

The Effect of Nutritional Status and Energy Consumption on the Length of Hospitalization Days of Type 2 Diabetes Mellitus Patients at Abdul Wahab Sjahranie Hospital, Samarinda

Rahmat Dony¹, Joko Cahyono², Kurniati Dwi Utami^{3*}

Politeknik Kesehatan Kementerian Kesehatan Kalimantan Timur

Corresponding Author: Kurniati Dwi Utami kurniati.utami88@gmail.com

ARTICLE INFO

Keywords: Nutritional Status, Energy Consumption, Length of Hospitalization, Type 2 Diabetes Mellitus

Received : 19 December

Revised : 17 January

Accepted: 21 February

©2025 Dony, Cahyono, Utami: This is an open-access article distributed under the terms of the [Creative Commons Atribusi 4.0 Internasional](https://creativecommons.org/licenses/by/4.0/).



ABSTRACT

Patients with Type 2 Diabetes Mellitus (T2DM) are at risk of complications that affect the length of the hospitalization days. Nutritional status and energy consumption levels play an important role in the patient's recovery process. This study analyzed the relationship between nutritional status and energy consumption level on the length of hospitalization of patients with Type 2 Diabetes Mellitus at Abdul Wahab Sjahranie Samarinda Hospital with a cross-sectional quantitative design using secondary data. The Spearman Rank correlation test showed a significant relationship between nutritional status and length of hospitalization ($p < 0.05$). Patients with less energy intake have a longer length of stay. Nutritional status and energy consumption levels play an important role in determining the length of hospitalization days of type 2 diabetes mellitus patients. Optimization of nutrition management is needed to accelerate recovery and reduce the burden on health services

INTRODUCTION

In Indonesia, Diabetes Mellitus (DM) is one of the chronic diseases with a high prevalence that has a significant impact on the burden of health services (Riskasdas, 2018; Fitriani, Pramono, and Utami, 2023). Patients with Type 2 DM tend to have a longer length of stay than patients without comorbidities, which is caused by metabolic disorders and a slower healing process (Muscogiuri et al., 2020). One of the important factors in the treatment of patients with Type 2 DM is nutritional status and energy consumption levels that affect the immune response as well as the speed of recovery of patients (Li et al., 2021; Nisa, Utami, and Pramono, 2023).

This study focuses on the relationship between nutritional status and energy consumption level with the length of hospitalization (LOS) of Type 2 DM patients at Abdul Wahab Sjahranie Samarinda Hospital. With the increasing need for effective patient care in hospitals, this study is expected to provide insights into optimizing nutritional care as part of a strategy for the care of patients with comorbidities.

This study aims to analyze the relationship between nutritional status and energy consumption level to the length of hospitalization days of Type 2 DM patients. Specifically, this study aims to: (1) describe the nutritional status and energy consumption level of patients, (2) identify the relationship between nutritional status and the length of hospitalization, and (3) identify the relationship between the level of energy consumption and the length of hospitalization days of Type 2 DM patients at Abdul Wahab Sjahranie Samarinda Hospital.

This study has made a significant contribution to the public health literature, particularly in the field of clinical nutrition and the management of patients with comorbidities. By understanding how nutritional status and energy consumption affect the length of hospitalization days, this study can be the basis for improving clinical policies in the nutrition management of inpatients. In addition, the results of this study can support the development of more effective evidence-based nutrition intervention strategies to improve the prognosis of patients with T2 DM.

Several previous studies have discussed the role of nutritional status in the length of treatment of patients with infectious diseases. According to Li et al. (2021), patients with malnutrition status have a higher risk of complications and a longer duration of hospitalization compared to patients with normal nutritional status. In addition, the research of Muscogiuri et al. (2020) emphasized the importance of adequate energy intake to support the immune response and recovery of patients with T2 DM.

In Indonesia, research related to the relationship between nutritional status and the length of treatment of patients is still limited. However, a study by Pramesti et al. (2021) showed that diabetic patients with poor nutritional status had a higher mortality rate and required longer intensive care. Meanwhile, research by Tamara et al. (2020) found that obesity in patients increases the risk of complications that prolong the length of hospitalization.

In general, nutritional status and energy consumption levels are important factors in the clinical management of patients with comorbidities. However, there is still a research gap in the context of patients with comorbid T2DM in Indonesia. Therefore, this study aims to fill this knowledge gap by exploring the relationship between nutritional status, energy consumption level, and length of hospitalization days of T2DM patients at Abdul Wahab Sjahranie Hospital.

