KNOWLEDGE AND AWARENESS RELATED TO DIABETES MELLITUS AMONG UNIVERSITY STUDENTS IN SOUTH AFRICA: A CROSS-SECTIONAL STUDY.

Sanelisiwe Sibusisiwe Vaminhlanhla Ndlovu, Ziningi Nobuhle Jaya, Nokukhanya Thembane[*]
Department of Biomedical Sciences, Faculty of Applied and Health Science, Mangosuthu University of Technology, South Africa, Durban.

ABSTRACT

Introduction
This study assessed diabetes mellitus (DM) knowledge among undergraduate students at a South African University of Technology. Using a cross-sectional, mixed-methods approach, the aim was to compare diabetes knowledge between students in health-related and non-health-related fields, evaluate their attitudes toward diabetes education, and assess self-perceived knowledge. With the rising global prevalence of diabetes, particularly among younger populations, this research explores awareness and education gaps regarding diabetes among university students.

Method
The study involved 206 students aged 18-25 from health-related and non-health-related faculties. A pre-validated questionnaire, consisting of multiple-choice, true/false, and open-ended questions, covered diabetes risk factors, symptoms, complications, prevention, and management. Convenience sampling was used, and data was collected through paper-based and electronic surveys. Descriptive statistics summarized the data, while thematic analysis was applied to open-ended responses. Spearman's correlation assessed the relationship between diabetes knowledge and the field of study.

Results
Of the participants, 89.2% were aware of diabetes. However, significant knowledge differences were observed between students in health-related and non-health-related fields. Health-related students demonstrated a more accurate understanding of diabetes types, diagnostic methods, and risk factors. In contrast, non-health students showed lower knowledge, with many unable to differentiate between Type 1 and Type 2 diabetes. Correlation analysis revealed a moderate negative relationship ($r = -0.352$, $p < 0.01$) between diabetes knowledge and field of study, indicating that non-health students possessed less knowledge. Furthermore, 32.9% of students rated their knowledge as unsatisfactory.

Conclusion
This study highlights a significant knowledge gap between health-related and non-health-related students. Health-related students showed a more comprehensive understanding, suggesting the need for broader diabetes education for all students across disciplines.

Recommendations
Diabetes education should be incorporated into university curricula, particularly for non-health students, and public health campaigns should be used to raise awareness.

Corresponding author: Nokukhanya Thembane[*]
Email: thembane@mut.ac.za
Department of Biomedical Sciences, Faculty of Applied and Health Science, Mangosuthu University of Technology, South Africa, Durban

BACKGROUND

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by elevated plasma glucose levels due to defects in insulin secretion or action (American Diabetes Association, 2021). The global rise in DM prevalence, particularly among younger populations, has become a significant public health concern (Clarke et al., 2019). Approximately .2 million global deaths due to diabetes annually, 46.2% of which occur in those under 60 (Saeedi et al., 2020). The disease burden is particularly concerning in Sub-Saharan Africa, due to challenges such as undiagnosed cases, limited access to treatment, and an annual diabetes cost of US$67.03 billion (Hall et al., 2011). South Africa has experienced a dramatic increase in diabetes rates, from 4.5% in 2010 to 12.7% in 2019, with an estimated 4.58 million people aged 20–79 living with diabetes in 2019, more than half of whom remain undiagnosed (International Diabetes Federation, 2019, 2021). Diabetes is now the leading underlying natural cause of death for women and the second-highest underlying cause of death overall in South Africa

(Statistics South Africa, 2021). The prevalence is highest among individuals identifying as Indian, followed by White and Coloured populations, with Black South Africans experiencing the lowest rates (Reddy et al., 2021). Risk factors include family history, obesity, and advancing age (Reddy et al., 2021).

