



The Relationship Between Physical Activity and Nutritional Status and Current Blood Glucose Levels in Diabetes Mellitus Sufferers at RSUP Dr. Wahidin Sudirohusodo Makassar

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Abstract

Diabetes Mellitus is a disease where there is an increase in glucose levels in the blood due to a lack of insulin. This disease is associated with hereditary factors, viruses, chemicals, unhealthy diet or lifestyle, lack of exercise, and being overweight or obese. The aim of this study was to determine the relationship between physical activity and nutritional status with blood glucose levels in diabetes mellitus sufferers at RSUP Dr. Wahidin Sudirohusodo Makassar. Type of non-experimental research with design Cross sectional study. The study population was all diabetes mellitus patients seeking treatment at Dr. Wahidin Sudirohusodo, the sample was 47 respondents who met the criteria. The collection technique uses accidental sampling. Data collection using questionnaires and observation sheets. The data that has been collected is processed and analyzed using computerization with appropriate tests. Data analysis includes univariate analysis and bivariate analysis using the chisquare test. Significance limit = 0.05, H₀ is rejected if $p < 0.05$ and H₀ is accepted if $p > 0.05$. The statistical test results showed a significant relationship between physical activity ($p=0.001 < \alpha 0.05$) and nutritional status ($p=0.001 < \alpha 0.05$) with instantaneous blood glucose levels. So, the more regularly you do physical activity, the more normal your blood glucose levels will be and the better your nutritional status, the more normal your blood glucose levels will be.

Introduction

Changes in lifestyle have an impact on the occurrence of epidemiological transitions which result in disease patterns experiencing a shift, namely infectious diseases that have not been completely treated and then non-communicable diseases emerging and equaling the position of infectious diseases. Like diabetes mellitus which is found in almost every country in the world (Siswati et al., 2022).

Diabetes can attack anyone, young or old, rich or poor, or thin or fat. Diabetes cannot be cured, but it can be prevented (Cox, 2023). Diabetes mellitus or also known as diabetes is caused by metabolic disorders related to the insulin hormone and if not treated properly will result in complications in various body organs such as the eyes, kidneys, heart, leg blood vessels, nerves and others (Mukhtar et al., 2020). With good experience, namely cooperation between patients, families and health workers, it is hoped that chronic complications of DM will be prevented, at least their development will be inhibited (Sanjaya & Mara, 2022).

Diabetes mellitus is defined as a metabolic disease that is included in the blood sugar group that exceeds normal limits or hyperglycemia (more than 120 mg/dl or 120 mg%). Because of this, DM is often called diabetes (Mukhtar et al., 2020).

The increasing prevalence of DM in Indonesia is thought to be related to diet (nutritional status) along with increasing prosperity, this is reflected in Indonesia's income in 1995 as high as US \$ 1030. Diet patterns are shifting from traditional diets which contain lots of

carbohydrates, fiber and vegetables. to a westernized diet with a composition that contains too much protein, fat, sugar, salt and little fiber (Indrahadi et al., 2021). Diabetes mellitus It is a disease that cannot be cured, especially with changes in diet, including poor diet (Awuchi et al., 2020). A good diet is a diet that is adjusted to the client's calorie needs but does not increase blood glucose levels.

Apart from diet, a very busy lifestyle, sitting behind a desk means there is no opportunity for recreation or exercise so that the prevalence of diabetes mellitus sufferers has increased (Blair et al., 2020). In principle, exercise for diabetics is no different from that for healthy people. Exercise can burn the body's calories, so that blood glucose can be used for energy and sugar levels can decrease (Inchauspé, 2022). So, it is certain that people who are lazy about doing physical exercise are also susceptible to this disease, but with good care, every sufferer can live a normal life (Baloh, 2022).

Effective methods applied to diabetes mellitus sufferers to avoid complications are diligent activity or exercise, plus meal planning (in this case improving nutritional status), as well as controlling blood sugar levels regularly, therapy (if necessary) and health education on complications (Sugandh et al., 2023). Although patient compliance with nutritional principles and meal planning is one of the obstacles to diabetes services, nutritional therapy is the main component of successful diabetes management (Baryakova et al., 2023).

