

Feeding Practices and Weight Gain in the First Six Months of Life

KC Ejianya *, HA Cole **, OF Njokanma **, G Okpuno #

Summary

Ejianya KC, Cole HA, Njokanma OF, Okpuno G. Feeding Practices and Weight Gain in the First Six Months of Life. *Nigerian Journal of Paediatrics* 2003; 30:18. The renewed effort to encourage the practice of breast feeding has awakened interest in the study of the relationship between different modes of infant feeding and growth patterns. This relationship was studied in a cohort of 196 children in the first six months of life. The babies were classified as exclusively breastfed (receiving no other form of food or drink except the mother's breast milk), mostly breastfed (receiving ≤ 3 sessions of supplementary feeds per day) and mostly formula fed (receiving > 3 sessions of supplementary feeds per day). In the first three months of life, the mean growth velocity was higher for exclusively breastfed babies (32.8 ± 7.3 g/day) than for their counterparts receiving supplementary feeds (31.3 ± 6.6 g/day and 31.0 ± 6.0 g/day, respectively). The mean cumulative weight was also higher in exclusively breastfed babies (6399 ± 797 g vs 6367 ± 724 g and 6363 ± 696 g) despite having the lowest mean birth weight. During the following three months, there was marked deceleration of growth rates involving all three groups with the exclusively breastfed babies the most affected: 49 percent deceleration for exclusively breastfed babies, 43 percent for mostly breastfed babies and 40 percent for mostly formula fed babies. However, exclusively breastfed babies retained the higher cumulative weight achieved earlier. None of the observed differences was statistically significant. It is concluded that body weight changes between three and six months of life, do not show a convincing advantage for the introduction of supplementary feeds. Extraneous considerations of convenience, economy and immunology tend to lend support to exclusive breastfeeding during this period.

Keywords: Exclusive breast feeding, Formula feeding, Growth velocity.

Introduction

INFANTS grow rapidly during the first four to six months of life and normal growth is one of the most important physical indicators of adequate nutrition.

University of Ibadan, Ibadan

Department of Human Nutrition

*Postgraduate Student

**Professor

Havana Specialist Hospital, Surulere, Lagos

** Consultant Paediatrician

Imperial Medical Centre, Ebute-Metta, Lagos

Specialist Paediatrician

Correspondence: OF Njokanma

Nutritional requirements are most critical in this period and a deficiency could have lasting effects on growth and development.^{1,2} Human breast milk was the sole source of infant nutrition prior to the turn of the 19th century but increased availability of formula milk substitutes led to a steady decline in the practice of breast feeding. The demonstration of nutritional, emotional, economic and immunological advantages of breast feeding has resulted in efforts to rekindle the widespread practice of breast feeding. Hence, the Baby Friendly Hospital Initiative was introduced in 1992 by the UNICEF as one of the latest global efforts seeking among other objectives, to encourage mothers to feed their infants solely on breast milk for the first six months of life. There is however, controversy surrounding the safe duration of exclusive breast feeding.^{3,4} Also, the growth pattern of exclusively

breastfed babies differs from that of formula-fed infants.⁵⁶ Thus, the applicability of currently used reference growth charts to breastfed infants has been called to question.³⁷ In 1995, an expert group of the World Health Organization (WHO) exposed the inappropriateness of an earlier chart approved by the body for growth monitoring of breastfed infants and recommended the development of a new one.⁸ This has provided the impetus for longitudinal studies of feeding practices and growth patterns.

The aim of this study was to determine the body weight changes in the first six months of life in a cohort of Nigerian infants who were exclusively breastfed, and their counterparts who received supplementary feeds.

Subjects and Methods

This study was part of a wider prospective investigation of the relationships between maternal nutritional status, birth weight, infant feeding practices and growth in early infancy. It was conducted from June 1996 to December 1997 at two centres: the Havana Specialist Hospital (HSH) and the Imperial Medical Centre (IMC), both in the city of Lagos. Both hospitals cater for the upper socio-economic classes but neither has been officially designated a "Baby Friendly Hospital". In the preparatory phase of the study, group discussions were held with women receiving antenatal care at the two study centres. During these sessions, the women were informed about the aims and methods of the study. Those who indicated willingness to participate received further information on a one-on-one basis. Following this, the delivery records were

examined daily to identify any of the volunteer subjects who may have delivered. The birth weight of the infant was obtained from the delivery register and monthly appointments were scheduled with the mother. This phase of the study lasted from June 1996 through May 1997.

