OPEN ACCESS



ISAR Journal of Medical and Pharmaceutical Sciences

Volume 4, Issue 11, 2026 | Page: 30-39

Abbriviate Title- ISAR J Med Pharm Sci

ISSN (Online)- 2584-0150

https://isarpublisher.com/journal/isarjmps

ANKLE-BRACHIAL INDEX SCREENING AMONG ADULTS WITH DIABETES MELLITUS: A SCOPING REVIEW

Prof. Jansan Mathew K [1*], Prof. Rincy Alex [2]

[1] Vice Principal, Al Shifa College of Nursing, Perinthalmanna.

[2] HoD, Al Shifa College of Nursing, Perinthalmanna.

***Corresponding Author**

Prof. Jansan Mathew K

Article History

Received: 02.08.2026

Revised: 13.09.2026

Accepted: 28.10.2026

Published: 23.11.2026

Abstract: -

Background: Peripheral arterial disease (PAD) is a common vascular complication among individuals with diabetes mellitus. The ankle-brachial index (ABI) is a non-invasive tool used for screening and assessment of PAD; however, its application and interpretation vary across studies. **Objective:** To map the existing evidence regarding the use of ABI for screening and assessment of PAD among adults with diabetes mellitus. **Methods:** A scoping review was conducted following the Joanna Briggs Institute methodology and reported according to PRISMA-ScR guidelines. Studies published in English from January 2010 onwards involving adults with diabetes mellitus and reporting ABI-based screening or assessment of PAD were considered. Relevant literature was identified through PubMed, Google Scholar, DELNET and other available sources. Data were charted using a structured extraction form and synthesized descriptively. **Results**: Seventeen studies were included in the review. Most studies were conducted in hospital or clinical outpatient settings (76.5%), and 64.7% focused exclusively on adults with type 2 diabetes mellitus. Cross-sectional studies were the predominant design (47.1%). ABI measurement methods, classification systems and diagnostic cut-off values varied across studies. More than half of the studies (52.9%) reported PAD prevalence exceeding 20%. Low or abnormal ABI findings were the most frequently reported category. Variations in measurement techniques, study populations and diagnostic criteria limited direct comparison of prevalence estimates. **Conclusion**: ABI is widely used for PAD screening and assessment among adults with diabetes mellitus. However, methodological heterogeneity and variations in ABI interpretation highlight the need for standardized measurement protocols and further research, particularly in community-based diabetic populations.

Keywords: Ankle-Brachial Index; Peripheral Arterial Disease; Diabetes Mellitus; Screening; Prevalence; Scoping Review.

This is an open access article under the CC BY-NC license

Cite this article:

Mathew, K. J, Alex, R., (2026). ANKLE-BRACHIAL INDEX SCREENING AMONG ADULTS WITH DIABETES MELLITUS: A SCOPING REVIEW. *ISAR Journal of Medical and Pharmaceutical Sciences, 4*(11), 30-39.

1. INTRODUCTION

Diabetes mellitus is a major public health concern associated with both microvascular and macro vascular complications. Peripheral arterial disease (PAD) is an important macrovascular complication characterised by narrowing or obstruction of the arteries supplying the lower limbs. It may lead to intermittent claudication, chronic limb-threatening ischaemia, delayed wound healing, diabetic foot ulcers and lower-limb amputation. PAD is also an indicator of systemic atherosclerotic disease and increased cardiovascular risk(1,2).

Adults with diabetes are particularly vulnerable to PAD because of the combined effects of hyperglycaemia, endothelial dysfunction, atherosclerosis and other cardiovascular risk factors. However, PAD may remain undiagnosed because many affected individuals are asymptomatic or have symptoms masked by peripheral neuropathy. Early identification is therefore important to facilitate appropriate management and prevent complications. [2,3]

Although ABI is widely used for PAD assessment, its diagnostic accuracy may be reduced in people with diabetes due to medial arterial calcification, which causes arterial stiffness and non-compressibility. Consequently, falsely elevated ABI values may occur despite underlying arterial disease. Additional investigations, such as toe-brachial index (TBI) and duplex ultrasonography, may be required when ABI findings are inconclusive or clinical suspicion persists. [4,5]

PAD is a common, underdiagnosed complication of diabetes in adults that can lead to diabetic foot ulcers, impaired wound healing, amputation and cardiovascular complications. Because early identification of peripheral arterial abnormalities is a critical aspect of diabetes care, ABI can be a useful method for assessing peripheral arterial circulation, but its utility is limited in people with diabetes because of arterial calcification, differences in measurement techniques and diagnostic cut-off values, and varying PAD prevalence and diagnostic performance when compared with TBI, duplex ultrasonography and CT angiography(3).