According to a survey conducted by the World Health Organization (WHO), the number of diabetes mellitus sufferers in Indonesia in 2000 was 8.4 million people, this number ranks 4th largest in the world, while the number above is India (31.7 million), China (20.8 million), and the United States (17.7 million) Nuari et al. (2022). It is estimated that the number of diabetes mellitus sufferers will increase in 2030, namely India (79.4 million), China (42.3 million), the United States (30.3 million) and Indonesia (21.3 million). According Awad et al. (2022) The number of Diabetes Mellitus sufferers in 2000 in the world, including Indonesia, was recorded at 175.4 million people, and it is estimated that in 2010 it will be 279.3 million people, in 2020 it will be 300 million people and in 2030 it will be 366 million people. The total number of diabetes mellitus sufferers in Indonesia in 2009 was around 8 million people, and it is estimated that the number will exceed 21 million people in 2025 Muktar et al. (2020).

In 2008, the number of diabetes mellitus sufferers treated outpatients in several hospitals in South Sulawesi included insulin-dependent diabetes mellitus (type 1) as many as 366 people (1.45%), non-insulin-dependent diabetes mellitus (type 2) as many as 1,352 people (5.35%), and other types of diabetes mellitus were 2,736 people (10.82%) Othman et al. (2020). Meanwhile, 341 people were hospitalized with insulin-dependent diabetes mellitus (type 1), 643 people (8.71%), non-insulin-dependent diabetes mellitus (type 2), and 643 people with other types of diabetes mellitus. 423 people (5.73%) (Sul-Sel Profile, 2009).

Based on data from RSUP medical records. Dr. Wahidin Sudirohusodo, the number of diabetes mellitus sufferers who were hospitalized in 2009 was 506 people, in 2010 there were 859 people, in 2011 there were 644 people, and in the January-March 2012 period the number of inpatients and outpatients was 178 people (Medical records of RSUP Dr. Wahidin Sudirohusodo).

Based on the description above, the prevalence of diabetes mellitus is still a health problem for this nation (Lovic et al., 2020). This is because many diabetes mellitus sufferers are unable to control their blood sugar levels (Kumar et al., 2020). Therefore, researchers are interested in examining the relationship between activity history and nutritional status with

blood glucose levels when suffering from diabetes mellitus at RSUP Dr. Wahidin Sudirohusodo Makassar (Chizewski et al., 2021).

Method

This study employed a non-experimental research design using a cross-sectional approach to investigate the relationship between physical activity, nutritional status, and blood glucose levels among diabetes mellitus patients treated at RSUP Dr. Wahidin Sudirohusodo Makassar. A cross-sectional design was chosen as it allows researchers to assess the exposure and outcome variables simultaneously, providing a snapshot of their interrelation at a specific point in time.

The population targeted in this research comprised all diabetes mellitus patients, including both inpatients and outpatients, who were receiving treatment at the hospital during the study period. From this population, a sample of 47 patients was selected using the accidental sampling technique. This sampling method involves selecting participants who are conveniently available and meet predefined eligibility criteria, making it practical for studies conducted in clinical settings where patient availability varies.

Data collection was carried out using two primary tools: structured questionnaires and observation sheets. The questionnaires were designed to gather detailed information on the patients' physical activity levels, including the frequency, duration, and type of exercises they performed. Observation sheets were employed to assess the nutritional status of the participants through direct observations and clinical parameters and to record their instantaneous blood glucose levels. This comprehensive approach ensured that relevant data were collected to address the research objectives effectively.

The data analysis process was conducted using SPSS for Windows version 16.0. The analysis comprised two main steps: univariate and bivariate analyses. Univariate analysis was used to describe the distribution and characteristics of individual variables, such as the participants' physical activity levels, nutritional status, and blood glucose levels. This step provided a foundational understanding of the data. The bivariate analysis was performed to examine the relationships between the independent variables (physical activity and nutritional status) and the dependent variable (instantaneous blood glucose levels). The chi-square test was used for this purpose, as it is suitable for analyzing categorical data and determining associations between variables.

