International Journal of Contemporary Pediatrics
Mete B et al. Int J Contemp Pediatr. 2025 Jul;12(7):1173-1179
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20251871

Original Research Article

Impact of maternal sociodemographic characteristics on infant and child nutrition and growth: a cross-sectional observational study

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Received: 19 May 2025
Accepted: 13 June 2025

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ABSTRACT

Background: A high prevalence of malnutrition in infants in India may be associated with socio-demographic characteristics of mother. We wanted to find out the association between maternal socio-demographic factors, dietary diversity and growth in 12 to 24 months children.
Methods: We enrolled 12 to 24 months children over 11 months in a tertiary care centre in North India, from outpatient and inpatient wards in an observational, cross-sectional study. Maternal education, occupation and socio-economic status were noted. Dietary history was recorded to determine Minimum Meal Frequency (MMF) and Minimum Dietary Diversity (MDD) as per WHO guidelines. Child's weight, length/height, mid upper-arm circumference (MUAC) and occipitofrontal circumference were recorded. Outcomes were proportion of underweight, stunted, wasted and severe acute malnutrition (SAM defined as MUAC <11.5 cm) in various dietary adequacy groups and as per maternal socio-demographics.
Results: Authors enrolled 246 children and mean (SD) age at assessment was 17.6(4.2). Mothers of 210 (85.4%) were unemployed, 73(29.7%) either uneducated or educated less than 10th and 31(12.6%) completed post-graduation. Complementary feeding was initiated between 6 months to 1year age in 208(84.2%) children. MMF was met in 169 (68.7%) and MDD in 74(30%). We found 79(32%) children were underweight, 51(20.7%) wasted, 83(33.7%) stunted and 20 (8.7%) SAM. Nearly 72% of unemployed mothers failed to provide MDD versus 55% (p=0.042) employed mothers. MDD increased with increasing education of mother(p=0.002). Children of less educated mothers had significantly higher underweight (p=0.029) and stunting (p=0.006).
Conclusion: Dietary diversity and growth are significantly affected by maternal sociodemographic characteristics in 12-24 months children.

Keywords: Maternal socio-demographics, MDD, MMF, Complementary feeding, Malnutrition, SAM

INTRODUCTION

India is a country of diverse cultures and practices with a variety of practices related to the feeding of infants and young children. An assortment of knowledge, beliefs, convictions, myths, and taboos create an environment where children may not receive food that is adequate and suitable in both nutrients and calories for proper nourishment, growth and development. World Health Organisation (WHO) has recommended that complementary feeding should be initiated at six months of age.[1]

In a study conducted by Karlsson et al across 92 low-middle income counties, including India, it was observed that 19.3% (95% CI, 18.9%-19.8%) children aged 6-23 months received zero-food, i.e. children who did not receive any animal milk, formula, or solid or semisolid food during the past twenty-four hours. India accounted for virtually half of zero-food children in this study.[2] As

per NFHS-5 data, which was gathered by the Government of India in 2019-20, the proportion of children receiving adequate diet in the age group of 6-23 months in India is only 11.3%.3 The prevalence of stunting in children under five years of age is 35.5%; wasting stands at 19.3%, and 32.1% children are underweight in our country.[3,4]

We hypothesize that growth parameters in this age group would be largely influenced by the complementary feeding provided to children by their mothers, which may be dependent on maternal socio-demographic characteristics. In India, mothers are the primary caregivers of children and their knowledge, education and occupational status are likely to impact the dietary habits and consequently nutritional status of children.

Hence, we devised this cross-sectional study to assess the growth in children 12-24 months in relation to their dietary pattern and maternal socio-demographic parameters like education and occupation.

METHODS

This prospective cross-sectional study was conducted in the Pediatric out-patient and inpatient ward of a tertiary care hospital in North India from October 2022 to August 2023 after approval by the Institute Ethics Committee (Letter No.-GMCH/IEC/870R/2022/23, dated 09/12/2022) and with the Helsinki Declaration of 1975, as revised in 2000.

