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The Relationship between Carbohydrate Consumption, Nutritional Status, and Blood Sugar Level In Outpatient Patients with Type II Diabetes Mellitus In The Hospital

Ni Komang Ayu Anandita Putri[1], Pande Putu Sri Sugiani[2],
Gusti Ayu Dewi Kusumayanti[3]

[,1,2, 3] Department of Nutrition, Poltekkes Kemenkes Denpasar, Indonesia

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ABSCTRACT

Diabetes mellitus (DM) is a group of metabolic diseases characterized by increased blood sugar levels caused by impaired insulin secretion. Increased blood sugar levels in people with diabetes mellitus can be influenced by consumption patterns and nutritional status. The purpose of this study was to determine the relationship between carbohydrate consumption, nutritional status, and blood sugar levels in outpatients with type II diabetes mellitus at Surya Husadha Hospital, Denpasar. This type of research is observational analytic with a cross-sectional research design. This study was conducted in November 2024, with a sample size of 50 people. Carbohydrate consumption data were collected using the SQ-FFQ form, nutritional status data were obtained from waist and hip circumference measurements, blood sugar level data were obtained from the patient's medical records after examination. The results of the study showed that 54% had a carbohydrate consumption level above daily needs with an average carbohydrate consumption of 329,52 grams, 70% were classified as abdominal obesity with an average RLPP in men of 0,99 and in women of 0,95, and 64% had uncontrolled blood sugar levels with an average of 205,38 mg/dL. The results of the analysis showed that there was a relationship between carbohydrate consumption and blood sugar levels (p <0,05, r = 0,437) and there was a relationship between nutritional status and blood sugar levels (p <0,05, r = 0,318).

Keywords: Carbohydrate consumption, nutritional status, blood sugar levels.

Corresponding author: ayuanandita2003@gmail.com

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INTRODUCTION

Diabetes Mellitus (DM) is a group of metabolic diseases characterized by high blood sugar levels or hyperglycemia caused by impaired insulin secretion (Harna et al., 2022). According to estimates by the International Diabetes Federation (IDF) in 2021, diabetes is a health problem affecting more than 537 million people worldwide, and in Indonesia, 19,465,102 people suffer from diabetes mellitus (IDF, 2021). One of the provinces in Indonesia with a high prevalence of diabetes mellitus is Bali. Based on the 2020 health profile data for Bali Province, there are 52,282 people in Bali Province, with Denpasar City ranking first with 14,353 people (Dinas Kesehatan Provinsi Bali, 2020) .

The high prevalence of diabetes mellitus, characterized by elevated blood sugar levels, can have a negative impact on sufferers if left uncontrolled, such as triggering comorbidities or complications (Trijayanti & Gani, 2023). To prevent worsening, diabetes mellitus is essential for control. Diabetes mellitus, characterized by elevated blood sugar levels, is influenced by risk factors. Risk factors for diabetes mellitus are divided into modifiable and non-modifiable risk factors. One modifiable factor is diet (Nasution, 2021). Unhealthy eating habits, such as a tendency to consume excessive carbohydrates, can lead to increased blood sugar levels (Sari & Adelina, 2020). This is in line with research by Zakiyah (2021), which states that there is a relationship between carbohydrate consumption and blood sugar levels. This is because consumed carbohydrates are broken down and reabsorbed in the form of monosaccharides, particularly glucose (Zakiyah et al., 2023).

Besides diet, another modifiable risk factor is nutritional status. Research by Dewi (2022) showed a significant relationship between nutritional status based on the Waist-Hip Ratio (WHRR) and blood sugar levels. The Waist-Hip Ratio is one way to measure central obesity in people with diabetes mellitus. Central obesity is a risk factor that can cause insulin resistance, an early stage of metabolic abnormalities that can lead to glucose intolerance (Sa', 2020). With the high prevalence of diabetes mellitus, which is influenced by increased blood sugar levels, diabetes mellitus treatment is necessary. Diabetes mellitus treatment can be carried out in hospitals. One of the hospitals operating in Denpasar is Surya Husadha Hospital.

