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Standardized Nutrition Care Process in a Pediatric Patient with Typhoid Fever, Dengue Hemorrhagic Fever, Measles with undernutrition: A case study

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ABSTRACT

In Indonesia, infectious diseases remain one of the leading health problems among children, particularly in developing regions. This study aimed to evaluate the implementation of standardized nutrition care for a pediatric patient with multiple infectious diseases treated at Harapan dan Doa Hospital, Bengkulu, through an observational case study involving a single subject. Nutritional assessment showed that the patient experienced malnutrition with low anthropometric indicators and inadequate dietary intake. During a three-day monitoring period, nutrient intake gradually improved following nutritional intervention: energy intake increased from 47.77% on the first day to 80% on the third day, protein intake from 65.19% to 109.01%, fat intake from 35.53% to 83.08%, and carbohydrate intake from 48.52% to 75.92%. In conclusion, the patient was prescribed a high-calorie, high-protein diet with soft food consistency administered orally. Improvement in dietary intake was observed during the intervention period, indicating that the nutritional therapy helped support recovery and improve the patient's nutritional status

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CASE REPORTS

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Key Messages:

- Infectious diseases such as typhoid fever, dengue hemorrhagic fever (DHF), and measles remain common among children and can negatively affect nutritional status due to decreased appetite and increased metabolic demands.
- Acute infections may lead to inadequate dietary intake and increased energy requirements, which can increase the risk of malnutrition and delay the recovery process in pediatric patients.
- The implementation of standardized nutrition care is important to identify nutrition problems, provide appropriate dietary interventions, and monitor improvements in dietary intake and clinical condition in hospitalized children.

INTRODUCTION

Infectious diseases and nutritional deficiencies remain significant health issues, particularly for children, in developing countries like Indonesia. Some common childhood illnesses include typhoid fever, dengue fever (DHF), measles, and under nutrition. These conditions not only impact a child's physical health but can also hinder growth and development, reduce immunity, and increase the risk of more serious complications if not properly managed [1].

Typhoid fever is a systemic gastrointestinal infection caused by the bacteria Salmonella typhi. Typhoid fever is an acute infection of the small intestine, characterized by fever lasting one week or more, accompanied by gastrointestinal disturbances [2]. Transmission occurs through the fecal-oral route due to the consumption of contaminated food or drink, which is often associated with poor personal hygiene and environmental sanitation. In Indonesia, the incidence of typhoid fever remains quite high,

with children aged 5–15 mostly affected due to indiscriminate snacking habits and suboptimal hygiene and healthy living practices [3].

Dengue fever is also an infectious disease common in tropical regions. It is transmitted through the bite of the Aedes aegypti and Aedes albopictus mosquitoes, with environmental factors such as stagnant water, high humidity, and the rainy season conducive to mosquito breeding. Dengue fever cases continue to occur in large numbers each year and can lead to serious complications and even death if not treated promptly and appropriately 4.

Measles is a highly contagious viral infection that often occurs in children. Transmission occurs through droplets from coughing or sneezing. Although most people recover, measles can cause serious complications, especially in children with weakened immune systems. While the disease is preventable through immunization, cases are still found in areas with suboptimal vaccination coverage 5.

On the other hand, malnutrition is also a serious public health challenge. Malnutrition is a state of nutritional deficiency caused by nutritional intake that falls short of nutritional requirements and persists for a significant period of time. Toddlers are categorized as malnourished if their weight falls between -3 SD and <2 SD 6. Malnutrition is generally caused by an imbalance in nutrient intake, irregular eating patterns, and increased nutrient requirements during periods of rapid growth 7. Malnutrition impacts physical fitness and productivity, and can affect reproductive health, especially in adolescent girls. Furthermore, this condition also leads to suboptimal growth and a weakened immune system, making adolescents more susceptible to infectious diseases and reducing learning abilities. 8.

