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Knowledge of diabetes mellitus complication prevention among patients in the central region of Ghana

Christiana Asiedu[1*], Evans Owusu-Berning[1] and Isaac Aidoo Erzuah[1]

Abstract

Diabetes Mellitus (DM) is a serious worldwide health issue that has put pressure on the global economy. The study examined the knowledge of complication prevention among patients living with Diabetes Mellitus (DM) in Ghana. The research was a quantitative study which involved the use of descriptive cross-sectional survey design. In all, 301 DM patients were included in the study. Data were processed using the Statistical Package for the Social Sciences (SPSS) version 25. The study recorded 66.12% ($n=199$) good knowledge level. Therefore, educational intervention programme should be organized by the health professionals at Twifo-Atti Morkwa hospital so every DM patient would have optimum knowledge about the disease that would ensure prevention of the DM complications.

Keywords Attitude, Complication, Diabetes mellitus, Hypertension, Knowledge

Background

Diabetes Mellitus (DM) is a critical global health concern that imposes a substantial economic burden, with an estimated annual cost of $1.31 trillion worldwide. This chronic condition is characterized by persistent hyperglycemia resulting from either inadequate insulin production or impaired insulin utilization, leading to complications such as microvascular, macrovascular, and neuropathic diseases [1–3]. Effective management of blood glucose levels is essential for maintaining the proper functioning of vital organs, including the brain, liver, and kidneys [4]. In 2021, the International Diabetes Federation (IDF) reported that approximately 537 million adults aged 20–79 years are living with DM, with projections indicating a significant increase by 2030 and 2045. The report also highlighted the disproportionate impact of DM in low- and middle-income countries, where over 75% of adults with DM reside. DM was responsible for 6.7 million deaths in 2021 and has led to substantial healthcare expenditures. Type 2 diabetes is the most prevalent form, typically affecting adults. It occurs when the body becomes resistant to insulin or fails to produce sufficient amounts. Over the past three decades, the prevalence of type 2 diabetes has increased dramatically across countries of all income levels. In contrast, type 1 diabetes, formerly known as juvenile diabetes or insulin-dependent diabetes, is a chronic condition in which the pancreas produces little to no insulin on its own [5].

In Africa, DM has emerged as a growing public health concern, with an estimated 19.4 million adults living with the disease, representing a regional prevalence of 3.9%. In Ghana specifically, approximately 2.5% of the adult population is affected, with many cases remaining undiagnosed, potentially leading to severe complications such as neuropathy, renal diseases, and cardiovascular ailments [6, 7]. Research has shown that enhancing patient knowledge of DM and its complications significantly improves treatment compliance and reduces the

*Correspondence:
Christiana Asiedu
casiedu@ucc.edu.gh
[1] Department of Adult Health, School of Nursing and Midwifery, University of Cape Coast, Cape Coast, Ghana

risk of complications [8]. Given this context, this study aims to assess patients' knowledge of DM complication preventive measures at Twifo Atti-Morkwa District Hospital. Understanding patient knowledge will provide valuable insights for developing targeted interventions to prevent DM-related complications. The study is crucial for informing healthcare strategies and improving DM patients outcomes in the region.

Methods

Research design

The study employed a descriptive cross-sectional survey design to collect quantitative data. A cross-sectional design enables data collection at a specific point in time without variable manipulation, making it appropriate for this research. The data collection process spanned four months. Researchers frequently use quantitative approaches to address research questions involving numerical values. This design was suitable for the study as it allowed for the collection and analysis of data on DM patients' knowledge of complication prevention at Twifo Atti-Morkwa District Hospital at a specific point in time, without follow-ups. Participants were selected based on predetermined inclusion and exclusion criteria. The cross-sectional design provided several advantages for this study. It allowed for a snapshot of the current state of patient knowledge. It facilitated the collection of data from a diverse group of patients simultaneously. It was time-efficient, enabling the completion of data collection within the four-month timeframe. And it also provided a foundation for potential future longitudinal studies on the same topic. This methodological approach aligned well with the study's objectives, enabling a comprehensive assessment of patients' knowledge regarding DM complication preventive measures at the specified hospital.