To interpret the results, a significance level (α) of 0.05 was applied. If the p-value obtained from the statistical tests was less than 0.05, the null hypothesis (which posited no significant relationship between the variables) was rejected, indicating a statistically significant relationship. This rigorous methodology facilitated an in-depth exploration of how physical activity and nutritional status influence blood glucose levels in diabetes mellitus patients, providing valuable insights for better management and intervention strategies in this population.

Result and Discussion

The analysis aims to provide empirical evidence regarding the extent to which physical activity and nutritional status are associated with temporary blood glucose levels among individuals with type II diabetes mellitus. This section presents the findings obtained from the univariate and bivariate analyses, supported by descriptive data on the characteristics of the respondents, including gender, education level, occupation, physical activity, and nutritional status. Through statistical interpretation using the chi-square test, the relationship between

these variables and blood glucose control is examined, offering insights into how lifestyle factors contribute to the management of diabetes mellitus in clinical settings.

Table 1. Distribution of respondents based on gender of type II diabetes mellitus sufferers at RSUP Dr. Wahidin Sudirohusodo Makassar 2012.

Gender	Frequency	%
Man	16	34.0
Woman	31	66.0
Total	47	100.0

Source: Primary Data 2012.

In Table 1 it is known that of the 47 respondents, 16 respondents (34.0%) were male and 31 respondents (66.0%) were female.

Education

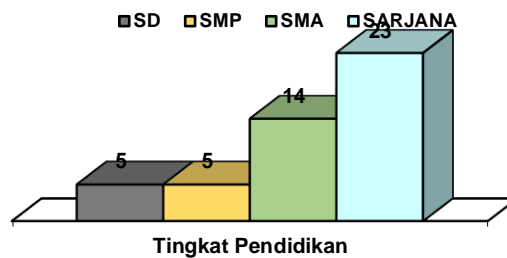


Table 2. Distribution of respondents based on education level of type II diabetes mellitus sufferers at RSUP Dr. Wahidin Sudirohusodo Makassar 2012.

Education	Frequency	%
elementary school	5	10.6
JUNIOR HIGH SCHOOL	5	10.6
SENIOR HIGH SCHOOL	14	29.8
Bachelor	23	48.9
Total	47	100.0

Source: Primary Data 2012.

In Table 2 it is known that of the 47 respondents, 5 respondents (10.6%) had an elementary school education, 5 respondents (10.6%) had a junior high school education, 14 respondents (29.8%) had a high school education and 23 respondents (48.9%) had a Bachelor's degree.

Work

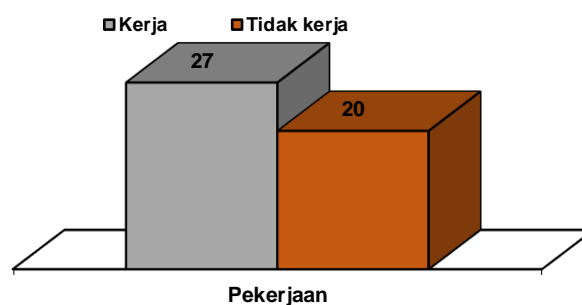


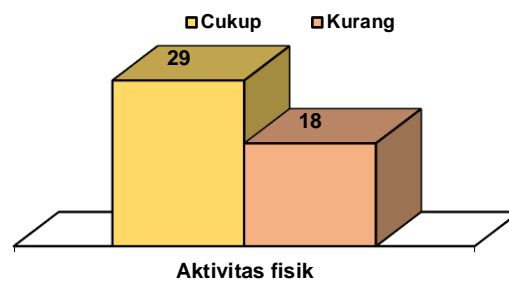
Table 3. Distribution of respondents based on occupation of type II diabetes mellitus sufferers at RSUP Dr. Wahidin Sudirohusodo Makassar 2012.

Work	Frequency	%
Work	27	57.4
Not working	20	42.6
Total	47	100.0

Source: Primary Data 2012.

