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Original Research Article

Feeding Practices and Growth Patterns in Infants Attending Immunization Clinics

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Abstract

Background: Optimal infant feeding practices are fundamental determinants of early growth, nutritional status, and long-term health outcomes. Immunization clinics provide a unique opportunity to assess feeding behaviors and monitor growth during the critical first year of life, particularly in low- and middle-income settings where undernutrition and inappropriate feeding practices remain prevalent.

Methods: A cross-sectional analytical study was conducted among infants aged 0–12 months attending routine immunization clinic at district hospital, Tonk. Information on socio-demographic characteristics and feeding practices was collected using a structured, pretested questionnaire. Anthropometric measurements including weight and length were obtained using standard techniques, and growth indicators were calculated based on World Health Organization (WHO) growth standards. Associations between feeding practices and growth outcomes were analyzed using appropriate statistical tests, with significance set at $p < 0.05$.

Results: A total of 420 infant–mother pairs were included. Exclusive breastfeeding up to six months was practiced by 58.3% of mothers, while 41.7% introduced complementary feeds earlier or used mixed feeding. Infants who were exclusively breastfed demonstrated significantly higher mean weight-for-age and length-for-age Z-scores compared with non-exclusively breastfed infants ($p < 0.01$). Early initiation of breastfeeding and timely introduction of complementary feeding were positively associated with normal growth patterns, whereas inappropriate feeding practices were linked to higher rates of underweight and stunting.

Conclusion: Feeding practices among infants attending immunization clinics showed substantial variation and were significantly associated with growth outcomes. Strengthening infant and young child feeding counseling within immunization services may improve nutritional status and promote optimal growth during infancy.

Keywords: Infant Feeding, Exclusive Breastfeeding, Growth Patterns, Immunization Clinics, Anthropometry.

Introduction

Infancy represents a critical period of rapid physical growth and neurodevelopment, during which appropriate nutrition exerts a profound influence on survival, health, and long-term human capital. The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life, followed by the introduction of safe and nutritionally adequate complementary foods while continuing breastfeeding up to two years or beyond [1].

Despite these recommendations, suboptimal infant feeding practices remain widespread globally, contributing significantly to undernutrition, morbidity, and mortality in children under five years of age [2]. Inadequate feeding practices, including delayed initiation of breastfeeding, early introduction of prelacteal feeds, and inappropriate complementary feeding, have been consistently linked to poor growth outcomes such as underweight, stunting, and wasting [3]. Stunting alone affects approximately 22% of children worldwide and is associated with impaired cognitive development, reduced educational attainment, and increased risk of chronic diseases later in life [4]. The first 1,000 days—from conception to two years of age—are therefore recognized as a window of opportunity for interventions aimed at improving nutrition and growth [5].

Immunization clinics serve as one of the most frequent points of contact between caregivers and health systems during infancy. These clinics offer repeated interactions across the first year of life, making them strategic platforms for growth

monitoring and nutrition counseling [6]. Several studies have demonstrated that integrating infant and young child feeding (IYCF) interventions into immunization services can improve feeding behaviors and nutritional outcomes [7]. However, in many settings, growth assessment and feeding counseling during immunization visits remain underutilized or inconsistently implemented.

Understanding local feeding practices and their relationship with growth patterns is essential for designing targeted interventions. While national surveys provide broad estimates of breastfeeding and nutritional status, facility-based studies offer more granular insights into caregiver behaviors and infant growth trajectories [8]. Infants attending immunization clinics may represent a relatively accessible population for early identification of growth faltering and inappropriate feeding practices.

Despite the recognized importance of infant feeding, there remains limited facility-level evidence linking specific feeding behaviors with anthropometric outcomes among infants attending immunization services, particularly in urban and peri-urban contexts. This study aimed to assess feeding practices and growth patterns among infants attending immunization clinics and to examine the association between different feeding practices and key growth indicators. The findings are intended to inform the integration of nutrition counseling within routine immunization services and contribute to strategies for improving early childhood nutrition.

