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PREVALENCE AND DETERMINANTS OF MODERATE-TO-SEVERE MALNUTRITION AMONG UNDER-FIVE CHILDREN ATTENDING ANGANWADI CENTRES IN RURAL INDORE, CENTRAL INDIA: A CROSS-SECTIONAL STUDY

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ABSTRACT **Background:** Under-five malnutrition remains common in India despite long-standing community nutrition programmes. Children attending Anganwadi centres represent a priority group for early detection because moderate growth failure may still be reversible. **Objective:** To estimate the prevalence of moderate-to-severe anthropometric malnutrition and examine associated sociodemographic, perinatal, feeding, sanitation and service-utilization factors among children aged 6-59 months attending rural Anganwadi centres in Indore, Central India. **Methods:** This community-based cross-sectional study included 200 children aged 6-59 months from rural Anganwadi centres in Indore, Madhya Pradesh, between April 2024 and September 2025. Data were collected using a pre-tested proforma from parents or guardians. Weight and height were assessed against World Health Organization child growth standards using weight-for-age, height-for-age and weight-for-height z-scores. Associations with nutritional status were tested using Pearson's chi-square test; mean z-scores were compared using ANOVA. **Results:** The mean age was 30.1 ± 15.8 months; 107 (53.5%) children were male. Overall, 101 (50.5%) children were normal, 77 (38.5%) had moderate malnutrition and 22 (11.0%) had severe anthropometric malnutrition, giving a combined moderate-to-severe prevalence of 49.5%. Nutritional status was not associated with age group (p=0.906) or sex (p=0.839). Socioeconomic status, income sufficiency, maternal education, birth weight, breastfeeding initiation, weaning timing, immunization status, toilet facility, drinking-water treatment and ICDS utilization were significantly associated with nutritional status (all p<0.001). **Conclusion:** Nearly half of the children had moderate-to-severe malnutrition. The clustering of malnutrition with low socioeconomic position, low maternal education, adverse birth and feeding practices, poor WASH conditions and non-utilization of ICDS services supports integrated counselling and service-strengthening at Anganwadi level.

KEYWORDS : Anganwadi; Icds; Malnutrition; Preschool Children; Sanitation; Breastfeeding

INTRODUCTION

Child malnutrition is usually assessed through anthropometric failure, including low weight-for-age, low height-for-age and low weight-for-height. The World Health Organization (WHO) child growth standards classify moderate failure below -2 standard deviations and severe failure below -3 standard deviations from the reference median [1]. These deficits are clinically important because they increase infection risk, impair linear growth and reduce developmental potential during the first five years of life.

India continues to carry a large share of the global burden of undernutrition. The National Family Health Survey-5 reported stunting in 35.5%, wasting in 19.3% and underweight in 32.1% of Indian children under five years [2]. The determinants are rarely isolated; maternal education, household wealth, birth weight, feeding practices, sanitation and access to health services interact across the same household environment [3].

Anganwadi centres under the Integrated Child Development Services (ICDS) programme provide an important platform for growth monitoring, supplementary nutrition and counselling. Studies from Anganwadi settings in India have still reported substantial undernutrition, indicating the need for local data that identify modifiable risk clusters [4,5]. The present study was conducted to estimate the burden of moderate-to-severe malnutrition among children aged 6-59 months attending rural Anganwadi centres in Indore and to assess associated household, feeding, sanitation and service-utilization factors.

MATERIALS AND METHODS

This community-based cross-sectional observational study was conducted through the Department of Pediatrics, Index Medical College, Indore, Madhya Pradesh, from April 2024 to September 2025. The study population comprised children aged 6-59 months residing in the coverage area of selected rural Anganwadi centres and available during the survey period. A total of 200 children were included. Children with terminal illness, genetic disease, mental retardation or cardiac illness, and children whose parents or guardians did not provide consent, were excluded.

Data were collected using a pre-tested structured proforma. Parents or guardians provided information on age, sex, religion, caste, family type and size, socioeconomic status, parental education, birth weight, infant and young child feeding practices, immunization, maternal health-post visits, sanitation, drinking-water treatment and ICDS service utilization. Written informed consent was obtained before participation, and confidentiality was maintained.

