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Caregivers' perceptions of feeding practices and diet diversity among children aged 12–59 months in a rural district of South India: an analytical cross-sectional study

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ABSTRACT

Objective The primary objective of this study was to assess caregivers' perceptions of feeding practices (breastfeeding and complementary feeding) and diet diversity among children aged 12–59 months in a rural district of South India. The secondary objective was to identify potential predictors of these perceptions and diet diversity.

Design An analytical cross-sectional study was performed from March 2023 to May 2023.

Setting In a rural district of Tamil Nadu, South India.

Participants This study included 301 mothers/caregivers of children between 12 and 59 months of age in a rural district of Tamil Nadu. The research gathered demographic information from caregivers, including details such as age, educational background, occupation, relationship with the child and place of residence. Additionally, the caregivers' perspectives were evaluated through a questionnaire focused on breastfeeding/complementary feeding, and the diet diversity of the children was also assessed.

Outcome measures The primary outcome was the perceptions of mothers/caregivers of children between 12 and 59 months of age about breastfeeding/complementary feeding practices, and the diet diversity of the children was measured. Additionally, predictors associated with these perceptions were evaluated through regression analysis.

Results In the present study, 188 (62.5%) and 179 (59.5%) of the participants had good perceptions of breastfeeding practices and complementary feeding practices, respectively. This binomial regression revealed that subjects with unstable occupations (adjusted OR=2.24, 95% CI 1.25 to 4.01), schooling (7.71, 95% CI 2.73 to 8.9) and higher education (38.32, 95% CI 4.63 to 316.85) had increased chances of having good perceptions of breastfeeding practices. Subjects with unstable occupations (0.23, 95% CI 0.06 to 0.85), stable occupations (0.13, 95% CI 0.04 to 0.51), schooling (0.43, 95% CI 0.25 to 0.74), higher education (0.15, 95% CI 0.04 to 0.50) and increased birth weights (2.54, 95% CI 1.35 to 4.78) had increased chances of having good perceptions of complementary feeding practices (p<0.05). This study revealed that 86.4% of the children had adequate diet diversity.

Conclusion The study revealed that most caregivers, particularly mothers, possess a strong understanding of breastfeeding and complementary feeding practices, with education and occupation exerting a notable influence. However, there is a crucial necessity to translate this knowledge into practical applications to effectively obtain feeding indicators.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The use of random sampling to select villages, wards and households reduced selection bias and enhanced the representativeness of the sample, thereby increasing the generalisability of the findings to the larger population in the rural district.
⇒ The use of a well-validated perception questionnaire, which is based on guidelines from recognised organisations (Ministry of Health, Republic of Uganda, and UNICEF), ensures that the assessment of caregivers' perceptions is reliable and valid.
⇒ The use of the interview method in the collection of data resulted in the absence of response bias. The use of a regression model for analysis was used to assess the predictor variables.
⇒ The lack of assessment of the health status of children, including anthropometric parameters such as weight and height, is a limitation.
⇒ The assessment of perceptions of breastfeeding and complementary feeding using questionnaire scales might have introduced subjective interpretations,which can lead to misclassification errors.

INTRODUCTION

The beginning years of life, especially before the age of 5, are extremely important for obtaining the best possible growth and nutrition. This phase is crucial for achieving

important stages of growth that involve social, physical and mental aspects and have a substantial influence on a child's life. Importantly, during the early years of development, approximately 40% of physical growth and 80% of mental development take place in children.[1] The first 1000 days of an individual's existence, which includes the period from conception to the age of 2, are crucial stages for the development of the body, brain, metabolism and immune system. This period represents both significant opportunities and susceptibility in a child's life. The provision of nourishment and care to both mothers and children during this period has an enormous influence on a child's capacity to grow, acquire knowledge and flourish. The developmental trajectory of a child's brain is significantly influenced during this period, establishing the foundation for their future health consequences.[2–5] The nutritional quality of children's diets is of utmost importance throughout the first 5 years of their lives, surpassing any other period. Introducing appropriate complementary foods and following correct feeding practices during this crucial phase greatly contributes to promoting child survival, good growth and development. Moreover, these methods aim to prevent the potential hazards of micronutrient deficiencies, disease and obesity in subsequent phases of life.[6 7]

Undernutrition among children under the age of 5 poses a significant public health challenge in India. The country's high prevalence of underweight children underscores the severity of the issue. Moreover, malnutrition is concentrated in specific regions, with certain states, districts and villages bearing the brunt of the problem. According to reports from the National Family Health Survey-5, alarming statistics reveal that 35.5% of children were stunted, 32.1% were underweight, 19.3% were wasted, 7.7% suffered from severe wasting and 3.4% were overweight.[8]

Research suggests that malnutrition is strongly associated with the family structure within a child's living environment since it actively influences and strengthens behaviours connected to nutrition.[9–11] The impact of breastfeeding on future weight status might demonstrate metabolic or behavioural programming, where its effects emerge later in life, possibly during adolescence or adulthood. The sensory properties of breast milk could aid in the transition to an adult diet. The introduction of complementary feeding presents a pivotal opportunity for children to explore new foods, exposing their senses to diverse stimuli. The implementation of appropriate food practices during infancy and early childhood establishes the foundation for children to attain their maximum growth and developmental capacity. The child's physical and mental development is highly dependent on the intake of nutrients and engagement in social interactions throughout this crucial phase.[12] The first 3 years of life are particularly sensitive to perceptions, cognitions and behaviours related to food. Children's preferences for foods, such as vegetables, are shaped by their experiences, with early childhood serving as a crucial period for establishing food preferences and dietary habits that impact long-term consumption patterns.[13–15]

