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Original Research Article

Knowledge, physical activity, and control of type 2 diabetes mellitus at Lansot Primary Health Center Tomohon, Indonesia

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ABSTRACT

Background: It is projected that the global population affected by diabetes mellitus will reach 783.2 million by the year 2045. In Indonesia, there is an anticipated rise of 28.6 million cases of diabetes in the same year. Lansot Primary Health Center has observed a consistent uptick in the prevalence of type 2 diabetes mellitus from 2019 to 2022. The objective was to know the relationship between knowledge level, physical activity, and the control of type 2 diabetes mellitus at Lansot Primary Health Center in Tomohon City.
Methods: The study, conducted from March to June 2023 at Lansot Primary Health Center in Tomohon City, Indonesia, used a cross-sectional design and analytical observational techniques. The population were 453 type 2 diabetes patients, and 100 respondents were selected through purposive sampling technique. Variables of interest were knowledge, physical activity, and type 2 diabetes control. Data underwent univariate and bivariate analysis, utilizing a questionnaire as the research instrument. Analysis was performed using SPSS version 29, employing the Chi-Square test.
Results: Knowledge among type 2 diabetes patients was sufficient, with moderate physical activity, but suboptimal diabetes control. There was a correlation between knowledge and physical activity with the control of type 2 diabetes, with p value 0.038 and 0.003 respectively.
Conclusions: The relationship between knowledge, physical activity, and the control of type 2 diabetes is important. Communities need better information and should engage in regular physical activity. Future studies may explore diverse locations and study designs.

Keywords: Control DMT2, Knowledge, Physical activity

INTRODUCTION

In Indonesia, the leading cause of fatalities is attributed to non-communicable diseases. This health issue remains a significant focal point, while the occurrence and fatality rates related to non-communicable diseases persist in their ascent. Diabetes mellitus stands as a prominent non-communicable disease afflicting a substantial number of individuals in contemporary society. According to data from the World Health Organization (WHO), diabetes mellitus alone accounted for 1.5 million deaths in the year 2019. What's of concern is that 48% of these fatalities transpired before reaching the age of 70.[1]

Drawing from the data furnished by the International Diabetes Federation (IDF), it is anticipated that the worldwide populace grappling with diabetes mellitus will reach an astounding 783.2 million by the year 2045. Within Indonesia, the count of adults aged 20-79 afflicted with diabetes mellitus is forecasted to surge by 28.6 million within the same timeframe. This constitutes a significant uptick of 47%, as compared to the 19.5 million documented cases in the year 2021. On a global scale,

Indonesia secures the fifth position among nations with the highest prevalence of diabetes mellitus patients, trailing behind China, India, Pakistan, and the United States.[2]

As per data from the National Basic Health Research (Riskesdas), approximately 2% of the population has been diagnosed with diabetes mellitus. Notably, there has been a 1.5% surge in the prevalence of diabetes mellitus among individuals aged 15 years and older. When considering the provinces, five regions within Indonesia display a notably elevated prevalence of diabetes mellitus. Among these, North Sulawesi ranks fourth with a prevalence rate of 2.3%.[3] The prevalence of diabetes mellitus tends to escalate with advancing age, and a significant upswing is evident within the 55 to 64 year-old category. Within this specific age bracket, the prevalence surges from 3.88% in the 45-54-year-old group to 6.29.[4]

The prevalence of diabetes mellitus in North Sulawesi Province is established by considering doctors' diagnoses across all age groups within each district and city. Among the cities within this province, Manado City has the highest prevalence of diabetes mellitus at 3.45%. On the other hand, the city of Tomohon is the fourth highest position in North Sulawesi province, with prevalence rate of 2.91%.[3] Derived from an initial study carried out at the Lansot Primary Health Center in January 2023, it has been consistently observed that diabetes mellitus ranks among the ten most prevalent diseases from the years 2019 to 2022.[5] This study underscores the continuous upward trajectory in the occurrence of diabetes mellitus within the jurisdiction of the Lansot Primary Health Center throughout year 2019 to 2022.