Only singleton, term (at least 37 weeks gestation), full size (at least 2500g at birth) babies were studied. Exclusion criteria were maternal diseases in pregnancy such as hypertension and diabetes mellitus, severe congenital abnormality, severe diseases in early infancy like severe perinatal asphyxia or meningitis. All consecutive deliveries in both study centres who met the inclusion criteria, were free of exclusion criteria and whose mothers gave informed consent, were recruited. The labour wards of both hospitals used similar *Waymaster* infant scales graduated in 50g units. The babies were weighed naked by qualified midwives within 30 minutes of delivery. Subsequently, the babies were weighed by one of us (EKC) at monthly intervals for the first six months. The same infant *Waymaster* scale graduated in 50g units, procured for the purpose, was used for the follow-up weights. All weighing scales used in the study were subjected to monthly standardization. Data derived from weight measurements included growth velocity, percentage increase in weight and deceleration in growth velocity. Growth velocity was calculated by dividing the weight increment (g) between two measurements by the time interval (in days) between measurements. The percentage increase in weight is the difference between two weight measurements expressed as a percentage of the earlier measurement. Deceleration in mean

Table I

Rates of Different Feeding Practices

Age in months	Feeding Practice			Total n (%)
	EBF n (%)	MBF n (%)	MFF n (%)	
1	163 (83.2)	17 (8.7)	16 (8.2)	196 (100.0)
2	152 (77.6)	28 (14.3)	16 (8.2)	196 (100.0)
3	139 (70.9)	41 (20.9)	16 (8.2)	196 (100.0)
4	104 (53.6)	74 (38.1)	16 (8.2)	194 (100.0)
5	62 (35.8)	97 (56.1)	14 (8.1)	173 (100.0)
6	45 (26.0)	114 (65.9)	14 (8.1)	173 (100.0)

EBF = Exclusively breastfed

MBF = Mostly breastfed

MFF = Mostly formula-fed

Table II*Growth Characteristics of Study Infants at 3 months*

	EBF	MBF	MFF
Number	139	41	16
Mean weight (g)	6499 (797)	6367 (724)	6363 (696)
Mean growth velocity (g/day)	32.8 (7.3)	31.3 (6.6)	31.0 (6.0)
Mean % weight gain	87 (22)	83 (21)	81(19)
Mean birth weight	3495 (456)	3516 (488)	3538 (461)

EBF = Exclusive breastfed

MBF = Mostly breastfed

MFF = Mostly formula-fed

Figures in parentheses represent one standard deviation of the mean.

weight velocity is the difference in mean growth velocities expressed as a percentage of the earlier mean velocity. Information on feeding practices was obtained from the mothers by recall at each visit and these were categorized as follows:

- Exclusively breastfed (EBF) - infants receiving no other form of food or drink except mothers' breast milk
- Mostly breastfed (MBF) - infants receiving breast milk in addition to three or less supplemental formula or cereal feeding sessions daily

- Mostly formula-fed (MFF) - infants receiving more than three supplemental feeding sessions daily.

Statistical Analysis

Student 't' test was used to compare continuous data; p-value <0.05 was accepted as statistically significant.

Results

Adequate data for analysis was obtained in respect of 196 infants: 104 of these were born at Havana Specialist Hospital (HSH) and 92 at Imperial Medical Centre (IMC). These figures represented 32.1 per cent of 324 and 31.5 percent of 311 respectively, of live singleton deliveries for the period June 1996 to May 1997 in both hospitals. Twenty-three infants were lost to follow-up (two between three and four months and 21 between four and five months of age). The rates of different feeding practices at various ages are shown in Table I. The proportion of exclusively breastfed (EBF) babies declined steadily from 82.1 percent at one month to 26 percent at six months. On the other hand, the proportion of babies in the mostly breastfed group (MBF) increased from 8.7 percent to 65.9 percent, while that of the mostly formula fed (MFF) group was fairly constant at 8.2 percent. All the infants who left the exclusively breastfed group qualified for analysis under the MBF group.