LITERATURE REVIEW

Type 2 Diabetes Mellitus

Definition and Pathophysiology: Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from two primary pathophysiological mechanisms: insulin resistance and impaired insulin secretion (American Diabetes Association, 2021). Insulin resistance occurs when peripheral tissues, particularly skeletal muscle, adipose tissue, and the liver, fail to respond effectively to insulin. Consequently, glucose uptake is reduced, and hepatic glucose production remains elevated, contributing to increased blood glucose levels. Over time, pancreatic beta cells compensate by increasing insulin secretion. However, prolonged demand leads to beta-cell dysfunction and progressive insulin deficiency, exacerbating hyperglycemia (DeFronzo et al., 2017).

Etiology and Risk Factors: The development of T2DM is influenced by a complex interplay of genetic predisposition and environmental factors. Studies indicate that individuals with a family history of diabetes have a higher risk of developing the disease due to inherited genetic variations affecting insulin sensitivity and beta-cell function (Zheng et al., 2018). However, environmental and lifestyle factors play a crucial role in disease onset, including: 1) **Obesity and Excess Adiposity:** Central obesity is strongly correlated with insulin resistance due to increased levels of pro-inflammatory cytokines and free fatty acids, which impair insulin signaling pathways (Kahn et al., 2019). 2) **Physical Inactivity:** A sedentary lifestyle reduces glucose uptake by muscles, exacerbating insulin resistance (Colberg et al., 2016). 3) **Unhealthy Diet:** High intake of processed carbohydrates, saturated fats, and sugary beverages contributes to weight gain and metabolic dysfunction (Ley et al., 2014). 4) **Age and Ethnicity:** Advancing age is associated with a decline in beta-cell function, and certain ethnic groups, such as South Asians, African Americans, and Hispanics, have a higher genetic predisposition to T2DM (Gupta et al., 2020).

Complications and Disease Burden: T2DM is associated with multiple microvascular and macrovascular complications, significantly affecting morbidity and mortality. Poor glycemic control accelerates the progression of these complications, emphasizing the importance of effective disease management (Li et al., 2021). **Macrovascular Complications:** Cardiovascular disease (CVD) is the leading cause of death in patients with T2DM. Chronic hyperglycemia, dyslipidemia, and hypertension contribute to atherosclerosis, increasing the risk of heart attacks, strokes, and peripheral artery disease (Kirkman et al., 2020). **Microvascular Complications:** These include diabetic nephropathy, a leading cause of end-stage renal disease; diabetic retinopathy, which can lead to blindness;

and diabetic neuropathy, which causes nerve damage, leading to foot ulcers and amputation risks (Chew et al., 2020).

Global Epidemiology and Public Health Impact: The prevalence of T2DM has risen dramatically worldwide. According to the International Diabetes Federation (2021), over 537 million people were estimated to have diabetes in 2021, with projections exceeding 700 million cases by 2045. This rise is attributed to increasing obesity rates, urbanization, and aging populations. The economic burden of T2DM is substantial, with high costs associated with hospitalizations, medication, and long-term care for diabetes-related complications (Zhou et al., 2020).

Management and Prevention Strategies: Given the progressive nature of DM T2, effective management focuses on glycemic control, lifestyle modifications, and pharmacological interventions (Wong et al., 2019). **Lifestyle Modifications:** Diet and physical activity remain the cornerstone of T2DM management. A balanced diet rich in whole grains, fiber, lean protein, and healthy fats can improve insulin sensitivity. Regular exercise (≥ 150 minutes per week) helps regulate blood glucose levels and enhances metabolic function (Colberg et al., 2016). **Pharmacological Therapy:** First-line treatment often includes metformin, which reduces hepatic glucose production. Additional medications, such as SGLT2 inhibitors, GLP-1 receptor agonists, and insulin therapy, may be prescribed based on individual patient profiles and disease severity (American Diabetes Association, 2021). **Preventive Measures:** Population-wide interventions, such as public health campaigns, screening programs, and policies promoting healthier food environments, play a vital role in curbing the diabetes epidemic (Norris et al., 2021).

Length of Hospitalization

Definition and Importance of LOS: Length of stay (LOS) is a critical metric in healthcare management used to evaluate the efficiency of hospital resource utilization. It is measured from the patient's admission date to the discharge date and serves as an indicator of healthcare quality, hospital workflow efficiency, and economic burden on healthcare systems (Cleary et al., 2021). Shorter LOS may indicate effective treatment and discharge planning, whereas prolonged LOS can reflect complications, suboptimal management, or healthcare inefficiencies.

