

Optimizing Nutrition Care Using Local Food in Malnourished Children with Measles: A Case Study

Alfiyyatunnisa¹ and Diana Mareta I F A Pitaloka^{1*}
Poltekkes Malang, Malang, Jawa Timur
*E-mail: diana_mareta@poltekkes-malang.ac.id

Abstract: *Introduction: Measles is a viral infectious disease and often accompanied by serious complications in children with malnutrition. Malnutrition and measles have a relationship that worsens each other, so as comprehensive management is needed through integrated nutrition care. This study aims to describe the application of integrated nutritional care in children with malnutrition and medical diagnosis of measles. Case presentation: The study used a case study design on a 33-month-old inpatient child. Data collection was carried out through anthropometric, biochemical, clinical, and dietary intake assessments, as well as interviews with parents and medical records review during three days of treatment. Discussion: The results of the study showed that the patient experienced acute malnutrition with very low energy and protein intake, accompanied by a clinical condition of measles infection. Nutritional interventions in the form of providing a High Calorie High Protein (HCHP) and diet nutrient-dense combinations can be achieved through appropriate selection and processing of local ingredients. Moreover, collaboration with others health workers, and nutrition education to the parents (mother) showed an increase in nutrient intake, improvement in clinical conditions, and early weight gain during the hospitalization period. However, improvements in laboratory parameters have not been seen significantly in a short period of time. Conclusion: Integrated nutritional care plays an important role in supporting patient recovery and needs to be continued on an ongoing basis after the patient is discharged from the hospital.*

Keywords: *children, high-energy protein diet, integrated nutrition care malnutrition, measles*

INTRODUCTION

Measles is a contagious viral infectious disease caused by viruses of the family Paramyxoviridae and can be spread through the air (Misin et al., 2020). One of the typical symptoms of measles infection is the appearance of grayish-white patches with a reddish base (Koplik's spot) (Do & Mulholland, 2025). In Indonesia, measles is still a serious public health problem with the highest proportion of cases in children aged 5-9 years (29%) and 1-4 years old (25%). Based on the 2022 Indonesian Health Profile, there were 21,175 mobile cases reported in all provinces with laboratory examination results showing 4,844 positive cases (22.9%). This condition shows an increase in cases from 2021 which is likely due to a decrease in immunization coverage during the pandemic which increased the population's vulnerability to measles (Riantina et al., 2024).

Risk factors of increasing measles transmission include: not getting measles vaccine, low knowledge or lack of information related to measles, and unhealthy environmental conditions. The vaccination is one of the ways to increase an individual's immunity to be resistant to viral infections (Basa et al., 2015; Khongthaw & Geetha, 2022; Concern et al., 2020). Children who do not get the measles vaccine or MMR vaccine have a much higher risk of contracting measles (Khongthaw & Geetha, 2022). In addition, unhealthy environmental conditions (poor ventilation, high occupancy density, and poor sanitation) can increase and accelerate the transmission of the measles virus (Basa et al., 2015). Knowledge (especially for mother) about measles, how it is transmitted, and the importance of

immunization is very influential on the risk of children getting measles (Prihanti et al., 2020). Thus, mothers with less knowledge are likely not to carry out complete vaccination for their children and less likely to maintain the cleanliness and health of the environment to prevent transmission.

Malnutrition and measles have a relationship that worsens children's health conditions. Children with malnutrition has decreased immune system function, especially cellular immunity, making them more susceptible to infections, including the measles virus. Lack of energy, protein, and micronutrients such as vitamin A, zinc, and iron can decrease the body's ability to form antibodies and fight pathogens (Tran et al., 2023). Measles in malnourished children tends to be heavier and accompanied by complications such as diarrhea, pneumonia, and dehydration (Bai et al., 2022). In addition, measles infection can worsen a child's nutritional status through decreased appetite, increased metabolic needs, and impaired nutrient absorption. This condition creates a cycle of infection and malnutrition that is difficult to break without proper intervention (Bai et al., 2022; Mardya et al., 2023).

Nutritional management in malnourished children with measles must be carried out comprehensively and gradually according to clinical conditions. Nutritional care is focused on meeting energy and protein needs to support the healing process and improve nutritional condition (Noori et al., 2022). The implementation of hospital menus based on local food ingredients represents a strategic approach not only to meet patients' nutritional requirements during hospitalization but also to ensure the sustainability of dietary practice after discharge (Utter et al., 2026). This alignment with local dietary patterns is critical, as it reduces the gap between therapeutic diets in hospitals and habitual intake at home. From a behavioral perspective, patients and caregivers are more likely to adopt and maintain dietary recommendations when the foods are familiar, accessible, and affordable. In addition, monitoring of food intake, dietary tolerance, and education to the parents as caregiver is necessary to prevent recurrence and support long-term recovery.