Anthropometry was assessed using weight and height/length, and nutritional status was classified using WHO child growth standards for weight-for-age, height-for-age and weight-for-height. Moderate anthropometric malnutrition was defined as z-score between -2 SD and -3 SD, and severe anthropometric malnutrition as z-score below -3 SD. Data were entered in Microsoft Excel and analysed using SPSS version 20.0. Categorical variables were summarized as number and percentage; continuous variables as mean and standard deviation. Pearson's chi-square test was used for associations, ANOVA for mean z-score comparison, and $p<0.05$ was considered statistically significant.

RESULTS

A total of 200 children were analysed. The mean age was 30.1 ± 15.8 months, with the largest group aged 12-23 months (54, 27.0%). Males constituted 107 (53.5%) children. Most families were Hindu (163, 81.5%) and nuclear (144, 72.0%). The largest socioeconomic group was upper-lower class (66, 33.0%), and 99 (49.5%) families reported insufficient income. Low birth weight was recorded in 90 (45.0%) children. Complete immunization was present in 101 (50.5%) children, and ICDS services were utilized by 101 (50.5%) families (Table 1).

Table 1. Profile of study participants (N=200)

Characteristic	Category	n (%)
Age group (months)	6-11	28 (14.0)
	12-23	54 (27.0)
	24-35	41 (20.5)
	36-47	38 (19.0)
	48-59	39 (19.5)
Sex	Male	107 (53.5)
	Female	93 (46.5)
Family type	Nuclear	144 (72.0)
	Joint	56 (28.0)
Socioeconomic status	Upper middle	53 (26.5)
	Middle	48 (24.0)
	Upper lower	66 (33.0)
	Lower	33 (16.5)

Income sufficiency	Yes	101 (50.5)
	No	99 (49.5)
Maternal education	Illiterate	59 (29.5)
	Primary	43 (21.5)
	Middle	11 (5.5)
	Secondary	44 (22.0)
	Graduate and above	43 (21.5)
Birth weight	Low birth weight (<2.5 kg)	90 (45.0)
	Normal birth weight (≥2.5 kg)	110 (55.0)
Breastfeeding initiation	1st day	100 (50.0)
	2nd day	51 (25.5)
	3rd day	49 (24.5)
Weaning timing	Timely (≤6 months)	102 (51.0)
	Delayed (>6 months)	98 (49.0)
Child immunization	Complete	101 (50.5)
	Partial	77 (38.5)
	Unimmunized	22 (11.0)
Toilet facility	Yes	101 (50.5)
	No	99 (49.5)
Drinking water treatment	Boiled/filtered	101 (50.5)
	No treatment	99 (49.5)
ICDS services utilized	Yes	101 (50.5)
	No	99 (49.5)
Nutritional status	Normal	101 (50.5)
	Moderate	77 (38.5)
	Severe	22 (11.0)

Data are presented as number (percentage).

Normal nutritional status was recorded in 101 (50.5%) children, while 77 (38.5%) had moderate and 22 (11.0%) had severe anthropometric malnutrition. Thus, the combined prevalence of moderate-to-severe malnutrition was 99 (49.5%) (Figure 1). Mean current weight and height were 11.5 ± 3.2 kg and 87.3 ± 12.3 cm. Mean WAZ, HAZ and WHZ for the whole sample were -1.24 ± 1.46, -1.22 ± 1.45 and -1.23 ± 1.42, respectively.

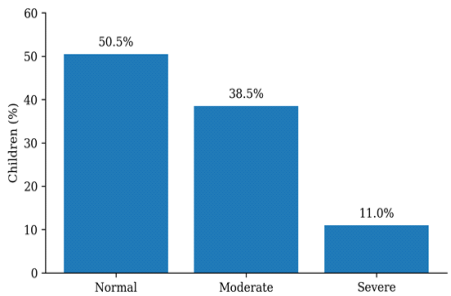

Figure 1. Distribution of participants according to nutritional status.

