

Analysis of Dietary Compliance on Blood Glucose Level Changes in Diabetes Mellitus Patients

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Abstract: Diabetes is a metabolic disorder characterized by increased blood glucose levels due to impaired insulin production, insulin function, or a combination of both. To date, no cure exists for the disease; current efforts focus on controlling blood glucose levels, one of which is through dietary management. The International Diabetes Federation (IDF) projects that among the top 10 countries with the highest number of diabetes cases, China, India, and the United States occupy the top three positions. Indonesia ranks seventh, with 10.7 million individuals diagnosed with diabetes. It is further estimated that by 2030, the global number of diabetes mellitus cases will increase to 678 million. This underscores Indonesia's significant contribution to the prevalence of diabetes cases in Southeast Asia. A diabetes mellitus diet is specifically designed to help patients achieve and maintain normal blood glucose levels. This study aimed to analyze dietary compliance and its impact on blood glucose level changes in diabetes mellitus patients. A qualitative descriptive research method was employed, conducted at Kenten Permai Public Health Center, Palembang. The qualitative data analysis was inductive, leading to hypothesis development. The study involved three diabetes mellitus patients as informants and one expert informant, a nutritionist. The findings revealed that one respondent was fully compliant with the diet, one was partially compliant, and one was non-compliant. Respondent D, who adhered to the schedule but not the portion sizes or food types, showed a reduction in blood glucose levels from 186 mg/dL to 160 mg/dL. Respondent R, who fully complied with portion sizes, food types, and meal timings, experienced a decrease from 213 mg/dL to 136 mg/dL. Meanwhile, respondent Y, who was less compliant, exhibited only a slight reduction, from 328 mg/dL to 298 mg/dL. All respondents demonstrated awareness of the diabetes mellitus diet and had started implementing it in their daily lives.

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Introduction

Diabetes mellitus is a chronic metabolic disorder with multifactorial etiology, characterized by elevated blood glucose levels accompanied by metabolic disturbances involving carbohydrates, lipids, and proteins because of insulin insufficiency. It is classified as a group of metabolic diseases with hyperglycaemia as a hallmark, occurring due to defects in insulin secretion, insulin action, or both. Diabetes mellitus is a chronic disease characterized by fasting blood glucose levels of

≥126 mg/dL and random blood glucose levels of ≥200 mg/dL (Sulastri, 2022).

According to the World Health Organization (WHO) in 2022, nearly 80% of global mortality was attributed to non-communicable diseases. Basic Health Research (2022) reported that the leading cause of death among Indonesians was non-communicable diseases, with a prevalence of approximately 60.6%. Among these, diabetes mellitus accounted for 8.5% of deaths. The prevalence of diabetes mellitus continues to rise globally.

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Based on data from the International Diabetes Federation (IDF) in 2021, the number of adults aged 20–79 suffering from diabetes mellitus worldwide reached 537 million. This number is projected to increase to 678 million by 2030 and 700 million by 2045 (Fatimah, 2023). The Arab-North Africa and Western Pacific regions rank first and second in diabetes prevalence among adults aged 20–79, at 12.2% and 11.4%, respectively. Southeast Asia, including Indonesia, ranks third with a prevalence of 11.3%. The IDF also projected the number of diabetes cases in the top 10 countries with the highest prevalence. China, India, and the United States occupy the top three spots with 116.4 million, 77 million, and 31 million cases, respectively. Indonesia ranks seventh, with 10.7 million cases, making it the only Southeast Asian country in the top 10 list, reflecting its significant contribution to diabetes prevalence in the region (Istiqomah, 2021).

The 10th edition of the IDF Atlas stated that in Indonesia, the estimated population of adults aged 20–79 with diabetes was 19,465,100, representing a prevalence of 10.6%. This means that one in nine individuals in this age group has diabetes. The annual healthcare cost for diabetes in this demographic is approximately USD 323.8. Compared to other countries, the healthcare expenditure for diabetes in Indonesia is considerably lower (Saraswati, 2022).

