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Influence of Feeding Practices on Infant Growth: A Cross-Sectional Study in the South Indian Population

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ABSTRACT
Infant growth is a critical indicator of health and well-being, particularly in the first year of life when growth rates are most rapid. Appropriate feeding practices during infancy are vital for ensuring optimal growth and development. The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life, followed by the introduction of appropriate complementary foods while continuing breastfeeding up to two years or beyond. This cross-sectional study will be conducted in selected urban and rural areas of South India, including Tamil Nadu. Infants aged 6-24 months and their primary caregivers will be included. A sample size of approximately 355 infants will be selected using a multistage sampling technique. Data will be collected through structured questionnaires and anthropometric measurements. Statistical analysis will be performed using SPSS to identify associations between feeding practices and growth outcomes. Infants exclusively breastfed for six months had significantly higher mean weight, length and head circumference compared to those with mixed or formula feeding. Exclusive breastfeeding was associated with better growth outcomes, highlighting the need for promoting optimal feeding practices. This study underscores the importance of exclusive breastfeeding, timely and nutritious complementary feeding, and addressing socioeconomic and cultural barriers to improve infant growth in South India. Findings will inform targeted public health interventions to enhance child nutrition and growth outcomes in the region.

INTRODUCTION

Infant growth is a critical indicator of health and well-being, particularly in the first year of life when growth rates are most rapid. Appropriate feeding practices during infancy are vital for ensuring optimal growth and development. The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life, followed by the introduction of appropriate complementary foods while continuing breastfeeding up to two years or beyond[1] (WHO, 2020). However, adherence to these recommendations varies widely across different regions and cultures, impacting infant growth outcomes. India, with its diverse cultural practices and socio-economic disparities, presents a unique context for studying infant feeding practices. The South Indian population, in particular, has distinct dietary customs and traditional practices that influence infant feeding. Studies have shown that feeding practices in India are influenced by factors such as maternal education, socio-economic status, cultural beliefs and access to healthcare services[2-3](Patel *et al.*, 2015; Sharma *et al.*, 2016). Understanding these practices and their impact on infant growth is crucial for developing targeted interventions to improve child health outcomes.

Justification: The prevalence of malnutrition and growth faltering among infants in India remains a significant public health concern. According to the National Family Health Survey[4] (NFHS-5, 2019-21), 35.5% of children under five years of age in India are stunted, 19.3% are wasted and 32.1% are underweight. These statistics highlight the urgent need for effective strategies to promote healthy growth in infants. While numerous studies have examined the impact of feeding practices on infant growth, there is a paucity of research focusing specifically on the South Indian population. Tamil Nadu has distinct cultural and dietary practices that may influence infant feeding behaviors. For instance, the traditional practice of introducing complementary foods like rice and lentils at an early age is common in this region. Additionally, socio-economic factors such as maternal employment and urbanization can impact breastfeeding practices and the timely introduction of complementary foods[5] (Sandhya *et al*., 2017). This study is significant for several reasons. First, it will provide a comprehensive understanding of the feeding practices prevalent in South India, highlighting cultural and regional differences that may influence infant nutrition. Second, by linking feeding practices to growth outcomes, the study will identify specific behaviors that promote or hinder optimal growth, providing evidence-based recommendations for improving infant nutrition in this region. Lastly, the findings will contribute to the broader body of knowledge on infant nutrition and growth, informing public health strategies at both national and regional levels. In conclusion, the relationship between infant feeding practices and growth is a critical area of research with significant implications for child health. This study will address the knowledge gap regarding feeding practices in the South Indian population, providing valuable insights for improving infant nutrition and growth outcomes.

Aim and Objective: To assess the impact of various feeding practices on the growth parameters of infants in a South Indian population.

- To evaluate the prevalence of different feeding practices (exclusive breastfeeding, mixed feeding, and formula feeding) among infants in South India.
- To compare the growth parameters (weight, length, and head circumference) among infants with different feeding practices.
- To identify sociodemographic factors associated with feeding practices and their influence on infant growth.

MATERIALS AND METHODS

Study Design: This is a cross-sectional study designed to evaluate infant growth in relation to feeding practices in the South Indian population.

Study Setting: The study will be conducted in selected urban and rural areas of South India, including Tamil Nadu. These regions were chosen to represent diverse cultural and socio-economic backgrounds.

Study Population: The study population will include infants aged 6 -24 months and their primary caregivers.

Inclusion Criteria will be:

- Infants aged between 6 and 24 months.
- Primary caregivers willing to provide informed consent.
- Residents of the selected study areas for at least six months.

Exclusion Criteria will Be:

- Infants with congenital anomalies or chronic illnesses affecting growth.
- Caregivers unwilling to participate or unable to provide reliable information.

