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ORIGINAL RESEARCH

Does glycated haemoglobin (HbA1c) correlate with the Ankle-Brachial Index (ABI) among patients with type 2 diabetes in Indonesia? An evaluation study

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Abstract
Type 2 Diabetes (T2D) is a chronic metabolic disorder characterized by hyperglycaemia, which can lead to severe microvascular and macrovascular complications over time. These issues typically emerge from suboptimal disease management, particularly poor glycaemic control. Ineffective T2D management not only fails to regulate blood glucose but also accelerates vascular complications such as Peripheral Arterial Disease (PAD), which can be clinically measured through a decline in the Ankle-Brachial Index (ABI). Consequently, monitoring both HbA1c and ABI is essential for tracking diabetes progression. This study analysed the correlation between HbA1c levels and ABI values in T2D patients to support the early detection of vascular complications and improve comprehensive disease management. Employing a quantitative approach with a cross-sectional design, the study evaluated a population of 163 patients at Ibu Fatmawati Soekarno General Hospital, Surakarta. Purposive sampling was applied to select 62 respondents who met the inclusion criteria: willingness to participate, a confirmed T2D diagnosis, and a history of glycated haemoglobin (HbA1c) laboratory testing. Research instruments included a clinical examination sheet, a sphygmomanometer, and a handheld Doppler device. Statistical analysis using Kendall's tau-b test yielded a p-value of 0.000 (p<0.05). The correlation coefficient of -0.615 indicated a moderately strong negative correlation, demonstrating that higher (poorer) HbA1c levels are significantly associated with lower (worse) ankle-brachial index values. Nurses with expertise in diabetes care must pay close attention to these findings. Innovation is highly imperative to address this issue and effectively prevent diabetic foot ulcer (DFU).

Keywords: Ankle Brachial Index, diabetic foot prevention, glycated haemoglobin, nursing care, type 2 diabetes

Introduction

Type 2 Diabetes (T2D) is a prevalent chronic disease that has emerged as one of the most critical public health challenges worldwide (Młynarska et al., 2025). Classic clinical manifestations of T2D stem from the body's inability to regulate blood glucose effectively, typically presenting as polyuria, polydipsia, and polyphagia. Because of its systemic impact, T2D is frequently termed the "mother of diseases," serving as the primary etiology for a broad spectrum of debilitating complications, including hypertension, stroke, nephropathy, retinopathy, and an elevated risk of lower-extremity amputation (Chatanaka & Diamandis, 2025). Globally, epidemiological data underscore the staggering trajectory of this crisis; the International Diabetes Federation (IDF) reported that approximately 463 million individuals were living with the disease, a figure projected to climb to 700 million by 2045 (Saeedi et al., 2019). Mirroring this global surge, regional data indicate that the prevalence of T2D in Indonesia is expected to rise sharply, growing from 9.1 million cases to an estimated 14.1 million cases within a few decades (Wahidin et al., 2024). This escalating incidence is heavily driven by suboptimal clinical management and poor self-care behaviors among patients, highlighting an urgent need for comprehensive management strategies that integrate multidisciplinary healthcare teams and robust public health policies. To mitigate this burden, effective T2D management relies on five cornerstone components: diabetes self-management education, strict dietary regulation, regular physical activity, adherence to pharmacological glucose-lowering therapies, and routine glycemic monitoring (Yu et al., 2022). The therapeutic success of these interventions is evaluated through objective health indicators—namely body weight stability, fasting blood glucose levels, and glycated hemoglobin (HbA1c) values. Failing to sustain these metrics leads to uncontrolled blood glucose levels, which subsequently triggers the onset and rapid progression of both microvascular and macrovascular complications (Lorestanifar et al., 2023).

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Suboptimal T2D management from inadequate health education, pharmacological non-adherence, and unmodulated dietary habits inherently leads to a failure in achieving target glycemic thresholds. This chronic metabolic instability is objectively reflected by sustained hyperglycemia and elevated HbA1c values (AlJedai et al., 2025). Over time, persistent hyperglycemia triggers a cascade of endothelial dysfunction, accelerating the progression of both microvascular and macrovascular complications. Prominent among these macrovascular sequelae is PAD, a condition highly prevalent in patients with a long-standing history of T2D. To detect this vascular decline early, the Ankle-Brachial Index (ABI) serves as a critical, non-invasive diagnostic instrument. Mathematically defined as the ratio of systolic blood pressure measured at the ankle to that measured at the brachial artery, a diminished ABI score signifies compromised arterial perfusion to the lower extremities (Danieluk & Chlabicz, 2021). This localized ischemia heightens the clinical risk for diabetic foot ulcers (DFU), secondary infections, and, in advanced stages, lower-limb amputation (Raja et al., 2023). Furthermore, an abnormal ABI serves as a potent independent predictor of systemic cardiovascular morbidity and mortality in this population. Routine ABI assessment plays a vital role as an early screening strategy to detect peripheral vascular impairment well before irreversible clinical manifestations occur.