Factors Influencing LOS in General: Several factors influence LOS in hospitalized patients, including: 1) **Severity of illness:** Critically ill patients or those with multiple comorbidities require extended hospitalization. 2) **Complications:** Postoperative infections, organ dysfunction, or adverse drug reactions prolong LOS. 3) **Nutritional status:** Malnutrition weakens immunity, delays recovery, and increases the risk of hospital-acquired infections (Muscogiuri et al., 2020). 4) **Effectiveness of medical interventions:** Delayed diagnosis, inappropriate treatment, or ineffective interventions can lead to extended hospitalization (Rojas et al., 2020). 5) **Hospital policies and discharge planning:** Efficient hospital management, rehabilitation programs, and coordinated discharge planning can significantly reduce LOS.

LOS in Patients with Type 2 Diabetes Mellitus (T2DM): Patients with T2DM often experience longer hospital stays due to the complex nature of the disease. The reasons include: 1) Increased Risk of Complications a) Hyperglycemia-related complications: Chronic hyperglycemia leads to increased risks of infections, poor wound healing, and microvascular/macrovascular complications (Kavanagh et al., 2019). b) Diabetic foot ulcers (DFU): T2DM patients with diabetic foot ulcers often require prolonged hospitalization due to the risk of infection and amputation. c) Cardiovascular disease: Patients with T2DM have a higher prevalence of hypertension, heart disease, and stroke, which may prolong LOS. d) Kidney dysfunction: Diabetic nephropathy can lead to acute kidney injury or end-stage renal disease, necessitating longer hospital stays.

Malnutrition and Immune System Impairment: T2DM patients with malnutrition have a significantly longer LOS due to weakened immune function, higher infection rates, and slower recovery (Muscogiuri et al., 2020). Malnutrition in T2DM can result from poor dietary intake, metabolic alterations, and underlying chronic inflammation. 3) Impact of Hospital Policies and Management. Rehabilitation and education programs: Hospitals that incorporate structured diabetes education, dietary counseling, and early rehabilitation programs can help reduce LOS (Brunetti et al., 2020). Multidisciplinary team approach: Effective management by a team consisting of endocrinologists, dietitians, nurses, physiotherapists, and social workers can facilitate early discharge and prevent readmissions.

Strategies to Reduce LOS in T2DM Patients : To minimize unnecessary hospital stays, several strategies can be implemented: 1) Early screening and intervention: Prompt identification of complications and appropriate interventions can reduce LOS. 2) Glycemic control optimization: Tight blood glucose control during hospitalization prevents further complications. 3) Nutritional support and management: Addressing malnutrition through personalized nutrition plans can enhance recovery. 4) Hospital care pathways and discharge planning: Implementing standardized care protocols and ensuring post-discharge follow-up can improve hospital efficiency.

LOS is a key indicator of hospital efficiency and patient recovery, and it is particularly prolonged in T2DM patients due to complications, nutritional issues, and hospital management factors. A multidisciplinary approach involving physicians, dietitians, and hospital administrators is crucial in optimizing care, improving outcomes, and reducing unnecessary hospitalization duration.

Nutritional Status

Nutritional status is a health indicator that reflects the balance between the body's nutritional needs and the intake of food consumed (Gonzalez et al., 2019). Evaluation of nutritional status can be carried out through the measurement of Body Mass Index (BMI), upper arm circumference (LILA), as well as biochemical parameters such as serum albumin and hemoglobin levels (Sanchez et al., 2021). In T2DM patients, poor nutritional status can worsen glycemic control and increase the risk of metabolic complications (Brunetti et al., 2020). Obesity, for example, is associated with higher insulin resistance, while malnutrition can weaken the immune system and increase the risk of infection (Li et al., 2021). A

study by Tamara et al. (2020) found that T2DM patients with obesity had a longer LOS compared to patients with normal weight.

Appropriate nutritional interventions can help improve the prognosis of patients with T2 DM. A balanced diet rich in fiber and low in glycemic index has been shown to help control blood sugar levels and reduce the risk of complications (Wong et al., 2019). Therefore, strict monitoring of nutritional status during hospitalization is essential in the therapy planning of T2DM patients to speed up recovery and reduce the duration of unnecessary hospitalization.