The increase in diabetes prevalence is largely attributed to poor dietary habits, sedentary lifestyles, obesity, and family history (De Rochas et al., 2021). Given the growing incidence of DM, particularly in South Africa and other regions, it is crucial to focus on enhancing public knowledge about diabetes, expertise plays a key role in promoting healthy behaviors and improving disease management (Werfalli et al., 2020). Adequate understanding of DM's causes, symptoms, risk factors, and preventive strategies is essential to reduce delayed diagnoses, prevent complications, and ensure effective disease management (Clarke et al., 2019). Studies have shown that students, especially those enrolled in non-health-related programs, often have insufficient knowledge of diabetes, which could contribute to the ongoing challenges in disease prevention and management (Clarke et al., 2019). This highlights the need for educational interventions tailored to the specific needs of various student groups.

In Sub-Saharan Africa, a significant knowledge gap about DM exists among students in non-health-related faculties, which can further contribute to the rising prevalence of the disease due to lifestyle factors and family history (Mohsen et al., 2021; Mohildein, 2018). However, despite these concerns, few comparative studies have evaluated diabetes knowledge among students in health-related versus non-health-related academic programs. It is well-established that healthcare professionals, including students in medical and allied health fields, need to possess a solid understanding of DM to provide appropriate care and management (Wu et al., 2022). Furthermore, students in health-related programs often receive more in-depth training in disease management and prevention, whereas students in non-health-related disciplines may have limited exposure to diabetes-related education, resulting in gaps in their knowledge (Jones & Taylor, 2021).

Previous studies have highlighted the critical need for comprehensive diabetes education among university students, as gaps in knowledge can have lasting consequences for individual health and public health outcomes (Robert et al., 2021). Evaluating diabetes knowledge among students in different academic programs can offer valuable insights into educational needs and guide context-appropriate health interventions (Smith et al., 2022). This study examines diabetes knowledge and awareness among health-related and non-health-related students at a university, aiming to identify knowledge gaps and inform initiatives to improve diabetes literacy and health outcomes. Tailored educational interventions, especially for non-health-related students, are vital to ensuring that all individuals are equipped with the necessary information to understand and manage diabetes risk effectively. This research aims to assess knowledge and perceptions of diabetes mellitus, and DM among students in health-related versus non-health-related qualifications at Mangosuthu University of Technology in Umlazi, Durban.

METHODS

Study Design

This cross-sectional survey assessed DM knowledge among undergraduate students at a university using a mixed-methods approach. The survey included multiple-choice, true/false, and open-ended questions on DM's risk factors, symptoms, complications, prevention, and management. The questionnaire was prechecked and piloted for quality control to ensure its validity and reliability. Participants in the pilot study were not included in the final sample for data analysis.

Study Setting and Population

The study was conducted at the University of Technology in KwaZulu-Natal, South Africa, in the City of Durban. Participants were students aged 18-34 enrolled across health-related and non-health-related faculties, including the Faculty of Applied and Health Sciences, Engineering, and Management Sciences.

Participants

The eligibility criteria for participation were that the participant had to be currently enrolled at the University of Technology, pursuing either a health-related or non-health-related qualification.
Sampling and Sample Size
Convenience sampling was used, with a calculated sample size of 373 participants based on a 95% confidence level and 5% margin of error. Data was collected through paper-based and electronic surveys.

Bias

The study utilized convenience sampling due to the practicality and efficiency of data collection. To eliminate business in the study we employed diverse recruitment strategies through the student community's social media and online platforms. Additionally, researchers maintained anonymity to encourage honest responses. Also, neutral language was used to avoid influencing respondents toward specific answers. Furthermore, we piloted the survey and addressed potential biases. And lastly, we analyzed and conducted a response rate monitoring.

Data Collection and Analysis

Data was gathered via an electronic survey link and paper-based surveys, with descriptive statistics used to summarize diabetes knowledge levels. Thematic analysis was applied to open-ended responses. Demographic

variables were compared to identify knowledge differences.

Ethical Considerations

Ethical approval was granted by the Institutional Research Ethics Committee Reference number: RD5/18/2024. The permission was granted on the 19th of February 2024 by the Mangosuthu University of Technology Research Ethics Committee. Participants were informed of the voluntary nature of participation, with confidentiality ensured. Data was securely stored and only accessible by the researcher and supervisor.

