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Prevalence of Malnutrition and Its Associated Risk Factors Among Children Aged 1-5 Years Admitted in Dr. Jamal Ahmad Rashid pediatric Teaching hospital

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Abstract

Background and Aims: Malnutrition continues to be a major public health in low and middle-income countries is a common pediatric issue, especially in hospitalized patients. This study aimed to establish the prevalence of malnutrition and risk factors for malnutrition in children (1-5 years of age) who were presented to Dr Jamal Ahmad Rashid Teaching Hospital for Pediatrics.

Methods: This was a cross-sectional study, which was carried out between December 2024 and March 2025, and studied among 329 children aged 1-5 years. Information was obtained via standardized questionnaires, measurements using scales, and scales for weight, gathered at the three time-points. weight and height, body mass index (BMI), mid-upper arm circumference (MUAC), and the STRONG kids screening tool. The WHO growth standards were used to determine nutritional status. Malnutrition predictors were analyzed by logistic regression.

Results: The mean age of the participants was 31.67 ± 16.166 months, and male children were52.3%. Anthropometric assessment 18.8% were stunted (Mild:16.4%, moderate 2.4%), 14.8% wasted (mild wasting (10.6%), moderate (3.6%) and severe (0.3) Moderate), while underweight was in 13%. The prevalence of overweight in children was relatively high at 13.7%, indicative of a double burden. MUAC detected 11.8% of children with acute malnutrition (93.4%), moderate acute (moderate: 10.9%; severe: 0.9%). Some significant predictors were brought by using logistic regression and they were younger age (OR = 0.978; 95% CI:0.958 – 0.999), paternal unemployment (OR = 0.167; 95% CI: 0.060– 0.463), housing conditions (owned house OR =3.041, rented house OR=3.OO8), and two daily meals (OR =2.045;95% CI:1.648 – 5.632).

Conclusions: The present study shows a high prevalence of acute malnutrition (wasting) and a substantial double burden of underweight and overweight in hospitalized children. Reinforcing regular nutrition assessment, guaranteeing an adequate dietary intake, and dealing with the socioeconomic factors like parents' occupation and housing are important actions that can help to confront this double burden. However, since the study subjects were only hospitalized children, this observed prevalence could likely be higher than in the general population.

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1. Introduction

Malnutrition is a major public health problem worldwide, particularly amongst children under the age of five years, as it significantly affects morbidity and mortality, with associated developmental defects(1). Globally, approximately 22.2% of children are stunted, 7.5% are wasted, and 12.6% are underweight, reflecting an ongoing trend of malnutrition in this population(2).

The malnutrition pattern in children <5 years of age commonly consists of stunting (chronic malnutrition, low height-for-age), wasting (acute malnutrition, low weight-for-height), and underweight (low weight-for-age), which have different causes and health consequences (3). Stunting is commonly a symptom of chronic malnutrition, where an individual has not been eating properly for a long period and catching illnesses, whilst wasting refers to weight loss, which is severe and occurs relatively quickly, usually due to a sudden shortage of food or due to illness (1). These manifestations of malnutrition are most common in poverty-, conflict-, and health-affected areas, with 75% of the world's stunted children residing in conflict zones (4).

Undernutrition alone accounts for nearly 45% of deaths among children under five (1). The double burden of malnutrition is apparent with 37 million children under five years of age overweight in the world, 2022(2, 5). Risk factors are numerous and involve low birth weight, suboptimal breastfeeding, poverty, maternal education, large family size, poor hygiene, and frequent infections (6, 7). Furthermore, malnutrition is not merely a predisposing condition toward disease susceptibility and death but leads to longer-lasting consequences, including impaired cognitive development, loss of productivity, and generation-spanning poor health (8, 9).

