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Burden of peripheral artery disease and risk factors among patients with diabetes mellitus in sub-Saharan Africa: a systematic review and meta-analysis

Kirubel Eshetu Haile[1*], Yordanos Sisay Asgedom[2], Gedion Asnake Azeze[3], Atitegeb Alebachew Amsalu[2], Gizachew Ambaw Kassie[2] and Amanuel Yosef Gebrekidan[2]

Abstract

Background Diabetes is a non-communicable disease that presents a substantial public health challenge on a global scale. Peripheral artery disease is a significant macrovascular problem in diabetes mellitus characterized by atherosclerotic narrowing of the artery in the lower extremities, leading to compromised distal perfusion, primarily caused by atherosclerosis, and resulting in impaired functional capacity. Although existing studies on, peripheral artery disease among patients with diabetes mellitus are available, the results have been inconsistent.

Objective To determine the pooled burden and associated factors of peripheral artery disease among patients with diabetes mellitus in sub-Saharan Africa.

Methods A systematic review and meta-analysis were performed following the guidelines established by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. To identify papers published in English up to August 10, 2024, the electronic databases of Medline, Science Direct, Excerpta Medica Database, Cochrane Library, African Journals Online, and Google Scholar were searched. A random-effects model was employed to estimate the pooled prevalence and associated factors of peripheral artery disease. To test for heterogeneity between studies and publication bias, forest plots and funnel plots were used.

Results This study revealed that the pooled prevalence of peripheral artery disease among patients with diabetes mellitus was 32.97% (95% CI 29.7, 36.24), reflecting the significant impact of diabetes mellitus on vascular health. Age (OR = 2.51, 95% CI = 3.41–12.09), increased level of low density lipoprotein (OR = 1.64, 95% CI = 1.05–13.09), BMI (OR = 3.03, 95% CI = 1.74–7.56), and illness duration exceeding 10 years (OR = 2.44, 95% CI = 1.12–5.13), were the significant predictors.

Conclusion Despite the alarming prevalence of peripheral artery disease among patients with diabetes in sub-Saharan Africa, it remains underdiagnosed; therefore, increased awareness, proactive screening initiatives, and management strategies within the clinical setting are necessary.

*Correspondence:
Kirubel Eshetu Haile
kiruesha2@gmail.com

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

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Introduction

Diabetes mellitus (DM) and peripheral artery disease (PAD) are growing public health issues linked to significant rates of cardiovascular risk as well as limb-related morbidity and mortality. PAD is among the significant macrovascular problems of DM and is associated with atherosclerotic narrowing of the artery in the lower extremities, with impaired distal perfusion, primarily caused by atherosclerosis, resulting in impaired functional capacity, and considerable morbidity and mortality [1, 2].

Diabetes mellitus increases the incidence of PAD, accelerates disease progression, and increases disease severity. Due to systemic atherothrombosis, PAD is a significant risk factor for coronary and cerebrovascular events, such as myocardial infarction, stroke, and mortality [3]. It is the third most common atherosclerotic condition following coronary artery disease and stroke. In 2015, approximately 236 million people were affected by PAD, which increased by 17.1% from the 2010 prevalence report [1, 4]. According to the American Diabetes Association (ADA), provided data indicate that individuals of African Americans and Hispanics have the highest rates of coexisting PAD and DM [5]. Patients with PAD and their treating healthcare professionals do not recognize functional impairment as a clinical future of vascular disease, 30 -50% of patients have atypical exertional leg symptoms, and only 20% suffer from intermittent claudication [3, 6, 7]. It is also the most commonly underdiagnosed disease, especially among patients with DM, because most patients with PAD are asymptomatic and do not complain of intermittent claudication due to decreased pain perception secondary to peripheral neuropathy, which could lead to adverse cardiovascular outcomes, limb related morbidity and mortality, poor quality of life, amputations, acute limb ischemia, infections, acute occlusions, ulcers, high health care expenditures, increased length of hospital stay, and increased admission and readmission rates [3, 8].

The prevalence of PAD among patients with DM is significant, and various predictors enhance its development and progression. People with diabetes are 3 to 4 times more likely to develop PAD than those without diabetes. Many authors have noted that in patients with diabetes, the diagnosis of PAD often occurs too late. Furthermore, in patients with DM, the presence of PAD significantly exacerbates the risk of lower limb complications, such as leg amputation, revascularization procedures, cardiovascular complications, and elevated mortality rates [1, 4]. Research conducted across the globe has shown differing prevalence rates, with a higher rate reported in the African region due to varying lifestyle factors and healthcare access. According to a systematic literature review, type 2 DM patients have a 12.5 – 22% prevalence of PAD, which is associated with increased morbidity and mortality [8]. Many studies have shown that the key contributing factors for the prevalence of PAD are advanced age, obesity, sedentary lifestyle, hyperglycemia, elevated HbA1c levels, dyslipidemia, smoking, hypertension; inflammation, and endothelial dysfunction [8–10]. In studies conducted in Korea [11], and India [12] the prevalence of PAD among patients with DM was 28.7% and 36%, respectively.

