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Standardized NCP in Pediatric Patients UTI by *Pseudomonas and* Marasmus

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ABSTRACT

Background: Urinary Tract Infection (UTI) is among the most common infectious diseases in children, alongside acute respiratory and gastrointestinal infections. UTI may cause decreased kidney function, acute kidney injury (AKI), and urosepsis, and may lead to renal scarring, hypertension, and end-stage chronic kidney disease.
Objective: To implement a standardized nutrition care process to support clinical stability, meet increased energy requirements during the catabolic state, and prevent deterioration of nutritional status.
Methods: This case study involved Master KNAP, an 8-year-and-4-month-old male pediatric patient diagnosed with UTI, acute kidney injury (failure stage), and severe protein-energy malnutrition (PEM) of the marasmic type. The patient was hospitalized in the Gardenia Pediatric Ward at Prof. Dr. I.G.N.G. Ngoerah General Hospital. Nutrition care was provided using the five steps of the Standardized Nutrition Care Process (NCP).
Results: Anthropometric assessment indicated severe malnutrition (BMI-for-age z-score: -3.02 SD), while biochemical assessment showed severe anemia. Oral nutritional intervention was introduced gradually, beginning at 50% of estimated nutritional requirements. Three days of monitoring demonstrated improvements in energy and protein intake, accompanied by favorable changes in nutrition-related clinical conditions.
Conclusions : Gradual nutrition therapy for pediatric UTI complicated by AKI and PEM supported clinical stabilization and contributed to the patient's recovery process.
Keyword : urinary tract infection, malnutrition, nutrition care process

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INTRODUCTION

Urinary tract infection (UTI) is defined as the significant proliferation and growth of bacteria or microbes within the urinary tract. The prevalence of UTIs among the Indonesian population ranges from 5% to 15%. In Indonesia, an evaluation of 200 children revealed that 33% of males and 67% of females suffered from UTIs, indicating a higher prevalence in females than in males. According to estimates by the Ministry of Health of the Republic of Indonesia, the incidence of UTIs in Indonesia stands at 90–100 cases per 100,000 population per year, translating to approximately 180,000 new cases annually (1). In children, the clinical manifestations of UTIs vary widely, ranging from asymptomatic presentations to severe symptoms that can trigger systemic infections. A UTI should be suspected in any child presenting with a fever, as it represents one of the most frequently encountered infectious diseases in pediatric patients, alongside acute respiratory and gastrointestinal infections. Furthermore, UTIs can lead to diminished renal function or acute kidney injury (AKI) and urosepsis, and may result in long-term complications such as renal scarring, hypertension, and end-stage chronic kidney disease (2).

Malnutrition remains a critical public health concern, contributing significantly to over one-third of all pediatric deaths worldwide. This condition is closely linked to immunodeficiency—particularly impaired cellular immunity—and a diminished inflammatory response, which renders affected children highly susceptible to infections. Consequently, malnutrition increases susceptibility to infectious diseases, while infections, in turn, exacerbate malnutrition by suppressing appetite, inducing a catabolic state, and elevating nutritional requirements(3).

This clinical nutrition care focused on dietary interventions tailored for a pediatric patient presenting with severe malnutrition complicated by a urinary tract infection and acute kidney injury. Through this clinical nutrition approach, it was expected that the patient could implement nutritional management appropriate to his condition to maintain and improve his health status. Therefore, a multidisciplinary approach involving physicians, dietitians, and other healthcare professionals is vital to enhance the patient's quality of life and mitigate the risk of more severe complications. With appropriate nutritional interventions, patients are expected to manage their condition more effectively, thereby improving their clinical outcomes and long-term prognosis.

METODE

This case study utilized a method based on the Nutrition Care Process (NCP) approach, which encompassed nutritional screening using the STRONGkids tool, nutritional assessment (comprising anthropometric, biochemical, clinical, and dietary data), nutritional diagnosis, nutritional intervention (dietary management and education), as well as monitoring and evaluation. The study was conducted at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital in March 2026, with an intervention duration of six days. Data were processed and presented descriptively using tables and diagrams, accompanied by narrative explanations.