RESULTS

Sample Characteristics

While the calculated sample size was 373, only 225 participants completed the survey initially; however, due to 19 incomplete responses, only 206 participants were included in the analysis. Based on the required sample of 373 participants, the response rate for the study was approximately 55.2%, with 206 completed surveys included in the analysis. According to survey literature, a 55% response rate is considered good, with many experts regarding a response rate of 50% or higher as excellent, indicating a strong representation of the target population and reliable data collection (Sataloff and Vontela, 2021). The majority (88.8%) of participants were aged between 18-24 years, with a smaller group of 2 participants (0.97%) who were under the age of 18. A group of 21 participants (10.19%) were in the 25-34 age group. The distribution showed a predominance of younger adults in the study, with minimal representation of participants under 18 years and those above 24 years. Of the participants, 116 (56.31%) were female, while 90 (43.60%) were male, with a significant predominance of female participants.

Table 1: Frequency of Participants by Age, Gender, and Field of Study

Gender	Age	Health-Related	Non-Health-Related
Male	Below 18	1	1
	18-24	13	63
	25-34	5	7
	Total	19	71
Female			
	18-24	43	64
	25-34	3	6
	Total	46	70

Quantitative Results

Understanding the Basics of Diabetes

Table 2 presents the results for the question of whether participants were familiar with diabetes. Most participants, both male and female, responded positively to the question, with 159 (89.2%) answering "Yes" and only 19 (10.6%) answering "No." Among males, a higher proportion of those in non-health-related qualifications responded "Yes" (64, 36%), while 11 (6.1%) answered "No." Similarly, the majority of female participants in non-health-related qualifications responded "Yes" (65, 37%), with only 6 (3%) responding "No."

Table 2: Frequency of Knowledge About Diabetes Between Health and Non-Health Qualifications

Gender	Faculty	Yes	No	Total
Male	Health-Related	18	1	19
	Non-Health-Related	64	11	75
Female	Health-Related	12	1	13
	Non-Health-Related	65	6	71
Total		159	19	178

Exploring Diabetes Knowledge and Perception

Participants rated their self-assessed knowledge of diabetes on a scale of 1 to 6. The largest group of participants 73 (32.9%) rated their knowledge as "Unsatisfactory." The second-largest group 32 (14.4%) rated their knowledge as "Poor." There were 37 participants (16.7%) who rated their knowledge as "Satisfactory," 28 (12.6%) as "Good," and 23 (10.4%) as "Excellent." This distribution indicates that the majority of participants had limited knowledge of diabetes, with only a small number rating their knowledge as "Good" or "Excellent."

Table 3: Exploring Diabetes Knowledge and Perception

Knowledge Level	Number of Participants	Percentage (%)
Very Poor (1)	29	13.1
Poor (2)	32	14.4
Unsatisfactory (3)	73	32.9
Satisfactory (4)	37	16.7
Good (5)	28	12.6
Excellent (6)	23	10.4
Total	222	100

Knowledge of the Main Types of Diabetes

The students were asked to identify the main types of diabetes. The responses varied between students in health-related and non-health-related fields. Students from health-related fields (e.g., Biomedical Sciences) were more accurate, with 49 participants correctly identifying both Type 1 and Type 2 diabetes. In contrast, non-health students exhibited more uncertainty, with 72 participants selecting "Not sure/don't know."