Currently, PAD is an increasingly serious public health challenge, especially in low-income countries, with varying rates reported across the regions that are underestimated and undertreated [2, 13, 14]. A study conducted in Nigeria [15], Chad [16], Tanzania [17], Uganda [18], Cameroon [19] and Ethiopia [20] revealed that the prevalence of PAD among patients with DM was 34.3%, 21.2%, 28%, 39%, 18% and 30.7% respectively, with significantly associated factors identified, such as the duration of diabetes, smoking, hyperglycemia, coexistence of hypertension and advanced stage of the disease. Despite the alarming prevalence there remains a concern regarding inadequate screening practices, which are underdiagnosed across the region. DM and PAD are associated with considerable economic burdens, which are driven mainly by direct costs for disease management [21–23].

However, previously available evidence has focused on the prevalence of PAD in the overall population; comprehensive data on the pooled prevalence of PAD and associated factors among patients with DM in sub-Saharan African countries are lacking. Therefore, our intent was to conduct a systematic review and meta-analysis of all available studies to determine the current pooled prevalence of PAD and associated factors among patients with DM in sub-Saharan African countries. Overall, understanding the pooled prevalence and handling of PAD is essential for healthcare systems to craft effective and efficient prevention strategies to mitigate the risk associated with PAD in patients with diabetes.

Method

Study design and reporting

A systematic review and meta-analysis of observational studies was conducted on the burden of PAD and its associated factors among patients with DM in sub-Saharan Africa. All studies on PAD and its associated factors among patients with DM in sub-Saharan Africa published up to August 10, 2024, were reported in guidelines with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [24] (supplementary file 1).

Protocol and registration

The review was registered in PROSPERO (International Prospective Register of Systematic Reviews), the University of York Center for Reviews and Dissemination with registration number CRD42024594577.

Search strategy

We conducted a systematic and comprehensive search of the electronic databases of ScienceDirect, Cochrane Library, Medline, Center for Evidence-based Medicine, African Journals Online (AJOL), Excerpta Medical Database, Scopus, and Google Scholar to identify all relevant observational studies on the prevalence of peripheral artery disease and associated factors among patients with DM in a sub-Saharan African region. The articles were downloaded, arranged, and referenced via the EndNote referencing manager version 20. To find more potentially relevant studies, a manual search was conducted using the reference lists of the retrieved articles. Research was restricted to works published in the English language. The search was carried out using the following keywords: 'prevalence', ('Peripheral artery disease, OR lower extremity artery disease OR 'arterial stiffness') and (people or patients OR individuals OR male OR female OR adults) and Diabetes Mellitus OR diabetic OR type 1 diabetes mellitus OR type 2 diabetes Mellitus) OR (associated Factors OR determinant factors OR risk factors) AND (epidemiology OR prevalence OR incidence) AND (Sub-Saharan Africa)). The search terms were used separately and in Combination with 'OR' or 'AND' (Supplementary file 2).

We considered studies that examined the prevalence of PAD and associated factors among patients with DM in sub-Saharan Africa to be relevant. Our imposed search limits restricted studies that were observational in nature, published in English, and involved human participants. The PubMed search engine with MeSH (Medical Subject Headings) and Boolean were searched.

Eligibility criteria

Studies were included if they met the following requirements: (i) study period: studies conducted or published until August 10, 2024; (ii) study type: cross-sectional and case control; (iii) population: research conducted on diabetes patients; (iv) outcome; prevalence (proportion); (v) place of study: research conducted in Sub-Saharan Africa; and (vi) studies published in the English language. Review articles, case series, case reports, and letters to the editors were not included.

Study selection and extraction

The retrieved studies were imported into EndNote (Version 20, for Windows, Thomson Reuters, Philadelphia, PA, USA), and Endnote was used to eliminate 1304 duplicate studies. Three independent reviewers (KEH, AAA and GAK) screened all papers for eligibility requirements: first; the abstracts and titles were screened, and then, the full texts were screened. Three investigators independently (YSA, AYG, and GAA) used a consistent data extraction format created in Microsoft Excel to extract data. Prior to the extraction process, the four independent researchers were blinded to the study data. Name of the first author, year of publication, country, subcontinent, country, sample size, and response rate (Fig. 1) (Table 1).

Quality assessment

Following the full text review, the Newcastle-Ottawa quality assessment scale (which was modified for cross-sectional studies) was used by three authors (AYG, GAK and YSA) to evaluate the article's quality [25]. Disagreements were settled by consensus and discussion. We employed the following elements as criteria for an appraisal: (1) the degree of representativeness of the sample (maximum score = 1) (2) magnitude of the Sample size (maximum score = 1) (3) incidence of non-respondents (maximum score = 1) (4) the method of ascertainment of the exposure (risk factor)(maximum score = 2) (5) The number of subjects in different outcome groups being comparable, on the basis of the study design(maximum score = 2) (6) the assessment of outcome(maximum score = 2) and (7) the statistical test (maximum score = 1). Articles with a score of ≥ 5 on the quality evaluation checklist criteria were considered low risk studies, and these studies were included in the systematic review and meta-analysis. No study was excluded after a quality rating was obtained (Table 2).

