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Original Research Article

A comparative study to assess the nutritional status of preschool children attending the Anganwadi centres of selected urban and rural areas of Davangere

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ABSTRACT

Background: Children are the foundation of a nation, and those in rural areas and lower socio-economic groups are vulnerable to malnutrition. This study aimed to evaluate and compare the nutritional status of preschool children and the socio-demographic factors affecting their growth in urban and rural Anganwadi centers (AWCs) of Davangere district.
Methods: An observational, descriptive, cross-sectional survey was conducted in year May 2023 to October 2024 in both urban and rural AWCs of the Davanagere district. A total of 120 children aged 3-5years children were selected using multistage sampling and were screened using anthropometric measurements such as height, weight and mid upper arm circumference. Socio-demographic information was collected using self-structured questionnaire. Data were analyzed using SPSS v20 with $p<0.05$. Descriptive statistics and chi-square tests assessed associations between nutritional status and dichotomized sociodemographic variables.
Results: In urban areas, 10% of children had moderate underweight and 5% had severe underweight, moderate stunting and severe stunting each, and 11.6% and 1.6% had moderate wasting and severe wasting respectively; whereas in rural areas, 6.6% had moderate underweight and 13.3% had severe underweight, 16.6% had moderate stunting and 5% had severe stunting, and 15% had moderate wasting with 5% showing severe wasting. Malnutrition was found to be associated with factors such as age of mother at marriage, family type, birth weight, breastfeeding practice, colostrum given and economic status of family.
Conclusions: Malnutrition exists in both settings, driven by maternal and socio-economic factors, warranting targeted interventions.

Keywords: Anthropometric measurements, Nutritional status, Socio-demographic factors, Anganwadi centres

INTRODUCTION

Malnutrition in the first years of life continues to be one of the biggest global public health problems, accounting for substantial morbidity, mortality, and long-term developmental deficits among children under five years. This negatively affects physical growth, cognitive development, immune competence, and survival outcome. Severe forms of malnutrition, particularly wasting, are responsible for a large proportion of under-five deaths worldwide.[1] India carries one of the largest burdens of childhood undernutrition, accounting for millions of deaths among children aged 6-60 months.[2] According to world health organization estimates, a significant proportion of under-five children are stunted, wasted, or underweight, and about half of all child deaths globally are linked to undernutrition.[3] These years of rapid growth require adequate nutrition; it is therefore particularly disadvantageous if deficiencies are accrued at these vulnerable years, as this enhances vulnerability to

infections and has a negative impact on long-term health outcomes.

Due to vast socioeconomic disadvantages, maternal nutritional deficiencies, early marriage, suboptimal infant and young-child feeding practices, poor sanitation, and limited access to quality healthcare, malnutrition is very deeply entrenched in India. According to NFHS-5, 2019-2021, 36% of children under five years were stunted, 19% wasted, and 32% underweight, despite marginal improvements since NFHS-4.[7] Children belonging to rural communities, urban slums, tribal populations, and socioeconomically disadvantaged households are at a higher risk of multiple deprivations, which include poverty, inadequate dietary intake, and scant health services.[8]

To address these challenges, the government of India launched the integrated child development services (ICDS) scheme in 1975, one of the world's largest community-based early-childhood programs. ICDS delivers supplementary nutrition, preschool education, health check-ups, referral services, and nutrition and health education through AWCs.[6] AWCs serve as an essential platform for growth monitoring and early detection of undernutrition. However, several studies across Indian states have shown considerable variation in the nutritional status of children attending AWCs, with persistently high levels of underweight, stunting, and wasting reported in both rural and urban settings.[10-14] Previous research also highlights the influence of maternal anemia, birth weight, feeding practices, socioeconomic status, and morbidity patterns on child nutritional outcomes.[13,15-17]

