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Nutrition Management In Children with Chronic Diarrhea, Vitamin D Deficiency, Iron Deficiency Anemia, And Stunting: A Case Study

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ABSTRACT

This case study assesses the effectiveness of nutritional management in a child with chronic diarrhea, vitamin D deficiency, iron-deficiency anemia, and stunting in the PICU. A 9-day intervention involving a rehabilitation phase diet and nutritional monitoring showed gradual improvements in intake and physical condition, despite no changes in anthropometric measurements. The study highlights the importance of standardized, individualized nutrition care in preventing deterioration and improving outcomes in malnourished children. The monitoring and evaluation results for patient intake showed that the respondents' intake continued to increase gradually. Meanwhile, the monitoring and evaluation results for nutrition education and counseling for the patients' mothers showed an increase in understanding of nutrition. This case study concludes that the standardized individualized nutrition care process has been proven to increase the respondents' intake, thereby preventing the deterioration of their condition and improving the mothers' understanding of the nutrition management provided

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CASE REPORTS

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Key Message

- Early and precise nutritional management is crucial in addressing complex pediatric cases.
- Holistic intervention can significantly improve growth outcomes and quality of life.

INTRODUCTION

Stunting is a chronic nutritional problem characterized by a child's height being below the standard for their age, and is often an indicator of prolonged malnutrition, recurrent infections, and unfavorable socioeconomic conditions. According to the World Health Organization (WHO), stunting reflects the failure of children to grow and develop optimally, which impacts their learning ability, productivity as adults, and the risk of chronic diseases later in life (1). UNICEF also emphasizes that the most critical period for preventing stunting is the first 1,000 days of life, from pregnancy to age two. In 2023, WHO and UNICEF reported that

approximately 148 million (22.3%) children under the age of five worldwide were stunted, with the highest proportions in South Asia and Sub- Saharan Africa (2).

The prevalence of stunting in Indonesia has remained a serious public health issue over the past five years. According to data from the Indonesian Nutrition Status Survey (SSGI), the national stunting rate shows a declining trend, although it remains above the set target. In 2018, the stunting prevalence was 30.8%, then decreased to 27.7% in 2019. After the survey was not conducted in 2020 due to the COVID-19 pandemic, it was resumed in 2021 and recorded a rate of 24.4%. The downward trend continued in 2022 with a rate of 21.6%, and in 2023, the stunting prevalence decreased further to 21.5% (3). Despite the consistent decline, the figure has not yet reached the national target of 14% by 2024, as outlined in the National Medium-Term Development Plan. This highlights the need for more focused and sustained efforts to address the key determinants of stunting across various regions in Indonesia.

Stunting is often the result of complex interactions between nutritional deficiencies and chronic infections, including recurrent diarrhea, micronutrient deficiencies, and anemia. A systematic review in developing countries found that children with iron deficiency have a 2.27-fold higher risk of stunting compared to those without anemia. In Indonesia, high rates of anemia and iron deficiency (around 30–45%) among low-income groups are closely correlated with stunting in infants (29.3%). Additionally, vitamin D deficiency significantly impairs bone mineralization and IGF-1 function, thereby slowing linear growth in stunted infants. Meta-analysis studies show that children with vitamin D deficiency have a 3.1 times higher risk of anemia, reinforcing that micronutrient deficiencies can worsen hematological status and growth. Recurrent chronic diarrhea also contributes to nutrient malabsorption and intestinal infections, deepening the malnutrition–infection–stunting cycle, although specific data from the past five years remains limited. Overall, evidence from journals between 2022 and 2025 confirms that chronic diarrhea, vitamin D deficiency, iron-deficiency anemia, and iron deficiency reinforce each other in the pathophysiological pathways leading to stunting.

