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Impact of infant feeding practices on physical indicators of nutritional status

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Abstract

Exclusive breastfeeding and complementary feeding at the age of six months are positively associated with optimum growth and development. This study was conducted in rural areas of Kurukshetra, Kaithal, Faridabad, Palwal, and Sonipat districts in Haryana to assess the trends of infant feeding practices and their impact on the nutritional status of infants. Three hundred mothers of newborns weighing more than 2.5 Kg were included in the study. Respondents were selected by a purposive random sampling technique through hospital visits, household surveys, and Anganwadi Centres. Weight (kg), height (cm), head circumference (cm), and chest circumference (cm) in infants were measured using the standard methodology given by WHO. Data on dependent and independent variables were collected using a pre-tested, well-structured interview schedule. Results indicated that the majority of the respondents (56.6%) had stopped exclusive breastfeeding after 6 months of age and started supplementary food at an early age of 5 months. Lack of sufficient milk production, shift to complementary feeding, sore and cracked nipples, and returning back to work were found to be the major reasons behind the discontinuity of exclusive breastfeeding. Further, results indicated that the length, chest circumference, and head circumference of male infants were found to be 46.46 cm, 2.51 cm, and 32.42 cm, respectively. Whereas, the same in female infants were found to be 46.85 cm, 32.11 cm, and 31.97 cm, respectively. Both exclusive breastfeeding and complementary feeding at the age of 6 months were found to influence the infants' weight, height, and head circumference positively.

Keywords: Complementary feeding, exclusive breastfeeding, head circumference, infants, nutritional status

Introduction

Breastfeeding is not just advantageous for newborns, but also holds considerable benefits for women, including a reduction in the incidence of ovarian and breast cancer as well as diabetes. This underscores the reciprocal health advantages for both maternal figures and newborns, thereby establishing nursing as a pivotal component of initial nourishment. According to the research, breastfeeding rates exhibited a notable decline from 74 percent at 12 months to 46 percent at 24 months (Chowdhury *et. al*., 2015) [5]. The prevalence of exclusive breastfeeding (EBF) among children under six months of age in low- and middle-income nations is reported to be 37 percent (Reddy *et. al*., 2023) [17]. The rates of exclusive breastfeeding (EBF) exhibit a wide variation within countries, as exemplified by India, where EBF rates range from 35.8 percent in Meghalaya to 77.2 percent in Chhattisgarh. The current nutritional situation needs immediate improvement because breastfeeding and complementary feeding serve as the fundamental approaches to address these issues. Mother's milk or exclusive breastfeeding is sufficient for an infant's growth and development during the first six months of life. Due to their fast-growing phase, newborns have increased requirements for all nutrients per kilogram of body weight. Additionally, starting at six months, the amount and nutritional concentrations of breast milk decrease. Breast milk feeding must therefore be supplemented with the feeding of other foods to meet the increased nutritional needs of newborns from six months onward and to support healthy growth in infants. These foods are referred to as complementary foods (Dietary Guidelines, 2024). Proper timing in complementary feeding prevents growth delays and immune deficiencies, and micronutrient disorders. The statistics from NFHS-5 demonstrate that semi-solid or solid food consumption with breast milk was observed in 45.9 percent of children between 6 to 8 months of age. The survey showed that the minimum acceptable diet success rate was 11.3 percent, the adequate dietary diversity rate was 23 percent, and the minimum meal frequency achievement was 35 percent across children aged 6-23 months, respectively (NFHS-5, India, 2019-21) [14]. The survey in rural Haryana indicated that breast milk and solid/semi-solid food consumption among 6 to 8-month-old children reached 43 percent, while minimum acceptable diet achievement among 6-to 23-month-olds was only 11.8 percent (NFHS-5, 2019-21) [14]. Structured educational programs need to address mothers and caregivers because the identified gaps show a critical need for intervention services. This study aimed to assess the trend of infant feeding practices and their association with the nutritional

status of infants in rural Haryana.

