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RESEARCH ARTICLE

Correlation between knowledge and characteristics of patients with type 2 diabetes mellitus in controlling blood glucose

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Abstract

Background: Type 2 Diabetes mellitus (T2DM) is a non-communicable disease, with an estimated prevalence based on the International Diabetes Foundation (IDF) to increase by 46%. Community knowledge about T2DM is relatively low. Improving this level of knowledge is essential to reduce the prevalence of this disease. **Objective:** To determine the correlation between patients' knowledge and characteristics of T2DM. **Method:** Knowledge was measured using the Indonesian translation of the Diabetes Knowledge Questionnaire 24 (DKQ-24) and distributed to 300 patients who met the inclusion criteria. The cross-sectional method was used in this study. **Result:** The results showed that the level of knowledge obtained high knowledge with a score of ≥ 12 in 151 patients (53%), while a low level of knowledge with a score of < 12 was in 149 patients (47%). Furthermore, there was a significant relationship between the level of knowledge and education, work, and blood glucose parameters. Furthermore, a high knowledge level was associated with better blood glucose control. **Conclusion:** This study concluded that knowledge and education determined the patient's glycemic control.

Introduction

Diabetes mellitus (DM) is a non-communicable disease that has affected millions worldwide. Based on data from the International Diabetic Federation (IDF), it was estimated to increase by 46% for the 20- 79-year-old age group and become a major health problem (Magliano *et al.*, 2021).

This disease requires long-term treatment, so a patient's understanding of controlling blood glucose levels is necessary to achieve successful therapy. In Indonesia, generally, patient knowledge is lacking, particularly about the DM disease (low health literacy) and drug information (low medication literacy) (Webber, 2013; Ministry of Health of the Republic of Indonesia., 2020; Soelistijo *et al.*, 2021). Research on knowledge of type 2 DM (T2DM) patients in Indonesia was conducted by Larasati and colleagues in 2019.

Nabila and colleagues in 2019 on DM patients at the Bantul and Karawang Primary Health Centre, respectively, using the Diabetes Knowledge Questionnaire 24 (DKQ-24), showed that the patients' knowledge about DM disease mainly was low (57%) and was correlated with blood glucose control (Larasati *et al.*, 2019; Nabila *et al.*, 2022). Meanwhile, another study at the Brunei Diabetes Clinic in 2022 used the same questionnaire. It showed that 118 T2DM patients (95.76%) had a knowledge level of DM disease that was below the average (Muhammad *et al.*, 2022). All these studies also indicated that knowledge was associated with patients' characteristics, thereby affecting blood glucose control (Larasati *et al.*, 2019; Fitriani *et al.*, 2020; Nabila *et al.*, 2022).

Adequate knowledge about the disease and medication will benefit the patients by allowing them to achieve adequate glycaemic control, preventing them from

micro- and macrovascular abnormalities (Zahedi *et al.*, 2020; Magliano *et al.*, 2021). However, many factors shape patients' understanding of DM disease and the medication that needs to be controlled. Hence, this study aimed to examine the characteristics of T2DM patients, which are related to the patient's knowledge of controlling blood glucose.

Methods

Design

A cross-sectional prospective study was conducted at the outpatient pharmacy unit in one of the government hospitals in the East Surabaya region from April to July 2023. The study was conducted among T2DM patients aged ≥ 30 years, with or without comorbidities, who consented to fill out the DKQ-24 questionnaire. Patients who could not read and write were excluded. In total, 300 patients who met the criteria were recruited in this study.

Ethical approval

The research received ethical approval with number 445/6/committee.ethics/2023.

