. All studies had good methodological quality. The pooled proportion peripheral arterial disease among diabetic patients was found to be 24.5% (95% CI: 17.5–31.4). The highest prevalence of peripheral arterial disease is 26.9% (95% CI: 16.9–36.9) was seen in central region, and the lowest is 18.0% (95% CI: 7.0–28.9) was seen in northern region.

**Conclusion:** This systematic review and meta-analysis demonstrates peripheral arterial disease is a substantial and clinically important complication among patients with diabetes mellitus in Ethiopia. Therefore integration PAD assessment into routine diabetes care, particularly for patients with established cardiovascular risk factors and diabetic foot complications is essential.

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## 1. Introduction

Diabetes mellitus is one of global public health problem and associated with a broad spectrum of microvascular and macrovascular complications [1, 2]. Among the macrovascular complications, peripheral arterial disease (PAD) is a major manifestation of systemic atherosclerosis characterized by partial or complete occlusion of the peripheral vessels of the upper and lower limbs [3–5]. PAD is concerning among people with diabetes because diabetes accelerates atherosclerotic processes and is associated with endothelial dysfunction, inflammation, and vascular injury [6–8]. Subsequently, individuals with diabetes have a greatly increased risk of developing PAD compared with those without diabetes [8].

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PAD among people with diabetes may remain clinically silent or present with symptoms such as intermittent claudication, lower-extremity pain, impaired wound healing, skin changes, and tissue loss [10, 11]. Because diabetic peripheral neuropathy may diminish pain perception, classic symptoms of PAD can be absent, resulting in delayed recognition and treatment [12]. Besides, undiagnosed PAD can contribute to diabetic foot ulceration, infection, lower leg amputation, reduced mobility, impaired quality of life, and increased mortality [14–16]. Moreover, the presence of PAD serves as an important marker of generalized cardiovascular disease and is associated with an increased risk of cardiovascular and cerebrovascular events [17].

In Ethiopia, diabetes mellitus is a public health challenge [18], while health systems remain to face significant burdens from infectious diseases and other chronic conditions [19, 20]. The growing diabetic population may consequently experience an increasing burden of vascular complications, including PAD [21]. However, evidence regarding the magnitude of PAD among Ethiopian diabetic patients appears to be dispersed across different settings. Despite of individual studies have investigated PAD among diabetic patients in Ethiopia, their findings may not provide a comprehensive estimate of the national burden. This study will synthesize the available evidence, quantify the overall prevalence, and explore possible sources of variation between studies. Such evidence is important for identifying the magnitude of PAD, strengthening screening and early detection strategies.

### 1.1. Objective of the review

To determine pooled prevalence of peripheral arterial disease among diabetic Patients in Ethiopia

## 2. Methods and materials

### 2.1. Study design and reporting guideline

The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guideline [22].

### 2.2. Inclusion criteria

Studies were included if they were conducted among patients with diabetes mellitus in Ethiopia, reported the prevalence of PAD, employed an observational study design, including cross-sectional, cohort, or case-control studies. Whereas if they were conducted outside Ethiopia, did not involve diabetic patients, did not assess PAD, case reports, case series, editorials, commentaries, letters, conference abstracts without sufficient data, narrative reviews, systematic reviews, and meta-analyses were also excluded.

### 2.3. Information sources and search strategy

Studies were taken based Population, Outcome, condition, and Context (POCC) criteria for prevalence study. Population: Studies conducted among patients diagnosed with diabetes mellitus, regardless of type of diabetes, age, sex, duration of diabetes, or treatment status. Outcome: The outcome was the prevalence of peripheral arterial disease. Condition: PAD which is defined by using the ankle-brachial index (ABI). Context: Studies conducted in Ethiopia.

A comprehensive literature search was conducted in PubMed, Scopus, Web of Science, Google Scholar, and the Cochrane Library databases from their inception to the September 3. Additional studies were identified by manually screening the reference lists of relevant articles and previously published reviews.

The search strategy combined terms related to diabetes, peripheral arterial disease, and Ethiopia using Boolean operators. Search terms included combinations of diabetes mellitus OR diabetic, DM AND peripheral arterial disease, OR peripheral artery disease, OR peripheral vascular disease, OR lower extremity arterial disease, OR Ankle brachial index, OR ABI, and “Ethiopia.