Table 4: Identification of Main Types of Diabetes by Students in Health-Related and Non-Health-Related Fields

Type of Diabetes	Health-Related Fields (n=71)	Non-Health-Related Fields (n=148)	Total Responses (n=219)
Type 1 and Type 2 Diabetes	49	41	90
Not Sure/Don't Know	7	72	79
Type 1 and Gestational Diabetes	2	0	2
Type 1 Diabetes Only	1	6	7
Type 2 Diabetes Only	0	10	10
Type 1, Type 2, and Not Sure/Don't Know	0	7	7

Diagnosis of Diabetes

Participants were asked about common diagnostic tests for diabetes. In health-related fields, the most common correct response was "Serum glucose test, Urine glucose test, Blood pressure test," selected by 27 participants. In non-health-related fields, 38 participants correctly identified the "Serum glucose test" as the main diagnostic method, though many were uncertain about other tests.

Table 5: Diagnostic Tests for Diabetes - Responses from Health-Related and Non-Health-Related Fields

| Diagnostic Test Combination	Health-Related Fields (n=71)	Non-Health-Related Fields (n=148)	Total Responses (n=219)
Serum glucose test, Urine test, Blood pressure test	27	0	27
Serum glucose test (Standalone)	25	38	63
serum glucose test, Blood pressure test, Not sure/Don't know	8	0	8
Serum glucose test, Urine test, Blood pressure test, X-ray test	1	0	1
Urine test (Standalone)	0	6	6
Serum glucose test, Urine test	0	16	16
Serum glucose test, Blood pressure test	0	10	10
Not sure/Don't know	0	35	35

Source of Information on Diabetes

The survey also examined the sources of information about diabetes. The Internet was the most frequently cited source, with 131 (62.1%) participants using it to obtain information. Health professionals were another key source, referenced by 109 (51.7%) participants, while academic courses, friends/family, books, and social media also contributed significantly to students' knowledge.

Figure 1: Sources of Information on Diabetes

211 responses
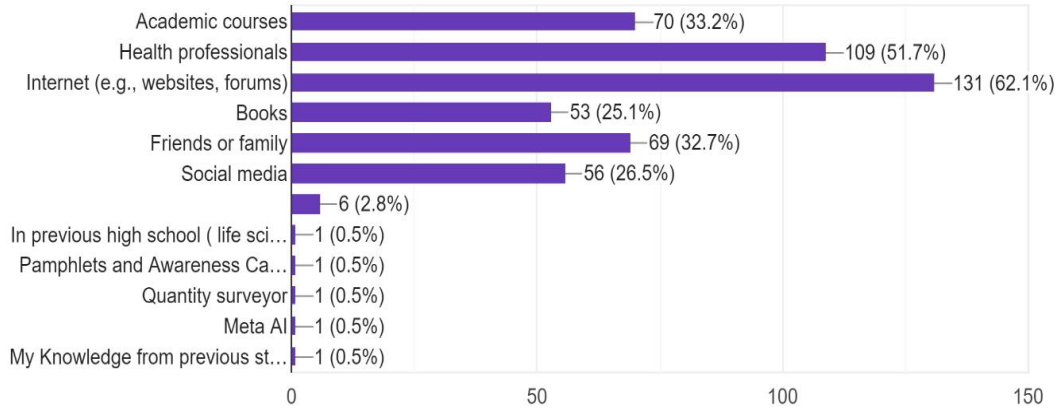
Correlation Analysis

A Spearman's rho correlation analysis revealed a moderate negative correlation between overall knowledge of diabetes and field of study (correlation coefficient = -0.352, $p < 0.01$), suggesting that students in non-health-related fields had lower levels of diabetes knowledge compared to their peers in health-related fields.

Table 6: Correlation Between Diabetes Mellitus Knowledge and Perception by Field of Study

			OVERALL, KNOWLEDGE OF DIABETES	CURRENT FIELD OF STUDY
Spearman's rho	OVERALL, KNOWLEDGE OF DIABETES	Correlation Coefficient	1,000	-,352**
		Sig. (1-tailed)	.	<0,01
		N	219	219
	CURRENT FIELD OF STUDY	Correlation Coefficient	-,352**	1,000
		Sig. (1-tailed)	<0,01	.
		N	219	219
	Overall, Knowledge of Diabetes		Current Field of Study	
Spearman's rho	Correlation Coefficient = -0.352**		p = 0.01	

Qualitative data analysis

Diabetes Knowledge, Awareness, and Perception Among Students

Table 6 highlights a significant knowledge gap between health-related and non-health-related students regarding diabetes. Health students, exposed to diabetes education as part of their curriculum, generally possess a deeper understanding of the condition, while non-health students often learn independently or through personal experiences. Despite misconceptions among non-health students, many see the value in incorporating diabetes education into all curricula to promote better awareness and informed lifestyle choices, underscoring the need for broader health education across disciplines.

