Original Research

NUTRITIONAL PRACTICES AND THEIR ASSOCIATION WITH MALNUTRITION AMONG CHILDREN UNDER FIVE YEARS HOSPITALIZED FOR ACUTE DIARRHEA IN 2025

NGUYEN Thi Thu Hau [1], PHAM Vu Khoa[2]

[1] *Children's Hospital 2, HoChiMinh City*
[2] *University of Medicine and Pharmacy, HoChiMinh City*

ABSTRACT

Aims: To describe nutritional care practices before and after hospital admission and to examine their association with malnutrition among children hospitalized for acute diarrhea.

Methods: A cross-sectional study was conducted among 197 children under five years of age admitted for acute diarrhea to the Gastroenterology Department of Children's Hospital 2 (March–April 2025). Nutritional status was assessed using WHO 2006 growth standards (Z-score < −2 SD), when the patient was clinically stable at discharge. Associations between malnutrition and caregiving practices were analyzed using chi-square tests and logistic regression models.

Results: The overall prevalence of malnutrition was 37.3%, including stunting (22.7%), underweight (19.7%), and wasting (14.6%). Prior to admission, 42.1% of the children experienced reduced dietary intake, 29.4% received incorrectly prepared oral rehydration solution (ORS), and 61.4% did not receive zinc supplementation. Multivariate logistic regression (adjusted for age and sex) identified reduced dietary intake (adjusted OR = 1.9; 95% CI: 1.1–3.5), incorrect ORS preparation (adjusted OR = 1.8; 95% CI: 1.0–3.2), early complementary feeding before 4 months (adjusted OR = 2.1; 95% CI: 1.2–3.9), and low birth weight (adjusted OR = 2.3; 95% CI: 1.3–4.3) as independent predictors of malnutrition.

Conclusions: Inappropriate nutritional practices prior to hospital admission were significantly associated with malnutrition in children with acute diarrhea.

Keywords: *acute diarrhea, malnutrition, nutritional practices, under-five children, oral rehydration therapy.*

I. INTRODUCTION

Acute diarrhea remains one of the leading causes of morbidity and mortality among children under five years of age, particularly in low- and middle-income countries. Diarrheal illness contributes to nutrient loss, impaired intestinal absorption, anorexia, and weight loss. Conversely, malnutrition weakens immune function and prolongs recovery, creating a bidirectional cycle between infection and poor nutritional status [1, 2].

Current WHO guidelines recommend early refeeding and continuation of an age-appropriate diet during diarrheal episodes. However, inappropriate caregiving practices, such as reducing dietary intake, diluting milk, or incorrectly preparing oral rehydration solution (ORS), remain common in clinical settings.

✉ Corresponding author: NGUYEN Thi Thu Hau
Email: thuhaunt@gmail.com
Doi: 10.56283/1859-0381/1020.
Received: 27/2/2026 Revised: 10/3/2026
Accepted: 27/4/2026
Published online: 28/4/2026

The present study highlights persistent gaps in maternal practices regarding feeding and oral rehydration in children with acute diarrhea. Nearly half of the mothers still believed in withholding food, contrary to current recommendations that emphasize continued feeding to prevent malnutrition and support recovery. Although most mothers recognized the importance of ORS, incorrect practices - particularly in managing vomiting - remained common, indicating insufficient practical knowledge. Similar findings were reported in a study conducted at Tien Giang General Hospital, where appropriate feeding and ORS practices were also suboptimal [3]. In Vietnam, the prevalence of malnutrition among children hospitalized for acute diarrhea has been reported to range from 25% to 45% [3, 4].

Understanding modifiable nutritional practices associated with malnutrition is essential for improving prognosis and optimizing treatment strategies. This study aimed to describe nutritional care practices before and after hospitalization and to examine their association with malnutrition among children under five years of age hospitalized for acute diarrhea. At a tertiary pediatric referral hospital like Children's Hospital 2, children hospitalized with acute diarrhea often present with severe conditions, including dehydration and comorbidities, where optimal nutritional care may critically influence outcomes. However, evidence on nutritional practices and their association with malnutrition in this population remains limited, warranting further investigation.

II. METHODS

2.1. Study design and participants

A cross-sectional study was conducted at the Gastroenterology Department of Children's Hospital 2 between March and April 2025. Children under five years of age hospitalized with a diagnosis of acute diarrhea were eligible. Exclusion criteria included refusal of caregiver participation, referral from another department, missing ≥ 70% of questionnaire data, or incomplete anthropometric measurements.