Energy Consumption Rate

The level of energy consumption refers to the amount of energy consumed by an individual through food and beverages compared to their metabolic needs (FAO, 2020). Insufficient or excessive energy intake can negatively affect health, especially in patients with T2DM. The energy needs of T2DM patients must be adjusted to their metabolic condition, weight, and physical activity level (American Diabetes Association, 2021).

Too low energy intake can lead to nutritional deficiencies and loss of muscle mass, which has an impact on decreased immunity as well as an increased risk of infection (Li et al., 2021). Conversely, excessive energy consumption can worsen insulin resistance and increase the risk of metabolic complications such as hyperglycemia and dyslipidemia (Wong et al., 2019). A study by Sanchez et al. (2021) showed that T2DM patients who received energy intake following nutritional recommendations improved their condition faster and had a shorter LOS compared to patients with insufficient energy intake.

Energy consumption management strategies in T2DM patients include monitoring daily diets, nutrition education, and regulating the amount and type of food to ensure optimal nutritional balance (Brunetti et al., 2020). This approach can help improve the effectiveness of medical therapies and speed up patient recovery during hospitalization.

Type 2 Diabetes Mellitus is a chronic metabolic disease that can prolong the length of hospitalization due to various accompanying complications. Nutritional status and energy consumption levels play an important role in determining patient prognosis and health service efficiency. Recent research shows that good nutrition management can help speed up patient recovery and reduce the burden of hospital care. Therefore, nutrition-based interventions are a crucial aspect of the management of T2DM patients during inpatient care.

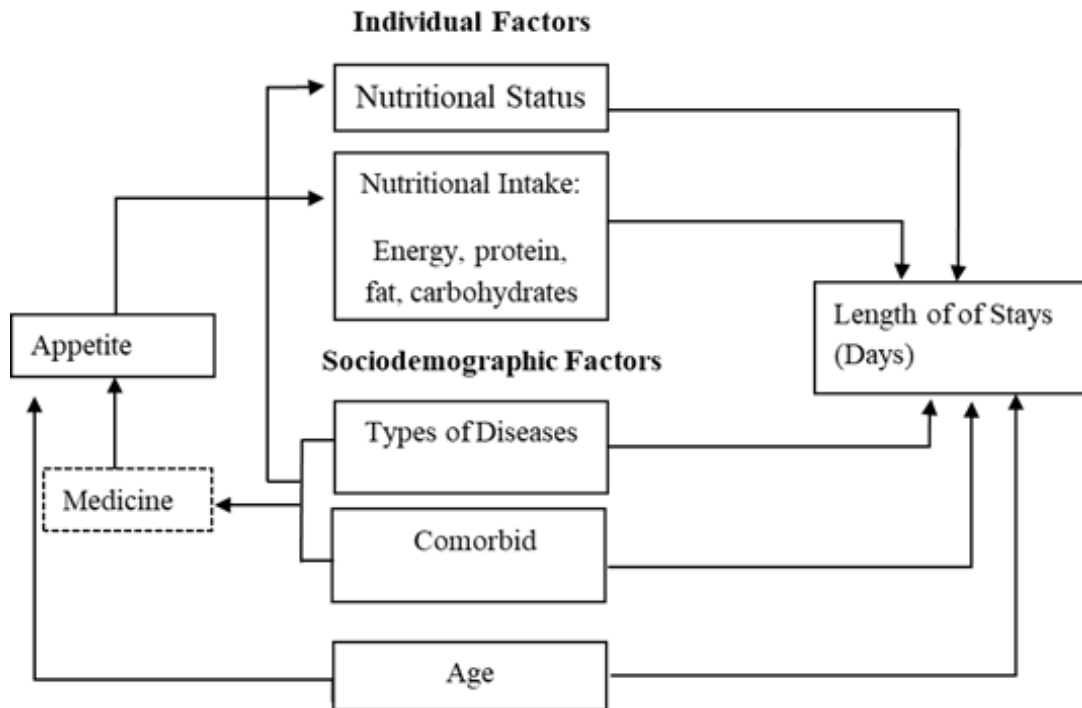


Figure 1. Theoretical Framework (Tedja, V. R.,(2012).

METHODOLOGY

Study Design and Approach

This study employs a quantitative research approach with a cross-sectional study design. A cross-sectional design was selected because it enables researchers to analyze relationships between variables at a specific point in time without requiring long-term follow-up. This design is particularly useful in identifying associations between nutritional status, energy consumption levels, and the length of hospitalization in Type 2 Diabetes Mellitus (DM T2) patients. By utilizing this approach, researchers can efficiently collect and analyze data from hospital records within a defined period.