Adults with diabetes are particularly vulnerable to PAD because of the combined effects of hyperglycaemia, endothelial dysfunction, atherosclerosis and other cardiovascular risk factors. However, PAD may remain undiagnosed because many affected individuals are asymptomatic or have symptoms masked by peripheral neuropathy. Early identification is therefore important to facilitate appropriate management and prevent complications. [2,3]

The ankle-brachial index (ABI) is a simple, non-invasive and relatively inexpensive method for assessing peripheral arterial circulation. It is calculated by comparing systolic blood pressure measured at the ankle with that measured at the brachial artery. An ABI of 0.90 or below generally indicates PAD, while borderline and elevated values require appropriate clinical interpretation. [3,4]

Although ABI is widely used for PAD assessment, its diagnostic accuracy may be reduced in people with diabetes due to medial arterial calcification, which causes arterial stiffness and non-compressibility. Consequently, falsely elevated ABI values may occur despite underlying arterial disease. Additional investigations, such as toe-brachial index (TBI) and duplex ultrasonography, may be required when ABI findings are inconclusive or clinical suspicion persists. [4,5]

Several studies have investigated ABI screening and assessment among adults with diabetes. These studies have examined PAD prevalence, ABI distribution, measurement techniques, diagnostic accuracy and associated risk factors. However, differences in study populations, healthcare settings, measurement procedures and ABI cut-off values make the evidence difficult to compare. Therefore, a comprehensive mapping of the available literature is necessary to understand the current evidence and identify gaps in ABI screening and assessment among adults with diabetes mellitus(4).

2. METHODOLOGY

2.1 Study design

A scoping review was conducted to map the available evidence on the use of the ankle-brachial index (ABI) for screening and assessment of peripheral arterial disease (PAD) among adults with diabetes mellitus. The review followed the methodological framework recommended by the Joanna Briggs Institute (JBI) for scoping reviews and was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR). This approach was selected to identify the range of available evidence, describe the characteristics of existing studies, and identify gaps in research related to ABI assessment in diabetic populations.

2.2 Review question

The review was guided by the following question:

What evidence is available regarding the use of the ankle-brachial index for screening and assessment of peripheral arterial disease among adults with diabetes mellitus?

Table: 1 Population, Concept and Context (PCC) framework.

PCC element	Description
Population	Adults aged 18 years and above with diabetes mellitus
Concept	ABI screening and assessment for peripheral arterial disease
Context	Community, primary healthcare, diabetic clinics, outpatient departments and hospital settings

2.3. Eligibility criteria

Inclusion criteria

- Studies involving adults aged 18 years and above diagnosed with type 1 or type 2 diabetes mellitus.
- Studies that used ABI for screening, diagnosis or assessment of PAD.
- Studies reporting ABI values, ABI categories, PAD prevalence, diagnostic performance or related findings.
- Studies conducted in community, primary healthcare, outpatient or hospital settings.
- Original research articles published in English.
- Studies published from January 2010 onwards.

Exclusion criteria

- Studies involving children or adolescents below 18 years.
- Studies involving participants without established diabetes mellitus, unless diabetic subgroup data were separately available.
- Studies that did not assess ABI.
- Review articles, editorials, letters, case reports and conference abstracts without sufficient data.
- Studies for which the full text or relevant findings could not be obtained.
- Duplicate publications or repeated reports of the same study.

2.4. Information sources

Relevant studies were identified through searches of PubMed and Google Scholar, along with literature identification and retrieval through DELNET and other available sources. Reference lists of relevant articles were also examined to identify additional eligible studies.

The search focused on publications from January 2010 onwards. Only studies published in English were considered.

2.5. Search strategy

The search strategy was developed using keywords and their combinations related to diabetes mellitus, ankle-brachial index and peripheral arterial disease. Boolean operators (AND and OR) were used to combine search terms.

The principal search terms included:

- “Ankle-Brachial Index” OR “ABI”
- “Peripheral Arterial Disease” OR “PAD”
- “Diabetes Mellitus” OR “Diabetes” OR “Diabetic Patients”
- “Screening” OR “Assessment” OR “Prevalence” OR “Diagnosis”

A representative search combination was:

("Ankle-Brachial Index" OR ABI) AND ("Peripheral Arterial Disease" OR PAD) AND ("Diabetes Mellitus" OR diabetes OR diabetic)

2.6. Study selection

The identified records were assessed for relevance based on their titles and abstracts. Records that appeared to meet the eligibility criteria were considered for full-text assessment. The full texts were examined to determine their suitability for inclusion in the review.

During the screening and file-reconciliation process, 41 records were considered at the title-and-abstract stage. Eleven records were excluded, and 30 PDF files were obtained for full-text assessment. Seven repeated PDF entries were identified and removed during full-text file reconciliation, leaving 23 unique full-text reports. Following full-text eligibility assessment, six reports were excluded, resulting in 17 studies included in the final scoping review.

The study selection process is presented in the PRISMA-ScR flow diagram (Figure 1).