The role of nurses is essential in providing diabetes self-management education, monitoring patients' glycemic status, performing early screening for vascular complications through ABI examination, and delivering diabetic foot care education to prevent DFU (Aalaa et al., 2012). In addition, wound care nurses have a strategic role in the early identification of peripheral perfusion disorders through ABI measurement as part of a comprehensive diabetic foot assessment. This role is consistent with international guideline recommendations emphasizing the importance of routine peripheral vascular complication screening as part of efforts to prevent amputation and advanced complications (Fitridge et al., 2023). In addition to healthcare professionals, government support also plays an important role in controlling diabetes mellitus through promotive and preventive programs such as early detection screening for non-communicable diseases, strengthening primary healthcare services, improving access to HbA1c and ABI examinations, and implementing national strategies for non-communicable disease control to reduce the incidence of diabetes complications and improve patients' quality of life. These efforts are aligned with the global strategy for non-communicable disease control through integrated promotive, preventive, curative, and rehabilitative approaches at the primary healthcare level. Inadequate management not only results in poor glycemic control but also accelerates the development of PAD, which can be assessed through decreased ABI values. Literature in Indonesia khususnya di Surakarta city (RSUD Ibu Fatmawati Soekarno) is currently scarce concerning the specific relationship between HbA1c profiles and ABI values in the T2D population, highlighting a critical research gap (Samual et al., 2024; Nikola et al., 2025). Therefore, this study aims to determine the association between HbA1c levels and ABI values among patients with T2D.

Method

This study employed an analytical observational quantitative research design using a cross-sectional approach. An observational design is appropriate because it allows researchers to study the natural correlation between HbA1c and ABI without ethically or practically manipulating patients' blood glucose levels (Hess, 2023). It provides a non-invasive way to examine existing physiological data from patients already managing T2D in Indonesia. This approach is highly effective for identifying potential risk factors and screening for peripheral artery disease in a clinical setting. Additionally, it establishes a foundational baseline of statistical relationships that can guide future interventional studies or clinical protocols (Mariani & Pêgo-Fernandes, 2014). The study was conducted in the Hospital of Ibu Fatmawati Soekarno, Surakarta, Indonesia. This specific site was selected for the study due to its remarkably high prevalence of T2D. Furthermore, the hospital was actively requiring observational data regarding the relationship between HbA1c and the Ankle-Brachial Index (ABI) to support its clinical assessments.

The study population comprised all hospitalized patients diagnosed with T2D, totaling 163 individuals (As of November 2025). To select eligible participants, the researchers established strict inclusion and exclusion criteria. The inclusion criteria required that participants be male or female, diagnosed with T2D, currently admitted as inpatients, and possess available HbA1c laboratory results from within the last three months. Conversely, the exclusion criteria comprised patients with wounds or physical deformities at the blood pressure measurement sites, as well as those with edema or thrombophlebitis in the lower extremities that could compromise the accuracy of the ABI measurements. However, not all individuals participated, as a final sample of 62 respondents was selected using a purposive sampling technique. No specific sample size formula was utilized to determine the number of respondents. There are several reasons why researchers might choose not to calculate a sample size using standard formulas, particularly in clinical and observational studies. First, when a study targets a highly specific or limited population, researchers often employ non-

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probability sampling, such as purposive or total sampling. In these cases, the sample size is dictated by strict inclusion and exclusion criteria rather than mathematical formulas, as the primary goal is to capture individuals who possess specific clinical characteristics rather than to generalize broadly. Second, practical and logistical constraints frequently play a major role. Researchers are often limited by a fixed data collection timeframe, available hospital budgets, or a low volume of accessible patients at the specific research site during the study period. In such scenarios, calculating a theoretical sample size is impractical if the available population cannot meet that number; instead, researchers utilize the maximum achievable sample size available to them, which is a recognized and acceptable approach in localized evaluation studies.