Assessment

This study measured patients' knowledge using the Indonesian version of the DKQ-24 questionnaire translated by Zakiudin *et al.* (2022). The questionnaire was tested for its reliability and validity. The internal consistency value was determined. The construct validity test, using the Kaiser-Meyer-Olkin (KMO) was carried out, and Bartlett's test was also carried out. Knowledge level was coded as "low" and "high". Patients who could answer ≥ 12 questions had a high level of knowledge, while the others were considered low (Garcia *et al.*, 2001; Larasati *et al.*, 2019). Patient characteristics were observed from their medical record data, including gender, education, and occupation. Laboratory data of fasting blood glucose and two hours post-prandial blood glucose were also evaluated.

Statistical analysis

The patients' characteristics were presented as frequencies and related percentages. Chi-square was used to examine the association between the patient's characteristics and blood glucose laboratory results. In contrast, binary logistic analysis was used to analyse the correlation between patients' knowledge and characteristics that provided the most significant potential for blood glucose control.

Results

Following the reliability and validity of the questionnaire, the internal consistency value was good, with Cronbach's $\alpha = 0.757$, indicating that the DKQ-24 questionnaire was reliable. The construct validity test, using the Kaiser-Meyer-Olkin (KMO), resulted in a value of 0.362, and Bartlett's test yielded a value of $X^2 = 428.144$ ($df = 276$, $p < 0.000$). This proved the validity of the translated DKQ-24 questionnaire (Garcia *et al.*, 2001; Zakiudin *et al.*, 2022).

A total of 300 participants agreed to join the study. Of those who filled out the DKQ-24 questionnaire, 53.3%, representing the majority, were male. About 40.3% were aged between 60 and 69. Among the respondents, 55.0% had a senior high school education background, and 47.3% were already retired. The results of measuring patient knowledge among the respondents showed that 53% had a high knowledge level. Participants' knowledge and patients' characteristics are presented in Table I.

Table I: Characteristics and knowledge level based on the DKQ-24 questionnaire of participants at the outpatient pharmacy unit for type 2 DM patients from April to July 2023

Variables	Number of patients= n (%)
Level of knowledge	
High	159 (53)
Low	141 (47)
Age (years)	
30 – 39	5 (1.7)
40 – 49	14 (4.7)
50 – 59	114 (38.0)
60 – 69	121 (40.3)
70 – 79	42 (14.0)
80 – 89	4 (1.3)
Gender	
Female	140 (46.7)
Male	160 (53.3)
Education	
Elementary School	62 (20.7)
Junior High School	70 (23.3)
Senior High School	165 (55.0)
Higher Education	3 (1.0)
Occupation	
Retired	142 (47.3)
Private employee	113 (37.7)
Self-employed	36 (12.0)
Government employee	9 (3.0)

The laboratory data of fasting blood glucose and post-prandial blood glucose based on the level of knowledge are presented in Table II, respectively. Most patients with high levels of knowledge (64.2%) had fasting blood sugar in the range of 100–149 mg/dl, while those with low knowledge (48.3%) were mainly in the range of 150–199 mg/dl. Similar to the fasting blood glucose data, the majority of patients with high knowledge (73.5%) possessed lower post-prandial blood sugar within a range of 150–199 mg/dl compared to patients with low knowledge (55.0%) who had post-prandial blood sugar in the range of 250–299 mg/dl.

Statistical analysis using Chi-square showed a significant association between patients' knowledge and characteristics, including gender ($p = 0.000$), education ($p = 0.000$), occupation ($p = 0.000$), and blood glucose level ($p = 0.000$). However, age did not correlate with knowledge ($p = 0.364$). Further analysis using binary logistics revealed that educational background possessed the highest odd ratio of 5.528. The complete results are displayed in Table III.