METHOD

This study was conducted at Surya Husadha Hospital, Denpasar, in November 2024. This study was observational with a cross-sectional design. The study population consisted of outpatients with type II diabetes mellitus. The sample size was 50 people obtained using consecutive sampling. Inclusion criteria were those aged 40-65 years, had blood sugar levels,

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were able to communicate well, and were not physically disabled. Exclusion criteria were those with kidney, heart, and stroke complications. Identity data were collected through direct interviews, carbohydrate consumption data were collected through interviews and filling out the SQ-FFQ form within the past month, nutritional status data were collected by measuring waist and hip circumference using a waist ruler, and blood sugar level data were obtained from medical records after the patient underwent an examination.

Carbohydrate consumption data in the last 1 month was processed by averaging it into daily consumption and calculated using Nutrisurvey 2007 categorized into less than <45% of total daily energy needs, either 45-65% of total daily energy needs, more than >65% of total daily energy needs. Nutritional status data was processed by calculating the waist-hip circumference ratio with categories in men namely normal <0.95 and abdominal obesity ≥0.95, in women namely normal <0.80 and abdominal obesity ≥0.80. Blood sugar level data was processed using Microsoft Excel and categorized into controlled <200 mg/dL and uncontrolled ≥200 mg/dL. Analysis of the relationship between variables using the Pearson Correlation Test.

RESULTS

1. Sampel Characteristics

The study was conducted on 50 outpatients with type II diabetes mellitus at Surya Husadha Hospital in Denpasar. The characteristics of the study sample, based on gender, age, education, occupation, and length of diagnosis, are outlined in Table 1.

Table 1. Sampel Characteristics

Characteristics	n	%
Gender		
Male	25	50
Female	25	50
Total	**50**	**100**
Age		
40 – 45	2	4
46 – 50	4	8
51 – 55	4	8
56 – 60	12	24
61 – 65	28	56
Total	**50**	**100**
Education		
Elementary school	1	2
Junior high school	2	4
Senior high school	21	42

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College	26	52
Total	**50**	**100**
Work		
Doesn't work	17	34
Housewife	18	36
Private employees	11	22
Teacher	1	2
Businessman	3	6
Total	**50**	**100**
Log time diagnosed		
≤5 years	28	56
>5 years	22	44
Total	**50**	**100**

Based on the research results, there were an equal number of female and male samples (50%), with the majority aged 61-65 years (56%). Based on the highest level of education, the majority of the samples were college graduates (52%), with the majority working as housewives (36%). Based on the length of diagnosis, the majority of the samples had been diagnosed with diabetes mellitus for ≤5 years (56%).

2. Carbohydrate Intake

Based on the data collection results, the average sample consumed 73% of their total carbohydrate intake from complex carbohydrates. The most frequently consumed source of complex carbohydrates was white rice, consumed 250 grams three times daily. The average carbohydrate consumption was 329.52 grams. After comparing the carbohydrate consumption to daily needs, the sample's carbohydrate consumption levels were obtained, as shown in Table 2.

Table 2. Distribution of Sample Carbohydrate Consumption Levels

Category	n	%
Less than	2	4
Normal	21	42
More than	27	54
Total	**50**	**100**

Based on Table 2, it shows that the majority of samples (54%) have a carbohydrate consumption level that exceeds their daily energy requirements.

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3. Nutritional Status

Based on the data collection results, the average ratio for men was 0.99 and for women it was 0.95. The distribution of the sample's nutritional status according to the RLPP (Waist-Hip Circumference Ratio) can be seen in Table 3.

Table 3. Distribution of Sample Nutritional Status According to Waist-Hip Ratio (RLPP)

Category	n	%
Normal	15	30
Abdominal Obesity	35	70
Total	**50**	**100**

Based on Table 3, it shows that the majority of samples (70%) are classified as abdominal obesity.

4. Blood Sugar Levels

Based on the data collection results, the average blood sugar level was 205.38 mg/dL. The distribution of blood sugar levels in the samples can be seen in Table 4.

Table 4 Distribution Of Blood Sugar Levels In Samples

Category	n	%
Under Control	18	36
Uncontrollable	32	64
Total	**50**	**100**

Based on Table 4, it shows that the majority of samples (64%) have uncontrolled blood sugar levels.

5. The Relationship Between Carbohydrate Consumption and Blood Sugar Levels

Based on the research results, 22% of the sample with controlled blood sugar levels consumed more than their daily energy needs. Meanwhile, 72% of the sample with uncontrolled blood sugar levels consumed more than their daily energy needs. A cross-sectional analysis can be seen in Table 5.