The primary issue for diabetes mellitus patients is hyperglycemia, which can lead to complications classified as microvascular and macrovascular. Microvascular complications include eye (retinopathy), kidney (nephropathy), and skin (dermopathy) conditions. Macrovascular complications encompass heart disease, myocardial infarction, stroke, hypertension, neuropathy, and vascular diseases (Simbolon, 2021).

Several risk factors contribute to diabetes, which can be categorized into modifiable and non-modifiable factors. Non-modifiable factors include genetics, age, gender, history of macrosomia births, or a history of gestational diabetes. Modifiable factors include obesity, lack of physical activity, hypertension, dyslipidemia, and unhealthy diets (Al Hadid, 2022). Prevention efforts for at-risk groups involve lifestyle changes such as maintaining a healthy lifestyle, regular exercise, and adhering to a healthy diet.

Nutritional therapy (diet) plays a crucial role in managing diabetes mellitus, offering significant health benefits when implemented correctly and as advised by healthcare professionals (Fatimah, 2023). Managing blood glucose levels includes regulating food intake to maintain optimal health and normal activity levels. Diet serves as a fundamental component for controlling blood glucose levels in diabetes mellitus patients (Hadribroto, 2015). Adherence to the “3Js” of diabetes

mellitus diet management—quantity, type, and schedule—is critical. Accurate calorie measurements and portioning are essential for patients with diabetes mellitus to maintain glucose levels effectively (Simbolon, 2021).

Holistic and independent diabetes mellitus management, including education, improves patients' quality of life and prevents acute and chronic complications, which can lead to disability or death (Magfiroh, 2023). Mismanaged diabetes can result in complications such as acute metabolic crises like symptomatic and asymptomatic hypoglycemia, hyperglycemic crises, ketoacidosis, hyperosmolar hyperglycemic states, and long-term vascular complications like macroangiopathy, cardiovascular disease, stroke, dyslipidemia, peripheral vascular disease, hypertension, retinopathy, and neuropathy (Sulastri, 2022).

Data from the South Sumatra Provincial Health Office in 2020 reported 41,502 cases of diabetes mellitus in the province. Diabetes cases increased in the following years, with 19,296 cases reported in Palembang in 2021, rising to 29,000 in 2022 (Parmin, 2022).

Dietary management is an integral part of comprehensive type 2 diabetes management. Success depends on the involvement of the entire care team (doctors, nutritionists, healthcare workers, patients, and their families) to meet individual patient needs. The dietary principles for diabetes mellitus are similar to general dietary recommendations, emphasizing balanced nutrition tailored to individual calorie and nutrient requirements. Emphasis should be placed on meal regularity, types of food, and calorie content, particularly for patients on insulin or insulin-secretion-enhancing medications (Nursihhah, 2021).

Research by Magfiroh (2023) found that among diabetes mellitus patients, 69.2% were non-compliant with their dietary recommendations, while only 30.8% demonstrated compliance. A survey conducted at the Kenten Permai Health Center in Palembang revealed that diabetes mellitus cases rose from 32 in 2020 to 35 in 2021 and 38 in 2022. The survey highlighted patients' lack of awareness about the role of diet in blood glucose management.

Considering these issues, this study seeks to explore dietary compliance and its effect on blood glucose changes in diabetes mellitus patients.

Method

This study employed a qualitative descriptive research method, conducted at the Kenten Permai Public Health Center in Palembang. The qualitative data analysis was inductive, meaning that it was based on the

data collected. The hypothesis was subsequently developed from the data and tested for acceptance or rejection based on the recurring patterns found. If the data consistently supported the hypothesis through triangulation techniques, the hypothesis was accepted and further developed into a theory.

The subjects of this study were patients with diabetes mellitus, involving three patient informants and one expert informant, specifically a nutritionist. Sampling was conducted using purposive sampling, selecting informants based on specific characteristics or attributes deemed representative of the social situation under study.