Table 7: Diabetes Knowledge and Education: A Comparison Between Health-Related and Non-Health-Related Students

THEME	KEY COMMENTS/RESPONSES
Diabetes Awareness and Education	
Knowledge of Diabetes Treatment	- 186 non-health students answered *"Yes"* (diabetes is treatable with medication).- 34 health-related students answered *"No."*
Exposure to Learning	- Health students are exposed to diabetes education regularly. - Non-health students typically learn independently or through personal experiences.
Perceptions of Knowledge Differences	- Health students are perceived to have better knowledge of diabetes. - Comments included: *"Yes, they are taught every day about the disease." "Yes, their career revolves around health and well-being." "Yes, they get enough knowledge about diseases such as diabetes."*
Career Relevance	- Health-related students' careers require knowledge of diabetes. - Non-health students focus on their fields and only learn about diabetes if personally motivated.
Knowledge Gaps in Health Students	- Not all health students fully understand diabetes.- Example responses: *"Diabetes is a disease that only affects older people." "UShukela"* (slang for diabetes, indicating lack of scientific familiarity).
Incorporating Diabetes Education for Non-Health Students	- Students felt health education on diabetes should be part of non-health curricula. - Comments included: *"To better understand diabetes so they could monitor it." "It can help sustain lifespan." "So that everyone can choose lifestyle wisely and know their diet."*
Common Awareness	- Diabetes knowledge is perceived as accessible to everyone. - Depth of understanding may vary depending on the field of study.
Perception and Attitude Towards Diabetes	
Belief in Greater Knowledge Among Health Students	- Non-health students believe health students know more.- Key points: *"They study about it every day." "They have much knowledge because it's in their syllabus."*
Exposure to Learning	- Health students receive structured education on diabetes. - Non-health students may only learn about it independently or if personally affected.
Depth of Knowledge	- Health students are seen as having a more in-depth understanding. - Non-health students often have partial knowledge.- Example responses: *"Diabetes affects only older people."* and *"UShukela"* (showing lack of scientific term awareness).
Relevance to Career	- Health-related students need diabetes knowledge for their future careers.- Non-health students may not engage with health topics unless personally relevant.
Varying Levels of Interest	- Not all health students fully engage in diabetes education.- Non-health students may only be motivated to learn if personally affected.

DISCUSSION

Knowledge about Diabetes Mellitus Among University Students

DM continues to be a significant global health issue, with rising prevalence among younger populations, especially in Africa (Integrated African Health Observatory, 2023). This study aimed to compare diabetes knowledge between university students in health-related and non-health-related programs, assess their attitudes toward health education, and evaluate their self-perceived knowledge of diabetes. The findings emphasize the impact of formal education, personal experiences, and external sources on students' awareness and understanding of diabetes.

Demographic Overview

The study involved 225 participants, with 206 valid responses. The majority (88.8%) were aged 18-24, a demographic consistent with the increasing trend of diabetes in younger populations globally. Females made up 56.31%, while males accounted for 43.60%, reflecting the growing burden of diabetes among youth (Brown et al., 2020).