Table II shows the growth characteristics of the study subjects at three months. Exclusively breastfed babies had consistently higher achievements despite a slightly lower mean birth weight in comparison with the other groups. At three months, they had gained

Table III*Growth Characteristics of Study Subjects at 6 months*

	Group A	Group B	Group C	Group D
Number	45	79	35	14
Mean weight (g)	8212 (1124)	8062 (947)	8013 (985)	8189 (937)
Mean growth velocity (g/day)	17.3 (5.4)	17.5 (4.7)	17.7 (5.2)	18.7 (4.4)
Mean % weight gain	24 (7)	25 (7)	25 (7)	26 (5)
% Growth deceleration	49	46	43	40
Mean birth weight	3464 (469)	3509 (469)	3557 (570)	3564 (470)

Group A = exclusively breastfed for 6 months

Group B = exclusively breastfed for 3 months, then mostly breastfed for the next 3 months

Group C = mostly breastfed for 6 months

Group D = mostly formula-fed for 6 months

Figures in parentheses represent one standard deviation of the mean

approximately 87 percent of their birth weight compared to 81 percent and 83 percent in the other groups. However, none of the observed differences was significant ($p > 0.5$). At six months, exclusively breastfed infants were still slightly ahead on cumulative weight (Table III). All groups experienced a marked reduction in growth velocity between three and six months compared to the figures recorded between one and three months. Infants who received supplementation after three months of exclusive breast-feeding were less affected than those who were exclusively breastfed throughout, but were more affected than their counterparts who were mostly formula-fed from the first month. The percentage increase in weight between three and six months of life varied within a narrow range of 24 to 26 percent. These observed differences were however, not significant ($p > 0.5$).

Discussion

The exclusively breast-feeding rate at three months herein reported (70.9 percent) was much higher than the two percent national average for Nigeria and the 32 percent average for sub-Saharan Africa.⁹ It is not clear how much of our rates are explained by increased awareness created by the Baby Friendly Hospital Initiative. Notwithstanding the fact that neither study centre was yet to be designated as 'baby friendly', most of the mothers in the study were aware of the renewed effort to encourage exclusive breastfeeding.

The comparison of growth rates between exclusively breastfed and formula-supplemented infants did not yield significant differences but the observed trends were too consistent to ignore. The practice of exclusive breast-feeding was associated with more impressive growth characteristics in the first three months of life. This was however, followed by a more marked deceleration in growth rates over the next three months, as has been observed by earlier workers.^{7,10,11} Our results are also similar to those of others¹¹ which found that supplementation after three months moderated the observed deceleration in growth rates. However, contrary to the findings of Forman *et al.*¹² we found that formula milk supplementation before three months was also associated with a lesser degree of growth deceleration. Furthermore, the subgroup of mostly formula-fed infants experienced less growth deceleration than those who received only token amounts of formula milk in early infancy.

The issues surrounding apparent growth faltering in breastfed infants have generated controversy between opposing schools of thought. Some workers have questioned the adequacy of exclusive breast-feeding

beyond the first three months, given the associated degree of growth deceleration.^{8,13} Others^{14,15} contest the assumption that higher growth rates in formula-fed infants beyond three months, is optimal or desirable. The latter school of thought finds support in the absence of higher morbidity or reduced activity in babies receiving breast milk beyond three months.⁹ Indeed, some workers suggest that growth deceleration is a protective mechanism against such diseases of later adulthood as obesity and cardiovascular disorders which are known to be associated with overnutrition in infancy.¹⁶ Thus in some opinions, breastfed infants reflect true self-selected level of energy and should be regarded as the standard for growth. While the controversy rages, some basic facts are unaltered. First, nutrition in early infancy is of central importance to subsequent well-being: the younger the infant, the more critical the nutritional question. Secondly, growth deceleration after three months is a natural phenomenon that occurs irrespective of feeding practice. Our study shows that formula supplementation after three months was only associated with a marginally higher growth velocity over continued exclusive breast-feeding. However, this apparent advantage was not enough to reverse the trend of higher cumulative weight earlier established by exclusively breastfed infants.

