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Original Research Article

Prevalence of nutritional problems and their association with feeding practices in children of age 1-3 years attending a tertiary care centre in South Kerala

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ABSTRACT

Background: Malnutrition during early childhood adversely affects growth, immunity, and neurodevelopment. Feeding practices play a major role in determining nutritional outcomes among young children.
Methods: A cross-sectional analytical study was conducted among 140 children aged 1-3 years attending a tertiary care centre in South Kerala. Sociodemographic details and feeding practices were assessed using a semi-structured questionnaire. Anthropometric assessment was performed using WHO growth standards. Associations between feeding practices and nutritional status were analysed using Chi-square/Fisher's exact test.
Results: Among 140 children, 52.9% were male and 65.7% belonged to the lower middle socioeconomic class. Underweight, stunting, and wasting were observed in 15.7%, 17.1%, and 8.6% of children respectively. Early initiation of breastfeeding was reported in 55.7%, while 89.3% were exclusively breastfed for six months. Most children had poor dietary diversity (57.2%). No statistically significant association was found between feeding practices, dietary diversity, maternal education, socioeconomic status, and acute malnutrition ($p>0.05$).
Conclusions: Despite favourable breastfeeding practices, undernutrition and poor dietary diversity persist among toddlers. Strengthening caregiver counselling on complementary feeding and dietary diversity remains essential.

Keywords: Malnutrition, Feeding practices, Breastfeeding, Dietary diversity, Toddlers, Complementary feeding

INTRODUCTION

Optimal nutrition during early childhood is fundamental to survival, growth, and long-term development. Every child has the right to adequate nutrition, as emphasised by the United Nations Convention on the Rights of the Child, which recognises nutrition as a basic human right essential for physical, cognitive, and emotional well-being.[1,2] The first 1,000 days of life- from conception to two years- form a critical window where appropriate feeding practices profoundly shape health outcomes. WHO and UNICEF recommend breastfeeding within one hour of birth, exclusive breastfeeding for six months, and timely introduction of safe, diverse complementary foods at six months, with continued breastfeeding up to two years or beyond.[3] Breastfeeding not only provides tailored nutrition and protection against infections but also supports neurodevelopment, cognition, and mother-child bonding.[2]

Beyond six months, breast milk alone cannot meet rising energy and micronutrient needs. Inadequate or delayed complementary feeding increases risks of growth faltering, deficiencies, and infections.[4] The 6-23-month period is particularly vulnerable, as children establish food preferences and eating patterns that influence later health. Despite clear guidelines, suboptimal feeding practices remain widespread, especially in low- and middle-income countries. In India, NFHS-5 highlights gaps in complementary feeding, contributing to persistent undernutrition. Even states with stronger health indicators,

such as Kerala, face challenges linked to misconceptions, family dynamics, and inappropriate feeding practices. Feeding practices are shaped by maternal education, employment, age, family structure, cultural beliefs, and access to reliable nutrition information. Caregiver knowledge of dietary diversity, food preparation, and responsive feeding is crucial for adequate intake. Children aged 1-3 years, though often overlooked in research, undergo rapid growth and evolving food preferences, making them highly susceptible to nutritional deficiencies.[5] Understanding the prevalence of problems and their association with feeding practices in this age group is vital for strengthening child nutrition programs and designing targeted interventions.

A cross-sectional study was conducted among 140 children aged 1-3 years attending a tertiary care centre in South Kerala to assess the prevalence of nutritional problems and their association with feeding practices, along with related socioeconomic and maternal factors.

METHODS

This was a cross-sectional analytical study conducted over 18 months in the paediatric outpatient department of a tertiary care centre in South Kerala. A total of 140 children aged 1-3 years were enrolled. Inclusion criteria were: (1) age between 12 and 36 months, and (2) full-term birth with birth weight ≥2.5 kg. Children with chronic illnesses, congenital anomalies, or genetic disorders were excluded.

The sample size was calculated using the prevalence of underweight (30%) reported by Prasad et al, with a 99% confidence level (Z=2.58) and 10% absolute precision.[6] Applying the standard formula for estimating proportions, the minimum required sample size was 139. Accordingly, 139 children were included to ensure reliable estimates of underweight prevalence with the desired confidence and precision.

