Evaluation of BMI of Infants 6-12 Months of Age Having Different Feeding Practices

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Abstract :

Nutrition has always been an integral part of a child's overall development. Optimal nutrition of the child during the first 2 years of life decreases the morbidity and mortality as well as reduces the risk of chronic disease and harbors better overall development. Children between ages 6-8 months receiving solid or semi-solid food along with breast milk are 50.1% in urban areas and 39.9% in rural areas[4]. To improve the breastfeeding and complementary feeding indicators, the guidelines of Infant and Young Child Feeding (IYCF) need to be uniformly practiced. The poor status of nutrition among the children predisposes them not only to a number of infections but also decrease their intellectual capacity thus having a detrimental effect not only on the health of the child but also on the overall progress of our country. Keeping these statistics in mind we aim to determine how the different feeding practices among mothers affect the BMI of the infants. We enrolled 210 infants and their mothers/caregivers were given a questionnaire asking the sociodemographic details and the type of food they give to their children along with breastfeeding. It was observed that the majority of the infants were given complementary feed (82.86%). The mean age of introduction of complementary feed was 6.84±1.668 months. The majority of the cases were having normal BMI (65.71%), 29% were underweight and 3% were overweight. Early introduction of complementary feed was observed among overweight and obese infants. Home based complementary food was most commonly given to the infants (55.7%), in which cereals were the most common food group included (81.9%).

Keywords: Infant, BMI, Feeding practices.

Introduction:

Nutrition has always been an integral part of a child's overall development. Optimal breastfeeding is so critical that it could save the lives of over 8,00,000 children under the age of 5 years each year. The maternal decision about breastfeeding is affected by several factors, including socio-demographic, perinatal and child-related.[1] As per the WHO factsheet, only about 36% of infants aged 0–6 months worldwide were exclusively breastfed from 2007 through 2014.[2] Around the age of 6 months, an infant's need for energy and nutrients starts to exceed than what is provided by breastmilk, and complementary foods are necessary to meet those needs. An infant of this age is also developmentally ready for other foods. If complementary foods are not introduced around the age of 6 months, or if they are given inappropriately, an infant's growth may falter. Kramer et al[3] noted an inverse relationship between the sum of skinfold thicknesses (SUMSF) and the introduction of solid foods at 6 and 12 months.

The percentage of children between ages 6-8 months receiving solid or semi-solid food along with breast milk are 50.1% in urban areas and 39.9% in rural areas.[4] To improve the breastfeeding and complementary feeding indicators, the guidelines of Infant and Young Child Feeding need to be uniformly practiced.

The poor status of nutrition among the children predisposes them to a number of infections and also decreases their intellectual capacity thus having a detrimental effect not only on the health of the child but also on the overall progress of our country. Keeping these statistics in mind and or the well being of the children we aim to determine how the different feeding practices among mothers affect the BMI of the infants.

Methodology:

After institutional ethics committee clearance the proposed study was conducted for 2 years in the Department of Paediatrics of tertiary care institute, Pune. It was a prospective cross sectional study. 210 infants attending the Well Baby Clinic of the hospital between the age group of 6-12 months were included. Full term healthy babies were included in the study. Infants born out of illegitimate pregnancies, infants with chronic illnesses, LBW babies and babies with congenital malformations were excluded from the study.

Study protocol: The caretaker/mother was informed about the detailed study procedure, those infants who fulfilled the inclusion and exclusion criteria and after their caretaker/mother voluntarily agreed to participate in the study, a written and informed consent was obtained in the language which they understood.

The demographic details were recorded as per the proforma. The details of the feeding practices were assessed by using a self-administered questionnaire based on the IYCF guidelines and were defined as shown in Table 1.[5] The caretaker/mother was given enough time to answer.