Caregivers are pivotal in shaping a child's personality and fostering their physical, emotional and cognitive development. They create food environments and influence children's experiences with eating. Children often emulate their caregivers' eating behaviours, lifestyle choices and attitudes towards food and body image. Initially, caregivers make food decisions for children, but by the age of 3 or 4, children begin to assert autonomy in feeding behaviours. This transition from reliance on caregivers to independent but contextually limited food choices is crucial in establishing lifelong eating habits. Informed caregiver decisions are essential for improving the diets of toddlers and preschoolers and can positively impact long-term health outcomes.[9 16–22]

Studies conducted in South India regarding the feeding practices of young children revealed that most subjects met most of the recommended indicators, including exclusive breastfeeding, early initiation of breastfeeding and optimal complementary feeding.[23–26] It is crucial for parents to be knowledgeable about proper feeding practices to enhance their child's health and immunity. Therefore, regular assessments should be conducted to gauge parental awareness in the current context, allowing for necessary interventions to educate parents on healthy feeding practices. There is a notable absence of studies in this region, that is, the rural backward district in Tamil Nadu, that explore caregivers' perceptions of feeding practices.

Objectives

The primary objective of this study was to assess caregivers' perceptions of feeding practices (breastfeeding and complementary feeding) and diet diversity among children aged 12–59 months in a rural district of South India. The secondary objective was to identify potential predictors of these perceptions and diet diversity.

METHODS

Sample selection

A community-based cross-sectional study was conducted in the field practising area (urban or rural) of a private medical college in the Perambalur district over a span of 3 months from March 2023 to May 2023 among mothers/caregivers of children between 12 and 59 months of age. The samples were taken randomly from five villages from rural areas (out of 18 villages) and five wards (out of 22 wards) from urban areas. The villages and blocks were selected randomly, and the subjects from each of these villages and blocks were selected through systematic random sampling. The investigators listed out houses with children under 12–59 months of age. The list was procured from village health inspectors assigned through the private medical college. In this study, 30 samples were collected from every village and ward. The samples were selected from every third house in the list, and the

next house was selected if the sample was not present at the time of visit. This was done until the sample size was reached.

The sample size was calculated based on the assumption that 50% of the caregivers had good perceptions of breastfeeding and by substituting for the formula $n=z_{\alpha}^{2}\ pq/d^{2}$ [z_{α}=1.96, p=50%, q=50%, d=6%], the sample size calculated with an 80% response rate was 296. The final number of samples collected was 301.

Data collection

The data were collected via the interview method by the investigators, who assessed the following details from the caregivers. In this study, much emphasis was placed on the proper design of data gathering tools to ensure the quality of the data collected. To maintain uniformity, the questionnaire was initially prepared in English before being translated into Tamil and back into English by the authors and experts.

The demographic data of the caregivers included their age, education, occupation, relationship with the child and residence. Data on the child, such as birth weight and birth order, were collected. The perception of the caregiver was assessed with a perception questionnaire regarding breastfeeding and complementary feeding. The questions were prepared from the guidelines of maternal, infant, young and adolescent nutrition by the Ministry of Health, Republic of Uganda, and UNICEF.[6 27]

- Caregivers' perceptions of feeding practices. Caregivers' understanding of challenges in breastfeeding, expressing and storing breast milk, the advantages of breast milk for both mothers and children, the optimal timing for breastfeeding and the introduction of complementary feeding alongside breastfeeding were assessed. Questions related to complementary feeding focused on when to initiate it, what foods to include and its significance alongside breastfeeding. The evaluation of perception levels in breastfeeding and complementary feeding was based on percentiles, with scores computed (agree=1, disagree/don't know=0). Scores equal to or exceeding the 50th percentile indicated good perceptions of breastfeeding (≥11) or complementary feeding (≥12). The questionnaire's internal consistency was evaluated via Cronbach's alpha, which demonstrated good consistency for breastfeeding (0.73) and complementary feeding (0.81).
- Diet diversity was assessed based on the variety of foods and food groups provided to their children. Data on food consumption were gathered through a 24-hour dietary recall method, encompassing 21 food items the child had consumed the previous day. These items included grains; roots; tubers such as porridge and bread; dairy products; various flesh foods such as fish, mutton, chicken and eggs; and vitamin A-rich fruits and vegetables such as carrots, papaya, pumpkins and mangoes. Additionally, other items, such as chocolates, cakes and biscuits, were included. In accordance with the WHO Infant and Young Child Feeding (IYCF) guidelines, these food items were categorised into seven food groups. The diet diversity of the child was scored from 0 to 7, indicating the range from no consumption of the 21 items to consumption from all seven food groups. Adequate diversified dietary intake was considered achieved if the child had consumed items from at least four of the seven food groups, while a score of 3 or less was deemed inadequate.[28 29]

The study variables

Independent variables

- Sociodemographic characteristics: age, education level, occupation and residency.
- Child-related factors: birth weight.

Dependent variables

- Caregivers' perceptions of breastfeeding practices and complementary feeding practices: good and poor.
- Dietary diversity: adequate and inadequate.

