Growth Rate from Birth to Three Months of Breastfed and Non-Breastfed Infants Delivered in Hospitals at Owo Metropolis

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Abstract: The growth rate from birth to three months of some breastfed and non-breastfed infants age 0 – 12 weeks delivered in hospitals at Owo metropolis was evaluated with a view to know the effect of breastfeeding on growth rate. A total of one hundred (100) breastfed and non-breastfed neonates were purposely selected in the neonatal sections of three hospitals in Owo, March 2012. Anthropometry measurement was used to assess growth rate for length, weight, head and mid upper arm circumference of the infants on weekly basis using standard length board, digital weighing scale and shakir tape for twelve weeks. Epi-info 2008 nutritional software was used to determine length for – age z-score, weight for – age z-score, Head and mid-upper arm for age z – scores. Data were analyzed using SPSS soft ware (version 17.0). Results show that the rate of growth in length per week ranged between 0.5 – 1.0cm within 4th to 12th weeks of growth while an average rate of growth in weight of 100 – 400g was discovered between 2nd to 6th weeks of growth among both breastfed and non-breastfed infants. Observation shows that between birth to 4th week formula fed babies tend to be leaner in weight compared to their breastfed counterpart which maintained stable weight within this period. The study shows that breastfeeding significantly (P> 0.05) affect rate of growth among the breastfed infants. Growth pattern of infant skewed toward – 2 and 0 when compared with the NCHS/CDC reference population growth curve. In all, 2% of the breastfed and 8% of non-breastfed were severely underweight. There is no alternative to breastfeeding at this critical stage of life for optimum growth of infants. Therefore, mothers should be encouraged to breastfeed exclusively for 6th months in order to achieve optimum growth and development.

Keywords: Growth rate, Breastmilk, Nutritional status, Infants, weight for age.

INTRODUCTION

Growth rate is the speed at which increase in length, weight and other body physical make up and composition change as a child matures. The process of human growth is characterized by a set of phenomena that reflect the action of biological control mechanisms [1]. These mechanisms are subject to genetic and environmental influences and their expression is characterized by variation in timing, magnitude and duration. Compared to other period of life, infancy is a period of rapid growth, but the relative relationship among rate of linear growth, body mass accretion and brain growth varies [2].

Adequate nutrition during infancy and early childhood is fundamental to the development of a child's full potential. It is well recognized that the period from birth to two years of age is a critical state for the promotion of optimum growth; good health and behavioral development [3].

Nutritional deficiency had been linked to impairments in growth, intellectual performance, work capacity, reproductive outcome and overall health status during childhood. The consequences of poor nutrition in terms of both food and feeding behavior during the first two years of life include significant illness, delayed mental development and death [4,5].

An infant's birth weight doubles in the first four to six months and triples within the first year. Such rapid growth requires a lot of both nourishment and sleep. The human body needs more food to support growth and development than it does to merely maintain its size once growth ceases. When nutrients are missing at a critical phase of growth and development, growth slows down and may even stop [6,7]. Infant and child growth is assessed by tracking body weight, length and head circumference over time [7]. Babies losses 5 – 10% birth weight in the first week and regains this by 2 – 3 weeks later. Birth weight is also double by 4 – 6 months and tripled by 12 months while birth length increases 1.5 times in 12 months. Moreover, head circumference increases by about 7.6cm before the first birthday. However, all babies grow differently and these are just general guidelines [8,9].

Evidence in literatures have shown that breastfeeding in infancy resulted in enhanced growth rate during the first two months but reduced growth rate during 3 – 12 months compared to infants fed with

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formula food throughout [10,11]. Breast milk offers complete nutrient nourishment for optimum growth and development of neonates. Breast feeding provides distinct advantages for the infants, the advantages of breastfeeding over formula feeding are numerous including fewer intestinal, respiratory and ear infections, fewer allergies, food intolerances and provides antibodies. Moreover, breast feeding is also less expensive, and possibly more convenient for the infant than formula feeding. It is also bacteriologically safer [12,13]. However, an infant can be adequately nourished with formula if the mother chooses not to breastfeed [14]. Breastfeeding is not desirable if the mother has certain disease (s) or must take medication potentially harmful to the infant. Mothers may not be able to breastfeed when they undergo certain surgery. Likewise, breastfeeding is not advised for infant with certain medical conditions like galactosemia, lactose intolerance, phenylketonuria maple syrup urine disease including some preterm infants [15]. In cases where mothers have active untreated tuberculosis and herpes lesions on a breast, it will not be in the best interest of the baby to breastfeed.