Children aged 12 to 24 months, were enrolled after taking written informed consent from parents. Children who were admitted to the intensive care unit, those diagnosed with chronic systemic diseases, inborn errors of metabolism, chromosomal abnormalities, major congenital defects and children born before 34 weeks of gestation were excluded.

At enrolment, data was entered into a predesigned case record form which included demographic details, perinatal history and dietary history. Detailed dietary history was taken from the care giver, preferably mother and included feeding history starting from birth; and time of introduction, nature and frequency of complementary foods. Current dietary history was taken utilizing 24-hour dietary recall method. Child's anthropometric measurements (weight, height/length, occipitofrontal circumference and mid-upper arm circumference) were recorded as per standard guidelines.

Underweight, stunting and wasting were defined as weight-for-age, length-for-age and weight-for-length less than 2 standard deviations (SD), respectively in accordance with WHO growth charts.5 Severe Acute Malnutrition (SAM) was described as weight-for-length below -3 z-scores of the median in WHO growth standards, presence of nutritional oedema, visible severe wasting, or a mid-upper arm circumference (MUAC) <11.5 cm.[6]

Study definitions of exclusive breastfeeding, complementary feeding, as well as dietary diversity, minimum dietary diversity (MDD), minimum meal frequency (MMF) and minimum acceptable diet were as per WHO guidelines.[1] Complementary feeding refers to the initiation of safe and nutritionally-balanced solid, semi-solid or soft foods supplementing breast milk for children aged 6-23 months.[7] Dietary diversity was defined as feeding a child several types of foods so as to meet his/her nutritional requirements.[7] MDD is defined as "the percentage of children 6-23 months who consumed foods and beverages from at least five out of eight defined food groups during the preceding day.

The 8 food groups include breast milk; grains, roots, tubers and plantains; pulses (beans, peas, lentils), nuts and seeds; dairy products (milk, infant formula, yogurt, cheese);eggs; flesh foods (meat, fish, poultry, organ meats); vitamin-A rich fruits and vegetables; as well as other fruits and vegetables."[1] MMF is defined as "the percentage of children 6-3 months who ate solid, semi-solid or soft foods (but also including milk feeds for non-breastfed children) no less than the minimum number of times during the previous day.

The minimum number of times is considered two feedings of solid, semi-solid or soft foods for breastfed infants aged 6-8 months; three feedings at 9-23 months; and four feedings of solid, semi-solid or soft foods or milk feeds for non-breastfed children aged 6-23 months, where at least one of the four feeds is a solid, semi-solid or soft feed."

Outcomes assessed were proportion of underweight, stunting, wasting and SAM as per MDD, maternal education, occupation, place of residence and SES of family.

Sample size calculation

According to NFHS-5 data, the proportion of underweight children in India is 32.1% however in our survey area (North India), the proportion of underweight children is roughly 20%. Hence to identify underweight rates of 20%, at a confidence interval of 95% and design effect of 1, sample size of 246 was gauged.

Statistical analysis

The normality of distribution was analysed by histogram, skewness, and kurtosis. Variables which showed normal distribution for quantitative variables were stated as mean and standard deviation. Categorical variables were expressed as 'n' and '%'.

Skewed data was expressed as median with IQR for quantitative data. To compare normally distributed data

of continuous variables, student's t-test was used, while Mann-Whitney test was used for skewed data.

Chi-square test with fisher's exact test was applied for categorical variables. Multiple group comparisons were accomplished by using ANOVA tests. Values of $p<0.05$ were considered to be statistically significant. SPSS statistical software 25.0 (SPSS Inc., Chicago, IL, USA) was used for analyzing data. Prevalence of malnutrition with 95% CI as well as z-scores were calculated using WHO Anthro Survey Analyzer. Report template with results from WHO Anthro Survey Analyzer. Analysis date: 2023-04-04 02:02:10.

RESULTS

Overall, 276 children were screened during the period of study, of which 30 were excluded, details in Figure 1 (flow chart) and 246 were enrolled. The mean age at assessment was 17.6 (4.2) months. The mean maternal age was 28 (4.5) years.