Despite available national-level data, there is a scarcity of current district-level evidence regarding the comparison of the nutritional status of preschool children attending AWCs among urban and rural areas in Karnataka, with special reference to Davanagere district. Other studies have focussed on states like Andhra Pradesh, Kerala, Tamil Nadu, Rajasthan and West Bengal or on tribal populations.[10-14,18-23] Many earlier studies have varying sampling methods or age groups or outcome measures, which may not be generalizable. Most crucially, there is a lack of recent research showing how selected socio-demographic determinants, namely maternal factors, infant-feeding practices and household socioeconomic status, differentially affect growth patterns in Anganwadi beneficiaries in both urban and rural Davanagere. This lack of localized evidence inhibits policymakers and ICDS supervisors from undertaking site-specific targeted interventions responsive to the peculiar urban or rural needs. Considering the high burden of malnutrition in early childhood and the critical role of AWCs in growth monitoring, with a lack of comparative data from Davanagere district, this study was therefore undertaken to evaluate and compare the nutritional status of preschool children attending AWCs, both urban and rural, and assess the socio-demographic factors influencing their growth. This will help in providing locally relevant evidence to strengthen community-based nutrition programs and aid in formulating area-specific strategies to reduce under-nutrition. Hence, the present study aims at evaluating and comparing nutritional status among preschool children attending AWCs, with examination of socio-demographic determinants, both in urban and rural areas of Davanagere district.

Objectives

The primary objective of this study was to assess and compare the nutritional status of preschool children attending AWCs in urban and rural areas of Davanagere district. The secondary objective was to determine the prevalence of underweight, stunting, and wasting and identify the socio-demographic factors that may influence the nutritional status of the preschool children.

METHODS

In order to evaluate the nutritional status of preschoolers aged three to five, this observational, descriptive, cross-sectional study was carried out throughout AWCs in the Davangere district. Both urban and rural AWCs were included in the field-based survey setting.

Sampling method

The northeast, northwest, southeast, and southwest are the four administrative zones that make up Davangere district. Two zones were chosen at random by flipping a coin, and two AWCs were selected from each zone for urban sampling. Plus, two additional centers were chosen at random from the remaining zones. Simple random sampling was used to select ten children between the ages of three and five from each center, resulting in 60 urban participants. For rural sampling, a similar procedure was used. Three villages were selected at random, two AWCs were selected from each village, and ten children from each centre were randomly enrolled, resulting in 60 rural participants. Overall, 120 children were included in the study.

Eligibility criteria

Children aged three to five years as of 1 June 2023 were included. Children with missing data or known chronic illnesses were excluded.

Data collection and questionnaire administration

Data collection was done over a period of 18months (May 2023 to October 2024), timed on weekdays between 10:00 AM to 12:00 noon. Three trained investigators, including one principal investigator and two medical interns, conducted the questionnaire through structured interviews. Standardised instructions were given to ensure consistency and minimize bias.

Anthropometric assessment

Children were measured at their AWCs in presence of parent or caregiver. Measurements taken were weight (on a digital scale with a precision of 0.01 kg), height (on a calibrated stadiometer), and mid-upper arm circumference (MUAC). All measurements were plotted on WHO growth charts. The anthropometric examination was conducted by principal investigator, whose training ensured minimal intra-observer error (Kappa score=0.8).

Growth chart interpretation

WHO Z-score classifications were used. Growth was assessed under parameters such as weight-for-age, height-for-age, and weight-for-height. Z-scores below-2 indicated moderate malnutrition; below -3 indicated severe malnutrition. MUAC<11.5 cm was considered a marker of severe acute malnutrition.

Statistical analysis

Data were compiled using Microsoft excel and analysed with SPSS version 20. Descriptive statistics were reported as frequencies and percentages. Chi-square tests examined associations between nutritional status and socio-demographic factors, with $p<0.05$ considered statistically significant. Subgroup analysis was conducted by dichotomising socio-demographic variables.

RESULTS

The research evaluated the nutritional status of 120 preschool children between 3 to 5 years, divided equally between six urban and six rural AWCs in Davangere district. Sixty children (50%) were from urban centers and 60 (50%) from rural centers. The mean age of urban children was 3.84±0.56 years, and that of rural children was 4.14±0.62 years. In urban centres, most of them were female (68.3%), whereas in rural centres, males were the majority (56.7%). The majority of participants in both environments were local-born and Hindu (86.7%).