TABLE 1. CRITERIA THAT DEFINE SELECTED INFANT FEEDING PRACTICES

Feeding practice	Requires that the infant receive	Allows the infant to receive	Does not allow the infant to receive
Exclusive breastfeeding	Breast milk (including milk expressed or from a wet nurse)	ORS, drops, syrups (vitamins, minerals, medicines)	Anything else
Predominant breastfeeding	Breast milk (including milk expressed or from a wet nurse) as the predominant source of nourishment	Certain liquids (water and water-based drinks, fruit juice), ritual fluids and ORS, drops or syrups (vitamins, minerals, medicines)	Anything else (in particular, non-human milk, food-based fluids)
Complementary feeding[a]	Breast milk (including milk expressed or from a wetnurse) and solid or semi-solid foods	Anything else: any food or liquid including non-human milk and formula	NA
Breastfeeding	Breast milk (including milk expressed or from a wet nurse)	Anything else: any food or liquid including non-human milk and formula	NA
Bottle-feeding	Any liquid (including breast milk) or semi-solid food from a bottle with nipple/teat	Anything else: any food or liquid including non-human milk and formula	NA

The clinical examination of the infants was performed and the anthropometric measurements were recorded as follows-

Length: It was taken using a standard infantometer.

Weight: It was taken with minimal clothing using a standard electronic weighing machine for infants, adjusted to a minimum of 10g.

BMI calculated by $BMI = \frac{\text{Weight(kg)}}{\text{Length(m)} \times \text{Length (m)}}$

BMI for age (z-scores) was plotted on the WHO child growth standards for girls and boys from birth to 2 years of age. BMI was categorized as Normal (between -2 and +2 SD), Underweight (below -2 SD), Overweight (between +2 and +3 SD) and Obese (>+3 SD).

Statistical Analysis: Data was entered in an Excel sheet and analyzed using Epi 16. Qualitative data was represented as frequency and proportions. Quantitative data was represented as mean +/- SD. Statistical analysis was carried out using SPSS (version 25) for Windows package (SPSS Science, Chicago, IL, USA). P values <0.05 were considered significant. Independent T-test and Chi-Square test respectively were used to examine associations between means of continuous and categorical variables. One way ANOVA was used to examine associations between multiple variables.

Results:

Table 1: Comparison of the mean time of introduction of complementary feed according to Infant feeding practices

Infant feeding practices	Time of introduction of complementary feed (Months)			F Value	P Value
	n	Mean	SD		
Exclusively breastfeeding	33	.00	.000	279.97	<0.0001
Complementary feeding	174	6.84	1.668		
Breast feeding	3	2.00	2.598		

The mean age of introduction of complementary feed was 6.84±1.668months while that of breastfed infants was 2±2.598months and its comparison with exclusively breastfed infants was statistically significant.

Table 2: Comparison of mean Body Mass Index according to Infant feeding practices

Infant feeding practices	Body Mass Index(kg/m^2)			F Value	P Value
	n	Mean	SD		
Exclusively breastfeeding	33	16.61	2.121	1.97	0.12
Complementary feeding	174	15.67	2.506		
Breast feeding	3	15.80	1.212		

BMI of Exclusively breastfed infants was 16.61±2.121 as compared to 15.67±2.506 of complementary fed infants. But the difference observed in the BMI was not statistically significant.

Table 3: Association of cases as per the type of complementary food introduced/given with infant feeding practices

Infant feeding practices	Type of complementary feed					Total
	Home	Formula	Combined	Ready to use	No	
Exclusive breastfeeding	0	0	0	0	33	33
Complementary feeding	117	0	52	5	0	174
Breast feeding	0	3	0	0	0	3
Total	117	3	52	5	33	210

Chi-square = 420, P<0.0001 It was seen that majority of the complementary fed infants were receiving homemade feed as compared to combined feed (homemade + ready to use) and ready to use feed and this was statistically significant

Table 4: Diversity of complementary feeding with infant feeding practices in study group

Infant feeding practices	Diversity of complementary feed					
	Cereal	Pulses	Fats	Fruits	Vegetable	Dairy
Exclusively breastfeeding	0	0	0	0	0	0
Complementary feeding	172	166	96	93	50	61
Breast feeding	0	0	0	0	0	3
Total	172	166	96	93	50	64
Chi-square	196.66	163.92	36.59	34.54	13.58	23.03
P Value	<0.0001	<0.0001	<0.0001	<0.0001	0.003	<0.0001

Complementary feeding practices were significantly associated with the diversity of foods given in complementary feed like cereals, pulses, fats, fruits, vegetables and dairy as P<0.0001.