Some mothers in Nigeria and particularly in Ondo state could not breastfeed their children because of some the above listed health problems, thereby hindering the growth rate of their children. Therefore, this study assesses the growth rate of some breastfed and non-breastfed infants delivered in hospitals at Owo metropolis, Ondo state Nigeria.

METHODOLOGY

Study Design

The study is a purposeful random survey designed to assess the effect of breastfeeding on the growth rate of some breastfed and non-breastfed infants attending hospitals in Owo, Ondo State.

Location and Period of Study

The study was carried out at the State General Hospital, St. Louis Hospital and Federal Medical Centre. It was conducted at their Neonatal and Pediatrics Clinics. These hospitals were located in Owo metropolis, Owo Local government Ondo State Nigeria. The study was carried out from September 2011 to March 2012.

Subject

The subjects were male and female breastfed and non-breastfed infants delivered in these hospitals between the ages 0 to 3 months.

Inclusion/Subject Eligibility

Eligibility of infants was defined by gestational age between 37th to 42nd week, weight at birth ranging from 2500 – 5000g apgar score higher than 7 at five minutes and absence of disease. The criteria for inclusion in the breastfed group were: (a) data available on growth during the first 3 months of life for infants fully breastfed for that period (b) measurement intervals no greater that one week throughout the 4 three months' period.

Sample Size and Selection

Subject selection was based on number admitted and available for the study, since numbers of cases of mothers with postpartum health problems of non-breastfed infants in these hospitals were low. Therefore, all available non-breastfed infants admitted at this period were adopted for the study. A minimum sample size of 50 non-breastfed and 50 breastfed infants were purposely selected for the study.

Ethical Considerations

Approval was obtained from the hospitals management and informed consent of the mothers was also obtained prior to the commencement of the data collection.

Sources of Data and Research Instrument

Anthropometry and questionnaire were the two research instrument used for this study. Questionnaire was used to obtained socio-demographic information of mothers through the interviewer's administered questionnaire. Data such as occupation of mothers, parity, age, and position of the child in the family, Diagnosed health problems of the mothers and diagnosed health problems of the child were also obtained through the use of questionnaire. Only infant without any health problem that may hinder growth were selected for the study.

Measurement and Data Collection

Anthropometric data was collected over a period of three months. Measurements such as length, weight, head circumference and mid upper arm circumference were taken on a weekly basis for both breastfed and non-breastfed infants. Standard length board was used to determine the length gained per week for the infants according to WHO procedure. Digital weighing scale was used to determine the weight gained per week.

Head circumference of the infants was also measured using tape measure to the nearest centimeter according to American Dietetic Association, [16], procedure and mid upper arm circumference of the infants were taken using shakir tape and special masking tape to measure to the nearest centimeter on a weekly basis.

Data Analysis

Data generated was analyzed using SPSS package (version 17.0) and nutrition software (Epi-info 2008) to determine the mean length, mean weight, mean head circumference and mean MUAC. Length for age, weigh for age, head circumference for age and MUAC were also determined with their respective Z – scores. Their various Z –scores were compared with the CDC/WHO reference growth chart. Their nutritional status was determined and outcome presented normal, underweight and overweight. Result was presented in mean, percentages, and standard deviations. Also graphical representations such as bar charts and graphs were also used to present the results. Statistical test such as student t-test were carried out to test for level of significance of quantitative data.

RESULTS AND DISCUSSION

Table **1** shows the z-scores of the anthropometric measurements of the infant from the first week to three months for weight, length, MUAC and head circumference respectively. Presented in Figures **1**, **2**, **3**, and **4** were the compared growth rate in length, weight, mid-upper arm circumference (MUAC) and head circumference of both breastfed and non – breastfed infants. Generally, a linear pattern was found in all areas of anthropometric measurements being represented in Figures **1**, **2**, **3**, and **4**. It was discovered in Figure **1** that the rate of growth in length for breastfed infant was more rapid than the non-breastfed infants. This occurrence cut across from first week to twelfth week of birth. An average of 1 cm rate of growth in length per week was observed among the breastfed infants between their 4th weeks to 12th weeks of growth, study [11] have shown that babies grow in length by about 2.5cm a month during the first six months and this growth rate among breastfed was higher than their non-breastfed counterparts between fourth to twelfth weeks of age. This pattern of growth rate was also reported by CDC [7] which shows that breastfeeding resulted in enhanced growth during the first two months but reduce growth compared to their counterpart fed with infant formula.