Materials and Methods

The study was carried out in rural Faridabad, Palwal, Sonipat, Kaithal, and Kurukshetra districts of Haryana. Three hundred mothers of newborns weighing more than 2.5 kg were included in the study. Respondents were selected by a purposive random sampling technique through hospital visits, household surveys, and Anganwadi Centres. Informed oral consent was taken from the respondents, and the purpose of the study was explained to them. Pre-tested, well-structured interview schedule was developed. The data was gathered through a pretested questionnaire. The data on pre-delivery vitals of mothers was collected from their health card maintained in primary health centres, which included the weight (kg) at the time of conception, weight gain (kg), blood pressure (mmHg), and haemoglobin (g/dL) during pregnancy. Nutritional status of infants was assessed in terms of anthropometric measurements such as recumbent length (cm), weight (kg), head circumference (cm), and chest circumference (cm), which were compared with the reference values given by WHO (2009) [23]. The recumbent length (cm), weight (kg), head circumference (cm) and chest circumference (cm) of infants were measured using standard methodology given by WHO (2011) [24]. A calibrated electronic scale for weight, an infantometer for recumbent length, and a non-elastic fibre tape was used to measure the infant's weight, height, head circumference, and chest circumference. Infants were weighed on the scale twice to the nearest decimal; for height, baby supine was laid with knees extended and soles against the footboard. For head circumference, wrapped the tape over the occipital protuberance and around the supraorbital ridges, and for chest circumference, measured at the level of the nipples. Data on dependent and independent variables were collected using a pre-tested, well-structured interview schedule.

Results and Discussion

The pre-delivery vitals of mothers have been represented in Table 1. The mean weight at the time of conception of mothers was 50.42 kg, and the weight in the ninth month of pregnancy was 62.08 kg. The mean blood pressure (Systolic) was 110.4, and the blood pressure (Diastolic) was 76.47 mmHg, which was consistent with the reference standard of the third trimester (Systolic is 115-130 mmHg and Diastolic is 70-80 mmHg. The mean hemoglobin was 10.01, which was consistent with the reference standard of third trimester 10-13 g/dl. There were no apparent health complications observed among them. Similar results on pre-delivery vitals of mothers were observed by Agarwal *et al*., 2006 [1]; Kajale *et al*., 2016 [9]; Feleke and Feleke, 2020 [6]; Rehman *et al*., 2021 [18] and Haiden *et al*., 2025 [7]. Our findings were broadly consistent with the established reference standards for the third trimester, in which systolic blood pressure is expected to range between 115-130 mmHg and diastolic blood pressure between 70-80 mmHg. The mean hemoglobin concentration also fell within the reference range of 10-13 g/dl for the third trimester.

Table 1: Pre- delivery vitals of mothers (N=300)

Parameters	Mean ± SD
Weight (Kg) at the time of conception	50.42 ±3.2
Weight (Kg) at the time of delivery	62.08 ± 3.6
Blood Pressure (Systolic) mmHg	110.4 ± 2.1
Blood Pressure (Diastolic) mmHg	76.47 ± 5.9
Hemoglobin (Hb) g/dL	10.01 ± 1.2
Health complications	Nil

Mean ± SD of three independent measurements

Nutritional status of Infants at birth

The mean anthropometric measurements of male and female infants at birth are represented in Figure 1. The total number of males was 160, and their mean body weight was 3.1 kg; the total number of females was 140, with a mean body weight of 2.9 kg. The mean birth weight observed in both the newborn male and female was slightly less than the normal weight (3.2kg). A similar trend was observed for the recumbent length; the male infants had 46.46 cm of recumbent length against the 49cm of reference recumbent length, whereas the female infants had 46.85 cm of recumbent length at birth. The mean head circumference was 32.42 cm in male infants and 31.97 cm in female infants. The mean chest circumference was 32.51 cm in male infants and 32.11 cm in female infants, against the reference value of 34.0 cm. Similar results of height, weight, and head and chest circumferences in newborn infants were observed by other coworkers (Jaldin *et al*., 2011; Khandelwal *et al*., 2022; Reddy *et al*., 2023) [8, 10, 17].