2.2. Sample size and sampling

The sample size was calculated using the formula for estimating a single proportion:

$$n = Z^2_{(1-\alpha/2)} \times \frac{p(1-p)}{d^2}$$

With α = 0.05, $Z_{(1-\alpha/2)}$= 1.96; the margin of error was set at d = 0.05; and the estimated proportion was p = 0.142, based on the study "Risk of nutritional status on diarrhea among under five children" [4]. The minimum required sample size was calculated to be 188 children.

2.3. Data collection

Data were collected through structured caregiver interviews covering sociodemographic characteristics, clinical features, and nutritional practices before admission. Anthropometric measurements (weight and length/height)

were obtained using standardized procedures of Children's Hospital 2, performed by trained healthcare staff using a scale with 0.1 kg precision and a stadiometer with 1 cm precision. Appropriate ORS refers to a reduced-osmolarity formulation; solutions with insufficient electrolytes and excessive sugar should not be used. Information on dietary intake before and during this illness episode, as well as pre-illness body weight, was obtained through direct interviews with caregivers

Nutritional status was assessed using WHO 2006 growth standards. Malnutrition was defined as Z-score < −2 standard deviations for: weight-for-age (underweight), height-for-age (stunting) and weight-for-height (wasting).

2.4. Statistical analysis

Data were analyzed using appropriate statistical software. Categorical variables were compared using chi-square tests. Odds ratio (OR) and 95% confidence interval (CI) wase calculated using univariate logistic regression. Multivariate logistic regression was performed to identify independent predictors of malnutrition, adjusting for age and sex. Statistical significance was set at $p < 0.05$.

2.5. Ethical considerations

Written informed consent was obtained from caregivers prior to participation. All data were coded to ensure confidentiality, and informed consent forms were stored separately from the questionnaires. The study was approved by the Institutional Review Board of Children's Hospital 2 (Approval No. 79/GCN-BVNĐ2, dated March 19, 2025).

III. RESULTS

Table 1. *Nutritional care practices before and after hospital admission (n = 197)*

Nutritional practice	*n (%)*
Before admission	
Reduced dietary intake (during this illness episode)	83 (42.1)
Milk dilution	76 (38.6)
Incorrect preparation of ORS or inappropriate selection of ORS type	58 (29.4)
No zinc supplementation	121 (61.4)
After admission	
Refeeding within 24 hours	127 (64.5)
Maintenance of undiluted milk feeding	134 (68.0)
Adherence to hospital dietary protocol	149 (75.6)

During March–April 2025, the study enrolled 197 pediatric patients; 56.3% were male, and 68% resided in urban areas. Children under 24 months accounted for 62.4%. The proportions of preterm birth (<37 weeks of gestation)

and low birth weight (at term, <2,500 g) were 12.7% and 15.2%, respectively. Overall, 54.8% of children were exclusively breastfed during the first six months of life. Most patients were admitted within the first 3–7 days after disease onset (79.7%). At admission, 71.1% presented with mild to moderate dehydration (corresponding to <5% and 5–10% body weight loss, or WHO dehydration grades A and B), while 8.6% had severe dehydration (≥10% body weight loss, or grade C). Mucus in stool was observed in 27.7% of cases, 7.5% had bloody mucus stools, and 25.7% had received antibiotics prior to admission.

Among 197 children, the overall prevalence of malnutrition was 37.3%. Stunting was the most common form (22.7%), followed by underweight (19.7%) and wasting (14.6%).

Table 2. *Univariate analysis of association between malnutrition and selected nutritional care factors (n = 197)*

Factor	Malnutrition n (%)	No malnutrition n (%)	OR (95%CI)	p-value
Reduced dietary intake	38 (52.1)	45 (36.3)	2.1 (1.2–3.8)	0.01
Incorrect ORS preparation	28 (38.4)	30 (24.2)	1.9 (1.1–3.4)	0.03
Early complementary feeding	26 (35.6)	21 (16.9)	2.3 (1.3–4.1)	0.02
Low birth weight	22 (30.1)	17 (13.7)	2.5 (1.4–4.6)	0.01
Milk dilution	31 (42.5)	45 (36.3)	1.3 (0.8–2.3)	0.18
No zinc supplementation	49 (67.1)	72 (58.1)	1.5 (0.9–2.6)	0.11

Table 3. *Multivariate analysis of multivariate logistic regression analysis of factors associated with malnutrition (n = 197)*

Factor	Adjusted OR	95% CI	p-value
Reduced dietary intake	1.9	1.1–3.5	0.02
Incorrect ORS preparation	1.8	1.0–3.2	0.04
Early complementary feeding	2.1	1.2–3.9	0.01
Low birth weight	2.3	1.3–4.3	0.01
Milk dilution	1.2	0.7–2.1	0.24
No zinc supplementation	1.4	0.8–2.5	0.15

As shown in Table 2, malnutrition defined as Z-score < −2 SD according to WHO 2006 standards. Univariate logistic regression analysis. Statistical significance was set at $p < 0.05$.