Study Setting and Period

The study was conducted at Abdul Wahab Sjahranie Samarinda Hospital over a 13-month period, from August 2022 to September 2023. Data collection was performed retrospectively by reviewing medical records of patients diagnosed with T2DM who had been hospitalized within this timeframe.

Population and Sampling Technique

Population dan Sample

The population for this study consists of all patients diagnosed with Type 2 Diabetes Mellitus (DM T2) who were hospitalized at Abdul Wahab Sjahranie Hospital. The study utilized purposive sampling, a non-probability sampling method in which participants were selected based on specific predefined criteria. Inclusion Criteria, Patients included in this study met the following conditions: 1) Age: Patients aged 18 years or older. 2) Nutritional Status Data Availability: Patients with complete nutritional status records. 3) Oral Food Intake: Patients who received food intake orally during hospitalization.

Exclusion Criteria, Patients who met the following criteria were excluded: 1) Mortality During Treatment: Patients who died during hospitalization. 2) Non-Oral Feeding: Patients who were fed through nasogastric tubes (NGT) or required ventilator support. 3) Incomplete Medical Records: Patients with missing or insufficient data regarding their nutritional status, energy consumption levels, or length of hospitalization.

Using these criteria, a total of 48 respondents were selected for the study.

Variables and Data Collection

This study examines three key variables: 1) Independent Variables: Nutritional Status: Measured using Body Mass Index (BMI), which is calculated based on the patient's weight (kg) divided by the square of their height (m²). Energy Consumption Level: Determined from dietary intake records collected by hospital nutritionists during the patient's hospitalization. 2) Dependent Variable: Length of Hospitalization (in days): Extracted from hospital medical records.

Data Collection Procedures

Data collection was conducted in several stages: 1) Patient Identification & Selection: Eligible patients were selected based on inclusion and exclusion criteria. 2) Nutritional Status Measurement: Data was extracted from medical records, and BMI was calculated based on recorded weight and height. 3) Energy Consumption Assessment: Information was obtained from nutritionist follow-up forms, which documented the patient's dietary intake during treatment. 4) Hospitalization Length Recording: The total number of hospitalization days for each patient was retrieved from the hospital's electronic medical record system.

Data Analysis

Data was analyzed using univariate and bivariate statistical methods: 1) Univariate Analysis: Used to describe the frequency distribution and proportions of each variable (nutritional status, energy consumption level, and hospitalization length). 2) Bivariate Analysis: Spearman Rank Correlation Test was employed to examine the relationship between nutritional status and energy consumption level with the length of hospitalization. This non-parametric test was selected due to the ordinal nature of the data and the potential for non-normal distributions.

Ethical Considerations

This study was conducted with ethical approval and permission from Abdul Wahab Sjahranie Hospital. The research adhered to ethical guidelines in health research, ensuring: 1) Confidentiality: All patient data was anonymized to protect patient privacy. 2) Data Usage Restrictions: Data was used exclusively for academic research purposes. 3) Compliance with Ethical Standards: Research followed the established ethical principles of medical and public health research. By maintaining strict ethical protocols, this study ensures validity, reliability, and integrity in its findings while protecting patient rights.

RESULTS

Table 1. Respondent Characteristic

Characteristic	Frequency (n=48)	Percentage (%)
Age (years)		
1. 18-24 years old	0	0
2. 25-34 years old	0	0
3. 35-44 years old	7	14.6
4. 45-54 years old	16	33.3
5. 55-64 years'	18	37.5
6. 65-74 years old	7	14.6
7. 75 years +	0	0
Gender		
1. Man	31	64.6
2. Woman	17	35.4

This study involved 48 respondents who underwent treatment at Abdul Wahab Sjahranie Samarinda Hospital. The majority of respondents were in the age range of 55-64 years (37.5%), followed by the age group of 45-54 years (33.3%). Respondents were dominated by 31 men (64.6%), while women amounted to 17 people (35.4%).

