ORIGINAL ARTICLE

Role of Sociodemographic and Environmental factors on early childhood weight: A Cross-sectional study in rural area

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ABSTRACT

Introduction: The duration between conception and two years of age is important for establishing the foundation of future health and overall well-being. Factors that can affect early child growth include dietary restriction, absolute poverty, feeding patterns, ignorance, parenting, social and cultural practices, poor hygiene and sanitation. **Objective:** To evaluate the prevalence of underweight and the determinants influencing the weight of children aged two months to two years. **Material and Methods:** A cross-sectional study was conducted in the rural area of Saharanpur using multistage random sampling among 300 children. Data were gathered via a pre-tested structured questionnaire, and analysis was conducted using IBM SPSS 27. **Results:** 23% children were under-weight and 11.7% were severely underweight There was significant association of underweight with sociodemographic factors like children religion, family type, parent education, father's occupation, parental separation and environmental factors like cross ventilation. **Conclusion:** The study revealed a concerning burden of underweight and many sociodemographic factors were associated with impaired growth in children.

KEYWORDS

Growth, Underweight, Sociodemographic factors

INTRODUCTION

The duration between conception and two years of age is important for establishing the foundation of future health and overall well-being. (1) A net increase in the size or mass of tissues is referred to as growth. (2) Factors affecting early child growth include dietary restriction, absolute poverty, feeding patterns, ignorance, parenting, social and cultural practices, poor hygiene and sanitation. (3) A major cause of delayed growth in infants is undernutrition. The three main markers used for assessing undernutrition are weight-for-age, height-for-age, and weight-for-height.(4) The current growth monitoring system in India, uses weight-for-age growth charts to detect underweight.(5) The National Family Health Survey-5(NFHS-5) data reveals among under five years children 32.1% were underweight.(6) Numerous research have investigated the frequency and identified risk factors of undernutrition among under five children in India; however, there is a paucity of literature addressing the prevalence and causes of malnutrition among children under two years of age. The purpose of this study was to determine the prevalence of underweight and the factors that contribute to it in children between the ages of two months and two years in the rural Saharanpur district.

Aim & Objective(s)

- To estimate the prevalence of underweight in rural area among children aged two months to two years.

- To evaluate the determinants influencing the weight of children aged two months to two years.

MATERIAL & METHODS

Study Design: Cross-sectional observational study

Study setting: Selected Community Development Block (Sarsawa) of Saharanpur district

Study Population: All children (both males and females) belonging to age group 2 months-2 years residing in study area.

Study Duration: 12 months (January 2024 to December 2024)

Inclusion Criteria

- Children aged 2 months – 2 years.
- Mother/caregiver who were willing to participate in the study.
- Mother/caregiver residing in the area of the selected AWC for >6 months.

Exclusion Criteria

- Children with major congenital anomalies, genetic defects, metabolic disorders and chronic illness.
- Children above the age of 2 years
- Mother/caregiver unwilling to participate or showed hostile behaviour.

Sample size calculation: The sample size was calculated by taking expected 10% prevalence of developmental delay as shown in Sharma N et al(7)study done in northern part of India, 95% confidence interval, 5% absolute error, design effect 2, by using these values we calculated the sample size from the formula: $n = (1.96)^2pq/L^2$ .The sample size came out 276, further on adding 5% non-response rate it became 290, which is rounded off to 300 to ensure equal number of study subjects from each selected Anganwadi Centre (AWC).

Note: This study is part of thesis work conducted to assess the growth and development among two months to two years children. Children with underweight in earlier months of life are more prone to show developmental delay under various domains, that is why sample size is calculated by taking the prevalence of developmental delay.

Sampling Technique and Data collection: Multi-stage random sampling was the sampling method used in the investigation. Eleven blocks make up the Saharanpur district's rural region; one block, **Sarsawa**, was chosen at random. Twenty of the 281 Anganwadi Centres (AWCs) in Sarsawa were chosen using a systematic random sampling method. 14 was found to be the sample interval. The random number tables were then used to select a number between 1 and 14 (the sampling interval), and the result was 10. The 10th AWC was the first centre chosen because the list of AWCs was organized alphabetically. 10 + 14 = 24 is the second AWC selected, then 38, 52, and so on, until the desired number of AWCs (20) were chosen. The list of enrolled children in the age range of two months to two years was given by the Anganwadi worker at each of the selected AWCs. Using a random number table, fifteen children were selected at random from the list of children enrolled at the selected AWCs in order to attain the sample size of 300. Next, the homes of the selected children were found and examined. The next child on the list was chosen using a random number table if parents or guardians refused to take part in the study. Data was collected using a pre-made, semi-structured questionnaire. Thirty people (10% of the sample size) participated in the pilot study. The study tools had several parts that included sociodemographic information, weight for age and related parameters.

