

Evaluating Growth Indicators Among Infants Aged 6–24 Months: The Role of Complementary Feeding in Preventing Malnutrition

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ABSTRACT

This study evaluates the relationship between complementary feeding (CF) practices and growth indicators among infants aged 6 to 24 months in Pune City. Using a cross-sectional observational design, anthropometric measurements (height-for-age and weight-for-age) were collected and analyzed according to WHO Child Growth Standards (2006). Infants were categorized into three age groups and assessed for nutritional status using Z-scores. The findings indicate that a majority of infants, particularly in the 6–12 months group, fell within the normal growth range, while stunting and underweight were more evident among older infants, suggesting a decline in appropriate CF practices over time. Chi-square analysis revealed a significant association between timely, adequate CF and better growth outcomes. These results underscore the importance of early nutritional education and intervention to prevent malnutrition during infancy.

INTRODUCTION

Malnutrition during infancy remains a major public health concern, particularly in developing countries, where inadequate dietary practices contribute significantly to growth faltering and increased child morbidity (Ijartotimi, 2013). The period from 6 to 24 months is considered a critical window for growth and development (Gillman, 2008), during which breast milk alone is no longer sufficient to meet the nutritional needs of the infant (Erick, 2018). Complementary feeding (CF)—the timely introduction of safe, age-appropriate, and nutritionally adequate foods alongside continued breastfeeding—plays a vital role in ensuring optimal physical and cognitive development (Srivastava and Chaturvedi, 2020). Poor CF practices, including delayed initiation, inadequate dietary diversity, or improper feeding frequency (Patel et al., 2022), are strongly linked to undernutrition outcomes such as stunting, wasting, and underweight, as well as the emerging issue of overweight (Akombi et al., 2017). This study aims to evaluate key anthropometric indicators, specifically height-for-age and weight-for-age, to assess the effectiveness of CF in supporting healthy growth and preventing malnutrition among infants aged 6–24 months.

Hypothesis

H₀ (Null Hypothesis): There is no significant relationship between complementary feeding practices and growth indicators (height-for-age and weight-for-age) among infants aged 6–24 months.

H₁ (Alternative Hypothesis): Appropriate complementary feeding practices are significantly associated with improved growth indicators (height-for-age and weight-for-age) and reduced prevalence of malnutrition among infants aged 6–24 months.

2. Materials and Methods

2.1 Study Design and Population

A cross-sectional observational study was conducted on a sample of infants aged 6 to 24 months. Participants were selected from pediatric health centers and community health camps in Pune City using purposive sampling. The study population was stratified into three age groups:

- Group I: 6–12 months
- Group II: 13–18 months
- Group III: 19–24 months

Parental consent was obtained before data collection. Infants with congenital disorders or chronic illness were excluded.

2.2 Data Collection Tools

Data collection in the study was conducted using a structured questionnaire designed to obtain detailed demographic information, feeding practices, and socio-economic background of the participants. To assess complementary feeding patterns, both a 24-hour dietary recall and a food frequency questionnaire were employed, providing insights into the types and frequency of foods consumed. Additionally, anthropometric measurements, including weight and length/height of the infants, were recorded using standardized equipment and procedures to ensure accuracy and consistency in evaluating the nutritional status of the subjects.

2.3 Anthropometric Measurements

Anthropometric data were analyzed using WHO Child Growth Standards (2006). Z-scores were calculated using WHO Anthro software, and infants were categorized as follows:

Table 1: Classification of Nutritional Status Indicators Based on Z-Scores for Height-for-Age (HAZ) and Weight-for-Age (WAZ)

Indicator	Category	Z-Score Range
Height-for-Age (HAZ)	Severely Stunted	< -3 SD
	Stunted	-3 SD to < -2 SD
	Normal	-2 SD to +2 SD
	Tall	> +2 SD
Weight-for-Age (WAZ)	Severely Underweight	< -3 SD
	Underweight	-3 SD to < -2 SD
	Normal	-2 SD to +2 SD
	Overweight	+2 SD to +3 SD
	Obese	> +3 SD

2.4 Statistical Analysis

Data collected from the study were systematically entered into Microsoft Excel and subsequently analysed using SPSS software. Descriptive statistics, including frequency, percentage, and mean $\pm$ standard deviation, were employed to summarize the demographic characteristics and anthropometric measurements of the study participants. To assess the association between complementary feeding practices and the nutritional status of infants, the Chi-square test was conducted. A p-value of less than 0.05 was considered statistically significant, indicating a meaningful relationship between feeding practices and growth outcomes such as height-for-age and weight-for-age.

2.5 Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee. Informed consent was taken from all parents or guardians before participation. Confidentiality and anonymity of the participants were maintained throughout the study.

4. Results and Discussion

Anthropometric measurements of subjects

Anthropometric measurement of subjects' (infants) body reflects morphological variations due to their CF.