Table 2. Respondents' Hospitalization Days

Length of Care Days	Sum	Percentage (%)
Ideal ≤14	28	58.3
Length >14	20	41.7
Total	48	100

Based on the results of the analysis, the length of hospitalization days was categorized into two groups: ideal (≤14 days): 28 respondents (58.3%) and length (>14 days): 20 respondents (41.7%)

Table 3. Nutritional Status by Body Mass Index

Nutritional Status (BMI)	Frequency	Percentage (%)
Usual	27	56.3
Lightweight Fat	6	12.5
Heavy Fat	15	31.3
Total	48	100

The nutritional status of respondents was categorized based on Body Mass Index (BMI): Normal (18.5-24.9 kg/m²): 27 respondents (56.3%), Mild fat (25-29.9 kg/m²): 6 respondents (12.5%), Overweight (≥30 kg/m²): 15 respondents (31.3%).

Table 4. Respondents' Energy Consumption Levels

Energy Consumption Rate	Number (n)	Percentage (%)
Less	19	39.6
Usual	29	60.4
Total	48	100

Respondents' energy consumption was categorized as follows: lacking: 19 respondents (39.6%) and normal: 29 respondents (60.4%)

Table 5. Cross-Tabulation of the Relationship Between Nutritional Status and the Length of Hospitalization Days of Respondents

Nutritional Status	Length of Care Days				Total		r-value	p-value
	Ideal		Long		N	%		
	n	%	N	%				
Usual	19	39.6	8	16.7	27	56.3	0.319	0.027
Lightweight Fat	4	8.3	2	4.2	6	12.5		
Heavy Fat	5	10.4	10	20.8	15	31.3		
Sum	28	58.3	20	41.7	48	100		

Relationship between Nutritional Status and Length of Hospitalization Days

Bivariate analysis using the Rank Spearman test showed a significant relationship between nutritional status and length of hospitalization ($p = 0.027$). Respondents with normal nutritional status had more ideal length of care days (39.6%). On the other hand, 20.8% of respondents with severely obese nutritional status had long treatment days. The correlation value $r = +0.319$, indicates a weak positive association, meaning that the higher the BMI, the longer the length of the hospitalization.

Table 6. Cross-Tabulation between Energy Consumption Level and Respondent's Length of Hospitalization

Energy Consumption Rate	Length of Care Days				Total		r-value	p-value
	Ideal		Length		n	%		
	N	%	N	%				
Less	6	12.5	13	27.1	19	39.6	-0.439	0.002
Usual	22	45.8	7	14.6	29	60.4		
Sum	28	58.3	20	41.7	48	100.0		

Relationship between Energy Consumption Level and Length of Hospitalization Days

The results of the Rank Spearman test showed a significant relationship between the level of energy consumption and the length of hospitalization ($p = 0.002$). Respondents with lower energy consumption levels are more likely to have a long hospitalization (27.1%). Meanwhile, 45.8% of respondents with normal energy consumption levels had an ideal length of hospitalization. A

correlation value of $r = -0.439$ indicates a moderate negative relationship, meaning that the lower the energy consumption, the longer the hospitalization. The results of this study show that nutritional status and energy consumption levels are related to the length of hospitalization days. Respondents with nutritional status, severe obesity, and poor energy consumption tended to be hospitalized longer. Optimizing nutritional status and meeting adequate energy needs during treatment can help speed up patient recovery and reduce the duration of hospital treatment.

In this section, you must provide us with each step taken to accomplish your studies. You must not put too much the result of descriptive statistics here; on the other hand, it should be summarized in an easier to read table or graphs. You must not forget the numbers for every table and chart presented in your paper.

DISCUSSION

Length of Hospitalization

The length of hospitalization days is an important indicator in assessing the effectiveness of patient care in hospitals. The results of this study showed that the average length of hospitalization days for patients with Type 2 Diabetes Mellitus (DM T2) was 13.31 ± 4.45 days, with the majority of respondents (58.3%) experiencing the ideal length of hospitalization days (≤ 14 days). The study by Kavanagh et al. (2019) found that patients with comorbidities of T2DM had a longer duration of hospitalization due to metabolic complications that slowed down the recovery process. This is also supported by the study of Li et al. (2021) which stated that patients with poor glycemic control have a risk of longer hospital stays due to increased complications such as diabetic ketoacidosis and severe hypoglycemia.

In addition, research by Sanchez et al. (2021) shows that other factors such as advanced age, the presence of comorbidities, and adherence to therapy also affect the length of hospitalization. Patients with better blood sugar control tend to have shorter treatments compared to patients who experience fluctuations in glucose levels. Based on the authors' assumptions, the results of this study support the previous findings that good metabolic control is indispensable to accelerate the healing of T2DM patients and reduce the burden on hospital health services.

