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The Relationship Between Eating Patterns and Blood Sugar Levels in Type 2 Diabetes Mellitus Patients in the Working Area of Amurang Barat Public Health Center, South Minahasa Regency

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Abstract

Diabetes mellitus is a prevalent chronic metabolic disorder marked by elevated blood glucose levels due to prolonged glucose intolerance. This condition is often linked to severe complications, including cardiovascular issues, nerve damage, and kidney dysfunction. In Indonesia, the incidence of type 2 diabetes continues to grow, reaching 8.6% of the total population, making it a significant public health concern. Dietary habits play a vital role in managing type 2 diabetes, as excessive consumption of fat, salt, and sugar can exacerbate the condition. This study aimed to examine the relationship between dietary behavior and blood glucose levels among patients with type 2 diabetes in the Amurang Barat Health Center area. A cross-sectional survey design was employed, involving 78 individuals diagnosed with type 2 diabetes. Data collection included demographic information, knowledge of healthy eating, and attitudes and practices related to diet management. The analysis revealed that although most participants demonstrated good knowledge regarding healthy diets, this was not consistently reflected in their daily practices. The Spearman's rho correlation test showed a significant relationship between knowledge, attitude, dietary practices, and blood sugar levels ($p = 0.001$; $p < 0.05$), highlighting the importance of consistent implementation of healthy dietary habits in effective diabetes management.

Keywords: Diet, Diabetes Mellitus, Blood Sugar Levels

Abstrak (Indonesian)

Diabetes melitus merupakan salah satu gangguan metabolik kronis yang paling umum, ditandai dengan kadar gula darah tinggi akibat intoleransi glukosa jangka panjang. Penyakit ini kerap menimbulkan komplikasi serius seperti gangguan jantung, kerusakan saraf, dan penurunan fungsi ginjal. Di Indonesia, prevalensi diabetes melitus, khususnya tipe 2, terus meningkat hingga mencapai 8,6% dari total populasi, menjadikannya masalah kesehatan masyarakat yang semakin mengkhawatirkan. Pola makan memiliki peran penting dalam pengendalian diabetes tipe 2, di mana konsumsi makanan tidak seimbang terutama tinggi lemak, garam, dan gula dapat memperburuk kondisi pasien. Penelitian ini bertujuan untuk menganalisis hubungan antara pola makan dan kadar gula darah pada penderita diabetes tipe 2 di wilayah kerja Puskesmas Amurang Barat. Metode yang digunakan adalah survei potong lintang dengan melibatkan 78 responden yang telah terdiagnosis diabetes tipe 2. Data yang dikumpulkan mencakup karakteristik demografi, pengetahuan tentang pola makan sehat, serta sikap dan perilaku dalam pengelolaan diet. Hasil analisis menunjukkan bahwa meskipun pengetahuan responden tergolong baik, penerapannya dalam kebiasaan sehari-hari belum konsisten. Uji statistik Spearman's rho menunjukkan adanya hubungan signifikan antara pengetahuan, sikap, dan tindakan dengan kadar gula darah (p = 0,001), menekankan pentingnya konsistensi dalam menjalankan pola makan sehat..

Kata Kunci: Diet, Diabetes Mellitus, Blood Sugar Levels

INTRODUCTION

Diabetes mellitus is when blood sugar levels are higher than usual and tend to be high (>200 mg/dl), or it can be defined as a metabolic disorder characterized by glucose intolerance. The disease occurs when the patient's body can no longer take sugar (glucose) into the cells and use it as energy. As a result, there is a buildup of excess sugar in the bloodstream. If diabetes is not well controlled, it can cause damage to various organs and tissues of the body, such as visual impairment or cataracts (retinopathy), visual impairment or cataracts. (retinopathy), impaired kidney function (nephropathy), nerve disorders (neuropathy), foot wounds and amputations, heart disease and stroke, and even death (Vorvick, 2019). Diabetes Mellitus is also a chronic or terminal disease, which means that this disease cannot be cured but can be controlled by keeping blood sugar levels within the normal range.

Indonesia ranks 4th in Diabetes Mellitus cases, with a prevalence of 8.6% of the total population. Every year, there are 3.2 million deaths directly caused by Diabetes Mellitus. According to WHO, the ten countries with the highest number of diabetes mellitus are India, China, the United States, Indonesia, Japan, Pakistan, Russia, Brazil, Italy, and Bangladesh. The high prevalence in Indonesia demonstrates the importance of nationwide diabetes prevention and management efforts, including promoting healthy lifestyles, education on a balanced diet, and improved access to quality medical care (Megawati, 2023).

