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Original Research Article

Prevalence and determinants of malnutrition among children aged 1-6 years registered in Anganwadis of urban health training centre of a medical college of North-West zone of Ahmedabad city

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ABSTRACT

Background: Child Malnutrition encompasses a wide spectrum of undernutrition, and among them, stunting is a global health issue presently. Higher levels of stunting among under-five children are still a major problem in Gujarat where rates have either stagnated or worsened. So, the study aims to investigate its burden and associated risk factors.
Methods: The cross-sectional study involved 101 registered children aged 13-71 months across 28 Anganwadi centres of UHTC, Ognaj, Ahmedabad. The sample size was 100, based on 39% prevalence of stunting in Gujarat (@ 3-4 children per Anganwadi). Mothers of children were interviewed physically using a pre-validated questionnaire and their anthropometric measurements were recorded. Results were analysed in MS Excel using descriptive statistics and chi-square test to draw inferences.
Results: Stunting, wasting, and underweight were present in 34 (33.7%), 32 (31.7%), and 41 (40.6%) children, respectively. Stunting alone was present in 54.8% of undernourished children. Undernutrition was at the base of the pyramid of malnutrition with 62 (61.4%) children, while at the tip were 10 (9.9%), with all three types of malnutrition. Key determinants of stunting included mother's height, father's education, caste, age, birth order, weight, and the timing of complementary feeding.
Conclusions: While one in two children faced undernutrition, one in three had stunting, accounting for over half of undernourished children. Timely interventions of modifiable factors, comprehensive management, amendment of current programs focusing more on severely stunted children, long-term follow-up, and integration with the RBSK program can help reduce stunting.

Keywords: Undernutrition, Stunting, Risk factors, Under-five children, Anganwadi centres, Urban area

INTRODUCTION

Malnutrition, also called undernutrition in children, includes stunting (chronic malnutrition), wasting (acute malnutrition), and deficiencies of essential vitamins and minerals (micronutrients), commonly measured by anthropometric indices like Low birth weight (LBW), wasting, underweight (UW), stunting, and low upper arm circumference.[1] Where stunting reflects chronic/ linear growth failure, wasting is due to acute growth failure, and underweight combines both stunting and wasting, resulting from either or both types of malnutrition.[2]

As per the UNICEF 2006 report, the causes of childhood malnutrition primarily include nutritional deficiencies, frequent infections, suboptimal practices related to breastfeeding and food intake, and the level of parental education.[3] Also, the mother's height and certain socioeconomic and environmental characteristics are some of the risk factors leading to malnutrition.[4]

Stunting, specifically, is a result of chronic depletion of nutrition that is sometimes linked with undetected hormonal disorders in children. It profoundly contributes to illness and death, and negatively impairs a child's physical and cognitive development.[5] Additionally, delayed mental growth, poor academic outcomes, and abridged intellectual capacity adversely impact national economic productivity. The fact has already been reflected in a global review, which states that each 1 cm increase in height corresponds to a 4% wage increase for men and a 6% increase for women.[6] And since it is an irreversible pathology, psychological and physical damage only propagate with no relief later in life.[2]

Globally over 144 million children suffer from stunting, with India contributing to around 48% for varying degrees of undernutrition in under-five children.[7,8] As per WHO estimates, Asia by 2022.[9] In the Global Hunger Index 2022, India ranked 107 out of 121 countries, with the highest child stunting rate of 35.5%, and state-wise it ranked from Telangana, Gujarat, Kerala, Maharashtra, and West Bengal, with Gujarat in second place overall.[7] As per NHFS-5 (Gujarat), 39% of under-five children are stunted, and despite all measures, it is shockingly unchanged since NHFS-4 (38.5%).[10] Furthermore, stunting in Ahmedabad has still increased by 6.1% from NFHS-4 to NFHS-5, which is quite worrisome.[11]

Since persistently higher levels of stunting are still a major problem in Gujarat, reducing it is vital for human and economic development.[10] Henceforth, it was planned to assess the validity of current statements on malnutrition by estimating its prevalence and exploring its determinants at Anganwadi Center, a proxy indicator of urban slums.

Objectives

To document the Prevalence and determinants of malnutrition among children aged 1-6 years registered in Anganwadi(s) of UHTC (Urban Health Training Centre) of a medical college of the North-West zone of Ahmedabad City.