Most of the mothers (n=210, 85.4%) were homemakers. While 72 (29.7%) mothers were either uneducated or educated less than 10th standard, 31 (12.6%) had completed their post-graduation. The baseline demographic characteristics are summarized in Table 1.

Table 1. Baseline demographic characteristics of enrolled children and their mothers.

Variables	n=246
Birth weight (kg)*	2.7 (0.6)
Gestational age (weeks)*	39.3 (1.3)
Gender+	
Male	153 (62.2%)
Female	93 (37.8%)
Maternal age (in years)*	28 (4.5)
Mother's Education+	
Uneducated or less than 10th standard	73 (29.7)
10th pass	42 (17.1)
Up to 12th	51 (20.7)
Graduate	49 (19.9)
Post-graduate	31 (12.6)
Mother's occupation+	
Unemployed	210 (85.4)
Employed	36 (14.6)
Socio-economic classification as per Kuppuswami scale+	
I Upper	13 (5.3)
II Upper middle	57 (23.2)
III Lower middle	71 (28.9)
IV Upper lower	103 (41.9)
V Lower	2 (0.8)
Residence+	
Rural	119 (48.2)
Urban	107 (43.3)
Urban slum	20 (8.1)

*: mean (SD), +: N (%)

Table 2: Proportion of children receiving minimum dietary diversity (MDD) according to socio-demographic profile of mother.

Maternal parameter	MDD adequate	MDD inadequate	P value
Mother's education			
Uneducated or less than 10th	12 (16.4)	61 (83.5)	
10th pass	11 (26.1)	31 (73.8)	
Up to 12th	17 (32)	34 (66.7)	0.002*
Graduate	17 (34.6)	32 (65.3)	
Postgraduate	17 (54.8)	14 (45.1)	
Mother's occupation			
Employed	16 (44.4)	20 (55.5)	0.042*

Continued.

Maternal parameter	MDD adequate	MDD inadequate	P value
Unemployed	58 (27.6)	152 (72.3)	
Socio-economic status			
Upper	6 (46.1)	7 (53.8)	0.016*
Upper middle	25 (43.8)	32 (56.1)	
Lower middle	22 (30.9)	49 (69)	
Upper lower	21 (20.3)	82 (31.06)	
Lower	0	2 (100)	
Residence			
Rural	32 (26.44)	89 (73.55)	0.081
Urban	38 (36.1)	67 (63.8)	
Urban slum	4 (20)	16 (80)	

Figures are expressed as n (%), *p< 0.05 significant. MDD-Minimum Dietary Diversity.

Table 3: Proportion of children who are underweight, stunted and wasted according to socio-demographic profile of mother.

Maternal parameter	Underweight n=79	Stunted n=83	Wasted n=51
Mother's education			
Uneducated or less than 10th	32 (40.5)	29 (34.9)	20(39.2)
10th pass	15 (19)	16 (19.3)	12(23.5)
Up to 12th	19 (24)	23 (27.7)	10(19.6)
Graduate	8 (10.1)	12 (14.5)	5(9.8)
Post-graduate	5 (6.3)	3 (3.6)	4(7.8)
P value	0.029*	0.006*	0.069
Mother's occupation			
Employed	9 (11.4)	8 (9.6)	9 (17.6)
Home-Maker	70 (88.6)	75 (35.7)	42 (82.4)
P value	0.607	0.132	0.600
Socio-economic status			
I-Upper	3 (3.8)	4(4.8)	1(2)
II-Upper Middle	7 (8.9)	9(10.8)	8 (15.7)
III-Lower Middle	31(39.2)	31(37.3)	9 (41.2)
IV-Upper Lower	37 (46.8)	38(45.8)	2 (3.9)
V-Lower	1 (1.3)	1(1.2)	2 (3.9)
P value	0.019*	0.055	0.046*

Figures are expressed as n (%), p<0.05 significant*

Table 4: Prevalence of malnutrition with 95% CI as per mother's education.