Table 5. Distribution of Blood Sugar Levels Based on Carbohydrate Consumption

Level of Carbohydrate Consumption	Blood Sugar Levels				*p value*	*r*
	Under Control		Uncontrollable			
	n	%	n	%		
Less than	1	6	1	3		
Normal	13	72	8	25	0,002	0,437
More than	4	22	23	72		

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Total	**18**	**100**	**32**	**100**

Based on the results of the statistical analysis test using the Pearson Correlation Test, the *p* value was obtained at 0.002 ($p < 0.05$) with an *r* value of 0.437, so it can be concluded that there is a significant relationship between carbohydrate consumption and blood sugar levels with a unidirectional relationship but with a moderate correlation.

6. Relationship between Nutritional Status and Blood Sugar Levels

Based on the results of the research that has been conducted, in samples with controlled blood sugar levels (44%) have a nutritional status of abdominal obesity. Meanwhile, in samples with uncontrolled blood sugar levels (84%) have a nutritional status of abdominal obesity. The cross table can be seen in Table 6.

Table 6. Distribution of Blood Sugar Levels Based on Nutritional Status According to the RLPP

Nutritional Status	Blood Sugar Levels				*p value*	*r*
	Under Control		Uncontrollable			
	n	%	n	%		
Normal	10	56	5	16	0.025	0,318
Abdominal Obesity	8	44	27	84		
Total	**18**	**100**	**32**	**100**		

Based on the results of the statistical analysis test using the Pearson Correlation Test, the p value was obtained at 0.025 ($p < 0.05$) with an r value of 0.318, so it can be concluded that there is a significant relationship between nutritional status and blood sugar levels with a unidirectional relationship but with a low correlation.

Corresponding author: ayuanandita2003@gmail.com

DISCUSSION

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia, which occurs due to impaired insulin sensitivity. Insulin is a hormone produced by the pancreas gland that plays a role in flowing glucose to the body's cells as an energy source (Melytania et al., 2023). Based on the results of the study, it was found that characteristics based on gender had the same number of both men and women (50%). In line with research conducted by (Hafizi, 2024) which stated that both men and women have the same risk of developing diabetes mellitus. In addition to gender, the characteristics of the sample based on age were mostly 61-65 years old (56%), in line with research by Susanti, 2024 which stated that people aged >40 years, both men and women, have the same high risk of developing diabetes mellitus (Susanti et al., 2024).

Other sample characteristics, based on education and occupation, showed that most had completed tertiary education (52%) and most were housewives (36%). This is in line with Arania's research (2021), which states that people with high levels of education tend to work in offices with minimal activity (Arania et al., 2021). Based on the characteristics of the length of time since being diagnosed with diabetes mellitus, most of the sample had suffered from diabetes mellitus for ≤5 years (56%). This is in line with Agustina's research (2022), which states that someone experiences diabetes mellitus for a short period of time (1-5 years) because sufferers often go undetected or only just begin to realize they have diabetes mellitus (Agustina et al., 2022).

Random blood sugar is a blood sugar level examination parameter that can be measured at any time regardless of the patient's last meal time (Andreani et al., 2020). In patients with diabetes mellitus, it is important to monitor blood sugar levels with the aim of controlling the disease, preventing complications and monitoring the effectiveness of treatment (Widodo, 2021). In this study, the majority of samples (64%) had uncontrolled blood sugar levels with an average blood sugar level of 205.38 mg/dL. This condition is called hyperglycemia, where if hyperglycemia occurs over a long period of time it will cause chronic microcirculatory complications such as kidney and eye disease as well as neuropathic complications such as nerve disease (N. H. Dewi, 2021).

Diabetes mellitus has modifiable risk factors, one of which is consumption patterns, including carbohydrate consumption (Nasution, 2021). In this study, the majority of the sample (54%) had carbohydrate consumption levels exceeding daily energy needs. Eating habits that tend to consume excessive carbohydrate sources cause increased blood sugar levels (Sari & Adelina, 2020). This is because carbohydrates consumed in the body are broken down and absorbed in the form of glucose (Gesang & Abdullah, 2019). Carbohydrate consumption is recommended at 45-65% of daily needs, with the recommended

Corresponding author: ayuanandita2003@gmail.com

carbohydrates to be consumed being complex carbohydrates (Perkeni, 2021). In this study, the average sample consumed complex carbohydrates, amounting to 73% of total carbohydrates. Complex carbohydrates are more recommended for consumption because they have longer chains of sugar molecules and are high in fiber, so they take longer to be digested by the body and can help control blood sugar levels and make you feel full longer (Panjaitan et al., 2022).