METHODS

Study type

This was a cross-sectional study involving 101 children aged 1-6 years.

Study place

Study was conducted across all 28 Anganwadi centers of Ognaj Urban Health Training Center (UHTC), Ognaj of GMERS Medical College & Hospital, Sola, Ahmedabad.

Study period

The Study was conducted between June 2024 and July 2024.

Selection of participants

The reference population for the study consisted of 2,265 children registered across all 28 Anganwadi centers of UHTC-Ognaj, affiliated with GMERS Medical College and Hospital, Sola, Ahmedabad. Considering the 39% (p=0.39) prevalence of stunting in Gujarat, at a 95% confidence interval (Z=1.96) and a 10% allowable error (d = 10), using the formula: $(Z\alpha)^2 p(1-p)/d^2$, the calculated sample size was 91.[10,12] After including a 10% non-response rate, we aimed for 100 participants. However, the final sample size turned out to be 101 children, who were selected from all 28 Anganwadi centers using a consecutive sampling technique. After randomly selecting the first Anganwadi center, the remaining 27 were covered consecutively, and from each Anganwadi center, 3 to 4 children aged 1-6 years (101/28=3.6 ~3 to 4) were selected for data collection. Only those children who were registered and available in the Anganwadi center during the interview were included in the study.

Study procedure

After obtaining informed consent, the data were collected by interviewing mothers of eligible children using pre-tested, pre-designed, semi-structured questionnaires (s). The child's anthropometrical measurements, like height and weight, were recorded using a Stadiometer and a digital weight scale, respectively following all the standard procedures.[13] The height of mothers was also recorded using the same instruments. The weight was measured with a digital weight scale (set to the nearest 0.0 kilograms), and the height was taken with a Stadiometer (set to the nearest 0.5cm). The children's and their mothers' footwear were removed, and their heads were upright before recording their body weight and height. In each visit same instruments were used and were calibrated before measurement every time to ensure the quality of the measurement.

Ethical approval

The study was approved by the institutional ethics committee, wide reference no: GMERSMCS/IEC/95/2024.

Statistical analysis

Data collected was entered in MS Excel version 2021 and Epi-Info 7.2.7, and was used for analysis, keeping in mind the objectives of the study. WHO simplified Z-score field tables were also utilized to assign HFA (Height for Age), WFH (Weight for Height), and WFA (Weight for Age) Z-scores to each child, and accordingly, they were further categorized into Stunted, Wasted, and Underweight.[14] This data set was then subjected to descriptive statistics to project the distribution of children, and the Chi-square test was applied accordingly to assess the statistical significance.

Operational definitions

Stunting, Wasting, and Underweight are defined as children with Z-score < −2SD for HFA, WFH, and WFA from the median of a reference population, respectively. Children with Z scores between – 2SD and – 3 SD fall in the moderate category, while < −3 SD fall in the severe category for all three mentioned indices.[4]

RESULTS

Profile and characteristics of the participants

In the present study comprising 101 children aged 13-71 months, there were relatively more (53.5%) boys than (46.5%) girls. Age-wise, a majority (79.1%) of the children were in the age group of 37-60 months, followed by 13-24 months (13.9%) and above 5 years (6.9%). The mean age of the studied children and mothers was 41.9 (+14.4) months and 27.5 (+3.4) years, respectively. Almost half (52.5%) of the children belonged to joint families. While more than half (60.4%) were from APL families, one-fourth (25) were from BPL families, and fifteen children were unsure about their poverty status. Caste-wise, most (45.5%) children were from the OBC, followed by SC and ST categories. Nearly 80% of children had families with ≤6 members in it, and the same number of children had 2 or less siblings in their families. Both fathers (99%) and mothers (90%) had a higher literacy rate, and 14.9% of mothers were employed.

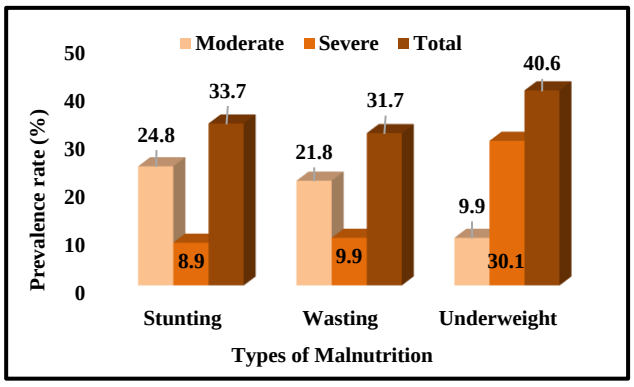

Figure 1: Prevalence of types of malnutrition among children (n=101).