Statistical analysis

The data were analyzed via STATA 14.2 software (StataCorp, College Station, Texas, USA). We used the DerSimonian and Laird method for random-effects models to calculate the pooled prevalence of PAD among patients with DM in sub-Saharan African countries [26]. I^2 statistical test was computed to check heterogeneity across studies. I^2 values of 0%, 25%, 50%, and 75% were assumed

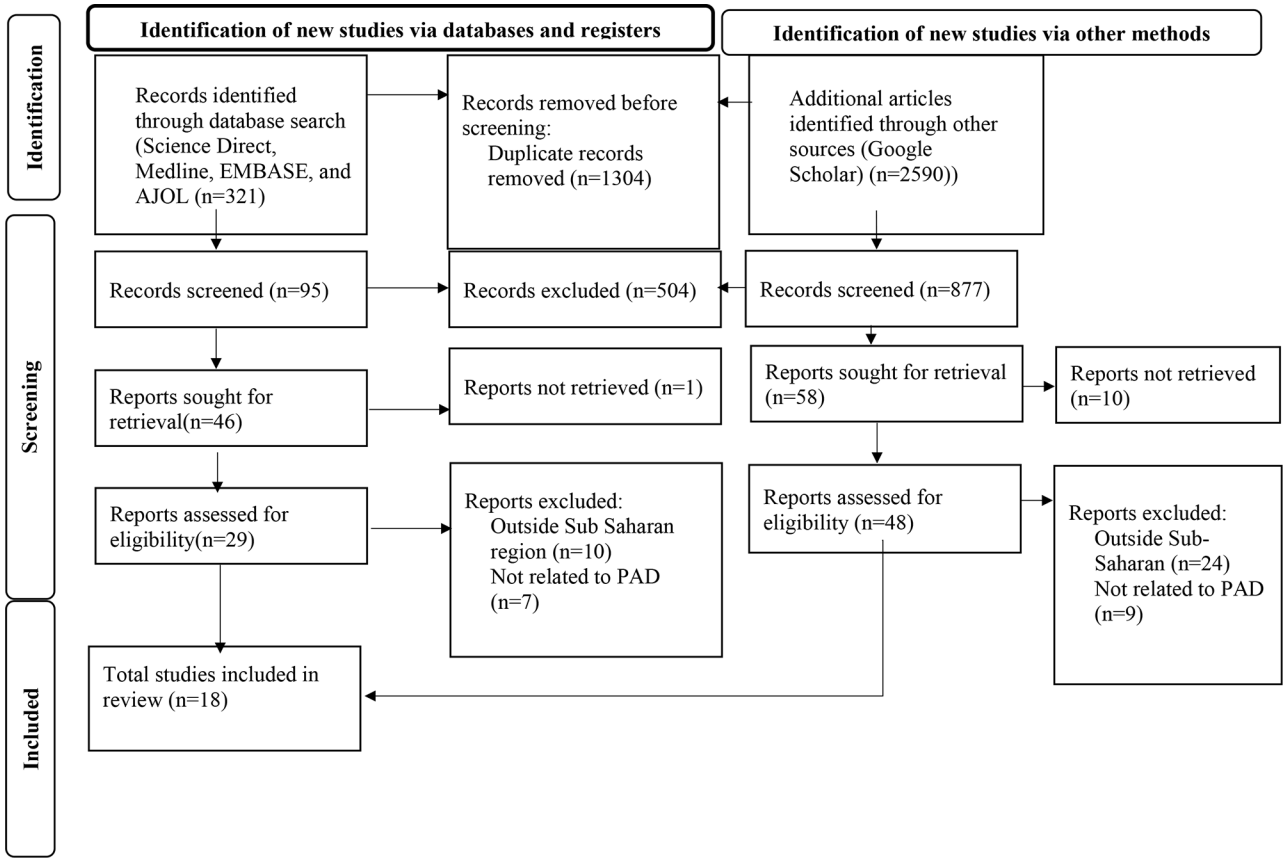

Fig. 1 PRISMA flow diagram of the selection process of studies on peripheral Artery disease among DM patients in Sub-Saharan Africa

Table 1 Characteristics of the 18 studies included in the systematic review and meta-analysis of peripheral artery disease among patients with DM in Sub-Saharan Africa

Study No	Author	Year	Country	Sub-Continent	Study design	Population	Prevalence	Sample Size	RR(%)
1	Akalu.Y et al.	2020	Ethiopia	East Africa	cross-sectional	T2DM	30.7	280	100
2	swali.A et al.	2017	Tanzania	East Africa	cross-sectional	T2DM	30.7	367	100
3	Osman.A et al.	2023	Sudan	East Africa	cross-sectional	T2DM	22	100	100
4	Agboghoroma et al.	2020	Nigeria	West Africa	cross-sectional	T2DM	38.5	200	100
5	Oyelade.B et al.	2012	Nigeria	West Africa	cross-sectional	DM	52.5	219	100
6	Okello. S et al.	2014	Uganda	East Africa	cross-sectional	DM	43.64	229	100
7	Immanuel.A et	2016	Ghana	West Africa	cross-sectional	T2DM	35.5	200	100
8	Yeboah.K et al.	2016	Ghana	West Africa	Case-control	DM	26.7	815	100
9	PD. Y et al.	2018	Nigeria	West Africa	cross-sectional	T2DM	29	200	100
10	Mwebaze. R et	2014	Uganda	East Africa	cross-sectional	DM	39	146	100
11	ACA.C et al.	2019	Nigeria	West Africa	cross-sectional	T2DM	31.1	405	100
12	Weledji.E et al.	2018	Cameroon	Central Africa	cross-sectional	DM	18	214	100
13	Ogbera. A et al.	2015	Nigeria	West Africa	cross-sectional	DM	40	225	100
14	Mahamet.A et al.	2024	Chad	Central Africa	cross-sectional	DM	21.2	782	100
15	Abbas.Z et al.	2020	Tanzania	East Africa	cross-sectional	DM	28	5,687	100
16	Anumah. F et al.	2023	Nigeria	West Africa	cross-sectional	DM	34.3	1,040	100
17	Codjo.H et al.	2016	Benin	West Africa	cross-sectional	DM	41.9	401	100
18	Umuerri. EM et al.	2013	Nigeria	West Africa	cross-sectional	T2DM	35.6	388	100