The inclusion criteria for patient informants were diagnosed with diabetes mellitus, male or female, willing to sign a consent form to participate in the study, aged between 40 and 65 years, and cooperative and able to communicate effectively. The inclusion criteria for the expert informant were professionally qualified as a nutritionist or dietary specialist, willing to serve as a key informant.

Data collection in this study utilized primary data obtained from in-depth interviews with respondents. The researchers recorded informants' responses as primary data. To complement the primary data, secondary data was gathered through literature reviews, including books, journals, and online resources relevant to the research topic.

1. The qualitative data analysis process was inductive, beginning with the data collected. This data was used to develop hypotheses, which were then tested for acceptance or rejection based on the collected evidence. If the data, verified through repeated triangulation techniques, supported the hypothesis, it was accepted and developed into a theoretical framework.

Result and Discussion

This study involved three respondents and one key informant. The profiles of respondents and the key informant are as follows: Mrs. D, 53 years, duration of diabetes Mellitus (DM) 7 years; Mrs. R, age 47 years, duration of DM 10 years; Mrs. Y, 48 years, duration of DM 4 years; key Informant was Mrs. E, Age 45 years, position as Head of the Nutrition Department, Kenten Permai Public Health Center.

All respondents were patients regularly treated at the Kenten Permai Public Health Center, while the key informant was the head of the nutrition department at the same health center.

The study findings are summarized as follows:

Question 1: What is a diabetes diet?

Responses:

- Mrs. D: "A diabetes diet means avoiding sugar, not eating excessive rice, avoiding warm rice, and staying away from noodles and sweet foods or drinks, like ice."
- Mrs. R: "Reducing food intake little by little, cutting back on sugar, and managing portions bit by bit."
- Mrs. Y: "I don't know what a diabetes diet is. Sometimes I eat if I have time; if I don't, I skip meals because I'm busy selling. My child often tells me not to eat too much rice."
- Mrs. E (Key Informant): "The diabetes diet consists of six types, tailored to calorie needs. It can range from 1000, 1100, 2100, to 3000 calories. We calculate calorie requirements and physical activity before determining the diet type."

Respondents generally understood a diabetes diet as reducing sugary and carbohydrate-rich foods. However, Mrs. Y showed limited understanding. The key informant emphasized that diabetes diets must be tailored to individual calorie needs, supporting findings from research (Nur Magfiroh et al., 2023) that energy needs vary depending on factors such as age, gender, and daily activity.

Question 2: How often and at what times do you eat daily?

Responses:

- Mrs. D: "I usually eat breakfast at 7:00 AM, lunch at 12:00 PM, and dinner around 8:00 PM."
- Mrs. R: "I sometimes eat only once a day because I lose my appetite. If I eat lunch, I skip dinner, maybe just a few grapes."
- Mrs. Y: "I eat whenever I can—sometimes three times a day, sometimes twice, depending on my schedule since I'm busy selling."

Mrs. D adhered closely to meal schedules, while Mrs. R and Mrs. Y were inconsistent, citing appetite loss and busy schedules as barriers. According to Anwar (2021), diabetes patients should maintain regular meal schedules with three main meals and three snacks daily, spaced three hours apart.

Question 3: What are your daily meal portions and types of food?

Responses:

- Family of Mrs. D: "She often snacks instead of eating the food prepared at home—bread,

noodles, or fried snacks. If she likes the dishes, she eats rice and avoids snacking.”

- Mrs. R: “I eat smaller portions now –just a little rice, vegetables, and whatever protein I want, but in small amounts.”
- Mrs. Y: “I eat rice and vegetables. If I feel like eating fish, I do; if not, I don’t. Sometimes, I just eat rice with sambal.”

Observation Analysis: Observation of dietary habits over four days revealed that Mrs. D consumed rice, vegetables, and protein inconsistently, often substituting meals with snacks. Mrs. R adhered to smaller portions with balanced intake, including fruits. Mrs. Y consumed high-glycemic foods like noodles, fried snacks, and occasional vegetables. Mrs. R demonstrated better adherence to portion control, while Mrs. D and Mrs. Y consumed foods with high sugar content, contributing to elevated blood glucose levels.