Operational Definitions:

Weight: It is the measurement of the body mass of the child. Measured in kilograms.

Underweight: Children whose weight for age (WAZ) is below -2SD are considered as underweight and below -3SD are considered severely underweight.

Overcrowding: It refers to situation in which more people are living within a single dwelling than there is space for, so that movement is restricted, privacy secluded, hygiene impossible, rest and sleep difficult.

Modified BG Prasad scale for January 2024 (Rupees/month)

Socio-economic class	Original BG Prasad classification of 1961 (Rupees/month)	Modified BG Prasad classification for January 2024 (Rupees/month)
I-upper	≥100	≥9131
II-upper middle	50–99	4566–9130
III-middle	30–49	2739–4565
IV-lower middle	15–29	1370–2738
V-lower	<15	<1370

RESULTS

In present study, 300 children under 2 years of age from rural area of Saharanpur district were included, and their data was analysed to assess the low weight for age along with the factors affecting the weight of children among the total study participants. 24.7% were in age group 2-6 months,

25.3% children were in age group 7-12 months and half of the children were in age group 13-24 months. Majority of children were female (56%) and followed by male (44%). Half of the children belonged to Hindu religion (52.3%) followed by Muslim religion (47.7%). Almost half of the children belonged to nuclear family (45.7%), followed by 37% children to joint family and 17.3% children to three generation family. Most of children belonged to lower middle class (39.3%), followed by middle class (33.7%). Most of the mothers were educated (78%). Among them, 33.3 % were educated up to middle school, 23.3% up to high school and Intermediate. Mothers with education graduate and above were 21.4% while 22% of the mothers were illiterate (Table 1). In present study, weight for age was normal (between +2SD to -2SD) in 57.3% children while 23% had low (≤ -2 to ≥ - 3 SD) and 11.7% had very low (<-3 SD) weight for age suggestive of underweight (Table 2, Figure 2). Table 3 shows the effect of various sociodemographic factors on weight of child. On assessing the age group of children, it was observed that children in older age group were comparatively more malnourished (19.7% and 27.3% in 7-12 months and13-24 months age group respectively) as compared to younger children but this difference was not found to be statically significant. On analysing weight for age in respect to religion, a significant association was observed (p-value = 0.028). Muslim children showed higher percentages of 'Very low' (14.7% vs 8.9%) and 'low' (28.7% vs 17.8%) weight for age as compared to Hindu children. Similarly, Muslim children also showed lower rates (49.7%) of 'normal' weight for age as compared to 64.3% Hindu children. This indicate that children belonging to the minority class were at risk of underweight. There was also significant association of family type with weight for age (p-value = 0.038). Children from nuclear families showed higher proportion of 'very low' weight for age (13.9%) as compared to joint families (9.8%) indicating reduced household support for childcare in nuclear families. The result of study also showed education of both the parents had significant association with child weight for age (p-value = 0.015 for father's education and p-value = 0.010 for mother's education). Children of illiterate fathers had the highest rates of 'low' weight for age (44.4%), compared to 12.5 % for graduate and above fathers. Among fathers with graduation and above education, 7.1% children had 'very low' weight for age while highest (15.9%) among fathers with middle school education and 8.3% in illiterate fathers. Similarly Illiterate mothers had 13.6% children in 'very low' weight for age while 5.7% among mothers with education upto high school and intermediate. Only 4.7% children were seen in 'low' weight for age category in mothers with graduate and above education while highest proportion (32.9%) of low weight for age children was observed in mothers educated upto high school and intermediate and 27.3% in illiterate mothers (Figure 2). This indicated that there was non-linear relationship, however outcomes improved with higher education. There was also statistically significant association between father's occupation and child weight for age (p-value = 0.012). Children of unemployed fathers had highest rates (50%) of 'very low' weight for age as compared to only 7.1% for those who were working in clerical, shop-owner and farmer occupation. Children belonging to lower socioeconomic status had higher rates of underweight (14.4% and 30.8% in class IV and V respectively as compared to children belong to higher socioeconomic status (4.3% and 11.9% in class II and III respectively), however no statically significant association was observed (Table 3). There was statistically significant association between child weight for age and their parent separation (p-value = 0.023) using Fisher's test. In present study, a much higher percentage (42.9%) of children with parental separation had 'high' weight for age as compared to children without parental separation (7.2%). 'Low' weight for age was also higher in children with parental separation (28.6%) while 22.3% in children without parental separation (Figure 3).