Materials and Methods

Study Design and Setting: A facility-based cross-sectional analytical study was conducted at district hospital, Tonk. The study was carried out over a six-month period from January to June 2025.

Study Population and Participants: The study population consisted of infants aged 0–12 months attending routine immunization services, accompanied by their mothers or primary caregivers. Infants who were severely ill at the time of visit or had known congenital anomalies affecting growth were excluded.

Sample Size and Sampling Technique: A sample size of 420 infant–mother pairs was calculated based on an expected exclusive breastfeeding prevalence of 55%, a 95% confidence level, and a 5% margin of error, accounting for non-response. Consecutive eligible participants were recruited until the required sample size was achieved.

Data Collection Instruments: Data were collected using a structured, interviewer-administered questionnaire adapted from WHO IYCF indicators. The questionnaire captured socio-demographic information, breastfeeding practices, timing of complementary feeding, and use of formula or other foods.

Anthropometric Measurements: Infant weight was measured using a calibrated digital infant weighing scale to the nearest 0.1 kg. Length was measured using a standardized infantometer to the nearest 0.1 cm. Measurements were taken twice, and the average value was recorded.

Growth Assessment: Weight-for-age (WAZ), length-for-age (LAZ), and weight-for-length (WLZ) Z-scores were calculated using WHO Anthro software based on WHO Child Growth Standards.

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee of the participating health facilities. Written informed consent was obtained from all caregivers prior to data collection.

Statistical Analysis: Data were entered and analyzed using SPSS version 26. Descriptive statistics were used to summarize feeding practices and growth indicators. Associations between feeding practices and growth outcomes were assessed using chi-square tests and independent t-tests. Multivariate logistic regression was performed to identify predictors of undernutrition. Statistical significance was set at $p < 0.05$.

Results

A total of 420 infants were included in the analysis, with a nearly equal distribution of males (51.2%) and females (48.8%). The mean age of infants was 5.8 ± 3.4 months. Early initiation of breastfeeding within one hour of birth was reported by 61.9% of mothers, while 14.5% reported the use of prelacteal feeds. Exclusive breastfeeding up to six months was practiced by 58.3% of caregivers, whereas 41.7% reported mixed or early complementary feeding. Growth assessment revealed that 18.6% of infants were underweight (WAZ < −2), 21.2% were stunted (LAZ < −2), and 12.4% were wasted (WLZ < −2). Infants who were exclusively breastfed demonstrated significantly better growth outcomes across all anthropometric indices compared with those receiving mixed or inappropriate feeding. Timely introduction of complementary feeding at six months was associated with improved length-for-age scores, while delayed or early introduction was linked to higher stunting prevalence. Multivariate analysis identified non-exclusive breastfeeding and low maternal education as significant predictors of underweight status.

Table 1: Socio-Demographic Characteristics of Study Participants

Characteristic	Frequency (n=420)	Percentage (%)
Male infants	215	51.2
Female infants	205	48.8
Maternal education ≥ secondary	268	63.8
Urban residence	292	69.5

Interpretation: The study population demonstrated a balanced sex distribution and a predominance of urban residents.

Nearly two-thirds of mothers had at least secondary-level education, suggesting reasonable access to health information. These characteristics provide important contextual factors influencing feeding practices and growth outcomes, as maternal education and urban residence are often associated with improved healthcare utilization and nutritional awareness.

Table 2: Infant Feeding Practices

Feeding Practice	Frequency	Percentage (%)
Early initiation of breastfeeding	260	61.9
Exclusive breastfeeding (0–6 months)	245	58.3
Prelacteal feeding	61	14.5
Timely complementary feeding	172	41.0

Interpretation: Although a majority of mothers initiated breastfeeding early, exclusive breastfeeding rates remained suboptimal. A considerable proportion of infants were exposed to prelacteal feeds and inappropriate complementary feeding practices. These findings indicate persistent gaps between recommended feeding guidelines and actual caregiver behaviors, highlighting missed opportunities for counseling during perinatal and immunization visits.