4.4.1 Height for age

Height for age for the infants was categorised as per WHO standards (2006).) WHO growth standards were compared with their height for age and the categories of height for age were- 1. Severely stunted (<-3SD), 2. Stunted, (<-2SD to -3SD) 3. Normal (+2SD to -2SD) and 4. Tall (>+2SD) and presented in in table 2.

Table 2: Distribution of subjects according to their height for age

Age (Months)	Categories	Respondents (n=190)	
		Frequency	
6-12	Severely stunted	00	0.00
	Stunted	6	3.16
	Normal	77	40.52
	Tall	12	6.32
	Total	95	50.00
13-18	Severely stunted	00	0.00
	Stunted	2	1.05
	Normal	34	17.9
	Tall	1	0.53
	Total	37	19.47
19-24	Severely stunted	0	0.00
	Stunted	19	10.00
	Normal	39	20.53
	Tall	0	0.00
	Total	58	30.53
Grand Total		190	100.00

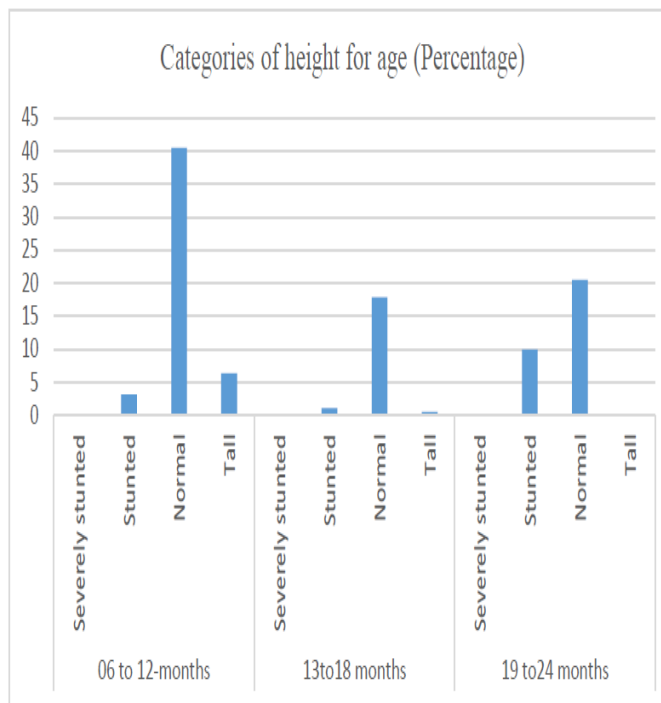


Fig 1: Distribution of subjects according to their height for age
A perusal of data in table 2 and figure 1 reveal that in the age group of 6 to 12 months 23.16% subjects were normal, 6.32% subjects were tall. In the age group of 13 to 18 months 17.9% subjects were normal, 0.53% subjects were tall and 1.05% subjects were stunted. In the age group of 19 to 24 months 20.53 subjects were normal and 10% subjects were stunted. There were no subject found in tall and severely stunted categories. The majority of subjects who were in the normal category, shows that their needs for the nutritional foods implemented properly and proper feeding techniques were utilized by parents. Stunting shows that children are not getting enough food, due to lack of knowledge and they may develop infections if not getting proper nutrition. Their growth in this regard guarantee adequate nutrition CF. For that proper education from the hospitals and Health Services should be provided to the respondents. Underweight, wasting, and stunting were found in 26%, 23%, and 28% of the population, respectively. (Ahmad et al. 2018).

4.4.2 Weight for age

Weight for age categorization of the subjects is done on the basis of WHO standards (2006). Categories of the weight for age (as per the Z score were) 1. Severely underweight ($<-3SD$), 2. Underweight ($<-2SD$ to $-3SD$), 3. Normal ($+2SD$ to $-2SD$), 4. Overweight ($>2SD$ to $+3SD$) and 5. Obese ($>3SD$). Subjects were subcategorized in 6 to 12 months, 13 to 18 months and 19-24 months. This information helps demonstrate how CF methods affect their growth and development. The classified data is presented in table 3.

Table 3: Distribution of subjects according to their weight for age

Age (Months)	Categories	Respondents (n=190)	
		Frequency	
6-12	Severely underweight	0	0.00
	Underweight	3	1.58
	Normal	83	43.68
	Overweight	9	4.74
	Obese	0	0.00
	Total	95	50.00
13-18	Severely underweight	0	0.00
	Underweight	2	1.05
	Normal	31	16.32
	Overweight	4	2.11
	Obese	0	0.00
	Total	37	19.47
19-24	Severely underweight	0	0.00
	Underweight	1	0.53
	Normal	46	24.21
	Overweight	11	5.79
	Obese	0	0.00
	Total	58	30.53
Grand Total		190	100.00