Nutritional status was not significantly associated with age group (chi-square=3.413, p=0.906) or sex (chi-square=0.351, p=0.839). In contrast, socioeconomic status, income sufficiency, maternal education, birth weight category, breastfeeding initiation, weaning timing, child immunization, toilet facility, water treatment and ICDS utilization showed significant associations with nutritional status (all p<0.001) (Table 2).

Table 2. Association of selected factors with nutritional status

Category	Normal n (%)	Moderate n (%)	Severe n (%)	Total	p value
Age group (months)	0.906				
6-11	15 (53.6)	10 (35.7)	3 (10.7)	28	
12-23	27 (50.0)	21 (38.9)	6 (11.1)	54	
24-35	19 (46.3)	17 (41.5)	5 (12.2)	41	
36-47	16 (42.1)	17 (44.7)	5 (13.2)	38	
48-59	24 (61.5)	12 (30.8)	3 (7.7)	39	
Sex	0.839				
Male	54 (50.5)	40 (37.4)	13 (12.1)	107	
Female	47 (50.5)	37 (39.8)	9 (9.7)	93	
Socioeconomic status	<0.001				
Upper middle	53 (100.0)	0 (0.0)	0 (0.0)	53	
Middle	48 (100.0)	0 (0.0)	0 (0.0)	48	
Upper lower	0 (0.0)	66 (100.0)	0 (0.0)	66	
Lower	0 (0.0)	11 (33.3)	22 (66.7)	33	
Maternal education	<0.001				
Graduate and above	43 (100.0)	0 (0.0)	0 (0.0)	43	
Secondary	44 (100.0)	0 (0.0)	0 (0.0)	44	
Middle	11 (100.0)	0 (0.0)	0 (0.0)	11	
Primary	3 (7.0)	40 (93.0)	0 (0.0)	43	
Illiterate	0 (0.0)	37 (62.7)	22 (37.3)	59	
Birth weight	<0.001				
Normal birth weight	101 (91.8)	9 (8.2)	0 (0.0)	110	
Low birth weight	0 (0.0)	68 (75.6)	22 (24.4)	90	
Breastfeeding initiation	<0.001				
1st day	100 (100.0)	0 (0.0)	0 (0.0)	100	
2nd day	1 (2.0)	50 (98.0)	0 (0.0)	51	
3rd day	0 (0.0)	27 (55.1)	22 (44.9)	49	
Weaning timing	<0.001				
Timely (≤6 months)	101 (99.0)	0 (0.0)	1 (1.0)	102	
Delayed (>6 months)	0 (0.0)	77 (78.6)	21 (21.4)	98	
Child immunization	<0.001				
Complete	101 (100.0)	0 (0.0)	0 (0.0)	101	
Partial	0 (0.0)	77 (100.0)	0 (0.0)	77	
Unimmunized	0 (0.0)	0 (0.0)	22 (100.0)	22	
Toilet facility	<0.001				
Yes	101 (100.0)	0 (0.0)	0 (0.0)	101	
No	0 (0.0)	77 (77.8)	22 (22.2)	99	
Drinking water treatment	<0.001				
Boiled/filtered	101 (100.0)	0 (0.0)	0 (0.0)	101	
No treatment	0 (0.0)	77 (77.8)	22 (22.2)	99	
ICDS services utilized	<0.001				
Yes	101 (100.0)	0 (0.0)	0 (0.0)	101	
No	0 (0.0)	77 (77.8)	22 (22.2)	99	

Percentages are row percentages. p values were obtained using Pearson's chi-square test and are reported to three decimal places; values below 0.001 are shown as <0.001.

Mean z-scores declined stepwise across nutritional categories. In the normal group, WAZ, HAZ and WHZ were 0.15 ± 0.24, 0.17 ± 0.22 and 0.11 ± 0.30. Corresponding values in the moderate group were -2.45 ± 0.17, -2.42 ± 0.21 and -2.41 ± 0.21, and in the severe group -3.41 ± 0.15, -3.40 ± 0.15 and -3.33 ± 0.22. ANOVA showed significant differences for all three indices (p<0.001) (Figure 2).