Variable	Weight for age		Length for age		Weight for length	
	-2SD (95%CI)	-3SD (95%CI)	-2SD (95%CI)	-3SD (95%CI)	-2SD (95%CI)	-3SD (95%CI)
Uneducated or less than 10th	39.7 (29.1;51.4)	20.5 (12.7;31.4)	34.8 (24.5;46.8)	21.7 (13.5;33.1)	26.8 (17.7;38.3)	15.5 (8.8;25.9)
10th pass	32.5 (19.8;48.4)	12.5 (5.3;26.8)	37.1 (22.9;54.1)	11.4 (4.3;26.9)	27.8 (15.6; 44.5)	13.9 (5.9;29.5)
Upto 12th	32.0 (20.6;46.1)	10.0 (4.2;22.0)	47.7 (33.5;62.4)	22.7 (12.6;37.4)	11.4 (4.8; 24.7)	2.3 (0.3;14.6)
Graduate	16.7 (8.5;30.0)	2.1 (0.3;13.5)	27.3 (16.1;42.2)	11.4 (4.8;24.7)	9.1 (3.4; 22.0)	0.0 (0.0;0.0)
Post-graduate	20.0 (9.2;38.1)	6.7 (1.7;23.2)	18.5 (7.9;37.7)	7.4 (1.8;25.4)	11.1 (3.6;29.5)	7.4 (1.8;25.4)

Figures are expressed as proportion (95%CI)

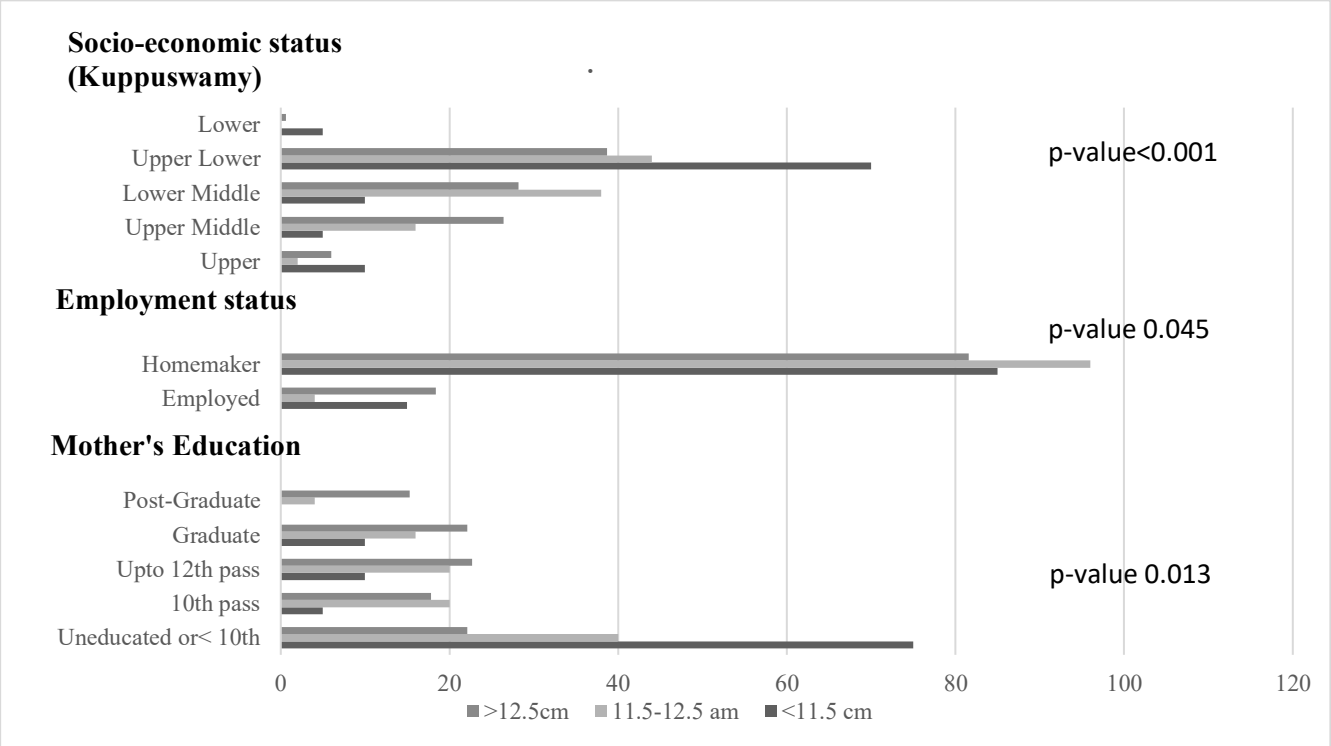

Figure 1: MUAC in relation to maternal education, employment status and socioeconomic category (%).

