

Original Research Article

The relationship between feeding and nutritional status: a prospective and observational study conducted in northern region of India

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ABSTRACT

Background: The health of Infants to a great extent depends upon the feeding practices and its awareness among the mothers. This study was conducted in Tertiary care hospital to find the correlation between feeding pattern with nutritional status.

Methods: Infants in the age group of 14 weeks to 1 year formed the sample of the study. The nutritional status was assessed in relation to breast feeding practice among infants ≤ 6 months. Among infants > 6 months of age, the nutritional status was assessed in relation to adequacy and timely start of weaning. Correlation was observed, and test of significance was applied through chi square test.

Results: Total 591 infants were included in the study out of which 232 infants were ≤ 6 months of age [120 (51.72%) were exclusively breastfed and 112 (48.28%) were top fed]. Out of these breast feed infants, 86/120 (71.67%) had normal nutrition compared to 54/112 (48.21%) of top-fed babies. Infants > 6 months of age were 359 in number [116 (32.31%) were having adequate complementary feed, 111 (30.92%) were having inadequate complementary feed and 132 (36.77%) did not receive any complementary feed]. Out of these infants in the age group of > 6 months, 56.90% of adequate complementary feed group, 27.03% of receiving inadequate complementary feed and 27.27% of not received complementary feed were having normal nutritional status. The association between nutritional status and breast feeding in ≤ 6 months and complementary feed in > 6 months has been found to be statistically significant (p value < 0.05 , $d.f = 1$).

Conclusions: Breastfeeding as well as adequate complementary feed has positive correlation to nutritional status in infants even when compared with the malnourished infants of grade I, II, III and IV.

Keywords: Breastfeeding, Complementary feed, Infants, Malnutrition, Nutritional status

INTRODUCTION

According to the Prime Minister of Norway, Gro Bruntland, a physician and Director General of WHO, real development of a nation is possible only with healthy population. For the sustenance of freedom, democracy and economic growth as well as human dignity, health requires to be treated as a basic human right. With an objective of health as a basic right the

infant health should be assigned a topmost priority. Emphasis on infant health through better nutrition as well as medical care is being laid by WHO and targets were fixed by United Nation through the Millennium Development Goals.

The Fourth Millennium Development Goal (MDG-4) mentions that during a period of 25 years i.e. from 1990 to 2015, there should be a reduction by two-thirds of the

infant mortality rate.¹ These MDGs have been replaced by SDGs (Sustainable Development Goals) and SDG-3 mentions to end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce under-5 mortality to at least as low as 25 per 1,000 live births by 2030. SDG-2 highlights the need to end all forms of malnutrition.²

WHO also declared that “Inappropriate Infant and Young Child Feeding practices (IYCF) and their consequences are major obstacles to sustainable socioeconomic development and poverty reduction”.³ Accordingly, it has been recommended that three principles of optimal IYCF i.e. timely initiation of breast feeding, exclusive breast feeding for first 6 months and continued breast feeding with introduction of nutritionally adequate and safe complementary (solid) foods at 6 months together with continued breastfeeding upto 2 years of age or beyond.⁴⁻⁶

The 2003 Lancet Child Survival Series¹⁰ ranked breastfeeding (exclusive for the first six months and continued breastfeeding from 6-11 months) as the number one preventive intervention, potentially reducing under-five child deaths by 13%, while complementary feeding contributes a further 6%.⁷

Maternal and child under nutrition, consisting of stunting, wasting, and deficiencies of essential vitamins and minerals, was discussed in series of papers in *The Lancet* in 2008. This series of papers identified the need to focus on the crucial period from conception to a child’s second birthday—the 1000 days in which good nutrition and healthy growth have lasting benefits throughout Life.⁸⁻¹²

The Lancet Nutrition Interventions Review Group, and the Maternal and Child Nutrition Study Group planned Ten nutrition specific interventions and programs which included Breastfeeding and complementary feeding, Dietary supplementation for children, and treatment of severe acute malnutrition. It was further stated that if these interventions were scaled-up from existing population coverage to 90%, an estimated 900 000 lives could be saved in 34 high nutrition-burden countries (where 90% of the world’s stunted children live) and the prevalence of stunting could be reduced by 20% and severe wasting by 60%.¹³