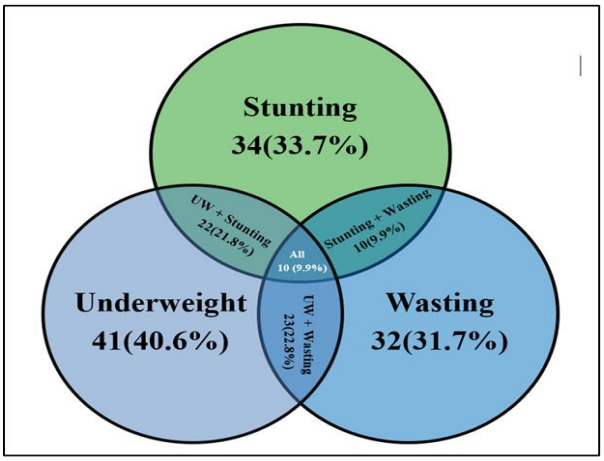

Figure 2: Relationship between types of malnutrition among children (n=101).

Nutritional status

The study revealed that more than half- 62 (61.4%) of children were undernourished (suffering from one or more forms of malnutrition), and among them, more than half- 34 (54.8%) had stunting exclusively. Overall, underweight was prevalent in 41 (40.6%), while wasting was seen in 32 (31.7%) children. Stunting, however, was present in 34 (33.7%) children; among these, 9 (8.9%) were severely stunted, and 25 (24.8%) were moderately stunted. In terms of wasting, severe and moderate status were prevalent in 10 (9.9%) and 22 (21.8%) children. In underweight children, severe and moderate categories were seen in 31 (30.1%) and 10 (9.9%) children, respectively (Figure 1).

Since malnutrition in children frequently overlaps, all three types were found to coexist in ten children (9.9%). Stunting and being underweight were prevalent in 22 (21.8%) children, while wasting and being underweight were found in 23 (22.8%) children (Figure 2).

Gender-wise, stunting was more common in girls- 19 (40.4%) than in boys- 15 (27.8%), but this difference was statistically not significant (p value= 0.180). Age-specific rate of stunting was lowest (7.7%) in the age group of 25-36 months and highest (53.8%) in 37-48 months, which was statistically significant (p value =0.002) (Table 1).

Determinants and their association with stunting

Out of a total of 7 sociodemographic determinants of stunting, it was observed that family composition, poverty, the number of siblings, and the mother's employment status had no impact on stunting. However, a significant association was found between the child's caste, especially the ST (scheduled tribe) category [p value =0.045] and stunted children. While Mother's education showed no correlation, the father's education revealed a much stronger, highly significant association [p value =0.0052] (Table 2).

Table 1: Age and gender-specific prevalence and their strength of association with stunting among children (n=101).

Variable(s)	No. of children with stunting	Prevalence rate (%)	CI at 95%	X^2 test	P value CI (95%)
Gender					
Boy (n=54)	15	27.8	16.5-41.6	1.80	0.180
Girl (n=47)	19	40.4	26.8-55.7		
Age Groups (In months)					
13- 24 M (n=14)	6	42.9	17.7-71.1	13.42	0.002*
25- 36 M (n=26)	2	7.7	0.9-25.1		
37- 48 M (n=26)	14	53.8	33.8-73.4		
49- 60 M (n=28)	9	32.1	15.9-52.3		
61- 71 M (n=7)	3	42.9	9.9-81.6		
Total (n=101)	34	33.7	24.6-43.8		

*Significant p value.

Table 2: Sociodemographic risk factors and their strength of association with stunting among children (n=101).