RESULT

Patient Identity and Clinical History

An 8-year-old male pediatric patient presented to the Maternal and Child Emergency Unit (PONEK KIA) at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital and was subsequently admitted to the Gardenia Pediatric Ward. He was diagnosed with a urinary tract infection (UTI) complicated by *Pseudomonas aeruginosa*, intrinsic renal acute kidney injury (AKI) (failure stage), and severe protein-energy malnutrition (PEM) of the marasmic type. The patient's chief complaint was abdominal pain lasting since March 1, 2026, which worsened one day prior to admission. The pain was described as intermittent and cramping, localized in the left lower quadrant, lower midline, and suprapubic regions. The onset of pain was unpredictable, not relieved by positional changes, and exacerbated both during and after urination (dysuria). The patient also experienced a fever starting three days prior to admission and reported milky-white urine (chyluria/pyuria).

Upon physical examination, the patient's general vital signs revealed a blood pressure of 113/77 mmHg, a respiratory rate of 30 breaths per minute, and a body temperature of 37°C. A 24-hour dietary recall indicated an energy intake of 450 kcal. Nutritional status assessment classified the patient as severely malnourished, with a BMI-for-age z-score of -3.02 SD, accompanied by severe anemia (Hb 8.5 g/dL). The patient was hospitalized on March 7, 2026, and was prescribed a liquid formula diet providing 1,440 kcal, with protein accounting for 15% of the total energy

Nutritional Screening

Nutritional screening was performed using the STRONGkids tool. The rescreening results yielded a score of 4, indicating that the patient was at high risk of malnutrition. Consequently, further comprehensive nutritional assessment was required.

Nutritional Assessment

Anthropometric data, including height and weight, were obtained through patient interviews and measurements using a digital scale. The patient's weight was 13.9 kg and his height was 108.1 cm. Nutritional status was assessed by calculating the BMI-for-age z-score, which was -3.02 SD. Based on these results, according to the Regulation of the Minister of Health of the Republic of Indonesia (Permenkes) No. 2 of 2020, the patient was classified as severely malnourished.

Laboratory findings indicated a severe bacterial infection, marked by a procalcitonin level of 438.98 ng/mL, and the patient also presented with severe anemia (Hb 8.5 g/dL).

Physical and clinical examinations revealed the patient's chief complaint of intermittent, cramping abdominal pain localized in the left lower quadrant, lower midline, and suprapubic regions. The symptoms had worsened three days prior to hospital admission, accompanied by milky-white urine. However, vital signs including blood pressure, respiratory rate, body temperature, and oxygen saturation were within normal limits.

The patient's dietary intake at home was classified as a severe deficit, with percentages of 59.47% for energy, 60.0% for protein, 50.7% for fat, and 61.4% for carbohydrates. His dietary habits consisted of eating three times a day, consuming two scoops of rice per meal. Animal protein sources included chicken (4 times/week), eggs (1–2 times/week), and chicken floss (1 tablespoon daily at breakfast). Plant-based protein sources included tempeh (once/week) and tofu (2–3 times/week). Vegetable intake consisted of spinach (2 times/week), water spinach (3 times/week), and green beans (once/week), while fruit consumption included papaya (2 times/week) and watermelon (once/week). During hospitalization, the patient's dietary intake remained inadequate, reaching only 62.5% of the provided 50% calculated nutritional requirement. Prior to the intervention, the prescribed diet was a liquid formula of 6 × 100 mL with a caloric density of 1.0 kcal/mL, meeting 50% of his requirements. Overall, the patient's nutritional intake both at home and in the hospital fell below 80% of his total requirements, rendering it inadequate to support his clinical recovery.

Nutrition Diagnosis

Table 1.
Nutritional Diagnosis

Domain	Problem	Etiology	Sign/Symptomp
NI-2.1	Inadequate Oral Intake	Related to the patient's pathological condition, specifically nausea and	As evidenced by an oral intake percentage of only 62.5% of estimated

		abdominal pain.	requirements.
NC-4.1.2	Malnutrition	Related to the patient's pathological condition and a history of inadequate past nutritional intake.	As evidenced by a BMI-for-age z-score of < -3 SD.
NC-2.2	Altered Nutrition-Related Laboratory Values	Related to the patient's pathological conditions, specifically a urinary tract infection (UTI) and acute kidney injury (AKI).	As evidenced by a hemoglobin (HGB) level of 8.5 g/dL, creatinine of 4.96 mg/dL, and blood urea nitrogen (BUN) of 91 mg/dL.