Generally, the trend of growth in weight (Figure **2**) increases with increase in age of the children per week. Although it was observed that growth rate from birth in weight to 3rd week of birth was almost stable and the same trend was observed for both breastfed and non-breastfed infants, it had been reported in studies conducted by Dewey, *et al*. [17] and Agostoni, *et al.* [9] that breastfed and formulated babies grow at basically the same rate in term of weight in the first few months.

Table 1: Pattern of Growth per Week of Infants for Weight, Length, MUAC and Head Circumference Using Their Z - Scores

	BREASTFED INFANTS			NON BREASTFED INFANTS				
GROWTH PER WEEK	Weight/Age (z-score)	Length/Age (z-score)	MUAC/Age (z-score)	HC/Age (z-score)	Weight/Age (z-score)	Length Age (z-score)	MUAC/Age (z-score)	HC/Age (z-score)
1	-.234±0.156	-1.30±0.175	0.049±0.786	0.640±0.154	-0.122±0.133	0.062±0.1.1	0.064±0.101	0.028±0.213
2	0.612±0.753	0.236±0.187	0.165±0.187	0.194±0.221	-0.350±0.261	0.155±0.463	0.188±0.415	0.140±0.409
3	0.386±0.756	0.147±0.708	0.194±0.154	0.142±0.177	0.024±0.177	0.304±1.123	0.085±0.486	0.148±0.455
4	0.188±0.336	0.549±1.479	0.142±0.183	0.146±0.209	0.179±0.196	0.031±0.993	0.180±0.116	0.154±0.084
5	0.218±0.336	0.038±0.311	0.114±0.145	0.646±0.598	0.958±0.969	0.158±0.453	0.151±0.102	0.169±0.102
6	0.178±0.287	0.218±0.246	0.202±0.958	0.264±0.556	0.638±3.973	0.260±0.523	0.178±0.109	0.157±0.107
7	0.233±0.162	0.253±0.135	0.182±0.121	0.186±0.108	0.183±0.118	0.217±0.391	0.173±0.196	0.167±0.130
8	0.222±0.172	0.295±0.248	0.157±0.123	0.155±0.127	0.217±0.134	0.254±0.301	0.112±0.222	0.157±0.127
9	0.213±0.137	0.221±0.130	0.173±0.081	0.023±0.165	0.026±0.986	0.253±0.207	2.155±0.809	0.267±0.086
10	0.210±0.099	0.335±0.237	0.194±0.091	0.023±0.166	-0.644±0.991	0.234±0.234	-2.80±0.805	2.668±0.977
11	0.237±0.116	0.376±0.279	0.191±0.143	0.128±0.090	0.211±0.123	0.350±0.298	0.167±0.099	0.261±0.205
12	2.035±0.665	0.591±0.139	0.205±0.139	0.223±0.144	0.308±0.159	0.452±0.347	0.297±0.171	0.261±0.205

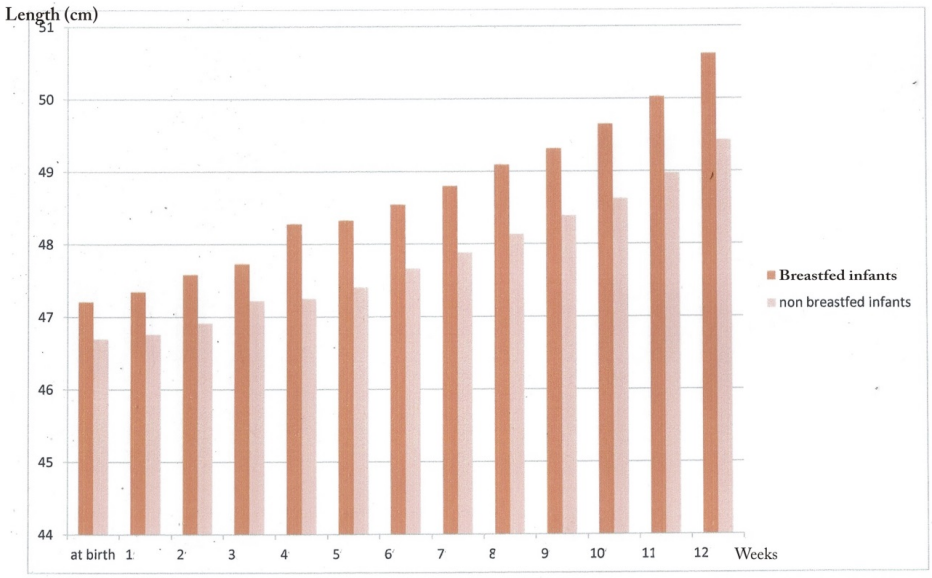

Figure 1: Growth rate (length) of breastfed and non-breastfed infants (age 0-12 weeks).