From Table 3 it is known that of the 47 respondents, 27 respondents (57.4%) worked and 20 respondents (42.6%) did not work.

Physical Activity



patient's physical activity type II diabetes mellitus at RSUP Dr. Wahidin Sudirohusodo Makassar 2012.

Physical Activity	Frequency	%
Enough	29	61.7
Not enough	18	38.3
Total	47	100.0

Source: Primary Data 2012.

In Table 4 it is known that of the 47 respondents, 29 respondents (61.7%) had sufficient activity and 18 respondents (38.3%) had insufficient activity.

Nutritional status

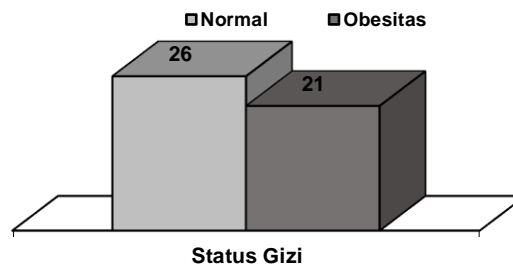


Table 5. Distribution of respondents based on nutritional status of type II diabetes mellitus sufferers at RSUP Dr. Wahidin Sudirohusodo Makassar 2012.

Nutritional Status (BMI)	Frequency	%
Normal	26	55.3

Obesity	21	44.7
Total	47	100.0

Source: Primary Data 2012.

In Table 5, it is known that of the 47 respondents, 26 respondents (55.3%) showed normal nutritional status (BMI for men between 20.1-25.0 and women 18.7-23.8) and 21 respondents (44.7%) showed obesity nutritional status (BMI in men >25.0 and women >23.8).

Bivariate Analysis

Bivariate analysis is used to get an idea of whether there is a relationship between the independent variable and the dependent variable.

The relationship between physical activity and temporary blood glucose levels.

Table 6. Distribution of the relationship between physical activity and blood glucose levels in type II diabetes mellitus sufferers at RSUP Dr. Wahidin Sudirohusodo Makassar 2012.

Physical Activity	GDS levels						<i>p</i> = 0.001
	Normal		Tall		Total		
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	
Enough	25	53.2	4	8.5	29	61.7	
Not enough	7	14.8	11	23.4	18	38.3	
Total	32	68.1	15	31.9	47	100	

Source: Primary Data 2012.

(53.2%) had normal blood glucose levels, and the remaining 4 respondents (8.5%) had high temporary blood glucose levels.

Meanwhile, 18 respondents (38.3%) had less activity, 7 respondents (14.8%) had temporary blood glucose levels were normal and the remaining 11 respondents (23.4%) had high temporary blood glucose levels.

So, it can be concluded that physical activity is related to temporary blood glucose levels. Respondents with more or less activity showed normal temporary blood glucose levels for type II diabetes mellitus sufferers, while respondents with more or less activity showed high temporary blood glucose levels for type II diabetes mellitus sufferers.

The relationship between nutritional status and temporary blood glucose levels.

Table 7. Distribution of the relationship between nutritional status and blood glucose levels in type II diabetes mellitus sufferers at RSUP Dr. Wahidin Sudirohusodo Makassar 2012.

Nutritional status	GDS levels						<i>p</i> = 0.001
	Normal		Tall		Total		
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	
Normal	23	48.9	3	6.4	26	55.3	
Obesity	9	19.1	12	25.5	21	44.7	
Total	32	68.1	15	31.9	47	100	

Source: Primary Data 2012.

Of the 26 respondents (55.3%) with normal nutritional status, 23 respondents (48.9%) had normal blood glucose levels, and the remaining 3 respondents (6.4%) had high temporary blood glucose levels. 21 respondents (44.7%) had obese nutritional status, 9 respondents

(19.1%) had temporary blood glucose levels were normal and the remaining 12 respondents (25.5%) had high temporary blood glucose levels.