Data analysis

The collected data were entered into Microsoft Excel and analysed via SPSS V.26 software (IBM. Released 2019; IBM SPSS Statistics for Windows V.26.0: IBM). For the primary objective, we used descriptive statistics, presenting categorical data as frequencies and percentages, and continuous data as means and standard deviations. To address the secondary objective, we first conducted bivariate analyses (independent t-test, Fisher's exact test and χ^2 test) to explore associations between variables. We then employed multivariable logistic regression models to identify potential predictors of caregivers' perceptions and dietary diversity. A regression model was used to determine the independent predictors of caregivers' perceptions of breastfeeding and complementary feeding practices and to identify potential confounders of good perceptions. The results from the regression models were expressed via adjusted ORs (AOR) along with 95% CIs. All variables with a p value <0.1 in the independent models were taken (to accommodate maximum confounders into the model) for the final regression model to determine the predictors for good perceptions of breastfeeding and complementary feeding practices. The regression coefficients were tested via the Wald statistic. The regression model was deemed fit via the Hosmer-Lemeshow test (p>0.05). The logistic regression model was assumed to be statistically significant if the p value was <0.05. Our study is described in line with the Strengthening the Reporting of Observational Studies in Epidemiology checklist[30] (online supplemental file 1) and a methodology diagram (online supplemental file 2).

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting or dissemination plans of our research.

Table 1 Caregiver perceptions of breastfeeding practices

	Agree n (%)	Disagree n (%)	Don't know n (%)
Breastfeeding within an hour after birth	288 (95.7)	4 (1.3)	9 (3)
Not to give prelacteal feeds	243 (80.7)	34 (11.3)	24 (8)
Exclusive breastfeeding involves only breastfeeding	279 (92.7)	13 (4.3)	9 (3)
Exclusive breastfeeding for a period of 6 completed months	280 (93)	12 (4)	9 (3)
Breast milk is sufficient for 6 months of age	278 (92.4)	11 (3.6)	12 (4)
Baby fed on demand during exclusive breastfeeding	259 (86)	19 (6.3)	23 (7.7)
Baby and mother benefited during exclusive breastfeeding	276 (91.7)	8 (2.7)	17 (5.6)
Presence of ways to express and store breast milk	176 (58.5)	17 (5.6)	108 (35.9)
Seek professional help during breastfeeding difficulties	261 (86.7)	3 (1)	37 (12.3)

RESULTS

The interviews were conducted with 301 mothers/caregivers. Their characteristics, such as their sociodemographic profile and feeding practices, are presented in the online supplemental table. In this study, education is categorised as nil/school/higher (degree, diploma, graduate and postgraduate), and occupation is categorised as nil/stable (salaried and retired with pensions)/unstable (agriculture, business and daily wagers). In this study, 83.1% of the study participants were mothers (n=250), with a mean age of 30.79±11.36 years.

Caregiver perceptions of breastfeeding and complementary feeding practices/diet diversity

Table 1 shows the caregiver perceptions of breastfeeding practices. By calculating the total score of perceptions, 188 (62.5%) caregivers had good perceptions of breastfeeding practices. Table 2 shows the perceptions of complementary feeding practices among caregivers. In the present study, 179 (59.5%) of the subjects had good perceptions of complementary feeding practices.

The type of food given by the caregiver to the child for the past 24 hours is depicted in the online supplemental figure. The study revealed that most of the participants consumed carbohydrate-rich foods (99.7%), dairy products (95.3%), fruits/vegetables (76.1%), vitamin A-rich fruits (73.8%), eggs (57.5%) and sugary foods such as chocolates/biscuits/cakes (57.1%). The diet diversity score was assessed for the children aged 12–59 months and revealed that 41 (13.6%) children had inadequate diet diversity.

Table 3 shows the associations between caregiver perceptions of breastfeeding practices and demographic variables. The primary analysis revealed that older individuals, subjects with unstable occupations, those with higher education levels, those living in urban areas and those in wards with decreased birth weights had good perceptions of breastfeeding. Multivariable logistic regression revealed that education and occupation were predictor variables after regressing for other variables (age of caregiver, residence and birth weight of the ward). The chance of having good perceptions of breastfeeding was 7.71, 38.32 and 2.24 times greater, respectively, among those with higher education levels and those with unstable occupations.

Table 4 shows the associations between caregiver perceptions of complementary feeding practices and demographic variables. The primary analysis revealed that subjects with unstable occupations, higher education levels and wards with increased birth weights had good perceptions of complementary feeding. Multivariable logistic regression revealed that education, occupation and birth weight were predictor variables after regressing for other variables. Caregivers of children with higher birth weight were 2.54 times more likely to have good perceptions of complementary feeding practices (AOR=2.54, 95% CI 1.35 to 4.78). Caregivers with formal education (including both basic schooling (AOR=0.43, 95% CI 0.25 to 0.74) and higher education (AOR=0.15, 95% CI 0.04 to 0.50)) and those with either stable (AOR=0.23, 95% CI 0.04 to 0.51) or unstable (AOR=0.13, 95% CI 0.06 to 0.85) occupations demonstrated significantly lower odds of having a good perception of complementary feeding practices. Compared with those without formal education, caregivers with basic schooling had 57% and those with higher education had 85% lower odds of having a good perception of complementary feeding practices. Caregivers with stable occupations had 77% and those with unstable occupations had 87% lower odds of having a good perception of complementary feeding practices.

Table 5 shows the associations between diet diversity adequacy and sociodemographic variables. The results revealed that 23 (18.3%) wards of caregivers with no occupation had inadequate diet diversity in comparison to 18 (11.5%) wards of caregivers with unstable occupations. Additionally, 27 (19.6%) of the wards in which caregivers resided in rural areas had inadequate diet diversity in comparison to 14 (8.6%) in urban areas.