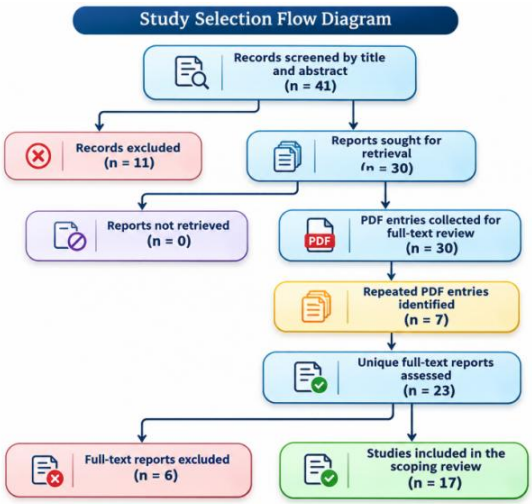

Figure 1. PRISMA-ScR Flow Diagram Illustrating the Study Selection Process for the Scoping Review on Ankle-Brachial Index Screening and Assessment Among Adults with Diabetes Mellitus

The search yielded 41 records after title-and-abstract screening, 11 records were removed because they did not meet the initial screening criteria, 30 PDF files were retrieved for full-text assessment, seven duplicate PDF entries were removed during reconciliation, and six full-text records were excluded during eligibility assessment (publication type, publication period, population, etc.), resulting in 17 studies that were included in the scoping review.

2.7 Data extraction and charting

A structured data extraction form was developed using Microsoft Excel to collect relevant information from the included studies. The extracted information included:

1. Author(s) and year of publication.
2. Country of study.
3. Study title.
4. Retrieval source.
5. Study design and setting.
6. Sampling technique.
7. Sample size.
8. Population and participant characteristics.
9. Age of participants.
10. Type and duration of diabetes mellitus.
11. ABI measurement method and equipment.
12. Arteries assessed.
13. Mean ABI and standard deviation.
14. ABI range.
15. ABI categories and distribution.
16. ABI cut-off values.
17. Reported PAD prevalence.

Relevant information was extracted from the full-text articles, including tables and figures wherever necessary. The extracted data were organized in a Microsoft Excel spread sheet for analysis and presentation.

2.8. Data analysis and synthesis

The extracted data were analysed using descriptive statistics. Frequencies and percentages were used to summarize the characteristics of the included studies, including publication year, country, study design, setting, sampling technique, sample size and participant characteristics.

ABI measurement methods, arteries assessed, reported ABI values, ABI classification criteria and PAD prevalence were summarized descriptively. The findings were presented using tables, figures and narrative descriptions.

A meta-analysis was not performed because of variations in study populations, settings, ABI measurement procedures, diagnostic cut-off values and reporting methods. In particular, prevalence estimates were not statistically pooled because of differences in study-level definitions and denominators, including participant-based and limb-based measurements. Instead, the findings were mapped and described to provide an overview of the available evidence.

2.9. Critical appraisal

A formal critical appraisal of the methodological quality of the included studies was not undertaken, as the primary objective of this scoping review was to map the available evidence on ABI screening and assessment rather than to estimate a pooled effect or determine the certainty of evidence.

3. RESULTS

Table 2. Distribution of included studies according to year of publication (N = 17)

Year of publication	Number of studies (n)	Percentage (%)
2010–2014	2	11.8
2015–2019	6	35.3
2020–2024	8	47.1
2025–2029	1	5.9
Total	**17**	**100.0**

The distribution of studies according to publication year revealed that the highest number of studies, 8 (47.1%), were published during 2020–2024. This was followed by 6 studies (35.3%) published during 2015–2019. Two studies (11.8%) were published during 2010–2014, while only one study (5.9%) was published during 2025–2029.

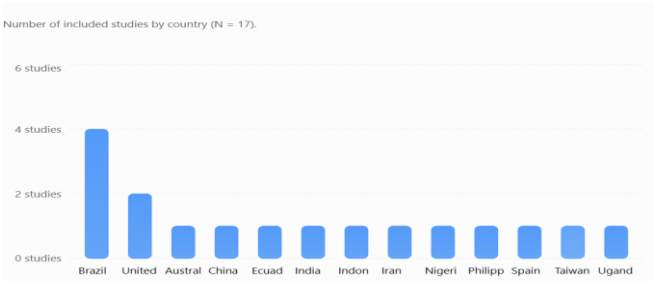

Figure 2: Distribution of included studies according to country of study (N = 17)

The country-wise distribution revealed that the highest number of studies, 4 (23.5%), were conducted in Brazil, followed by 2 studies (11.8%) from the United States of America. One study each (5.9%) was conducted in Australia, China, Ecuador, India, Indonesia, Iran, Nigeria, the Philippines, Spain, Taiwan and Uganda

Table 3. Distribution of included studies according to study design (N = 17)

Study design	Number of studies (n)	Percentage (%)
Cross-sectional studies	8	47.1
Cohort studies (prospective and retrospective)	5	29.4
Cross-sectional and prospective study	1	5.9
Reliability study	1	5.9
Diagnostic accuracy study	1	5.9
Validation study	1	5.9

When the included studies were grouped by study design, the majority, 8 (47.1%), used a cross-sectional design, followed by 5 cohort studies (29.4%) that included prospective and retrospective cohort studies, with one study each (5.9%) using a combined cross-sectional and prospective design, a reliability assessment, diagnostic accuracy design and a validation design.