Nutritional Status of Respondents

Most of the respondents in this study had normal nutritional status (56.3%), while 31.3% were obese. Nutritional status is an important factor in the prognosis of patients with DM T2. Research by Muscogiuri et al. (2020) shows that obesity increases the risk of systemic inflammation and insulin resistance, which can worsen a patient's condition and prolong the length of hospitalization. In addition, research by Gonzalez et al. (2019) confirmed that obese patients are more prone to complications such as hypertension and dyslipidemia, which contribute to an increase in the length of hospital stay.

Furthermore, FAO research (2020) emphasizes that optimal nutritional status is very important in supporting the recovery of patients with DMT2. Appropriate nutrient intake helps accelerate cell regeneration and optimize blood sugar level control. Based on the author's assumptions, patients with T2DM need

to maintain nutritional balance to avoid long-term complications and improve the effectiveness of the therapy given during hospitalization.

Energy Consumption Rate

In this study, as many as 39.6% of respondents had a low level of energy consumption, while 60.4% had a normal level of energy consumption. Insufficient energy intake can affect the immune system and slow wound healing, which contributes to an increase in the duration of hospitalization (Wong et al., 2019). The FAO study (2020) also confirms that meeting energy needs following the patient's metabolic condition is very important to accelerate recovery and reduce the risk of complications.

A study by Li et al. (2021) highlighted that patients with poor energy intake have unstable glucose levels, increasing the risk of hypoglycemia and inflammation. Based on the author's assumptions, the level of sufficient energy consumption greatly affects the metabolic stability of patients and has a direct impact on the effectiveness of treatment and the duration of hospitalization.

Relationship between Nutritional Status and Length of Hospitalization Days

Statistical analysis showed that there was a significant relationship between nutritional status and length of hospitalization ($p = 0.027$). Respondents with obesity tended to stay in the hospital for longer periods compared to those with normal nutritional status. A study by Sanchez et al. (2021) found that obesity contributes to increased chronic inflammation and metabolic disorders that can prolong a patient's treatment. In addition, the study of Tamara et al. (2020) showed that obese patients had a higher risk of developing complications, which had an impact on increasing the length of hospitalization.

Based on the author's assumptions, the relationship between nutritional status and length of hospitalization is caused by the influence of obesity on metabolic disorders which increases the risk of complications. Patients with obesity need more intensive interventions in blood sugar management and nutrient intake to speed up recovery.

Relationship between Energy Consumption Level and Length of Hospitalization Days

The level of energy consumption also showed a significant relationship with the length of hospitalization days ($p = 0.002$). Respondents with less energy consumption tended to have a longer duration of hospitalization. This is in line with the research of Brunetti et al. (2020), which stated that energy deficiency can hinder tissue repair and prolong the recovery process. The study of Li et al. (2021) also found that a good energy balance can help improve immunity and speed up the recovery time of patients with DM T2.

Based on the author's assumptions, patients with sufficient energy consumption are more likely to experience faster recovery because the body gets optimal nutritional support to fight infection and repair damaged tissue. Therefore, appropriate nutritional interventions are key in reducing the duration of hospitalization of patients with DM T2.

CONCLUSIONS AND RECOMMENDATIONS

The conclusion of this study shows that nutritional status and energy consumption level have a significant effect on the length of hospitalization of T2DM patients. Patients with obesity tend to have a longer duration of hospitalization than patients with normal nutritional status, while patients with low energy consumption also experience longer treatments. These factors underscore the importance of optimizing nutrition management as part of patient care in hospitals.

We suggest that hospitals need to develop more effective nutrition intervention programs for T2DM patients to improve their nutritional status and energy balance. Education about appropriate diets and optimal nutrition management needs to be improved both for patients and health workers. In addition, strict monitoring of blood glucose levels as well as periodic evaluation of energy intake should be part of the treatment strategy of patients with T2DM to speed up recovery and reduce the length of hospital stay.