It was observed that 120 (48.8%) children had been breastfed within one hour of birth and 142 (57.7%) had been exclusively breast fed for six months. Breast feeding had been continued beyond one year of age in 158 (64%) of children in this study. Almost 72.4% of enrolled children (178/246) were started on complementary foods at six months of age, while 68 (27.6%) children did not start receiving any semi-solid food till after 12 months of age. At enrolment, 221 (89.9%) children were receiving only home-based food while 25 (10.1%) were receiving both home-based as well as commercial complementary food and 93 (37.7%) children had received commercial complementary food at some point of time from birth till enrolment. At enrolment, 169 (68.8%) children were receiving MMF and 74(30%) children were receiving MDD. Amongst the eight essential food groups recommended by WHO, fruits or vegetables rich in Vitamin A were missing from diet in almost 80.2% (198) children. The population was mostly vegetarian with only a few children receiving eggs (29, 11.7%) and meat (3, 1.2%).

Authors assessed the feeding pattern of these children in relation to maternal education and occupation. It was seen that in the 25 children who received both home-based and commercial food, mothers of 7 (28%) were employed as compared to 18 (72%) were home makers. In the 221 children who were receiving home-based diet alone, 29 (13.1%) mothers were employed as compared to 192 (86.9%) were home makers (p value 0.046). Proportion of children receiving MDD as per mother's education and occupation is given in Table 2.

Almost a third, 79 (32%) of the enrolled children were underweight, 51 (20.7%) were wasted and 83 (33.7%) were stunted. Proportion of underweight, stunting and wasting according to education and occupation of mothers is given in Table 3. MUAC of <11.5 cm was seen in 20 out of the 232 (8.7%) children whose MUAC was measured, 50 (21.5%) had MUAC 11.5-12.5 cm and 162 (69.8%) had MUAC >12.5 cm. MDD was adequate only in 6 (8.8%) in MUAC< 11.5 cm group, 7 (10.3 %) in 11.5-12.5 cm group and 55 (81%) in MUAC >12.5 cm group (p value 0.027). Underweight, stunting, wasting and MUAC<11.5 cm did not vary according to the duration of exclusive breastfeeding. Uneducated mothers were more likely to have children with poor nutrition as inferred from a lower MUAC and employed mothers had less chances of having a child with lower MUAC (Figure 2).

Table 4 describes the prevalence of malnutrition with 95% CI as per maternal education. It shows that the prevalence of malnutrition in children with mothers with higher educational qualification is lower.

DISCUSSION

In this study on infant feeding practices, we observed that a high proportion (70%) of north Indian children between 12 to 24 months of age lacked minimum diversity in their diet. We also observed that maternal education, occupation and socioeconomic status were significantly associated with adequate dietary diversity and nutritional parameters in children 6-23 months of age. Mothers who

were employed and more educated were more likely to provide a diverse diet; and their children were less likely to be underweight, stunted, wasted, or severely malnourished. We also observed that almost a third of the enrolled infants did not start receiving any semi-solid food till after one year of age.

Minimum dietary diversity (MDD) and minimum meal frequency (MMF) are the two components of minimum acceptable diet advocated by the WHO, as an indicator to assess infant and young child feeding. It is considered to reflect micronutrient adequacy and quality of the diet.[8] In 2021, WHO expanded the guidance to include breast milk as one of the 8 food groups recommended to feed infants and young children. In our study, MDD was found to be more likely to be met in children whose mothers were employed, had received higher education, resided in urban areas and belonged to families with higher socio-economic status.