### 2.4. Study selection and data extraction

All retrieved records were exported to Endnote, and duplicate records were removed. Titles and abstracts were independently screened by all reviewers against the eligibility criteria. Potentially relevant articles were retrieved in full text. Disagreements between reviewers during screening and full-text assessment were resolved through discussion.

A standardized data extraction form was developed before data extraction. Two reviewers independently extracted relevant information from each eligible study. The following information was extracted: first author and year of publication, study setting, study design, sample size, and prevalence of PAD. Discrepancies in extracted data were checked against the original article and resolved through discussion or consultation with a third reviewer.

### 2.5. Outcome of the study

The primary outcome of the review was the prevalence of peripheral arterial disease among diabetic patients in Ethiopia.

### 2.6. Quality assessment of the studies

The methodological quality of the included studies was independently assessed by two reviewers using an appropriate standardized Joanna Briggs Institute (JBI) critical appraisal tool for observational studies [23]. The assessment considered domains such as representativeness of the study population, adequacy of the sample size, appropriateness of the sampling method, validity and reliability of PAD measurement, completeness of outcome assessment, and appropriateness of statistical analysis. Disagreements between reviewers were resolved through discussion and, when necessary, consultation with a third reviewer.

### 2.7. Data synthesis and analysis

Statistical analysis was performed using Stata version 14 statistical software. The prevalence of PAD was extracted from each study and pooled to obtain an overall prevalence estimate with its corresponding 95% confidence interval (CI). Because variation among the included studies was anticipated with respect to study setting, population characteristics, and diagnostic methods a random-effects model was used to estimate the pooled prevalence. Statistical heterogeneity among studies was assessed using Cochran's Q test and the $I^2$ statistic. An $I^2$ value of approximately 25%, 50%, and 75% was interpreted as low, moderate, and high heterogeneity, respectively [24]. Potential sources of heterogeneity were explored using subgroup analyses and meta-regression. Subgroup analyses were planned based on study region and sensitivity analysis was performed by sequentially excluding individual studies to determine whether any single study had a substantial influence on the pooled prevalence. Visual inspection of a funnel plot was performed, and statistical tests such as Egger's regression test were considered to assess funnel plot asymmetry.

## 3. Results

### 3.1. Study selection and characteristics of the study

A total of 2742 studies were identified through database and manual searches. Of these, 491 records were excluded due to duplication. The remaining 2251 records undertook title and abstract screening, resulting in the removal of 1709 articles. 542 records were sought for retrieval, 36 not retrieved because of they are irrelevant.506 full-text publications were then assessed for eligibility, with 494 rejected due to omission of key findings. Finally, 12 studies met the inclusion criteria and were included in the analysis (Fig. 1).

Most of the included studies were cross-sectional studies [25–36] with 4254 participants and mostly conducted in the central region. The sample size ranges from 78 [34] to 1158 [30] participants. Among included studies the prevalence of PAD ranges from 4.4 [26]–49% [34]. All studies had good methodological quality (Table 1).