Systematic review and meta-analysis by WHO concluded that breastfeeding may have long-term benefits. Subjects who had been breastfed were found to have a lower mean blood pressure and lower total cholesterol and showed higher performance in intelligence tests. The prevalence of overweight/ obesity and type-2 diabetes was lower among breastfed subjects.¹⁴

According to UNICEF, in group of 29 developing countries out of approximately 56 million infants of less than six months of age, approximately 34 million (61.72%) are non-exclusively breastfed and India has highest number of non-exclusively breast-fed infants i.e 7

million.¹⁵ The state wise data in India (NFHS 3) depicts that Punjab region has only 32.6% exclusively breast-fed infants from 0-5 months of age while India has 36% exclusively breast fed infants and complementary foods are introduced at 6 months to 50% of children both in Punjab as well as in India showing faulty complementary feeding practices to be a significant problem of public health.

These complementary feeding practices lead to underweight and malnourished children and these underweight under 3 children in Punjab are 29.9% while in India they are 27%, thus necessitating appropriate complementary feeding as well as exclusive breastfeeding till the age of 6months.¹⁶⁻¹⁸

The objective of present study was to estimate the infant health as well as infant’s nutritional status in Punjab. From this study author may be able to build a strategy to improve the feeding and nutritional status of infants.

METHODS

This is a prospective observational study carried out in a tertiary care hospital. All the Infants in the age group of 14 weeks to 1 year admitted in the Government Medical College and hospital, Amritsar during 1.10.2007 to 30.09.2010 were taken into account as a basis for the study. During this time period 618 infants were admitted, and 27 infants were excluded as unfortunately they were lost to serious illnesses like meningitis, septicemia etc. and thus 591 infants formed the sample of the study.

The simple sampling technique was used, and the inclusion group was the Infants admitted in the hospital in the age group of 14 weeks to 1 year. A detailed proforma was prepared and written consent obtained from the parents of the child. Socioeconomic status (SES) was calculated as per Kuppuswamy scale¹⁹. Based on the feeding pattern infants were categorized as breast fed and top fed.

Top feed included animal milk and tinned milk. Feeding pattern was categorized as under:

- Exclusively Breast Fed comprised of infants who were given only breast feeding excluding water even
- Top fed included infants who were given milk (cow’s, buffalo’s, tinned etc) i.e. other than breast milk or were given both breast milk as well as other milk (mixed fed).
- Complementary feeding was classified as adequate, inadequate or not given at all depending on whether complementary foods were introduced or not and whether given in adequate amounts or not.^{20,21} Adequacy of weaning foods was considered according to WHO recommendations i.e. 3 meals per day if breastfed and 5 meals per day if not breastfed. Nutritious snacks between meals included egg, banana or bread.²²

For babies between 6-8 months in age

- Two to three meals per day of at least 2-3 table spoonful's per meal along with breastfeeding.

For babies between 9-12 months in age

- Three to four meals of ½ of 250 ml bowl at each meal along with breastfeeding
- If baby is not breastfed, in addition to above: 1-2 cups of milk per day and 1-2 extra meals per day.

All other details of feeding practices, weaning foods etc. were taken as per proforma. Nutritional Status was determined as per proforma based on IAP criteria laid down regarding malnutrition and its grades.

IAP classification

It is the most popular classification in India proposed by IAP 1972.²³

Table 1: IAP classification.

Nutritional status	Weight for age (% of expected)
Normal	>80
Grade I	PEM 71-80
Grade II	PEM 61-70
Grade III	PEM 51-60
Grade IV	<50

The Indian Academy of Pediatrics recommended diagnostic criteria (2007), adapted from the earlier WHO guidelines, are weight for height/length below 70% or 3SD of NCHS median and/or visible severe wasting and/or bipedal edema; mid upper arm circumference criteria may also be used for identifying severe wasting.²⁴ In present study WHO growth reference charts were used.²⁵

Clinical assessment

Physical examination of each child was conducted. Detailed clinical examination and necessary investigations like Hb, TLC, DLC and if needed Blood C/s, Urine C/s, Chest X-ray etc. were also done according to the disease and its severity. Infants under study were divided into 2 age groups i.e. 14 weeks till 6 months and from more than 6 months-12 months of age. Anthropometry i.e weight, length, mid arm circumference was recorded.