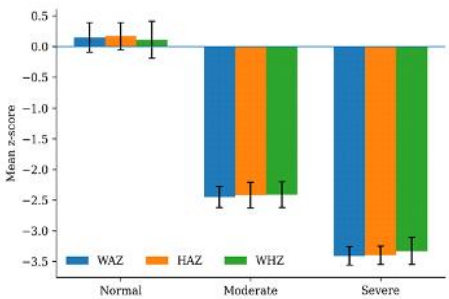

Figure 2. Mean WAZ, HAZ and WHZ across nutritional-status categories (mean ± SD).

ANOVA p<0.001 for WAZ, HAZ and WHZ.

DISCUSSION

This study found that almost one in two children attending rural Anganwadi centres had moderate-to-severe anthropometric malnutrition. The burden is consistent with Indian Anganwadi-based studies reporting persistent undernutrition despite programme access. Das et al. found underweight, stunting and wasting in 34.14%, 45.52% and 35.52% of children attending Anganwadi centres in Tumkur, while Carolin et al. reported stunting in 63.8% and underweight in 45.2% among Anganwadi children in Andhra Pradesh [4,5]. The present estimate is not directly interchangeable with individual stunting or

wasting prevalence because a combined nutritional-status category was used, but it points to a similarly high-risk preschool population.

The absence of association with age and sex suggests that malnutrition in this setting was distributed across the under-five age range and was not limited to either boys or girls. By contrast, socioeconomic status and income sufficiency showed a clear gradient. This is biologically and socially plausible: poor households face lower dietary diversity, greater exposure to infections and less ability to buffer illness or food-price shocks. Corsi et al. identified maternal education and household wealth as important predictors of child undernutrition in India, and Sinha et al. reported links between food security, sanitation and anthropometric failure in high-burden Indian settings [3,6].

Maternal education was strongly associated with child nutritional status. Education may influence recognition of growth faltering, care-seeking, breastfeeding, complementary feeding and hygiene practices. Low birth weight was another important correlate. Children born with lower reserves are more vulnerable to infection and growth failure; Abbas et al. similarly reported a higher risk of stunting and wasting among low-birth-weight children [7].

Feeding practices showed the expected direction. Delayed breastfeeding initiation and delayed weaning clustered with malnutrition. Early initiation of breastfeeding and timely complementary feeding at six months are central to infant nutrition because breast milk alone becomes insufficient for rapidly growing infants after six months [8-10]. These findings support counselling that begins during antenatal care and continues through Anganwadi follow-up.

Environmental and service-related factors were equally important. Open defecation, untreated drinking water and incomplete immunization were associated with malnutrition, supporting the infection-undernutrition pathway. Rahman et al. described an association between open defecation and child malnutrition in India [11]. In the present study, ICDS utilization was strongly linked with better nutritional status, consistent with national evidence showing beneficial linkages between ICDS use and underweight reduction among children aged 6-59 months [12]. Strengthening growth monitoring, ensuring regular supplementary nutrition, completing immunization and improving WASH counselling can therefore act together rather than as separate interventions.

LIMITATIONS

The study was cross-sectional, so temporality and causality cannot be established. The sample was limited to rural Anganwadi centres in one district, which may restrict generalizability. Several exposure variables, including feeding practices, birth weight and service use, were caregiver-reported and may be affected by recall or reporting bias. Dietary diversity, recent morbidity, micronutrient status and biochemical markers were not measured.

CONCLUSION

Moderate-to-severe malnutrition affected 49.5% of children aged 6-59 months attending rural Anganwadi centres in Indore. Age and sex were not significant correlates, whereas socioeconomic disadvantage, lower maternal education, low birth weight, delayed breastfeeding or weaning, incomplete immunization, poor sanitation, untreated drinking water and non-utilization of ICDS services were strongly associated with malnutrition. The findings support integrated Anganwadi-based screening, maternal counselling, low-birth-weight follow-up, immunization completion and WASH improvement.

DECLARATIONS

Ethical approval: Institutional Ethics Committee approval was obtained before initiation of the study.

Conflict of interest: Nil.
Source of funding: Nil.
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