Malnutrition can disrupt physical growth and cognitive development, and increase a child's vulnerability to infectious diseases. Inadequate nutritional status is closely related to insufficient food intake, environmental conditions, and family socioeconomic factors. Data shows that nutritional problems in children, such as stunting, wasting, and underweight, are still common in Indonesia and require comprehensive treatment 9.

The link between infectious diseases and nutritional status is very close, as infections can reduce appetite and nutrient absorption, while inadequate nutrition can lower immunity, making children more susceptible to disease. Therefore, comprehensive attention is needed through prevention efforts, education on clean and healthy lifestyles, providing balanced nutrition, and appropriate management to reduce morbidity in children 10.

Case Description

A girl (An. K), aged 8 years 9 months, presented to the Emergency Room on February 23, 2026 with a 4-day history of fluctuating fever, followed by a 2-day history of productive cough, decreased appetite, weakness, vomiting, abdominal pain, dizziness, and generalized myalgia. On admission, her temperature was 38.5°C with a rash on the hands and face. She had no history of chronic disease or previous hospitalization and lived with both parents and one older sibling as the second of two children.

She was diagnosed with typhoid fever, dengue hemorrhagic fever, and measles. Initial anthropometry showed a weight of 18.5 kg, height 126.3 cm, mid-upper arm circumference 15.5 cm, and head circumference 49 cm. Indices indicated weight-for-age 66% (underweight), height-for-age 96% (normal), weight-for-height 74% (wasted), and BMI-for-age < –3 SD, consistent with severe malnutrition. Nutritional screening tools classified her as at risk of malnutrition, warranting detailed assessment and intervention.

Laboratory tests on February 23, 2026 showed leukocytes 3,900/µL, neutrophils 80%, lymphocytes 16%, hemoglobin 13.5 g/dL, hematocrit 39%, and platelets 165,000/µL, with further leukocyte and platelet decline the following day, supporting an acute viral infection compatible with dengue hemorrhagic fever. On physical examination she was moderately ill, compos mentis, with temperature 38.5°C, pulse 100/min, respiratory rate 24/min, and oxygen saturation 99% on room air. Clinical complaints included anorexia, weakness, cough, rhinorrhea, nausea, diarrhea, abdominal pain, and rash. During hospitalization she received intravenous Ringer's lactate and 5% dextrose, intravenous ceftriaxone, and supportive therapy including intravenous paracetamol, ondansetron, omeprazole, and symptomatic medications (salbutamol, bromhexine, and trifedrine).

The results of the dietary intake assessment using the 24-hour recall method before hospital admission showed that the patient's nutritional intake was very low. Total energy intake was only 222.5 kcal (16.17% of the requirement), 9.8 g protein (19.03%), 7 g fat (18.32%), and 2.8 g carbohydrate (1.36%). This indicates that the patient experienced a severe deficit in energy and nutrient intake before receiving hospitalization. Furthermore, the results of the Food Frequency Questionnaire (FFQ) showed that the patient's dietary pattern was less varied, with a predominance of instant foods and snacks high in sodium and sugar, while vegetable consumption was relatively low.

RESULT

Nutritional diagnoses were established across multiple domains of the standardized Nutrition Care Process. In the Nutrition Intake (NI) domain, the diagnosis was inadequate oral intake related to decreased appetite and acute infectious disease, evidenced by very low pre-intervention food intake and insufficient energy, protein, fat, and carbohydrate consumption relative to calculated requirements, which contributed to deterioration of nutritional status. In the Nutrition Clinical (NC) domain, the diagnosis was malnutrition related to increased metabolic demand and reduced intake during acute

infections (typhoid fever, dengue hemorrhagic fever, and measles), as reflected by undernutrition on anthropometry, including low body weight and severe wasting, indicating a mismatch between intake and infection-related metabolic needs.