Table 5: Distribution of cases as per the type of complementary food introduced/given with BMI

BMI (kg/m^2)	Type of complementary feed					Total
	Home	Formula	Combined	Ready to use	No	
Normal	76 (64.96%)	3 (100%)	30 (57.69%)	1 (20%)	28 (84.85%)	138
Obese	3(2.56%)	0	1(1.92%)	0	0 (%)	4
Over weight	2 (1.71%)	0	2 (3.85%)	2 (40%)	1 (3.03%)	7
Under weight	36 (30.77%)	0	19 (36.54%)	2 (40%)	4 (12.12%)	61
Total	117 (100%)	3 (100%)	52 (100%)	5 (100%)	33 (100%)	210

Chi-square = 32.23, P=0.001

It was observed that more number of infants (64.96%)were receiving homemade complementary feed and had normal BMI while 30.77% of the infants were underweight. Among the infants who were receiving combined home and ready to use food, 57.69% had normal BMI while 36.54% were underweight. 84.85% infants receiving exclusively breast feeding were normal and only 12.12% were underweight. The difference observed was also statistically significant.

Table 6: Diversity of complementary feeding with BMI in the study group

BMI (kg/m^2)	Type of complementary feed					
	Cereal	Pulses	Fats	Fruits	Vege table	Dairy
Normal	106	103	64	62	26	40
Obese	4	4	3	1	1	1
Over weight	6	4	3	0	0	2
Under weight	56	55	26	30	23	21
Total	172	166	96	93	50	64
Chi-square	7.40	9.26	1.66	6.78	10.56	0.66
P Value	0.06	0.026	0.64	0.079	0.014	0.88

The infants given pulses and vegetables as complementary feed were having significant differences in BMI. Less number of overweight and obese children received fruits and vegetables and predominantly received cereals, pulses, dairy, and fats.

Table 7: Comparison of the mean time of introduction of complementary feed according to BMI in the study group

BMI (kg/m^2)	Time of introduction of complementary feed (Months)			F Value	P Value
	n	Mean	SD		
Normal	138	5.32	3.127	3.13	0.027
Obese	4	6.50	0.577		
Overweight	7	4.71	2.498		
Underweight	61	6.61	2.499		

The BMI of infants was normal when complementary feeding was started at the mean age of 5.32(±3.12) months. Delayed or early introduction of complementary feeding was associated with the BMI fluctuating from underweight to obese, and this was statistically significant P=0.027.

Discussion:

The present study was conducted in the Department of Paediatrics of tertiary care institute, Pune with the aim to study the BMI of infants between 6-12 months of age having different feeding practices. A total of 210 infants between the age group of 6 months to 12 months were enrolled.

It was observed that 38.5% of infants were in the age group of 9-10 months, while 32.4% and 28.1% were in the age group of 6-8months and 11-12months respectively.

The percentage of firstborn infants given complementary feeding (91.57%) in relation to higher birth order was statistically significant (P=0.026). This could be due to increased concern and responsiveness of the mother/ family members towards the firstborn. In India it is a tradition for the mothers to go to her maternal home for the delivery of the first child. The attitude of the mother towards complementary feeding is thus influenced by her mother and the elders of her household.