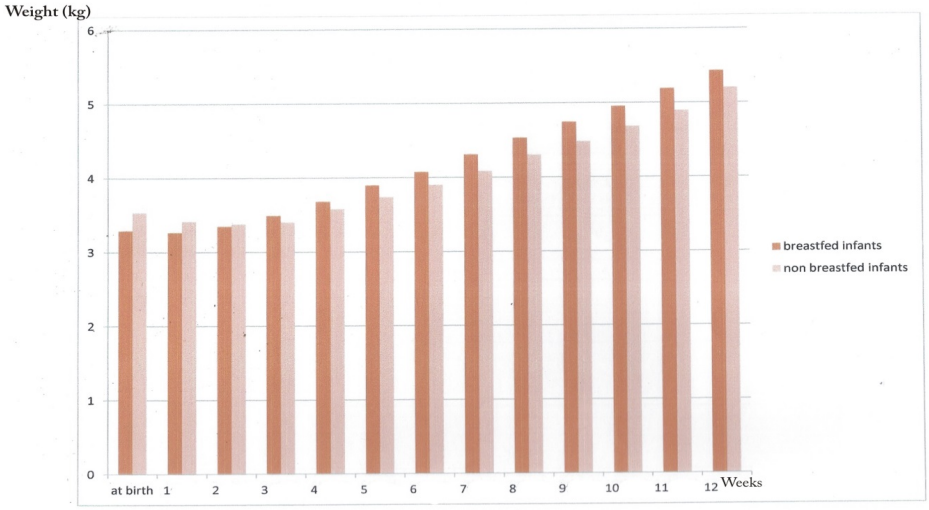

Figure 2: Growth rate (weight) of breastfed and non-breastfed infants (age 0-12 weeks).

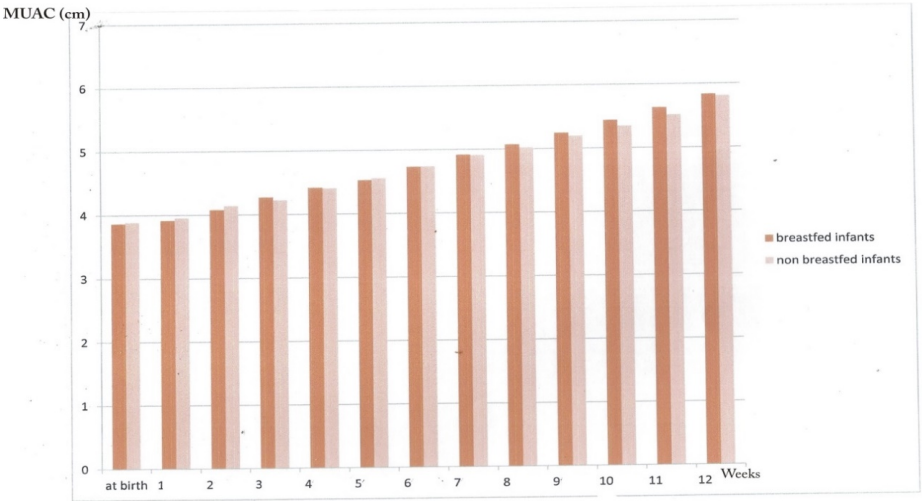

Figure 3: Growth rate (MUAC) of breastfed and non-breastfed infants (age 0-12 weeks).

