ORIGINAL ARTICLE

Frequency of Underweight and its Risk Factors in Children Aged 6 to 59 Months

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Abstract

Background: Globally, approximately 104 million children suffer from underweight conditions, with a significant majority residing in regions such as sub-Saharan Africa and South Asia. In Pakistan, the issue of underweight prevalence among children under the age of 5 is alarming across all provinces, ranging from 19.2% in Islamabad Capital Territory to 41.3% in Sindh.

Objective: To assess the frequency of underweight and identify its associated factors among children aged 6 to 59 months in Nawabshah City, Sindh.

Methods: A cross-sectional study was conducted at Baqai Institute of Health Sciences, Karachi from February 2023 to March 2024. The study included a total of 371 children aged 6 to 59 months. Data collection was performed using interviews and weight measurement. Being underweight was defined as children with a weight-for-age z-score of <-2SD, determined by using WHO child growth standards. Statistical analysis was performed using SPSS version 20.

Results: The mean age of the children was 24.21±13.14 months, 198 (53.4%) were female whereas only 44 (11.9%) were completely immunized. Moreover, 111 (29.9%) study children were found to be underweight. Multivariable analysis further revealed that female gender, not exclusively breastfeeding a child for six months, weaning at 6 months of age or above, bottle feeding, and not providing meat to a child in any form were significantly associated with the child being underweight.

Conclusion: Around thirty percent of the study children were identified as underweight. Moreover, many participant characteristics and practices studied were significantly associated with children being underweight.

Keywords: *Frequency, underweight, demographics, risk factors, children.*

INTRODUCTION

Underweight, as per the World Health Organization's definition, is characterized by a low weight for a particular age, falling below -2 standard deviations for that age and gender [1]. Worldwide, an estimated 104 million children are grappling with underweight conditions, with a significant concentration of these cases found in regions like sub-Saharan Africa and South Asia [2]. According to the statistics of the National Nutritional Survey of Pakistan, the prevalence of underweight among children under 5 years of age is high in all provinces from 19.2% in Islamabad capital territory to 41.3% in Sindh. The burden of malnutrition is becoming increasingly apparent, with 28.9% of children being underweight. The prevalence of underweight is below 20% only in Islamabad [3]. The reported high prevalence of underweight children in Pakistan remains a big concern for policymakers and thus requires urgent attention from all stakeholders.

Addressing underweight children is a complex issue that cannot be remedied through a single solution. It stems from a multitude of factors, with the most immediate determinants being inadequate dietary intake and disease. These factors, in turn, are influenced by a myriad of underlying causes such as household dynamics, maternal and childcare practices, access to safe water, frequency of meals, bottle feeding habits, maternal feeding practices, weaning patterns, vaccination status, and recent illness history. Moreover, these underlying causes are further shaped by broader economic, political, and sociocultural contexts at both national and global levels. At the community level, socioeconomic factors play a pivotal role in determining the prevalence and incidence of underweight children [4].

Underweight persists as a prevalent cause of morbidity and mortality among children in low-income nations. A significant majority of these fatalities are linked to improper feeding practices occurring within the first five years of life [5]. Undernutrition not only contributes to children being underweight but also elevates the risk of infections, morbidity, and mortality while hindering mental and cognitive development.

Sufficient nutrition is crucial for fostering a robust immune system and supporting optimal physical and cognitive development during early childhood [6]. While the National Nutrition Survey of 2018 indicated a prevalence of underweight to be 28.9% [3], to the best of the authors' knowledge, the recent local literature on this topic is limited at best. Moreover, over the past five years, several factors such as population growth and urbanization have significantly influenced people's livelihoods and health practices. In the given context,

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this study was conducted to assess the prevalence of underweight and its associated factors among children aged 6 to 59 months in Nawabshah City, Sindh. The results of this study will help in broadening the local evidence base and will aid in devising suitable strategies for future targeted interventions in our local settings.

METHODS

A cross-sectional study was conducted at Baqai Institute of Health Sciences with data collection performed at a private medical center and maternity home in Union Council Number 9, Nawabshah City, Sindh, Pakistan from February 2023 to March 2024. The study population consisted of children aged 6 months to 59 months coming to a private medical center in Union Council Number 9, Nawabshah City, Sindh, Pakistan. Children aged from 6 months to 59 months were included in the study whereas those with any chronic illness, history of recent illness in the last 2 weeks, congenital anomalies, and history of congenital metabolic disorders were excluded from the study.