Nutritional Intervention

The patient was prescribed a renal diet modified for co-existing urinary tract infection (UTI) and severe protein-energy malnutrition (PEM) of the marasmic type in the rehabilitation phase. The diet was administered via the oral route, divided into three main meals and two snacks, in the form of a liquid diet. Nutritional intake was initially introduced at 50% of the calculated requirements, taking into account the patient's clinical condition, specifically abdominal pain. The objectives of this dietary intervention were: (1) to increase energy intake, (2) to provide adequate nutritional intake, and (3) to support weight gain toward the normal range.

The patient's energy requirement was calculated at 90 kcal/kg of ideal body weight (IBW)/day, totaling 1,440 kcal. Protein was provided at 15% of the Recommended Dietary Allowance (RDA), amounting to 54 g. Fat was allocated at 25% of total energy requirements (40 g), and carbohydrates were allocated at 60%, totaling 216 g/day. Fluid intake was restricted to 1,200 mL/day. Nutritional support was advanced progressively: 50% of the total requirements was provided during the first three days; from the fourth to the fifth day of intervention, the intake was increased to 80% using a modification of regular food supplemented with a liquid diet; and by the sixth day, 100% of the requirements was achieved through a combination of regular food and a liquid diet.

Additionally, nutritional education and counseling were provided to improve the knowledge and understanding of both the patient and his family regarding the prescribed diet. This counseling emphasized the importance of dietary adherence to support the improvement of the patient's nutritional status.

Monitoring and Evaluation
a. Anthropometric Monitoring and Evaluation

Table 2
Anthropometric Monitoring and Evaluation

Parameter	Pre-Intervention	After Intervention					
		11/3/26	12/3/26	13/3/26	14/3/26	15/3/26	16/3/26
Weight (kg)	13,9 kg	-	-	-	-	-	13,9 kg
Height (cm)	108,1 cm	-	-	-	-	-	108,1 cm
Weight-for-Age	-4,7 SD	-	-	-	-	-	-4,7 SD
Weight-for-Age (WAZ)	-3,62 SD	-	-	-	-	-	-3,62 SD
BMI-for-Age	-3,02 SD	-	-	-	-	-	-3,02 SD

Source: Primary Processed Data, 2026.

Based on the table above, there were no changes in body weight and height following the intervention. The patient's body weight did not increase, remaining at 13.9 kg, which indicated that the patient remained severely malnourished.

b. Monitoring and Evaluation of Laboratory Results

Tabel 3
Monitoring and Evaluation of Laboratory Results

Parameter	Pre-Intervention	Normal Range	During Intervention	
			11/03/26	16/03/26
HGB	8,5 g/dL	12.0 – 16.0 g/dL	8,5 g/dL	9,7 g/dL
BUN	91 mg/dL	7.0 – 18.7 mg/dL	91 mg/dL	61 mg/dL
Kreatinin	4,96 mg/dL	0.57 – 1.11 mg/dL	4,96 mg/dL	3,82 mg/dL

Source: Primary Processed Data, 2026.

Based on Table 3, the post-intervention laboratory data indicated improvement in several parameters, although they remained outside the normal reference ranges. Hemoglobin (Hb) levels increased from 8.5 g/dL to 9.7 g/dL but remained below the normal threshold. Similarly, Blood Urea Nitrogen (BUN) and creatinine levels decreased, though they had not yet normalized. In pediatric patients with Urinary Tract Infections (UTIs), BUN and creatinine levels typically remain within the normal range if the infection is mild (cystitis). However, if the UTI progresses to a kidney infection (pyelonephritis) or leads to complications, creatinine and BUN levels will elevate. Other laboratory markers, such as White Blood Cell (WBC) count and procalcitonin, were unavailable at the end of the intervention. Overall, the biochemical monitoring results suggest that the patient's condition remains unstable, necessitating further monitoring and subsequent interventions.