Nutritional status assessment

Anthropometric measures found noteworthy differences between urban and rural groups. In urban environment, 10% were moderately underweight and 5% severely underweight. Stunting was seen in 5% (moderate) and 5% (severe), while wasting was seen in 11.6% (moderate) and 1.6% (severe). There was a higher burden of malnutrition in rural areas: 6.6% were underweight moderate and 13.3% were severe underweight; stunting was 16.6% (moderate) and 5% (severe); and wasting was 15% (moderate) and 5% (severe) (Table 1).

Gender-wise distribution of nutrients

Among the urban areas, 46.3% of females were malnourished compared to 26.3% of males. In contrast, within the rural areas, 52.9% of males were malnourished compared to 38.5% of females. Although these differences were noted in both settings, the association between gender and malnutrition was not statistically significant (Chi-square=2.169; p=0.990).

Co-morbidities and hospitalization

The 78% of urban children and 72% of rural children did not have any acute illness at the time of the study. Morbidities of an upper respiratory infection, sore throat, fever, and gastrointestinal symptoms were prevalent.

The 27% of urban children and 35% of rural children had been hospitalized since birth, but this finding was not statistically significant (p=0.292).

Immunization status

All the children (100%) in both study groups were immunized according to age up to 1½ years as per the national immunization schedule.

Maternal factors

There was a positive association between child nutrition and the age at maternal marriage. Children of mothers married below 21 years were found to be more likely to be malnourished (62%) than those born to mothers who were married above 21 years (45%) (p=0.048).

Maternal anemia during pregnancy also showed a significant association. In rural children, 53% of those whose mothers were anemic during pregnancy were malnourished compared to 39.4% whose mothers were non-anemic (p=0.05) (Table 2). Similar trends were seen in urban participants.

Birth factors

In urban settings, 54.2% were normal vaginal deliveries (NVD) and 43.8% were lower segment cesarean sections (LSCS). In rural settings, 45.8% were NVD and 56.2% LSCS (p=0.042).

The average birth weight in malnourished children was significantly lesser than that of well-nourished children. Malnourished children in urban settings had an average birth weight of 2.25±0.28 kg compared to 2.74±0.27 kg in normally nourished children. The same pattern was observed among rural children (p=0.023), (Figure 2).

Colostrum intake had a relationship with improved nutritional status. Of children not given colostrum, 77.7% urban and 83.3% rural were malnourished. There was no statistical significance to this association.

The length of exclusive breastfeeding (EBF) was also strongly associated with nutritional status. Extended EBF longer than 6 months correlated with higher malnutrition:

in urban samples, 75.7% of malnourished children were compared with 52% of children who were normally nourished and had EBF >6 months. The same patterns were found in rural subjects (p=0.05) (Table 3).

Breastfed children aged >2 years had variable nutritional status. In urban settings, 37.5% of malnourished vs. 13.9% of well-nourished children were breastfed >2 years. In rural settings, children breastfed for <1 year were more likely to be malnourished (53.7%).

Supplementary feeding and diet

Bottle feeding was highly correlated with malnutrition. The rural children fed with bottles had 80% malnutrition against 48.3% of children with other methods of feeding or breastfeeding (p=0.05). Similar trends were seen in urban children.

The association between top feeding practices and malnutrition was analyzed among urban and rural preschool children. In urban areas, 37.3% of children who did not receive any top feeds were malnourished, compared to 55.6% of those fed cow's milk and 50% of those given formula feeds. Notably, the one child who received donkey's milk was well-nourished. In rural areas, 46.3% of children who did not receive top feeds were malnourished, while 39.4% of those fed cow's milk and 0% of those given formula feeds were malnourished, the association was not statistically significant (Chi-square=3.101; p=0.541).

Socio economic status and family type and number of family members

The study demonstrated a clear association between malnutrition and socioeconomic indicators such as socioeconomic class, family type, and number of family members. Based on the modified Kuppuswamy scale (2024), malnutrition was more common in children from lower socioeconomic classes: 66.7% of malnourished rural children and 50% of urban malnourished children belonged to lower or lower-middle classes.