Data collection

Anthropometric measurements (weight, height/length, MUAC, and head circumference) were recorded by trained staff using calibrated instruments, with accuracy maintained to 0.1 kg and 0.1 cm. Nutritional status was assessed using WHO growth standards, with z-scores calculated for weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ). Anthropometric measurements were taken using standard equipment: electronic weighing pan, infantometer/ stadiometer, and non-stretchable measuring tape. Nutritional assessment was performed with WHO growth charts and WHO Anthro software. Dietary intake was evaluated using a 24-hour recall method, and dietary diversity was scored based on WHO guidelines. Sociodemographic and feeding practice information was collected through a semi-structured questionnaire administered to caregivers.[7]

Nutritional status assessment

Children's nutritional status was evaluated using WHO growth standards (2006). Those with z-scores below −2 SD were classified as underweight, stunted, or wasted. Breastfeeding was assessed using WHO IYCF indicators. Calorie and protein adequacy was calculated against ICMR-NIN 2020 recommendations for children aged 1-3 years (energy: 1010 kcal/day; protein: 11.3 g/day). Intake was categorised as excess (>100%), adequate (90-100%), mild deficit (70-89%), or deficit (<70%).[8] Dietary diversity was evaluated using the Dietary Diversity Score (DDS), based on the number of food groups consumed in the previous 24 hours. Children were classified as having very poor (0-2 groups), poor (3-4), minimum acceptable (5-6), or good/adequate diversity (7-8), in line with WHO/UNICEF standard.[9,10]

Table 1: Dietary diversity score.

DDS score	Dietary diversity status	Interpretation
0-2	Very poor diversity	Severely inadequate diet
3-4	Poor diversity	Inadequate variety
5-6	Minimum acceptable diversity	Meets basic nutrition needs
7-8	Good/adequate diversity	Optimal balanced diet

Statistical analysis

Data were analysed using SPSS version 27. Continuous variables were expressed as means ± SD or medians with interquartile ranges, while categorical variables were presented as frequencies and percentages. Associations between feeding practices, dietary diversity, socioeconomic status, maternal education, and nutritional outcomes were tested using Chi square or Fisher's exact test. A p value<0.05 was considered statistically significant.

Ethical considerations

The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from parents prior to participation.

RESULTS

General characteristics of study population

A total of 140 children aged 1-3 years were included, of whom 52.9% (n=74) were male. The largest proportion of children belonged to the 3-year age group, comprising 42.9% (n=60) of the study population (Table 2). The majority (65.7%) belonged to the lower-middle socioeconomic class based on the Modified Kuppuswamy

Scale.[11] 62.9% mothers had education up to 12th standard and below, while 37.1% were graduates and above.

Analysis showed that more than half of the study participants were first-born children (57.9%), followed by second-born children (37.1%). Higher birth orders accounted for only a small proportion of the population. 65.0% were delivered vaginally and 35.0% by lower segment caesarean section (LSCS). Term births constituted the majority of the study population (94.3%), while preterm births accounted for only 5.7%, hence reducing confounding related to prematurity-associated growth impairment.

Growth parameters

Weight for age

According to WHO growth standards, 82.1% of children had a normal weight-for-age (≥-2 to ≤+2 SD). Underweight was observed in 15.7% (≥-3 to <-2 SD), while 2.1% were severely underweight (<-3 SD). Only a small proportion (0.7%) were classified as overweight (>+2 SD) (Table3).

Height for age

77.9% were within the normal height-for-age range (≥-2 to ≤+2 SD) according to WHO growth standards. Stunting was observed in 17.1% (≥-3 to <-2 SD), while 5.0% were severely stunted (<-3 SD), reflecting a notable deviation from expected growth patterns (Table 3).

Weight for height

88.6% of children were within the normal range (-2 to +2 SD) for weight for height. Wasting was identified in 8.6% (≥-3 to <-2 SD), with an additional 2.1% classified as severely wasted (<-3 SD). Only a small proportion (0.7%) were overweight (>+2 SD) (Figure 1).

MUAC:86.4% (n=121) of study population had normal MUAC (>12.5 cm). While 13.6% (n=19) is in borderline category of 11.5-12.5 cm. No children were noted to have MUAC below 11.5 cm.

Head circumference

93.6% have a normal head circumference (-2 SD to +2 SD) according to WHO Z-score growth chart. Macrocephaly, which is defined as head circumference between >+2 SD and +3 SD, was rare, observed in only 1.4% of subjects. Microcephaly, with values between -3 SD and -2 SD, was noted in 5% of participants.