Although there is a vast body of literature, the majority of studies concentrate upon populations in community settings, and there is scarce documentation on hospitalized children who may have more severe malnutrition or multiple forms. Regional data is also deficient for Sulaimani; however, this is likely due to possible local cultural and socioeconomic determinants on nutritional status. Thus, this study aims to explore the prevalence and characteristics of malnutrition and its associated risk factors among 1- to 5-year-old children hospitalized in Sulaimani Pediatric Hospital, which will support the development of effective interventions in this regard.

2. Methods and Materials

2.1. Study design and setting

A cross-sectional study was carried out at Dr. Jamal Teaching Hospital for Pediatrics in Sulaimani City, Iraq, from December 2024 to March 2025.

2.2. Study population

The study population included children aged from one to five years old hospitalized in the pediatric wards of Dr Jamal Teaching Hospital for Pediatrics. The sample size was estimated from previous studies in children with malnutrition. With a confidence interval of 95% and an error margin of 5%, the sample size was estimated to be at least two hundred and forty-four children. To allow for non-response, the target final sample size was approximately 329 children. Sampling was conducted through convenience.

Inclusion criteria: All children aged 1 through 5 years of age at admission, admitted to the pediatric ward in Dr. Jamal hospital throughout the study period, and had parental or guardian approval for participation, who lived in Sulaimani City and its rural areas.

2.3. Data collection

A structured questionnaire was used to obtain information on the socioeconomic status (parental education, income, and household size), dietary practices (breastfeeding duration, meal frequency, and dietary diversity), as well as health history (sicknesses, rate of hospitalization). The pediatric malnutrition screening tool STRONGkids validated risk categories (low, moderate, high) on combined clinical and dietary factors(10).

The body weight of children less than two years old was measured on an infant scale accurate to 10 grams. The child was measured to be either supine or, if capable of sitting alone, in a seated position. Body weight in children ≥2 years old was measured with a standard scale with 100 g sensitivity; the same type of scale was used to maintain consistency. All measurement instruments were calibrated at periodic intervals to maintain precision (11). Among children <2 y old, length was measured in a supine position using a headboard and footboard to the nearest 0.1 cm. For children aged between two years and above, the height was measured with a stadiometer in a standing position. In this procedure, each child was asked to stand with their back straight, heels together, and feet flat on the ground. Special care was taken to place the head in the Frankfurt plane at which the suppository aligns with the inferior orbital fissure and the upper margin of the auditory meatus. This standardized position was used to standardize the measuring technique and measure all participants at the same height level of height (11). Mid-upper arm circumference (MUAC) was measured with a non-elastic tape measure (in millimeters). Measurements were taken on the child's non-dominant arm at the discretion of the child or caregiver, with observational verification. For an under-1-year-old, the left arm was used when a dominant arm could not be found. The midpoint of this line was determined by flexing the arm to 90 degrees at the elbow and then holding it parallel to the body. The distance between the acromion and olecranon was measured, and a mark was placed on the midpoint. At the midpoint of the relaxed upper arm, with the arm hanging at the side, a snug (not tight) measurement was taken. The outcome was measured to the nearest millimeter

(11). MUAC at the figure 1, and 2 cut off (measured Color band with z-score cut off) was derived for children aged from two months to 18 years.

Reference Table for z-Score Ranges on Tape		
Color/Pattern Key	**MUAC z-Score Range**	**Risk Classification**
Solid Orange	2 to 3	Moderate overweight
Solid Yellow	1 to 2	Mild overweight
Solid Green	0 to 1	Normal
Hashed Green	−1 to 0	Normal
Hashed Yellow	−2 to −1	Mild Undernutrition
Hashed Orange	−3 to −2	Moderate Undernutrition
Hashed Red	−4 to −3	Severe Undernutrition

Figure 1. Z-score classification according to MUAC bands (11).