The study and data collection were conducted during June 2025. The process for this study relied on a structured protocol utilizing both secondary medical records and primary clinical measurements. To capture glycemic control profiles, a dedicated medical record documentation sheet was developed to systematically extract the most recent HbA1c values from the patients' official laboratory charts. In addition, a demographic questionnaire was utilized to ascertain the baseline characteristics of the participants. This instrument underwent rigorous content validation by academic advisors and clinical experts to ensure its comprehensiveness in capturing the data required to achieve the research objectives. For the primary clinical assessment of peripheral arterial perfusion, the ABI was determined using a combination of a precise aneroid sphygmomanometer and a high-sensitivity handheld Doppler ultrasound device. The Doppler probe was paired with a standard, water-soluble acoustic ultrasound gel to facilitate optimal signal transmission and ensure the accurate detection of subtle arterial wall pulsations in both the brachial and pedal arteries (specifically the dorsalis pedis and posterior tibial arteries) (Danieluk et al., 2023). To safeguard the internal validity and clinical reliability of the study's findings, stringent quality control measures were applied to all physical assessment tools prior to the commencement of data collection. The validity and calibration of the ABI measurement instruments were maintained according to the manufacturer’s rigorous operational standards, ensuring that all pressure readings remained highly precise and free from mechanical bias. Furthermore, to minimize inter-observer variability and ensure procedural consistency, all physical measurements and Doppler assessments were performed by trained examiners following a standardized, evidence-based clinical sub-protocol for lower-extremity vascular evaluation.

The data collection phase was initiated only after securing formal ethical approval from the Institutional Review Board (IRB) or Ethics Committee of RSUD Moewardi Surakarta, Indonesia (No: 457/II/HREC/2025). Potential participants who met the inclusion criteria were approached individually and provided with a comprehensive explanation regarding the study's purpose, potential risks, benefits, and their right to withdraw at any stage without compromising their standard medical care. To uphold the principles of autonomy and clinical research ethics, individuals who voluntarily agreed to participate were required to provide written informed consent by signing the consent forms prior to the commencement of any data collection procedures or clinical examinations. The acquisition of quantitative data was executed through a rigorous dual-approach method consisting of retrospective chart reviews and prospective clinical assessments. Secondary clinical data, specifically the HbA1c values from the preceding three months, were carefully extracted from the patients’ official electronic or paper-based medical records to establish their baseline glycemic control profiles. Concurrently, primary physiological data were gathered through direct ABI measurements. To ensure procedural efficiency and minimize inter-examiner variability, these specialized non-invasive vascular assessments were performed directly by the principal investigator, who was actively assisted by three trained research assistants. This team adhered to a standardized, evidence-based lower-extremity vascular assessment protocol using calibrated equipment. All generated clinical parameters and demographic details were immediately transferred and recorded onto structured, coded documentation sheets to ensure data integrity and confidentiality.

Statistical analysis was performed using IBM SPSS Statistics software, with all data initially subjected to descriptive evaluation and normality testing to determine the appropriate statistical approach. Because the datasets for HbA1c levels and ABI values demonstrated an ordinal nature or deviated significantly from a normal distribution based on preliminary diagnostic tests (such as the Kolmogorov-Smirnov or Shapiro-Wilk tests), a non-parametric approach was warranted. Consequently, the bivariate relationship between HbA1c and peripheral arterial perfusion (ABI) was rigorously evaluated using the Kendall’s Tau-b correlation coefficient, which is highly robust against non-normally distributed data and tied ranks (Flight et al., 2025). For all inferential statistical tests, the threshold for determining statistical significance was strictly established a priori at a two-tailed p-value of less than 0.05 ($p<0.05$), ensuring a confidence level of 95% for all resulting correlations.

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Results

The baseline data revealed that the vast majority of the respondents fell within the late adulthood age classification, spanning from 46 to 65 years of age. Specifically, this dominant age bracket accounted for 50 individuals, representing a substantial 80.7% of the total study sample (n=62). In terms of the overall age distribution across the entire sample, the chronological age of the participants exhibited a relatively wide span; the youngest participant enrolled in the study (the minimum age) was recorded at 40 years old, whereas the oldest participant (the maximum age) was documented at 67 years old **(Table 1)**. Analyzing the gender distribution presented in the table **(Table 2)**, the demographic composition of the study sample reveals a distinct maternal or female predominance. Specifically, the majority of the enrolled respondents were female, accounting for 37 individuals and representing nearly two-thirds of the entire cohort at 59.7%. In comparison, male respondents constituted the remaining portion of the sample, totaling 25 individuals and accounting for 40.3% of the studied population (n=62).