Feeding practices (Table 4)

More than half of the mothers (55.7%) initiated breastfeeding within one hour of birth. A substantial proportion still experienced delayed breastfeeding initiation. Exclusive breastfeeding for six months was practiced by 89.3% of mothers, while 10.7% discontinued exclusive breastfeeding before six months. The relationship between breastfeeding initiation time, weaning practices, and nutritional status was analysed using Fisher's exact test. Among children initiated on breastfeeding within one hour, 57.6% were normal and 40% were wasted, compared to 42.4% normal and 60% wasted among those with delayed initiation. The test value was 1.681 (p value 0.195), indicating no significant association. Similarly, for weaning practices, most children in both groups were exclusively breastfed for six months or more. The p-value for weaning time was 1.000, showing no statistically significant association with nutritional status.

Nutritional parameters

Assessment showed that 70.7% of children had adequate calorie consumption. Excess intake was observed in 21.4%, while 7.9% had calorie deficiency (Figure 2). Chi-square analysis showed no significant association between meal frequency and malnutrition (χ^2=7.24, p=0.93). No significant association was found between calorie intake and malnutrition (χ^2=4.846, p=0.089) (Table 5).

There showed no significant association between snack intake and malnutrition (χ^2=4.284, p=0.232). Similarly, no significant association was observed between soft drink intake and malnutrition (χ^2=2.454, p=0.484 (Figure 3) (Table 7). Overall, a substantial proportion of children were exposed to packaged snacks and beverages at least weekly.

Dietary diversity

Most children consumed cereals, vegetables, milk, and legumes daily. Milk and dairy intake were highest, with 93.57% consuming them 6-7 times per week (Table 5). In contrast, eggs and flesh foods were rarely consumed daily. This indicates adequate staple and dairy intake, but relatively lower daily consumption of animal-source protein foods.

Dietary diversity assessment showed that 22.9% of children had very poor diversity, while 34.3% had poor diversity (Table 6). Minimum acceptable diversity was seen in 23.6% of participants, and only 19.3% had good or adequate diversity. These findings indicate suboptimal dietary diversity among a majority of children. Chi square analysis revealed no significant association between dietary diversity score and malnutrition (χ^2=2.336, p=0.506). Among children without malnutrition, 32.8% had poor diversity, 24% had minimum acceptable diversity, and 20.8% had good diversity (Table 7). In contrast, wasted children more often had poor (46.7%) or very poor diversity (26.7%).

Other parameters

No statistically significant association was observed between socioeconomic status or maternal education and nutritional status among the study population.

The majority of children, including those with wasting and severe wasting, belonged to the lower middle socioeconomic class. Similarly, most children of mothers educated up to 12th standard as well as graduates and above had normal nutritional status, with only a few cases of acute malnutrition. Statistical analysis showed no significant relationship between socioeconomic status (χ^2=2.897, p=0.408) or maternal education (χ^2=0.89, p=0.34) and malnutrition.

Table 2: Demographic distribution.

Variables	Category	Frequency (N)	Percentage (%)
Age (years)	More than or equal to 1 year to less than 2 years	38	27.1
	2 years to less than 3 years	42	30.0
	3 years to less than 4 years	60	42.9
Gender	Male	74	52.9
	Female	66	47.1

Table 3: Nutritional status of children based on WHO growth standards (n=140).

Indicators	Category	Frequency (N)	Percentage (%)
Weight-for-age	Normal (≥ -2 to ≤ +2 SD)	115	82.1
	Underweight (≥ -3 to < -2 SD)	22	15.7
	Severely underweight (< -3 SD)	3	2.1
	Overweight (> +2 SD)	1	0.7
Height-for-age	Normal (≥ -2 to ≤ +2 SD)	109	77.9
	Stunted (≥ -3 to < -2 SD)	24	17.1
	Severely stunted (< -3 SD)	7	5.0

Table 4: Distribution of subjects based breastfeeding practices (n=140).

Breastfeeding practices	Categories	Number (N)	Percentage (%)
Initiation of breastfeeding	Within one hour of birth	78	55.7
	More than one hour after birth	62	44.3
Exclusive breastfeeding duration	Exclusive (≥ 6 months)	125	89.3
	Non-exclusive (< 6 months)	15	10.7
Weaning practices	< 6 months	0	-
	At or after 6 months	140	100

Table 5: Distribution of study subjects based on weekly frequency of consumption of 7 food groups (n=140).