In the Nutrition Behavior (NB) domain, the diagnosis was a food- and nutrition-related knowledge deficit due to limited understanding of balanced nutrition, characterized by irregular eating patterns and low dietary diversity prior to admission, potentially predisposing to inadequate intake and malnutrition during illness.

The planned nutrition intervention consisted of a high-calorie, high-protein diet individualized to the patient's clinical condition and requirements, aiming to increase energy and protein intake, prevent further nutritional decline, support immune function, and promote recovery, with gradual advancement according to tolerance. Dietary principles focused on providing adequate energy with sufficient protein and easily digestible foods appropriate to the patient's condition. Calculated requirements were 1,375.74 kcal/day, 51.5 g protein, 38.2 g fat, and 206.3 g carbohydrates, with additional emphasis on meeting vitamin and mineral needs to support immune function and convalescence. The form of food provided was a soft diet administered orally, consisting of three main meals and two snacks, including milk supplementation (200 ml) to help meet daily nutritional requirements. The feeding schedule was arranged gradually according to the patient's tolerance and appetite to improve dietary intake during hospitalization.

Table 1. Nutrition Screening using 4 nutrition screening methods

Nutrition Screening Day	**STRONGkids**	**Simple Nutrition Screening Tool (SNST)**	**Pediatric Yorkhill Malnutrition Score (PYMS)**	**Screening Tool for the Assesment of Malnutrition in Paediatrics (STAMP)**
February 23, 2026	Score (4) Severe risk of malnutrition	Score ≥ 3 = At risk of malnutrition	Score ≥ 1 High Risk	Score > 4 High Risk
February 24, 2026	Score (3) Moderate risk of malnutrition	Score ≥ 3 = At risk of malnutrition	Score ≥ 1 High Risk	Score > 4 High Risk
February 25, 2026	Score (2) Moderate risk of malnutrition	Score ≥ 3 = At risk of malnutrition	Score ≥ 1 High Risk	Score > 4 High Risk
Conclusion	Based on the results of nutritional screening using STRONGkids, a score of 4 indicates a severe risk of malnutrition, while scores of 3 and 2 indicate a moderate risk of malnutrition.	Based on the SNST results with a total score of 6 (≥3), the patient is included in the category at risk of malnutrition and requires further nutritional monitoring and intervention.	Based on the PYMS screening results, the patient is included in the high-risk category for malnutrition, so he requires further assessment and treatment by a nutritionist or nutrition doctor.	Based on the screening results using the STAMP form, on three examinations the patient obtained a total score of >4 so he was included in the high risk category for malnutrition.

Nutrition screening results indicated that the patient was at risk of malnutrition based on several pediatric nutrition screening tools, namely STRONGkids, SNST, PYMS, and STAMP. On the first day of examination, the STRONG kids score indicated a severe risk of malnutrition, then decreased to a moderate risk of malnutrition on the second and third days, indicating the need for continuous monitoring of nutritional status throughout the treatment period. SNST screening results also indicated that the patient was included in the category of at risk of malnutrition, while PYMS and STAMP indicated a high risk of malnutrition, so the patient required further nutritional assessment and appropriate nutritional intervention.

Table 2. Nutritional Needs Plan

Nutrients	Calculation of Nutrient Requirements	Implementation Plan Day 1 (>50% of Requirements)	Implementation Plan Day II (>70% of Requirements)	Implementation Plan Day III (>80% of Requirements)
Energy (kcal)	1.375,74	687,87	963,018	1100
Protein (g)	51,5	25,75	36,05	41,2
Fat (g)	38,2	19,1	26,74	30,56
Carbohydrates (g)	206,3	103,15	144,41	165,04
Vitamin A (IU)	500	250	350	400
Vitamin C (mg)	45	22,5	31,5	36

The results of the nutritional fulfillment planning in Table 2 show that the patient's energy and nutrient needs were calculated based on individual nutritional needs using the Estimated Energy Requirement (EER) formula for girls aged 3–18 years. The target was to gradually increase intake, namely >50% on the first day, >70% on the second day, and ≥80% on the third day of daily needs. This strategy was implemented to adapt to the patient's clinical condition and food tolerance during the acute phase of the disease.