Table 2 Quality rating for studies included in the systematic review and meta-analysis of peripheral artery disease among patients with DM in sub-saharan Africa region

Study	Selection Criteria				Comparability	Outcome		
	Representativeness of the sample *	Sample size *	Non respondents *	Ascertainment of the exposure(maximum score = 2) **	The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled((maximum score = 2)) **	Assessment of the outcome(maximum score = 2) **	Statistical test *	Total(10)
Akalu.Y et al.	1	1	1	2	1	1	1	8
swali.A et al.	1	1	1	2	1	1	1	8
Osman.A et al.	1	0	1	2	1	1	1	7
Agboghoroma et al.	1	1	1	2	1	1	1	8
Oyelade.B et al.	1	1	1	1	1	1	1	7
Okello. S et al.	1	1	1	1	1	1	1	7
Immanuel.A et	1	1	1	2	1	1	1	8
Yeboah.K et al.	1	1	1	1	1	1	1	7
PD. Y et al.	1	1	1	1	1	1	1	8
Mwebaze. R et	1	1	1	1	1	1	1	7
ACA.C et al.	1	1	1	1	1	1	1	7
Weledji.E et al.	1	1	1	2	1	1	1	8
Ogbera. A et al.	1	1	1	2	1	1	1	8
Mahamet.A et al.	1	1	1	2	1	1	1	8
Abbas.Z et al.	1	1	1	2	1	1	1	8
Anumah. F et al.	1	1	1	1	1	1	1	7
Codjo.H et al.	1	1	1	1	1	1	1	7
Umuerri. EM et al.	1	1	1	1	1	1	1	7

to denote the absence of heterogeneity, a low level of heterogeneity, a moderate degree of heterogeneity, and a high degree of heterogeneity, respectively. Because significant heterogeneity was detected between studies, a meta-analysis using a random effects model was conducted to estimate pooled prevalence with 95% confidence intervals (CI). A forest plot was used to present the results of the meta-analysis. The Egger's test was employed to assess the existence of publication bias, and any possible publication bias was specified by visual examination of the funnel plot.

To pinpoint the key studies that had the most significant influence on between-study heterogeneity, a leave-one-out sensitivity analysis was also conducted. By omitting each study individually, an analysis was conducted to determine the impact of each study on the pooled estimated prevalence of PAD patients with DM in the sub-Saharan Africa. The input variables needed by the cells of the two-by-two tables for factors related to peripheral artery disease are binary data, or "prevalence of peripheral artery disease," i.e., the proportion of patients in each study's exposed and non-exposed groups who have and do not have PAD.

The odds ratio (OR), which was calculated on the basis of the binary results of the included main studies, was used to evaluate all factors associated with peripheral artery disease. The pooled odds ratio was calculated via random-effects meta-analysis, and a 95% confidence interval was employed. The effect magnitude and 95% confidence intervals are shown through forest plots.

Results

A total of 4,215 scholarly articles were obtained, through the use of electronic databases. In total, 1,304 articles were excluded because of duplication. Of the remaining 2.911 articles, 2,834 were removed by title and abstract, whereas 77 were read in full and assessed for eligibility. On the other hand, one study that fulfilled the eligibility criteria but was excluded failed to access the full text. Finally, 18 studies with a total of 11,898 participants who fulfilled the eligibility requirements were included in the meta-analysis (Fig. 1) (Table 1).

Characteristics of the included studies

Among the 18 included studies, 10 were conducted in Western Africa [15, 21, 23, 27–34], 6 were conducted in Eastern Africa [17, 18, 20, 35–37], and 2 were conducted in Central Africa [16, 19]. The highest prevalence (52.5%) of peripheral artery disease among patients with DM in sub-Saharan Africa was reported in a study conducted in Nigeria [31]. The lowest prevalence (18%) was reported in a study conducted in Cameroon [19]. Depending on

the study population category, 10 studies included both type 1 DM and type 2 DM [15–19, 23, 29, 31, 34, 35] and the remaining 8 studies included only type 2 DM [20, 27, 28, 30, 32, 33, 36, 37].

Pooled burden of PAD among patients with DM in sub-Saharan Africa

The pooled prevalence of peripheral artery disease among patients with DM in sub-Saharan African countries was 32.97 (95% CI 29.7, 36.24). The forest plot in Fig. 2 shows a statistically significant heterogeneity ($I^2 = 91.4\%$; $p < 0.001$) (Fig. 2). Therefore, a random-effects model was used to estimate the pooled prevalence of peripheral artery disease among patients with DM in sub-Saharan African Countries. Additionally, subgroup analysis was conducted to determine the potential source of heterogeneity among the studies because of the high degree of heterogeneity.