CASE DESCRIPTION

Assessment of respondent An.SK, male, born on December 10, 2023, admitted to the PICU on March 28, 2025. The respondent is the second of two siblings. The father is a daily wage laborer with a high school education, and the mother is a housewife with a high school education. Admitted to the hospital with severe diarrhea. The child has a history of frequent illnesses, including fever, cough, flu, and diarrhea. The respondent's weight has been difficult to increase and has tended to decrease over the past two months. Anthropometric data: birth weight 2.1 kg, current weight (April) 7 kg, MUAC 12 cm, height 70 cm. Nutritional status: weight-for-age severely stunted, height-for-age severely short, weight-for-height malnourished. The child appears shorter and thinner than peers, less active, weak and lethargic, reluctant to eat or drink, with loose stools containing some residue 5 to 8 times daily in small amounts, occasionally accompanied by seizures. The child's feeding history indicates that the child was not exclusively breastfed but was given formula milk when the parents had the funds to purchase it, up to a maximum of 700 g per month. The remainder of the time, the child was given sweetened condensed milk whenever requested. After six months, the child was introduced to complementary foods, including rice porridge with salt, until the age of 11 months. Formula milk and sweetened condensed milk were continued until the child was admitted to the hospital. At the age of 12 months, the respondent began to be given family meals with a soft consistency, consisting of white rice (porridge), animal-based side dishes such as chicken, eggs, and fish, 1-2 times a week. The child refused to eat vegetables and was reluctant to drink plain water. Every day, the child ate snacks such as crackers, biscuits, and bread obtained from neighbors.

The results of the biochemical data at the beginning of the anamnesis on March 29, 2025, were Random Blood Glucose 82 mg/dl (hypoglycemia), hemoglobin 10.9 g/dl (anemia), and vitamin D 16 ng/ml (vitamin D deficiency). Based on the calculation of total energy requirements of 1050 kcal, protein 21 g, fat 31.5 g, and carbohydrates 170.62 g. The recall results before intervention, which included full milk, showed that total energy intake was 57.1%, protein 77.9%, fat 69.3%, and carbohydrates 48%, indicating that the recall results fell into the category of mild deficiency (according to the WHO: mild deficiency <80% of requirements).

RESULTS

From the identification of nutritional problems in the nutritional assessment, a nutritional diagnosis was established: NI 2.1 inadequate oral intake related to the child being reluctant to eat, weak, and having loose stools, characterized by 24-hour recall results of 57.1% energy, 77.9% protein, 69.3% fat, and 48% carbohydrates. NI 5.1 increased specific nutritional needs related to accelerated growth, characterized by GDS

82 mg/dl (hypoglycemia), Hb 10.9 g/dl (anemia), vitamin D 16 ng/ml (vitamin D deficiency), and stunting. NB 1.7: Inappropriate food selection is associated with the perception of insufficient resources (financial), preventing consistent food selection in line with recommendations, as evidenced by the provision of sweetened condensed milk to children under 1 year of age as a substitute for formula milk.

The nutritional intervention plan provided is consistent with the established nutritional diagnosis, namely a malnutrition management diet in the rehabilitation phase with liquid consistency via enteral route orally, with the aim of: Providing the body with the opportunity to adapt to increasing energy and protein intake to prepare the child for the rehabilitation phase, Providing

adequate nutrition for catch-up growth, Motivate the mother and respondent to finish their portions, Help prevent further weight loss, especially during the Nutrition-Focused Physical Exam (NFPE), to gradually increase the MUAC measurement toward normal levels, To help achieve normal nutritional status gradually with a target weight gain of more than 10 g/kgBW/day or ≥ 50 g/kgBW/week, To help improve the nutritional knowledge of mothers and patients' families as well as the quality of life of patients through nutrition education and counseling. The requirements and principles of the diet are: Energy 150 kcal/kgBW/h. The body weight used for calculation is the actual body weight at the time of intervention, which is 1050 kcal, Protein 3 g/kg body weight/hour, which is 21 g or 8% of total requirements, Fat 27% of total requirements or 31.5 g 170.62 g, Fluids calculated using the Holiday Fresh method with a total fluid requirement of 700 cc/day.

Interventions in the form of nutrition counseling were also provided, including education/counseling and monitoring of the children's condition. Nutrition education/counseling was provided on: 1) an explanation of the children's current nutritional condition and status; 2) an explanation of the causes/effects that arise/will arise from the stunting experienced by the children; 3) explanation of meeting the child's needs gradually, especially after returning home 4) explanation of the risks of incorrect selection of formula milk substitutes for children and 5) education on local PMT alternatives that are cheap/easily available and can be made at home when the child refuses to eat. Monitoring and evaluation plan. Physical data related to nutrition are monitored and evaluated at each visit using direct observation methods, with success indicators including the child willing to eat/drink milk, the child not feeling weak, reduced frequency of bowel movements, and stools not being watery. Nutritional intake monitoring and evaluation are conducted daily using a 24-hour recall method, with success indicators including a gradual increase in intake according to the child's tolerance. For monitoring and evaluation of biochemical values, laboratory tests are conducted according to the latest laboratory standards, with success indicators including laboratory values approaching normal levels.