It must be stressed that our study failed to establish a statistically demonstrable superiority of any feeding mode over another with respect to growth rates. Thus, at this point, extraneous factors bearing on infant feeding must be considered. Breast-feeding, in addition to being more convenient, continues to enjoy an economic advantage over formula feeding. Also, the avoidance of exposure to potential allergens in formula milk with its attendant risks of asthma and other allergic disorders is a point in favour of breast-feeding. It is on these grounds that we will favour exclusive breast-feeding for six months. The study showed that mothers who practised exclusive breast-feeding for just three months, generally introduced only token amounts of formula milk thereafter. Those who gave large amounts of formula feeds tended to do so right from the first month. It would therefore appear that the effort to promote exclusive breast-feeding for six months would be more successful with the former group of mothers. Perhaps, if their reasons for introducing formula feeds after three months are identified and addressed, they might be persuaded to prolong the period of exclusive breast-feeding.

References

1. Tershavec AM, Stallings VA. Child and Behavioral Pediatrics. In: Behrman RE, Kliegman RM, eds Nelson

- Essential Pediatrics. Philadelphia: WB Saunders company, 2002:57 - 92.
2. Caballero B. Nutrition. In: Avery ME, First LR, eds. Paediatric Medicine. Baltimore :Williams and Wilkins, 1994: 95 - 143.
 3. Salmenpera L, Perheentupa J, Silmes MA. Exclusively breastfed infants grow slower than reference infants. *Paediatric Research* 1985; 19: 307-12.
 4. Rowland MGM, Rowland SG, Cole TJ. Impact of infection on the growth of children from 0 to 2 years in an urban West African community. *Am J Clin Nutr* 1988; 47: 134-8.
 5. Waterlow JC, Thompson AM. Observation on the adequacy of breastfeeding. *Lancet* 1979; ii: 238-42.
 6. Waterlow JC, Ashworth A, Griffiths M. Faltering infant growth in the developed countries. *Lancet* 1980; ii: 1176-8.
 7. Dewey KG, Pearson JM, Brown KH, Krebs NF, Michaelson KF, Pearson KA, Salmenpera L, Whitehead RG, Young DL. Growth of breastfed and formula fed infants 0 - 18 months: The DARLING Study. *Pediatrics* 1995; 89: 1035-41.
 8. WHO Working Group on Infant Growth. An evaluation of infant growth: the use and interpretation of anthropometry in infants. *Bull WHO* 1995; 73: 165 - 74.
 9. UNICEF. Focus on Nutrition. State of the World' Children. 1998.
 10. Dewey KG. Cross-cultural patterns of growth and nutritional status of breastfed infants. *Am J Clin Nutr* 1998; 67: 10-7.
 11. Hitchcock NE, Gracey M, Gilmour AI. The growth of breastfed and artificially fed infants from birth to twelve months. *Acta Paediatr Scand* 1985; 74: 240-5.
 12. Forman MR, Gupta KS, Chang DN, Sarov B, Berendes HW, Naggan L, Hundt GL. Undernutrition among Bedouin Arab infants: the Bedouin infant feeding study. *Am J Clin Nutr* 1990; 51: 343- 9.
 13. Whitehead RG, Paul AA. Infant growth and human milk requirements: a fresh approach. *Lancet* 1981; ii: 161-3.
 14. Simoes EAF, Pereira SAM. The growth of exclusively breastfed infants. *Ann Trop Paediatr* 1986; 6: 17-21.
 15. Fawzi WW, Forman MR, Levy A, Graubard BI, Naggan L, Berendes HW. Maternal anthropometry and infant feeding practices in Israel in relation to growth in infancy: The North African Feeding Study. *Am J Clin Nutr* 1997; 65: 1731-7.
 16. British Paediatric Association Standing Committee On Nutrition. Is breastfeeding beneficial in the UK? *Arch Dis Child* 1994; 71: 376-80. .