Based on the percentage frequency of the study outcome of 41.0% [6], with a 95% confidence level and 5.5% precision, the required sample size was calculated to be 308 children by using the openepi online calculator [7]. Children were included in the study by using a non-probability consecutive sampling technique.

The data were collected through a predesigned questionnaire. There were two sections of the questionnaire, section A and section B. Section A contained demographic information, such as gender, age, weight, parent's education, parent's employment status, monthly household income, and type of family. Section B consisted of feeding and health information such as exclusive breastfeeding in the first six months, age of weaning, bottle feeding, source of drinking, history of diarrhea, measles, or any other illness in the last two weeks. Being underweight was defined as children with a weight-for-age z-score of <-2SD [1], determined by using WHO child growth standards [8]. The parents of the children were briefed on the nature of the study, and the principal investigator personally filled out the questionnaires.

The data were entered into and analyzed using the Statistical Package for the Social Sciences version 20 while Microsoft Excel was utilized for creating graphs and tables. Descriptive analysis was performed by calculating frequencies and percentages for categorical variables such as gender, type of family, parent's educational level, and age of weaning and mean and standard deviation for continuous variables such as household family size, number of siblings, household family income, and history of recent illness. For inferential analysis, binary logistic regression was applied to compute univariate odds ratios with a 95% confidence interval for determining the association of participant characteristics and practices with children being underweight. Variables with $p<0.25$ and other important variables irrespective of $p<0.25$ in univariate analysis were used to build a multivariable regression model to compute adjusted odds ratios with a 95% confidence interval. A two-tailed p-value of ≤0.05 was considered statistically significant.

RESULTS

Against the calculated sample size of 308, a total of 371 children were included in the study with a response rate of 100%. The mean age of the children was 24.21±13.14 months, their mean weight was 11.48±2.97 kg, 172 (46.4%) of them were aged between 12 to 23 months, 198 (53.4%) were female, 349 (94.1%) mothers accompanied their children, 190 (51.2%) households had 5 or more members, the mean sibling count was 1.75±1.24 whereas 190 (51.2%) had 2 or more siblings. Furthermore, 44 (11.9%) of them were completely immunized, 181 (48.8%) mothers had primary education or less, 151 (40.7%) fathers had only religious education, 353 (95.1%) mothers were housewives, 333 (89.8%) fathers were employed, 365 (98.4%) respondents were married, 331 (89.2%) reported a monthly household income of less than 30,000 rupees whereas 288 (77.6%) children belonged to joint family system (**Table 1**).

Table 1: Demographic characteristics.

Demographic Characteristics	Count (%)/Mean ± S.D
Age (Months)	24.21 ± 13.14
Age Group (Months)	
Up to 11 months	41 (11.1)
12 to 23 months	172 (46.4)
24 to 35 months	93 (25.1)
36 to 47 months	23 (6.2)
48 to 59 months	42 (11.3)
Gender	
Male	173 (46.6)
Female	198 (53.4)
Weight in Kg	11.48 ± 2.97
Who is Accompanying the Child?	
Mother	349 (94.1)
Father	22 (5.9)
Sibling Count	1.75 ± 1.24
Less than 2	181 (48.8)
2 or more	190 (51.2)
Immunization Status for Age	
Completely Immunized	44 (11.9)
Partially Immunized	259 (69.8)
Not Immunized	68 (18.3)
Mothers Education	
Primary or less	181 (48.8)
Secondary	111 (29.9)
Intermediate and above	5 (1.3)
Only religious education	74 (19.9)
Father Education	
Primary or less	12 (3.2)
Secondary	90 (24.3)
Intermediate and above	118 (31.8)
Only religious education	151 (40.7)

Demographic Characteristics	Count (%)/Mean ± S.D
Mother's Employment Status	
Employed/ self-employed	10 (2.7)
Student	8 (2.2)
House Wife	353 (95.1)
Father's Employment Status	
Unemployment	30 (8.1)
Employed/ self-employed	333 (89.8)
Student	8 (2.2)
Marital Status	
Married	365 (98.4)
Divorced	2 (0.5)
Separated	3 (0.8)
Widowed	1 (0.3)
Monthly Household Income (Rupees)	
Less than 30 thousand	331 (89.2)
30-60 thousand	36 (9.7)
More than 60 thousand	4 (1.1)
Family Type	4.75 ± 1.21
Single	83 (22.4)
Joint	288 (77.6)