Table 4. Distribution of included studies according to retrieval source (N = 17)

Retrieval source	Number of studies (n)	Percentage (%)
DELNET	3	17.6
Google Scholar	5	29.4
PubMed	7	41.2
Other / retrieval source not specified clearly	2	11.8

The number of studies that were retrieved from each source was classified as PubMed (n = 7, 41.2%), Google Scholar (n = 5, 29.4%), DELNET (n = 3, 17.6%), and inadequately defined retrieval source in the extraction sheet (n = 2, 11.8%).

Table 5. Distribution of included studies according to study design (N = 17)

Study design	Number of studies (n)	Percentage (%)
Cross-sectional studies	7	41.2
Cohort studies (prospective and retrospective)	5	29.4
Cross-sectional and prospective study	1	5.9
Cross-sectional study with diagnostic accuracy evaluation	1	5.9
Reliability study	1	5.9
Observational diagnostic accuracy study	1	5.9
Prospective validation study	1	5.9

The number of included studies, by study design, showed that most studies used cross-sectional design, followed by cohort studies, followed by studies using a cross-sectional design with diagnostic accuracy evaluation, reliability design, observational diagnostic accuracy design, and prospective validation design, respectively, suggesting that the available evidence is mainly based on cross-sectional studies.

Table 6. Distribution of included studies according to sample size (N = 17)

Sample size	Number of studies (n)	Percentage (%)
Below 100	4	23.5
100–499	6	35.3
500–999	2	11.8
1,000 and above	5	29.4

When the included studies were categorized by sample size, the results showed that the majority (6 studies [35.3%]) had sample sizes between 100 and 499 participants, followed by 5 studies (29.4%) with sample sizes of 1,000 and above, 4 studies (23.5%) with sample sizes less than 100, and 2 studies (11.8%) with sample sizes of 500 to 999. The results suggest that sample sizes varied widely, from small-scale investigations to population-based studies.

Table.7. Distribution of included studies according to study setting (N = 17)

Study setting	Number of studies (n)	Percentage (%)
Hospital and clinical outpatient settings	13	76.5
Primary healthcare settings	2	11.8
Community and population-based screening settings	2	11.8

Distribution of studies by setting showed that 13 (76.5%) were conducted in hospital and clinical outpatient settings, two (11.8%) were conducted in primary healthcare settings, and two (11.8%) were conducted in community and population-based screening settings.

Table 8. Distribution of included studies according to sampling technique (N = 17)

Sampling technique	Number of studies (n)	Percentage (%)
Consecutive sampling	5	29.4
Other non-probability sampling (purposive, convenience and volunteer/self-referred recruitment)	5	29.4
Random sampling	1	5.9
Retrospective database-based selection	1	5.9
Sampling technique not reported or not clearly specified	5	29.4

Of the included studies, 5 (29.4%) used consecutive sampling and 5 (29.4%) used other non-probability sampling methods; 5 (29.4%) did not specify the sampling technique, 1 (5.9%) used random sampling, and 1 (5.9%) used retrospective database-based selection.

Table 9. Distribution of included studies according to diabetes type and population characteristics (N = 17)

Population characteristics	Number of studies (n)	Percentage (%)
Adults with type 2 diabetes mellitus (T2DM)	11	64.7
Adults with type 1 and type 2 diabetes mellitus	2	11.8
Adults with diabetes mellitus; type not specified	4	23.5

The included studies by diabetes type and population characteristics showed that most, 11 (64.7%), included only adult patients with type 2 diabetes mellitus, two (11.8%) included patients with both type 1 and type 2 diabetes mellitus, and four (23.5%) included adult patients with diabetes mellitus without specifying the type of diabetes; this suggests that the available evidence is mostly applicable to patients with type 2 diabetes mellitus.

Table 10. Distribution of included studies according to specific diabetic population groups (N = 17)

Specific diabetic population group	Number of studies (n)	Percentage (%)
General adult diabetic population	8	47.1
Adults with suspected PAD or increased risk of PAD	3	17.6
Adults with cardiovascular comorbidities or cardiovascular risk	3	17.6
Adults with diabetic foot ulcers	1	5.9
Adults with diabetic neuropathy	1	5.9
Adults with diabetic nephropathy / proteinuria	1	5.9

Studies included by specific groups of the diabetic population showed that the majority, 8 (47.1%) were of the general adult diabetic population, three (17.6%) were of adults with suspected or increased risk of peripheral arterial disease, three (17.6%) were of adults with cardiovascular comorbidities or cardiovascular risk factors, and one (5.9%) was of adults with diabetic foot ulcers, diabetic neuropathy, and diabetic nephropathy or proteinuria.