Table 3. Results of Monitoring and Evaluation of Biochemical Values

Biochemical Data	Reference Value	February 24, 2026	February 25, 2026	February 26, 2026
Moderate Leukocytes 3	5.000-10.000 ul	2.700 ul	2.900 ul	4.300 ul
Hemoglobin	11-16 g/dL	12,4 g/dL	12,4 g/dL	11,7 g/dL
Hematocrit	33-52	39	40	37
Medium Platelets 3	150.000-500.000 ul	131.000 ul	119.000 ul	173.000 ul

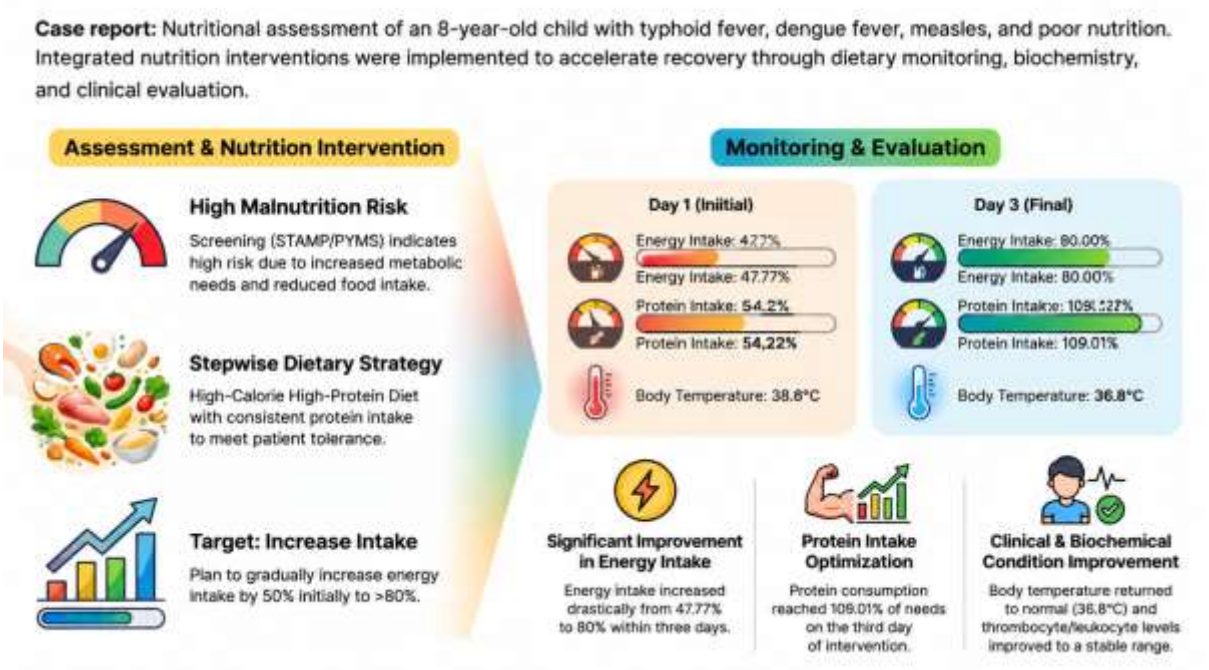
The biochemical monitoring results in Table 3 indicate changes in several hematological parameters during the treatment period. The patient's leukocyte count was below the reference value (leukopenia) at the beginning of the examination and gradually increased over the following days. Hemoglobin and hematocrit levels remained relatively stable within the normal range throughout the monitoring period. Meanwhile, the platelet count, which was initially low (thrombocytopenia), decreased on the second day, then increased on the third day to approach normal values. These changes indicate an improvement in the patient's clinical condition.

