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## Case Study of Nutritional Care on Changes in Nutrient Intake, Nutritional Status, and Blood Glucose Levels in Children with Type 1 Diabetes Mellitus and Malnutrition

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### ABSTRACT

Type 1 Diabetes Mellitus in children with malnutrition is a complex clinical condition requiring multidisciplinary management, including appropriate nutritional care. This study aimed to evaluate the effect of nutritional care on changes in nutrient intake, nutritional status, and blood glucose levels in a child with Type 1 DM and severe malnutrition. The subject was an 11-year-10-month-old girl who received basal-bolus insulin therapy and a 2,500 kcal/day diabetic diet intervention. Data were collected through direct monitoring of nutrient intake, anthropometric measurements, and daily blood glucose levels, and analyzed descriptively. The results showed an increase in energy intake from 1,764 kcal to 2,304.5 kcal, protein from 67.5 g to 90.6 g, and fat from 44.3 g to 89.3 g. Body weight increased from 28 kg to 31 kg, and nutritional status based on weight-for-height improved from severe malnutrition (70%) to moderate malnutrition (77.5%). Random blood glucose level increased from 66 mg/dL (hypoglycemia) to 135 mg/dL (normal). In conclusion, structured nutritional care tailored to clinical needs can improve nutritional status and glycemic control in children with Type 1 DM and malnutrition

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### Key Messages:

- This study demonstrates that structured nutritional care tailored to clinical needs can improve nutritional status and glycemic control in children with Type 1 Diabetes Mellitus and malnutrition.
  - The results of this study show significant improvements in energy, protein, and fat intake, as well as nutritional status and blood glucose control, following a tailored diabetic diet intervention.
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### INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disease characterized by absolute insulin deficiency due to pancreatic  $\beta$ -cell destruction, necessitating lifelong insulin therapy and nutritional management (Tipici *et al.*, 2023). Children with T1DM and malnutrition are at increased risk of metabolic disturbances, growth retardation, and unstable blood glucose levels. A study in Baghdad reported a prevalence of wasting and stunting in children with DM ranging from 21-38%, exceeding that of the general pediatric population (Hussein *et al.*, 2023).

The incidence of Type 1 Diabetes Mellitus (T1DM) in Indonesian children and adolescents has increased approximately sevenfold (Pulungan *et al.*, 2021). The incidence rate rose from 3.88 per 100,000 population in 2000 to 28.19 per 100,000 population in 2010 (Pulungan *et al.*, 2021). According to the Indonesian Pediatric Association (IDAI) data in 2014, there were 1,021 children with T1DM, with peak incidence observed in children aged 5-6 years and 11 years (UKK Endokrinologi Anak dan Remaja, 2017). By 2018, IDAI reported 1,220 cases of T1DM in children, indicating a rising trend (IDAI, 2015).

Nutritional interventions have been shown to improve glycemic control (HbA1c reduction of 1-1.9%) and nutritional status in children with Type 1 Diabetes. However, research on children with malnutrition remains limited. (Athanasiadou *et al.*, 2024). This case study aims to evaluate the effectiveness of nutritional care on improving nutritional status and glycemic control in a child with Type 1 Diabetes and malnutrition

## CASE DESCRIPTION

This study was conducted at the Pediatric Intensive Care Unit (PICU) of Dr. Wahidin Sudirohusodo Hospital, Makassar, over a 9-day period (April 16-24, 2025). The subject, an 11-year-old girl referred to as An. M, was diagnosed with Type 1 Diabetes Mellitus, moderate diabetic ketoacidosis, and severe malnutrition (Nutritional Marasmus). Her physical characteristics included a weight of 28 kg and height of 148.5 cm, indicating severe malnutrition based on weight-for-height status. During her hospital stay, she received structured nutritional care with a 2,500 kcal/day diabetes diet and insulin therapy consisting of Lantus and Novorapid. Data collection involved direct monitoring and review of medical records, analyzed using descriptive qualitative and simple quantitative methods.

Over a 10-day monitoring period, the patient's fasting blood glucose levels demonstrated a marked transition from dysglycemia to normoglycemia. Prior to intervention (April 15), the patient exhibited hypoglycemia (66 mg/dL). In the initial three days post-intervention (April 16–18), severe hyperglycemia was recorded, with glucose levels peaking at 308 mg/dL. By Day 4 (April 19), glucose levels normalized (104 mg/dL), and from Day 5 to Day 9 (April 20–24), values remained within the normal range (108–143 mg/dL). These trends suggest a favorable glycemic response to the intervention, indicating improved metabolic regulation and potential therapeutic efficacy.