Table 11. Distribution of included studies according to the reported mean or median age of participants (N = 17)

Age group (years)	Number of studies (n)	Percentage (%)
50–59	8	47.1
60–69	7	41.2
Multiple age groups reported	1	5.9
Mean/median age not reported	1	5.9

The majority of included studies (8 studies, 47.1%) reported a mean or median age between 50 and 59 years, followed by 7 studies (41.2%) that reported a mean or median age between 60 and 69 years, with one study (5.9%) reporting different mean ages across participant subgroups, and another (5.9%) not reporting a mean or median age.

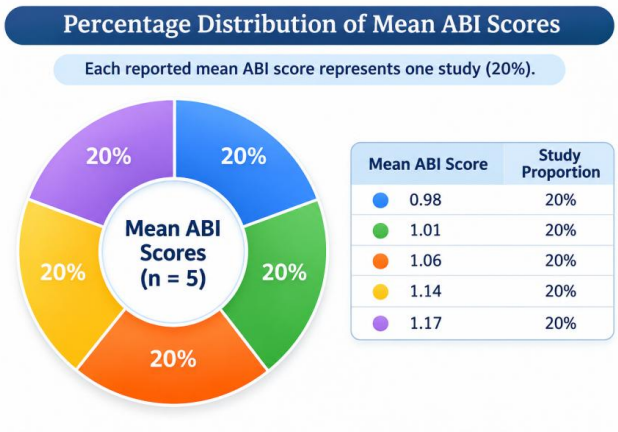

Figure. 3: Percentage Distribution of Mean ABI Scores in Five Studies

The mean ABI scores ranged from 0.98 to 1.17. The highest mean ABI was reported by Cerqueira et al. (2024), while the lowest was reported by Barrera-Guarderas et al. (2020).

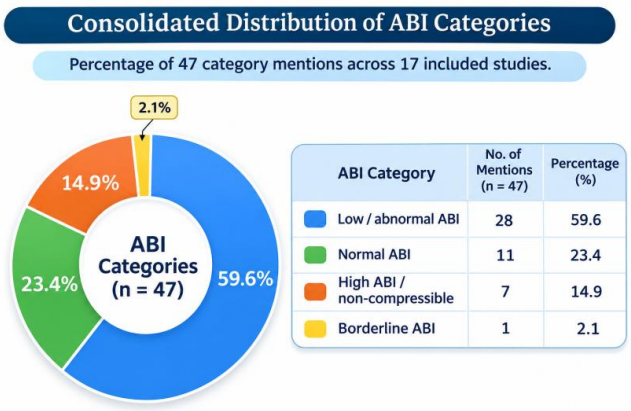

Figure.4 : Consolidated Distribution of ABI Categories Reported in the Included Studies.

Low or abnormal ABI, including mild, moderate and severe PAD classifications, accounted for the largest proportion of

category mentions (59.6%). Normal ABI accounted for 23.4%, followed by high ABI/non-compressible arteries (14.9%) and borderline ABI (2.1%).

Table 12: Classification of PAD Prevalence Among Adults with Diabetes (N = 17)

Broad classification	PAD prevalence	Number of studies (n)	Percentage (%)
Low prevalence	Less than 10%	1	5.9
Moderate prevalence	10–20%	4	23.5
High prevalence	More than 20%	9	52.9
Variable prevalence across subgroups	6.5–11.4%	1	5.9
PAD prevalence not separately reported	—	2	11.8

More than half of the included studies (52.9%) reported a high PAD prevalence of more than 20%. Moderate prevalence (10–20%) was reported in 23.5% of studies, while 5.9% reported low prevalence.

4. DISCUSSION

4.1. Overview of the present study

This scoping review aimed to map the available evidence of ABI screening and assessment in adults with diabetes mellitus by screening and eligibility assessment of 17 studies and mapping the publication trends, geographical distribution, study designs, settings, sampling techniques, diabetic population characteristics, ABI measurement methods, mean ABI values, ABI categories and reported prevalence of PAD. The results showed that ABI has been investigated in various populations of people with diabetes, including the general adult population with diabetes and those with diabetic foot ulcers, neuropathy, nephropathy, and cardiovascular risk factors. However, there was great variation in ABI cut-off values, measurement methods and reported PAD prevalence, and the results showed the importance of considering high ABI values and non-compressible arteries when assessing PAD in people with diabetes.