Family type also influenced nutritional outcomes-58.3% of malnourished urban children and 64.3% of malnourished rural children came from nuclear families. In contrast, children from joint families had comparatively lower malnutrition rates (41.6% in urban and 35.7% in rural areas) (Table 5).

The number of family members played a contributing role as well. Among families with more than five members, 60% of urban and 68% of rural children were malnourished, suggesting that larger family size may strain nutritional resources. These findings underscore the influence of household structure and economic capacity on preschool child nutrition.

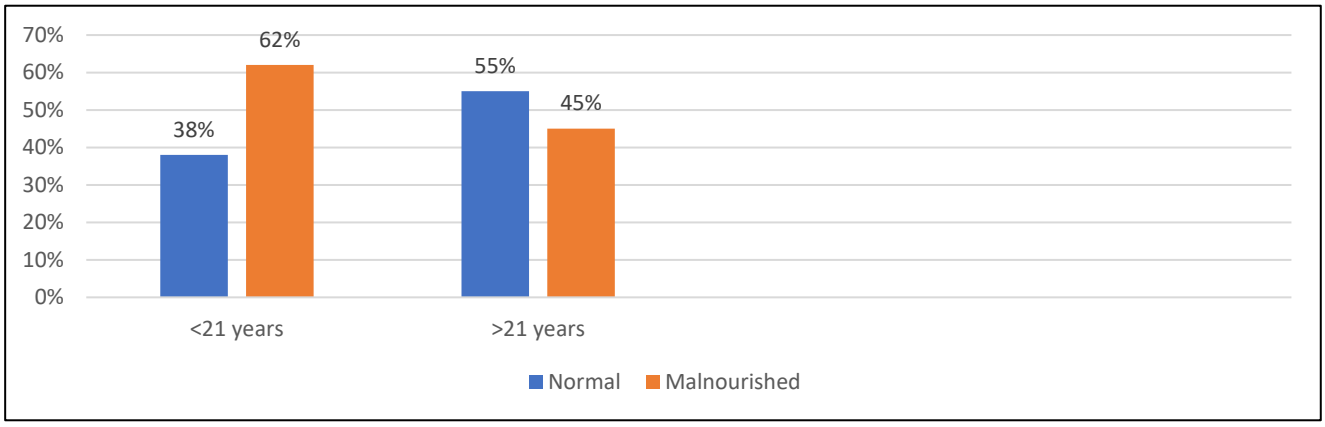

Figure 1: Association between nutritional status of children and age of mother at her marriage.

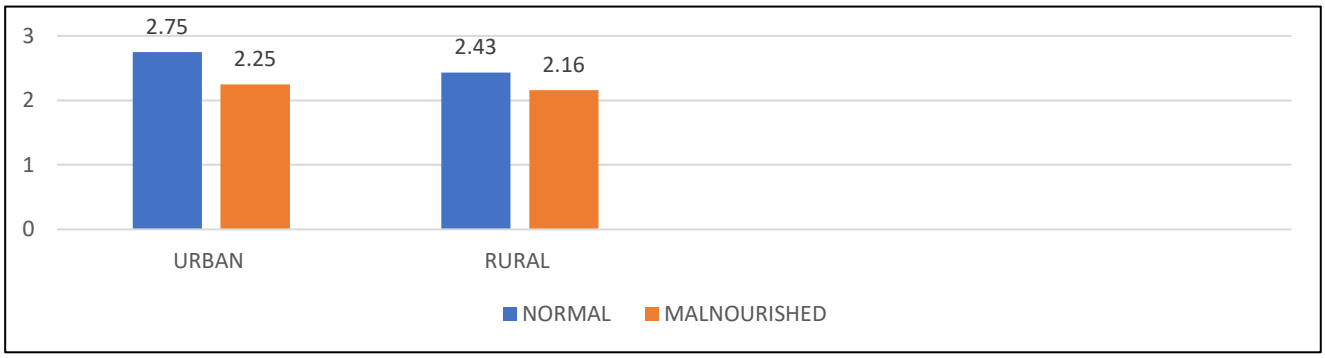

Figure 2: Mean birth weight and nutritional status of children feeding practices.