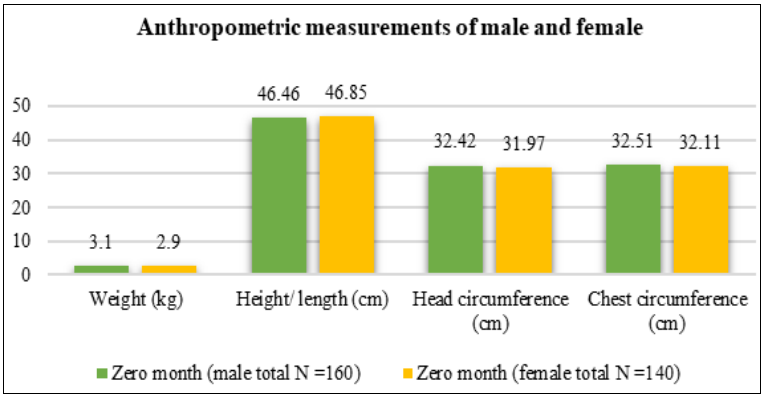

Fig 1: Anthropometric measurements of infants at birth

Nutritional status of Infants at the age of six months

Nutritional status of infants who received exclusive breastfeeding and other top feeding has been depicted in terms of anthropometric measurements (Table 2). The mean

body weight of exclusively breastfed male infants was 6.90 kg, which was slightly less for non-exclusively breastfed male infants (6.70 kg). Similarly, the mean height of exclusively breastfed infants was 66.13 cm, and was found slightly less (63.33 cm) for non-exclusively breastfed male infants. The mean head circumference was found to be 44.23 cm in the exclusively breastfed group, and was almost similar 44.20 cm, in the non-exclusively breastfed group. Mean chest circumference was 42.23 cm for exclusively breastfed male infants and 42.05 cm in non-exclusively breastfed male infants. Similar patterns were observed for the anthropometric measurements between exclusively and non-exclusively breastfed female infants. It was observed that the mean body weight of female infants at the age of six was 6.83 kg in the exclusively breastfeed group, and it was 6.7 kg for the group of non-exclusively breastfeed female infants. The mean height was 64.25 cm in exclusively breastfeed female infants, and it was 61.34 cm in non-exclusively breastfeed female infants. Mean head circumference was found to be 42.30 cm in the exclusively breastfed group and 42.26 cm in the non-exclusively breastfed group. Mean chest circumference was 40.42 cm for exclusively breastfed female infants and 40.37 cm in non-exclusively breastfed female infants. Results presented in Table 2 demonstrated that the mean height, weight, and head and chest circumferences of male and female infants who were exclusively breastfed were found to be superior to the non-exclusively breastfed infants; a significant difference was observed between the groups. Similar results of the impact of exclusive and non-exclusive breastfed on anthropometric measurements of infants were observed by Meshram *et al*., 2012 [11]; Motee *et al.*, 2013 [13]; Patel *et al*., 2015 [16]; Rollins *et al*., 2016 [19]; Asoba *et al*., 2024 [2]; Parmar *et al*., 2025 [15].

Table 2: Impact of exclusive breastfeeding on nutritional status of infants

Variable	Exclusive Breastfeeding	No Exclusive Breastfeeding	*t* - value	*P* - value
Male (06 months)				
Weight (kg)	6.89 ±. 35	6.70 ±. 29	3.65	0.02*
Height/length (cm)	66.13 ± 1.85	63.33 ± 1.69	9.63	0.01*
Head Circumferences (cm)	44.23±0.87	44.20±0.14	1.47	0.14^{NS}
Chest Circumferences (cm)	42.23±0.49	42.05±0.79	1.78	0.07^{NS}
Female (06 months)				
Weight (kg)	6.83 ±. 19	6.07 ±. 23	20.3	0.02*
Height/length (cm)	64.25 ± 1.12	61.34 ± 2.27	8.83	0.03*
Head Circumferences (cm)	42.30±0.19	42.26±0.16	1.34	0.18^{NS}
Chest Circumferences (cm)	40.42±0.23	40.37±0.24	1.25	0.21^{NS}