Question 4: What type of sugar do you use, and how often?

Responses:

- Mrs. D: “We use regular sugar, but we rarely cook sweet dishes at home.”
- Mrs. R: “I used corn sugar before but switched back to regular sugar in small amounts.”
- Mrs. Y: “I rarely use sugar. Sweet foods make me nauseous since my diagnosis, but I occasionally use corn sugar.”

Respondents used regular sugar in reduced quantities, which aligns with recommendations by Setyaningsityas et al. (2022) that individuals without diabetes limit sugar intake to 10% of daily energy needs and diabetes patients limit sugar to 5%.

Question 5: How often do you monitor your blood sugar, and do you take regular medication?

- Mrs. D: “The doctor visits every three months. I’ve been taking regular medication for three months now.”
- Mrs. R: “I visit the doctor when I feel unwell but rarely monitor my blood sugar. I take hypertension medication instead of diabetes medication.”
- Mrs. Y: “I rarely check my blood sugar because it scares me. I take gout medication, but no diabetes medication.”

Respondents inconsistently monitored their blood sugar levels and often prioritized other medications over diabetes management. Below is Random Blood Glucose (RBG) in the first day and fourth day after educated about diet.

Table 1. RBG of informant

Informants	Day First	Day Fourth
Mrs. D	186 mg/dL	160 mg/dL
Mrs. R	213 mg/dL	136 mg/dL
Mrs. Y	328 mg/dL	298 mg/dL

Based on the interviews and field observations, the findings revealed that Mrs. D was partially compliant with meal schedules but not with portion sizes or food types. Her initial blood sugar level of 186 mg/dL decreased to 160 mg/dL. Mrs. R was Compliant with portion sizes, food types, and schedules. Her initial blood sugar level of 213 mg/dL significantly decreased to 136 mg/dL. Mrs. Y was a non-compliant with dietary recommendations, consuming high-sugar and high-carbohydrate foods. Her blood sugar level showed minimal improvement, reducing from 328 mg/dL to 298 mg/dL.

These findings emphasize the critical role of diet in regulating blood glucose levels. Food consumed enters the digestive tract, breaking down into basic components –carbohydrates into glucose, proteins into amino acids, and fats into fatty acids. These nutrients are absorbed by the intestines and circulated in the bloodstream to provide energy for bodily functions. Insulin plays a pivotal role in metabolism by facilitating glucose entry into cells, where it is metabolized into energy. Without adequate insulin action, glucose remains in the bloodstream, causing hyperglycemia.

Dietary mismanagement, particularly the consumption of sugary foods, excessive carbohydrates, and snacking on high-glycemic foods, is a significant contributor to hyperglycemia. Sustained high blood sugar levels can lead to prediabetes and eventually type 2 diabetes. Conversely, reactive hypoglycemia can occur as a response to high carbohydrate intake, characterized by a sudden drop in blood sugar levels (Oktora, 2022).

Conclusion

1. Dietary Compliance

An informant demonstrated good compliance with dietary recommendations (Mrs. R). Another one was partially compliant with meal schedules but inconsistent with portion sizes and food types (Mrs. D). The last informant was non-compliant, with minimal improvements in blood sugar levels (Mrs. Y).

2. Impact on Blood Sugar Levels

Mrs. R’s compliance with portion sizes, food types, and schedules led to a significant decrease in blood sugar levels (from 213 mg/dL to 136 mg/dL). Mrs. D’s partial compliance resulted in moderate improvement (from 186 mg/dL to 160 mg/dL). And Mrs. Y’s non-compliance resulted in only a slight decrease (from 328 mg/dL to 298 mg/dL).

3. Dietary Factors in Blood Sugar Control

Mismanagement of dietary habits, such as excessive sugar and carbohydrate intake, significantly affects blood sugar levels. Long-term hyperglycemia can lead to severe complications, including type 2 diabetes and other chronic conditions.

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