Variable(s)		Stunting		X2 test	P value CI (95%)
		Yes	No		
Family composition	Joint	18	35	0.00	0.971
	Nuclear	16	32		
Family poverty n=86**	APL	17	44	1.21	0.271
	BPL	10	15		
No. of sibling	≤2	25	56	1.44	0.231
	>2	9	11		
Mother's employment	Employed	4	11	0.39	0.534
	Unemployed	30	56		
Caste of child	Open	6	9	4.011	0.045*
	OBC	11	35		
	SC	8	13		
	ST	9	10		
Mother's education (Years of schooling)	≤8	19	43	1.667	0.1967
	9-10	8	9		
	11-12	3	6		
	>12	4	9		
Father's education (Years of schooling)	≤8	15	13	7.822	0.0052*
	9-10	10	21		
	11-12	5	19		
	>12	4	14		

*Significant p value, **15 participants didn't know about their poverty status.

Table 3: Maternal and child risk factors and their strength of association with stunting among children (n=101).

Variable(s)		Yes	No	X2 test	P value CI (95%)
Maternal risk factor					
Type of diet	Vegetarian	29	60	0.391	0.5318
	Mixed	5	7		
Height category	Normal	17	49	5.368	0.0208*
	Short stature	11	12		
	Stunted	6	6		
****Child spacing (>3 yrs) (n=63)**	Adopted	11	23	1.658	0.1979
	Not adopted	14	15		
Child risk factors					
Weight of the child	Normal weight	12	48	12.36	0.0004*
	Underweight	22	19		

Continued.

Variable(s)		Yes	No	X2 test	P value CI (95%)
Birth order	1st	10	32	3.881	0.0488*
	2nd	19	27		
	3rd	5	7		
	4th	1	0		
Birth weight (kg)	<2.5	9	12	1.003	0.3166
	2.5 or more	25	55		
Maturity at the time of delivery	Term	28	54	0.046	0.8302
	Preterm	6	13		
Time of initiation of complementary feeding (months)	≤6	10	12	9.816	0.0017*
	7-9	19	42		
	10-12	2	8		
	>12	3	5		
Status of vaccination	Fully immunized	27	51	0.139	0.7093
	Partially immunized	7	16		
	Unimmunized	0	0		
Vitamin A supplementation	Given as per age	22	29	4.141	0.0419*
	Not given as per age	12	38		
H/O Chronic Illness (present or past)	Yes	5	3	2.12	0.1453
	No	29	63		
H/O congenital malformation	Yes	3	1	3.186	0.0743
	No	31	66		
H/O no. of admissions	Never	23	46	0.818	0.3658
	1 time	8	18		
	>1 time	3	3		

*Significant p value, **38 mothers with fist child were not applicable to variable.

Moreover, out of a total of 13 Maternal and child biological determinants (3 maternal and 10 child) for stunting, maternal height among all was statistically significant (p value 0.0208). Among the child biological determinants, a highly significant association was noted between the weight of the child and stunting (p value =0.0004). Additionally, birth order (p value =0.0488), time of initiation of complementary feeding (p value =0.0017), and age-wise administration of Vitamin A supplementation (VAS) (p value =0.0419) were found to carry a statistically significant relationship with stunting in children. Other factors such as Birth weight, maturity at the time of delivery, current vaccination status, History of chronic illness, congenital malformations, and number of admissions, too, were tested as determinants, but they failed to show any statistical significance with stunting (Table 3).

DISCUSSION

The prevalence rate of stunting in this study was on the lower (33.7%) side than observed in NFHS-5, which was 35.5% for India and 39% for Gujarat.[10] Such a lower rate could be due to the study was done in the urban population. Nearly identical stunting rates were observed in the studies of Dhok RS et al, Patra M et al, Peter R et al, and Chowdhury A et al at 34.8%, 34.8%, 39.8%, and 39.7%, respectively.[5,15-17] However, most studies showed stunting to be prevalent beyond 40% in India.18-22 But two studies showed lower rates of 28.6% and 19.5%.[23,24] In the case of wasting, prevalence rates as per NFHS-5 Gujarat were 19.3% among under-five children (lower than our study, 31.7%), and for underweight, it was 39.7% (consistent with our study, 40.6%).[10] In the various studies conducted in India, the rate of wasting ranged from as low as 8.9% to as high as 48.1%.[15,17-19,21-24] Whereas underweight ranged from 9.2% (lowest) to 63% (highest).