In 2022, Lansot Primary Health Center reported a cumulative count of 453 new cases of diabetes mellitus. Among the different classifications of diabetes mellitus, type 2 diabetes mellitus stands out as the predominant form, constituting a staggering 95% of all cases. This specific variant of diabetes mellitus is notably prevalent within the demographic of individuals aged 45 years and above. It is noteworthy that this age group, ranging from 45 to 64 years old, aligns with the age range ascertained in data from the ministry of health, indicating heightened vulnerability to the onset of diabetes mellitus.[3]

The escalation in the number of individuals with diabetes mellitus can be attributed to inadequate management of blood sugar levels. When left unaddressed, this condition can result in persistent hyperglycemia, presenting substantial health hazards and potentially giving rise to severe complications.[6] These complications encompass a spectrum of issues spanning both macrovascular and microvascular domains, including peripheral vascular disease, nerve impairment, cardiovascular ailments, stroke, kidney dysfunction, diabetic retinopathy, and even the potential for blindness.[7] Previous research found that resident living with diabetes mellitus in the Lanjas subdistrict, highlights that the absence of a healthy lifestyle also poses a significant health challenge for those with diabetes mellitus. Factors such as insufficient physical activity, irregular blood sugar monitoring, and an unhealthy diet are identified as contributing elements to this issue.[8]

It is crucial for individuals who have diabetes to meticulously manage their blood sugar levels as a means to prevent or alleviate potentialcomplications.[7] Attaining effective diabetes control is intricately linked to the foundational aspects of diabetes management, which encompass diabetes education, dietary choices, engagement in physical activity, and the formulation of a suitable treatment regimen.[9] Insufficient diabetes knowledge is influenced by several factors, including educational attainment, occupation, income, and accessibility to public health information. A higher level of education generally corresponds to increased access to diverse information concerning diabetes.[10] Nevertheless, it's important to clarify that a lower level of education doesn't necessarily equate to a lower level of knowledge.[11] Lack of physical activity is one of the leading causes of death in non-communicable diseases such as diabetes.[12] Physical activity and history of diabetes also influence the incidence of diabetes.[13] Physical activity is how people with type 2 diabetes regulate and control blood sugar levels.[14]

METHODS

An analytical observation using a cross-sectional design was conducted at Lansot Primary Health Center, Tomohon, Indonesia, from March to June 2023. The population of the study were type 2 diabetes mellitus cases at Lansot Primary Health Center. Sample size was calculated with Lemeshow formula, and then the sample were selected through purposive sampling technique.[15]

Inclusion criteria

The inclusion criteria were patients diagnosed with type 2 diabetes mellitus at Lansot Primary Health Center, aged between 45-64 years, residing within Lansot Primary Health Center's catchment area, and willing to participate by providing informed consent.

Exclusion criteria

Exclusion criteria were patients with communication difficulties, those undergoing insulin therapy, and individuals experiencing cognitive impairment (dementia).

The sample size for this study was 100 respondents.

The study used questionnaires as the research instrument for evaluating the variables. Level of knowledge was evaluated using the diabetes knowledge questionnaire (DKQ)-24, which classifies comprehension as poor

(<56%), enough (56-75%), and good (76-100%) according to measurement outcomes.[16-18] Physical activity levels were assessed using the international physical activity questionnaire-short form (IPAQ-SF), which categorizes activity intensity as intense (>1500 MET-minutes/week), moderate (≥600-1500 MET-minutes/week), or light (<600 MET-minutes/week) based on the measurements obtained.[19] The control of type 2 diabetes mellitus management was conducted through the diabetes self management questionnaire-revised (DSMQ-R), which determines control levels as good (76%-100%) and poor (<76%) according to the measurement outcomes..[16,20]

The research employed univariate analysis to describe each variable of interest and bivariate analysis to examine the relationship between the level of knowledge and physical activity with control of type 2 diabetes mellitus. Data analysis was conducted using SPSS software version 29.0.

RESULTS

Univariate analysis

Respondents in the age group of 45-54 years were 32 respondents (32%) and respondents in the age group 55-64 years were 68 respondents (68%) (Table 1).

Table 1: Distribution respondents based on age.

Age (years)	N	%
45-54	32	32.0
55-64	68	68.0
Total	100	100.0

Table 2: Distribution of respondents based on gender.