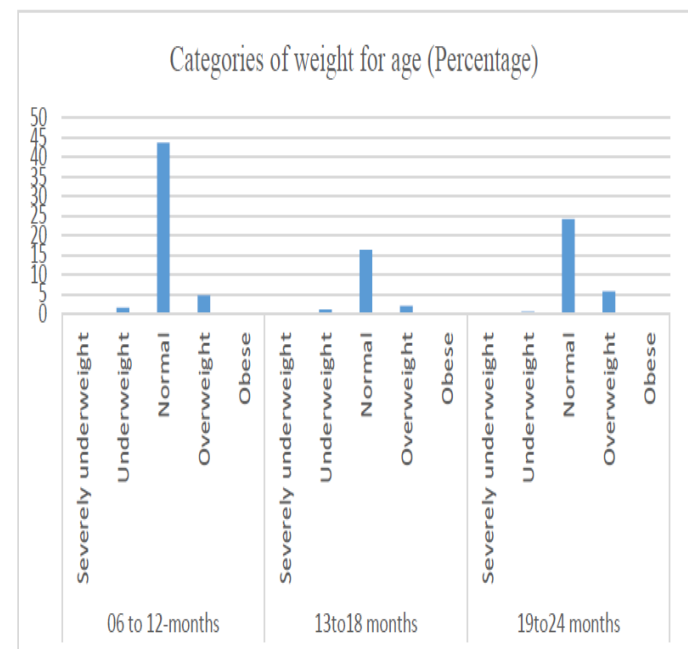


Fig 2: Distribution of subjects according to their weight for age

A perusal of the data in table 3 and figure 2 reveal that in the age group of 6 to 12 months 43.68% subject were in the normal category 1.58% in the underweight category. 4.74% subjects were in overweight category. There were no subjects found in severely underweight and obese categories. In the age group of 13 to 18 months 16.22% infant were in normal category. 2.11% subjects were in overweight category, whereas 1.05% subjects were in underweight category. In the age group of 19-24 months subjects 24.21% subjects were in normal category, 5.79% subjects were Overweight, and 0.53 were Underweight.

Most of subjects from 6 to 12 months age had normal nutritional status, which says that as age increase overfeeding or underfeeding practices were developed. Similar results shown in a study (Begin & Aguayo, 2017) and they found that one in 3 children under 5 are either under nourish or overweight.

3.8.4.3 Weight for height for age

A crucial anthropometric measurement for evaluating the nutritional condition of infants is weight-for-height-for-age. Weight-for-height z-scores (WHZ) categorize nutritional status in accordance with the World Health Organization's (WHO) growth criteria as follows: Normal growth is indicated by WHZ > -2 , moderate acute malnutrition (MAM) was indicated by WHZ < -2 , and severe acute malnutrition (SAM) was indicated by WHZ < -3 . Overweight is indicated by a WHZ $+2$ and obesity by a WHZ $+3$. In order to address malnutrition or over nutrition, these classifications aid in the identification of growth problems and direct therapies. When assessing temporary shifts in weight in relation to height brought on by diet or health initiatives, this metric is especially helpful.

S. N.	Category	Z score
1	Severely wasted	$< -3SD$
2	Wasted	$> -2 SD$ to $\leq -3 SD$
3	Normal	$-2 SD$ to $+2 SD$
4	Overweight	$> +2 SD$ to $\leq +3 SD$
5	Obese	$> +3 SD$

Adequate CF practices are strongly associated with better nutritional outcomes, according to an examination of growth indicators—weight-for-age (WAZ) and height-for-age (HAZ)—among infants aged 6-24 months. Higher proportions within normal HAZ and WAZ ranges were seen in infants aged 6-12 months, demonstrating the beneficial effects of prompt and

sufficient CF throughout the early complementary feeding window. On the other hand, older infants showed higher rates of underweight and stunting, which may indicate a gradual deterioration in the consistency or quality of feeding. The statistically significant correlations ($p < 0.05$) between anthropometric measurements and CF practices highlight the importance of frequent, age-appropriate, and varied feeding in preventing malnutrition. These results confirm that in order to promote ideal development trajectories and reduce the risk of undernutrition during infancy, effective CF treatments are crucial.

CONCLUSION

In conclusion, this study highlights the critical influence of complementary feeding (CF) practices on the growth and nutritional status of infants aged 6-24 months. The findings clearly demonstrate that timely and appropriate CF is significantly associated with improved growth indicators, particularly in younger infants who showed higher rates of normal height-for-age and weight-for-age classifications. However, a noticeable decline in nutritional status among older infants points to the gradual deterioration of feeding practices over time, emphasizing the need for sustained parental education and support. The significant association between CF practices and anthropometric outcomes, as confirmed by statistical analysis, underscores the importance of early interventions and continuous monitoring to prevent malnutrition. Strengthening community-based nutritional programs and promoting awareness through healthcare services can play a pivotal role in ensuring optimal growth and development during this critical window of infancy.

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