On assessing the environmental factors affecting the weight for age, there was statistically significant association between cross ventilation and child weight for age (p-value = 0.011). Children living in house with cross ventilation had lower (17.6%) rates of 'low' weight for age compared to 31.9% children who were living in house without cross ventilation. Children living in overcrowded houses had slightly higher rates of 'very low' weight for age as compared to children living in houses without overcrowding (13.1% and 9.8% respectively). Half (50%) children with open field defecation had 'low' weight for age as compared to 22.3% children who uses sanitary toilet. Higher proportion of children had 'low 'weight for age who drinks non-purified water as compared to children who drinks purified water (23.9% vs 17.7%). These factors indicate that good environmental conditions are needed for lowering the 'low' weight among children however there was no statically significant association between them (Table 4).

Table 1: Sociodemographic factors of the study population (n=300).

Characteristics	Frequency (N)	Percentage (%)
Age		
02 – 06 months	74	24.7
07 – 12 months	76	25.3
13 – 24 months	150	50
Sex		
Male	132	44
Female	168	56
Religion of babies:		
Hindus	157	52.3
Muslims	143	47.7
Caste of babies		
General	54	18
OBC	155	51.7
SC/ST	91	30.3
Types of families		
Nuclear	137	45.7
Joint	111	37
Three generation	52	17.3
Education of fathers		
Illiterate/just literate	36	12
Education upto middle school	108	35.3
High school and Intermediate	100	33.4
Graduate and above	56	18.6
Education om mothers		
Illiterate/just literate	66	22
Education upto middle school	100	33.3
High school and intermediate	70	23.3
Graduate and above	64	21.4
Occupation of fathers		
Unemployed	6	2
Unskilled worker	93	31
Semiskilled worker	72	24
Skilled worker	67	22.3
Clerical, shop owner, farmer	28	9.3
Semi-professional	14	4.7
Professional	20	6.7
Occupation of Mothers:		
House wife	289	96.3
Worker (Private or government sector)	11	3.7
Socioeconomic classification (As per modified BG Prasad Scale-January 2024):		
Class I (Upper Class)	21	7
Class II (Upper Middle Class)	47	15.7
Class III (Middle Class)	101	33.7
Class IV (Lower middle Class)	118	39.3
Class V (Lower class)	13	4.3

Table 2: Assessment of weight for age of study population as per WHO growth chart (n=300)

Weight for age (Z-score)	Frequency (N)	Percentage (%)
High (> 2 SD)	24	8
Normal (In between + 2 to – 2 SD)	172	57.3
Low (≤ -2 to ≥ - 3 SD)	69	23
Very low (<-3 SD)	35	11.7
Total	300	100

Table 3: Association between socio-demographic factors and weight for age.