Curricular Factors and Diabetes Knowledge

A significant finding was the marked difference in diabetes knowledge between students in health-related fields and those in non-health fields like engineering and business. This pattern is consistent with previous studies (Orok et al., 2024; Sadikan et al., 2024), which found that healthcare students generally possess superior knowledge about diabetes, including its types, risk factors, and diagnostic procedures. In this study, 89.2% of participants were aware of diabetes, with a higher

proportion of non-health students (64 males, 65 females) showing basic knowledge. However, only a few non-health students correctly identified both Type 1 and Type 2 diabetes, unlike health students, who demonstrated a more accurate understanding (Table 4). This mirrors the findings by Brown et al. (2020), showing that health-related students tend to have better diabetes knowledge. Similarly, studies from South Africa (le Roux et al., 2025) and Saudi Arabia (Alhilali et al., 2023) highlight the gaps in diabetes knowledge, particularly among non-health students. These findings highlight the vital role of formal health education in fostering a comprehensive understanding of diabetes.

Knowledge of Types and Diagnosis of Diabetes

Health-related students outperformed non-health students in understanding the types of diabetes and common diagnostic tests. Health students demonstrated greater knowledge of both Type 1 and Type 2 diabetes, with 49 students correctly identifying both types, while 72 non-health students remained unsure (Table 4). With regards to knowledge of the types of diabetes, 18,7% (n=41) of students from non-health qualifications knew about diabetes. Whilst, 2,7 % (n=6) and 4,5% (n=10) understood the difference between type 1 and type 2 diabetes respectively. This discrepancy in knowledge aligns with Orok et al. (2024), who noted a similar knowledge gap between healthcare and non-health students. Health-related students were also more familiar with diagnostic tests beyond serum glucose tests, such as urine tests and blood pressure measurements. This gap emphasizes the influence of formal education in providing a broader understanding of diabetes and its diagnostic procedures. Similar trends have been observed in Ethiopia (Shiferaw et al., 2019) and Thailand (Phoosuwan et al., 2022), where significant gaps in diabetes knowledge, particularly regarding insulin use, were noted. These studies further highlight the need for enhanced health education initiatives, especially in regions with limited health literacy.

Self-perceived knowledge and Attitudes

A substantial portion of participants (32.9%) rated their knowledge as "unsatisfactory," while only 10.4% rated it as "excellent" (Table 3). Particularly, non-health students exhibited greater uncertainty about the types and diagnosis of diabetes. This gap in self-perceived competence reflects the limited knowledge many students have, particularly those outside health disciplines. Orok et al. (2024) and Xu et al. (2016) found similar trends in non-health students, who recognized their knowledge gaps and expressed the need for more focused educational interventions. This sheds light on the importance of expanding diabetes education, especially for non-health students, to improve their understanding and self-perceived competence in managing the condition.

The Role of External Sources in Diabetes Knowledge

The study also examined the sources from which students obtained diabetes information. The internet was the most common source, used by 62.1% of respondents, followed by health professionals (51.7%) and personal connections (32.7%). Academic sources were cited by 33.2%, while social media and books were used by 26.5% and 25.1%, respectively. These findings align with Asiedu et al. (2024), where health professionals were the primary source for 83.1% of participants. The increasing reliance on the internet and social media for health information raises concerns about the accuracy and reliability of the content, as observed in other populations (Grudziąż-Sękowska et al., 2024). This highlights the need for tailored educational campaigns on digital platforms to ensure the accuracy of diabetes information.

Perception and Attitudes Toward Diabetes Education

Students in health-related fields viewed diabetes education as crucial for both academic and professional development. In contrast, non-health students acknowledged its importance but felt it was insufficiently covered in their curricula. Many non-health students expressed a desire for more comprehensive education, particularly concerning lifestyle management and prevention. This aligns with findings by Orok et al. (2024), who suggested that non-health students would benefit from more structured diabetes education. Despite the generally better knowledge and attitudes among health-related students, gender differences were noted, with females typically exhibiting higher knowledge levels (Kolačko et al., 2023; Amankwah-Poku, 2019). Interestingly, the study found that more males (82) reported higher knowledge than females (77), contrary to the commonly held belief that females are more knowledgeable about diabetes. These findings stress the need for comprehensive diabetes education across all disciplines to improve awareness and prevention efforts (Kolačko et al., 2023; Rao et al., 2018).