As illustrated in the table **(Table 3)**, the vast majority of respondents possessed a senior high school educational background, accounting for 46 individuals (74.2%). The largest occupational segment among the respondents consisted of private-sector employees, accounting for 25 individuals (40.3%). Employment status—particularly within the demanding private sector—can significantly influence a patient's glycemic control. Disrupted metabolic management, in turn, accelerates vascular complications, ultimately impacting ABI values as a critical indicator of PAD **(Table 4)**. The majority of respondents at RSUD Ibu Fatmawati Soekarno Surakarta had a relatively short history of T2D, with 57 individuals (91.9%) having been diagnosed for less than 5 years **(Table 5)**. As illustrated by the clinical data presented in the table **(Table 6)**, the distribution of HbA1c categories among the evaluated patients revealed notable variations in metabolic management. The findings indicate that the largest subset of the study cohort exhibited moderate glycemic control, accounting for 24 respondents and representing 38.7% of the total sample (n=62). This substantial proportion of patients maintaining a moderate glycemic status reflects a critical clinical window; while these individuals are avoiding the immediate crisis of severe hyperglycemia, their blood glucose levels remain sub-optimal, highlighting a persistent risk for the gradual development of long-term microvascular and macrovascular complications.

The largest portion of the sample exhibited a normal ABI, accounting for 29 respondents (46.8%). However, while nearly half of the cohort maintained adequate peripheral perfusion, a substantial percentage still presented with diminished ABI values. This subclinical decline underscores the hidden progression of peripheral arterial circulation impairment among this diabetic population. Ultimately, these findings indicate that macrovascular complications can insidiously develop and progress, even in hospitalized patients who otherwise appear clinically stable **(Table 7)**. The inferential statistical analysis using Kendall's tau-b test yielded a p-value of 0.000 (p<0.05), indicating a statistically significant relationship between HbA1c levels and ABI values. The correlation coefficient (tau_b=-0.615) demonstrated a moderately strong negative correlation, meaning that elevated HbA1c levels were significantly associated with lower, compromised ABI values. This crucial finding underscores the fact that optimal glycemic control plays a foundational role in preserving peripheral vascular perfusion and mitigating macrovascular degradation in patients **(Table 8)**.

Table 1. Characteristics of respondents based on age.

Variable	Frequency (n)	Percentage (%)
Early Adulthood (21–35 years)	0	0
Middle Adulthood (36–45 years)	10	16.1
Late Adulthood (46–65 years)	50	80.7
Elderly (>65 years)	2	3.2

Table 2. Characteristics of respondents based on sex.

Variable	Frequency (n)	Percentage (%)
Male	25	40.3
Female	37	59.7

Table 3. Characteristics of respondents based on educational level.

Variable	Frequency (n)	Percentage (%)
Primary School	8	12.9
Junior High School	8	12.9
Senior High School	46	74.2

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Bachelor's Degree	0	0

Table 4. Characteristics of respondents based on educational level.

Variable	Frequency (n)	Percentage (%)
Housewife	15	24.1
Farmer	8	13
Private-Sector Employee	25	40.3
Civil Servant	0	0
Retired	0	0
Trader	14	22.6

Table 5. Characteristics of respondents based on duration of T2D.

Variable	Frequency (n)	Percentage (%)
<5 years	57	91.9
≥5 years	5	8.1

Table 6. Characteristics of respondents based on HbA1c scores.

Variable	Frequency (n)	Percentage (%)
Normal (3.5–5.5%)	0	0
Good Glycemic Control (5.6–6.5%)	20	32.3
Moderate Glycemic Control (6.6–8.0%)	24	38.7
Poor Glycemic Control (>8.0%)	18	29

Table 7. Characteristics of respondents based on ABI categories.

Variable	Frequency (n)	Percentage (%)
Normal	29	46.8
Mild Occlusion	23	37.1
Moderate Occlusion	10	16.1
Severe Occlusion	0	0
Non-compressible	0	0

Table 8. Statistical analysis.