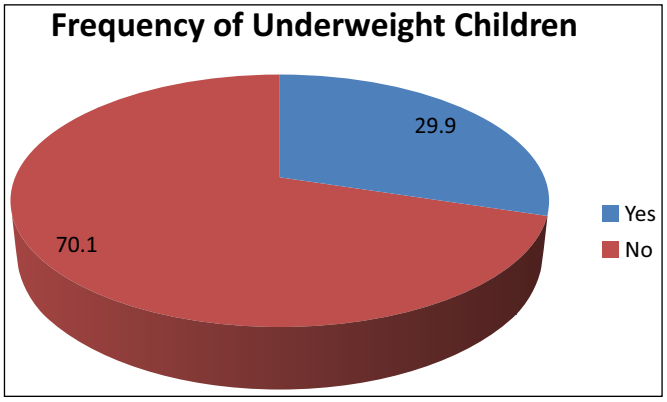

Fig. (1): Frequency of underweight children.

The feeding and health profile of the children showed that their mean age of weaning was 6.60±2.70 months, 276 (74.4%) children were exclusively breastfed for six months, 122 (30.2%) mothers breastfed their children for 2 years, 236 (63.6%) children were bottle-fed, 102 (27.5%) mothers provided meat in any form to their children whereas 150 (40.4%) used non-boiled tap water as a water source (**Table 2**). Moreover, it was seen that out of the total 371 children surveyed, 111 (29.9%) were underweight (**Fig. 1**).

Multivariable analysis further revealed that female gender (aOR=3.08, 95% CI: 1.26-7.54, p=0.014), not exclusively breastfeeding child for six months (aOR=269.95, 95% CI: 35.42-2056.86, p<0.001), weaning at 6 months of age (aOR=48.47, 95% CI: 6.39-367.42, p<0.001) or above (aOR=36.11, 95% CI: 5.62-232.04, p<0.001), bottle feeding (aOR=4.09, 95% CI: 1.94-8.64, p<0.001) and not providing meat to child in any form (aOR=3.67, 95% CI: 1.56-8.65, p=0.003) were significantly associated with the child being underweight (**Table 3**).

Table 2: Feeding and health parameters.

Feeding and Health Parameters	Count (%)/Mean±S.D.
Age of weaning (Months)	6.6 ± 2.70
Exclusively breastfed for six months	
Yes	276 (74.4)
No	95 (25.6)
Did child take mother feed for 2 years?	
Yes	112 (30.2)
No	259 (69.8)
Was the child Bottle Fed?	
Yes	236 (63.6)
No	135 (36.4)
Do you provide meat in any form to the child?	
Yes	102 (27.5)
No	269 (72.5)
Source of drinking water at home	
Boiled tap water	149 (40.2)
Non-boiled tap water	150 (40.4)
Borehole	6 (1.6)
Mineral/Bottled water	4 (1.1)
Filtered water	62 (16.7)

Table 3: Multivariable analysis of association between participant characteristics and children being underweight.

Participant Characteristics	aOR	95% CI		p-value
		Lower	Upper	
Child Age (Months)				
6 to 23 months	1.07	0.53	2.17	0.841
24 to 59 months	Ref			
Child Gender				
Male	Ref			
Female	3.08	1.26	7.54	0.014
Household Size				
Less than 5	1.07	0.65	1.77	0.774
5 or more	Ref			
Sibling Count				
Less than 2	2.47	0.53	11.56	0.249
2 or more	Ref			
Immunization Status for Age				
Completely Immunized	Ref			
Partially Immunized	2.38	0.27	20.92	0.432
Not Immunized	0.46	0.04	5.05	0.533
Mother's Education				
Primary or less	0.22	0.01	3.50	0.284
Secondary	1.32	0.16	10.79	0.793
Intermediate and above	7.32	0.58	92.19	0.123
Only religious education	Ref			
Father's Education				
Primary or less	2.73	0.39	18.84	0.308
Secondary	0.43	0.07	2.56	0.357
Intermediate and above	0.08	0.01	1.17	0.066
Only religious education	Ref			
Mother's Employment Status				
Employed/ self-employed	1.55	0.31	7.79	0.591
Student	0.21	0.01	2.62	0.226
House Wife	Ref			
Father's Employment Status				
Unemployment	0.39	0.03	4.29	0.446