Table 4. Results of Monitoring and Evaluation of Physical Nutrition Focus

Parameter	Pre-Intervention (February 23)	1st day of Intervention (February 24)	2nd day of Intervention (February 25)	3rd day of Intervention (February 26)
Awareness	Compos Mentis	Compos Mentis	Compos Mentis	Compos Mentis
Red Rash	There is	There is	There is	Reduce
Cough	There is	There is	Reduce	Reduce
Have a cold	There is	There is	Reduce	Reduce
RR (x/minute)	24	23	23	23
Pulse (x/minute)	100	99	105	116
Temperature (°C)	38,6	36.1	36,6	36,8
SpO_2 (%)	99%	99%	99%	99%

The results of the physical nutrition monitoring focus in Table 4 indicate an improvement in the patient's clinical condition during the nutritional intervention period. The patient's consciousness remained stable and compos mentis throughout the monitoring period. Clinical symptoms such as a red rash, cough, and runny nose were still present at the beginning of the intervention, but gradually decreased until the third day of the intervention. The patient's body temperature, which initially had a fever (38.6°C), also decreased to within the normal range in the following days. In addition, the respiratory rate and oxygen saturation remained within normal limits, indicating the patient's respiratory condition

was relatively stable during treatment. These changes indicate an improvement in the patient's clinical condition, likely influenced by the medical therapy and nutritional support provided during the treatment period.



DISCUSSION

Nutritional requirements were determined using the Estimated Energy Requirement (EER) formula for girls aged 3–18 years. The patient's total energy requirement was 1,375.74 kcal/day, with protein, fat, and carbohydrate targets set at 15%, 25%, and 60% of total energy, corresponding to 51.5 g/day, 38.2 g/day, and 206.3 g/day, respectively. She was prescribed a high-calorie, high-protein oral diet with soft consistency, adjusted to her clinical condition. This dietary regimen is recommended for pediatric patients with infectious diseases to meet increased metabolic demands while maintaining gastrointestinal tolerance. Nutritional intake was advanced gradually from approximately 50% to ≥80% of total requirements according to the patient's tolerance and clinical status during the acute phase. Adequate nutritional support in hospitalized children is crucial to prevent further deterioration of nutritional status and to facilitate recovery. Infectious diseases such as typhoid fever, dengue hemorrhagic fever, and measles can reduce appetite and increase metabolic stress, thereby decreasing nutrient intake while elevating metabolic needs and ultimately increasing the risk of malnutrition[11].. These observations are consistent with previous evidence suggesting a bidirectional relationship between infection and malnutrition, whereby infection worsens nutritional status and undernutrition impairs immune function and increases the risk of complications [9].

Dietary interventions focus on providing easily digestible foods with temporary fiber restriction to reduce gastrointestinal burden, particularly in cases of typhoid. Adequate micronutrients, such as vitamins A and C, are also considered to support immune function and the healing process. This approach aligns with research showing that adequate micronutrients play a crucial role in enhancing the immune response and accelerating recovery in children with infectious diseases [12,13].

Energy intake increased from 16.17% before the intervention to 80% on the third day, while protein intake reached 109.01% of the requirement. This indicates that the nutritional intervention was effective in increasing food intake and supporting the patient's recovery process. This improvement was likely influenced by improvements in clinical condition, increased appetite, and a feeding strategy tailored to the patient's condition.

Evaluation of biochemical parameters showed improvement in the patient's clinical condition during the treatment period. At the initial examination, the patient experienced leukopenia, characterized by a leukocyte count below the reference value, which then gradually increased over the following days. This condition is often found in viral infections, including dengue fever, due to bone marrow suppression and impaired immune response during the acute phase [14]. The patient also experienced thrombocytopenia at the start of treatment, characterized by a platelet count below normal, which then increased to near-normal levels by the third day. This condition is a key characteristic of dengue hemorrhagic fever, caused by increased platelet destruction and decreased production in the bone marrow.[15] Improvement in leukocyte and platelet counts reflects recovery from the infection condition supported by medical therapy and adequate nutritional intake.