Food groups	6-7 f (%)	3-5 f (%)	1-2 f (%)	Never (%)
Cereals, roots and tubers	101 (72.14)	21 (15)	16 (11.42)	2 (1.4)
Vitamin a fruits and vegetables	112 (80)	16 (11.42)	12 (8.57)	0
Other fruits and vegetables	108 (77.14)	13 (9.28)	19 (13.57)	0
Eggs	8 (5.71)	95 (67.85)	31 (22.14)	6 (4.28)
Milk and dairy products	131(93.57)	6 (4.28)	3 (2.14)	0
Flesh foods (meat/fish, poultry)	6 (4.28)	114 (81.42)	17 (12.14)	3 (2.14)
Legumes, nuts and seeds	118 (84.28)	18 (12.85)	3 (2.14)	1 (0.71)

Table 6: Dietary diversity score among the participants.

Dietary diversity score	Frequency	Percentage
Very poor diversity	32	22.9
Poor diversity	48	34.3
Minimum acceptable diversity	33	23.6
Good/adequate diversity	27	19.3

Table 7: Comprehensive overview of all dietary practices and their association with nutritional status.

Variables	Categories	No malnutrition (n=125)	Wasting and severe wasting (n=15)	χ^2 / test value	P value
Meal frequency	3 meals/day	3 (2.4%)	0 (0.0%)	7.24	0.93
	4 meals/day	65 (51.6%)	7 (46.7%)		
	5 meals/day	56 (45.2%)	8 (53.3%)		
	6 meals/day	1 (0.8%)	0 (0.0%)		
Calorie intake	Adequate	85 (68.0%)	14 (93.3%)	4.846	0.089
	Deficient	10 (8.0%)	1 (6.7%)		
	Excess	30 (24.0%)	0 (0.0%)		
Snack intake	Never	5 (4.0%)	0 (0.0%)	4.284	0.232
	1–2 times/week	19 (15.2%)	3 (20.0%)		
	3–5 times/week	88 (70.4%)	8 (53.3%)		
	>6 times/week	13 (10.4%)	4 (26.7%)		
Soft drink intake	Never	30 (24.0%)	4 (26.7%)	2.454	0.484
	1–2 times/week	66 (52.8%)	10 (66.7%)		
	3–5 times/week	17 (13.6%)	1 (6.7%)		
	>6 times/week	12 (9.6%)	0 (0.0%)		
Dietary diversity score	Very poor diversity	28 (22.4%)	4 (26.7%)	2.336	0.506
	Poor diversity	41 (32.8%)	7 (46.7%)		
	Minimum acceptable diversity	30 (24.0%)	3 (20.0%)		
	Good/adequate diversity	26 (20.8%)	1 (6.7%)		

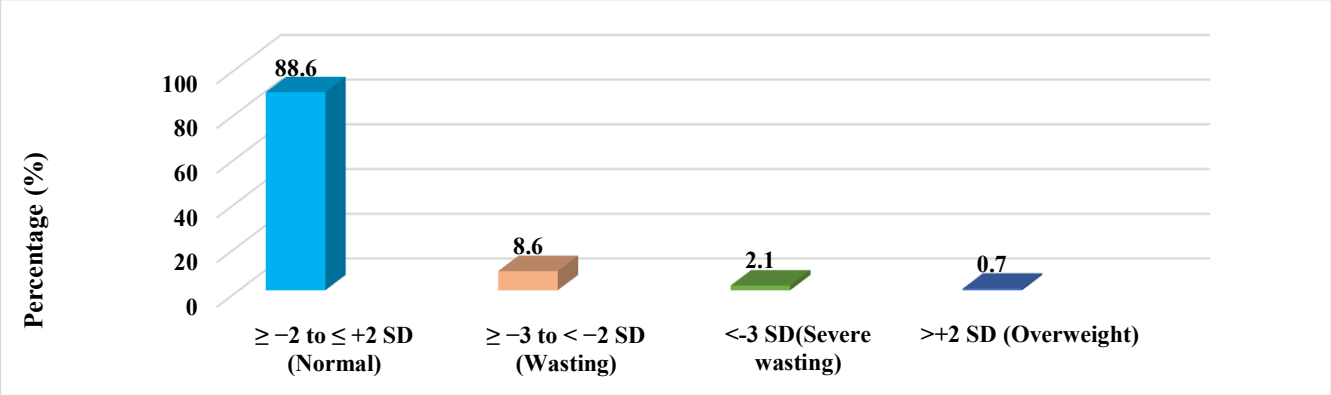

Figure 1: Distribution of study subjects based on weight for height (n=140).