	Weight for Age					
Characteristics	High (n = 24) (%)	Normal (n = 172) (%)	Low (n = 69) (%)	Very Low (n = 35) (%)	Total (300) (%)	P-value
Age group						P-value = .107
02-06 Months	8 (10.8)	43 (58.1)	13 (17.6)	10 (13.5)	74 (24.7)	df=6
07-12 Months	2 (2.6)	46 (60.5)	15 (19.7)	13 (17.1)	76 (25.3)	X^2 = 10.447
13-24 Months	14 (9.3)	83 (55.3)	41 (27.3)	12 (8)	150 (50)	
Sex						
Male	9 (6.8)	74 (56.1)	35 (26.5)	14 (10.6)	132 (44)	P-value = .578
Female	15 (8.9)	98 (58.3)	34 (20.2)	21 (12.5)	168 (66)	df=3
						X^2 = 1.972
Religion						
Hindu	14 (8.9)	101(64.3)	28 (17.8)	14 (8.9)	157 (52.3)	P-value = .028
Muslim	10 (7)	71 (49.7)	41 (28.7)	21 (14.7)	143 (47.7)	df=3
						X^2 =9.115
Caste						
General	4 (7.4)	32 (59.3)	12 (22.2)	6 (11.1)	54 (18)	P-value = .977
OBC	13 (8.4)	85 (54.8)	39 (25.2)	18 (11.6)	155 (51.7)	df=6
SC/ST	7 (7.7)	55 (60.4)	18 (19.8)	11 (12.1)	91 (30.3)	X^2 = 1.188
Type of family						
Nuclear	8 (5.8)	74 (54)	36 (26.3)	19 (13.9)	137 (45.7)	p-value = .038
Joint	16 (9.8)	98 (60.1)	33 (20.3)	16 (9.8)	163 (54.3)	df- 3
						X^2 = .243
Education of father						
Illiterate	2 (5.6)	15 (41.7)	16 (44.4)	3 (8.3)	36 (12)	p-value = .015
Education up to Middle school	8 (7.5)	56 (52.3)	26 (24.3)	17 (15.9)	107 (35.6)	df – 9
						X^2 = 20.422
High school and intermediate	6 (5.9)	64 (63.4)	20 (19.8)	11 (10.9)	101 (33.7)	
Graduate and above	8 (14.3)	37 (66.1)	7 (12.5)	4 (7.1)	56 (18.7)	
Education of Mother						
Illiterate	4 (6.1)	35 (53)	18 (27.3)	9 (13.6)	66 (22)	p-value = .010
Education up to Middle school	7 (7)	53 (53)	25 (25)	15 (15)	100 (33.3)	df = 9
						X^2 = 21.700
High school and intermediate	7 (10)	36 (51.4)	23 (32.9)	4 (5.7)	64 (23.3)	
Graduate and above	6 (9.4)	48 (75)	3 (4.7)	7 (10.9)	64 (21.4)	
Occupation of father *						
Unemployed	0 (0)	2 (33.3)	1 (16.7)	3 (50)	6 (2)	p-value = .012
Unskilled worker	11 (11.8)	49 (52.7)	23 (24.7)	10 (10.8)	93 (31)	df = 6
Semiskilled worker	2 (2.8)	41 (56.9)	19 (26.4)	10 (13.9)	72 (24)	F – 14.479
Skilled worker	5 (7.5)	40 (59.7)	16 (23.9)	6 (9)	67 (22.3)	
Clerical, shop owner, farmer	1 (3.6)	17 (60.7)	8 (28.6)	2 (7.1)	28 (9.3)	
Semiprofessional	3 (21.4)	7 (50)	2 (14.3)	2 (14.3)	14 (4.7)	
Professional	2 (10)	16 (80)	0 (0)	2 (10)	20 (6.7)	
Socioeconomic status*						
Class I	3 (14.3)	16 (76.2)	2 (9.5)	0 (0)	21 (7)	P-value = .107
Class II	3 (6.4)	34 (72.3)	8 (17)	2 (4.3)	47 (15.7)	df =12
Class III	8 (7.9)	55 (54.5)	26 (25.7)	12 (11.9)	101 (33.7)	X^2 = 18.301
Class IV	9 (7.6)	62 (52.5)	30 (25.4)	17 (14.4)	118 (39.3)	
Class V	1 (7.7)	5 (38.5)	3 (23.1)	4 (30.8)	13 (4.3)	

*Df – degree of freedom, X^2 = Chi-square, F – Fisher's exact test, * Merged for chi-square test*

Table 4: Association between environmental factors and weight for age.

	Weight for Age					
Characteristics	High (n = 24) (%)	Normal (n = 172) (%)	Low (n = 69) (%)	Very Low (n = 35) (%)	Total = 300 (%)	P-value
Cross ventilation						
Present	18 (9.6)	109 (58.4)	33 (17.6)	27 (14.4)	187 (62.3)	.011
Absent	6 (5.3)	63 (55.7)	36 (31.9)	8 (7.1)	113 (37.7%)	df=3;X^2 = 11.174
Overcrowding						
Present	11 (6.5)	96 (57.1)	39 (23.2)	22 (13.1)	168 (56)	.640
Absent	13 (9.8)	76 (57.6)	30 (22.7)	13 (9.8)	132 (44)	df=3; X^2 = 1.685
Defecation facility						
Sanitary toilet	24 (8.2)	169 (57.9)	65 (22.3)	34 (11.6)	292 (97.4)	.294
Open field defecation	0 (0)	3 (37.5)	4 (50)	1 (12.5)	8 (2.6)	df=3; F = 3.831
Water purified before drinking						
Yes	7 (15.6)	27 (60)	8 (17.7)	3 (6.7)	45 (15)	.161
No	17 (6.7)	145 (56.9)	61 (23.9)	32 (12.5)	255 (85)	df=3; F = 5.077