By and large, published literature on dietary diversity in young child feeding is available from Africa.9,10,11 Several of these studies have found maternal socio-demographic characters to be linked with MDD. A study by Atosona et al from Ghana found that 64% children 9-24 months age met MDD and employed mothers were two times more likely to meet MDD compared with unemployed women.10 Aboagye et al determined that in children aged 6 to 23 months from 21 countries in Sub-Saharan Africa, MDD ranged from 9% in Libya to 61% in South Africa. They also concluded that MDD is influenced by women empowerment with mothers with higher social independence and high decision-making being more likely to meet MDD.11 Suboptimal dietary diversity has also been determined to be one of the risk factors for poor growth in children.[12] In India, the assessment of infant and young child feeding using key indicators recognized by WHO and its relationship with the nutritional status of children has been explored in the secondary analysis of National Family Health Survey in 2005-06.13 MDD in Indian children was determined to be only 15% and in those below one year of age it was a dismal 5.5%.

The risk factors for inadequate dietary diversity were determined to be age of the child below one-year, uneducated mother, mother not having access to radio and television and poor economic health of household. A similar analysis of NFHS 2019-21 data showed prevalence of MDD at 25%, only a small increase over a 15-year period.[14] A corresponding decline in prevalence of wasting in under five children has also been sub-optimal, from 30% in 2005 to 20% in 2020.

Significant association was seen between MDD and wealth status of family and between MDD and wasting in children. In 2013, a community-based study in west Bengal noted a linear relationship between infant and young child feeding scores and grades of malnutrition in under-two slum dwelling children, with a lower score in children with a higher grade of malnutrition. The IYCF score used by them was a composite feeding index constructed by using several indices including MMF and MDD amongst others.[15] In an Indian study from Uttar Pradesh, MDD was met in 42.6% children 6-23 months of age and prevalence of stunting was significantly associated with the diversity of diet.[16]

As per NFHS-5 data from Chandigarh, proportion of children under five who are stunted or wasted is 25% and 8%, respectively against the corresponding national figures of 35% and 19%.[3,4] We also found the rates of stunting and wasting to be similar to those seen in Chandigarh. Proportion of children 6-23 months who received an adequate diet were 19% in Chandigarh and 11% in national data.[3,4] In the study of 12-24 months old children, almost a third had received adequate dietary diversity in the last 24 hours, which is higher than the national average but is a definite cause for concern. Adequacy of diet in this data was determined by a composite score including MMF and MDD.

The limitations of the current study are that it is not based in the community, hence may not be generalizable. Data was collected from cases who reported in hospital only. This study also may not tell us about the causal association between the studied parameters as it is a cross-sectional study. We did not assess any recent acute illnesses which may have aggravated the malnutrition.

Strength of the study was adequate sample size, detailed analysis of dietary pattern and their effects on child's growth and nutrition as per maternal socio-demographic characteristics. The WHO has defined global nutritional targets for 2025 and sustainable developmental goals (SDG) 2030, which aims to reduce the prevalence of stunting to 28.2% by 2025 and 23.7% by 2030.17 However, the prevalence of stunting in India is 31.7% as of 2022.[17]

Similarly, the target prevalence of wasting is 5% and 3% for 2025 and 2030, respectively, which our country is far off from target as the current national prevalence of wasting is 19.1% as per NFHS-5.3 Major efforts will be required at local as well as at higher levels to meet these targets.[17]

CONCLUSION

The study finds a strong association between maternal education and socio-demographic factors and child health, growth and malnutrition. Hence it is imperative to address these parameters at a regional and national level to enhance and maintain child health, growth and nutrition. Future research and public health policies should focus on studying the knowledge, attitude and practices of mothers regarding child nutrition and growth; empowering mothers to provide adequate and diverse diet to their children and eradicating malnutrition in childhood for a healthier India.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Mete B, Randev S, Guglani V. Impact of maternal sociodemographic characteristics on infant and child nutrition and growth: a cross-sectional observational study. Int J Contemp Pediatr 2025;12:1173-9.