In a study by Waghela et al undernutrition was observed to be 70.8% compared to our 61.4%, mostly due involvement of rural children. Combined malnutrition showed that 5.94% of children suffered from both underweight and stunting, while our study found it to be 21.8%. Wasting and underweight were in 10.5% of children in their study, but 22.8% in the current study. Additionally, stunting and wasting co-occurred in 22.16% of their subjects, compared to 9.9% in the current study.[24]

Stunting is the chronic outcome of malnutrition, and age is the predictor. It reflects cumulative exposure to malnutrition, and the age of the child for the onset of malnutrition can be considered a crucial determinant of childhood stunting and such identical observations were noted in two more studies. However, stunting was observed more among 25-36 months and 25-59 months.[17,21] While in the current study, it was found in the higher age group of 37-48 months, followed by 49-60 months.

Gender discrimination, preference for male child, also better care, are some of the important social determinants

of Stunting, which were reflected in the current study; Stunting was higher in girls than in boys, though statistically not significant. In fact, girls were more severely stunted than boys in general. A similar finding was observed by Dhok et al, but the difference, just like in current study was not statistically significant (p=0.586).[5] May it was due to a lower sample size. In total contrast, in the study by Patra et al and Murakar et al stunting among under-five children was significantly associated with the sex of the child in the urban slum (Adj. OR=1.77, p<0.05).[15,18] As per belief and various research have proven that mothers' literacy plays an important role in child nutrition, however, no link between mother's education and stunting was observed, perhaps due to the low sample size. Sunny R et al, reported that stunting was 1.15 times more common among children of illiterate mothers than those of literate mothers.[21] Patra et al, also found a significant association between maternal education and stunting [OR=2.1(95% CI=1.2-3.2), p=0.02].[15] However, the father's education, on the other hand, showed a significant impact on childhood stunting in this study, which was noted in only a few studies.[19,24] This indicates that both parents' educational levels should be further explored as determinants of childhood stunting.

Among sociodemographic correlates, only caste (ST category) displayed the determining power in our research. Patra M et al, too, in their study showed a significant association between stunting and ST category children [OR=1.6 (95% CI=1.2 -2.7); p<0.05] compared with general and OBC children.[15] Among child risk factors, higher birth order, time of initiation of complementary feeding, and VAS (Vitamin A Supplementation) according to age were strongly associated with stunting in our study. NFHS-5 too, strongly endorsed birth order does hurt a child's height and overall nutritional status.[10] Similarly, the role of higher birth order in childhood stunting was observed in the studies done by Patel et al, Peter et al, Patra et al, and Tekeba et al in varied settings, endorsing its validity.[15,16,19,20] In agreement too, Chaudhary et al stated that stunting in children had a high correlation with complementary feeding, while Waghela et al concluded that the late age of starting complementary feeding was significantly associated with under-nutrition.[17,24] However, although a significant association between VAS and stunting was noted in our studies, two other studies differed in it since they found no significant link, raising questions about its protective value.[15,20] Moreover, it is a well-established fact that maternal height influences stunting in children. The current study, in concurrence with this, found a significant association between maternal health and childhood stunting, helping to validate the fact once again.

Strengths and limitations of the study

This research has both strengths and limitations. While as many as twenty risk factors for chronic malnutrition could be tested, data was collected based on the mother's account, which could impose recall bias. Plus, Fathers' employment status and family's socioeconomic class could not be captured, which also limited the study of these important determinants. Additionally, since the study population was representative of children attending the Anganwadi centers, the findings can at most be generalized to children of urban slums and not to those from rural areas.

CONCLUSION

While every second child in the current study appears to be affected by one or more forms of undernutrition, every third child is the victim of chronic malnutrition in the population. Additionally, stunting alone contributes to more than half of the undernourished children, which shows its dominance and expanding influence, affecting a much larger proportion of the children compared to other forms. Though under-researched, the father's education and ST category project themselves as important determinants of stunting and demand further validation. Higher birth order, the weight of the child, and the time of initiation of complementary feeding were found to be crucial predictors. Also, girls' child stunting (outcome) can become the predictor for next-generation stunting. Finally, further amendments in Poshan Abhiyaan (Re-aligned as part of Mission Saksham Anganwadi and Poshan 2.0) with more focus on severely stunted children are desirable and so are advisable. Rather than targeting mainly the treatment of SAM/MAM children, comprehensive management, including long-term follow-up and integration with the RBSK program, can help improve the child's nutrition.

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