CASE DESCRIPTION

This study was conducted to A 2 year and 9 month (33 months) boy with a medical diagnosis of measles and malnutrition. The patient came to Hospital with fever, cough, and runny nose for approximately three days, along with a rash all over his body. The results of anthropometric measurements showed a body weight (BW) of 9,40 kg and a height (H) of 88,00 cm. Normal pregnancy history up to 9 months gestational age, the patient was born with a body weight of 3.5 kg through normal delivery. Patients received breast milk until the two years old. Based on the results of the interview with the patient's mother, the patient did not have a vaccination history and did not regularly visit the posyandu (integrated health post) so that the patient's growth and development monitoring was not optimally monitored because he did not have a KIA (Kesehatan ibu dan anak; maternal and child health) book. Observations were carried out for three days (September 20th-23rd, 2025). The data obtained were analyzed descriptively to describe the nutritional care process and the development of the patient's condition during the hospitalization period.

Based on the results of anthropometric data measurement, the results of the WHO Z-Score (2017) were obtained as follows: BW/A= -2.70 (underweight), H/A= -1.9 (Normal), and BW/H= -2.7 (undernourished). These results showed that the patient was suffering from acute malnutrition. The results of the laboratory examination (September 18, 2025), the following data were obtained:

Table 1. Laboratorium test results (Biochemistry Data)

Parameters	Results	Normal Values	Remarks
Haemoglobin (Hb)	10.14 g/dL	10.5 -13.5 g/dL	Low
Haematocrit (HCT)	32,9 %	33 -49 %	Low
MCH	23.96 PG	23 -31 pg	Normal
MCHC	30,84 %	30 – 36 %	Normal
Neutrophil %	56,1 %	32 – 54 %	High

Parameters	Results	Normal Values	Remarks
Monocyte %	7,41 %	3 – 6 %	High
MPV	4.9 fL	6.90 – 10.6 fL	Low

Based on the assessment of physical examination, it was found that general consciousness was weak (GCS 456), cough, runny nose, fever (temperature 38.5°C), rash all over the body and mouth ulcers which resulted in a decrease in appetite. This clinical condition causes the patient's food intake was very low when the body in the metabolism enhancement. Moreover, the dietary assessment used SQ-FFQ form to dig up information on previous eating history and the 24h recall form to see the current nutritional history, the following data was obtained in Table 2.

Table 2. Dietary History Results

Previous nutritional history	Current eating history
<ul style="list-style-type: none"> - Eating for 3-4x a day with 3x snacks. - The staples that are commonly consumed are rice (1 spoonful per meal, every day), noodles (1/2 pack) and bread (1-2 combs) 1-2 times a week. - Animal sources that are often consumed are eggs (processed by boiling or frying) 1 egg at each meal 3-4 times a week. - Vegetable sources that are often consumed are tofu and tempeh (processed by frying or steaming) 2-3 small pieces 3-4 times per week. - Vegetables that are often consumed are carrots, potatoes, chickpeas, cabbage, spinach, young jackfruit and sprouts 1-2 times per week. - Fruits that often consumed are bananas, melons, watermelons 2-3 times per week - The snack consumed was in the form of packaged snacks and fried dishes. 	<ul style="list-style-type: none"> - During in the hospital, patients have been given a regular diet with low fiber and 4x 100 ml growth milk. - The results of the recall carried out on September 19th, 2025 obtained the following results: Energy : 316.2 kcal (24%) Protein : 9.3 grams (18%) Fat : 5.7 grams (15%) Carbohydrates : 57 grams (29%) <p>With the category of intake fulfillment rate "Severe Deficit" because the intake is less than 70% (Gibson, 2005).</p>

Based on Table 2, the dietary history reflects both chronic inadequate intake prior to illness and acute deterioration during infection, which together contribute to the patient's malnutrition status. This emphasizes the need for comprehensive and continuous nutritional management, not only during hospitalization but also after discharge.