DISCUSSION

The study was performed with the objective of assessing the caregiver's perception of the feeding practices (breastfeeding and complementary feeding) of children

Table 2 Caregiver perceptions of complementary feeding

Complementary feeding		n	%
The child should be weaned at 6 completed months	Agree	289	96.0
	Disagree	2	0.7
	Don't know	10	3.3
Complementary feeds increase the weight and appetite of the child	Agree	289	96.0
	Disagree	4	1.3
	Don't know	8	2.7
The child should be fed on demand for breast milk after the start of complementary feeding	Agree	273	90.7
	Disagree	10	3.3
	Don't know	18	6.0
Recommendation for continuation of breastfeeding until 2 years	Agree	247	82.1
	Disagree	17	5.6
	Don't know	37	12.3
The breast milk alone is not sufficient (enough)/ cannot supply all the nutrients needed for growth/from 6 months, baby needs more food in addition to breast milk	Agree	286	95.0
	Disagree	7	2.3
	Don't know	8	2.7
When you are starting with complementary feeding, start with milder single foods like ragi, carrot and apple	Agree	277	92.0
	Disagree	14	4.7
	Don't know	10	3.3
Home-based meals would be better for complementary feeding	Agree	284	94.4
	Disagree	13	4.3
	Don't know	4	1.3
The child should be given plenty of fluids along with the meal	Agree	278	92.4
	Disagree	12	4.0
	Don't know	11	3.6
It is always better to have a separate plate and spoon for the baby at the start of feeding	Agree	229	76.1
	Disagree	43	14.3
	Don't know	29	9.6
You should prepare separate complementary feeds for children	Agree	212	70.4
	Disagree	43	14.3
	Don't know	46	15.3

between 12 and 59 months of age and assessing the diet diversity among the children.

The study assessed caregivers' perceptions of breastfeeding and complementary feeding practices among children aged 12–59 months, revealing that 62.5% and 59.5% of respondents exhibited good perceptions regarding breastfeeding and complementary feeding practices, respectively. However, significant gaps in knowledge have been identified in specific areas, such as expressing and storing milk, administering prelacteal feeds, determining feeding times during exclusive breastfeeding and seeking professional assistance for breastfeeding difficulties. Similarly, ignorance regarding complementary feeding practices, such as preparing separate food for children and using separate cooking utensils, was also noted.

Our finding that 62.5% of caregivers had good perceptions of breastfeeding practices is consistent with a study in South Africa where 67% of caregivers had good feeding knowledge, with a high awareness of breastfeeding initiation (96.5%), positive perceptions of exclusive breastfeeding for the first 6 months (59.3%) and the importance of breast milk (90.7%).[31] In a study performed in Kenya,[32] 98.7% of caregivers believed that breastfeeding should continue beyond 6 months, highlighting the importance of caregiver education for positive attitudes towards feeding practices. A study in North India[33] revealed that most mothers understood the importance of initiating breastfeeding shortly after birth, with 58.1% recognising the need for exclusive breastfeeding for at least 6 months. A study performed in Nigeria[34] reported that 80% of subjects responded positively about the initiation of breastfeeding. Research conducted in South India revealed that 81.7% of mothers were knowledgeable about exclusive breastfeeding and that 68.7% of mothers were aware that colostrum should be given as the first feed to newborns.[24] These studies, including our own, highlight the need for education and increasing awareness about breastfeeding. Furthermore, these findings highlight the continuous need to advocate for and encourage optimal breastfeeding methods among caregivers.

Similar to our study, where a majority of caregivers (>90%) possessed good knowledge about exclusive breastfeeding, a study in 2015[35] and the Lucknow study[36] reported that 56.6% and 92.5% of caregivers were well informed about exclusive breastfeeding, respectively. In a South African study, Mphasha *et al*[37] reported that only 55% of participants demonstrated good feeding practices, which is lower than the positive perceptions observed in our study. In a study performed in Columbia,[38] 93.9% of caregivers of infants under 6 months of age recognised the benefits of exclusive breastfeeding. A study performed in Waterberg District, South Africa,[35] an Egyptian study[39] and a Lucknow study[36] reported that 93%, >60% and >70%, respectively, commented positively on the benefits of breastfeeding, which is consistent with our results, where 91.7% agreed with the positive benefits of breastfeeding for both mothers and babies. A study conducted in North India revealed that 41.8% of participants were informed about the advantages of breastfeeding in terms of babies only.[33] In our study, 80.7% of the participants agreed with prelacteal feeds, whereas in an Egyptian study, more than 60% of the participants adversely commented on prelacteal feeds, and approximately 60% negatively perceived exclusive breastfeeding.[39] In our study, 86% of the mothers agreed with the feeding on demand for breast milk, which is greater than that reported in research conducted in South India, where only 37.4% of mothers possessed knowledge about demand feeding.[24] A study conducted in North India reported that the

Table 3 Multivariable regression model to predict caregiver perceptions of breastfeeding practices

Basic characteristics		Breastfeeding perception		Table value/ unadjusted OR	Adjusted OR (95% CI)
		Poor	Good		
Age of the caregiver		29.58±9.645	31.61±12.368	43.29*†	0.98 (0.94 to 1.02)
Occupation	No occupation	58 (46.0%)	68 (54.0%)	13.03‡*	1
	Unstable occupation	44 (28.2%)	112 (71.8%)		2.24 (1.25 to 4.01)*
	Stable occupation	11 (57.9%)	8 (42.1%)		2.51 (0.17 to 7.32)
Education	No formal education	15 (93.8%)	1 (6.3%)	57.01‡*	1
	Schooling	54 (58.7%)	38 (41.3%)		7.71 (2.73 to 8.9)*
	Higher education	44 (22.8%)	149 (77.2%)		38.32 (4.63 to 316.85)*
Residency	Urban	50 (30.7%)	113 (69.3%)	1.89 (1.18–3.04)‡*	1.08 (0.61 to 1.91)
	Rural	63 (45.7%)	75 (54.3%)		1
Birth weight		2.82±0.39	2.74±0.39	0.27†§	1.36 (0.68 to 2.69)