Table II: Participants' laboratory data of fasting blood glucose and post-prandial blood glucose based on knowledge level

Range (mg/dL)	Level of knowledge n (%)	
	Low knowledge	High knowledge
Fasting blood glucose		
50 – 99	0 (0)	4 (2.6)
100 – 149	45 (30.2)	97 (64.2)
150 – 199	72 (48.3)	50 (33.1)
200 – 249	30 (20.1)	0 (0)
250 – 299	2 (13)	0 (0)
300 – 349	0 (0)	0 (0)
Post-prandial blood glucose		
100 – 149	0 (0)	37 (24.5)
150 – 199	0 (0)	111 (73.5)
200 – 249	59 (39.6)	3 (2.0)
250 – 299	82 (55.0)	0 (0)
300 – 349	5 (3.4)	0 (0)
350 – 399	0 (0)	0 (0)
400 – 449	0 (0)	0 (0)

Table III: Association between participants' characteristics and knowledge

Characteristics	Significance ($p < 0.005$)	Odds ratio (Coefficient B)	Potency
Age	0.364	1.27 (+)	1.27
Education	0.000	5.528 (+)	5.528
Occupation	0.000	0.454 (-)	1/0.455 = 2.203
Fasting blood glucose	0.000	0.232 (-)	1/0.232 = 4.31
Post-prandial blood glucose	0.000	0.000 (-)	Infinite value

Figure 1 compares the knowledge level and education of participants. Most patients with high knowledge and low blood glucose (within 100–149 mg/dL for fasting and 150–199 mg/dL for post-prandial) graduated from senior high school. Meanwhile, patients with low knowledge and high blood glucose (within the range of 150–249 mg/dL for fasting and 200–299 mg/dL for post-prandial) possessed elementary and secondary education.

Discussion

The present study examined the association of sociodemographic characteristics with the knowledge of diabetes among T2DM outpatients at one of the government hospitals in the East Surabaya region. Participants' knowledge was measured using the Indonesian version of the DKQ-24 questionnaire. This

questionnaire contained 24 questions and was comprised of three parts: assessing basic knowledge about DM disease, glucose control knowledge, and knowledge about the prevention of DM complications (Garcia *et al.*, 2001; Larasati *et al.*, 2019; Zakiudin *et al.*, 2022).

In this study, more than half of the participants (53%) had adequate knowledge about their disease, and this level of knowledge was significantly associated with gender ($p = 0.000$), education ($p = 0.000$), occupation ($p = 0.000$), and blood glucose level ($p = 0.000$). Among these predictors, educational background obtained the highest odds ratio with a value of 5.528 and a positive coefficient B(+), meaning that a higher education level was 5.528 times more likely to have high-level knowledge. Similar studies conducted in Malaysia and Thailand aligned with the results obtained in this present study (Ismail *et al.*, 2016; Phoosuwan *et al.*, 2022).