4.2 Discussion of trends and geographic distribution

In the present review, the highest proportion of included studies, 8 (47.1%), was published between 2020 and 2024, followed by 6 studies (35.3%) published between 2015 and 2019. Two studies (11.8%) were published between 2010 and 2014, and one study (5.9%) was published between 2025 and 2029. This distribution indicates that nearly half of the included evidence was published during 2020–2024, suggesting increased research attention towards ABI screening and assessment in adults with diabetes in recent years.

The increased representation of recent studies may reflect growing recognition of PAD as an important macrovascular complication of diabetes and the need for early identification of peripheral arterial abnormalities. The study by Alves-Cabratosa and colleagues, published in 2020, examined ABI categories and their association with diabetes complications in a large cohort of 34,689 adults with T2DM. Similarly, Ugwu and colleagues, in 2021, investigated the diagnostic usefulness of ABI in comparison with duplex ultrasonography among high-risk adults with T2DM. These studies demonstrate the continuing interest in evaluating both the clinical and prognostic usefulness of ABI in diabetic populations(5,6).

Regarding geographical distribution, Brazil contributed the largest number of studies, 4 (23.5%), followed by the United States with 2 (11.8%). One study each (5.9%) was conducted in Australia, China, Ecuador, India, Indonesia, Iran, Nigeria, the Philippines, Spain, Taiwan and Uganda. Thus, the evidence originated from 13 countries.

4.3 Discussion of Study design and methodological characteristics

The current review demonstrated that cross-sectional studies accounted for the majority of the included evidence (8 studies, 47.1%), followed by cohort studies (5 studies, 29.4%), one study each (5.9%) using a combined cross-sectional and prospective design, reliability assessment, diagnostic accuracy design and validation design. The prevalence of cross-sectional studies reflects the fact that most of the available research has been aimed at characterizing ABI abnormalities and PAD at a single point in time, which provides valuable information about the distribution of ABI values and their association with demographic and clinical characteristics, but is limited in determining the temporal relationship between risk factors and PAD development or progression.

Diagnostic accuracy studies included in the present review also contributed important evidence regarding the limitations of ABI. In particular, studies comparing ABI with duplex ultrasonography and CT angiography demonstrated that diagnostic performance may vary according to the reference standard and the characteristics of the diabetic population.

4.4 Discussion on Study settings and sampling techniques

Thirteen (76.5%) were hospital and clinical outpatient studies, 2 (11.8%) were primary healthcare studies, and 2 (11.8%) were community or population-based screening studies, indicating that ABI assessment among adults with diabetes has been studied more frequently in clinical settings than in the general community. The results are consistent with several included studies: Doza and colleagues conducted their study among 1,121 adults with T2DM attending a heart and diabetic clinic in North India, and the

study by Ugwu and colleagues was conducted in a high-risk cohort of adults with T2DM and ABI was measured against duplex ultrasonography, which are both examples of the importance of clinical settings in identifying peripheral vascular abnormalities in patients with diabetes(1,6). However, the limited representation of community-based studies suggests a gap in evidence regarding the early identification of PAD among individuals who may not yet have symptoms or established diabetes-related complications. Community-based ABI screening may be particularly useful in identifying high-risk individuals and facilitating early referral.

Regarding sampling techniques, 5 studies (29.4%) used consecutive sampling and other non-probability sampling methods, 5 studies (29.4%) did not clearly describe the sampling technique, and random sampling and retrospective database-based selection were each reported in 1 study (5.9%). Given the dominance of non-probability sampling, the representativeness of the study populations and the generalizability of the findings may be influenced, and future community-based research using appropriate probability sampling techniques may offer more representative estimates of PAD among adults with diabetes.

4.5 Discussion on Characteristics of the diabetic population

The current review found that 11 studies (64.7%) investigated adults with T2DM only, 2 studies (11.8%) included both type 1 and type 2 diabetes, and 4 studies (23.5%) did not specify the type of diabetes, suggesting that the evidence is largely limited to T2DM. This aligns with the pattern observed across several studies included in the review: Doza and colleagues examined the distribution of ABI and cardiovascular risk factors in 1,121 adults with T2DM in North India, Alves-Cabratosa and colleagues investigated ABI categories among 34,689 adults with T2DM, and Singhania and colleagues evaluated ABI and toe-brachial index (TBI) in 175 adults with T2DM(7).

The inclusion of high-risk populations is important because PAD may coexist with other diabetes-related complications. Chevtchouk and colleagues studied 225 adults with diabetes in relation to diabetic neuropathy and reported abnormal ABI findings in 64.2% of participants. They also found that prolonged duration of T2DM was associated with altered ABI(8).