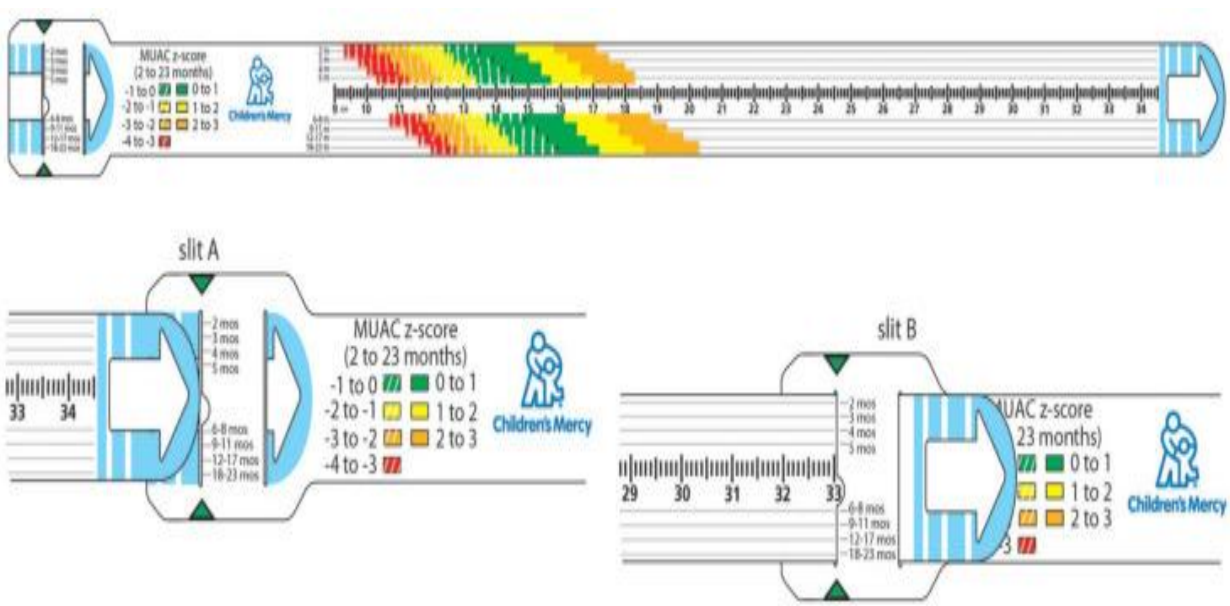

Figure 2. Prototype MUAC Z-score tape (11).

BMI is a critical tool for assessing nutritional status in children under 5 years, as it accounts for age- and sex-specific growth patterns. Unlike adults, children's BMI values are interpreted using standardized growth charts and Z-scores to reflect developmental stages.

$$BMI = \frac{\textbf{weight (kg)}}{\textbf{height (m)}^2}$$

BMI values were interpreted using Z-scores (standard deviations from the median of the reference population) or percentiles from growth charts, as children's growth patterns vary by age and sex.

WHO Growth Standards (11): Underweight: BMI-for-age Z-score <-2 SD (below the 2.3rd percentile). Overweight: BMI-for-age Z-score

> +2 SD (above the 97.7th percentile). Obese: BMI-for-age Z-score > +3 SD.

In assessing undernutrition among children under five, weight for height percentiles and z-scores were interpreted based on WHO standards (11, 12). A WFH percentage ranging from 90% to 110% was classified as “normal.” Values between 80% and 90% indicated “acute mild malnutrition,” while those from 70% to 80% were categorized as “acute moderate malnutrition.” Measurements falling below 70% were considered indicative of “acute severe malnutrition.” Similarly, z-score classifications were applied: a z-score between −2 and −1 denoted “acute mild malnutrition,” scores from −3 to −2 represented “acute moderate malnutrition,” and a z-score below −3 was defined as “acute severe malnutrition.” Stunting (height-for-age Z-score < -2), wasting (weight-for-height Z-score < -2), and underweight (weight-for-age Z-score < -2) defined malnutrition severity (3).

2.4. Ethical consideration

Ethical approval was secured from the Institutional Review Board (IRB) of the College of Medicine, University of Sulaimani (Reference: 325, 13/10/24). Approval from Dr. Jamal Ahmad Rashid hospital was taken also written informed consent forms were provided to parents/guardians, emphasizing voluntary participation and confidentiality.