Diabetes mellitus is one of the 'silent killers' because in the early stages, it often shows no symptoms. In DM patients, hyperglycemia conditions can further cause various complications, so it is necessary to control blood glucose levels as a preventive measure. Controlling blood glucose levels can be done through pharmacological therapy (using drugs) or non-pharmacological therapy. Research shows that non-pharmacological therapy through dietary regulation effectively controls blood glucose levels, lipid profiles, and blood pressure in patients with DM. Dietary management strategies that can help control blood glucose levels include choosing healthy and balanced food consumption to control blood sugar levels (Ministry of Health, 2024).

According to data from the North Sulawesi Health Office, in 2022, there were 13,981 cases of diabetes mellitus, an increase from 6,804 cases in 2020. Therefore, it is essential to routinely check blood sugar levels to identify, detect early, and prevent diabetes mellitus. South Minahasa District Health Office said that the number of cases of diabetes mellitus that received services in South Minahasa Regency experienced a significant jump from 779 cases in 2020 to 5599 cases in 2023. In the Amurang sub-district West itself, the number of DM sufferers from the results of posbindu screening in each village is relatively high, namely 343 sufferers.

Modern lifestyles have become part of people's secondary needs. Especially in terms of choosing food, diet becomes one of the factors causing diabetes mellitus. The human diet in modern times now prioritizes practicality and ignores the health side, for example, foods that contain high fat, lots of salt, and high sugar. This is one of the causes of the increase in degenerative diseases, one of which is diabetes mellitus (Yuantari, 2022). Susanti and Difran Nobel Bistara (2018) stated that diet is food consumption that includes various types of food, the amount consumed, and the eating schedule a person follows. An irregular diet, according to them, can trigger an increased risk of degenerative diseases such as Type II Diabetes Mellitus. The leading cause of Type II DM is an unhealthy lifestyle and diet (Febrinasari, R. P., et al, 2020). One of the recommended methods of regulating eating (diet) for people with DM is the application of the 3J diet. The 3J diet emphasizes the importance of regularity regarding the amount of food consumed, the type of food chosen, and a regular eating schedule (PERKENI, 2019).

A proper diet plays a vital role in an individual's health. By following a regular diet, one can avoid the increased risk of degenerative diseases such as Type II Diabetes Mellitus. This disease, which is heavily influenced by unhealthy lifestyles and eating habits, can be prevented by

implementing a better diet. Research by Febrinasari, R. P., et al (2020) showed that one of the effective ways to manage DM is by regulating diet through the 3J method, which emphasizes the amount, type, and schedule of meals. PERKENI (2019) also supports this approach, highlighting the importance of consistency and regularity in managing diet for people with DM. This study examines the relationship between diet and blood sugar levels of patients with type 2 diabetes mellitus

METHODS

The research design used in this study was quantitative with a cross-sectional approach. This design was chosen to simultaneously measure the independent and dependent variables, allowing researchers to identify the relationship between diet and blood sugar levels in patients with type 2 diabetes mellitus in the West Amurang Health Center working area. This approach is considered appropriate because it allows the collection of data that can be used for more in-depth statistical analysis. The population in this study was all patients with type 2 diabetes mellitus in the West Amurang Health Center working area, consisting of 343 patients. The sample of this study was taken using a purposive sampling technique, where the respondents were selected based on the predetermined inclusion criteria, namely type 2 diabetes mellitus patients aged 40 years and over, who were willing to participate in the study.

Research. Based on calculations with the Slovin formula, a sample of 78 respondents was obtained with a *margin of error of* 10%. The research instrument consisted of a questionnaire used to measure knowledge, attitudes, and actions related to diet in patients with type 2 diabetes mellitus. This questionnaire has been tested for validity and reliability and is suitable for data collection. In addition, a glucometer was used to measure the respondents' blood sugar levels. A glucometer is considered adequate because it provides fast and accurate results.

Data collection was conducted in several stages. The first stage was a pretest, where researchers measured blood sugar levels and collected data on respondents' knowledge, attitudes, and actions before the intervention. The second stage was the intervention, where researchers provided the treatment group education on healthy eating patterns, while the control group did not receive the intervention. The last stage is *posttest*, where researchers again measure blood sugar levels and collect data after the intervention to assess changes that occur.

The collected data were processed through *editing*, *coding*, *entry*, and *cleaning* to ensure the data used in the analysis was error-free. Data analysis was conducted using univariate analysis to describe the characteristics of respondents and the variables studied, and bivariate analysis using the Spearman correlation test to test the relationship between diet and blood sugar levels. The Spearman test was chosen because the data were not normally distributed.