c. Nutrition-Focused Physical Findings Monitoring and Evaluation

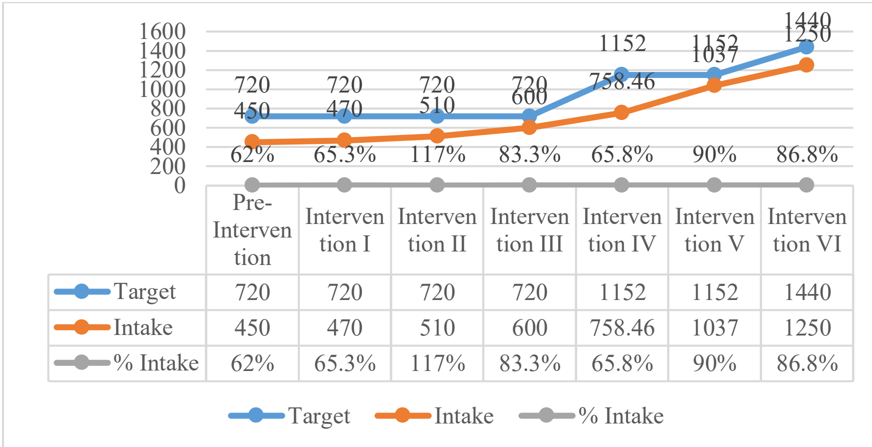
Table 4
Monitoring and Evaluation of Physical and Clinical Status

Indicator	During Intervention						
	Pre-Intervention	11/3/26	12/3/26	13/3/26	14/3/26	15/3/26	16/3/26
Consciousness (GCS)	15(E4M6V5) Compos mentis	15(E4M6V5) Compos mentis	15(E4M6V5) Compos mentis	15(E4M6V5) Compos mentis	15(E4M6V5) Compos mentis	15(E4M6V5) Compos mentis	15(E4M6V5) Compos mentis
Abdominal pain	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Urinalysis	Blood (+) Protein (+)	Blood (+) Protein (+)	Blood (+) Protein (+)	Blood (+) Protein (-)	Blood (+) Protein (-)	Blood (-) Protein (-)	Blood (-) Protein (-)
SpO^2	SpO^2 99%	SpO^2 99%	SpO^2 99%	SpO^2 99%	SpO^2 99%	SpO^2 99%	SpO^2 99%
Blood Pressure	113/77 mmHg	107/75 mmHg	110/77 mmHg	105/75 mmHg	117/75 mmHg	100/77mmHg	103/75 mmHg
Respiratory Rate (x/menit)	30	30	28	24	28	22	22
Heart Rate (x/menit)	128	120	110	115	110	112	108
Temperature (° C)	37,2	37,5	36,2	36,5	36,8	36,2	36,7

Source: Digital Medical Records, 2026

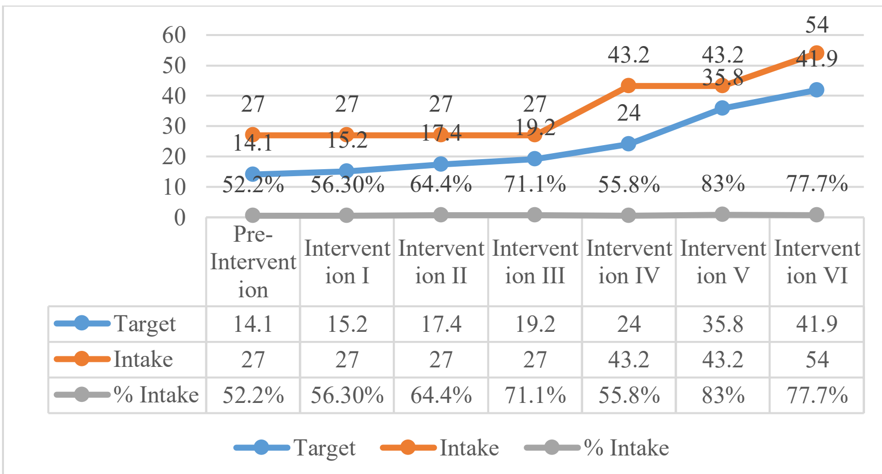
Based on Table 4, the monitoring of nutrition-focused physical and clinical findings indicated a gradual improvement in the patient's general condition throughout the intervention period. At the beginning of treatment, the patient experienced intermittent abdominal pain secondary to a urinary tract infection. Although abdominal pain persisted at the end of the intervention, its severity had significantly decreased compared to the first day.