As shown in Table 3, the multivariate logistic regression model was adjusted for age and sex, reduced dietary intake, incorrect ORS preparation, early complementary feeding, and low birth

weight remained independently associated with malnutrition ($p < 0.05$). Low birth weight showed the strongest association. Milk dilution and lack of zinc supplementation were not independently associated with malnutrition after adjustment.

IV. DISCUSSION

4.1. Nutritional status according to WHO standards and nutritional care before and after hospital admission

The prevalence of malnutrition (37.3%) observed in this study underscores the substantial nutritional burden among children hospitalized with acute diarrhea. The predominance of stunting (22.7%) suggests that a considerable proportion of affected children entered the diarrheal episode with pre-existing chronic nutritional deficits. This finding is consistent with previous studies conducted in Vietnam [4-7] and aligns with global evidence indicating that diarrhea frequently occurs in children already experiencing growth faltering Tertiary referral centers may concentrate children with underlying vulnerabilities, potentially explaining the higher prevalence compared with some private healthcare settings

The coexistence of stunting and wasting highlights the dual burden of chronic and acute malnutrition. Recurrent or persistent diarrheal episodes have been shown to disrupt intestinal integrity, impair nutrient absorption, and compromise linear growth, thereby contributing to long-term growth deficits Conversely, acute reductions in dietary intake and increased metabolic demands during illness may precipitate rapid weight loss and wasting The bidirectional interaction - between diarrhea and malnutrition - where infection impairs growth and malnutrition increases susceptibility to infection - has been well documented [1,2]

Importantly, our findings emphasize the clinical relevance of pre-admission caregiving practices. A substantial proportion of caregivers reduced dietary intake or diluted milk during illness, practices that contradict WHO recommendations advocating continued feeding and maintenance of an appropriate diet during acute diarrhea Evidence suggests that maintaining a normal diet during diarrheal episodes shortens recovery time and reduces weight loss [2]. The high proportion of incorrect ORS preparation and lack of zinc supplementation observed in this study reflects persistent gaps in caregiver knowledge, consistent with previous Vietnamese studies demonstrating an association between caregiver practices and child nutritional status [6, 7].

Encouragingly, early refeeding within 24 hours was implemented in the majority of hospitalized children, indicating adherence to evidence-based inpatient treatment protocols. However, delayed refeeding in a subset of patients suggests room for improvement. WHO guidelines emphasize that while ORS significantly reduces mortality from dehydration, it does not replace the role of comprehensive nutritional management Integrated strategies combining appropriate rehydration, early feeding, and micronutrient supplementation are therefore essential to interrupt the diarrhea–malnutrition cycle and improve both short- and long-term outcomes.

4.2. Association between malnutrition and nutritional care practices

Univariate analysis demonstrated that several pre-admission nutritional practices were significantly associated with malnutrition, including reduced dietary intake during illness, incorrect ORS preparation, early complementary feeding, and low birth weight. These findings highlight the role of modifiable caregiving factors in the risk of malnutrition among children hospitalized with acute diarrhea.

Reduced dietary intake during the diarrheal episode was associated with more than a twofold increase in the odds of malnutrition in univariate analysis and remained significant after multivariate adjustment. This finding is consistent with WHO recommendations advocating continued feeding and avoidance of dietary restriction during acute diarrhea Sullivan also emphasized that maintaining a normal diet during diarrheal episodes preserves body weight and shortens recovery time [2]. Children with reduced intake may experience acute energy deficits, contributing to the increased prevalence of wasting observed in this study.

Incorrect ORS preparation was also independently associated with malnutrition in the adjusted model. Errors in ORS dilution may result in inadequate rehydration or electrolyte imbalance, potentially compromising recovery and nutritional status. Previous Vietnamese studies have demonstrated associations between caregiver knowledge and practice and child nutritional outcomes in diarrheal illness [6,7]. These findings reinforce the importance of caregiver education and correct ORS preparation as part of integrated diarrhea management.