Nutrition screening results indicated that the patient was at moderate to high risk of malnutrition based on several screening tools, namely STRONGkids, SNST, PYMS, and STAMP. This condition reinforces the importance of nutrition screening early in treatment to detect nutritional problems early. Previous research has shown that hospitalized pediatric patients are at high risk of malnutrition and require

appropriate nutritional interventions [16]. The use of screening tools such as STRONGkids and PYMS has also been shown to be effective in identifying malnutrition risk and assisting in determining appropriate interventions [17].

This case demonstrates that the implementation of the Standardized Nutrition Care Process (SPC), which includes comprehensive assessment, appropriate intervention, and continuous monitoring and evaluation, can improve nutritional intake and support the recovery process in pediatric patients with multiple infectious diseases.

Table 5. Energy and macronutrients intake

Date Intervention	Energy and Macronutrient	RDA	Actual intake	Percentage of RDA	Status
February 23, 2026	Energy (kcal)	1375,74	657,24	47,77%	Deficit
	Protein (g)	51,5	27,925	54,22%	Deficit
	Fat (g)	38,2	9,845	25,77%	Deficit
	Carbohydrate (g)	206,3	36,81	17,84%	Deficit
February 24, 2026	Energy (kcal)	1375,74	1.067,45	77,59%	Deficit
	Protein (g)	51,5	40,58	78,80%	Deficit
	Fat (g)	38,2	25,725	67,34%	Deficit
	Carbohydrate (g)	206,3	91,51	44,36%	Deficit
February 25, 2026	Energy (kcal)	1375,74	1.097,25	80%	Enough
	Protein (g)	51,5	56,14	109,01%	Enough
	Fat (g)	38,2	37,3	97,64%	Enough
	Carbohydrate (g)	206,3	126,85	61,49%	Deficit

Based on Table 5, there was a gradual increase in energy and macronutrient intake during the intervention period. Energy intake increased from 47.77% on the first day to 80% on the third day, followed by an increase in protein, fat, and carbohydrate intake, although most remained below the recommended intake. This increase is thought to be influenced by the provision of a high-energy, high-protein diet tailored to the patient's needs, a structured meal schedule, and the provision of soft foods that increase food tolerance. Furthermore, improvements in the patient's clinical condition during treatment contributed to increased appetite and nutrient intake. Management of infectious diseases also played a role in reducing metabolic stress, thus optimizing nutrient utilization. These findings indicate that the nutritional intervention was effective in gradually increasing nutrient intake and supporting the patient's recovery process.