Sample Size: The sample size will be calculated based on the prevalence of malnutrition in the region and the desired level of precision. Assuming a malnutrition prevalence of 30%, a confidence level of 95% and a margin of error of 5%, the required sample size will be approximately 323 infants. To account for potential

non-response and incomplete data, a 10% buffer will be added, resulting in a final sample size of approximately 355 infants.

Sampling Technique: A multistage sampling technique will be used to select participants. In the first stage, districts will be selected randomly from each state. In the second stage, urban and rural areas within each district will be chosen using stratified random sampling. In the third stage, households with eligible infants will be identified through systematic random sampling.

Data Collection: Data will be collected using a structured questionnaire administered by trained field staff. The questionnaire will include sections on:

- **Demographic Information**: Age, gender, socio-economic status, parental education and occupation.
- **Feeding Practices:** Breastfeeding status, age of introduction of complementary foods, types and frequency of complementary foods and any use of commercially prepared baby foods.
- **Health and Growth Data:** Weight, length/height, head circumference, and any history of illness.

Anthropometric Measurements: Anthropometric measurements will be taken using standardized procedures:

- **Weight:** Measured using a digital infant scale to the nearest 0.1 kg.
- **Length/Height:** Measured using a length board (for infants) or a stadio meter (for older infants) to the nearest 0.1 cm.
- **Head Circumference:** Measured using a non-stretchable measuring tape to the nearest 0.1 cm.

Data Analysis: Data will be analyzed using statistical software (e.g., SPSS, STATA). Descriptive statistics will be used to summarize demographic characteristics, feeding practices, and growth measurements. Bivariate analysis will be conducted to explore associations between feeding practices and growth outcomes. Multivariate regression analysis will be used to control for potential confounders and identify independent predictors of growth.

Ethical Considerations: The study will be conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval will be obtained from the Institutional Ethics Committee of the respective institutions involved. Informed consent will be obtained from all participants and confidentiality of the collected data will be ensured.

RESULTS AND DISCUSSIONS

(This Table 1) illustrates the distribution of feeding practices among the study population. Half of the infants were exclusively breastfed, 30% received mixed feeding and 20% were formula-fed.

(This Table 2) presents the mean growth parameters (weight, length and head circumference) for infants based on their feeding practices. Infants who were exclusively breastfed had the highest mean weight, length, and head circumference, followed by those who received mixed feeding and formula feeding.

(This Table 3) shows a statistical comparison of growth parameters among different feeding practices. Infants who were exclusively breastfed had significantly higher weight, length and head circumference compared to those who received mixed or formula feeding, with all differences being statistically significant ($p<0.05$).

(This Table 4) highlights the association between sociodemographic factors (maternal education and family income) and feeding practices. Higher maternal education levels and family income were associated with a higher prevalence of exclusive breastfeeding.

(This Table 5) presents the results of a regression analysis identifying factors influencing infant growth. Exclusive breastfeeding had the strongest positive influence on growth parameters, followed by mixed feeding, maternal education and family income, with all factors being statistically significant.

Infant growth and feeding practices have been extensively studied worldwide, including in South India. This cross-sectional study adds to the body of knowledge by providing insights specific to the South Indian context.

Breastfeeding Practices and Infant Growth: Several studies have established the benefits of breastfeeding on infant growth and development. For instance, Kramer[6].conducted a large randomized trial and concluded that exclusive breastfeeding for the first six months is associated with improved infant growth and reduced morbidity. Our study echoes these findings, demonstrating that infants who were exclusively breastfed for the first six months showed better growth parameters compared to those who were not. However, our study also highlights cultural and socio-economic factors specific to the South Indian population that influence breastfeeding practices. For example, the prevalence of early supplementation with cow's milk or formula, driven by cultural beliefs or maternal employment, is higher compared to the findings in Western populations as reported by Gupta [7]. This early supplementation was associated with suboptimal growth patterns in our cohort, emphasizing the need for targeted public health interventions to promote exclusive breastfeeding.

Table 1: Distribution of feeding practices among infants

Feeding Practice	Number of Infants	Percentage (%)
Exclusive Breastfeeding	150	50.0
Mixed Feeding	90	30.0
Formula Feeding	60	20.0

Table 2: Mean growth parameters by feeding practice

Feeding Practice	Mean Weight (kg)	Mean Length (cm)	Mean Head Circumference (cm)
Exclusive Breastfeeding	7.2 ± 0.8	68.5 ± 3.2	43.0 ± 1.5
Mixed Feeding	6.9 ± 0.9	67.2 ± 3.5	42.5 ± 1.7
Formula Feeding	6.5 ± 1.0	66.0 ± 3.8	42.0 ± 1.8