Similarly, Aulia and colleagues examined ABI among adults with diabetic foot ulcers and reported normal ABI in 43.9%, mild ABI abnormality in 43.9% and moderate abnormality in 12.2%. The study also reported a tendency for lower ABI values to be associated with higher Wagner grades, although the relationship was not statistically significant. These findings indicate the relevance of vascular assessment in individuals with diabetic foot complications(9)

4.6 Discussion on Mean ABI values reported in the included studies

In the present review, five studies reported mean ABI values. The mean ABI values ranged from 0.98 to 1.17. The lowest mean ABI value (0.98) was reported by Barrera-Guarderas and colleagues (2020), while the highest (1.17) was reported by Cerqueira and colleagues (2024). The other reported mean values included 1.01, 1.06 and 1.14.

The mean ABI of 0.98 reported by Barrera-Guarderas and colleagues is close to the borderline range and may indicate a tendency towards reduced peripheral arterial perfusion in their study population. Their retrospective cohort study of 578 adults with diabetes attending a primary-care diabetes clinic in Ecuador reported a PAD prevalence of 13.98%. The study also reported an incidence rate of 23.38 per 1,000 person-years during follow-up(10)

4.7 Discussion on Distribution of ABI categories

The present review consolidated ABI findings into four broad categories: low or abnormal ABI, normal ABI, high ABI or non-compressible arteries, and borderline ABI. Low or abnormal ABI, including mild, moderate and severe PAD classifications, accounted for the largest proportion of category mentions (59.6%). Normal ABI accounted for 23.4%, followed by high ABI or non-compressible arteries (14.9%) and borderline ABI (2.1%).

The predominance of low or abnormal ABI mentions indicates that reduced peripheral arterial perfusion was frequently reported across the included studies. Similar findings were observed in the study by Chevtchouk and colleagues, in which abnormal ABI was reported in 64.2% of the 225 participants. The authors also observed that ABI below 0.90 was more frequent among participants with T2DM than among those with type 1 diabetes(8).

4.8 Discussion on PAD prevalence among adults with diabetes

The present review demonstrated considerable variation in the reported prevalence of PAD among adults with diabetes. For descriptive comparison, the reported estimates were grouped into broad categories. Nine studies (52.9%) reported high prevalence of more than 20%, four studies (23.5%) reported moderate prevalence between 10% and 20%, and one study (5.9%) reported low prevalence of less than 10%. One study (5.9%) reported variable prevalence across diabetic subgroups, while two studies (11.8%) did not report a separate PAD prevalence.

The finding that more than half of the included studies reported PAD prevalence above 20% suggests that PAD is an important vascular concern in the diabetic populations investigated. However, the reported estimates varied according to study population, clinical setting, diagnostic method and ABI cut-off values.

Doza and colleagues, in their study of 1,121 adults with T2DM in North India, reported low ABI prevalence of 4.47% among men and 4.67% among women. In contrast, Chevtchouk and colleagues reported abnormal ABI in 64.2% of their selected population of adults with diabetes and neuropathic pain. The difference between these findings may be related to the characteristics of the study populations, particularly the selection of individuals with neuropathic symptoms in the latter study(1,11)

4.9 Discussion on ABI measurement methods and equipment

The included studies used different methods and equipment for ABI measurement. Conventional Doppler-assisted measurement was commonly employed, while some studies evaluated automated devices and alternative palpation-based approaches.

Mercado and colleagues conducted a prospective validation study in the Philippines to assess the validity of palpation-based ABI measurement compared with Doppler ABI among adults with T2DM. Their study included 79 participants and 158 ABI readings. The study investigated the feasibility of palpation-based measurement as a screening approach, particularly in clinical settings where Doppler equipment may not be readily available(2).

4.10 Discussion on ABI cut-off values and classification of PAD

The present review identified variation in the ABI cut-off values used by the included studies. Although ABI below or equal to 0.90 was commonly used to identify PAD, some studies also considered high ABI values and non-compressible arteries as abnormal findings.

Doza and colleagues classified ABI values of 0.90 or below as low ABI and values of 1.30 or above as high ABI. Alves-Cabratosa and colleagues used different ABI categories to examine the relationship between ABI and diabetes-related complications. Their findings showed increased risk associated with both low ABI and high ABI(12).

4.11Discussion on diagnostic performance and limitations of ABI

The present review identified studies evaluating the diagnostic usefulness of ABI by comparing it with vascular imaging methods, particularly duplex ultrasonography and CT angiography.

Singhania and colleagues reported that ABI had a sensitivity of 35.29% for detecting PAD confirmed by CT angiography, compared with 82.35% for TBI. The study also reported fair agreement between ABI and CT angiography, while TBI showed substantial agreement. These findings indicate that ABI alone may have limited sensitivity in certain adults with T2DM, particularly when arterial calcification is present(13).