HbA1c	Ankle Brachial Index (ABI) Status				Total n (%)	*r*	*p*
	Moderate Occlusion n (%)	Mild Occlusion n (%)	Normal n (%)	Non-compressible n (%)			
Normal	0 (0)	0 (0)	3 (4.8)	0 (0)	3 (4.8)	-0.615	0.000
Good	0 (0)	2 (3.2)	13 (21)	1 (1.6)	16 (25.8)		
Moderate	2 (3.2)	12 (19.4)	12 (19.4)	1 (1.6)	27 (43.5)		
Poor	7 (11.3)	9 (14.5)	0 (0)	0 (0)	16 (25.8)		

Discussion

The findings indicate that advanced age acts as a potent accelerator for vascular decline; specifically, the risk of experiencing decreased ABI values escalates significantly within the late adulthood cohort, particularly among patients who exhibit poor glycemic control. Advancing age is intrinsically tied to progressive physiological alterations within the vascular tree, reduced arterial elasticity and an accelerated atherosclerotic process that impairs peripheral blood flow (Herzoq et al., 2025). This age-related vulnerability is exacerbated by chronic hyperglycemia, as reflected by elevated HbA1c levels (Chia et al., 2017). This metabolic strain triggers a cascade of oxidative stress, endothelial dysfunction, and systemic inflammation—all of which serve as foundational mechanisms in the pathogenesis and progression of PAD (Wang & He, 2024). Therefore, individuals with T2D in the late adulthood group require more optimal management to reduce complications. This finding is consistent with the study x, which reported that women are at higher risk of developing T2D (Rosalinda & Nugraheni, 2023). Women with T2D have a greater susceptibility to vascular complications

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due to hormonal influences (estrogen and progesterone), body fat distribution, and metabolic factors such as higher insulin resistance, all of which may worsen endothelial function and accelerate the development of atherosclerosis (da Cruz et al., 2025). This condition indicates that elevated HbA1c levels reflect poor glycemic control, which is directly associated with endothelial dysfunction, increased oxidative stress, and activation of inflammatory pathways that contribute to narrowing and stiffening of peripheral blood vessels. Therefore, women with T2D who have elevated HbA1c levels belong to a high-risk group for experiencing decreased ABI values as an early manifestation of PAD.

The empirical data from this study demonstrate that low health literacy directly undermines critical diabetes self-management behaviors. Specifically, it impairs a patient's capacity to comprehend the clinical importance of strict dietary modifications, maintain strict adherence to pharmacological therapies, and effectively execute the self-monitoring of blood glucose (SMBG) levels (Sriklo & Sermsinsiri, 2026). Beyond these cognitive and educational barriers, external socio-economic variables introduce additional challenges; for instance, private-sector employees within this cohort frequently contend with prolonged working hours, high job-related stress, and restricted access to healthcare services during operational hours. These workplace barriers cumulatively disrupt healthy dietary patterns, impede regular physical activity, compromise medication compliance, and derail routine glycemic tracking. Sustained lifestyle challenges and workplace constraints contribute to persistently elevated blood glucose levels, as reflected by increased HbA1c values (Alrasheeday et al., 2024). This finding suggests that occupation may act as a potent, indirect socio-environmental risk factor for the development of macrovascular complications among individuals living with T2D (Seo et al., 2022). Beyond these external variables, the chronicity or duration of diabetes mellitus stands as a critical internal determinant influencing the risk of long-term systemic damage. A prolonged duration of diabetes is consistently associated with deteriorating glycemic control and the progressive decline of peripheral vascular perfusion, which can be clinically tracked using the ABI. As the time elapsed since diagnosis increases, patients in this study experience a cumulative exposure to chronic hyperglycemia, oxidative stress, and systemic inflammatory cascades. These compounding pathological conditions lead to severe endothelial dysfunction, the thickening of capillary basement membranes, and accelerated atherosclerosis within peripheral vessels. Consequently, arterial compliance decreases and luminal obstruction occurs, manifesting clinically as reduced ABI values (Lilly et al., 2014).