Study population

The study population for this research comprised patients living with diabetes mellitus (both type 1 and type 2) receiving care at the Twifo Atti-Morkwa District Hospital in Ghana. The target population consisted of 1,212 registered diabetes patients at the hospital.

The inclusion criteria for the study were patients aged 18 years and above, patients with diagnosis of diabetes mellitus (type 1 or type 2) and patients receiving care at the Twifo Atti-Morkwa District Hospital. The exclusion criteria also were patients with gestational diabetes, individuals with severe cognitive impairment, those with mental illness, and critically ill patients.

By applying these inclusion and exclusion criteria, the researchers identified the eligible study population from the total of 1,212 registered diabetes patients. This rigorous selection process ensured that the sample was representative of the target population and could provide reliable data to address the research objectives. This approach offered several advantages: It focused the study on the most relevant patient group; It minimized potential confounding factors that could affect the results; It ensured that participants were capable of providing informed consent and accurate responses; It aligned the study population with the specific research goals related to type 1 and type 2 diabetes knowledge and complication prevention. The careful definition of the study population and application of inclusion/exclusion criteria strengthened the validity and reliability of the research findings, making them more applicable to the broader population of diabetes patients receiving care in similar settings.

Sample size

Using Slovin's formula for calculating sample size which is $n = \frac{N}{1+Ne2}$ (where N represented number of DM patients at the Twifo Atti-Morkwa district hospital and taking precision (e) to be 0.05, the sample size (n) for the study will be 301.

Sample size calculation $n = \frac{N}{1+Ne2}$

Where N = population sample, n = sample size, e = level of precision which is assumed to be 0.05 in this study. $N = 1212$ $n =$? e = 0.05 $n = \frac{860}{1+860(0.05)2} n = 273.02$.

To cater for the potential attrition rate, 10% of the sample size calculated was added. Hence, a sample size of 301 will be used for the study.

Data collection instruments

Questionnaires were administered to obtain information from all study participants. These questionnaires were personally administered to patients with DM during their visits to the Twifo Atti-Morkwa District Hospital. The researchers created the instrument based on the research questions derived from the related literature [9]. The structured questionnaire was divided into two sections, A and B with close-ended questions. Section A: Sociodemographic variables and Section B: Patient knowledge on DM and its complications. This approach to data collection offered several advantages for the study. The use of a structured questionnaire ensured consistency in data collection across all participants. The close-ended questions facilitated quicker responses and easier data analysis. By basing the questionnaire on research questions, the researchers ensured that the collected data was pertinent to the study objectives. The two-section structure allowed for a thorough assessment of both demographic factors and disease-specific knowledge. Personal administration of the questionnaires allowed researchers to clarify any participant queries, potentially improving

response accuracy. Administering the questionnaires during hospital visits ensured that participants were in a relevant setting, potentially enhancing their focus on health-related questions. This methodological approach to data collection was designed to gather comprehensive, relevant, and reliable data to address the research objectives effectively.

Validity and reliability

The questionnaire's validity and reliability were established through a comprehensive literature review and expert panel validation [10]. Validity assessed the instrument's accuracy, while reliability evaluated its consistency [11]. After analysis, the instrument demonstrated a reliability coefficient of 0.7, indicating good reliability [12]. Consequently, the questionnaire was deemed both reliable and valid for use in the study [13].

Pre-testing

A pilot study was conducted to validate the research instrument's content and clarity. This preliminary assessment involved a small sample of twenty (20) diabetic patients at the Cape Coast Metropolitan Hospital. These participants were selected due to their similar conditions to those at the Twifo Atti-Morkwa District Hospital (TADH).

Data collection procedures

An introductory letter from the Department of Adult Health, School of Nursing and Midwifery, University of Cape Coast was presented to the Medical Superintendent of the Twifo Atti-Morkwa District Hospital (TADH). Official permission was obtained from the facility's administration to commence data collection, which was conducted over four months. Respondents were assured of the confidentiality of their responses. Each participant was allocated twenty (20) minutes to complete the questionnaire. All questionnaires were completed and returned to the researchers, ensuring a comprehensive data set for analysis.

Ethical consideration

Ethical approval for the study was obtained from the Ghana Health Service Ethics Review Board (ERB). Informed consent was secured from all participants prior to their inclusion in the study. To ensure confidentiality and anonymity, no names were recorded on the questionnaires. Participants were fully informed of their right to withdraw from the study at any stage without consequence. These measures were implemented to uphold ethical standards and protect participants' rights throughout the research process.