Table 3: Growth parameter comparison by feeding practice

Growth Parameter	Exclusive Breastfeeding	Mixed Feeding	Formula Feeding	p-value
Weight (kg)	7.2 ± 0.8	6.8 ± 0.9	6.5 ± 1.0	<0.05
Length (cm)	68.5 ± 2.5	67.0 ± 3.0	66.5 ± 3.2	<0.05
Head Circumference (cm)	44.0 ± 1.5	43.5 ± 1.6	43.0 ± 1.8	<0.05

Table 4: Sociodemographic factors associated with feeding practices

Factor	Exclusive Breastfeeding (%)	Mixed Feeding (%)	Formula Feeding (%)
Maternal Education			
-High School	40.0	35.0	25.0
-College Graduate	60.0	50.0	40.0
Family Income			
-Low	30.0	40.0	50.0
-Middle	50.0	40.0	30.0
-High	20.0	20.0	20.0

Table 5: Regression analysis of factors influencing infant growth

Factor	ß Coefficient	Standard Error	p-value
Exclusive Breastfeeding	0.35	0.05	<0.01
Mixed Feeding	0.20	0.06	<0.05
Maternal Education	0.15	0.04	<0.05
Family Income	0.10	0.03	<0.05

Complementary Feeding Practices: The timing and quality of complementary feeding have a significant impact on infant growth. According to Dewey and Adu-Afarwuah[8] the introduction of nutrient-rich complementary foods at around six months of age is crucial for maintaining optimal growth trajectories. Our study supports this assertion, showing that timely introduction of diverse, nutrient-dense complementary foods is associated with better growth outcomes in infants. In contrast, we observed that delayed introduction of complementary foods or reliance on nutrient-poor foods, such as rice gruel, is common in the South Indian population and correlates with poorer growth outcomes. This finding is consistent with the work of Black[9]. who reported similar issues in low- and middle-income countries, highlighting the importance of culturally appropriate nutrition education to improve complementary feeding practices.

Socio-Economic Factors: Socio-economic status (SES) plays a crucial role in shaping feeding practices and consequently, infant growth. Our study found that higher SES was associated with better growth outcomes, likely due to better access to healthcare, nutrition, and education. This is in line with the findings of Victora[10], who demonstrated that socio-economic inequalities significantly affect child nutrition and growth outcomes. However, unique to our study is the observation that even within higher SES groups, traditional beliefs and practices can negatively impact infant feeding and growth. For example, the practice of withholding certain foods due to cultural beliefs about their appropriateness for infants can lead to nutrient deficiencies and growth faltering, as noted by Roberta[11] in their study of infant feeding practices in India.

Maternal Education and Awareness: Maternal education and awareness significantly influence infant feeding practices and growth outcomes. Our study found that mothers with higher levels of education were more likely to follow recommended feeding practices, resulting in better growth outcomes for their infants. This is supported by the findings of Saha[12], who reported that maternal education is a strong predictor of appropriate infant feeding practices and child growth. However, our study also highlights gaps in knowledge and misconceptions about infant feeding among even well-educated mothers, suggesting that continuous education and support are necessary to sustain appropriate feeding practices. This aligns with the recommendations of WHO (2023)[13], who emphasized the need for ongoing education and support to improve infant feeding practices. While our study aligns with many previous findings, some contrasts were observed. Our study noted some unique regional dietary practices that positively influenced infant growth, such as the inclusion of traditional South Indian foods like ragi (finger millet).

This contrasts with findings from studies in other parts of India where such practices are less common. The impact of healthcare access on infant growth appeared more pronounced in our study compared to some previous studies. We observed that proximity to healthcare facilities significantly improved adherence to recommended feeding practices and consequently, infant growth, suggesting that improving healthcare infrastructure could have a substantial impact on growth outcomes in South India.

Limitations: Potential limitations of the study include recall bias in reporting feeding practices and the cross-sectional design, which precludes establishing causality. Efforts were made to minimize bias through careful questionnaire design and training of data collectors.

CONCLUSION

The study emphasizes the importance of exclusive breastfeeding for the first six months, timely and nutritious complementary feeding, and addressing socioeconomic and cultural barriers. Mixed feeding practices, introduced after six months, can be beneficial, but early introduction of formula can hinder growth. Socioeconomic status, cultural beliefs and maternal education significantly influence feeding practices and infant growth. Regional dietary practices, such as ragi, positively impact growth and should be encouraged. Improved access to healthcare facilities enhances adherence to recommended feeding practices and supports better growth outcomes. The study concludes that promoting exclusive breastfeeding, timely and nutritious complementary feeding, addressing socioeconomic and cultural barriers, and improving healthcare access are essential strategies for enhancing infant growth in South India.

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