Df – degree of freedom, X^2 = Chi-square, F – Fisher's exact test

Figure 1 Distribution of study population as per weight for age

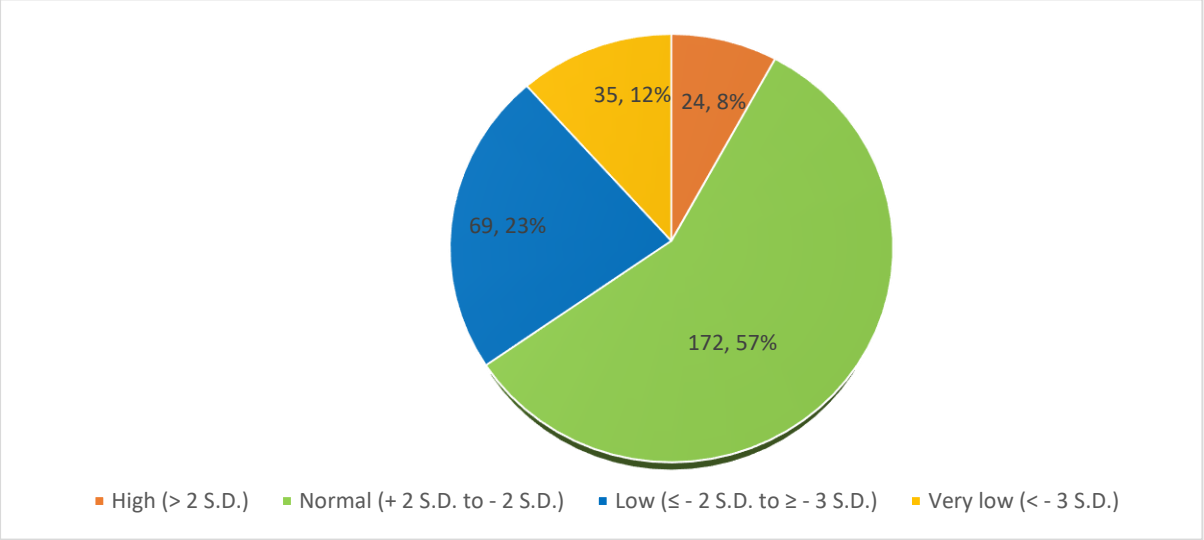


Figure 2: Association between mother education and weight for age of children

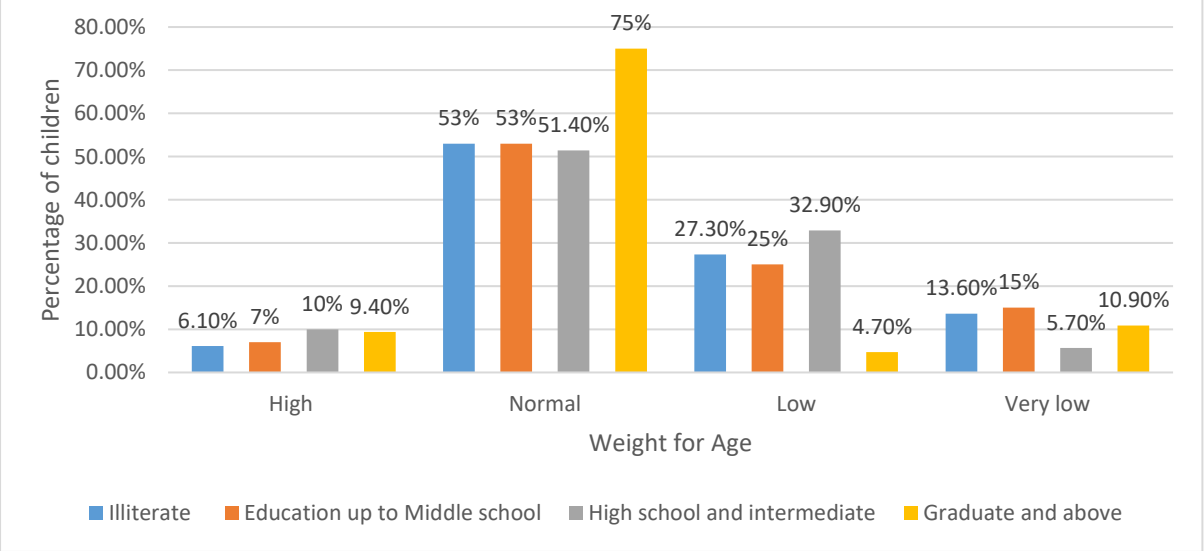
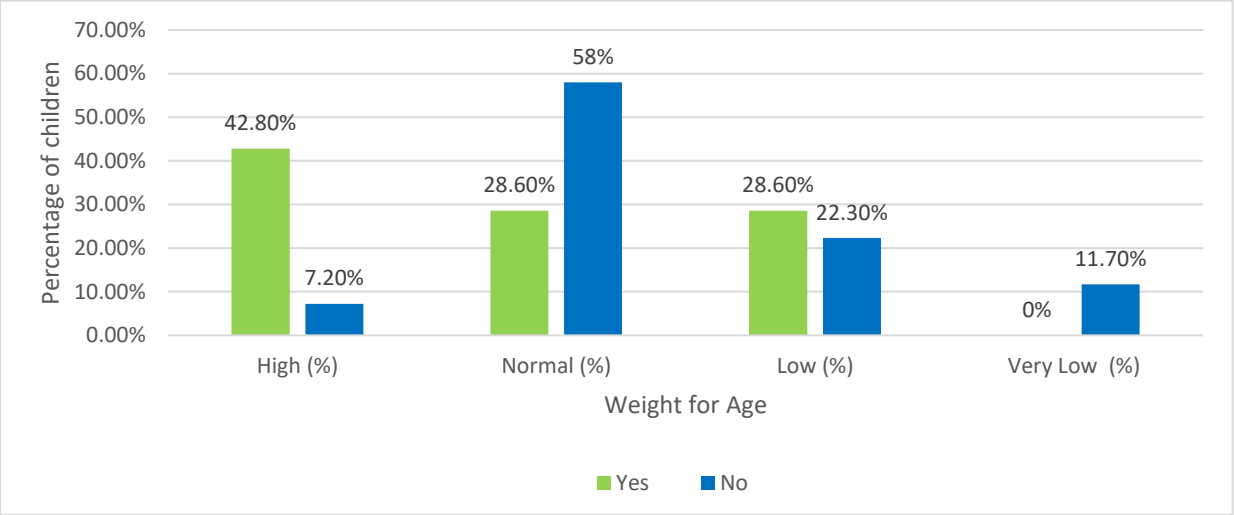


Figure 3: Association of Parental separation with children weight for age (n=300)



DISCUSSION

Our study showed a significant burden of undernutrition among children with 23% were underweight and 11.7% were severely underweight. Our findings were similar to study by Kalyan G et al(8) on 140 under five children in Haryana with 22.9% children underweight and 15.7% severely underweight. The rates of underweight (34.7%) in present were similar to NFHS-5 data for Uttar Pradesh (32.1%).(6) The findings of present study indicate that significant portion of children in study area are not receiving adequate nutritional intake for optimal physical growth.