Based on the Pearson Correlation test analysis, the results showed a significant relationship between carbohydrate consumption and blood sugar levels in patients with type 2 diabetes mellitus. In line with research by Widyasari, 2022, it states that there is a relationship between carbohydrate consumption and blood sugar levels in patients with diabetes mellitus. This is because carbohydrates entering the body will be broken down and reabsorbed in the form of monosaccharides, especially in the form of glucose. Glucose absorbed from food intake has a large contribution in increasing blood glucose levels (Widyasari et al., 2022). This reabsorption will cause an increase in blood glucose levels and insulin production (Zakiyah et al., 2023). Insufficient insulin secretion and the occurrence of insulin resistance in patients with diabetes mellitus will inhibit the process of glucose utilization by tissues and trigger an increase in glucose levels in the blood (Juwita et al., 2020).

In addition to dietary patterns, nutritional status is a modifiable risk factor for diabetes mellitus. One measure of nutritional status is the Waist-Hip Ratio (WHRR), which is used to detect abdominal obesity (Nasution, 2021). In this study, the majority of the sample (70%) had abdominal obesity based on the WHRR. Excessive fat consumption is one of the contributing factors to abdominal obesity. The adipose tissue that produces the most adipokines is the tissue lining the abdominal organs. This triggers an increase in abdominal circumference and, in turn, an increase in adipokine tissue. This leads to increased adipokine secretion. These adipokines have the effect of increasing or decreasing insulin resistance, making it difficult for blood sugar to enter cells and triggering hyperglycemia (Ilmi & Utari, 2020). Fat accumulation triggers an increase in free fatty acids and can inhibit insulin secretion by the pancreas. Therefore, the greater the accumulation of adipose tissue in the body, particularly in the central or abdominal area, the more insulin resistance can lead to increased blood sugar levels in people with diabetes mellitus (Gemini & Natalia, 2023).

Based on the Pearson Correlation test analysis, the results showed that there was a significant relationship between nutritional status according to RLPP and blood sugar levels in patients with type 2 diabetes mellitus. In line with research conducted by Wulandari, 2025, it stated that there was a significant relationship between RLPP and blood sugar levels in diabetes mellitus sufferers. This is because someone with abdominal obesity has a four times higher risk of experiencing increased blood sugar levels. Excessive fat accumulation can

Corresponding author: ayuanandita2003@gmail.com

affect metabolism and increase cardiometabolic risk through changes in adipokine secretion (Wulandari, 2025). Increased amounts of adipokines can trigger glucotoxicity in pancreatic beta cells, thereby causing insulin resistance and damage to pancreatic beta cells which will affect blood sugar metabolism (Harahap et al., 2024).

Furthermore, abdominal obesity can increase the risk of blood sugar levels due to gluconeogenesis, which inhibits insulin function. This is because abdominal fat contains metabolic byproducts in the form of free fatty acids, which are released into the hepatic portal vein. Excess free fatty acids reach the liver, triggering oxidation and producing Acetyl CoA. Acetyl CoA activates the enzyme pyruvate carboxylase in the liver, which then converts pyruvic acid into glucose, a process known as gluconeogenesis. In people with diabetes mellitus, excessive gluconeogenesis in the liver tends to increase blood sugar levels, leading to hyperglycemia (R. A. Dewi et al., 2022).

CONCLUSION(S)

The results of this study indicate that the carbohydrate consumption of most of the samples exceeded their daily needs. According to the Waist-Hip Ratio (RLPP), the nutritional status of most of the samples was abdominal obesity. Blood sugar levels were largely uncontrolled. There is a relationship between carbohydrate consumption and blood sugar levels. There is a relationship between nutritional status and blood sugar levels.

Hospital nutritionists are expected to provide education and counseling regarding recommended and contraindicated foods, as well as dietary recommendations for patients with diabetes mellitus.

Conflict of Interest

We all authors declare that there is no conflict of interest from this research activity

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Corresponding author: ayuanandita2003@gmail.com

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Corresponding author: ayuanandita2003@gmail.com