This research was carried out by complying with applicable research ethical principles, ensuring that all stages of the study were carried out with respect for the rights and privacy of respondents. Before data collection, the researcher took care of research permits from relevant agencies and obtained ethical approval from the Health Research Ethics Committee of the Poltekkes Kemenkes Manado.

RESULTS AND DISCUSSION

A. RESULTS

This study involved 78 respondents, consisting of patients with type 2 diabetes mellitus in the working area of Amurang Barat Health Center. Identification of respondent characteristics based on age showed that the largest age group was 50-59 with a percentage of 45%, followed by the age group 60-69 years old by 30%, and the age group 40-49 years old by 25%. 40-49 years old by 25%. Most respondents were female (55%), while the rest were male (45%).

Respondents' knowledge about healthy eating patterns showed significant variations. As many as 30% of respondents had good knowledge, 50% had sufficient knowledge, and 20% had poor knowledge. Attitudes towards healthy eating were also well distributed, with 60% of respondents showing a positive

attitude. However, only 40% of respondents consistently implemented healthy eating daily.

Measurement of blood sugar levels showed that 35% of respondents had blood sugar levels above 200 mg/dL, indicating poor blood sugar control. In contrast, 65% of respondents had blood sugar levels between 126-200 mg/dL, indicating better blood sugar control, although still within the range that requires attention.

Table 1. Analysis of Dietary Knowledge with Blood Sugar Levels of Patients with Type 2 Diabetes Mellitus.

Variable	Correlation Coefficient	Sig.
Dietary Knowledge Blood Sugar Level	0.382	0.001

The bivariate analysis showed a significant relationship between dietary knowledge and blood sugar levels ($r = -0.382$, $p < 0.05$). Respondents with better knowledge about healthy eating patterns tend to have more controlled blood sugar levels.

This confirms the importance of comprehensive education on healthy eating patterns in diabetes control efforts.

Table 2. Analysis of Dietary Attitudes with Blood Sugar Levels of Patients with Type 2 Diabetes Mellitus.

Variable	Correlation Coefficient	Sig.
Dietary Knowledge Blood Sugar Levels	0.362	0.001

Bivariate analysis showed a significant relationship between dietary attitudes and blood sugar levels ($r = -0{,}362$, $p < 0{,}05$). Respondents with a positive attitude towards a healthy diet tended to have better blood sugar control than those with a neutral or unfavorable attitude.

These positive attitudes included a willingness to reduce consumption of foods high in sugar, adjusting diet according to medical recommendations, and choosing healthier foods.

Table 3. Analysis of Dietary Measures with Blood Sugar Levels of Patients with Type 2 Diabetes Mellitus.

Variable	Correlation Coefficient	Sig.
Dietary Action Blood Sugar Levels	0.353	0.002

The bivariate analysis showed a significant relationship between dietary actions and blood sugar levels ($r = -0.353$, $p < 0.05$). This means that the better the respondents' actions in implementing a healthy diet, the more controlled their blood sugar levels. Nevertheless, implementing a healthy diet still requires further support so that good actions can be more consistent and sustainable in the long term.

DISCUSSION

Blood sugar level is the amount of glucose in the blood at a particular time. Glucose is the body's primary energy source, and the hormone insulin regulates blood glucose levels. Generally, normal blood sugar levels range from 70-100 mg/dL when fasting, and less than 140 mg/dL two hours after eating.

Based on the research data, most respondents in the West Amurang Health Center working area have normal blood sugar levels. 84.62% of the respondents had blood sugar levels greater than or equal to 200 mg/dL. This shows the high prevalence of high blood sugar levels among respondents, which indicates a significant risk of diabetes mellitus, such as extreme fatigue, blurred vision, and frequent urination, for short-term hazards. In addition, the long-term dangers of high and uncontrolled blood sugar levels can cause atherosclerosis which increases the risk of heart attack and stroke, nerve damage that often occurs in the feet and hands, damage to the kidneys that can lead to kidney failure, cause blindness, and have a higher risk of infection so that wound healing is slow, which can lead to amputation. In contrast, only 12 respondents, or around 15.38% had blood sugar levels below 200 mg/dL, which is considered closer to the normal range. These findings indeed indicate the importance of health interventions, such as emphasizing the importance of diabetes management through regular monitoring of blood sugar levels and healthy lifestyle modifications. People with diabetes should be aware of the dangers that can occur due to high blood sugar levels. They should strive to maintain blood sugar levels within normal limits to reduce further risks associated with diabetes mellitus in the West Amurang Health Center working area.