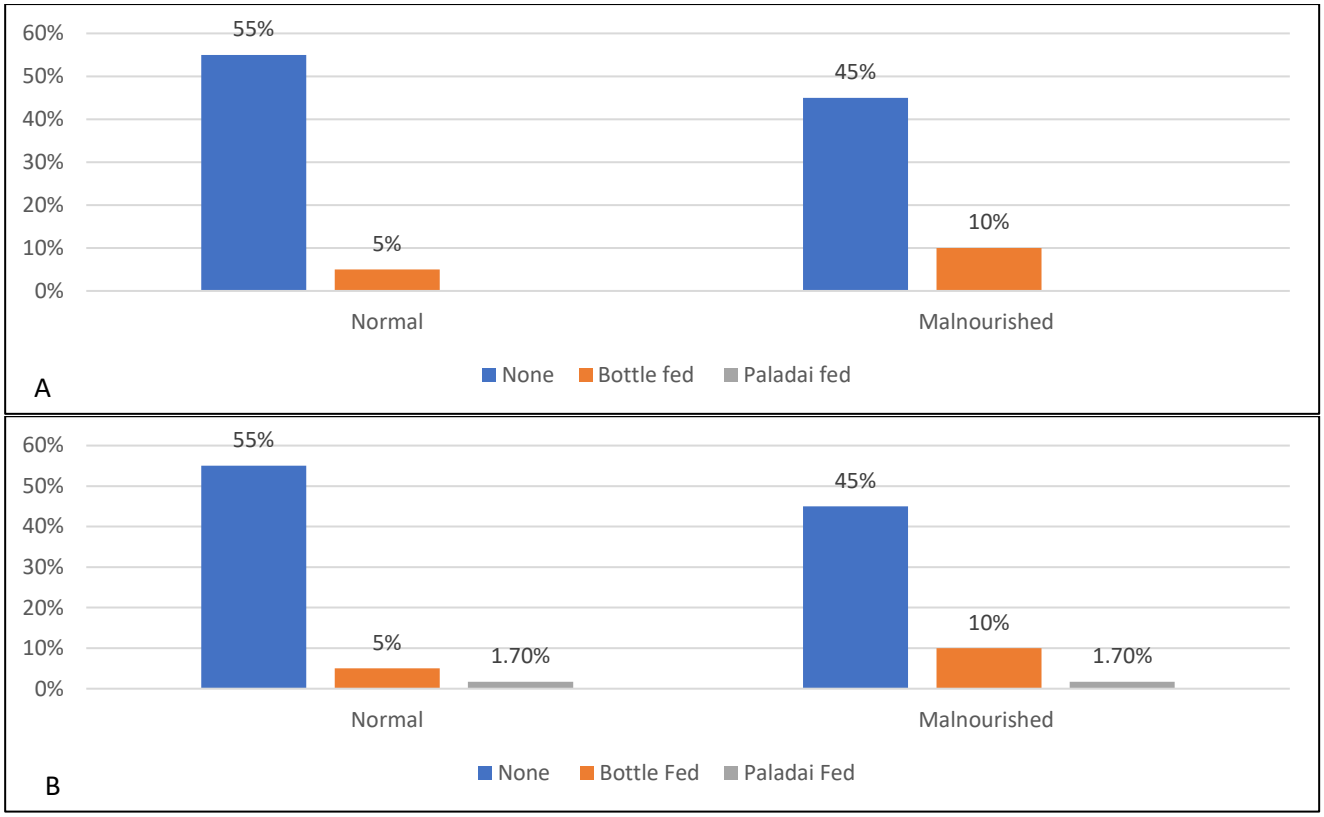

Figure 3 (A and B): Feeding practice and nutritional status of children in urban centre. Feeding practice and nutritional status of children in rural centre.

Table 1: Nutritional status of children in both urban and rural residency.