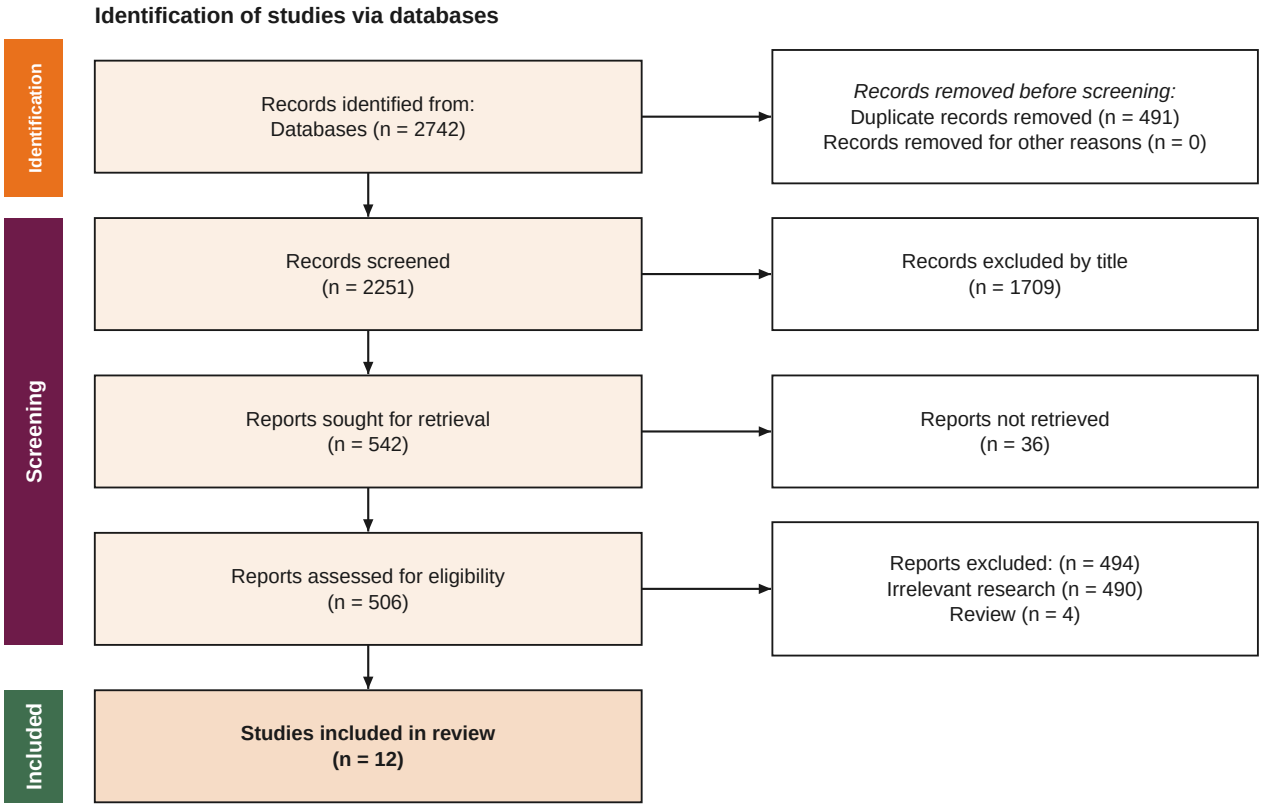


**Fig. 1.** PRISMA flow diagram of study selection for prevalence of peripheral arterial disease among diabetic patients in Ethiopia.

**Table 1.** Characteristics of the study included in systematic review and meta-analysis.

| Authors name | Study area | Study design | Sample size | Prevalence with 95% CI |
|---|---|---|---|---|
| Akalu Y (2020) | Debre Tabo | Cross-sectional | 280 | 30.7 (25.2–36.1) |
| Solela G (2024) | Addis Ababa | Retrospective | 272 | 4.4 (1.9–6.8) |
| Deme ZC (2025) | Addis Ababa | Cross-sectional | 275 | 12 (8.1–15.8) |
| Yeshitla M (2025) | Addis Ababa | Cross-sectional | 317 | 31.6 (26.4–36.7) |
| Wolde HF (2018) | Gonder | Cross-sectional | 341 | 15.1 (11.2–18.9) |
| Berhe KK (2023) | Tigray | Cross-sectional | 1158 | 9 (7.3–10.6) |
| Jemal SK (2025) | Addis Ababa | Cross-sectional | 408 | 31.4 (26.8–35.9) |
| Gedamu M (2022) | Addis Ababa | Cross-sectional | 361 | 5.8 (3.3–8.2) |
| Betelhem A (2019) | Addis Ababa | Cross-sectional | 213 | 31 (24.7–37.2) |
| Fikadu T (2020) | Addis Ababa | Cross-sectional | 78 | 49 (37.9–60.0) |
| Seyoum N (2019) | Addis Ababa | Cross-sectional | 386 | 34.2 (29.4–38.9) |
| David KI (2025) | Addis Ababa | Cross-sectional | 165 | 47.3 (39.6–54.9) |

### 3.2. Prevalence of peripheral arterial disease among diabetic patients

The pooled proportion peripheral arterial disease among diabetic patients was found to be 24.5% (95% CI: 17.5–31.4) with a heterogeneity index of 97.8%, with a P-value of less than 0.001(Fig 2). The Eggers test yielded significant result (P = 0.002). Therefore, Duval and Tweedie's trim-and-fill method was applied to assess the potential impact of publication bias. The adjusted pooled prevalence is similar, suggesting that publication bias have no influenced the original pooled estimate.