Statistical analysis

The number of infants were counted under different parameters and each relation was statistically tested through chi square test at 95% and 99% level of significance. Analysis was done to find association between Nutritional status and feeding pattern in infants

who were ≤6 months i.e Malnutrition in breast fed and top fed. And for association between nutritional status and feeding pattern in infants >6 months i.e. Malnutrition in infants receiving complementary feed (complete, partial and not fed complementary feed).

RESULTS

Out of 591 infants, 232 (41.65%) infants were less than 6 months of age and 359 (58.35%) infants were greater than 6 months of age (Table 2).

There were 375 (63.45%) males and 216(36.55%) females exhibiting sex ratio of 1.73:1 (Table 2). Majority of the infants were from Class IV [267(45.18%)] of socioeconomic status as per Kuppuswamy scale while 126 (21.32%), 132 (22.34%) 47 (7.95%) and 19 (3.21%) belonged to Class V, Class III, Class II and Class I respectively (Table 2).

Table 2: Demographic data.

Age group	Number of Infants	Percentage
≤6 months	232	41.62
> 6 months	359	58.38
Sex		
Male	375	63.45
Female	216	36.55
Socio-economic status		
Class I	19	3.21
Class II	47	7.95
Class III	132	22.34
Class IV	267	45.18
Class V	126	21.32

Among Infants ≤6months of age, 51.72% were exclusively breast fed while 48.28% were top fed (Table 6). Among Infants >6months of age 32.31%,30.92% and 36.77% were adequately, inadequately and not received complementary feed at all respectively (Table 6).

Table 3: Nutritional status of infants.

Nutritional status	Age ≤6 months		Age >6 months		Total	
	No.	%	No.	%	No.	%
Normal	140	60.34	132	36.77	272	46.02
Grade I	47	20.26	74	20.61	121	20.47
Grade II	15	6.47	66	18.38	81	13.71
Grade III	13	5.60	54	15.05	67	11.34
Grade IV	17	7.33	33	9.19	50	8.46
Total	232	100	359	100	591	100

In the age group of Infants ≤6months 60.34% were having normal nutritional status while Infants with grade I, II, III and IV were 20.26%, 6.47%, 5.60% and 7.33% respectively. In age group of >6 months 36.77% were having normal nutritional status while Infants with grade

I, II, III and IV were 20.61%, 18.38%, 15.05% and 9.19% respectively (Table 3).

Among Infants ≤6 months of age 71.67% of breast fed were having normal nutritional status while only 48.21% of top fed had normal nutritional status. Grade IV malnutrition was seen in 5% of breast fed and 9.8% of top fed Infants (Table 4).

Table 4: Nutritional status and feeding pattern in infants upto 6 months of age.

Nutritional status	Age ≤ 6 months		p value*
	B.F.	T.F.	
Normal	86 (71.67%)	54 (48.21%)	
Grade I	19 (15.83%)	28 (25%)	0.011882
Grade II	5 (4.16%)	10 (8.93%)	0.0359
Grade III	4 (3.33%)	9 (8.03%)	0.031517
Grade IV	6 (5%)	11 (9.8%)	0.040094
Total	120 (100)	112 (100)	

p value* (comparison of normal nutritional status and other grades of malnutrition)

The association between nutritional status and feeding pattern (breast feeding) among Infants of less than six months of age has been found statistically significant.

13.28= χ^2 , p value 0.000267 df=1.

A statistically significant association was found between normal nutritional status and breastfeeding on comparing normal nutritional status with grade I, grade II, grade III and grade IV malnutrition separately with following χ^2 values.

- 6.328, p value 0.011882 (grade I)
- 4.396= χ^2 , p value 0.0359 df=1 (grade II)
- 4.623= χ^2 p value 0.031517 df=1 (grade III)
- 4.2133= χ^2 p value 0.040094 df=1 (grade IV)

Table 5: Nutritional status and complementary feeding pattern in infants above 6 months of age.