Subgroup analysis

Because of the significant heterogeneity among the studies, a subgroup analysis was conducted to identify potential sources of heterogeneity. Subgroup analysis was conducted depending on the study area (sub-continent) (Fig. 3) and year of publication to identify possible sources of heterogeneity. With respect to the sub-group analysis by sub-continent, the highest pooled prevalence of PAD was reported in the Western Africa sub-continent at 36.24% (95% CI 31.96, 40.52), whereas the lowest was documented in the Central Africa sub-continent at 20.34% (95% CI 17.57, 23.12) (Table 3).

Publication bias

The graphical presentation of the funnel plot indicates the presence of asymmetry (Fig. 4). The results of the Egger test were also statistically significant with coefficient = 3.34, 95% CI (3.10, 3.42) and with a p value of

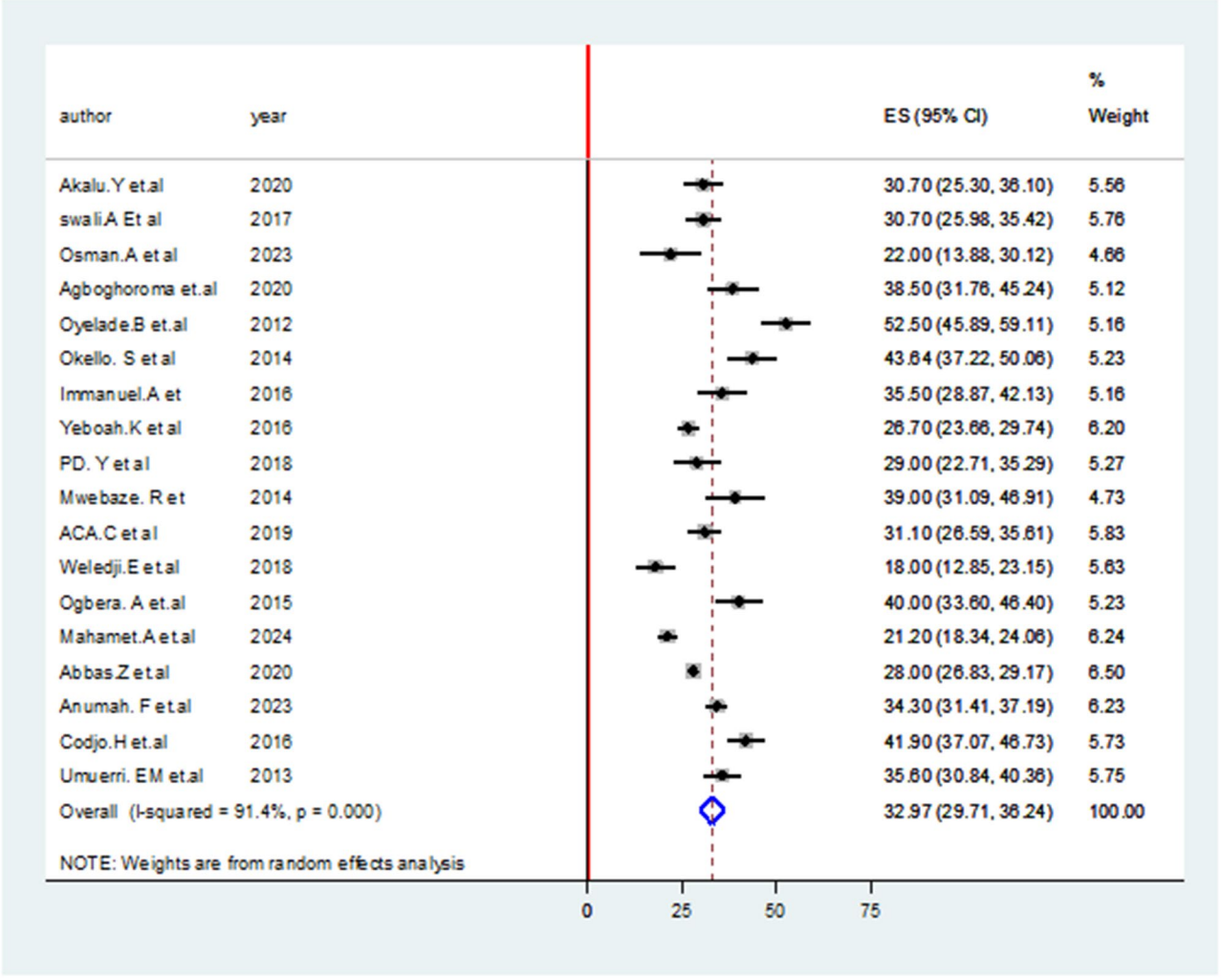

Fig. 2 Forest plot for pooled prevalence of the systematic review and meta-analysis of peripheral Artery disease among patients with DM in Sub-Saharan Africa