Nutritional screening results for respondents indicated malnutrition and other conditions related to nutrient deficiencies. Standardized nutritional care was provided over 9 days of intervention in the PICU. Anthropometric measurements were taken before intervention and on the last day of intervention, showing no changes in MUAC and high measurements for respondents, thus maintaining their nutritional status in the "nutritionally deficient" category. Laboratory tests were conducted before the intervention and on the sixth day of the intervention (Table 1), after which no further tests were conducted until the intervention ended on the ninth day.

Table 1. Results of Monitoring and Evaluation of Biochemical Values

Parameter	Before	During intervention		Reference Value	Interpretation
	29/04/2025	05/05/2025	06-08/05/2025		
Hemoglobin	10.9	10.8	-	12-16 g/dl	Iron Deficiency Anemia
Vitamin D	16			30-100 ng/ml	Vitamin D Deficiency
Random Blood Glucose	82	88		4-6 x10^6/UL	Hypoglycemia
Natrium	-	134	-	135-145 mmol/L	Risk of hyponatremia

The results of monitoring and evaluation of nutrition education and counseling for mothers of patients show an increase in understanding of the current condition and nutritional status of children, the causes/consequences arising from or likely to arise from the stunting experienced by the child, the gradual fulfillment of the child's needs, especially after returning home, and the risk of incorrect selection of formula milk substitutes for the child can be assessed based on compliance with the feeding schedule provided and compliance with the gradual feeding method, which does not insist that the volume must always be the same.

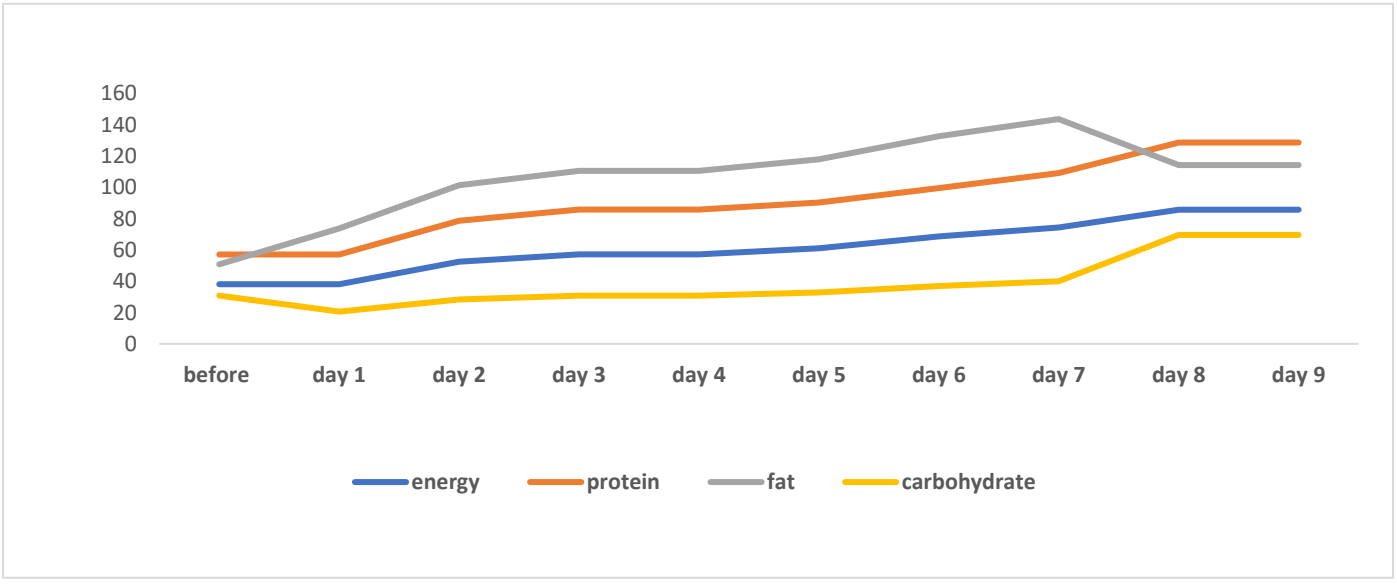

Figure 1. The Subject intake of energy and nutrient

The results of monitoring and evaluation of patients' energy intake during the 9-day intervention based on the 24-hour recall method and observation results can be seen in Graph 1, which shows that the respondents' intake continued to increase gradually. As for fat intake, there was a decrease due to a change in the type of milk provided, but the decrease was still within the adequate intake category.