2.5. Statistical analysis:

Data were analyzed using IBM SPSS v28.0. Descriptive statistics (means, frequencies) summarized socio-demographic and anthropometric data. Chi-square tests assessed associations between categorical variables (e.g., socio-economic status and malnutrition). Binary logistic regression identified predictors of malnutrition, with odds ratios (OR) and 95% confidence intervals (CI) reported. Z-scores for stunting, wasting, and underweight were calculated using the WHO Anthro software. Statistical significance was set at $p < 0.05$.

3. Results

The current study included 329 children, and the children's mean age was 31.67 ± 16.166 months, with 172 (52.3%) being boys and 157 (47.7%) being girls. Regarding place of residence, 235 (71.4%) children were from urban areas, while 94 (28.6%) resided in rural areas. Father's education level indicated that 34 (10.3%) fathers had no formal education. The mother's education level showed that 46 (14%) mothers had no formal education. The employment status of fathers and mothers revealed that 72 (21.9%) fathers and 40 (12.2%) mothers were employed. Housing conditions of the households indicated that 180 (54.7%) households owned their homes, 112 (34%) households rented their homes, and 37 (11.2%) households lived in other types of housing (father-in-law’s house) (Table 1).

Table 1. Socio-Economic Information Among Children Aged 1-5 Years(n=330).

Socio-Economic information		Frequency	Percent
Age		31.67 ± 16.166	
Sex	Male	172	52.3%
	Female	157	47.7%
Place of residence	Urban	235	71.4%

	Rural	94	28.6%
Father's education level	No formal education	34	10.3%
	Primary education	50	15.2%
	Secondary education	150	45.6%
	Higher education	95	28.9%
Mother's education level	No formal education	46	14%
	Primary education	54	16.4%
	Secondary education	123	37.4%
	Higher education	106	32.2%
Father's employment status	Employed	72	21.9%
	Unemployed	257	78.1%
Mother's employment status	Employed	40	12.2%
	Unemployed	289	87.8%
Family's monthly income	Less than 500000 IQD (Low or below average)	8	2.4%
	500000-1000000 IQD (Middle or average)	228	69.3%
	More than1000000 IQD (High or above average)	93	28.3%
Housing condition	Owned house	180	54.7%
	Rented house	112	34%
	Other house (father-in-law's house)	37	11.2%

Anthropometric measurements of children are presented in Table 1. The children's mean weight was 13.518 ± 3.745 kg, the mean height was 90.954 ± 11.353 cm, the mean BMI was 16.158 ± 1.986 kg/m², and the mean MUAC was 14.497 ± 1.685 cm.

Table 2. Anthropometric measurement Among Children Aged 1-5 Years.

Anthropometric	Minimum	Maximum	Mean ± SD
Weight	7.60	32	13.518 ± 3.745
Height	70	120	90.954±11.353
BMI	11.11	24.151	16.158 ± 1.986
MUAC	11	21	14.497 ± 1.685

The STRONG kids score for all children indicated that 168 (51.1%) children scored 0, 54 (16.4%) scored 1, 103 (31.3%) scored 2, and 4 (1.2%) scored 3 (Table 3).

Table 3. Strong kids score Among Children Aged 1-5 Years.

Strong kids score		Frequency	Percent
Strong kids score	0	168	51.1%
	1	54	16.4%
	2	103	31.3%
	3	4	1.2%

The height for age Z score of the children is presented in Table 4. Among the sample, 267 (81.2%) children exhibited HAZ scores greater than or equal to -1 standard deviation (SD), which corresponds to normal height-for-age. Mild stunting, defined by HAZ scores between -2 SD and -1 SD, was observed in 54 (16.4%) children. Additionally, 8 (2.4%) children demonstrated moderate stunting, with HAZ scores ranging from -3 SD to -2 SD. Notably, no cases of severe stunting (HAZ <-3 SD) were identified.