The unadjusted OR was given for the residency variable.
*Significant p value <0.05.
†Independent t-test results are expressed as the means±SDs.
‡X^2 test expressed as frequency (%).
§Significant p value <0.1.

majority (64.3%) acknowledged the necessity of feeding infants on demand.[33]

Our finding that 59.5% of caregivers had good perceptions of complementary feeding practices aligns with the findings of a study conducted in Nigeria,[34] where 72% of the participants commented on the use of locally available foods as complementary foods and 84% commented about the right time to start weaning. In studies performed in South India,[24] South Africa,[37] Ghana[40] and Tirupati, India,[41] it was reported that 82.6%, 55.0%, 52.0% and 54.0% of mothers, respectively, were knowledgeable about complementary feeding. In a study conducted in 2018, 61.2% of caregivers continued breastfeeding for up to 2 years. Interestingly, 54% of participants were unaware of the recommended duration for continued breastfeeding, whereas 89.1% were aware of the recommended

Table 4 Multivariable regression model to predict caregiver perceptions of complementary feeding practices

Basic characteristics		Complementary feeding perception		Table value/ unadjusted OR	Adjusted OR (95% CI)
		Poor	Good		
Age of the caregiver		29.58±9.64	31.61±12.36	2.72*	
Occupation	No occupation	61 (48.4%)	65 (51.6%)	0.012†	1
	Unstable occupation	58 (37.2%)	98 (62.8%)		0.23 (0.06 to 0.85)‡
					0.13 (0.04 to 0.51)‡
	Stable occupation	3 (15.8%)	16 (84.2%)		
Education	No formal education	12 (75.0%)	4 (25.0%)	0.001‡	1
	Schooling	44 (47.8%)	48 (52.5%)		0.43 (0.25 to 0.74)‡
	Higher education	66 (34.2%)	127 (65.8%)		0.15 (0.04 to 0.50)‡
Residency	Urban	60 (36.8%)	103 (63.2%)	0.71 (0.45, 1.13)	
	Rural	62 (44.9%)	76 (555.1%)		
Birth weight		2.70±0.39	2.81±0.39	0.02*§	2.54 (1.35 to 4.78)‡

The unadjusted OR was given for the residency variable.
*Independent t-test results are expressed as the means±SDs.
†X^2 test expressed as frequency (%).
‡Significant p value <0.01.
§Significant p value <0.05.

Table 5 Association between diet diversity and demographic variables

Basic characteristics		Diet diversity		
		Adequate	Inadequate	Table value/unadjusted OR
Age of the caregiver		31.13±11.80	28.63±7.86	1.89*
Occupation	No occupation	103 (81.7%)	23 (18.3%)	0.02†‡
	Unstable occupation	138 (88.5%)	18 (11.5%)	
	Stable occupation	19 (100%)	0	
Education	No formal education	14 (87.5%)	2 (12.5%)	0.36‡
	Schooling	81 (88.0%)	11 (12.0%)	
	Higher education	165 (85.5%)	28 (14.5%)	
Residency	Urban	149 (91.4%)	14 (8.6%)	0.39 (0.19–0.77)§¶
	Rural	111 (80.4%)	27 (19.6%)	
Birth weight		2.79 (0.39)	2.63 (0.44)	1.04*

The unadjusted OR was given for the residency variable.
*Independent t-test results are expressed as the means±SDs.
†Significant p value <0.05.
‡Fisher's exact test expressed as frequency (%).
§Significant p value <0.01.
¶X^2 test expressed as frequency (%).

age to introduce complementary feeding.[38] In a study performed in Lucknow, 83.75% responded positively to weaning.[36] The ignorance about expressing and storing milk found in our study (41.5%) is echoed in a 2018 study, in which 57.6% of caregivers expressed uncertainty regarding the appropriate timing for expressing and storing breast milk.[38] A study in Western India reported that over 90% of participants were aware of the timing for introducing complementary feeding, but many were unaware of its purpose (49.27%) and content (74.88%).

The variation among the studies can be attributed to several factors, including cultural beliefs and practices; the extent and quality of breastfeeding education programmes; areas with strong public health campaigns and educational interventions; access to healthcare services and professional guidance; socioeconomic factors such as income, education level and employment status; and the effectiveness of awareness campaigns and the dissemination of information about feeding.

This study revealed that 86.4% of the children had adequate diet diversity. Research conducted across Bangladesh, Vietnam and Ethiopia revealed that 31.1%, 74.8% and 6.3% of children, respectively, had adequate diet diversity.[42] In a study performed in Nigeria, 52.5% of the participants in the age group of 6–24 months met the diet diversity score adequately.[34] A study performed in Ethiopia revealed that 23% of infants and young children consumed the required minimum number of food groups/adequate diet diversity.[43] A study conducted among African countries revealed that the proportion of children reaching adequate diversity was highest in Mozambique (27.4%), whereas it was 23.9% in Kenya and lowest in Ethiopia (12%).[44 45] A study from Nepal and Ghana revealed that 30.4% and 10.5% of subjects, respectively, had adequate diet diversity.[40 46] A study from Uttar Pradesh reported an adequate diet diversity of 42.6%.[47] In a study performed in Tamil Nadu, only 25% (95% CI 21.6% to 28.5%) had an appropriate diversified diet, and another study from southern India[48] reported that only 43 (45.26%) consumed an adequate quantity of complementary feed.[25] The variation in the proportion can be due to variations in sample size, study population (under 2 years/5 years), study setting (rural/urban), data collection methods, timing and duration of data collection, seasonality of food availability and selection criteria.