Longitudinal studies have shown that patients with T2D who maintain controlled HbA1c levels (below 7%) have a significantly lower prevalence of PAD compared to those with elevated HbA1c levels (Baty et al., 2025). Effective HbA1c control plays a critical role in preventing microvascular complications such as nephropathy, retinopathy, and neuropathy. Improving overall diabetes management not only enhances laboratory parameters such as HbA1c but also has a direct positive impact on vascular health (Liu et al., 2022). Multidisciplinary collaboration among physicians, nutritionists, diabetes nurse educators, and patients is essential to maintaining long-term glycemic stability. Through this comprehensive approach, the risk of developing PAD can be reduced. Complications can be prevented through a comprehensive and consistent diabetes management approach that emphasizes dietary control, regular physical activity, medication adherence, and routine monitoring of glycemic and vascular parameters (Migdalis, 2024). Respondents with ABI values below 0.9 are at a significantly higher risk of developing macrovascular complications due to impaired peripheral blood circulation such as DFU, gangrene, limb ischemia, and eventual amputation, as well as a higher risk of cardiovascular mortality. Therefore, ABI measurement plays an important role as an early screening tool to identify peripheral vascular impairment before severe complications occur. In clinical practice, healthcare professionals particularly nurses and wound care nurses have an important role in performing early peripheral circulation assessments using ABI as part of routine diabetic foot screening. Regular ABI assessment allows early identification of perfusion abnormalities and supports timely preventive interventions such as foot care education, pressure off-loading strategies, vascular referral when necessary, and risk stratification for ulcer prevention. This approach is consistent with international recommendations emphasizing routine vascular assessment in diabetic foot evaluation to reduce the incidence of ulceration and amputation (American Diabetes Association Professional Practice Committee, 2025). Therefore, multidisciplinary interventions that include optimal metabolic control, cardiovascular pharmacotherapy, lifestyle modification, and routine peripheral circulation monitoring should become the primary focus in maintaining favorable ABI values.

Conclusion

Monitoring both HbA1C and ABI serves as a critical, non-invasive indicator for tracing diabetes progression and the onset of macrovascular complications. Diabetes specialist nurses and healthcare providers must give greater attention to these parameters, as early detection through routine screenings is vital to mitigating systemic vascular damage and preventing

severe long-term complications, such as diabetic foot ulcers. Future studies should expand the sample size and include multiple healthcare centers across different regions in Indonesia to enhance the generalizability of the findings to the broader Indonesian population. Research should investigate the efficacy of specific nursing interventions and innovative foot-care protocols aimed at stabilizing blood glucose levels and improving lower-extremity perfusion to actively DFU.

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AI statements
During the research and writing of this article, the research team did not use generative AI to generate any ideas or concepts. All work was derived entirely from the independent thought and analysis of the authors.

Author declaration
All members of the research team contributed to conceptualizing the study, formulating the research problem and methodology, conducting the data collection process, and preparing the manuscript from initial drafting and revision through to final publication.

Availability of data and materials
All data and materials supporting the findings of this study are included within this article. For further details, readers may contact the corresponding author upon reasonable request. Certain data, such as participant identities, have been anonymized to ensure compliance with research ethics and confidentiality.

Competing interests
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this publication.

Ethical clearance
The study secured formal ethical approval from the Institutional Review Board (IRB) or Ethics Committee of RSUD Moewardi Surakarta, Indonesia (No: 457/II/HREC/2025).

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Publishers and journal's note
This research is of great interest because it looks at two essential aspects of diabetes management: HbA1c and ABI. I am confident that healthcare providers will find these results highly useful, as they directly impact the provision of nursing care. It is hoped that the outcomes of this study will inspire new innovations in HbA1c and ABI assessments.

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Authors' perspective

Innovation points

- The study focuses on the critical link between long-term blood glucose management and macrovascular health, which serves as a vital non-invasive screening tool for PAD.
- With specifying the patient population in Indonesia, the study highlights the unique impact of regional healthcare access, dietary staples, health literacy, and employment patterns on clinical outcomes.
- The research underscores how monitoring shifts in these two biomarkers can help clinicians identify subclinical vascular impairment in patients who appear otherwise stable, allowing for therapeutic adjustments.

Potential areas of interest

- What is the specific statistical correlation between HbA1c levels and ABI values among patients diagnosed with T2D in the Indonesian clinical setting?
- To what extent do local socio-demographic factors act as indirect risk factors compounding the relationship between poor glycemic control and reduced ABI values?
- Does the duration of T2D significantly moderate the strength of the inverse relationship observed between elevated HbA1c scores and impaired peripheral perfusion in this population?

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