Participant Characteristics	aOR	95% CI		p-value
		Lower	Upper	
Employed/ self-employed	0.84	0.10	6.82	0.873
Student	Ref			
Marital Status				
Married	0.14	0.01	1.85	0.138
Divorced/Widowed/Separated	Ref			
Monthly Household Income (Rupees)				
Less than 30 thousand	0.94	0.11	8.01	0.956
30 to 60 thousand	Ref			
Type of Family				
Nuclear	0.26	0.01	5.08	0.381
Joint	Ref			
Exclusively Breastfed for Six Months				
Yes	Ref			
No	269.95	35.42	2056.86	*<0.001
Age at Weaning				
Less than 6 months	Ref			
6 months	48.47	6.39	367.42	*<0.001
More than 6 months	36.11	5.62	232.04	*<0.001
Did child take mother feed for 2 years?				
Yes	1.70	0.70	4.16	0.239
No	Ref			
Was the child bottle fed?				
Yes	4.09	1.94	8.64	*<0.001
No	Ref			
Do you provide meat in any form to the child?				
Yes	Ref			
No	3.67	1.56	8.65	*0.003

aOR: Adjusted odds ratio, CI: Confidence interval, Ref: Reference category, *Significant at p<0.05

DISCUSSION

The study results showed that 29.9% of children were underweight. Similarly, the National Nutritional Survey of Pakistan, 2018 reported that 28.9% of children are underweight [9]. Likewise, Ahmad *et al.* in 2022 from Batgaram KPK, Pakistan reported 33.3% of children to be underweight [10]. Menghwar *et al.* 2021 from District Tharparkar Sindh though reported that 57.3% of children aged less than 5 years are underweight [11]. Another study by Ahmad *et al.* in 2020 reported that 19.5% of children are underweight in rural areas of the District Multan [12]. This shows that a considerable percentage of children in our country are underweight, highlighting the need for urgent targeted interventions for children to improve their nutritional status.

Moreover, it was found that the mean age of weaning was 6.6±2.70 months among the studied children. Breast milk is the best food for all babies [13]. Infants should be introduced to complementary foods at 6 months while continuing to breastfeed. The American Academy of Pediatrics and the World Health Organization also recommend exclusive breastfeeding for about the first 6 months, with continued breastfeeding along with introducing appropriate complementary foods for up to 2 years of age or longer [14].

The study results further showed that 74.4% of children were exclusively breastfed for 6 months. Similarly, Ahmad *et al.* 2022 reported that 60.5% of children were exclusively breastfed for 6 months [15]. Moreover, the National Nutritional Survey of Pakistan, 2018 reported that 63.0% of children have been exclusively breastfed [9]. Unlike these results, Penugonda *et al.* in 2022 reported that 47% of their study participants breastfed their children for 6 months [16]. These findings show that the majority of Pakistani children are exclusively breastfed for six months, in line with the established guidelines [14]. Cultural practices, socio-economic status, and maternal education levels influence breastfeeding practices in different regions of the world.

The present study results showed that only 30.2% of mothers breastfed their children for 2 years. Similarly, Jama *et al.* reported that 20.4% of mothers breastfed their children for 2 years [17]. Breast milk is extremely important for children, so there should be an immediate awareness program to inform mothers about the importance of breastfeeding for their children. Prolonged breastfeeding, in particular, has been associated with better cognitive development and long-term health outcomes for children.

The results further revealed that 63.6% of children in our study were bottle-fed. Similarly, Duraisamy *et al.* in 2020 reported that 78.6% of participants bottle-fed their children [18]. Unlike these results, Ahmad *et al.* reported that 28.3% of participants bottle-fed their children [15]. Breastfeeding is extremely important for children, and while bottle feeding may be permitted under medical necessity with a practitioner's approval, providing bottle feeding to children on such a large scale is an alarming situation that requires unanimous practical measures to prevent it. Societal attitudes towards breastfeeding, as well as the availability and promotion of formula-feeding products, may contribute to higher rates of bottle-feeding in certain populations.

The study results showed that 27.5% of mothers provided meat in any form to their children. Children should be given minced meat, which contains protein and helps with muscle building. Introducing weaning alongside breastfeeding on time is very beneficial for the child, especially with soft foods such as rice, and porridge, including minced meat, proves to be beneficial.