The nutritional diagnosis enforcement refers to Nutrition Care Process Terminology (2020) as follows:

1. (NC-4.1) Malnutrition related to inadequate energy - protein intake and increased metabolism (measles infection) is characterized by a Z-Score of BW/BH -2.7 SD and BW/A -2.7 SD and BW/A -2.7 SD.
2. (NI-2.1) Inadequate oral food and beverage intake related to decreased appetite and mouth ulcer is characterized by the results of the recall showing a severe deficit category (<70% of total daily needs).
3. (NI-5.1) Increased protein energy requirements are associated with increased metabolism due to measles infection characterized by fever and pursue growth and development.
4. (NB-1.1) lack of knowledge related to nutrition and growth and development related to the infrequent visits to posyandu is characterized by not having a KIA book, Ultra Processed Food (UPF) consumption habits.

The nutritional interventions are given based on etiology in established nutritional diagnoses. Based on the diagnosis formed, the interventions plans provided are as follows: modified meals and snack (Energy 1300 kcal, protein 39 gram, fat 43 gram, carbohydrate 178 gram, and micronutrients (vitamins and minerals) is given according to the RDA (ASDI, 2025)), collaboration with other health workers such as doctors, nurses and pharmacists, and give nutrition education. The Diet menu consist of appropriate selection and processing of local ingredients. For example, the combination of rice with animal (chicken, eggs, fish) and plant-based proteins (tempeh, tofu) provides a complementary amino acid profile, while traditional cooking methods (steaming, boiling, sautéing) help preserve nutrient quality and improve digestibility, especially important for patients with compromised conditions such as infection or oral lesions. Daily needs are divided into 3 main meals and 2 snacks.

Table 3. Menu Implementation

	Day 1	Day 2	Day 3
Lunch	Nasi tim (soft textured rice) Chicken rolls Yellow spice tofu Sayur bening (carrots and gambas) Watermelon	Rice Vegetable omelet (chicken egg and carrots) Yellow spiced tempeh vegetable soup (prawns, carrots, and potatoes) Banana	Rice Chicken Pepes yellow spice tofu sayur bening (carrots and corn peeled) Watermelon
Lunch	Nasi tim (soft textured rice) beef rendang Yellow Seasoning Tempeh Lodeh (chayote and eggplant) Apples	Rice Chicken Soto Tahu Cetak (tofu, potatoes, rice noodles) Melon	Rice Beef rawon Tempeh menjeng bakar Sauteed chayote Apples
Breakfast	Nasi tim (soft textured rice) Flour fried dori Rolade tofu cah sayur (Carrot and Corn Peeled)	Rice Eggs with Balinese spices Baked potato cakes (potatoes and chicken eggs) oseng-oseng (carrots and soun)	Rice Steamed fish rolade (mackerel) Red spice tofu cah sayur (carrots and chayote)

The administration of soft textured meals is due to the patient's experience of mouth ulcer, so the administration of soft textured meals is expected to facilitate the chewing process and increase the patient's acceptance of the food given. There is a change in the form of food given on the second day (from soft to normal texture). This is expected on the second day that the condition of mouth ulcer in patients was getting better.

Monitoring and evaluation are carried out based on the parameters used as signs and symptoms in the diagnosis that has been enforced.

a. Daily food intake

Daily food intake monitoring was carried out for three days using the 24h recall and Comstock method. The results of the intake monitoring were obtained as follows:

Table 4. 24-h Recall Monitoring Result

		Energy (kcal)	Protein (gram)	Fat (gram)	Carbohydrates (gram)
Day 1	Food Intake	1.159	38	20	209

		Energy (kcal)	Protein (gram)	Fat (gram)	Carbohydrates (gram)	
Day 1	Growth-milk 4x100	-	-	-	-	
	Total	1.159	38	20	209	
	% Intake	89	97	46	117	
	Categories	Mild deficit	Appropriate	Weight deficit	Appropriate	
	Food intake	1.120	45	35	215	
	Growth-milk 4x100	-	-	-	-	
	Total	1.120	45	35	215	
	% Intake	86	104	81	120	
	Categories	Mild deficit	Appropriate	Mild deficit	Appropriate	
	Food intake	1.196	42	37	180	
Day 2	Growth-milk 4x100	28.7	3.2	4.7	16.6	
	Total	1.225	45	42	196	
	% Intake	94	115	97	110	
	Categories	Appropriate	Appropriate	Appropriate	Appropriate	
	Day 3	Growth-milk 4x100	-	-	-	-
		Total	1.120	45	35	215
		% Intake	86	104	81	120
Categories		Mild deficit	Appropriate	Mild deficit	Appropriate	
Food intake		1.196	42	37	180	
Growth-milk 4x100		28.7	3.2	4.7	16.6	
Total		1.225	45	42	196	
% Intake	94	115	97	110		
Categories	Appropriate	Appropriate	Appropriate	Appropriate		

b. Body Weight

The body weight measurement is carried out every morning (before breakfast and/or after defecation) every two days, so that the following data is obtained:

Table 5. The Body Weigh Monitoring Result

	September 20, 2025	21 September 2025	22 September 2025
Weight (kg)	9,4	-	9,7

c. Clinical Physical Conditions

Based on the results of monitoring carried out for three days, the patient's condition showed gradual improvement. There was a decrease in body temperature on the third day of reaching normal body temperature (36°C), the red rash slowly began to blacken and fade on the third day, and the appetite began to improve on the second day and was followed by the condition of mouth ulcer which began to improve on the third day.

d. Laboratory data

The laboratory examination was carried out on September 20 and 21, 2025 with the following results:

Table 3. The Laboratory Profil Monitoring Results

Parameters	Normal Values	September 20, 2025	September 21, 2025
Hemoglobin (Hb)	10.5 -13.5 g/dL	10.4 g/dL	9.67 d/dl
Hematocrit (HCT)	33 -49 %	30,2 %	31,2 %
MCH	23 -31 pg	23.96 PG	23.47 PG
MCHC	30 - 36 %	30,84 %	30,6 %
Neutrophil %	32 - 54 %	66,3 %	63,4 %
Monocyte %	3 - 6 %	8,7 %	8,4 %
MPV	6.90 - 10.6 fL	4.9 fL	4,525 fL

Based on the results of laboratory examinations, there were no significant changes when compared to the data obtained before the nutritional intervention was carried out.

e. Knowledge level

Monitoring and evaluation of the level of knowledge is carried out orally through questions and answers and repetition of material. Based on the results of the questions and answers, the patient has understood the definition, goals and requirements of a high-protein energy diet. In addition, patients also understand the selection of food ingredients in the preparation of menus and portions by being guided by the leaflets of food exchangers.

PATIENT CONSENT

Written informed consent was obtained from the patient's parent/legal guardian prior to inclusion in this study. The parent/legal guardian provided signed consent for the participation of the patient and for the publication of anonymized clinical data. All procedures performed were in accordance with ethical standards, and all reasonable efforts have been made to protect the patient's identity and confidentiality.

DISCUSSION

This case study demonstrates that malnutrition and measles interact in a bidirectional and mutually aggravating cycle, where pre-existing inadequate nutritional status increases susceptibility to infection, while the infection itself further deteriorates nutritional condition. The patient presented with anthropometric indicators of acute malnutrition (BW/H -2.7 SD) alongside clinical manifestations of measles, confirming that poor nutritional reserves had already compromised immune function prior to infection. This finding is consistent with previous evidence showing that children with malnutrition have impaired immune responses, particularly in cellular immunity, making them more vulnerable to infectious diseases such as measles (Tran et al., 2023).

From a dietary perspective, the results indicate that the patient had experienced chronic inadequate intake before hospitalization, characterized by low portion sizes, infrequent consumption of protein-rich foods, and limited intake of fruits and vegetables. This pattern reflects not only insufficient macronutrient intake but also potential micronutrient deficiencies, which are critical for immune competence. The presence of such deficiencies may explain the severity of the patient's clinical presentation, as inadequate intake of vitamin A, zinc, and other micronutrients is known to worsen measles outcomes and increase the risk of complications (Bai et al., 2022). Importantly, this condition highlights that malnutrition in this case is not an acute event but rather the result of long-standing suboptimal dietary practices, likely influenced by caregiver knowledge and feeding behavior (Prihanti et al., 2020).

The biochemical findings further support the presence of a compromised nutritional and inflammatory state. Low hemoglobin and hematocrit levels indicate microcytic hypochromic anemia, which is commonly associated with chronic nutritional deficiencies and increased physiological demands during infection (Ghosh et al., 2015; Kurunandani & Ngaling, 2025). At the same time, elevated neutrophil and monocyte levels reflect an active inflammatory and infectious response due to measles (Solmaz et al., 2020). The coexistence of anemia and infection suggests that the patient's body is under dual physiological stress, where nutrient deficiencies limit the ability to mount an effective immune response, while infection increases nutrient requirements.