The results of research on behavior and knowledge showed

That there is a significant relationship between dietary knowledge and blood sugar levels in patients with type 2 diabetes mellitus in the West Amurang Health Center working area (p = 0.001 <0.05) with a correlation coefficient of 0.382. Knowledge is the understanding or information that a person has about a subject. In this context, knowledge includes understanding diabetes, diet, and monitoring blood sugar levels. Knowledge can be measured through questionnaires that cover various aspects. Factors affecting knowledge, namely the level of formal education, affect an individual's ability to understand health information and access information through medical personnel, literature, the internet, and social media. Personal or family experience with diabetes also affects knowledge. The results of this study align with the results of research conducted by Muhasidah et al. (2017), which says that there is a significant relationship between the level of dietary knowledge and blood sugar levels of patients with diabetes mellitus. Researchers say that the level of knowledge can affect a person's diet, so a lack of knowledge will make a person's diet less healthy and can affect blood sugar levels in the body.

The behavior and attitude research results show a significant relationship between dietary attitudes and blood sugar levels (p = 0.001 <0.05) with a correlation coefficient of 0.362. In this study, a positive attitude towards a healthy diet cancontribute to better control of blood sugar levels. Respondents with a positive attitude tend to be more consistent in implementing a healthy and balanced diet. A good attitude reflects strong motivation and commitment in implementing the behavioral changes needed to manage diabetes effectively. In contrast, the attitudes that occurred during the study were that respondents tended to have less motivation and awareness to control sugar levels and ignored setting a pattern for their diet. Hence, the respondents' blood sugar levels increased above normal limits. This is in line with the results of Mia Nurul Fauziah's research. (2020) related to the description of the attitude of patients who not care about recommendations eating recommendations for people with DM can increase levels sugar levels blood sugar levels besides in addition to the lack of motivation patient diabetes mellitus with compliance run program diet because of the lack of information obtained, the lack of awareness and motivation in managing the disease suffered by the patient itself which can cause blood sugar levels to increase.

The results of behavior and action research show that.

A significant relationship exists between dietary actions and blood sugar levels (p = 0.002 <0.05) with a correlation coefficient 0.353. This finding shows that the respondents' dietary actions are influenced by lifestyle, eating habits and regional culture which are more concerned with delicious and satisfying food than regulating diet, such as reducing sugar and carbohydrate intake, increasing fiber

consumption, and monitoring calorie intake, this has a significant effect on controlling blood sugar levels in patients with type 2 diabetes mellitus. Consistent and appropriate implementation of actions in dietary management is the key to effective diabetes control. This aligns with previous studies that found a strong relationship between diet and blood sugar levels. Suppose the diet is not as good as recommended by the 3J principle. In that case, there will be instability in blood sugar levels, so it is essential to manage dietary intake in people with diabetes to control blood sugar levels. Hence, they remain controlled (Susanti and Nobel, 2018). Action or practice refers to applying theory in a real context to achieve specific goals. Practice manifests attitudes that have not fully manifested in overt behavior. Supportive conditions are needed to change attitudes into actions, such as facilities and support from the surrounding environment, such as family or coworkers (Notoatmodjo, 2010; Prawita, 2018).

The results of this study show the importance of health promotion in this case, which is related to the diet of patients with type 2 diabetes mellitus. Puskesmas Amurang Barat can use these findings to develop education and intervention programs that target the knowledge, attitudes, and dietary actions of people with diabetes. These programs could include counseling, workshops, and individual counseling on the importance of dietary management in controlling blood sugar levels. In addition, developing educational materials appropriate to the respondents' education level and demographic characteristics may increase the intervention's effectiveness.

CONCLUSION

Based on the results and discussion of the research on the relationship between diet and blood sugar levels in patients with Type 2 Diabetes Mellitus in the Amurang Barat Health Center working area, it can be concluded that most respondents were female and most were over 60 years old. The respondents' education level is mainly at the high school/vocational school level, with the majority working as housewives. Although the respondents' knowledge about healthy eating patterns for type 2 diabetes mellitus patients is quite good, their attitudes and actions in following healthy eating recommendations are still less than optimal. Most respondents realized the importance of a healthy diet recommended by doctors, but still had difficulty in taking action to control blood sugar levels effectively. There is a significant relationship between knowledge, attitudes, and actions related to diet and blood sugar levels, where respondents with good knowledge are more likely to take action to control blood sugar levels. Knowledge, better knowledge, positive attitudes, and actions tend to have better blood sugar control.

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