*=Significant at 5% level, NS = non-significant

Nutritional status of Infants at the age of twelve months

Nutritional status of 12-month-old infants who have started complementary feeding at the age of six months in continuation of breastfeeding and who were taking only complementary was assessed in terms of anthropometric measurements (Table 3). The mean body weight of male infants having complementary feeding along with breastfeeding was 9.12 kg, whereas, it was 7.81 kg in the male infants who had only complementary feeding. The mean height of male infants having complementary and breastfeeding was 75.26 cm, whereas, it was 71.21 cm in the male infants who had only complementary feeding. It was observed that the group only had complementary feeding along with breastfeeding met the standards; however, the mean height and weight of the group that had only complementary feeding were significantly lower than the reference values. The mean head circumference was 46.01 cm in the group that only had complementary feeding, whereas it was 46.12 cm in the complementary and breastfeeding group. Mean chest circumference was 45.04 cm for the complementary feeding group and 45.15 cm for the complementary and breastfeeding group. In female infants at 12 months of age, the mean body weight was 7.1 kg in the complementary feeding group whereas female infants belonged to the complementary and breastfeeding group had 8.2 kg of body weight. The mean height of female infants was 70.1 cm in the complementary feeding group, whereas it was 73.12 cm in the breastfeeding, along with the complementary feeding group. The mean head circumference of female infants was 44.01 cm in the complementary group and 44.13 cm in the breastfeeding along with complementary feeding group. The mean chest circumference of female infants was 43.90 cm for the complementary group, whereas it was 43.92 cm in the complementary feeding and breastfeeding group (Table 3).

Table 3: Impact of breastfeeding along with complementary feeding on nutritional status of infants

Variable	Complementary Feeding + Breastfeeding	Complementary Feeding	*t* - value	*P* - value
Male				
Weight (kg)	9.12 ± 0.18	7.81 ± 0.17	47.8	0.02*
Height/length (cm)	75.26 ± 71.2	71.22 ± 0. 82	30.8	0.01*
Head Circumferences (cm)	46.12 ± 0.64	46.01 ± 0.74	1.0	0.31^{NS}
Chest Circumferences (cm)	45.15 ± 0.35	45.04 ± 0.80	1.1	0.26^{NS}
Female				
Weight (kg)	8.21 ± 0.17	7.10 ± 0.09	48.8	0.02*
Height/length (cm)	73.12 ± 1.33	70.18 ± 0.60	17.2	0.01*
Head Circumferences (cm)	44.13 ± 0.50	44.01 ± 0.80	1.1	0.26^{NS}
Chest Circumferences (cm)	43.92 ± 0.51	43.90 ± 0.63	1.1	0.28^{NS}

*=Significant at 5% level, NS = non-significant

Results presented in Table 3 indicated that the mean height, weight, and head and chest circumferences of male and female infants served with complementary feeding along with breastfeeding were found to be superior to those of infants who were fed only complementary feed; a significant difference was observed between the groups. Similar findings of the impact of complementary feeding in continuation of breastfeeding on anthropometric measurements of infants were observed by (Sinhababu *et al*., 2010; Mitra *et al*., 2017; Campbell *et al*., 2018; Yu *et al*., 2020; Wood *et al*., 2021; Verduci *et al*., 2025) [20, 12, 3, 26, 25, 22].

Conclusion

The findings highlight that maternal health indicators during pregnancy were within acceptable ranges, and exclusive breastfeeding had a positive impact on infant growth. Infants who received both breastfeeding and complementary feeding showed better weight and height compared to those who were only given complementary foods. However, head and chest circumference were not significantly effected. These results emphasize the importance of promoting exclusive breastfeeding for the first six months of life, followed by the introduction of safe and nutritious complementary foods while continuing breastfeeding up to two years or beyond, as recommended by the World Health Organization. Creating greater awareness among mothers about the benefits of breastfeeding, overcoming barriers such as lack of knowledge, and providing support for working mothers are crucial steps to ensure improved nutrition and growth outcomes in infants.

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