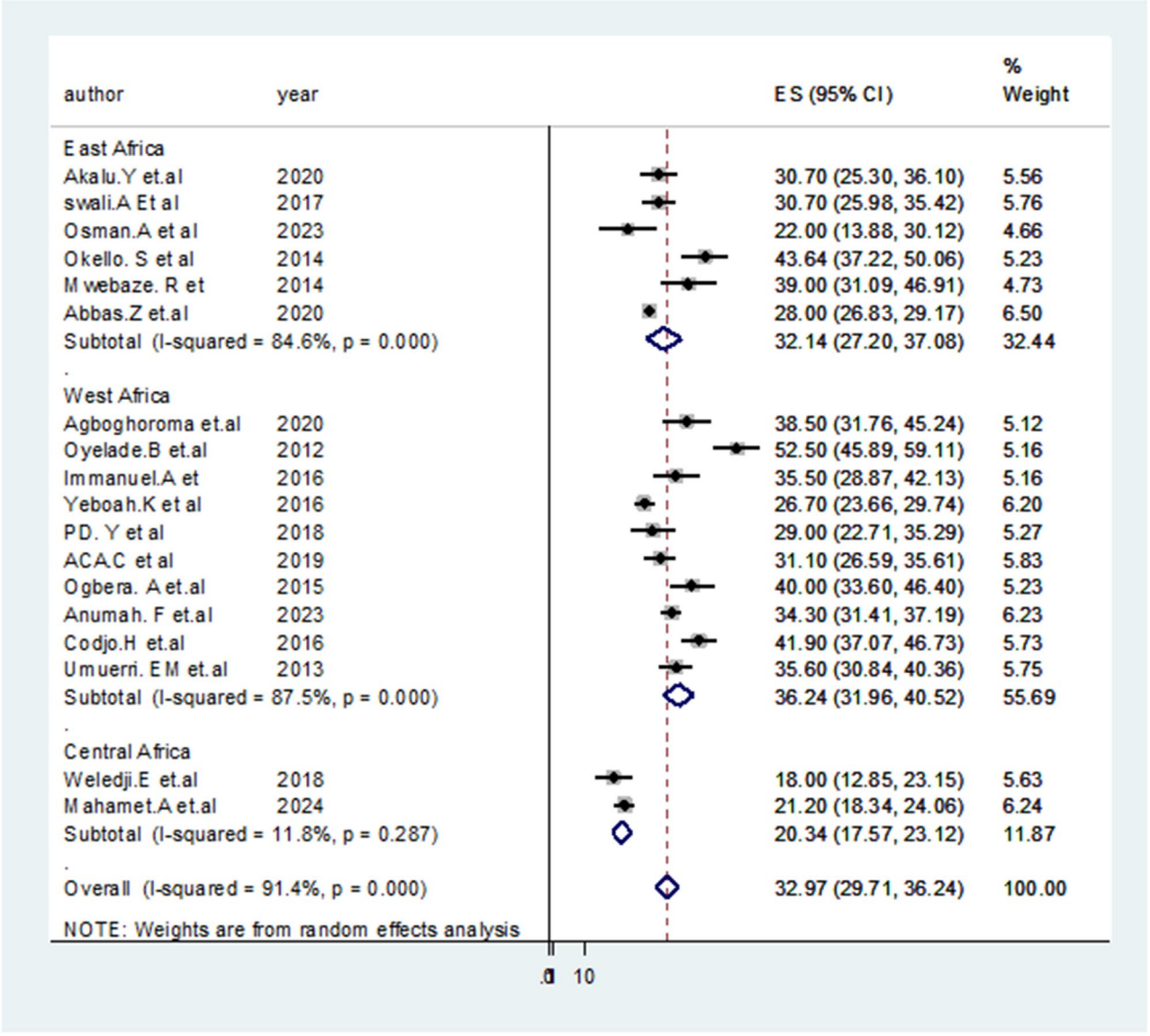

Fig. 3 Subgroup analysis based on study area (sub-continent) for the systematic review and meta-analysis of peripheral artery disease among patients with diabetes mellitus in sub-Saharan Africa

Table 3 Subgroup analysis of the pooled prevalence of peripheral artery disease among patients with DM in sub-saharan Africa

Subgroups	Number of studies	Prevalence (95% CI)	Heterogeneity statistics	*P*-value	I^2	Tau^2
Subcontinent						
East Africa	6	32.14(27.28 to 38.10)	32.49	< 0.0001	84.6	29.4
West Africa	10	36.24(3.96 to 40.52)	72.24	< 0.0001	87.5	40.25
Central Africa	2	20.34(17.57 to 23.12)	1.13	0.287	11.8	0.60
Overall	18	32.97(29.71 to 36.24)	198.36	< 0.0001	91.4	42.28
Study population						
DM	10	34.03(29.14–38.92)	177.28	< 0.0001	94.9	55.77
Type 2 DM	8	31.91(29.04 to 34.78)	14.2	< 0.0001	50.7	8.48
Overall	18	32.97(29.71 to 36.24)	198.36	< 0.0001	91.4	42.28