When stratified by sex, 143 (83.1%) boys and 124 (79%) girls had HAZ scores ≥ -1 SD, indicating normal height-for-age within these subgroups. Mild stunting was present in 26 (15.1%) boys and 28 girls (17.8%), while moderate stunting was observed in 3 (1.7%) boys and 5 (3.2%) girls.

Table 4. HAZ Among Children Aged 1-5 Years.

HAZ		Frequency	Percent
HAZ Score	≥ -1 SD Normal	267	81.2%
	-2 SD < HAZ < -1 SD Mild stunting	54	16.4%
	-3 SD < HAZ < -2 SD Moderate stunting	8	2.4%
	HAZ <-3 SD Severe stunting	-	--
HAZ Score in boys	≥ -1 SD Normal	143	83.1%
	-2 SD < HAZ < -1 SD Mild stunting	26	15.1%
	-3 SD < HAZ < -2 SD Moderate stunting	3	1.7%
	HAZ <-3 SD Severe stunting	-	
HAZ Score in girls	≥ -1 SD Normal	124	79%
	-2 SD < HAZ < -1 SD Mild stunting	28	17.8%
	-3 SD < HAZ < -2 SD Moderate stunting	5	3.2%
	HAZ <-3 SD Severe stunting	-	-

Summary of weight for height Z-score of the children is shown in Table 5. By weight-for-height, 281 (85.4%) children were greater than or equal to -1 SD and therefore not wasted. Mild wasting (WHZ score between -2 and -1 SD) was found in 35 (10.6%) children. 12 (3.6%) children had moderate WHZ (-3 to -2 SD). Moreover, 1 (0.3%) child had severe wasting < -3 WHZ scores.

Upon sexes' stratification, 142 (82.6%) boys and 139 (88.5%) girls had WHZ scores ≥ -1 SD, which is indicative of normal weight-for-height among them. 24 (14%) boys and 11 (7%) girls were found to be mildly wasted. Moderate wasting was found in 5 (2.9%) boys and 7 (4.5%) girls, whereas severe wasting in only 1 (0.6%) boy could be detected.

Table 5. Weight-for-Height Z-Score Among Children Aged 1-5 Years.

WHZ		Frequency	Percent
WHZ Score	≥ -1 SD Normal	281	85.4%
	-2 SD < WHZ < -1 SD Mild wasting	35	10.6%
	-3 SD < WHZ < -2 SD Moderate wasting	12	3.6%
	WHZ <-3 SD Severe wasting	1	0.3%
WHZ Score in boys	≥ -1 SD Normal	142	82.6%
	-2 SD < WHZ < -1 SD Mild wasting	24	14%
	-3 SD < WHZ < -2 SD Moderate wasting	5	2.9%
	WHZ <-3 SD Severe wasting	1	0.6%
WHZ Score in girls	≥ -1 SD Normal	139	88.5%
	-2 SD < WHZ < -1 SD Mild wasting	11	7%
	-3 SD < WHZ < -2 SD Moderate wasting	7	4.5%
	WHZ <-3 SD Severe wasting	0	0

The WAZ of the children is shown in Table 6. 241 (73.3%) children had the WAZ between -1 SD and +1 SD (normal weight for age). Forty-five (13.7%) children were overweight (WAZ scores > +1 SD). Mild underweight, with WAZ between -2 SD and -1 SD, was found in 43 (13.1%) children. BOYS-GIRLSWhen analyzed by sex, 128(74.4%) boys and 113 (72%) girls had normal WAZ scores (-1 SD to +1 SD). Overweight ranged from 28 boys (16.3%) to 17 girls (10.8%), whereas mild underweight was observed in 16 boys (9.3%) and 27 girls (17.2%).

Table 6. WAZ Among Children Aged 1-5 Years.