Nutritional status	Urban, (n=60)	Rural, (n=60)	X^2 value	P value
Normal	36 (60%)	22 (36.6%)	11.071	0.136 (NS)
MAM	7 (11.6%)	9 (15%)		
SAM	1 (1.6%)	3 (5%)		
Moderate stunting	3 (5%)	10 (16.6%)		
Severe stunting	3 (5%)	3 (5%)		
Moderate underweight	6 (10%)	4 (6.6%)		
Severe underweight	3 (5%)	8 (13.3%)		
Overweight	1 (1.6%)	1 (1.6%)		
Obese	0	0		

*NS-not significant

Table 2: Association between anaemia among mothers during pregnancy and nutritional status of children.

Anaemia	Urban, (n=60)		Rural, (n=60)		X^2 value	P value
	Normal	Malnourished	Normal	Malnourished		
Present	11 (52.4%)	10 (47.6%)	10 (37%)	17 (53%)	-	-
Absent	25 (64.1%)	14 (35.9%)	20 (60.6%)	13 (39.4%)		

Table 3: Association between duration of EBF feeding and nutritional status of children.

Duration of EBF	Urban, (n=60)		Rural, (n=60)		X^2 value	P value
	Normal	Malnourished	Normal	Malnourished		
<6 months	0	1 (2.7%)	6 (19%)	2 (9%)	3.390	0.05(s)
6months	2 (9%)	0	18 (56%)	2 (17.8%)		
>6 months	12 (52%)	28 (75.7%)	8 (25%)	22 (78.6%)		
No EBF	9 (39%)	8 (21.6%)	0	0		

Table 4: Use of top feeds and nutritional status of children.

Top feeds	Urban, (n=60)		Rural, (n=60)		X^2 value	P value
	Normal	Malnourished	Normal	Malnourished		
None	32 (62.7%)	19 (37.3%)	29 (53.7%)	25 (46.3%)	3.101	0.541
Cow's milk	4 (44.4%)	5 (55.6%)	32 (60.6%)	3 (39.4%)		
Buffalo's milk	0	0	0	0		
Formula milk	1 (50%)	1 (50%)	1 (100%)	0		
Donkey's milk	1 (100%)	0	0	0		

Table 5: Socio -economic class and nutritional status of children.

Socioeconomic class	Urban, (n=60)		Rural, (n=60)		X^2 value	P value
	Normal	Malnourished	Normal	Malnourished		
Class III	22 (64.7%)	7 (27%)	8 (20.5%)	8 (28.6%)	8.323	0.016 (S)
Class IV	7 (20.6%)	12 (46%)	15 (46.9%)	4 (14.3%)		
Class V	5 (14.7%)	7 (27%)	9 (28.1%)	16 (57.1%)		

*S-significant

DISCUSSION

Demographic factors and child nutrition

The present study assessed 120 preschool children aged 3-5 years from urban and rural AWCs in Davangere, Karnataka. The mean age of children was 3.84±0.56 years in urban and 4.14±0.62 years in rural areas, which is comparable to findings from Carolin et al, Najiya et al and George et al where most participants were aged 3-4 years.[4-6,27-29] Of the total sample, 44.1% were boys and 55.9% were girls, which closely matches studies by Sangeetha and Priyadarsini in Tamil Nadu.[7] Gender did not show a significant association with malnutrition in the present study, a finding supported by other national research.[34]

Comorbidities and healthcare utilization

Study found that 14% of children had upper respiratory tract infections (URTI), consistent with Carolin et al who reported a 20% URTI prevalence.[4] Frequent hospital visits were noted in 30.8% of sample, often for respiratory, gastrointestinal/urinary infections. Muse et al reported a similar trend in Ethiopia, with 33% of children under 5 having hospital visits for acute infections.[8]

Immunization status

All children in present study had completed immunization as per the national immunization schedule. This indicates a positive health-seeking behavior, in contrast with Debnath et al in Pune who reported only 10% immunization coverage among severely malnourished children.[9]

Maternal factors and birth outcomes

Early maternal age at marriage was significantly associated with the malnutrition. Of the malnourished children, 62% were born to mothers married before 21 years, consistent with Raj et al who demonstrated that early maternal marriage negatively affects child health due to lower maternal education and restricted access to care.[10]

Maternal anemia during pregnancy was also closely associated with child malnutrition-47.6% of urban and 53% of rural malnourished children were born to anemic mothers. This finding is supported by Black et al who showed increased stunting and low birth weight in such cases and Rahman et al who reported a 29% increased risk of LBW and a 21% increased risk of preterm birth.[11,12]

Low birth weight (LBW) and prematurity were more common in malnourished children. Christian et al. found that LBW was associated with significantly higher odds of stunting (OR=1.46), wasting (OR=1.33), and underweight (OR=1.76).[13-15] Although gestational age was not statistically significant in this study, 50% of urban and 60% of rural preterm babies were malnourished.