### 3.3. Sub-group analysis

The subgroup analysis was conducted based on two region of Ethiopia. The highest prevalence of peripheral arterial disease is 26.9% (95% CI: 16.9–36.9, $I^2$ = 98.1%) was seen in central region, and the lowest is 18.0% (95% CI: 7.0–28.9, $I^2$ = 96.7%) was seen in northern region (Fig. 3).

### 3.4. Meta-regression and publication bias

Substantial between-study heterogeneity was observed among the included studies. Therefore, meta-regression analysis was performed to explore whether year of publication and sample size could explain some of the observed heterogeneity. The results indicated that neither year of publication nor sample size was significantly associated with the varia-

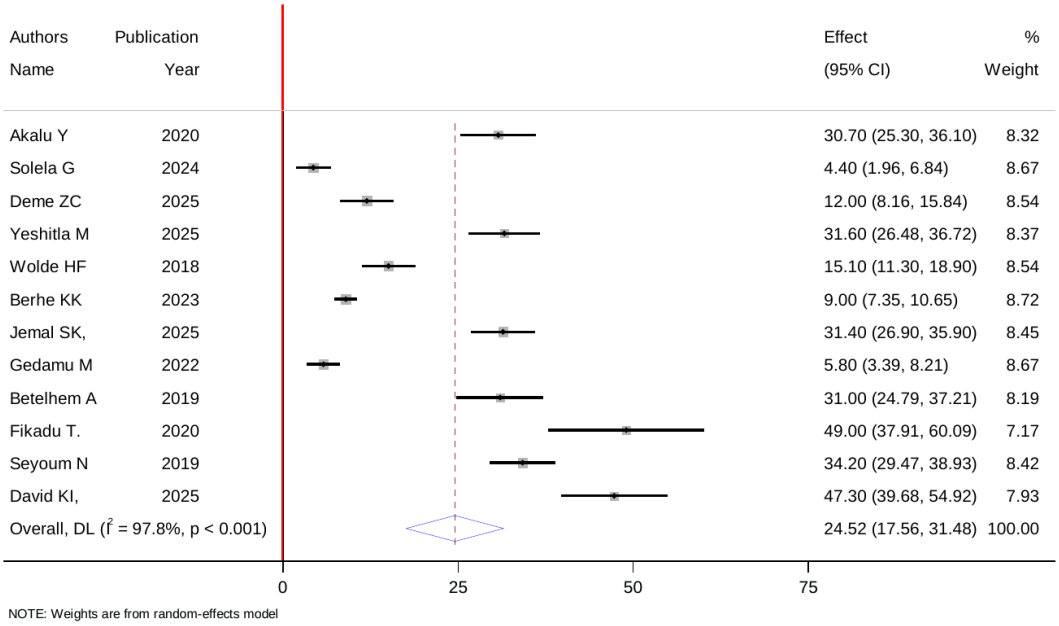


**Fig. 2.** Forest plot showing the pooled prevalence of peripheral arterial disease among diabetic patients in Ethiopia.