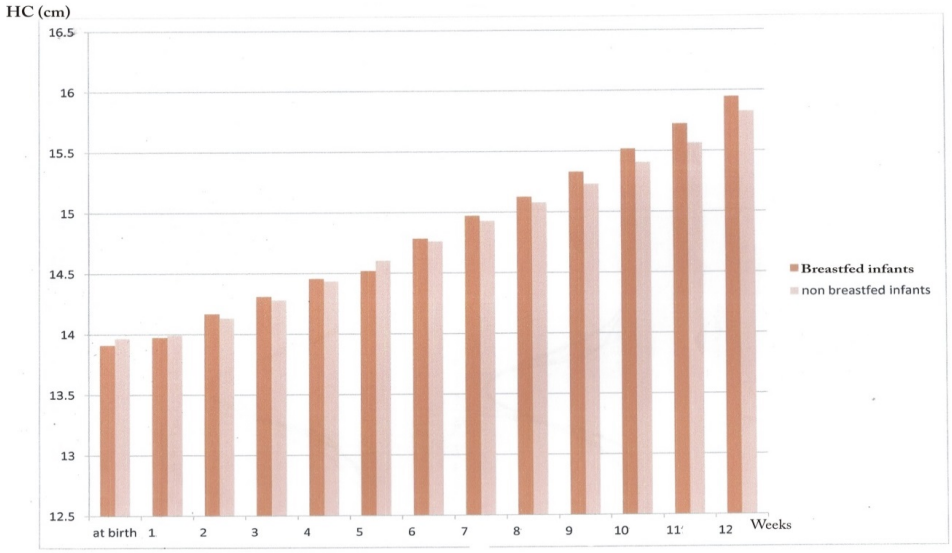

Figure 4: Growth rate (head circumference) of breastfed and non-breastfed infants (age 0-12 weeks).

However, between four and six months formulated babies tended to gain weight faster than their breasted babies. Although observation from this study shows that between births to 4th week formulated babies tend to be leaner in weight compared to their breastfed counterparts which maintain stable weight within this period. This was contrary to the report of Dewey *et al.* [18] in their study which shows that breastfed infants are leaner than formulated infants at one year of age. Also in this study, after the first six months, breastfed babies gained an average of one pound less during the first twelve months. It was suggested that the extra weight gained in formulated infants may be due to excess water retention and variation due to different genetic makeup of the babies. An average rate of growth in weight of 100g to 400g was observed between 2nd weeks to 6th week among the babies as observed in this study (Figure **2**) while 0.5kg to about 1.5kg was observed between 7th to 12 weeks of age among the infants.

However, it was reported that breastfed babies gained between 112 – 200g per week during the first month, an average of 0.5 – 1kg per month for the first six months of life [17]. More so, about 250g was gained per week between 8th weeks to 12th weeks of growth while about 150g was gained between 3rd to 6th weeks of growth.

In Figure **3**, it was found that the rate of growth in their mid-upper arm circumference (MUAC) was at the same rate for both breastfed and non-breastfed babies from birth to 12th weeks of growth. In Figure **4**, it was discovered that the rate of growth in their head circumference (HC) was at the same growth proportion from birth to 6th weeks for both breastfed and non-breastfed babies. But it was discovered that a steady and more rapid rate of growth was found among the breastfed infants between 7th to 12th weeks compared to the non-breastfed infants. This pattern of growth in mid-upper arm and head circumference was similar to growth pattern of children reported by Dewey *et al.* [17] and Agostoni, *et al.* [9].

Presented in Table **2** were the various nutritional status of both breastfed and non-breastfed infants. As indicated in Table **2**, 30.9% in all of the breastfed babies were underweight, while overall of 22% of non-breastfed babies were underweight. In all 2% of the breastfed and 8% of non-breastfed were severely underweight respectively. Underweight at this stage might be as a result of reduction in amount of fluid intake and refusal to feed.

CONCLUSION AND RECOMMENDATIONS

From the outcome of this study, observation shows that infants that were breastfed has a better growth rate (Figure **1**, **2**, & **4**) compared to their non-breastfed counterpart. This finding buttress earlier evidence which shows that breastfeeding resulted in enhanced growth during the first two (2) months but reduced growth during 3 - 12 months compared to infants-fed formula throughout [7,19]. Since the growth rate of breastfed infants were better than non–breastfed infants in all the anthropometric measurements assessed, therefore is no alternative to breastfeeding at this critical stage of life for optimum growth of infants. Mothers are therefore encouraged to

Table 2: Nutritional Status of Breastfed and Non-Breastfed Infants

	Breastfed			Non- breastfed		
Nutritional Status	**Male (n=26) n (%)**	**Female (n=24) n (%)**	**Total (n = 50) n (%)**	**Male (n=22) n (%)**	**Female (n=28) n (%)**	**Total (n = 50) n (%)**
Normal	19(73.0)	15(62.5)	39(68.0)	17(77.2)	22(78.6)	39(78.0)
Under weight	6(23.0)	9(37.5)	15(30.9)	3(13.6)	4(4.3)	7(22.0)
Severely under weight	1(3.8)	0(0.0)	1(2.0)	0(0.0)	2(7.1)	2(8.0)

breastfeed exclusively for six months in order to achieve optimum growth at this particular period of life and to prevent childhood disease and malnutrition. However, it is not known whether differences in body composition at this period of their life may have any long term consequences on growth or health. More research should therefore be carried out to probe further into this critical stage of life.

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