d. Monitoring and Evaluation of Dietary Intake



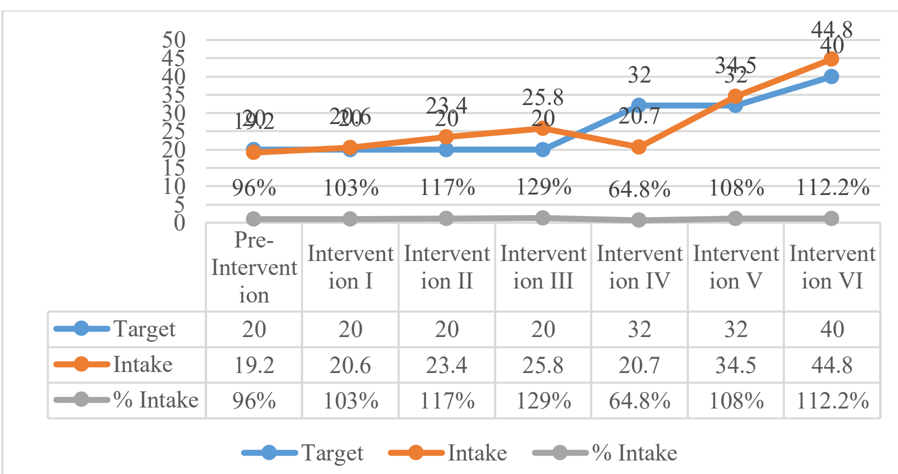
	Pre-Intervention	Intervention I	Intervention II	Intervention III	Intervention IV	Intervention V	Intervention VI
Target	720	720	720	720	1152	1152	1440
Intake	450	470	510	600	758.46	1037	1250
% Intake	62%	65.3%	117%	83.3%	65.8%	90%	86.8%

Picture 1. Chart of Energy Intake Level



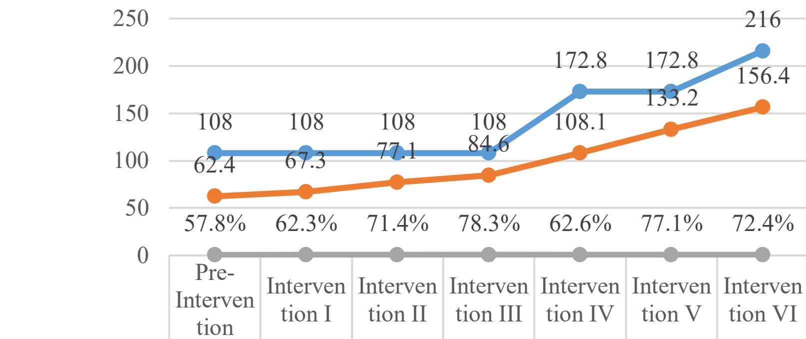
	Pre-Intervention	Intervention I	Intervention II	Intervention III	Intervention IV	Intervention V	Intervention VI
Target	14.1	15.2	17.4	19.2	24	35.8	41.9
Intake	27	27	27	27	43.2	43.2	54
% Intake	52.2%	56.30%	64.4%	71.1%	55.8%	83%	77.7%

Picture 2. Chart of Protein Intake Level



	Pre-Intervention	Intervention I	Intervention II	Intervention III	Intervention IV	Intervention V	Intervention VI
Target	20	20	20	20	32	32	40
Intake	19.2	20.6	23.4	25.8	20.7	34.5	44.8
% Intake	96%	103%	117%	129%	64.8%	108%	112.2%

Picture 3. Chart of Fat Intake Level



	Pre-Intervention	Intervention I	Intervention II	Intervention III	Intervention IV	Intervention V	Intervention VI
Target	108	108	108	108	172.8	172.8	216
Intake	62.4	67.3	77.1	84.6	108.1	133.2	156.4
% Intake	57.8%	62.3%	71.4%	78.3%	62.6%	77.1%	72.4%

Picture 3. Chart of Carbohydrate Intake Level

Based on the dietary intake chart, the patient's pre-intervention energy intake reached only 62.5% of the prescribed target, which was set at 50% of total energy requirements. During Intervention I, the prescribed target remained at 50% of requirements, but the patient was only able to consume 65.3% of the served meals. In Interventions II and III, there was a progressive increase in intake percentages to 70.8% and 83.3%, respectively. Subsequently, during the fourth and fifth interventions, the prescription was increased to 80% of total requirements, combined with texture modifications consisting of regular and liquid diets. The intake percentage during the fourth intervention reached 65.2%, thereby failing to meet the 80% target. However, by the fifth intervention, the intake percentage increased to 90%. On the sixth intervention, the patient was prescribed 100% of their total energy requirements, achieving an intake percentage of 86.8%.