WAZ		Frequency	Percent
WAZ Score	-1 SD < WAZ < +1 SD Normal	241	73.3%
	> +1 SD Overweight	45	13.7%

	-2 SD < WAZ < -1 SD Mild underweight	43	13.1%
WAZ Score in boys	-1 SD < WAZ < +1 SD Normal	128	74.4%
	> +1 SD Overweight	28	16.3%
	-2 SD < WAZ < -1 SD Mild underweight	16	9.3%
WAZ Score in girls	-1 SD < WAZ < +1 SD Normal	113	72%
	> +1 SD Overweight	17	10.8%
	-2 SD < WAZ < -1 SD Mild underweight	27	17.2%

The results of logistic regression analysis and predictors of malnutrition in children are presented in Table 7. Child's Age: A significant relationship was observed between the child's age and malnutrition. As the child's age increased, the risk of malnutrition decreased (OR = 0.978, 95% CI: 0.958–0.999, P ≤ 0.038).

Father's Employment Status: A significant relationship was found between the father's employment status and malnutrition. When the father was employed, the risk of malnutrition in children decreased (OR = 0.167, 95% CI: 0.60–0.463, P ≤ 0.001).

Housing condition: A relationship was noted between housing condition and malnutrition. House ownership was a risk factor for malnutrition (OR = 3.041, CI: 1.198–7.723, P<0.019). Living in a house on rent also significantly increased the risk of malnutrition (OR = 3.008; 95% CI: 1.158–7.813, P ≤ 0.024). The magnitude of the increased risk in both houses, above expectation, may be due to other factors that were not measured (e.g., intra-household food allocation, caregiving practices, or household crowding), indicating 'house-type' as a proxy for malnutrition risk was only partially valid.

Number of meals per day: Eating two meals per day was significantly associated with increased risk of child malnutrition (OR = 2.045,95% CI(1.648–5.632), P ≤ 0.011).

Table 7. Predictor variables: Malnutrition Among Children Aged 1-5 Years.

Variable		OR, CI 95%	P-value
Age		0.978, 0.958 - 0.999	0.038
Sex	Male	0.989, 0.520 – 1.549	0.698
	Female	1	
Place of residence	Urban	0.792, 0.440 – 0.1.423	0.435
	Rural	1	
Father's employment status	Employed	0.167, 0.60 – 0.463	0.001
	Unemployed	1	
Mother's employment status	Employed	2.33, 0.798 – 6.821	0.122
	Unemployed	1	
Housing condition	Owned house	3.041, 1.198 – 7.723	0.019
	Rented house	3.008, 1.158 – 7.813	0.024

	Other house	1	
	1 meal	1.25, 1.10 – 3.11	0.010
How many meals does your child consume daily?	2 meals	2.045, 1.648 – 5.632	0.011
	3 meals	5.150, 0.993 – 26.705	0.051
	More than 3 meals	1	

4. Discussion

The present study determined the prevalence as well as its associated risk factors of malnutrition among hospitalized children aged 1-5 years in the pediatric hospital using anthropometric indices and MUAC at admission. Anthropometric assessment showed that 81.2% of children had normal HAZ, 16.4% mild stunting , and 2.4% moderate stunting. Severe stunting was not evident in any of the cases, which is also worth mentioning. With respect to WHZ, 85.4% of children had normal WHZ; 10.6% mild wasting, 3.6% moderate, and only 0.3% severe wasting. In terms of WAZ, 73.3% of children were normal, 13.1% mild underweight, and, interestingly, 13.7% overweight.

According to the MUAC, 0.9% of children reported had severe wasting (MUAC ≤ 11.5 cm), and 10.9% had moderate wasting (MUAC = 11·6–12·4 cm) , and thus, 88·1% were normally nourished. The stunting rate in our study was 18.8%, which is consistent with the statistics reported for several countries and regions, between 2.88% and 23%(13, 14). Such discrepancies might be explained by differences in population samples included, since hospitalized children are not necessarily representative of the general population, and they may be admitted with more acute complications rather than chronic ones, like stunting.