5. CONCLUSION

This scoping review mapped the existing evidence on ABI screening and assessment among adults with diabetes mellitus in 17 studies across 13 countries, with an increased representation of research conducted in 2020–2024, most studies focusing on adults with T2DM, and being conducted in hospital or clinical outpatient settings. The review identified significant variation in reported prevalence of PAD, ABI values, classification systems and measurement procedures, with more than half of the included studies reporting a high PAD prevalence of more than 20%. Low or abnormal ABI represented the largest proportion of category mentions in the consolidated ABI findings; however, these results should not be interpreted as pooled participant-level prevalence due to differences in study populations, diagnostic methods and denominators. The review also highlighted the limitations of ABI in diabetes, including the presence of medial arterial calcification and non-compressible arteries, although ABI is a useful, non-invasive screening method and additional investigations, such as TBI and duplex ultrasonography, may be required in some individuals. These findings underscore the need for integration of peripheral vascular assessment into overall diabetes care and call for further community-based research and standardisation of ABI measurement practices to support early identification of PAD through risk assessment, ABI screening, diabetic foot examination, health education and timely referral by nurses, especially community health nurses.

References

1. Mercado, J., Sison, M., Landicho-Kanapi, M. P., & Gadong, L. C. (2018). Validity of Ankle Brachial Index using Palpation Method in Screening for Peripheral Arterial Disease in Type 2 Diabetes Mellitus Patients at a Tertiary Hospital in the Philippines. *Journal of the ASEAN Federation of Endocrine Societies*, *33*(2), 146.
2. Alves-Cabratosa, L., Comas-Cufí, M., Ponjoan, A., Garcia-Gil, M., Martí-Lluch, R., Blanch, J., ... & Ramos, R. (2020). Levels of ankle–brachial index and the risk of diabetes mellitus complications. *BMJ Open Diabetes Research & Care*, *8*(1), e000977. doi:10.1136/bmjdrc-2019-000977.
3. Ugwu, E., Anyanwu, A., & Olamoyegun, M. (2021). Ankle brachial index as a surrogate to vascular imaging in evaluation of peripheral artery disease in patients with type 2 diabetes. *BMC Cardiovascular Disorders*, *21*(1), 10. doi:10.1186/s12872-020-01821-6
4. Li, Y. H., Sheu, W. H. H., & Lee, I. T. (2020). Use of the ankle-brachial index combined with the percentage of mean arterial pressure at the ankle to improve

prediction of all-cause mortality in type 2 diabetes mellitus: an observational study. *Cardiovascular diabetology*, *19*(1), 173. doi:10.1186/s12933-020-01149-7.

5. Singhania, P., Das, T. C., Bose, C., Mondal, A., Bhattacharjee, R., Singh, A., ... & Chowdhury, S. (2024). Toe brachial index and not ankle brachial index is appropriate in initial evaluation of peripheral arterial disease in type 2 diabetes. *Diabetology & Metabolic Syndrome*, *16*(1), 52. doi:10.1186/s13098-024-01291-2.
6. Chevtchouk, L., da Silva, M. H. S., & do Nascimento, O. J. M. (2017). Ankle-brachial index and diabetic neuropathy: study of 225 patients. *Arquivos de Neuro-psiquiatria*, *75*(08), 533-538. doi:10.1590/0004-282X20170084.
7. Selomo PAM, et al. (2019). Correlation between ankle-brachial index and diabetic foot ulcer severity. Int J Med Rev Case Rep. doi:10.5455/IJMRCR.Correlation-Ankle-Brachial-Index.
8. Barrera-Guarderas, F., Carrasco-Tenezaca, F., & De la Torre-Cisneros, K. (2020). Peripheral artery disease in type 2 diabetes mellitus: survival analysis of an Ecuadorian population in primary care. *Journal of primary care & community health*, *11*, 2150132720957449. doi:10.1177/2150132720957449.
9. Alves-Cabratosa, L., Comas-Cufí, M., Ponjoan, A., Garcia-Gil, M., Martí-Lluch, R., Blanch, J., ... & Ramos, R. (2020). Levels of ankle–brachial index and the risk of diabetes mellitus complications. *BMJ Open Diabetes Research & Care*, *8*(1), e000977. doi:10.1136/bmjdrc-2019-000977.
10. Singhania, P., Das, T. C., Bose, C., Mondal, A., Bhattacharjee, R., Singh, A., ... & Chowdhury, S. (2024). Toe brachial index and not ankle brachial index is appropriate in initial evaluation of peripheral arterial disease in type 2 diabetes. *Diabetology & Metabolic Syndrome*, *16*(1), 52. doi:10.1186/s13098-024-01291-2.
11. Members, W. C., Gornik, H. L., Aronow, H. D., Goodney, P. P., Arya, S., Brewster, L. P., ... & Wilkins, L. R. (2024). 2024 ACC/AHA/AACVPR/APMA/ABC/SCAI/SVM/SVN/SVS/SIR/VESS Guideline for the Management of Lower Extremity Peripheral Artery Disease. *Journal of the American College of Cardiology*, *83*(24), 2497. doi:10.1016/j.jacc.2024.02.013.