## RESULTS

### *Intake of Nutrient and Anthropometric*

Table 1. Changes in Nutrient Intake, Nutritional Status, and Blood Glucose Levels Before and After Intervention

<b>Variable</b>	<b>before</b>	<b>after</b>	<b>delta</b>	<b>justification</b>
Energy (kcal)	1.764	2.304	+540.5	Nutrient intake increased, approaching daily needs (92.2%)
Protein (g)	67.5	90.6	+23.1	Nutrient intake increased, reaching 96.4% of daily requirements
Fat (g)	44.3	89.3	+45.0	There was a significant increase in nutrient intake, approaching daily needs
Carbohydrate (g)	360	293.1	-66.9	Intake was decreased and adjusted to meet individual needs
Body Weight (kg)	28	31	+3,0	Nutritional status showed improvement with increased intake
Nutritional Status (WHZ)	70% Gizi Buruk	77.5% Gizi Kurang	+7.5%	Nutritional status improved by one category based on CDC standards
Random Blood Glucose (mg/dL)	66	135	+69	Blood glucose levels shifted from hypoglycemia to within the normal range.

Following the intervention, the patient exhibited notable improvements across multiple nutritional and physiological parameters. Caloric and macronutrient intake became more aligned with recommended daily allowances, reflecting enhanced dietary adequacy. These dietary adjustments were accompanied by measurable gains in body weight and nutritional status, suggesting a shift toward better overall health. Importantly, the patient's glycemic profile transitioned from a clinically concerning level to within the normal range, indicating a successful metabolic response. Collectively, these changes underscore the effectiveness of the intervention in promoting nutritional recovery and stabilizing blood glucose levels.

## DISCUSSION

The subject of this case study is an 11-year-old girl admitted to the Pediatric Intensive Care Unit (PICU) of Dr. Wahidin Sudirohusodo Hospital, Makassar, with a diagnosis of Type 1 Diabetes Mellitus (T1DM), moderate diabetic ketoacidosis, and severe malnutrition (marasmus). This condition presents a complex clinical situation, as the patient not only experiences chronic metabolic disturbances due to insulin deficiency but also suffers from severe malnutrition, which can worsen glycemic control and slow down the recovery process. Children with T1DM and malnutrition are at higher risk of metabolic imbalance, hypoglycemia, and growth impairment.

According to a study by Libman et al. (2022), poor nutritional status in children with T1DM can impair the effectiveness of insulin therapy, increase susceptibility to infections, and worsen blood glucose control. In this context, proper nutritional management becomes a crucial aspect of comprehensive clinical care. During her hospital stay, the subject received insulin therapy combining basal insulin (Lantus) and rapid-

acting insulin (Novorapid), a common intensive insulin regimen used in managing T1DM in children, aiming to mimic physiological insulin secretion.

The combination of Lantus (insulin glargine) and Novorapid (insulin aspart) proved effective in lowering HbA1c levels significantly in children and adolescents with T1DM without increasing the risk of severe hypoglycemia, as shown in a study by Battelino et al. (2018). This supports the approach used in this case. Initially, the subject's blood glucose level was 66 mg/dL, indicating hypoglycemia, likely due to an imbalance between insulin dosage and inadequate nutrient intake. After adjusting her diet to 2,500 kcal and providing proper nutritional care, her blood glucose levels gradually improved and stabilized within the normal range starting from the fourth day of intervention.

This case highlights the importance of coordinating insulin therapy with nutritional management in achieving effective glycemic control in children with T1DM. After the nutritional intervention, there was a significant increase in the subject's nutrient intake, from 1,764 kcal (70.5% of needs) to 2,304.5 kcal (92.2% of needs), with protein intake reaching 96.4% of requirements. This improvement aligns with the recommendations of Medical Nutrition Therapy (MNT) for children with T1DM, emphasizing the importance of adequate energy and protein intake to support growth and optimize metabolic function.

The subject's nutritional status also improved, with her weight increasing from 28 kg to 31 kg and her nutritional status based on weight-for-height index (CDC) shifting from severe malnutrition to mild malnutrition. The improvement in blood glucose levels, from hypoglycemia to a stable range, further indicates that the combination of insulin therapy and proper nutritional management was effective in achieving glycemic control. This is supported by ISPAD guidelines (2022) and studies showing that structured nutritional interventions can significantly improve outcomes in children with T1DM.

## CONCLUSION

In conclusion, the complex interplay between T1DM and malnutrition requires a comprehensive approach that includes both insulin therapy and nutritional management. The findings from this case study underscore the importance of personalized nutrition education and structured meal planning in achieving optimal glycemic control and improving nutritional status in children with T1DM, particularly those suffering from severe malnutrition.

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