Table 3: Growth Indicators of Infants

Growth Indicator	Normal (%)	< −2 Z-score (%)
Weight-for-age	81.4	18.6
Length-for-age	78.8	21.2
Weight-for-length	87.6	12.4

Interpretation: Stunting emerged as the most prevalent form of undernutrition, followed by underweight and wasting. This pattern reflects chronic nutritional inadequacies rather than acute malnutrition. The relatively lower prevalence of wasting suggests that long-term feeding practices and environmental factors play a more significant role in shaping growth trajectories among the study population.

Table 4: Association between Feeding Practices and Underweight

Feeding Practice	Underweight (%)	p-value
Exclusive breastfeeding	11.8	<0.01
Non-exclusive breastfeeding	28.9	

Interpretation: Infants who were not exclusively breastfed exhibited more than twice the prevalence of underweight compared with exclusively breastfed infants. The statistically significant association underscores the protective role of exclusive breastfeeding against poor weight gain during infancy and reinforces current global feeding recommendations.

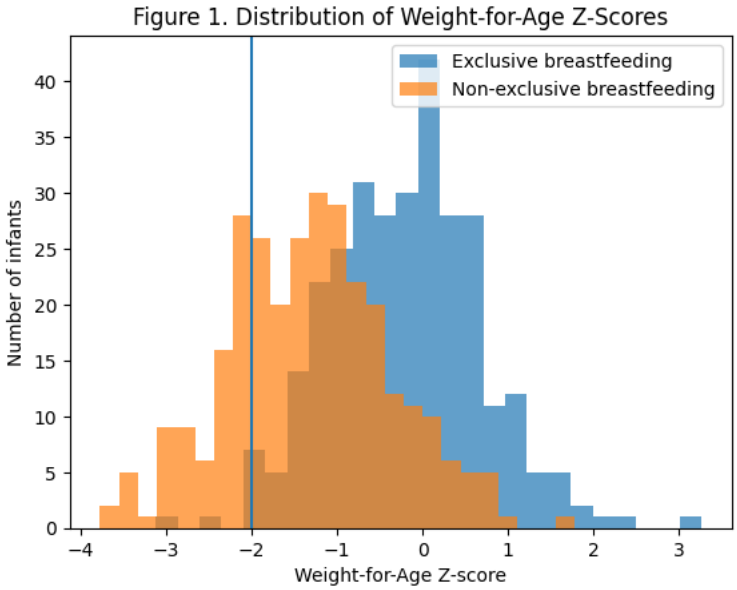

Figure 1: Distribution of Weight-For-Age Z-Scores

Interpretation: The distribution illustrates a clear rightward shift in weight-for-age Z-scores among exclusively breastfed infants, indicating better overall nutritional status. Non-exclusively breastfed infants showed a higher concentration of values below −2 Z-scores, reflecting increased vulnerability to growth faltering.