Infant and young child feeding practices

Colostrum, an essential source of immunity and nutrition, was not given to 77.7% of malnourished urban and 83.3% of rural children. This aligns with studies showing that children deprived of colostrum are at increased risk of infections and growth failure.[16,17]

Initiation of breastfeeding within the first hour of birth showed better outcomes, though the association was not statistically significant. Debes et al and Setegn et al previously reported that delayed initiation increases neonatal morbidity and undernutrition.[18,19] Urban children had a higher proportion of delayed initiation (50%) compared to rural children (33.3%).

Weaning practices were suboptimal. Malnourished children had a slightly higher mean age of weaning, indicating delayed complementary feeding. WHO recommends the introduction of nutritionally adequate complementary foods at six months supported by Rao et al who found late weaning to be linked to undernutrition.[20-22]

EBF beyond six months was significantly associated with malnutrition (p=0.05). While EBF is protective during the first six months, continued exclusivity beyond this period without complementary feeding results in nutrient deficiencies. Dewey and Adu-Afarwuah reported that late complementary feeding impairs protein and micronutrient intake.[23]

Top feeds and feeding methods

Children who received cow's milk or were bottle-fed had higher rates of malnutrition. Dewey and Chaparro and Patel et al. found similar outcomes, linking early introduction of cow's milk to iron deficiency and gastrointestinal infections.[24,25] Kaur et al emphasized the risks of bottle feeding, including microbial contamination and diarrheal disease.[26]

Caloric and protein deficit

Urban malnourished children showed higher mean calorie deficits compared to rural ones. Kaur et al and Singh et al suggested that poor diet quality and high processed food consumption contribute to this urban deficit, although Maiti et al found rural children to have greater overall deficits.[27-29]

Family type, size, and socioeconomic status

Family structure and SES significantly influenced nutrition. In urban areas, 57.7% of malnourished children were from joint families; in rural areas, this was 60.6%. Ghosh et al highlighted that both large and joint families may limit personalized child care and strain resources.[30]

Socioeconomic status was significantly associated with malnutrition (p=0.016). Most malnourished urban children were from class III or IV, while 57.1% of rural malnourished children belonged to class V. These findings echo those of Meshram et al and Kandpal et al who reported higher malnutrition among lower socioeconomic strata.[31,32]

Prevalence of malnutrition

Urban children had better nutritional status (60% normal) compared to rural children (36.6% normal). SAM and MAM were more prevalent in rural areas, similar to NFHS-5 findings.[2] A small number (1.6%) of children were overweight, reflecting India's emerging double burden of malnutrition.[26] MUAC assessments showed most children had values >12.5 cm, indicating the usefulness of this tool in community-level screening.

Limitations

The study has certain limitations. The sample size is small, n=120, selected through multistage sampling among only twelve AWCs, and hence may not be truly representative or generalize for all pre-school children of Davanagere district. It is a cross-sectional study, and hence, any causal relationship between socio-demographic factors with the nutritional status cannot be proposed. Anthropometric measurements, though standardized, may still have minor measurement errors, and dietary assessment by a single 24-hour recall may not reflect the habitual intake. Additionally, some possible confounders like detailed morbidity history, parental nutritional status, and household food insecurity are not fully captured.

CONCLUSION

The findings of this study suggest that malnutrition is present in both urban and rural settings. Contributing factors include maternal anemia during pregnancy, preterm births, low birth weight, extended periods of EBF, delayed initiation of breastfeeding, introduction of animal milk in place of human milk, and low socio-economic status. These factors appear to play a significant role in the nutritional status of preschool children attending AWCs in Davangere district.

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