In the present study, however, while wasting was 14.5%, the proportion differed from those reported globally (15, 16). This finding underscores the high burden of acute malnutrition in hospitalized children. These are commonly admitted with infectious illness and they require immediate treatment, where there is a potential for rapid weight loss and wasting. This highlights the need for early nutritional screening at hospital admission and proper nutritional intervention to intervene with progression and improve patient outcomes. It also highlights that we need to reinforce early intervention and community-based management of malnutrition with the use of solid infrastructure for first referral units to avoid reaching end-stages leading to hospitalization.

The prevalence of underweight (13.1%) in the present study is similar to that reported for the region(17). Moreover, 13.7% overweight, was found with underweight, indicating a high prevalence of double burden of malnutrition, which has been increasingly reported in the literature worldwide and is on the rise mainly in LMICs(18, 19). The complexity of nutrition problems in the region and elsewhere emphasizes the need for comprehensive, multisectoral nutritional programs that tackle deficiencies together with excesses, rather than addressing a single facet of undernutrition.

When the results of that investigation are juxtaposed with this study, similarities and differences can be observed between those in Iraq and its surrounding countries as well. For instance, Ghazi et al. described a prevalence of underweight of 18.2% in Baghdad children aged 3–5 years, which is not much higher than that found (13.1% mild underweight) in the present study(20). In another study in Babylon, Iraq, severe wasting and underweight were 1.3% in both; stunting was 6.5%, severe stunting was also 5.2%, not differing by sex. Malnutrition rates were as high as 14.3 % for children under five years old

(21). These differences could be due to local factors such as the availability of food, income, and healthcare facilities as well

Zhang et al. in China had much lower incidence of stunted growth (3.9%), underweight (0.5%), and wasting (1.5%) due to differences in public health efforts and economic development(22).

Age of the child was significantly ($p < 0.05$) correlated with the risk of malnutrition, but raises in age reduced the odds ratio. This correlation reveals that younger children, particularly those in the early years of childhood, bear a higher risk of being malnourished (3). The frequency of meals was also important, and one or two meals per day were associated with high malnutrition risk; three meals had a marginally significant (OR = 5.15, $p = 0.051$). This suggests that frequency may not guarantee the adequacy of dietary intake, portion size, and nutrient quality, as well as feeding practices, also have a role in nutritional status.

Father's occupation was also found significantly associated with malnutrition, and children of fathers employed were at less risk than those whose fathers did not work. This association demonstrates well the importance of a stable income for household food security and the availability of healthy food (23). Surprisingly, a qualitative association was found for housing status, where both owned and rented house occupied to higher odds of being malnourished. This finding is not in line with the common belief that stable housing should favor better economic status and reduce the risk of malnutrition (24, 25). One explanation might be that the out-group category, father-in-law house in our sample is comprises 11.2% the population and is typically a component of an extended family system. In many cases, it provides more resources to share, social support, and a shared responsibility for the care and feeding of children. These support systems may act as a buffer to the impact of financial stress and reduce child wariness.

The STRONGkids (screening tool for risk on nutritional status and growth) screening method was also applied in their study, which showed that 51.1% of subjects were at low-risk, while 16.4%, 31.3%, and 1.2% were moderate-, high-, or very high-risk, respectively [21]. STRONGkids scores were significantly associated with the various MUAC classification groups. This is consistent with the results obtained in previous studies (26, 27). Hence, our findings indicate that the STRONGkids screening tool is indeed a valid instrument for malnutrition risk screening in hospital populations. Standardized admission screening with instruments, such as STRONGkids and MUAC, seems necessary

5. Conclusions

This study showed a high burden of acute malnutrition (wasting) and significant co-presence of underweight with obesity among children aged 1 to <5 years admitted to Sulaimani pediatric hospital, evidencing the double burden of malnutrition. Important risk factors were young age, paternal unemployment, having low meals per day, and poor housing conditions, demonstrating the complexity of nutritional deprivation. The study underscores the critical importance of nutrition screening at admission and comprehensive health and nutrition programs.

We propose the application of hospital-wide nutritional screening routines such as STRONGkids and MUAC for early detection and adequate management of malnourished children.

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