Sociodemographic and Environmental Factors Influencing Growth of Child: The present study showed higher (47%) rates of underweight children in 7-24 months age group compared to 17.6% in 2-6 months age group, however no statically significant association was observed. Similarly, Saha et al(9) showed higher (19%) rates of underweight in 7-24 months compared to 17.8% in up to 6 months children. This indicates that older children had risk of malnutrition may be due to increased nutritional demand with increasing age. Male and female children did not significantly differ in weight for age. Muslim children having higher rates of undernutrition as compared to Hindu Children (p-value = 0.028). Singh A et al(10) showed no significant association of religion with undernutrition however higher rates of undernutrition in Muslim children (35.4%) as compared to Hindu religion children (31.8%). Our findings were similar to study conducted by Brainerd E et al(11), who reported disparities in anthropometric outcomes between Hindu and Muslim children in India. This difference may be due to socioeconomic factors, cultural practices, dietary practices and access to utilization of healthcare services in different religion. Higher rates of underweight were seen in OBC caste (25.2%) followed by general caste (22.2%) and SC/ST category (19.8%), however no statically significant association was observed. These findings were contrary to findings by Singh A et al(10) who reported highest undernutrition in ST category (69%) followed by SC (49.1%), OBC (29.8%) and general category (21.7%). We observed that children from nuclear homes were more likely to be underweight as compared to children from joint families with significant association of family type with child's weight(p-value=0.038). Similar findings were given by Kumar A et(12) al with higher rates of underweight in nuclear families (46.4%) as compared to non-nuclear family (40.5%). This might be due to reduced support for childcare in nuclear families as reported by Khodnapur B et al(13). Maternal education had significant association with children weight-for-age. Children of illiterate mothers had highest rates of underweight (27.3% underweight and 13.6% severely underweight) as compared to mothers with higher education. This was similar to various studies demonstrating maternal education had strong protective effect on child nutrition by Jain et al(14) and Rehan A et al(15). Educated mothers have better knowledge of nutrition, hygiene and healthcare practices which leads to improvement in child growth and development. Similarly, paternal education was also significantly associated with child weight-for age. Illiterate fathers had highest (44.4%) rates of underweight for age. This was consistent to finding of study by Kumari S et al(16)who concluded that paternal education and occupation plays important role in child growth and development. Higher education generally correlated with higher income and better access to resources like nutritious food,

safe water, sanitation facilities and healthcare services (Chaudhary et al)(17).

The findings of present study showed significant association (p-value =0.012) of father's occupation with child weight-for-age with unemployed fathers having highest rates of underweight (50%). Chaudhary et al(17) showed that parental occupation is important factor for family income and access to various resources for child growth and development. Higher rates of underweight seen in lower middle class (25.4% children with underweight) and lower class (23.1% children with underweight) compared to upper class and upper middle class but no statically significant association was found. Singh A et al(10) showed significant association of children nutrition status with socioeconomic class (p-value=0.032) with highest undernutrition in lower class (69.4%). Our study showed statistically significant association between parental separation with child weight for age (p-value=0.023). This may be due to disruption of home life and financial difficulties after parental separation. On analyzing the environmental factors, there was statistically significant association between cross ventilation and child weight-for-age (p-value = 0.011). Children living in houses with cross ventilation had lower rates of 'low' weight-for-age (17.6%) compared to those without cross ventilation (31.9%). This highlights the importance of home environment as good ventilation helps in less chances of respiratory infections, which may lead to undernutrition. Murarkar et al(18)reported that respiratory infections such as pneumonia and acute respiratory infection (ARIs) had negative impact on appetite of child with reduced nutrient absorption and increased energy demands which leads to growth faltering and undernutrition. The present study showed no significant association of underweight with overcrowding however Sharma A et al(19) found a strong correlation ($p<0.01$) between overcrowding and undernutrition in children, with children from overcrowded homes being twice as likely to be underweight as children from non-overcrowded families.

Conclusion

The study revealed a concerning burden of underweight indicating lack of sufficient nutrition to under two years children. Many sociodemographic factors like children religion, family type, parent education, father's occupation and parental separation and environmental factors like cross ventilation were associated with weight for age among under two years children in India.

Recommendation

Study emphasizes the need of targeted interventions for children with illiterate parents, unemployed father and children belonging to socioeconomically vulnerable populations, including communities with higher observed prevalence. It is also recommended that areas such as improved nutrition, safe drinking water supply and improved housing conditions should be focused along with improved hygienic practices among mothers and children.

Limitation of the Study

- Larger number of sample size can be used for future studies.
- Weight of urban and rural children can be compared.
- Sample size can be calculated by taking prevalence of underweight rather than developmental delay.

Relevance of the Study

By understanding the factors affecting child weight, improvement in nutritional status of children can be ensured and nourished children can fight the diseases more efficiently further growing as healthy adolescents.

Authors Contribution

All authors have contributed equally.

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Nil

Conflict of Interest

There are no conflicts of interest.

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Declaration of Generative AI and AI Assisted Technologies in the Writing Process

I affirm that no part of this study has been generated or solely written by AI and AI assisted technologies.

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