Data processing and analysis

The questionnaires were coded by assigning numbers to the different response categories for analysis and then entered into the Statistics Package for Social Sciences (SPSS) version 25 for Windows. Prior to coding the questionnaires, each item was reviewed to ensure that instructions were followed and responses were correctly given. Frequencies and percentages were used to describe the demographic characteristics of the responses, while mean and standard deviation were employed to analyze the extent of knowledge variables.

Results

Demographic characteristics of persons living with DM (see Appendix)

Table 1 presents a descriptive analysis of the participants' socio-demographic information. The majority were female, comprising 74.1% ($n=223$). Most participants resided in towns, accounting for 60.1% ($n=181$). In terms of educational qualifications, 34.5% ($n=104$) had no formal education. A notable portion of participants, 35.2% ($n=106$), were engaged in trading, and 48.5% ($n=146$) were married.

Knowledge Level of Patients on DM Toward Complication Prevention (see Appendix)

Under level of knowledge, 13 questions were asked with each having a score of 2 totaling 26 point score, hence 0–13 was rated poor knowledge while 14–26 was rated Good knowledge. The total possible score ranged from 7 (7 statements x 1 point for Strongly Disagree) to 35 (7 statements x 5 points for Strongly Agree). A score of 14–26 out of 35 was categorized as "Good knowledge," while a score of 0–13 was considered "Poor knowledge." The study revealed that 67.11% ($n=202$) of participants had good knowledge of DM (refer to Tables 2 and 3). For instance, 57.1% ($n=172$) correctly identified that anti-DM medications should be taken regularly to prevent complications, 63.1% ($n=190$) correctly indicated that DM patients should consult a doctor if their feet exhibit redness, blisters, cuts, or wounds, and 70.1% ($n=211$) recognized that reducing carbohydrate intake can help mitigate DM and its complications.

The highest mean score was 4.36 ± 0.67 for the statement regarding the regular intake of anti-DM medications. The mean score for consulting a doctor was 4.27 ± 0.53. The lowest mean score, 4.08 ± 0.70, was associated with the necessity of blood pressure control for glycemic control. Additionally, 32.89% (n=99) of participants displayed poor knowledge of DM complication prevention.

Sources of Information and Risk Factors Concerning DM (see Appendix)

The majority of participants, 83.1% (n=250), identified health workers as their primary source of information about DM and its complications. The study also highlighted that a family history of DM was the most frequently reported risk factor, cited by 71.1% (n=214) of participants. Only 9% reported having "high" knowledge of diabetes and its complications, while 45.8% had "low" knowledge, and 40.2% (n=121) had moderate knowledge.

The association between patients' socio-demographics and their knowledge towards complication prevention of DM: (see Appendix)

A binary logistic regression was conducted to examine the association between socio-demographics and participants' knowledge levels. The model was statistically significant ($\chi^2(36)= 114.206$, $p < 0.001$). It explained 54.0% of the variance in knowledge levels according to the Nagelkerke R^2 and 31.6% according to the Cox & Snell R^2, and it correctly classified 84.5% of the cases. The Hosmer and Lemeshow test indicated a good fit to the data ($\chi^2(8) = 4.279$, $p = 0.831$).

Discussion

According to the 2021 United Nations (UN) report on World Population, Ghana's population is 31,732,128, with 16.09 million males and 15.65 million females, resulting in a slight male predominance of 0.44. Despite this, females in the Twifo Atti-Morkwa district of Ghana exhibit a higher susceptibility to diabetes mellitus (DM) compared to males, aligning with findings from Kautzky-Willer et al., [14], which suggest that DM and its risk factors are more prevalent among women. In Ghana, traditional gender roles often position men as household heads and primary breadwinners, leading to disparities in income and resource access. These socioeconomic factors may increase women's vulnerability to DM. Leslie et al., [15] discusses how sex and gender differences affect DM, noting that while DM is more common in men at younger ages, obesity—a significant DM risk factor—is more prevalent in women. Differences in biology, culture, lifestyle, environment, and socioeconomic status also contribute to the variation in DM prevalence between genders. Additionally, sex hormones play a critical role in metabolic functions, body composition, vascular health, and inflammatory responses, further influencing DM risk.