The results of physical monitoring and evaluation of patient nutrition were observed and recorded from the medical electronic results during the intervention, the child initially exhibited classic signs of severe malnutrition—appearing thin, short, weak, and lethargic, with frequent watery stools occurring 5 to 8 times per day, alongside nausea and occasional seizures. In the early days, there were no significant improvements in appetite or strength. By the fifth day, the child began accepting milk, although solid foods such as porridge and rice were still refused. Noticeable recovery emerged by days seven and eight, with the child showing increased enthusiasm and reduced lethargy. Digestive symptoms improved significantly, as bowel movements normalized and nausea subsided. Seizures were no longer observed. These progressive physical changes reflect the positive impact of individualized nutritional management and therapeutic feeding, contributing to clinical recovery despite the absence of measurable changes in weight or height indicators

DISCUSSION

Stunting in toddlers is a condition of growth failure due to poor micronutrient status and infectious diseases, with iron and vitamin D deficiencies playing significant roles. Addressing iron and vitamin D deficiencies, along with preventing and managing gastrointestinal infections like acute diarrhea, is crucial in managing stunting in children The anthropometric monitoring on day XI showed no significant changes in patients' nutritional status, which remained poor and stunted. This outcome aligns with studies indicating that short-term nutritional interventions often fail to yield substantial improvements in anthropometric indicators like weight and height in children with stunting and malnutrition (4),(5), highlighting the need for longer-term and more comprehensive interventions.

Follow-up laboratory examinations showed that patients still had hypoglycemia and anemia, while sodium levels remained normal. Research indicates that children with acute diarrhea and poor nutritional status are susceptible to electrolyte imbalances and declines in hematological and metabolic parameters (6),(7),(8).

Providing a rehabilitation phase diet is a crucial nutritional therapy option for malnourished children, particularly those with acute diarrhea, micronutrient deficiencies, and stunting. Studies have shown that rehabilitation diets can improve nutritional status, accelerate weight gain, enhance hemoglobin and vitamin D levels, and support intestinal recovery (9),(10),(11). The intervention using WHO F100 formula and balanced formula milk effectively increased patients' energy and nutrient intake, despite their refusal to consume solid foods. Studies have shown that F100 formula can meet daily energy needs, support weight gain, and maintain nutrient intake in children with severe malnutrition (12),(13).

Nutrition education and counseling for parents, especially mothers, play a crucial role in improving understanding and appropriate childcare practices for children with nutritional issues such as stunting. A study by Fatima et al. (2020) showed that educational interventions based on nutrition counseling can enhance mothers' knowledge about the causes and long-term consequences of stunting, including its impact on children's growth and development (14). Another study by Kurniawan et al. (2021) in Indonesia showed that improved maternal understanding after nutrition counseling was significantly correlated with increased compliance in feeding practices, including the selection of appropriate formula types and the gradual implementation of tailored feeding techniques (15). Similar results were also found by Alemayehu et al (2023), who reported that nutrition education for parents plays an important role in preventing incorrect feeding practices after discharge from health facilities, including in terms of adapting food volume and frequency without coercion, which is crucial for preventing digestive issues and ensuring gradual acceptance by the child. Previous studies reinforce the importance of nutrition counseling (15)(16)(17)(18) as an integral part of managing stunting in children (8). While knowledge gains were significant, future studies should track actual changes in children's nutritional status post-intervention (19)(20).

CONCLUSION

Based on the case study, the standardized individualized nutrition care approach was proven to increase respondents' intake, thereby preventing worsening of their condition and enhancing mothers' understanding of the nutrition management provided.

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Conflict of Interest: The authors declare no conflict of interest.

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