In this study, the majority opted for carbohydrate-rich foods (99.7%), dairy products (95.3%), fruits/vegetables (76.1%), vitamin A-rich fruits (73.8%), eggs (57.5%) and sugary foods such as chocolates/biscuits/cakes (57.1%). A study performed in South Africa revealed that starch-based diets (98.3%), vegetables (79.2%), meat (60%), eggs (41.7%) and biscuits (45%) were given to children.[49] In a Columbian study, subjects consumed meats (84.7%), roots and tubers (77.4%), grains (95.6%), other foods rich in sugar (76.6%), other fruits and vegetables (71.5%), legumes–nuts and fruits–vegetables (73.7%), dairy products (73%) and eggs (59.1%).[38]

In this study, individuals of greater age, those with unstable occupations, those with higher education levels, those with urban residency and those with infants with lower birth weights demonstrated good perceptions of breastfeeding. Additionally, subjects whose wards had higher birth weights exhibited good perceptions of complementary feeding. Previous research has consistently highlighted the significant influence of maternal or caregiver education in determining the characteristics and nutritional aspects of child feeding practices.[50–52] Understanding the concepts of feeding demands clarity

of thought, openness to address doubts and resilience to dispel myths. Therefore, individuals with higher education levels are more likely to possess the necessary knowledge regarding breastfeeding practices. Interestingly, this study revealed that individuals in unstable occupations presented better knowledge, a finding corroborated by another study.[53] The preference for certain occupations could be attributed to factors such as flexible working hours or proximity to the caregiver's residence, which may facilitate greater access to knowledge. Furthermore, the variation in birth weight extremes can be elucidated by contrasting dynamics: lower birth weight prompts caregivers to actively seek knowledge about breastfeeding, whereas higher birth weight may prompt caregivers to sustain feeding practices by incorporating complementary feeding methods.

In the study, caregivers with formal education (including both basic schooling and higher education) and those with either stable or unstable occupations demonstrated significantly lower odds of having a good perception of complementary feeding practices. The study indicated that caregivers' perceptions of feeding practices had an inverse relationship with their education and occupation. A research conducted in West Bengal, India,[54] found that individuals with higher education levels exhibited poorer practices in IYCF. A Bangladesh study[55] noted that caregiver/mother's knowledge may not be the sole determinant in shaping their child rearing practices. This suggests that other factors, such as socioeconomic status, cultural norms and access to resources, may play a significant role in influencing caregivers' behaviours and practices related to child development and well-being. Also, the potential gaps in nutrition education at various education levels and time constraints with respect to employment can be a contributing factor.

Strength and recommendation

The evaluation of infant and young feeding practices among the caregivers provided an authentic assessment of the feeding practices in the area. The research was first of its kind from the study area, and the interview method allowed the subjects to respond clearly, with the clarification of doubts. The 24-hour recall period minimized potential recall bias in food intake assessment.

The study should be replicated in various settings, such as migrants, tribes and urban slums, to assess perceptions and variations. The use of triangulation in methodology captures the various novel food preparations and the barriers/facilitators in acquiring proficiency in infant/young feeding practices.

Limitations

The study was a cross-sectional study, so a longitudinal long-term assessment of food variation could not be performed. The assessment of the degree of malnutrition (stunting, wasting, etc) was not performed because of the absence of direct measurements of anthropometric parameters in the children. Response bias could occur in reporting the consumption of various food items. The assessment of diet diversity via single-day recall cannot be a benchmark for determining the usual dietary behaviour of a community. The assessment of perceptions of breastfeeding and complementary feeding using non-standard scales can lead to misclassification errors.

CONCLUSION

This study provides valuable insights into caregivers' perceptions of feeding practices and diet diversity among children aged 12–59 months in rural South India. A majority of caregivers demonstrated good perceptions of breastfeeding (62.5%) and complementary feeding practices (59.5%), with 86.4% of children exhibiting adequate diet diversity. Notably, older caregivers, those with unstable occupations, higher education levels, and urban residency, and those caring for infants with lower birth weights showed better perceptions of breastfeeding. Conversely, caregivers of children with higher birth weights demonstrated improved perceptions of complementary feeding. Paradoxically, formal education and employment status were inversely associated with good perceptions of complementary feeding practices. These findings challenge conventional assumptions about socioeconomic factors and nutritional knowledge, underscoring the complex interplay of cultural and contextual influences on feeding perceptions. Future research should explore the underlying mechanisms of these associations to inform targeted interventions for improving child nutrition in similar settings.

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Contributors All authors agreed with the content of the manuscript and study design. NG, MG: data analysis, manuscript preparation, critical review, interpretation of data for the work. RBD: manuscript preparation, critical review. MRKRS: drafting the work. KG, LM, KSD, KV, MCR, MR: data collection. NG accepted full responsibility for this article as guarantor.