Gender	N	%
Male	39	39.0
Female	61	61.0
Total	100	100.0

The breakdown of participants by gender indicated that there were more female respondents than male respondents (Table 2).

Table 3: Distribution based on work.

Work	N	%
Farmer	21	21.0
Civil servant	12	12.0
Housewife	38	38.0
Entrepreneur	14	14.0
Retired	15	15.0
Total	100	100.0

In Table 3, the most frequently performed jobs by respondents were housewives (38%), then followed by farmers (21%), retirees (15%), entrepreneurs (14%), and civil servants (12%) (Table 3).

Table 4: Distribution of respondents based on level of education.

Study	N	%
Primary school	10	10.0
Junior high school	28	28.0
High school	40	40.0
Degree/bachelor	22	22.0
Total	100	100.0

The study found that most respondents were high school graduates (40%), then followed by junior high school graduates (28%), degree/bachelor (22%), and the least was primary school graduates (10%) (Table 4).

Table 5: Distribution of knowledge about diabetes mellitus type 2.

Knowledge of diabetes mellitus type 2	N	%
Good	16	16.0
Enough	51	51.0
Poor	33	33.0
Total	100	100.0

Based on the three categories of knowledge, 16 respondents (16%) had good knowledge, 51 respondents (51%) had enough knowledge and 33 respondents (33%) had poor knowledge (Table 5).

Table 6: Distribution of physical activity level.

Physical activity	N	%
High	36	36.0
Moderate	43	43.0
Low	21	21.0
Total	100	100.0

Distribution of physical activity in Table 6, shows that there were 36 (36%) respondents with high physical activity, 43 respondents (43%) with moderate level, and 21 respondents (21%) with low (Table 6).

Table 7: Distribution of control of type 2 diabetes mellitus.

Control of type 2 diabetes mellitus	N	%
Good	44	44.0
Poor	56	56.0
Total	100	100.0

Table 7, shows that out of 100 respondents, 56 respondents (56%) had poor type 2 diabetes mellitus

control and 44 respondents (46%) had good control (Table 7).

Bivariate analysis

In Table 8, respondents with good knowledge and good diabetes control were 11 (11%), while those with good knowledge but poor control were 5 (5%). Good knowledge and good control were found in 23 respondents (23%), but 28 respondents (28%) with sufficient knowledge showed poor diabetes control. Limited knowledge with good control was seen in 10 respondents (10%), and 23 (23%) had poor knowledge with inadequate diabetes control. The Chi-Square test yielded a significant p value of 0.038 (<α=0.05), indicating a relationship between knowledge level and type 2 diabetes control at the Lansot Primary Health Center in Tomohon (Table 8).

Table 8: Relationship between knowledge level and type 2 diabetes mellitus control.

Level knowledge	Control of type 2 diabetes mellitus				Total		P value
	Good		Poor				
	N	%	N	%	N	%	
Good	11	11.0	5	5.0	16	16.0	0.038
Enough	23	23.0	28	28.0	51	51.0	
Poor	10	10.0	23	23.0	33	33.0	
Total	100	100.0	100	100.0	100	100.0	

Table 9: Relationship between physical activity and type 2 diabetes mellitus control.

Physical activity	Control of type 2 diabetes mellitus				Total		P value
	Good		Poor				
	N	%	N	%	N	%	
High	24	24.0	12	12.0	36	36.0	0.003
Moderate	14	14.0	29	29.0	43	43.0	
Low	6	6.0	15	15.0	21	21.0	
Total	100	100.0	100	100.0	100	100.0	

In Table 9, high physical activity was associated with good control for 24 respondents (24%) and poor control for 36 respondents (36%). Moderate physical activity showed good control for 14 respondents (14%) and poor control for 29 respondents (29%). Low physical activity correlated with good control for 6 respondents (6%) and poor control for 15 respondents (15%). The chi-square test revealed a significant relationship between physical activity and type 2 diabetes control at the Lansot Primary Health Center in Tomohon, indicated by a p value of 0.003 (<α=0.05) (Table 9).