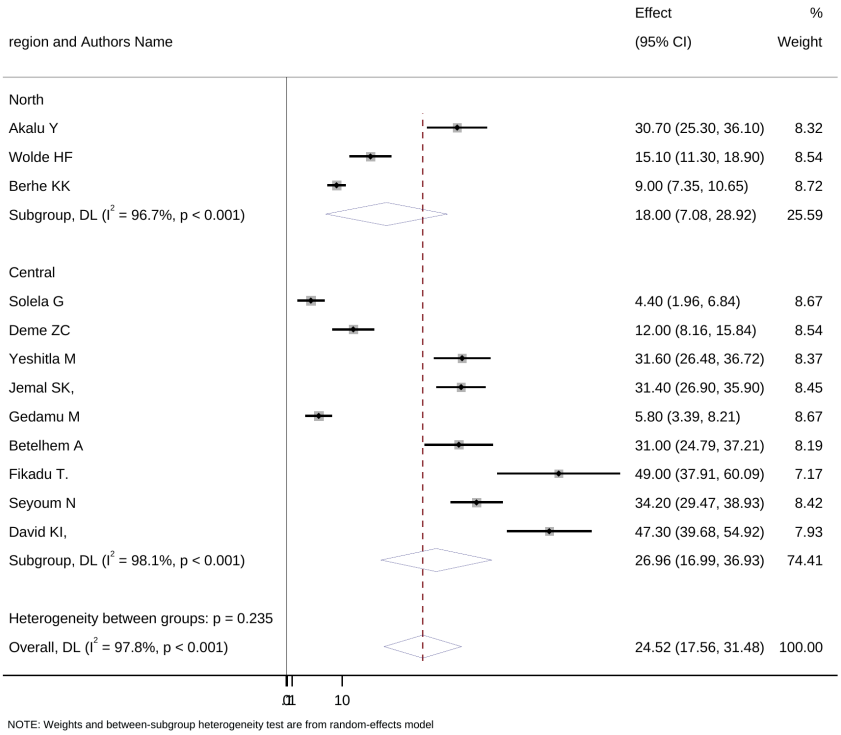


**Fig. 3.** Subgroup analysis of pooled prevalence of peripheral arterial disease among diabetic patients in Ethiopia.

tion in effect estimates, with P-values of 0.470 and 0.961, respectively Potential small-study effects and publication bias were assessed using funnel plot inspection and Egger's regression test, with statistical significance set at $P < 0.05$. The funnel plot showed some degree of asymmetry (Figure 4), and Egger's regression test indicated statistically significant asymmetry (P= 0.002), suggesting potential publication bias. A trim-and-fill analysis was subsequently conducted as a sensitivity analysis to examine the potential influence of missing studies on the pooled estimate. Following the trim-and-fill procedure, the funnel plot appeared approximately symmetrical (Figure 5).

### 3.5. Sensitivity analysis

Sensitivity analysis was performed to determine how various sources of uncertainty contribute to the overall uncertainty among the studies, but the results indicated that uncertainty has an insignificant influence on pooled prevalence (Fig 6).

## 4. Discussion

This systematic review and meta-analysis provides pooled estimate of the prevalence of peripheral arterial disease among patients with diabetes mellitus in Ethiopia. Evidence shows PAD is a manifestation of systemic atherosclerotic disease and prevalent among older adults and individuals with major cardiovascular risk factors, including diabetes,



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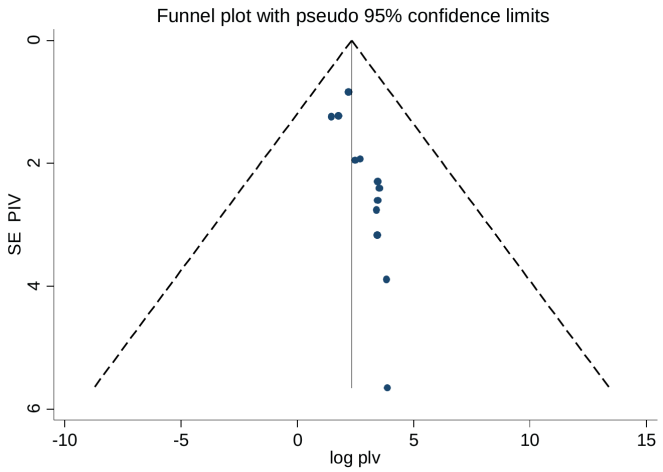