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REFERENCES

1 Bagchi A, Sardar JC, Karmakar PR. Feeding Practice and Nutritional Status of Under Five Children: A Cross Sectional Descriptive Study in a Slum Community of West Bengal. *Int J Res Rev* 2021;8:197–203.
2 Likhar A, Patil MS. Importance of Maternal Nutrition in the First 1,000 Days of Life and Its Effects on Child Development: A Narrative Review. *Cureus* 2022;14:e30083.
3 First 1,000 days of life: importance of maternal and child nutrition during pregnancy and up to two years of age | news. 2024. Available: https://swachhindia.ndtv.com/first-1000-days-of-life-importance-of-maternal-and-child-nutrition-during-pregnancy-and-up-to-two-years-of-age-50895/
4 Australia H. The first 2 years of a baby's life can impact their health and wellbeing later on. here's what you can do to give your child the best possible start. 2023. Available: https://www.pregnancybirthbaby.org.au/the-first-1000-days
5 The first 1,000 days of a child's life are the most important to their development - and our economic success | world economic forum. 2024. Available: https://www.weforum.org/agenda/2017/01/the-first-1-000-days-of-a-childs-life-are-the-most-important-to-their-development-and-our-economic-success/
6 Infant and young child feeding - unicef data. 2024. Available: https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding/
7 Unicef. FROM the first hour of life making the case for improved infant and young child feeding everywhere. 2024 Available: http://data.unicef.org/topic/nutrition/infant-and-young-child-feeding/
8 Ministry of Health &Family Welfare G of I. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-5): India.Mumbai. *Int Inst Popul Sci* 2021;1–116. http://rchiips.org/nfhs/factsheet_NFHS-5
9 Stephenson J, Heslehurst N, Hall J, *et al*. Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. *The Lancet* 2018;391:1830–41.
10 Scaglioni S, De Cosmi V, Ciappolino V, *et al*. Factors Influencing Children's Eating Behaviours. *Nutrients* 2018;10:706.
11 Finnane JM, Jansen E, Mallan KM, *et al*. Mealtime Structure and Responsive Feeding Practices Are Associated With Less Food Fussiness and More Food Enjoyment in Children. *J Nutr Educ Behav* 2017;49:11–8.
12 Malnutrition in children - unicef data. 2023. Available: https://data.unicef.org/topic/nutrition/malnutrition/
13 Kramer MS, Kakuma R. The optimal duration of exclusive breastfeeding: a systematic review. *Adv Exp Med Biol* 2004;554:63–77.
14 Birch LL, Marlin DW. I don't like it; I never tried it: effects of exposure on two-year-old children's food preferences. *Appetite* 1982;3:353–60.
15 Savage JS, Fisher JO, Birch LL. Parental Influence on Eating Behavior: Conception to Adolescence. *J Law Med Ethics* 2007;35:22–34.
16 Cuellar J, Jones DJ, Sterrett E. Examining Parenting in the Neighborhood Context: A Review. *J Child Fam Stud* 2015;24:195–219.
17 Montaño Z, Smith JD, Dishion TJ, *et al*. Longitudinal relations between observed parenting behaviors and dietary quality of meals from ages 2 to 5. *Appetite* 2015;87:324–9.
18 Mura Paroche M, Caton SJ, Vereijken C, *et al*. How Infants and Young Children Learn About Food: A Systematic Review. *Front Psychol* 2017;8:1046.
19 Vereijken C, Weenen H, Hetherington MM. Feeding infants and young children. From guidelines to practice-conclusions and future directions. *Appetite* 2011;57:839–43.
20 Coulthard H, Harris G, Emmett P. Long-term consequences of early fruit and vegetable feeding practices in the United Kingdom. *Pub Health Nutr* 2010;13:2044. https://www.cambridge.org/core/product/526442B43D13F0E8B3974055429D37DE
21 Jacquier EF, Gatrell A, Bingley A. Caregiver experiences, attitudes and perceptions about feeding toddlers and preschool children in Switzerland: a qualitative study. *BMC Nutr* 2016;2:60.
22 May AL, Dietz WH. The Feeding Infants and Toddlers Study 2008: opportunities to assess parental, cultural, and environmental influences on dietary behaviors and obesity prevention among young children. *J Am Diet Assoc* 2010;110:S11–5.
23 Khandelwal S, Kondal D, Chakravarti AR, *et al*. Infant Young Child Feeding Practices in an Indian Maternal-Child Birth Cohort in Belagavi, Karnataka. *Int J Environ Res Public Health* 2022;19:5088.
24 Venugopal S, Arulparithi CS. A study on knowledge of breast feeding and complementary feeding practices among mothers in a rural area, Tamil Nadu, India. *Int J Contemp Pediatr* 2018;5:1790.
25 Ganesan S, Jayaraj J, Geminiganesan S, *et al*. A study on parental awareness of feeding practices in children in the age-group 12-24 months. *J Prev Med Hyg* 2021;62:E909–17.
26 HamsaL, Pradeep Kumar NG, Ranganath TS. Feeding practices among under two years children in urban slum, Bengaluru: a cross sectional study. *Int J Community Med Public Health* 2023;10:2062–7.
27 Guidelines on maternal, infant, young child and adolescent nutrition (miycan) | unicef uganda. 2023. Available: https://www.unicef.org/uganda/reports/guidelines-maternal-infant-young-child-and-adolescent-nutrition-miycan
28 Indicators for assessing infant and young child feeding practices: definitions and measurement methods. 2023. Available: https://www.who.int/publications/i/item/9789240018389
29 Organization WH. Indicators for assessing infant and young child feeding practices: part 2: measurement. World Health Organization; 2010.
30 Knottnerus A, Tugwell P. STROBE--a checklist to Strengthen the Reporting of Observational Studies in Epidemiology. *J Clin Epidemiol* 2008;61:323.
31 Muleka N, Maanaso B, Phoku M, *et al*. n.d. Infant and Young Child Feeding Knowledge among Caregivers of Children Aged between 0 and 24 Months in Seshego Township, Limpopo Province, South Africa. *Healthcare (Basel)*11:1044.
32 Oduor FO, Boedecker J, Kennedy G, *et al*. Caregivers' nutritional knowledge and attitudes mediate seasonal shifts in children's diets. *Matern Child Nutr* 2019;15:e12633.
33 Tiwari B, Tandon VK, Arya G, *et al*. Knowledge and awareness of infant feeding practices in antenatal mothers: A cross sectional study. *MedPulse Int J Pediatr* 2017;36–9. Available: http://medpulse.in/Pediatrics/index.php
34 Samuel FO, Akintayo B, Eyinla TE. Complementary Feeding Knowledge and Practices of Caregivers in Orphanages Improved after Nutrition Education Intervention in Ibadan, Nigeria. *OJN* 2021;11:642–52.
35 Frans RA, Malema RN, Matlala SF. Knowledge and practices of mothers regarding exclusive breastfeeding in the mahwelereng local area of the limpopo province, south africa. 2015.
36 Jain S, Thapar RK, Gupta RK. Complete coverage and covering completely: Breast feeding and complementary feeding: Knowledge, attitude, and practices of mothers. *Med J Armed Forces India* 2018;74:28–32.
37 Mphasha MH, Makwela MS, Muleka N, *et al*. Breastfeeding and Complementary Feeding Practices among Caregivers at Seshego Zone 4 Clinic in Limpopo Province, South Africa. *Children (Basel)* 2023;10:986.
38 Rodríguez Wilchez OO, Barrera Sánchez LF, Ospina Diaz JM. Knowledge, attitudes and food practices in caregivers and nutritional status in infants from Ventaquemada, Boyacá, Colombia. *archmed* 2019;19:74–86.
39 Abul-Fadl A, Shawky M, El-Taweel A, *et al*. Evaluation of mothers' knowledge, attitudes, and practice towards the ten steps to successful breastfeeding in Egypt. *Breastfeed Med* 2012;7:173–8.
40 Bimpong KA, Cheyuo E-E, Abdul-Mumin A, *et al*. Mothers' knowledge and attitudes regarding child feeding recommendations,