Studies by Amadi et al., [16] indicate that socio-demographic factors such as religion and coping mechanisms can impact DM outcomes. Similarly, Dewi et al., [17] found that religiosity, coping strategies, and self-care significantly affect the quality of life for individuals with DM. Furthermore, Al-Rasheedi [18], observed that educational level impacts awareness of DM complications and treatment adherence, with higher education levels generally correlating with better outcomes. However, in regions like the Twifo Atti-Morkwa district, where illiteracy rates are high, poor adherence to diet and lifestyle recommendations may exacerbate DM prevalence. Research by Rodrigues et al., [19] underscores the significance of education on knowledge and attitudes toward diabetes mellitus (DM). Additionally, studies by Azimi-Nezhad et al., [20] and Ramezankhani et al., [21] highlight how occupation and marital status can influence DM prevalence. Discrepancies in knowledge levels among DM patients, as noted by Riaz et al., [22] and Okonta et al., [23], may arise from variations in educational attainment and access to diabetes education.

The association between socio-demographic characteristics and knowledge has been extensively documented in the literature. Various studies have investigated how factors such as age, gender, place of residence, religion, educational level, occupation, and marital status influence an individual's knowledge and understanding.

Age significantly impacts knowledge, with younger individuals often demonstrating higher levels compared to their older counterparts [24]. This trend is likely due to greater exposure to educational opportunities and the rapid dissemination of information in the digital age. Gender has also been examined, with some studies suggesting that women may have a slight advantage in certain areas [25]. However, these findings are context-dependent and can vary based on the specific topic. Place of residence, particularly the rural-urban divide, is another crucial determinant of knowledge. Urban residents often have better access to educational resources and diverse information sources, resulting in higher knowledge levels [20]. Religious affiliation has been explored as well, with some studies indicating that religious beliefs and practices can influence an individual's understanding of various subjects [26]. The relationship between religion and knowledge is complex and varies across different cultural and social contexts.

Educational level is widely recognized as a strong predictor of knowledge, with higher education generally associated with greater knowledge and understanding [27]. This is due to direct exposure to educational content and the enhancement of critical thinking skills. Occupational status also correlates with knowledge, as certain professions necessitate or facilitate the acquisition of specific knowledge [28, 29]. Individuals in particular occupations may have better access to relevant information and resources. Finally, marital status has been examined in relation to knowledge, with some studies suggesting that married individuals may possess slightly higher levels of

knowledge compared to their unmarried counterparts [30, 31]. This may be attributed to shared experiences, social support, and access to information within the marital context.

Conclusion

In conclusion, addressing DM requires a comprehensive understanding of its socio-demographic determinants and risk factors. Improving education, access to resources, and awareness of DM care are crucial steps in mitigating its impact, particularly in vulnerable populations like those in the Twifo Atti-Morkwa district of Ghana.

Appendix

Table 1 Demographic characteristics of participants (*n*=301)

Demographic characteristics	Frequency (f)	Percentage (%)
Age		
21-40	19	6.3
41-60	158	52.0
61-80	109	36.2
81-100	15	5
Gender		
Male	78	25.9
Female	223	74.1
Place of residence		
Village	114	37.9
Town	181	60.1
City	6	2
Religion		
Christianity	274	91
Traditional	9	3
Islamic	15	5
None	3	1
Highest level of education		
No formal educational qualification	104	34.6
Certificate	78	25.9
Diploma	21	7
HND	9	3
Degree	36	12
Masters	12	4
Doctorate	36	12
Others	5	1.7
Occupation		
Farming	96	31.9
Apprenticeship	9	3
Trading	106	35.2
Artist/Beauticians	15	5
Teaching	9	3
Nursing	9	3
Others	57	18
Marital Status		
Single	31	10.3
Married	146	48.5
Divorced	45	15
Widowed	66	21.9
Others	13	4.4
Region in Ghana		
Greater Accra	15	5
Ashanti	18	6
Eastern	39	13
Central	171	56
Western	21	7
Western North	3	1
Volta	21	7
Savanna	7	2.3
Bono	6	2