The following is a figure of the results of Intake Energy ang macronutrients

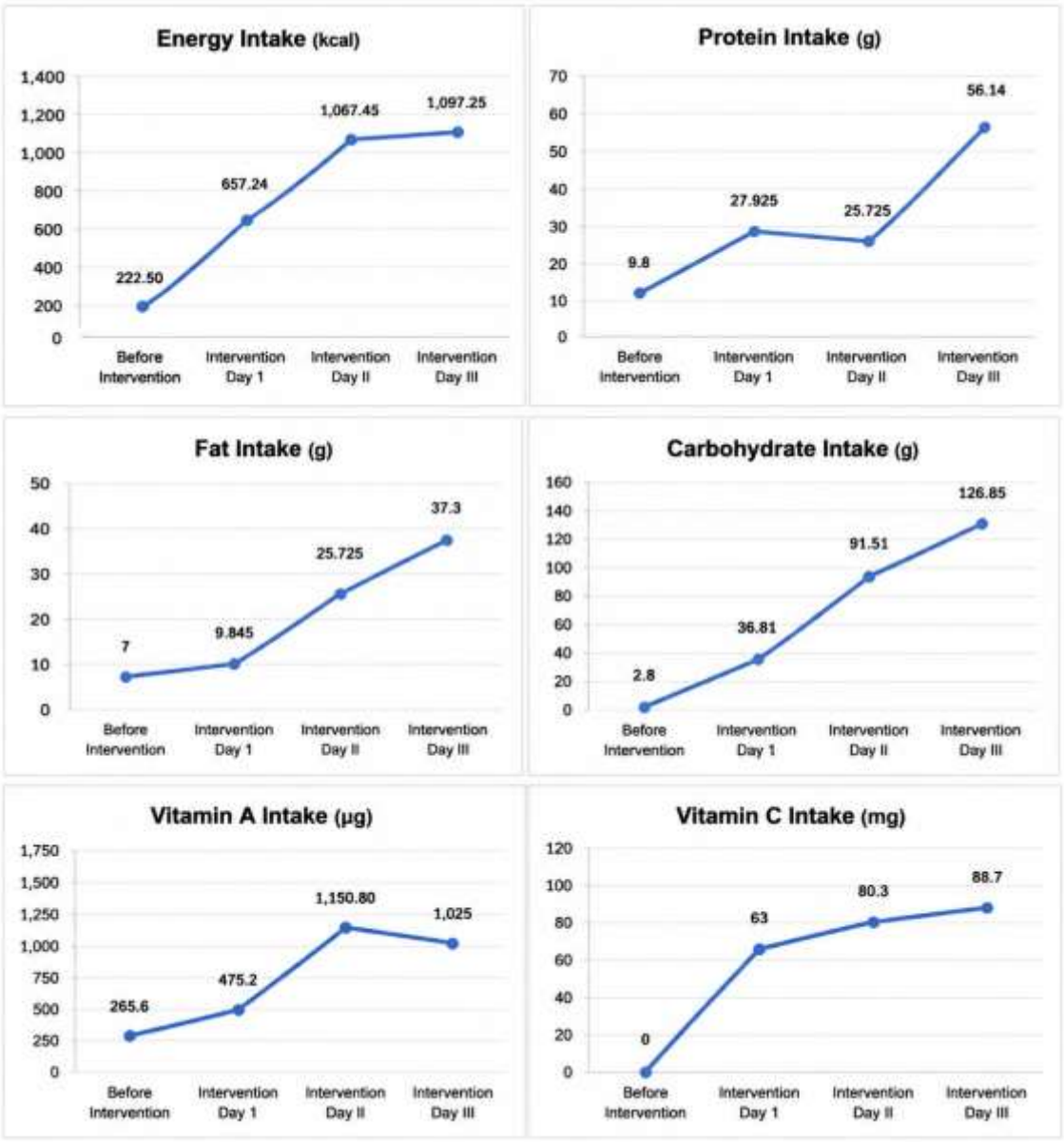


Figure 1. Improvement in Energy and Macronutrient Intake During Intervention

CONCLUSION

Based on the case description indicated that the patient experienced malnutrition associated with acute infections, namely typhoid fever, dengue hemorrhagic fever (DHF), measles and undernutrition. The application of the Nutrition Care Process can serve as a systematic approach to identify nutrition problems appropriate nutrition interventions, and monitor patient progress. It is necessary to implement NCP routinely and continuously which is adjusted to daily rescreening so as to accelerate patient healing through dietary interventions in collaboration with doctors, ward nurses and pharmacists.

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

REFERENCES

1. Puspitasari M, Herdiani N, Masyarakat JK, et al. Literature Review : Penyakit Infeksi terhadap Status Gizi Balita. J Kesehat. 2021;14(1):18-22.
2. Ngii Y, Novianti SW, Andiarsa D, et al. Asuhan Keperawatan Anak Dengan Penyakit Infeksi.; 2021.
3. Rampengan M. Demam Thypoid pada Anak di Ruang Hamka RSU PKU Muhammadiyah Delanggu. J Ilmu Kesehat. 2022;17(1):52-58.