Qualitative Insights: Diabetes Knowledge Among Health-Related and Non-Health-Related Students

The study revealed significant differences in diabetes knowledge between health-related and non-health-related students, consistent with previous research by Khamaiseh et al. (2019), who found that health students had a better grasp of chronic conditions due to their formal education. Health students benefited from structured learning through lectures and practicals, which contributed to a deeper understanding of diabetes. Non-health students, on the other hand, relied on independent learning through personal experiences or external sources like the Internet, which limited the depth of their

knowledge. This gap highlights the importance of formal education in diabetes awareness. While some non-health students exhibited greater awareness due to personal relevance, such as a family history of diabetes, these findings support Amankwah-Poku (2019), suggesting that personal experiences can enhance health literacy.

CONCLUSION

In conclusion, this study highlights the significant gap in diabetes knowledge between university students in health-related and non-health-related fields. The data revealed that health students possess a more comprehensive understanding of diabetes, including its types, risk factors, and diagnostic methods, due to their formal education. In contrast, non-health students demonstrated a more basic or uncertain knowledge of the condition, relying largely on personal experiences or independent learning, such as online resources. The results also indicated that despite a general awareness of diabetes, a substantial portion of both groups reported their knowledge as unsatisfactory or poor, emphasizing the need for improved education across all academic disciplines. Moreover, a notable difference in perceptions of diabetes knowledge between health-related and non-health-related students was evident, with non-health students acknowledging the importance of diabetes education but recognizing its insufficient coverage in their curriculum. The findings stress the importance of incorporating more detailed and structured diabetes education into non-health-related fields to address these knowledge gaps. Additionally, the reliance on external sources, such as the internet and health professionals, highlights the need for careful curation of health information to ensure its accuracy and reliability. Overall, expanding diabetes education for all students, regardless of their field of study, is crucial in improving awareness, prevention, and management of diabetes in younger populations.

STUDY LIMITATIONS

A limitation of this study is the use of convenience sampling, which may limit the generalizability of the findings to the broader student population. Additionally, the reliance on self-reported data and the overrepresentation of business and engineering majors may affect the accuracy and representativeness of the results. Future studies should include a broader range of non-health disciplines and utilize qualitative methods, such as interviews, to gain deeper insights. Expanding diabetes education across all academic fields could help bridge the knowledge gap and enhance health literacy among students.

RECOMMENDATIONS

This study highlights the need for directed diabetes education, particularly for students in non-health-related fields, who exhibit knowledge gaps that could affect their ability to recognize and manage diabetes. While students in health-related disciplines generally have a better understanding, integrating diabetes education into the university's health initiatives and community engagement curricula could help address these gaps and encourage healthier lifestyle choices. As diabetes becomes more prevalent, enhancing diabetes education across all university programs is crucial for fostering a more informed and proactive student population.

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CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

ABBREVIATIONS

DM – Diabetes Mellitus
ADA - American Diabetes Association
IDF - International Diabetes Federation
SA - South Africa
WHO - World Health Organization
n - Sample size (number of participants)
p - p-value (used in statistical testing)
rho - Spearman's rho (statistical term for correlation coefficient)
% - Percentage
95% CI - 95% Confidence Interval
Spearman's rho - Statistical test used to assess correlation

DATA AVAILABILITY

The data supporting the findings of this study are available upon reasonable request to the corresponding author, with consideration given to confidentiality and ethical guidelines.

AUTHOR CONTRIBUTIONS

SSV collected, cleaned, and analyzed the data, and wrote the initial draft of the manuscript. ZNJ and NT supervised all stages of the research, provided mentorship throughout the process, and reviewed the draft manuscript. They also contributed to the study design, data interpretation, and the discussion of results. SSV incorporated feedback from ZNJ and NT and

prepared the final version of the manuscript. ZNJ and NT also ensured adherence to ethical guidelines and secured the necessary resources for the study.

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