So, it can be concluded that nutritional status is related to current blood glucose levels. More respondents with normal nutritional status showed normal temporary blood glucose levels for type II diabetes mellitus sufferers, while more respondents with obese nutritional status showed high temporary blood glucose levels for type II diabetes mellitus sufferers.

The relationship between physical activity and temporary blood glucose levels.

with less activity, 7 respondents (14.8%) have temporary blood glucose levels were normal and the remaining 11 respondents (23.4%) had high temporary blood glucose levels.

By using the *chi-square test*, the value of $p = 0.001$ ($p < \alpha (0.05)$) is obtained, so the null hypothesis is rejected and the alternative hypothesis is accepted, which means there is a relationship between physical activity and blood glucose levels in people with type II diabetes mellitus.

So, it can be concluded that physical activity is related to temporary blood glucose levels. Respondents with more or less activity showed normal temporary blood glucose levels for type II diabetes mellitus sufferers, while respondents with more or less activity showed high temporary blood glucose levels for type II diabetes mellitus sufferers.

The results of this research are supported by theory:

Lack of physical activity causes the body to be susceptible to obesity and has a risk of higher blood glucose levels. To avoid this, we should get used to cycling, walking or other physical activities.

Sports health experts recommend exercising 6 days a week in moderate portions. The type is aerobics such as walking or exercise, at least 20-45 minutes/day. Exercising regularly can help you lose weight and control blood sugar levels (Amanat et al., 2020).

The benefits of exercise for diabetes include reducing blood glucose levels, preventing obesity, and playing a role in overcoming the possibility of *atherogenic complications* (Magkos et al., 2020). Exercise in diabetes can cause an increase in the use of glucose by active muscles, so that exercise can directly cause a decrease in blood glucose, whereas in the resting state muscle metabolism uses very little glucose as a fuel source so that blood glucose levels can increase.

The relationship between nutritional status and temporary blood glucose levels

respondents (44.7%) with obesity nutritional status, 9 respondents (19.1%) have temporary blood glucose levels were normal and the remaining 12 respondents (25.5%) had high temporary blood glucose levels. By using the *chi-square test*, the value of $p = 0.001$ ($p < \alpha (0.05)$) is obtained, so the null hypothesis is rejected and the alternative hypothesis is accepted, which means there is a relationship between nutritional status and blood glucose levels in type II diabetes mellitus sufferers.

So, it can be concluded that nutritional status is related to current blood glucose levels (Wu et al., 2020). More respondents with normal nutritional status showed normal temporary blood glucose levels for type II diabetes mellitus sufferers, while more respondents with obese nutritional status showed high temporary blood glucose levels for type II diabetes mellitus sufferers (Kohek et al., 2023; Kaur et al., 2021). The results of this research are supported by the theory: Nutritional regulation for diabetics is prioritized to achieve normal blood glucose levels, blood pressure and blood fat levels (Kwan et al., 2020).

management is an important component in the management of diabetes mellitus, good nutritional intake to achieve and maintain normal blood glucose levels (Alam et al., 2021). Consuming good nutrition regularly will make it easier to control blood glucose levels to normal. Managing food or controlling nutritional intake for diabetes mellitus sufferers is actually an important factor that supports the care of diabetes sufferers because it can achieve and maintain normal blood glucose levels (Petroni et al., 2021; Bults et al., 2023). The essence of the diet or nutritional intake for diabetes sufferers is to reduce the composition of carbohydrates. In fact, this therapy has two goals at once, namely reducing body weight and regulating blood sugar levels closer to normal.

Conclusion

Based on the research results and discussions that have been presented previously, the conclusions that the author can put forward are as follows; (1) There is a relationship between physical activity and blood glucose levels in people with type II diabetes mellitus. Therefore, the more regularly you do physical activity, the more normal your blood glucose levels will be, and vice versa, the less physical activity you will have, the higher your blood glucose levels will be; (2) There is a relationship between nutritional status and blood glucose levels in people with type II diabetes mellitus. The better the nutritional status, the more normal the blood glucose levels are at times, and vice versa, the less nutritional status, the higher the blood glucose levels at times.

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