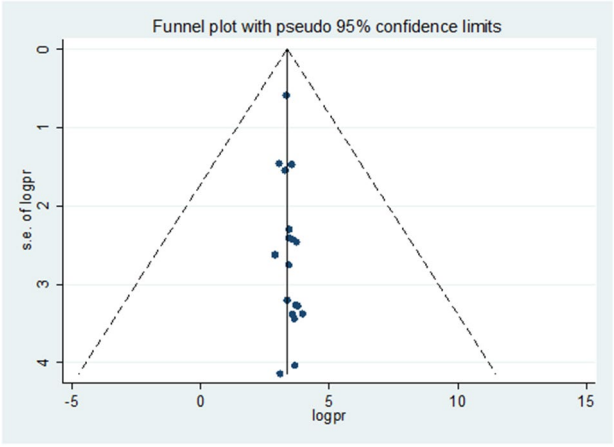

Fig. 4 Funnel plot for publication bias for systematic review and meta-analysis of peripheral artery disease among patients with DM in sub-Saharan Africa

Table 4 Tests for funnel plot asymmetry (Eggers test) of peripheral artery disease among patients with diabetes mellitus in sub-saharan Africa

Standard effect	Coefficient	Standard error	T	*P* > t	95% CI
Slope	3.34	0.075	43.06	< 0.0001	(3.10 to 3.42)
Bias	0.074	0.043	1.73	0.1	(0.02 to 0.17)

< 0.001 (Table 4). As a result, we used a trim and fill analysis to estimate the number of potentially missed studies by potentially filling out three studies and adjusting for the overall effect estimate. By trim and fill analysis, the overall pooled estimate was 3.33%, 95% CI (2.55 to 4.11).

Sensitivity analysis

Leave- out one sensitivity analysis

By excluding each study individually, a leave-out-one sensitivity analysis was used to assess the impact of each study on the pooled prevalence of PAD among patients with DM in sub-Saharan Africa. The findings revealed that the studies that were removed had no discernible impact on the pooled prevalence of PAD among patients with DM in sub-Saharan Africa.

Factors associated with PAD among patients with DM in sub-Saharan Africa

To determine factors associated with PAD among patients with DM in sub-Saharan Africa, variables such as age, diabetic foot ulcer, body mass index, duration of illness, presence of comorbidities such as hypertension, BMI, hemoglobin A1C (Hba1c), and serum cholesterol level were extracted from the relevant studies. Among these variables, four were identified as significant factors associated with PAD among patients with DM: age, BMI, duration of diabetes, and serum cholesterol (Table 5). However, in our study, there was no significant association between hemoglobin A1C (Hba1c), hypertension, and diabetic foot ulcers with prevalence of PAD.

To identify the association between age and PAD, three studies were included, all of which demonstrated a statistically significant association. Ultimately, our systematic review and meta-analysis revealed that individuals aged over 60 years had a 2.51 fold greater risk of developing peripheral artery disease than individuals who were younger (OR = 2.51, 95% CI = 3.41–12.09). Moreover, the odds of developing peripheral artery disease were 3.03 times greater in individuals with a BMI of obesity than in those with a normal BMI (OR = 3.03, 95% CI = 1.74–7.56).

The odds of having a higher serum cholesterol level were 1.64 times higher than those of individuals having a lower cholesterol level (OR = 1.64, 95% CI = 1.05–13.02). The length of time a patient was diagnosed with diabetes mellitus increased the likelihood of developing peripheral arterial disease by a factor of 2.44 (OR = 2.44, 95% CI = 1.12–5.13).

Discussion

To determine the pooled burden of peripheral artery disease among patients with DM in sub-Saharan Africa, we conducted a systematic review and meta-analysis. The findings revealed that the pooled prevalence of PAD among patients with DM in sub-Saharan Africa was 32.97 (95% CI 29.7, 36.24). This result was consistent with those of studies conducted in Nigeria [15], Tanzania [37], and Ethiopia [20], which reported pooled prevalences of peripheral artery disease of approximately 34.30%, 30.70%, and 30.7%, respectively. The possible explanations could be the inclusion of studies within the continent of Africa, with most of the sub-continent having similar socio-demographic traits, poor self-care

Table 5 Factors associated with peripheral artery disease among patients with DM in sub-Saharan Africa

Determinants (Ref.No)	Number of studies	Sample size	OR(95% CI)	*P*-value	$I^2_{(\%)}$	Heterogeneity test(*P*-value)
Age [19, 35, 36]	3	747	2.51(3.41–12.09)	< 0.001	76%	< 0.001
Serum cholesterol [27, 36]	2	567	1.64(1.05–13.02)	0.047	74%	3.98
Body Mass Index (BMI) [27, 35, 36]	3	667	3.03(1.74–7.56)	< 0.001	45.5%	1.83
Duration of DM [29, 36]	2	567	2.44(1.12–5.13)	0.024	28.4%	1.40

behaviors, low-income countries, culture, and poor accessibility of healthcare service-related factors.

Our systematic review and meta-analysis data on the burden of PAD are higher than those of studies conducted in Asia and Korea, which reported rates of 17.7% and 3.2%, respectively [38, 39]. The reason for this disparity may be the fact that Asian countries have screening programs, educated populations, easily accessible healthcare services, high-income levels, and better health career providers than countries in sub-Saharan African nations.