Nutritional Status	Adequate complementary feeding	Inadequate complementary feeding	No complementary feeding	*p value
Normal	66 (56.90%)	30 (27.03%)	36 (27.27%)	
Grade I	20 (17.24%)	25 (22.52%)	29 (21.97%)	0.005525
Grade II	14 (12.07%)	24 (21.62%)	28 (21.21%)	0.000576
Grade III	9 (7.76%)	21 (18.92%)	24 (18.18%)	0.000167
Grade IV	7 (8.62%)	11 (9.91%)	15 (11.36%)	0.004464
Total	116 (100%)	111 (100%)	132 (100%)	

p value* (comparison of normal nutritional status and other grades of malnutrition)

In Infants >6 months of age normal nutritional status was seen in 56.90%, 27.03% and 27.27% of adequately, inadequately and not having any complementary feed respectively. Grade IV malnutrition was seen in 8.62%, 9.91% and 11.36% of adequately, inadequately and unweaned Infants respectively (Table 5).

II, grade III and grade IV malnutrition with following χ^2 values.

- 7.7202 d.f.=1, p value 0.005525 (Grade I)
- 11.8509 χ^2 d.f.=1, p value 0.000576 (Grade II)
- 14.1673 χ^2 d.f.=1, p value 0.000167 (Grade III)
- 8.0845 χ^2 d.f.=1, p value 0.004464 (Grade IV)

Table 6: Feeding pattern of infants.

Feeding pattern (Age ≤ 6 months)	No. of infants	Percent
Exclusively Breastfed	120	51.72
Top fed	112	48.28
Weaning (age > 6 months)		
Adequate complementary feeding	116	32.31
Inadequate complementary feeding	111	30.92
No complementary feeding	132	36.77

A statistically significant association was found between normal nutritional status and adequate complementary feeding group vs no complementary feeding group on comparing normal nutritional status with grade I, grade

DISCUSSION

In our study, infants ≤6 months of age, 71.67% of breast fed were having normal nutritional status while only 48.21% of top fed had normal nutritional status (Table 3) which is in consonance with study of tea garden workers of Assam in which among ≤6 months old Infants (n=62), 11.63% of the exclusively breastfed group and 47.37% of partial or artificial feeding group were underweight.

Though difference in the percentages may be due to the difference in sample size as our study had 232 infants in this age group while in study of tea garden workers there were 62 Infants. Lower prevalence of nutritional deficits in 0-6 months age group in study of tea garden workers

could be attributed to prevailing practice of exclusive breast feeding.²⁶

In present study the association between nutritional status and feeding pattern (breast feeding) among Infants of less than six months of age has been found statistically significant, $13.2 = 2\chi$, P value 0.000267 df=1.

On comparing normal nutritional status with grade I, II, III, IV in breast fed and top fed statistically significant positive relation between nutritional status and breast feeding was found (Table 3). No such association was calculated in the study of tea garden workers.²⁷

In present study in Infants >6 months of age normal nutritional status was seen in 56.90%, 27.03% and 27.27% of adequate, inadequate and no complementary feeding group respectively. Grade IV malnutrition was seen in 8.62%, 9.91% and 11.36% of adequate, inadequate and no complementary feeding group infants respectively. On comparing normal nutritional status to grade I, II, III and IV in adequate complementary feeding group and not adequate complementary feeding group, statistically significant positive relation between nutritional status and adequate complementary feeding was found (Table 4).

Present study is supported by a study from Bangladesh in which a significant correlation was found between high infant and child-feeding index (ICFI) and weight for age Z score in Infants aged 6-8 months. (standardized regression coefficient, $\beta = 0.1$ and p value = 0.1).²⁶ A study from Gujarat also showed similar result in which a significant association were revealed between positive Complementary Feeding practices and nutritional status of the Infants as measured by and Weight for Age Z score ($p < 0.01$).²⁷

On reviewing literature, we could not find any study in which an association has been found between nutritional status and breast feeding upto 6 months and with complementary feeding after 6 months in comparison with undernourished Infants of Grade I, II, III, IV.

CONCLUSION

Contrary to IYCF recommendations, 51.72% infants are exclusively breast fed and 32.31% had adequate complementary feeding in our study. It is statistically evident at a good level of significance that normal nutritional status is positively correlated to exclusive breast feeding upto 6 months of age and adequate complementary feeding from 6 months to 12 months of age. This association of nutritional status with breast feeding for Infants upto 6 months and adequate complementary feeding for Infants from 6-12 months of age is also consistent even when compared with the undernourished Infants of grade I, II, III and IV.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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