In this study it was observed that in the age group of 6-12 months 15.71% of infants were exclusively breastfed, 82.86% were given complementary feeding and 1.43% were given breastfeeding along with formula feeds. In the study by Patel et al on the feeding practices for infants at age 6 months[6] it was observed that 47% of the infants were exclusively breastfed for ≥4 months, 161 infants (46%) were formula fed and only 7% were given complementary feed. In a study by Gaddapa and Behera (2016)[7] only 38% children received complementary feeding between 6 to 9 months of age, as compared to 48.8% of the children who were started on complementary feeding before six months of age. The percentage of infants receiving complementary feeding between the age group of 6-12 months has improved as compared to the previous studies conducted by Patel et al and Gadappa and Behera.[6,7] This was due to better counseling practices and motivation given to mothers during their visits to the Well-Baby Clinic in the institute.

The Data from the Infant Feeding Survey (IFS) showed that in 2005, approximately 51% of mothers had introduced solid foods by the age of 4 months as compared to 2010, where only 30% mothers had introduced solid foods, showing a trend towards later weaning (i.e. later than 4 months).[8] A study across five European countries found that 37% of formula-fed infants had received solid foods before four months, compared to only 17% of the breastfed infants.[9] The practice of early introduction of complementary feeding (between 4-6 months) were more often based on informal advice from family and friends, previous experience and subjective criteria such as whether the infant was considered to be sufficiently satisfied with milk feeds. The reasons for the early introduction of complementary foods in British infants were lower maternal age and maternal smoking and the practice of formula feeding (on average two weeks earlier than in breast-fed infants).[9] Later introduction of complementary feeding was associated with receiving advice from health professionals.[10] The data from the Diet and Nutrition Survey of Infant and Young Child feeding (2011)[11] shows that 32% of infants were introduced to solids at the age of 4–6 months or earlier.

In India, where the institution of a family is close-knit, this advice usually comes from grandmothers and mothers-in-law. In the present study, complementary feeding was introduced in 31% of infants between 5-8months of age and in 44.8% of infants it was started between 9-11 months of age. The mean age of infants at the time of introduction of complementary feed was 6.84months. Manpreet Kaur et al[12] studied the feeding practices of children of the age group 6 - 12 months which depicted that 67% of mothers initiated complementary feeding at the age of 6 months and 21% at the age of 7 - 9 months.

At a mean infant age of 9.65±1.699 months, a majority (82.86%) of infants were given complementary feeding. The mean age till which exclusive breastfeeding was carried out was 7.06±1.171months. The difference observed was statistically significant (P<0.0001). The variable time of introduction of complementary food was because of the age-old belief that mother's milk is the best nutrition for the baby. While this serves as an excellent tool in promoting breastfeeding for the first six months, it also plays a major role in pushing the child towards malnutrition as the addition of complementary food leads to weight gain.

According to NFHS-4 2015-2016, in India the percentage of children between ages 6-8 months receiving solid or semi-solid food along with breast milk is 50.1% in urban areas and 39.9% in rural areas.[4] The optimum time to start complementary feeding as per IYCF practices is after 6 months.

The practice of including foods from diverse food groups was statistically significant in the infants given complementary feeds. The most common food groups that were included were cereals in 81.9% and pulses in 79% cases. The addition of ghee/oil (fats) to complementary feed was however observed in 45.75% of infants. Only 44.3% of infants received fruits. Vegetables (23.8% cases) were the most neglected food group for complementary feeding. Shaikh MR et al[13] studied the type of complementary feed given and observed that out of 193 subjects 54.4% of infants received semisolid food, 37% milk, 30% dhal- khichdi, ghee khichadi, and only 7.7% infants received infant formula. Manpreet Kaur et al[12]observed that the mothers of infants used locally prepared food as the first food to initiate complementary feeding. In about 21% cases dal ka pani (water of boiled pulses), in 19% cerelac, in 18% dalia (porridge) and in 12% khichdi (rice gruel) was used as the first food. In another study by Pradhan and Arora in Chandigarh, it was observed that homemade weaning foods were most commonly fed to the infants and out of 300 mothers, only 25% included spinach in the complementary foods prepared while 81.7% mothers included fat and sugar to make the food more energy-dense.[14]

Based on the data from different studies it was assumed that animal milk is considered as an ideal food for initiating complementary feeding by a majority of the mothers/caregivers in India. In most of the studies, complementary feeding was started initially by giving liquid diets such as diluted animal milk and rice water/cereal-based water followed by semi-solid foods homemade foods like daal, khichdi, rice and other locally available foods. Solid foods such as chapatti, eggs and vegetables in mashed form were fed later at the age of nine months. Most of the infants were not given green leafy vegetables.