The implementation of a High Calorie High Protein (HCHP) diet, combined with interprofessional collaboration and nutrition education, demonstrated measurable improvements in several short-term outcomes. There was a progressive increase in dietary intake, with intake adequacy reaching normal levels by the third day of intervention. This improvement can be critically attributed not only to the nutritional prescription itself but also to the modification of food texture and the management of clinical symptoms, such as mouth ulcers and fever, which initially limited intake. This finding underscores the importance of integrating clinical and nutritional management, as untreated symptoms can act as barriers

to achieving adequate intake despite appropriate dietary planning (Maidelwita et al., 2025). Furthermore, the integration of local food into hospital menus supports economic and cultural sustainability. Local ingredients are generally more affordable and readily available, reducing the financial burden on families after discharge. This is particularly relevant in low-resource settings, where adherence to dietary recommendations is often constrained by economic factors. By designing hospital menus that mirror home food environments, healthcare providers indirectly facilitate long-term adherence and reduce the risk of relapse into malnutrition. This aligns with the broader concept of contextualized nutrition care, where interventions are tailored not only to clinical needs but also to socio-cultural realities (Utter et al., 2026). Despite these advantages, the implementation of local food-based hospital menus requires careful planning to ensure nutritional adequacy and food safety. Variability in nutrient composition, preparation methods, and portion sizes can affect the consistency of nutrient intake. Therefore, standardized menu planning, portion guidance, and continuous monitoring remain essential. Additionally, while short-term improvements in intake and clinical condition were observed in this case, sustained recovery depends on whether these dietary practices are continued at home. This highlights that the true effectiveness of hospital nutrition intervention should be evaluated beyond inpatient outcomes, extending into post-discharge adherence and long-term nutritional status.

In parallel, clinical improvements were observed, including normalization of body temperature, reduction of rash, and improved appetite. These changes suggest that the intervention contributed positively to the patient's recovery process. However, it is important to note that these improvements cannot be attributed solely to nutritional intervention, but rather to a synergistic effect of medical treatment and nutritional support, highlighting the importance of interprofessional collaboration (Syafiq & Kesehatan Kementerian Kesehatan Jambi, 2025). Nutritional care, therefore, should be viewed as a supportive yet essential component within a broader therapeutic framework.

The observed weight gain of 300 grams within three days may reflect a positive response to improved intake. However, this outcome should be interpreted with caution. Short-term weight changes may be influenced by factors such as fluid balance and do not necessarily indicate true nutritional recovery. As noted in previous studies, meaningful and stable changes in body weight require longer observation periods, and early weight gain should be considered a preliminary indicator rather than definitive evidence of intervention success (Pearcey & De Castro, 2002). Therefore, continuous monitoring after discharge is essential to evaluate sustained improvement. In contrast to clinical and intake improvements, laboratory parameters did not show significant changes during the short observation period. This finding is expected, as biochemical recovery, particularly in cases involving infection and anemia, typically requires a longer duration of intervention. The persistence of abnormal laboratory values suggests that while initial clinical stabilization has been achieved, the patient remains in a recovery phase that requires ongoing nutritional and medical support. Previous evidence indicates that improvements in laboratory indicators may take several weeks, depending on the severity of the condition and the adequacy of interventions (Safiri et al., 2021).

Another critical aspect highlighted in this case is the role of caregiver knowledge and behavior. The patient's history of irregular posyandu visits, absence of immunization, and suboptimal feeding practices indicate that non-biological factors significantly contributed to the development of malnutrition and infection risk. The improvement in caregiver knowledge following nutrition education suggests that behavioral interventions are essential for ensuring long-term sustainability of nutritional care. Without addressing these underlying determinants, there is a high risk of recurrence after hospital discharge. Overall, this case illustrates that the management of malnutrition in children with measles requires a multidimensional approach, addressing not only immediate nutritional deficits but also clinical conditions, caregiver factors, and long-term behavioral changes. The findings reinforce that short-term improvements in intake and clinical status are achievable; however, sustained recovery depends on continuous, integrated care beyond hospitalization. This includes ongoing dietary management, regular

monitoring of growth and development, and reinforcement of caregiver education to prevent relapse and support optimal child health outcomes (Bai et al., 2022; Tran et al., 2023).

CONCLUSIONS

In conclusion, the use of local food in hospital menus is not merely a practical choice but a critical component of effective and sustainable nutrition care. It bridges the gap between clinical intervention and real-life application, enhances patient and caregiver acceptance, and supports long-term adherence to therapeutic diets. However, its success is contingent upon comprehensive nutrition education, caregiver engagement, and ongoing monitoring after discharge. Without these supporting components, the potential benefits of local food-based interventions may not be fully realized, and the risk of recurrence of malnutrition remains significant.

CONFLICT OF INTEREST STATEMENT

The authors confirm that this research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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