4. Salam MR, Apriyanti R. Faktor Determinasi Pengetahuan Terhadap Dengue Vaccine : Cross-Sectional Study Pada Orang Tua di Sulawesi Tenggara Determining Factors of Knowledge of Dengue Vaccine : Cross Sectional Study of Parents in Southeast Sulawesi. Heal Inf J Penelit. 2024;16(2):233-243.
5. Misin A, Antonello RM, Bella S Di, et al. Measles : An Overview of a Re-Emerging Disease in Children and Immunocompromised Patients. Microorganisms. Published online 2020:1-16. doi:doi:10.3390/microorganisms8020276
6. Rostanty RA, Khairani MD, Junita DE, Pringsewu UA, Kurang G. Hubungan Pola Makan dengan Kejadian Gizi Kurang pada Balita Usia 24-59 Bulan di Desa Sumbersari Kecamatan Sekampung Tahun 2023. J Gizi Aisyah. 2023;6(2).
7. Rahmah S, Haryana NR, Sandy YD, Firmansyah H. Hubungan Asupan Zat Gizi Makro Dengan Status Gizi Remaja. 2024;5(2):72-79.
8. Gusmita D, Fatmawati TY, Jeki AG, Indrawati I, Makan P, Putri R. Hubungan Pola makan dengan Kejadian Gizi Kurang pada Remaja Putri di SMPN Kota Jambi. J Ilm Pamenang. 2024;(September):199-205.
9. Clara M, Ribeiro SA, Sousa LS De, et al. Undernutrition and Intestinal Infections in Children : A Narrative Review. 2025;5.
10. Alvira M, Muslim ZA, Annabila ZI, Daniyal M, Zara N. Studi Kasus Anak Usia 10 Bulan dengan Gizi Kurang di Desa Kuala Keureuto Barat Puskesmas Tanah Pasir Tahun 2025. J ilmu Kesehat Umum. 2025;3:114-129. doi:https://doi.org/10.61132/vitamin.v3i4.1742
11. Ijaiya MA, Anjorin S, Uthman OA. Quantifying the increased risk of illness in malnourished children : a global meta - analysis and propensity score matching approach. Glob Heal Res Policy. 2024;0. doi:10.1186/s41256-024-00371-0
12. Gombart AF, Pierre A, Maggini S. A Review of Micronutrients and the Immune System – Working in Harmony to Reduce the Risk of Infection. Published online 2020.
13. Neerven RJJ Van. Macronutrients , Micronutrients , and Malnutrition : Effects of Nutrition on Immune Function in Infants and Young Children. Published online 2025.
14. Ramadhani AF. Analisis Jumlah Trombosit Dan Leukosit Pada Pasien Dengue Hemorrhagic Fever (DHF) Di Rumah Sakit Umum Daerah Kabupaten Barru Analysis of Platelet and Leukocyte Counts in Dengue Hemorrhagic Fever (DHF) Patients at the Barru District General Hospital WIDARTI Sulawesi Selatan 90222 Email : widwidarti53@gmail.com Abstrak. 2023;05(02):95-103.
15. Yulianti F, Saraswati KD. Hubungan Jumlah Trombosir dengan IGG IGM Dengue pada Pasien Demam Berdarah Dengue di RSU Aisyiyah Ponorogo. 2024;1(3):221-226.
16. Malekiantaghi A, Asnaashari K, Mirzaee HS, Vigeh M. Evaluation of the risk of malnutrition in hospitalized children by PYMS , STAMP , and STRONGkids tools and comparison with their anthropometric indices : a cross - sectional study. BMC Nutr. Published online 2022:1-7. doi:10.1186/s40795-022-00525-8
17. Chen H, Zhang Y, Han H. Modified STRONGkids outperforms PYMS for WHO-defined malnutrition : a screening-to-action pathway for pediatric wards. 2026;(February):1-7. doi:10.3389/fped.2025.1628856