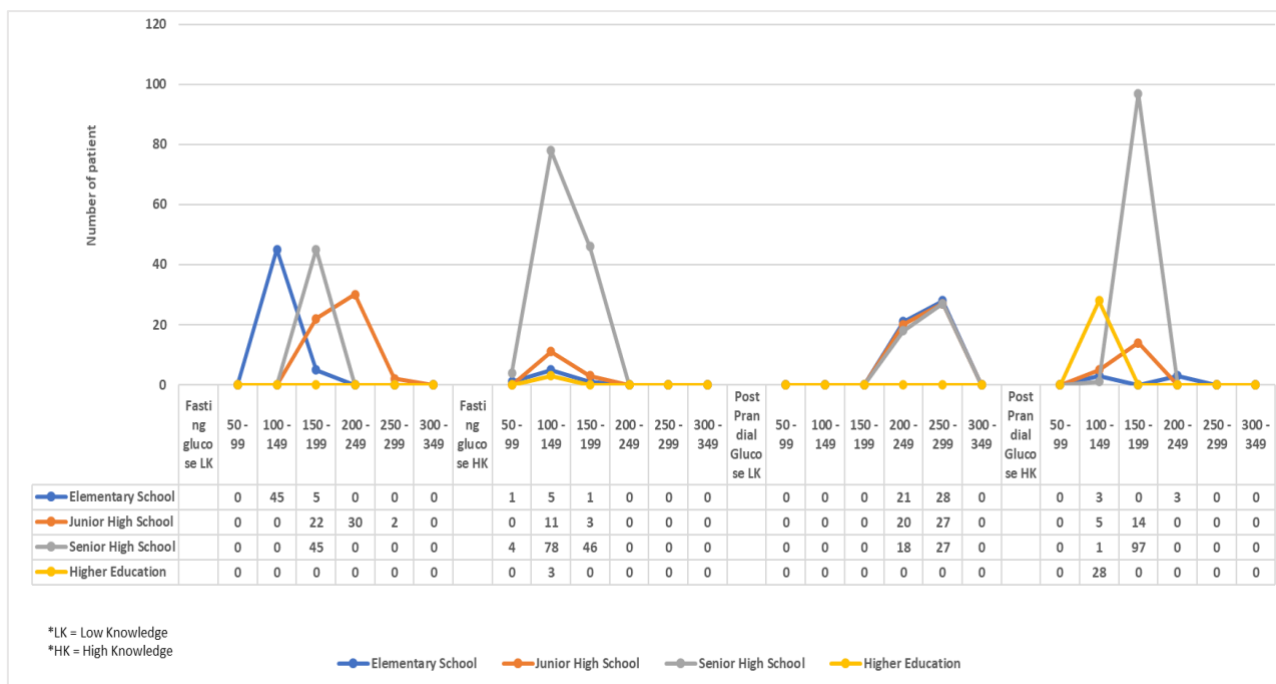


Figure 1: Comparison between participants' knowledge and education in blood glucose control

This study showed that age did not significantly influence the level of knowledge among T2DM patients. Patients who are older and have suffered from T2DM for longer tend to have more knowledge because they receive more education from health providers (Poulimeneas *et al.*, 2016). This occurs in patients of productive age (Poulimeneas *et al.*, 2016). Patients of productive age are expected to get more information about their health impairment through the services of health providers by reading health magazines, health leaflets or news sources about T2DM and its therapy available on the internet (Poulimeneas *et al.*, 2016). This is because young patients still have the motivation to improve their health and slow the progression of their disease (Noorrizka *et al.*, 2023; Poulimeneas *et al.*, 2016).

In this study, 47% of T2DM patients had low knowledge of the DKQ-24 results. The patient's low knowledge of the questionnaire results was due to a lack of understanding of blood glucose control. Patients do not understand the importance of controlling blood glucose to prevent disease progression and complications (Almoussa *et al.*, 2023). The habit of eating large amounts of carbohydrates is an influential sociocultural factor, and adherence to visiting doctors and taking medication is a socio-economic factor that also has great influences (Almoussa *et al.*, 2023; Rinda *et al.*, 2023)

These results indicated that patients with a high level of knowledge have controlled fasting blood glucose

values compared to patients with a low level of knowledge. Based on the pathophysiology of DM, the metabolism of carbohydrates into glucose is transported into cells by insulin produced by β -pancreatic cells. Besides that, physical activity such as regular exercise also helps insulin uptake glucose into cells (Zahedi *et al.*, 2020; Brickman, 2018; Olokoba *et al.*, 2015). Type 2 DM patients need this knowledge; patients with high knowledge tend to understand the need to limit carbohydrate intake and get to exercise regularly to control their blood glucose (Ismail *et al.*, 2016; Garcia *et al.*, 2020; Phoosuwan *et al.*, 2022; Elsayed *et al.*, 2023). Based on the research results, pharmacists and other health professional staff need to educate patients with low levels of education to improve patients' level of understanding and to increase patients' knowledge about T2DM disease and blood glucose control.

Conclusion

Based on the study's results, there was a significant relationship between education and knowledge in controlling blood glucose. High knowledge and education may result in blood glucose control. Researchers suggest the collaboration of health service providers with the government and educators to provide more frequent and effective education to increase the knowledge level of T2DM among patients

through counselling by health providers, mass media, public service advertisements or other health media.

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