DISCUSSIONS

Nutritional screening is the initial step performed to detect the risk or presence of malnutrition in patients. This process serves as an early identification of nutritional problems, providing the foundation for subsequent nutritional assessment and intervention. Ideally, a nutritional screening method should be brief, rapid, and tailored to the conditions and policies of each hospital. The implementation of nutritional screening serves as a strategic measure to address the high prevalence of malnutrition in pediatric cancer patients. The nutritional screening tool utilized in this case study was Strongkids. Strongkids is a validated screening tool designed to identify the risk of nutritional problems associated with malnutrition in children (4). The screening results in this case study indicated that the patient was at risk for malnutrition. Based on anthropometric measurements, the patient weighed 13.9 kg and had a height of 108.1 cm; these data revealed a BMI-for-age (BMI/U) z-score of -3.02 SD. According to the Ministry of Health Regulation (Permenkes) No. 2 of 2020, children with a BMI/U between -3 SD and < -2 SD are classified as undernourished (moderate malnutrition). The patient had been previously diagnosed with marasmus, which aligns with research by Victoria (2015) demonstrating that children with marasmus experience a drastic decline in immune function (immunity) due to severe protein-energy malnutrition (PEM)(5).

Urinary Tract Infection (UTI) is one of the infectious diseases frequently encountered in children. Similar to other infectious diseases, UTIs are influenced by nutritional status. Malnutrition in these children exacerbates the impairment of the immune system—including innate, adaptive, and mucosal barrier immunity—thereby enabling pathogenic bacteria to proliferate more easily and cause disease. A study by Bagga et al. showed that approximately 7.5 million young children, including 2 million malnourished children, are at risk of contracting a UTI(3). A study by Babu and Mallikrjuna reported that 16.67% of malnourished children were diagnosed with a UTI. A higher percentage was reported in a study by Sharma et al., where 22.4% of children with severe acute malnutrition (SAM) were diagnosed with a UTI. Furthermore, Reddy NK and Reddy AC in Kurnool, India, found that 15.5% of malnourished children presented with positive urine cultures (6).

The patient's biochemical monitoring data indicated the presence of infection, characterized by a high procalcitonin level of 438.98 ng/mL. Additionally, elevated Blood Urea Nitrogen (BUN) and creatinine levels indicated that the patient suffered from Acute Kidney Injury (AKI). AKI is defined as the inability of the kidneys to regulate fluid and electrolyte balance, characterized by a sudden, reversible decline in the glomerular filtration rate (GFR). This condition is marked by an increase in blood urea and creatinine levels (>50% of normal values); some cases present with a decrease in urine output (less than 0.5–1 mL/kg body weight/hour) (7). The patient's hemoglobin (Hb) level at the beginning of the intervention was 8.5 g/dL (severe anemia), which was caused by urinary output accompanied by blood (hematuria). At the end of the intervention, the Hb level increased to 9.7 g/dL, although it had not yet normalized. This is consistent with a study by Airlangga (2018), which states that hematuria is a fairly common symptom and a primary complaint among parents whose children experience renal and urinary tract disorders (8). Anemia that is accompanied by hematuria requires further evaluation to identify other underlying causes or conditions. Nonetheless, blood loss through the urinary tract can cause anemia if the volume of blood loss is substantial (gross hematuria). This is in accordance with a study in the MKS Journal (2014), which found that 56.4% of children with urinary tract infections experienced mild to severe anemia (9).

Nutrition-focused physical and clinical data revealed that the patient's general clinical state was weak, though the patient remained fully conscious (compos mentis) with a documented GCS of 15 (E4M6V5). The patient also appeared wasted, characterized by a BMI/U of -3.02 SD. The patient reported intermittent, squeezing abdominal pain localized in the lower left, lower middle, and suprapubic areas. The pain occurred unpredictably and did not subside with positional changes. In older children, clinical symptoms are typically milder and may manifest as localized urinary tract symptoms such as pollakiuria, dysuria, urgency, frequency, and enuresis. Abdominal pain, flank pain, or high fever may also be present (10). By the end of the intervention, the reported abdominal pain had subsided.