DISCUSSION

This study involved 100 respondents between the ages of 45 and 64 years. The aim is to identify the prevalence of diabetes mellitus in this age group. Distribution of age groups based on the Republic of Indonesia in late adulthood a range of age 45-54 years and early elderly with an age range of 55-64 years.[3] This is following the basic health research data which shows a high prevalence of diabetes mellitus in this age group. The findings indicated that the majority of those suffering with type 2 diabetes were between the group age of 55-64 years with an average age of 57 years.[21] In that study also stated that the majority of individuals with type 2 diabetes in developing countries were in the age range of 45-64 years. These findings are consistent with existing theory and knowledge regarding diabetes mellitus prevalence and general features in this age group.

The results of this study shows more female (61%) than male (39%) respondents. Females were also more susceptible to type 2 diabetes mellitus than males.[22,23] Research shows that there are more females than males. The concept of sex is used to differentiate males and females based on existing biological and anatomical factors.[24] Females are more at risk of experiencing weight gain and obesity. In 2013, the proportion of overweight females increased to 38% compared to 37% for males. Females have a higher risk of weight gain and obesity, especially after the age of 45. One of the contributing factors is the problem of obesity due to the lack of physical activity in females.[22] This leads to overproduction of insulin and insulin resistance, which can eventually lead to type 2 diabetes mellitus. These findings support the existing theory.

The most common occupation of the respondents was homemakers with 38 respondents (38%) and the most uncommon was government employees with 12 respondents (12%). Type of work affects the risk of developing type 2 diabetes mellitus. Work with low physical activity can cause a lack of burning energy which can lead to weight gain. In this condition, the glucose level in the blood becomes too high and there is a great risk of developing type 2 diabetes mellitus.

Treatment for type 2 diabetes mellitus can be done in several ways, such as managing a healthy diet with exercise, controlling blood sugar levels regularly, and avoiding excessive stress.[25]

The majority of respondents were high school graduates (40%) and education with the lowest frequency was primary school graduates (10%). Knowledge is a person's attitude related to an object at different levels, it can be said that the higher a person's education level, the better the knowledge that person has.[26] Other research also shows that there is a relationship between education and diabetes mellitus.[27] The study findings indicate a positive correlation between higher education and good knowledge about diabetes mellitus. As education level increases, there is an increased likelihood of accessing diverse information related to diabetes mellitus.[10]

In this study, the majority of the respondents had adequate knowledge about diabetes mellitus, specifically 51%. Sufficient knowledge about diabetes mellitus enables the implementation of appropriate measures in preventing and managing the associated complications. Knowledge is acquired through observing objects using the senses such as vision, audition, scent, taste, and tactile perception. The level of individual comprehension of these objects varies.[26] Accessible information and support from healthcare professionals contribute to the enhancement of knowledge about diabetes mellitus in the community.[28]

The findings revealed that most respondents with type 2 diabetes mellitus had a moderate level of physical activity, specifically 43 respondents (43%). Physical activity is one of the primary factors in managing type 2 diabetes mellitus. Physical activity pertains to bodily movements that involve the contraction of skeletal muscles and the burning of calories.[29] The level of physical activity can vary among individuals depending on their lifestyle and other factors. Physical engagement encompasses work, sleep, and recreation, including planned and structured exercise. Insufficient physical activity can lead to an increase in body fat, weight gain, and type 2 diabetes mellitus risk. Excess fat in the body can be converted into glucose, resulting in an 8.333 times higher risk of developing diabetes mellitus for individuals who are obese.[30]

Most of the respondents still lack control over type 2 diabetes mellitus, specifically 56 respondents (56%). This is primarily due to insufficient physical activity (47%) and uncontrolled eating habits (63.3%). Insufficient physical activity and uncontrolled eating habits are common obstacles in achieving control over type 2 diabetes mellitus. Adhering to dietary recommendations and engaging in type 2 diabetes mellitus can be much better controlled with the use of proper physical activity. Effective control of diabetes mellitus necessitates active management and regulation by individuals, with the goal of achieving optimal blood glucose levels. This entails various aspects such as dietary adjustments, physical activity, monitoring of blood sugar levels, adherence to medication, and regular consultations with healthcare professionals. By effectively controlling diabetes mellitus, individuals can reduce the risk of complications and maintain their overall health.[31]

Research outcomes were deemed significant when the p value was <0.05. In this study, the chi-square test yielded a p value of 0.038, indicating a value <0.05. This suggests a strong association between the knowledge level variable and the control of type 2 diabetes mellitus among type 2 diabetes patients at Lansot Primary Health Center in Tomohon. The results underscore the impact of knowledge on the control of type 2 diabetes mellitus.