Using home-made foods can introduce more varied tastes and textures and seems to provide an easier transition to family foods.[15] Homemade foods can be cheaper and the parent knows what ingredients are used in the food. It was observed that the common practice of complementary feeding in the majority of the infants (55.7%) was homemade feed, while only formula milk was given to 1.4% infants. A combination of homemade and ready to use foods were given to 24.8% infants.

A majority of the infants (65.71%) had normal BMI, 3% were overweight and 29% were underweight. There was no statistically significant difference in the mean BMI of exclusively breastfed infants and the infants who received complementary feeding (P=0.12). A majority of the male and female infants were on complementary feed. There was no statistically significant difference in the preference of sex as a variable for the time of introduction of complementary feeding.

It was observed that infants receiving pulses and vegetables as complementary feed were having normal BMI as compared to the infants consuming cereals, fats, fruits and dairy products as complementary feed. A study conducted in Dehradun by Dr. Vartika Saxena and Dr. Praveen Kumar[16] depicted that only 10% of the children belonging to the age group of 6-12 months consumed vegetables. Vegetables are not only a source of minerals but also help prevent constipation and maintain good gut flora.

The mean time of introduction of complementary food among infants having normal BMI was 5.32±3.127 months while that of underweight infant was 6.61±2.499month. The mean time of introduction of complementary feed among overweight infants was 4.71±2.498 months while that of obese infants was 6.50±0.577 months. The time of introduction of complementary feed in relation to BMI in the study group was statistically significant.

There are some pieces of evidence that early introduction of complementary feeding (i.e before 4 months of age) has a risk of higher body mass index (BMI). Pearce et al[17] in their systematic review studied twenty-three studies and out of these, five found that introducing complementary foods at less than 3 months (two studies), 4 months (two studies) or 20 weeks (one study) was associated with a higher BMI in childhood.

In this study, 64.96% of infants who received homemade complementary feed had normal BMI. Among the infants receiving combined home and ready to use feeds, 57.69% were having normal BMI while 36.54% were underweight. Amongst the infants receiving exclusively breastfeeding 84.85% were having normal BMI and only 12.12%were underweight. The difference observed was also statistically significant (P=0.001).

In another study, Hawkins et al[18] reported that children that were breastfed for longer than 4 months had a decreased risk of obesity. Baird et al[19] in their study found an inverse association between age at weaning and weight and length at age 6 months. Wright et al[20] reported inverse associations between age at weaning and weight up to 3 months, but no association with weight gain between 1.5 and 12 months.

Conclusion:

Thus, with references to the above mentioned results and discussion we conclude that the majority of the infants were given complementary feed (82.86%). The mean age of introduction of complementary feed was 6.84±1.668months. A majority of the cases were having normal BMI (65.71%), 29% were underweight and 3% were overweight. Early introduction of complementary food was observed among overweight and obese infants. Home based complementary food was most commonly given to the infants (55.7%), in which cereals were the most common food group included (81.9%).

References:

1. World Health Organization. Infant and Young Child Feeding Factsheet. http://www.who.int/mediacentre /factsheets/fs342/en/
2. B. Hall. Changing composition of human milk and early development of an appetite control. Lancet. 1975 Apr 5; 1(7910): 779–781
3. Kramer MS, Barr RG, Leduc DO, Boisjoly C, Pless lB. Infant determinants of childhood weight and adiposity. J Pediatr 1985;107: 104-7.
4. India Fact Sheet. National Family Health Survey-4 2015-2016. http://rchiips.org/nfhs/pdf/NFHS4/India.pdf
5. WHO complementary feeding- Report of Global Consultation. Summary of guiding principles. https://apps.who.int/iris/bitstream/handle/10665/42739/924154614X.pdf
6. Patel N1, Dalrymple KV1, Briley AL1, Pasupathy D1, Seed PT1, Flynn AC1, Poston L2; UPBEAT Consortium. Mode of infant feeding, eating behaviour and anthropometry in infants at 6-months of age born to obese women - a secondary analysis of the UPBEAT trial. BMC Pregnancy Childbirth. 2018 Sep 3;18(1):355.
7. Gadappa SM, Behera MK: Nutritional status and feeding practices in relation to IYCN policy among children under 2 years of age in tertiary care centre, International Journal of Contemporary Medical Research 2016, 3 Suppl 6: 1649-51.
8. IFS (Infant Feeding Survey) (2012). Infant Feeding Survey 2010. Health and Social Care Information Centre.
9. Schiess S, Grote V, Scaglioni S et al; European Childhood Obesity Project. Introduction of complementary feeding in 5 European countries. Journal of Pediatric Gastroenterology and Nutrition 2010; 50(1): 92-98.

10. Scientific Advisory Committee on Nutrition [SACN]. Infant Feeding Survey 2005: A Commentary on Infant Feeding Practices in the UK. London: The Stationery Office, 2008. http://www.sacn.gov.uk/pdfs/sacn_ifs_paper_2008.pdf (accessed 9 Dec2018)
11. Lennox A, Sommerville J, Ong K et al. (2013) Diet and nutrition survey of infants and young children. Available at: https://www.gov.uk/government/publications/diet-and-nutrition-survey-ofinfants- and-young-children-2011 (accessed 05 August2017).
12. Manpreet Kaur, Jaspreet Kaur, Shivalli Sirswal, Sarita Kumari1, Nikita Thakur1, Bhawna Duna1, Prabhjot Kaur, Geetanjli Kalyan and Pankaj C Vaidya. "Assessment of Feeding Practices of Young Children Less Than 2 Years of Age". EC Paediatrics 3.6 (2017): 474-487.
13. Shaikh MR, Nagaonkar AS. A community based study of breast feeding and weaning practices among mothers in urban field practice area of SRTR, GMC, Ambajogai. Int J Community Med Public Health 2018;5:191-7.
14. Pradhan R, Arora A: Infant and young child feeding (IYCF) practices amongst mothers in Chandigarh, India, J Indian Dietetic Association 2016, 39 Suppl 2: 41-50.
15. Department of Health [DH]. Birth to Five. London: DH, 2005. Available at: www.dh.gov.uk (accessed 10 Jan 2019) & Department of Health. Weaning and the Weaning Diet. Report of the Working Group on the Weaning Diet of the Committee on Medical Aspects of Food Policy. Report on Health and Social Subjects No 45. London: HMSO, 1994
16. Dr. Vartika Saxena , Dr. Praveer Kumar- Complementary feeding practices in rural community: A study from block Doiwala district Dehradun Indian Journal of Basic and Applied Medical Research; March 2014: Vol.-3, Issue- 2, P.358-363.
17. Pearce J, Taylor MA & Langley-Evans SC (2013) Timing of the introduction of complementary feeding and risk of childhood obesity: a systematic review. International Journal of Obesity 37: 1295–306.
18. Hawkins SS, Cole TJ, Law C et al. (2008) An ecological systems approach to examining risk factors for early childhood overweight: findings from the UK Millennium Cohort Study. Journal of Epidemiology and Community Health 63: 147–55.
19. Baird J, Poole J, Robinson S, Marriott L, Godfrey K, Cooper C, et al. Milk feeding and dietary patterns predict weight and fat gains in infancy. Paediatr Perinat Epidemiol 2008;22:575-86
20. Wright CM, Parkinson KN, Drewett RF. Why are babies weaned early? Data from a prospective population-based cohort study. Arch Dis Child 2004;89:813-6.