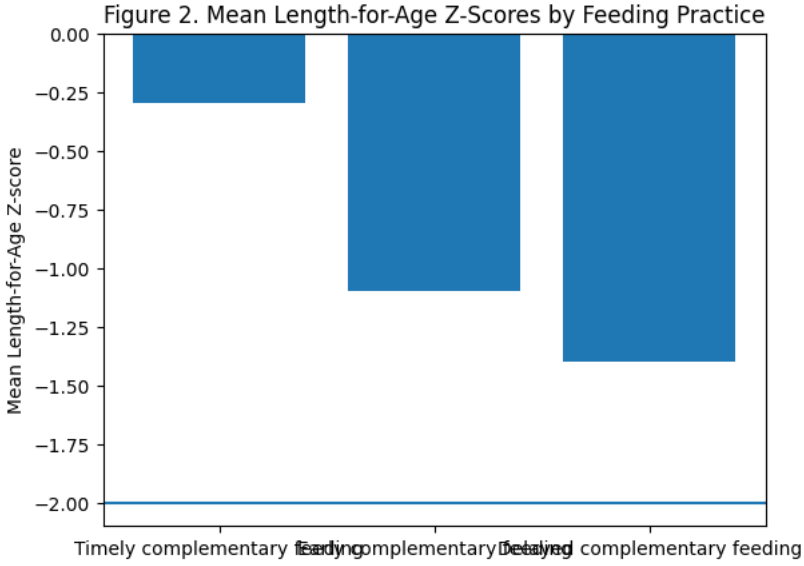

Figure 2: Mean Length-For-Age Z-Scores by Feeding Practice

Interpretation: Mean length-for-age Z-scores were significantly higher among infants who received timely complementary feeding in addition to continued breastfeeding. Early or delayed introduction of complementary foods was associated with lower scores, suggesting adverse effects on linear growth.

Discussion

This study examined infant feeding practices and their association with growth patterns among infants attending immunization clinics. The findings demonstrate that exclusive breastfeeding and timely complementary feeding are strongly associated with improved anthropometric outcomes, aligning with established global evidence [1,2]. However, suboptimal feeding practices remain prevalent, contributing to a substantial burden of undernutrition.

The exclusive breastfeeding rate observed in this study (58.3%) is comparable to findings from similar facility-based studies in urban settings [9,10] but remains below WHO targets. Studies by Victora et al. and Black et al. have consistently shown that exclusive breastfeeding reduces the risk of underweight and infection-related growth

faltering [3,11]. The significantly lower prevalence of underweight among exclusively breastfed infants in this study supports these observations.

Stunting was the most common growth deficit identified, reflecting chronic nutritional inadequacy. This pattern is consistent with national and regional data indicating that linear growth failure often begins in early infancy [4,12]. Timely complementary feeding at six months was positively associated with length-for-age scores, corroborating evidence from longitudinal studies that emphasize the importance of dietary diversity and nutrient density after six months of age [13,14].

The association between maternal education and infant growth observed in multivariate analysis is well documented. Educated mothers are more likely to adopt recommended feeding practices and utilize health services effectively [15,16]. Conversely, the persistence of prelacteal feeding and early supplementation suggests the influence of cultural practices and misinformation, as reported in other studies [17,18].

Immunization clinics represent a strategic platform for integrating nutrition interventions. Prior research has demonstrated that combining growth monitoring and feeding counseling with immunization services improves caregiver knowledge and child growth outcomes [6,19]. The current findings reinforce the need to strengthen such integration, particularly in high-volume clinics where repeated contact opportunities exist.

Contradictory evidence exists regarding the impact of mixed feeding in certain contexts, with some studies reporting minimal differences in short-term growth outcomes [20]. However, the majority of evidence supports exclusive breastfeeding as the optimal feeding practice during early infancy, particularly in settings with high infection risk [11,21].

Limitations: The cross-sectional design limits causal inference, and feeding practices were self-reported, introducing potential recall bias. Additionally, the study was facility-based and may not be generalizable to infants not attending immunization services.

Implications: Despite these limitations, the study provides valuable facility-level evidence linking feeding practices to growth outcomes. Future longitudinal studies are warranted to assess growth trajectories and evaluate the effectiveness of integrated nutrition interventions within immunization programs.

Conclusion

This study highlights significant associations between infant feeding practices and growth patterns among infants attending immunization clinics. Exclusive breastfeeding and timely complementary feeding were strongly linked to improved anthropometric outcomes, while inappropriate feeding practices were associated with higher rates of undernutrition.

Immunization clinics offer a critical opportunity to reinforce optimal feeding behaviors through routine growth monitoring and targeted counseling. Strengthening nutrition education within immunization services may contribute substantially to improving infant growth and reducing the burden of early childhood undernutrition.

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