On the other hand, the pooled prevalence reported in this systematic review and meta-analysis was greater than that reported in a previous study on the prevalence of PAD among patients with DM in Cameroon [19], Chad [16], and Sudan [36] 18%, 21.2%, and 22%, respectively; this discrepancy may be due to differences in sample size, study population, and study year. However, the findings of this systematic review and meta-analysis were also lower than those of studies conducted in Benin, Uganda, and Nigeria, where the prevalence of PAD was 41.9%, 43.64% and 52.5%, respectively [29, 31, 35]. A possible justification for this discrepancy is the difference in sample size, study population, and study year.

According to our pooled findings, patients aged greater than 60 years had a 2.51 fold increased risk of developing peripheral arterial disease compared with their younger counterparts. This phenomenon may be attributed to the fact that as age increases, the prevalence of risk factors such as cardiovascular disease, chronic kidney disease, stroke morbidity and mortality increases, all of which are associated with an escalation in PAD incidence. Generally, the older an individual is, the greater the probability of peripheral vascular compromise. This finding was consistent with studies conducted in Sudan, Ethiopia, India, Tanzania, and the United States (USA) [20, 36, 37, 40, 41]. For instance, a study in the USA reported that the prevalence of PAD was 15.9% among individuals aged 60–69 years and 33.8% among those aged 70–82 years [40].

Our data also suggested that peripheral artery disease was associated with the duration of diabetes mellitus with an odds of 2.44 times greater risk of developing; the result is consistent with a previous study done in Ghana, Tanzania, and Brazil [30, 37, 42]. For instance, a study conducted in Tanzania revealed that a T2DM duration of more than 10 years was significantly associated with a 2.0 fold greater risk of developing PAD than participants with less than 10 years of DM duration [37]. The plausible explanation could be that the most common level of arterial occlusion in PAD associated diabetic feet is femoral-popliteal segment followed by tibia segment which is a prominent risk factor for PAD.

A body mass index exceeding a normal threshold level elevates the risk of developing peripheral artery disease. Obesity is one of the contributing factors of peripheral artery disease. Our findings indicate that individuals classified as living with obesity are prone to developing peripheral artery disease, which is 3.03 times greater. The results were aligned with studies conducted in Sudan and Pakistan [14, 36]. It is presumed that living with obesity have all the risk factors necessary to develop peripheral arterial disease. The other additional factors correlated with peripheral artery disease include elevated serum cholesterol levels, with an odds ratio of 1.64. These findings are supported by studies conducted in Brazil, Ethiopia, Nigeria, Sudan, Spain, and Korea [39, 42–46]. The possible justification is that elevated serum cholesterol levels affect fibrinolytic activity, elevated lipoprotein, increased circulating level of procoagulants such as tissue factor, factor IV, and decreased levels of anticoagulants like ant-thrombin-III and protein C, thus favoring a tendency toward coagulation, impaired fibrinolysis, endothelial wall dysfunction, and persistence thrombi, which are among the feasible mechanisms connecting PAD incidence [1, 32].

Limitations of the study

The presence of significant heterogeneity (more than 91%) in a small number of studies conducted on the study population may affect the generalizability of the findings. The included studies were from 9 countries, further affecting the generalizability of the findings to the entire subcontinent. The included studies were cross-sectional for prevalence of factors; as a result, the outcome variable might be affected by other confounding variables, decreasing the power of the study and it decreased causal conclusion between peripheral artery disease and factors associated with a peripheral artery disease. Studies with a small sample size for all the included studies may be another limitation. The restriction of studies written in English, which limits the number of studies included in this meta-analysis, and the use of clinically healthy respondents may also lower the actual prevalence of PAD.

Conclusion and recommendations

According to our systematic review and meta-analysis, the pooled burden of PAD was 32.97%, reflecting the significant impact of diabetes on vascular health. Exceeding 10 years duration of diabetes mellitus, advanced age, increased serum cholesterol level, and greater threshold level of BMI are all strong determinants of PAD. Despite the alarming prevalence of PAD among patients with diabetes, it remains underdiagnosed; increased awareness, regular screening using the ankle-brachial index (ABI) for early detection, and a management strategy within the clinical setup for diabetic patients is necessary.

Abbreviations

ABI	Ankle-Brachial Index
ADA	American Diabetes Association
AJOL	African Journals Online
BMI	Body mass index
DM	Diabetes mellitus
PAD	peripheral artery disease
PICO	Population Intervention Comparison Outcome
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
HbA1c	Hemoglobin A1C
USA	United States of America
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12902-025-01866-8.

Supplementary Material 1

Supplementary Material 2

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Author contributions
KEH: conceived and designed the study, methodology, data analysis, and interpretation, and wrote the original draft. GAK, YSA, GAA, AAA and AYG: established the search strategy, extract the data, and assess the quality of included studies. Each authors contributed to the software, writing review and document editing process. All authors have read and approved the manuscript. The guarantor accepts full responsibility for the work and/or the conduct of the study, has access to the data, and controls the decision to publish.

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Data availability
All pertinent information about this research study is included in the manuscript.

Declarations

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Not applicable.

Consent for publication
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Competing interests
The authors declare no competing interests.

Author details
[1]School of Nursing, College of Health Sciences and Medicine, Wolaita Sodo University, Wolaita Sodo, Ethiopia
[2]School of Public Health, College of Health Sciences and Medicine, Wolaita Sodo University, Wolaita Sodo, Ethiopia
[3]School of Midwifery, College of Health Sciences and Medicine, Hawassa University, Hawassa, Ethiopia

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