**Fig. 4.** Funnel plot to test publication bias in 12 studies with 95% confidence limits.

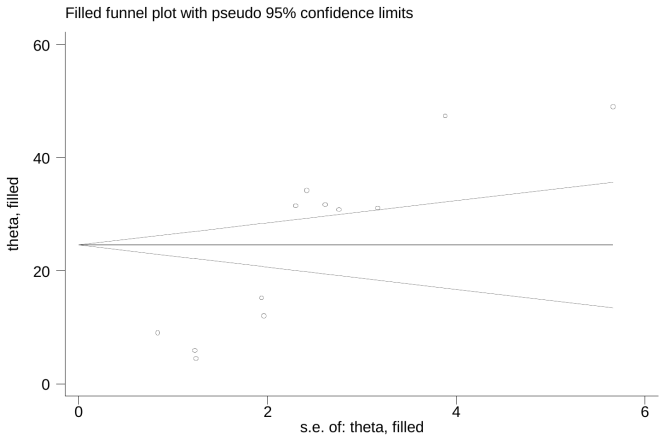


**Fig. 5.** Funnel plot to test publication bias in 12 studies with 95% confidence limits by trim and fill analysis.

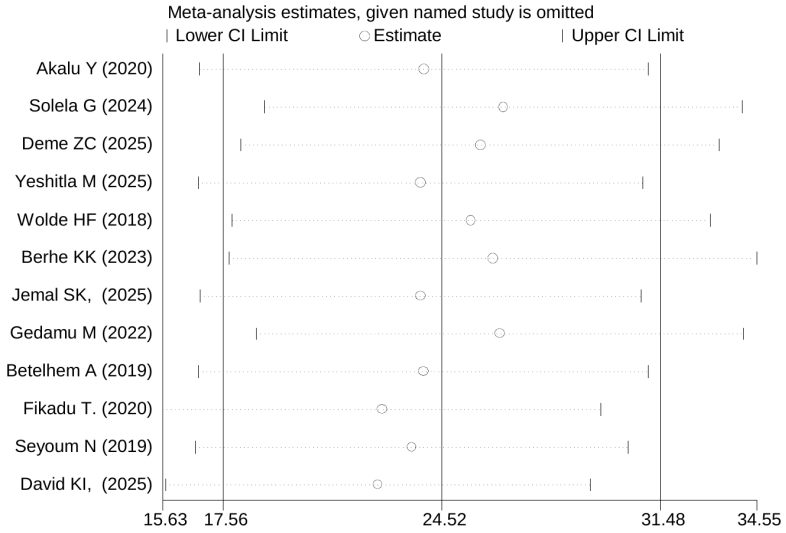


**Fig. 6.** Sensitivity analysis of pooled prevalence of peripheral arterial disease among diabetic patients in Ethiopia for each study being removed one at a time.

smoking, and chronic kidney disease. In people with diabetes, PAD may remain asymptomatic or present with atypical manifestations, particularly in the presence of concomitant diabetic peripheral neuropathy. The clinical significance of PAD extends beyond lower-limb ischemia, as it is associated with impaired mobility and functional status, reduced quality of life, lower-extremity complications, cardiovascular events, and increased mortality [37–39].

The present systematic review and meta-analysis found that the pooled prevalence of peripheral arterial disease among patients with diabetes mellitus in Ethiopia was 24.5% (95% CI: 17.5–31.4), indicating that approximately one in four diabetic patients may have PAD. This finding demonstrates that PAD constitutes a substantial vascular complication among people with diabetes in Ethiopia

The regional analysis demonstrated further geographical variation, with the highest pooled prevalence observed in the central region at 26.9% (95% CI: 16.9–36.9) and the lowest in the northern region at 18.0% (95% CI: 7.0–28.9). The observed difference may reflect variations in the characteristics of the diabetic populations, healthcare access, lifestyle patterns, cardiovascular risk-factor profiles, and study methodologies across regions. Moreover the relatively high prevalence observed in the central region may partly reflect the characteristics of populations attending large referral and specialized hospitals.

## 5. Limitations

This review has some limitations. Considerable heterogeneity was observed among the included studies, which may be related to differences in study populations, settings, sample sizes, and diagnostic methods used to identify PAD. Most studies were hospital-based, which may limit the generalizability of the findings to the broader diabetic population. Differences in regional representation and the availability of studies may also have influenced the regional estimates. In addition, variations in the use and measurement of the ankle-brachial index and other diagnostic criteria may have contributed to differences in reported prevalence. Finally, the possibility of publication bias and other biases inherent in the primary studies cannot be completely excluded.

## 6. Conclusion

This systematic review and meta-analysis demonstrates peripheral arterial disease is a substantial and clinically important complication among patients with diabetes mellitus in Ethiopia. Therefore integration PAD assessment into routine diabetes care, particularly for patients with established cardiovascular risk factors and diabetic foot complications is essential. Future researchers should conduct large, multicenter and population-based studies using standardized diagnostic methods to provide more representative estimates of PAD in Ethiopia.

## Disclosures

**Ethical considerations:** Ethical approval was not required because this study did not involve direct interaction with human participants.

**Consent for publication:** Not applicable.

**Availability of data and materials:** The data analyzed during the current systematic review and meta-analysis is available with reasonable request from corresponding author.

**Competing interests:** All the authors declare that they have no competing interests.

**Funding:** The authors received no specific funding for this work.

**Acknowledgment:** We would like to thank all authors of studies included in this systematic review and meta-analysis.

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