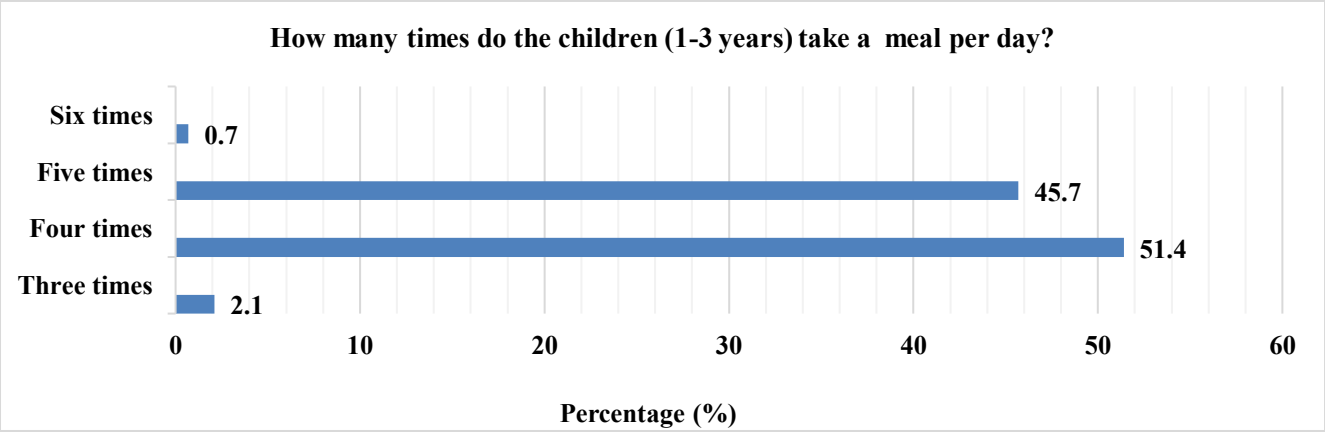

Figure 2: Distribution of study subjects based on meal intake time (n=140).

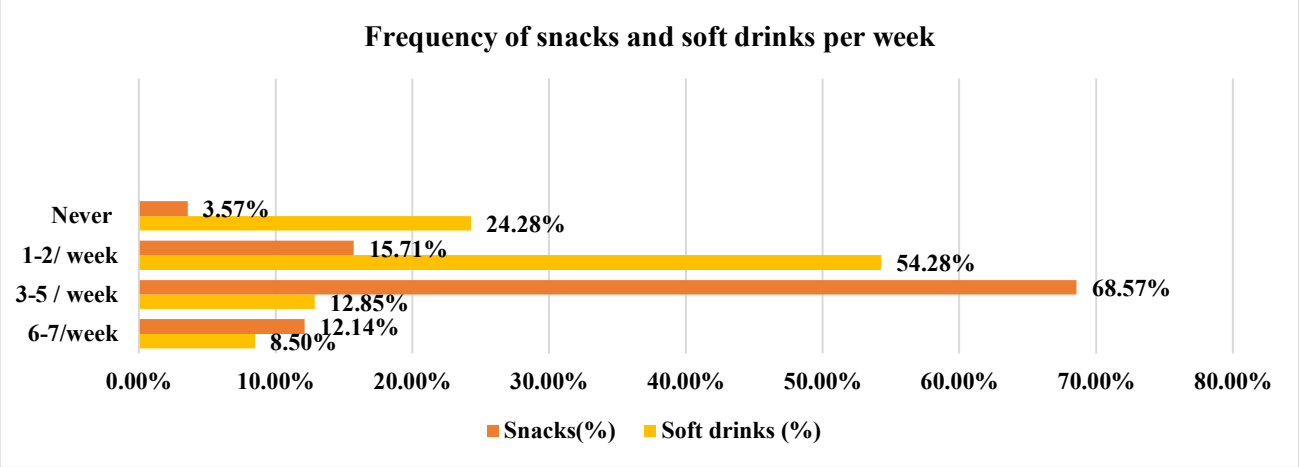

Figure 3: Distribution of study subjects based on frequency of snacks and soft drinks.

DISCUSSION

This study assessed the prevalence of nutritional problems and their association with demographic and feeding-related factors among children aged 1–3 years attending a tertiary care centre in South Kerala. Although most children had normal anthropometric indices, underweight, stunting, and wasting were still observed, highlighting that childhood malnutrition continues to remain a public health concern even in Kerala.