complementary feeding practices and determinants of adequate diet. *BMC Nutr* 2020;6:67.
41 Manjusha M, Knowledge PA. *Attitude and Practice Regarding Complementary Feeding among Mothers of Infants in Urban and Rural Areas of Tirupati*. .2017:3.27–31.
42 Nguyen PH, Avula R, Ruel MT, *et al*. Maternal and Child Dietary Diversity Are Associated in Bangladesh, Vietnam, and Ethiopia1, 2. *J Nutr* 2013;143:1176–83.
43 Bedada Damtie S, Benti Tefera T, Tegegne Haile M. Dietary Diversity Practice and Associated Factors among Children Aged 6-23 Months in Robe Town, Bale Zone, Ethiopia. *J Nutr Metab* 2020.:9190458.
44 Kang Y, Chimanya K, Matji J, *et al*. Determinants of Minimum Dietary Diversity Among Children Aged 6–23 Months in 7 Countries in East and Southern Africa (P10-035-19). *Curr Dev Nutr* 2019;3:nzz034.
45 Mutuku JN, Ochola S, Osero J. Maternal Knowledge and Complementary Feeding Practices and their Relationship with Nutritional Status Among Children 6-23 Months Old in Pastoral Community of Marsabit County, Kenya: A Cross-Sectional Study. *Curr Res Nutr Food Sci* 2020;8:862–76.
46 Khanal V, Sauer K, Zhao Y. Determinants of complementary feeding practices among Nepalese children aged 6–23 months: findings from demographic and health survey 2011. *BMC Pediatr* 2013;13:131.
47 Ahmad I, Khalique N, Khalil S, *et al*. Dietary diversity and stunting among infants and young children: A cross-sectional study in Aligarh. *Indian J Community Med* 2018;43:34.
48 Selvaraj K, Stephen T, Priyadharshini SP, *et al*. Exploration of dietary diversity and its associated factors among infant and young children in Rural Tamil Nadu - A mixed-method study. *Indian J Public Health* 2021;65:218–25.
49 Motebejana TT, Nesamvuni CN, Mbhenyane X. Nutrition Knowledge of Caregivers Influences Feeding Practices and Nutritional Status of Children 2 to 5 Years Old in Sekhukhune District, South Africa. *Ethiop J Health Sci* 2022;32:103–16.
50 van Ansem WJ, Schrijvers CT, Rodenburg G, *et al*. Maternal educational level and children's healthy eating behaviour: role of the home food environment (cross-sectional results from the INPACT study). *Int J Behav Nutr Phys Act* 2014;11:113.
51 Tsegaye M, Ajema D, Shiferaw S, *et al*. Level of exclusive breastfeeding practice in remote and pastoralist community, Aysaita woreda, Afar, Ethiopia. *Int Breastfeed J* 2019;14:6.
52 Randhawa A, Chaudhary N, Gill BS, *et al*. A population-based cross-sectional study to determine the practices of breastfeeding among the lactating mothers of Patiala city. *J Family Med Prim Care* 2019;8:3207.
53 Parikh RH, Tolani JN, Shah ND. Knowledge and attitude of mothers regarding feeding practices among children of 6 months to 2 years of age visiting a tertiary care centre of Ahmedabad, Gujarat, India. *Int J Contemp Pediatr* 2019;6:2132.
54 Das N, Chattopadhyay D, Chakraborty S, *et al*. Infant and Young Child Feeding Perceptions and Practices among Mothers in a Rural Area of West Bengal, India. *Ann Med Health Sci Res* 2013;3:370–5.
55 Owais A, Suchdev PS, Schwartz B, *et al*. Maternal knowledge and attitudes towards complementary feeding in relation to timing of its initiation in rural Bangladesh. *BMC Nutr* 2019;5:7.