Other studies also found a positive relationship with a correlation coefficient of 0.326 between knowledge and self-management in type 2 diabetes mellitus patients, p value 0.013 <α (0.05) which means between expertise in type 2 self-management for diabetes mellitus patients.[32] Other research showed the degree of knowledge and patients' ability to control themselves are related. with diabetes mellitus. The statistical results show strong significance with a p value of 0.000 and a correlation coefficient of 0.799, also shows a significant relationship with a p value of 0.000 confirms that to what extent knowledge affects the control of diabetes mellitus.[25,26,33] The overall results of this study indicate that good knowledge plays an important role in effective self-management of diabetes mellitus. Confirms that the level of knowledge affects the control of diabetes mellitus. Adequate knowledge enables patients to take appropriate actions in managing diabetes mellitus, including in terms of diet, use of drugs, and a healthy lifestyle.[34] The importance of the level of knowledge in controlling diabetes mellitus. the greater one's level of knowledge of diabetes mellitus, the better the control of this condition. Good knowledge provides an in-depth understanding of the disease, risk factors, and effective management strategies. Increasing the amount of knowledge among people with type 2 diabetes is important to improve control of their condition and quality of life.[35]

Physical activity contributes significantly to maintaining health and managing blood glucose levels, especially in individuals with diabetes mellitus. Lack of exercise is a risk factor for chronic disease and can have serious health impacts. Emphasizes the importance of physical activity by increasing muscle glucose recovery and helping to improve blood glucose control.[36]

The findings of the research involving 100 participants revealed that participants with high levels of effective type 2 diabetes control and physical exercise were 24 participants (24%), while participants with low levels of physical activity and poor control of type 2 diabetes were 15 participants (15%). Chi-square analysis yielded a significant p-value of 0.003, highlighting the strong link between physical activity variables and type 2 diabetes control at Lansot Primary Health Center in Tomohon City. The significance of physical activity in controlling

blood sugar levels includes increasing how well muscles use glucose to lower blood sugar levels, decreasing insulin resistance, and improving insulin sensitivity.[37] Additionally, physical activity also positively impacts heart health, physical fitness, and weight management. It is important for people with type 2 diabetes to do physical activity regularly, about 3-4 times a week, with a duration of about 30 minutes, and follow the principles of CRIPE (continuous, rhythmical, interval, progressive, endurance training).[38] It is important to achieve 75-85% of maximal heart rate during exercise. This factor becomes crucial especially when the patient does physical exercise when insulin has reached its maximum level. By setting the right time for physical exercise, patients can improve their glucose control.[36] Therefore, physical activity is an important component in managing diabetes mellitus and controlling blood glucose.

The consistent practice of physical exercise is linked to a 45-70% decrease in mortality rates among individuals with type 2 diabetes mellitus. Additionally, it helps to reduce HbA1c levels to a point where complications are prevented. Engaging in a minimum of 150 minutes per week of both aerobic and strength training exercises can contribute to a decrease in HbA1c levels in individuals with type 2 diabetes mellitus.[39]

Based on the findings of this research, it can be argued that having a sufficient level of knowledge and engaging in physical activity are vital for controlling, treating, and preventing type 2 diabetes mellitus. This research demonstrates the significance of having a sufficient level of knowledge and engaging in physical activity when it comes to controlling, treating, and preventing type 2 diabetes mellitus.

The limitations of this study includes using a purposive sampling method and the lower representation of men. Generalization should be done with caution. The nature of the cross-sectional design also limits the potential to ascertain the causal relationship with the determinants.

CONCLUSION

There is a notable correlation between the level of knowledge and the control of type 2 diabetes mellitus at Lansot Primary Health Center, Tomohon. Similarly, there is a significant association between physical exercise and the control of type 2 diabetes mellitus at Lansot Primary Health Center, Tomohon.

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