Early complementary feeding (<4 months of age) and low birth weight emerged as strong risk factors in both univariate and multivariate analyses. Low birth weight reflects limited initial nutritional reserves, rendering children more vulnerable to nutritional deterioration during acute illness. Early complementary feeding may increase exposure to enteric pathogens and adversely affect long-term growth trajectories. International evidence has consistently demonstrated the bidirectional relationship between recurrent diarrhea and poor nutritional status, contributing to growth faltering and prolonged illness

In contrast, milk dilution and lack of zinc supplementation were not independently associated with malnutrition after multivariate adjustment. Their apparent effects in univariate analysis may have been confounded by underlying dietary patterns or baseline nutritional status. Nevertheless, WHO continues to recommend zinc supplementation in the management of acute diarrhea to reduce illness duration and recurrence risk

Overall, pre-admission nutritional practices appear not only to influence current nutritional status but also to have implications for clinical prognosis. Early screening for malnutrition and strengthened caregiver education are therefore essential to reduce complications and improve treatment outcomes in children with acute diarrhea.

Strengths: This study applied standardized WHO 2006 anthropometric criteria, ensuring comparability and accuracy in nutritional classification. It also assessed both pre-admission and in-hospital nutritional practices, providing a comprehensive view of caregiving. Multivariate analysis was used to control

for confounding factors and identify independent associations.

Limitations: The cross-sectional design limits causal inference. Pre-admission data were self-reported and may be subject to recall bias. The single-center setting may limit generalizability, and some potential confounders, such as socioeconomic status and disease severity, were not included in the analysis.

IV. CONCLUSIONS

Malnutrition was prevalent among children under five hospitalized for acute diarrhea, with stunting being the most common form. Reduced dietary intake, incorrect ORS preparation, early complementary feeding, and low birth weight were independent predictors of malnutrition.

References

1. Mahmoudifar K, Hashempoor M, Asadi Touranlou F, Rezaie M. The effect of oral nutritional supplements in improving the condition of children with diarrhea: a systematic review. Pediatr Gastroenterol Hepatol Nutr. 2025 Jan 1;28(5):267–79. doi:10.5223/pghn.2025.28.5.267
2. Musdzalifah A, Khasanah U, Zaidah N Correlation between Nutritional Status and Diarrhea in Toddlers at Slawi Health Center, Tegal, Central Java, Indonesia. J Matern Child Health. 2024. 09(06): 894-892. https://doi.org/10.26911/thejmch.2024.09.06.04.
3. Ta TKT, Nguyen TN. Knowledge, attitude, and practice of mothers of children under five years old with acute diarrhea treated at the Pediatric Department of Tien Giang General Hospital GIANG GENERAL HOSPITAL. Vietnam Journal of Medicine. 2022;519:351–8.
4. Iskandar WJ, Sukardi W, Soenarto Y. Risk of nutritional status on diarrhea among under five children. Paediatr Indones. 2015 Jun 31;55(4):235-8. doi: 10.14238/pi55.4.2015.235-8.
5. Dinh TKA, Ninh TN, Nguyen TMC. The nutritional status of children under 25 months old with acute diarrhea at the Gastroenterology Department in Thai Binh Pediatric Hospital in 2019. VN J Nutr Food [Internet]. 2022 Jul 3 [cited 2026 Mar 28];16(3+4):85-91. Available from: https://tapchidinhduongthucpham.org.vn/index.php/jfns/article/view/157.
6. Nguyen VS, Pham TD, Hoang NT, Ngo TB. Nutritional status of children under five years with diarrhea hospitalized in Vinh Phuc Obstetric and Pediatric Hospital in 2016. VN J Nutri Food [Internet]. 2017 May 29 [cited 2026 Apr. 26];13(3):14-20. Available from: https://tapchidinhduongthucpham.org.vn/index.php/jfns/article/view/468.
7. Nguyen VS, Hoang NT, Pham TD, Ngo TB. Material knowledge and practices in relation with nutrition status of children under five with acute diarrhea hospitalized in Vinh Phuc Obstetric and Pediatric Hospital in 2016. VN J Nutri Food [Internet]. 2017 May 29 [cited 2026 Apr. 28];13(3):50-6. Available from: https://tapchidinhduongthucpham.org.vn/index.php/jfns/article/view/474.
8. Luu TMT, Pham VP, Pham TH. Feeding situation off children under 5 years old with acute diarrhea at the Vietnam Natiional Children's Hospital VN J Nutri Food [Internet]. 2022 Sep. 12 [cited 2026 Apr. 28];14(6):19-24. Available from: https://tapchidinhduongthucpham.org.vn/index.php/jfns/article/view/350.