Prior to the illness, the patient maintained a regular eating pattern that fell short of nutritional requirements, with an intake percentage below 80%. The patient's dietary habit consisted of eating three times a day, consuming 2 scoops of rice per meal. Dietary protein sources included chicken 4 times a week, chicken eggs 1–2 times/week, and 1 tablespoon of shredded chicken (*abon*) daily at breakfast. Plant-based protein sources included tempeh once a week and tofu 2–3 times/week. Vegetable intake consisted of spinach twice a week, water spinach (*kangkung*) 3 times a week, and green beans once a week, while fruit intake included papaya twice a week and watermelon once a week. Based on the intake percentage analysis using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), the child's home consumption consisted of 856.5 kcal of energy (59.4%), 32.4 g of protein (54%), 20.3 g of fat (40%), and 132.7 g of carbohydrates (61.4%), all of which were below the 80% adequacy threshold. Prolonged inadequate dietary intake forces the body to deplete its energy reserves, ultimately leading to childhood malnutrition. This aligns with findings published in the Journal of Public Health and Nutritional Sciences, which state that malnutrition is driven by insufficient caloric intake that compels the body to continuously utilize its energy reserves. Marasmus typically occurs in children during the early years of life. Symptoms include a wasted and small body, an aged facial appearance, a head that appears disproportionately large for the child's age, apathy, irritability, and a heightened susceptibility to infections, diarrhea, and dehydration (11).

From the first to the third day of intervention, the patient was prescribed 50% of total energy requirements. This restriction was due to the patient experiencing abdominal pain and a decreased appetite. Additionally, because the patient was diagnosed with marasmus in the rehabilitation phase, liquid diet therapy using a formula with a density of 1 kcal/mL was administered at a frequency of 6 times 135 mL. Fluid intake was restricted to 1200 mL per day, taking into account urine output and insensible fluid loss. On the first day of intervention, energy intake reached only 65.3%; however, it progressively increased to 70.8% on the second day and 83.3% on the third day. During the fourth and fifth days of intervention, the prescription was increased to 80% of total requirements, combined with dietary modifications consisting of soft and liquid foods. The intake percentage on the fourth day was only 65.8%, due to persistent abdominal pain and decreased appetite. However, by the fifth day of intervention, the intake percentage reached 90%. Following these achievements, the patient was prescribed 100% of their total energy requirements (1440 kcal) on the sixth day of intervention, achieving an intake percentage of 86.8%. This protocol complies with the guidelines established by McClave et al. (2016), which state that nutritional support must be adjusted according to patient tolerance and metabolic status, both of which fluctuate during intensive care (12). A gradual increase in dietary intake, coupled with stringent clinical and biochemical monitoring, is vital to support recovery, preserve muscle mass, and prevent further complications. Consequently, the nutritional approach implemented was appropriate, although further optimization remains necessary (12).

CONCLUSIONS

Nutritional screening using the STRONGkids tool indicated that the patient was at high risk for malnutrition. The nutritional assessment revealed several issues across anthropometry, laboratory values, and dietary intake. Consequently, the nutritional diagnoses identified multiple problems, including inadequate oral intake, malnutrition, and altered nutrition-related laboratory values. The prescribed intervention consisted of a 1440 kcal liquid diet administered progressively, starting at 50% of the total requirement to accommodate the patient's physical impairment, specifically abdominal pain. Monitoring results demonstrated improvements in both the patient's appetite and dietary intake. Furthermore, observations of hemoglobin (Hb) levels showed a temporary increase, although laboratory parameters remained below the normal reference range. No weight gain was observed during the 6-day intervention period.

CONFLICT OF INTEREST

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

AUTOR CONTRIBUTIONS

KW designed the research, conducted the nutritional interventions, collected the clinical data, drafted the manuscript, and performed the statistical and biochemical data analyses. NS, TD, and AA supervised the study and critically revised the manuscript for important intellectual content. All authors have read and approved the final manuscript.

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

The authors used Gemini (Gemini AI) to assist in improving the language and grammar of the manuscript. The authors reviewed and verified the content to ensure accuracy and integrity.

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