REFERENCES

- Al-Fariqi, M.Z. & Yunika, R.P. (2021) 'The Effect of Diabetic Gymnastics and Energy Intake on Changes in Blood Sugar Levels in Patients with Type 2 Diabetes Mellitus at Patut Patuh Patju Hospital', *Journal of Nutrition*, 2(April), pp. 18-25.
- American Diabetes Association (2021). Standards of medical care in diabetes – 2021. *Diabetes Care*, 44(Suppl 1), S1-S232.
- Brunetti, M. et al. (2020). 'Nutritional status and diabetes control: Impact on hospital length of stay', *Clinical Nutrition*, 39(5), pp. 1482-1490. <https://doi.org/10.1016/j.clnu.2020.04.002>
- FAO (2020). Human energy requirements. Rome: Food and Agriculture Organization. <https://www.fao.org/3/y5686e/y5686e.pdf>
- Fitriani, N., Pramono, J.S. and Utami, K.D. (2023) 'The Relationship between Diet Compliance and Physical Activity with Blood Sugar Levels in Patients with Type II Diabetes Mellitus in the Work Area of the Pasundan Health Center', *Formosa Journal of Science and Technology*, 2(8), pp. 2083-2096. Available at: <https://doi.org/10.55927/fjst.v2i8.5663>.
- Gonzalez, C. et al. (2019). 'Anthropometric and biochemical indicators as predictors of health outcomes in diabetic patients', *Nutrition Research*, 68, pp. 40-48. <https://doi.org/10.1016/j.nutres.2019.08.003>
- Kavanagh, P. M. et al. (2019). 'Hospital length of stay in patients with type 2 diabetes: A systematic review', *Diabetes Care*, 42(2), pp. 225-235. <https://doi.org/10.2337/dc18-1106>
- Kemenkes RI. (2018). Results of Basic Health Research in 2018. Ministry of Health of the Republic of Indonesia, 53(9), 1689-1699.
- Kirkman, M. S. et al. (2020). 'Diabetes in older adults', *Diabetes Care*, 43(2), pp. 345-353.
- Li, H. et al. (2021). 'Nutritional intervention in diabetes management', *Journal of Clinical Endocrinology & Metabolism*, 106(8), pp. 2895-2908. <https://doi.org/10.1210/clinem/dgab134>

- Muscogiuri, G. et al. (2020). 'Obesity and diabetes: The impact on hospital length of stay', *European Journal of Clinical Nutrition*, 74(6), pp. 850-856. <https://doi.org/10.1038/s41430-020-0605-y>
- Nisa, K., Utami, K.D. and Pramono, J.S. (2023) 'Pengaruh Edukasi Gizi dengan Media Booklet terhadap Pola Makan dan Kejadian Dispepsia di Sma Budi Bakti Samarinda', 1, pp. 1-6.
- Nisrina, N., Sari, D.R. & Widiyanto, R. (2023) 'DM Dietary Glycemic Load, Energy, Protein, and Fiber Consumption Levels in Association with Blood Glucose Levels in Type 2 DM Patients', *Nutriture Journal*, 3(2), pp. 59-65. DOI: 10.31290/nj.v3i2.4200.
- Pramono, J.S. and Utami, K.D. (2023) 'The Relationship between Knowledge About Hypertension and Nutritional Status with Blood Pressure', *Indonesian Journal of Applied and Industrial Sciences (ESA)*, 2(5), pp. 519-530.
- Sanchez, A. et al. (2021). 'The role of inflammation and metabolic disturbances in prolonged hospital stay among diabetic patients', *Diabetes Research and Clinical Practice*, 173, 108682. <https://doi.org/10.1016/j.diabres.2021.108682>
- Sugiani, S. & Putu, P.P. (2022) 'The Long-Term Relationship of Suffering from DM and Energy Consumption with the Nutritional Status of Type 2 Diabetes Mellitus Patients at UPTD Puskesmas II West Denpasar', *Scientific Journal of Nutrition*, 11(1), pp. 1-10. DOI: 10.31983/jig.v11i1.2112.
- Tamara, A., & Tahapary, D. L. (2020). 'Obesity as a predictor for a poor prognosis of diabetic patients: A systematic review', *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(4), pp. 655-659 <https://doi.org/10.1016/j.dsx.2020.05.020>
- Tedja, V. R. (2012). Relationship Between Individual, Socio-Demographic, and Administrative Factors and Length of Hospitalization Days of Inpatient Respondents Rumah Sakit Pantai Indah Kapuk Year 2011. 1-157.
- Wong, C. et al. (2019). 'Energy balance and diabetes management', *Current Diabetes Reports*, 19(8), pp. 65-72. <https://doi.org/10.1007/s11892-019-1204-5>
- Zhang, Y., Hu, G., Yuan, Z. & Chen, L. (2019) 'Glycemic control in type 2 diabetes mellitus patients with cancer', *Journal of Diabetes*, 11(12), pp. 878-887. DOI: 10.1111/1753-0407.12925.