Demographic characteristics

Boys constituted a slight majority of the study population (52.9%), though no significant gender difference in nutritional status was observed, suggesting relatively equitable caregiving practices.[12] Most children belonged to the 36-47 month age group, a vulnerable period for growth faltering due to transition from breastfeeding to complementary family foods.[12,13] More than half were first born children, and the majority were born at term, both of which are favourable factors associated with better nutritional outcomes.[14,15] Most participants belonged to the lower middle socioeconomic class, and although socioeconomic disadvantage is widely associated with malnutrition, the predominance of middle-income households may have contributed to the comparatively lower prevalence observed in this study.[14,16,17] Maternal education showed no statistically significant association with nutritional status, though children of mothers educated up to 12th standard had slightly higher wasting compared to children of graduate mothers.[18,19] Overall, these findings highlight the multifactorial nature of childhood nutrition and the importance of continued nutritional support and education during early childhood.

Overall nutritional status

In the present study, most children had normal anthropometric indices according to WHO standards, with 82.1% having normal weight-for-age, 77.9% normal height-for-age, and 88.6% normal weight-for-height. However, underweight (15.7%), stunting (17.1%), and wasting (8.6%) were still observed, indicating persistent nutritional vulnerability among a subset of children. Compared to studies from socioeconomically disadvantaged populations, the prevalence of undernutrition in this study was relatively lower, possibly reflecting better living conditions, healthcare access, and parental awareness in South Kerala.[16,20]

Nutritional status of study population

Underweight, which reflects both acute and chronic undernutrition, was observed in 15.7% of children, with 2.1% being severely underweight. The prevalence was lower than that reported in several Indian studies, though comparable to findings from rural North Kerala.[12,14,16] Despite the relatively favourable prevalence, severe underweight remains clinically important because of its association with increased susceptibility to infections, developmental delay, and mortality.

Stunting, an indicator of chronic undernutrition, was present in 17.1% of children, including 5% who were severely stunted. This prevalence was lower than that reported among urban slum and tribal populations in Kerala and other parts of India. The lower prevalence in the present study may be attributed to better maternal health, antenatal care, and reduced low birth weight.[12,15] However, the persistence of stunting in nearly one fifth of children highlights ongoing nutritional inadequacies and the long-term impact on cognitive development, educational performance, and adult productivity.

Wasting, reflecting acute malnutrition, was observed in 8.6% of children, with 2.1% severely wasted. Compared to studies conducted in tribal and rural populations, the prevalence was relatively lower, possibly due to improved healthcare access and timely management of acute illnesses.[12,14,15,17] Nevertheless, wasting remains a significant concern because of its strong association with childhood morbidity and mortality.

MUAC screening identified 13.6% of children with moderate acute malnutrition, while no cases of severe acute malnutrition were detected. These findings parallel the comparatively low prevalence of wasting and may reflect better health seeking behaviour and availability of nutritional services in the study area.[14,17] The study also reinforces the value of MUAC as a simple and reliable screening tool for routine community and outpatient nutritional assessment.

Feeding practices

Delayed weaning, inadequate dietary diversity, and inappropriate complementary feeding have been consistently associated with stunting and wasting in children. Previous studies have identified poor weaning practices and recurrent diarrhoeal illnesses as important predictors of malnutrition.[13,14] The comparatively better nutritional outcomes observed in the present study suggest that many caregivers may be adhering to recommended feeding practices. However, persistent gaps in caregiver knowledge and prevailing misconceptions indicate the continuing need for nutrition education focusing on timely complementary feeding, dietary diversity, and responsive feeding practices.

Community based studies generally report a higher prevalence of malnutrition compared to hospital-based studies.[12-17] This variation may be due to selection bias, as families seeking tertiary healthcare are often more health conscious and socioeconomically stable. Similar observations have been reported in other facility-based studies showing comparatively better nutritional indicators. Therefore, the findings of the present study may underestimate the actual burden of malnutrition in the broader community population.

CONCLUSION

Undernutrition in early childhood continues to pose serious health and developmental risks, including infections, delayed growth, poor academic performance, reduced productivity, and long-term chronic disease. Addressing this challenge requires strengthening growth monitoring, enhancing caregiver education, improving dietary diversity, and ensuring early detection and management of malnutrition. Integrating hospital and community-based interventions, with special focus on vulnerable groups such as low-income families and children with recurrent illnesses, remains essential.

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