Table 2 Knowledge level of persons living with DM

Statement	Mean X ± SD	SD *n* (%)	D *n* (%)	UD *n* (%)	A *n* (%)	SA *n* (%)
Anti-DM medications should be taking regularly	4.36 ± 0.67	0.0	3(1)	3(1)	172(57.1)	123(40.9)
DM patients should consult a doctor	4.27 ± 0.53	0.0	0.0	12(4)	190(63.1)	93(30.9)
Exercise can be helpful to prevent DM	4.18 ± 0.57	0.0	6(2)	9(3)	211(70.1)	75(24.9)
Reducing carbohydrate intake can reduce DM	4.18 ± 0.48	0.0	0.0	12(4)	223(74.1)	66(21.9)
Alcohol can increase in the risk of DM	4.17 ± 0.60	0.0	6(2)	15(5)	202(67.1)	78(25.9)
DM complication can be controlled by avoiding smoking	4.12 ± 0.65	0.0	9(3)	21(7)	196(65.1)	75(24.9)
Blood pressure control is necessary for glycemic control	4.08 ± 0.70	6(2)	3(1)	18(6)	208(69.1)	66(21.9)

X Mean, *SD S*trongly Disagree, *D* Disagree, *UD* Undecided, *A* Agree, *SA* Strongly Agree, *n* Frequency

Table 3 Knowledge level scale

Knowledge	Score range	Frequency(*n*)	Percentage (%)
Good knowledge	14–26	202	67.11
Poor knowledge	0–13	99	32.89

Table 4 Source of information and risk factors of persons living with DM

Source of information	Frequency (f)	Percentage (%)
Health worker	250	83.1
Radio	12	4
Internet	21	7
Family member	12	4
Friends/peers	3	1
Risk factors of DM		
Family history	214	71.1
Age	15	5
Physical inactivity	9	3
Increased weight	9	3
Other	20	6.6
Knowledge of DM and its complications		
None	15	5
Low	138	45.8
Moderate	121	40.2
High	27	9

Table 5 Association between knowledge and socio-demographics characteristics

Socio-Demographics	B	S. E	Wald	*p*-value
Age	-3.24	1.77	6.89	.75
Gender	– .68	.62	1.20	.27
Place of residence	– .36	.64	.32	.85
Religion	-2.51	1.08	5.44	.14
Educational level	1.56	.59	12.84	.08
Occupation	15.9	.733	2.80	.83
Marital status	2.16	1.37	2.46	0.02

Table 6 Operational definitions

QUESTION	APPROPRIATE RESPONSE
Anti-DM medications should be taken regularly:	A score of 4 or 5 on the 5-point Likert scale, corresponding to "Agree" or "Strongly Agree".
DM patients should consult a doctor:	A score of 4 or 5 on the 5-point Likert scale, corresponding to "Agree" or "Strongly Agree".
Exercise can be helpful to prevent DM:	A score of 4 or 5 on the 5-point Likert scale, corresponding to "Agree" or "Strongly Agree".
Reducing carbohydrate intake can reduce DM:	A score of 4 or 5 on the 5-point Likert scale, corresponding to "Agree" or "Strongly Agree".
Alcohol can increase the risk of DM:	A score of 4 or 5 on the 5-point Likert scale, corresponding to "Agree" or "Strongly Agree".
DM complication can be controlled by avoiding smoking	A score of 4 or 5 on the 5-point Likert scale, corresponding to "Agree" or "Strongly Agree".
Blood pressure control is necessary for glycemic control	A score of 4 or 5 on the 5-point Likert scale, corresponding to "Agree" or "Strongly Agree".

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12902-024-01744-9.

Supplementary Material 1.

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Authors' contributions
Conceptualization, design, data collection, and analysis, were done by C.A. and E.O-B. Preparation of the manuscript was done by C.A., E. O-B., and I.A.E. All authors reviewed the manuscript and authorized for publication.

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Data availability
Raw data of the study is not available to the public due to participants privacy. The data are, however, available from the corresponding authors upon reasonable request through email: casiedu@ucc.edu.gh.

Declarations

Ethics approval and consent to participate
Ethical clearance was obtained from the Ghana Health Service and University of Cape Coast ethics review committees. Written consent was obtained from all participants and informed about their willingness to participate or refuse in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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