The study results showed that 40.4% of participants were using non-boiled tap water as a water source. In countries like Pakistan, diarrhea and pneumonia are common illnesses. Non-boiled water contributes to many diseases, including diarrhea, which is a major cause of weight loss. It is of the utmost importance to boil water. There is a critical need to raise awareness about using boiled water at every level and to continue this practice.

Moreover, female gender was found to be significantly associated with child being underweight. Likewise, Kumar *et al.* in 2019 reported a higher likelihood of a girl child being underweight than a boy child [19]. Female child, especially in our society faces a lot of discrimination since their birth, which includes the nutritional choices made for them during their childhood.

The study results did not show parental education level to be significantly associated with the child being underweight, though dissimilar findings have been reported previously [20-23]. A parent who is well-educated can be reasonably expected to know about better nutritional choices for his/her child and is also more likely to be aware of the side effects of bad nutritional practices.

Expectedly, the study results showed that the frequency of underweight was significantly associated with the age at weaning. Delaying weaning or initiation of supplementary foods can lead to insufficient intake of energy, proteins, and micronutrients, resulting in underweight and compromised micronutrient levels. Late weaning can also cause difficulties in eating behaviors, such as chewing food properly and refusing to eat, which further affects nutritional status.

Interestingly, the study results showed that the odds of being underweight were significantly higher if the child was not exclusively breastfed for six months. In a recent study by Yakubu *et al.,* it was noted that many mothers did not breastfeed their children for up to 6 months, and as a result, the children were underweight [24]. Breastfeeding is widely recognized as a crucial factor in promoting optimal growth and development in infants. The nutrients present in breast milk are tailored to meet the specific needs of the growing child, providing essential vitamins, minerals, and antibodies that contribute to healthy weight gain and immune function. Furthermore, the benefits of breastfeeding extend beyond mere nutrition, encompassing factors such as bonding between mother and child and protection against infections and chronic diseases.

The study results also showed that the odds of being underweight were significantly higher in children who were bottle-fed. This association underscores the potential consequences of bottle-feeding practices on child health outcomes as bottle feeding may lead to inadequate nutrient intake and compromised growth. These findings emphasize the importance of promoting breastfeeding initiatives and discouraging reliance on bottle feeding to ensure optimal child health outcomes. Recognizing and addressing factors influencing bottle feeding is crucial to improving infant feeding practices and mitigating the risk of being underweight among children.

It is acknowledged that being a single-center study with a moderate sample size, the generalizability of study findings is limited.

CONCLUSION

It was found that only thirty percent of mothers continued breastfeeding their children for up to two years. Moreover, non-boiled tap water was used for drinking purposes by forty percent of the respondents, posing potential health risks. Notably, around thirty percent of the study children were identified as underweight. Furthermore, multivariable analysis revealed that female gender, not exclusively breastfeeding a child for six months, weaning at 6 months of age or above, bottle feeding, and not providing meat to a child in any form were significantly associated with the child being underweight.

Implementation of targeted interventions to promote exclusive breastfeeding for the recommended duration and improving breastfeeding continuation rates are vital. Public health campaigns should raise awareness about the risks associated with bottle-feeding while efforts should also be made to ensure access to safe drinking water sources. High underweight prevalence in our local setting requires tailored interventions to improve child nutrition outcomes within the community.

ETHICS APPROVAL

The ethical approval of the study was taken from the Baqai Institute of Health Sciences (Ref. No. FHM 29-2023). The study procedures were in line with the institutional ethical standards for human experiments and the Helsinki Declaration.

CONSENT FOR PUBLICATION

Before data collection, verbal informed consent was taken from each participant in the study.

AVAILABILITY OF DATA

Data cannot be shared publicly because it is the intellectual property of the Baqai Institute of Health Sciences. Data are available from the Baqai Institute of Health Sciences (contact *via* manager.mph@baqai.edu.pk).

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Declared none.

AUTHORS' CONTRIBUTION

MAM: Study concept, designing, and manuscript drafting.
SNR: Study design, critical review, and revision of the initial draft.
SMZHN: Result in analysis and interpretation, critical review, and revision of the initial draft.
SIAJ: Critical review and revision of the initial draft.

All authors have read and approved the manuscript.

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