Original Article

GROWTH OF VERY LOW BIRTH WEIGHT INFANTS AND ITS ASSOCIATION WITH FEEDING REGIMENS

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Abstract

Clinical care of infants with very low birth weight (weighing < 1500 gm at birth) in developing countries can be labour intensive and is often associated with a prolonged stay in hospital. Although several studies have shown the benefits of early discharge from the hospital for premature infants, it is still a common practice to delay discharge of these infants until they reach a weight of 2000 gm or more. The present study was undertaken to test the assumption that very low birth weight (VLBW) infants can attain optimum growth at home and to find its association with feeding regimens. This prospective observational study was conducted at Neonatal Out-patient Department, Dhaka Shishu Hospital over a period of 1 year from January 2010 to December 2010. A total of 92 very low birth weight neonates were enrolled during discahrge in the Neonatal Unit of Dhaka Shisu Hospital. Out of these 92 neonates 16 neonates expired while 7, 4 and 1 neonates dropped out in the first, second and third follow up respectively. The neonates after discharge were fed on three types of feeding regimens at home. The feeding regimens were expressed breast milk (EBM), EBM+ infant formula (mixed feeding) and infant formula only).The outcome variable was growth in terms of increase in weight, length and occiputo-frontal circumference (OFC). The other outcome measures were respiratory tract infection (RTI), diarrhoea and anaemia, visit to physician and readmission to hospital for the morbidities they encountered. The neonates were observed up to three consecutive follow-ups from their date of discharge. The median gestational age at birth was 31 weeks. Approximately 57% of the neonates were admitted within 72 hours of birth with median age at admission being 24 hours. Females were slightly higher (54.3%) than the males (45.7%). The mean weight, length and OFC at admission were 1208 gm 39.8 cm and 28.3 cm respectively. The study demonstrated a steady increase of weight, length and OFC of the infants up to a median age of 6 months with mixed and EBM feeding compared to infant formula group. Regarding RTI, diarhoea and anaemia the breast fed group suffered less frequently than the groups fed with infant formula and EBM+infant formula groups. The frequency of visits to physician and hospital admission were significantly lower in the EBM group than the other two groups. Higher frequency of breast feeding reduced the chance of infection and its severity. Infants discharged below1500 gm grew well with exclusive breast milk.

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Key words: Growth, very low birth weight infants, feeding regimens, morbidity.

Introduction

Management of very low birth weight (weighing < 1500 gm) infants has always been a problem for both clinician as well as parents. In the developed world survival and outcome of these infants have improved

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tremendously in recent years accounting for 80 – 90% survival rates for infants weighing 750 – 1500 gm.[1,2] Early neonatal intensive care unit (NICU) discharge has been advocated for selected preterm infants to reduce both the adverse environment of prolonged hospital stay and to encourage earlier parental involvement by empowering parents to contribute to the ongoing care of their infants and thereby reducing costs of care. Although several studies have shown the benefits of early discharge from the hospital for premature infants, it is still a common practice to delay discharge of these infants until they reach a weight of 2000 gm or more.[3,4] The consequences of prolonged hospitalization are well-established. They are maternal deprivation affecting the growth and development of the infants,[5] skilled nursing time that should be devoted to sick infants are spent in the routine care of healthy infants, chances of increased nosocomial infection and considerable drain of scarce health resources.[3,6] In this context, several studies concurrently reported some criteria needed to be achieved before hospital discharge of the premature infants. The creteria were temperature stability out of an incubator, ability to suck and gain weight on oral intake and no symptoms.[3,4,7] All these studies suggest that achieving these criteria, instead of attaining a targeted weight, are sufficient to augment normal growth, reduce the incidence of RTI, diarhoea and recurrent hospitalization provided the feeding regimen is nutritionally sound.

Three possible milk regimens are advocated for these infants, namely, expressed breast milk (EBM), preterm infant formula and mixed feeding (EBM+ infant formula). However, different investigators claim different growth rates using these regimens.[8]

The World Health Organization (WHO) is in favour of mothers' milk alone during the first six months of life,[9] though research data from industrialized countries suggest that VLBW infants require additional nutrients which is unavailable in unmodified mothers' milk.[10] Another study reported that infants fed on Preterm Formula (PTF) grew significantly better than those fed on breast milk alone or in combination with PTF. These trails demonstrate that WHO feeding strategy is not enough for VLBW infants during the first month of life.[11] Faced with this background, the present study was undertaken to determine whether preterm neonates discharged at or below 1500 gm can attain optimum growth at home care with appropiate feeding regimens. The effetcs of different feeding regimens on subsequent morbidity was also assessed.

Material and Methods

The present prospective study included a total of 92 VLBW (weighing < 1500 gm) neonates admitted in the Neonatal Unit of Dhaka Shisu Hospital and at discharge achieved the following criteria: 1) neonates maintained a normal body temperature in an open crib, 2) nippled feeding, 3) gained weight consistently at least for 3 days and 4) were free from symptoms and received no medications for at least 3 days. Weight was not considered as a criterion for their discharge. The neonates excluded from the study were 1) infants with congenital anomalies, 2) those requiring oxygen therapy (>40%) or assisted ventilation, 3) those discharged on request of their parents, 4) multiple or joint families living in the same home and 5) those without basic utilities. At 1st follow up 16 infants expired, 7 neonates dropped leaving 69 and at 2nd and 3rd follow ups 4 and 1 infants dropped respectively.

At discharge mothers were instructed as to how to take care of their neonates and to bring them regularly at follow up clinic specially designed to provide care for the VLBW babies. The neonates were observed up to three consecutive follow-ups from their date of discharge. In the follow up sessions information was collected on weight, length, OFC and other pertinent variables.

Infants were divided into three groups. Group 1 received EBM only, group 2 received EBM+infant formula and group 3was given infant formula alone. The main outcome variables were increase in weight, length, OFC, morbidity (RTI, diarrhoea and anaemia), visit to physician and readmission to same or different hospitals for the morbidities encountered. If any neonates failed to attend follow up session their parents were contacted to get information about them.

Data were analyzed using SPSS (Statistical Package for Social Sciences) version 11.5. The statistics used were Chi-square (χ^2) or Fisher's Exact Probability Test and ANOVA .

Results

Baseline demographics & anthropometry

Baseline characteristics show that median gestational age at birth was 31 weeks. Approximately 57% of the

Table-1: *Baseline characteristics of neonates (n = 92)*

Baseline characteristics	Frequency (%)	Median± SEM	Range
Gestational age (weeks)	——	31±1	29–33
Age at admission (hours)			
≤ 24	52(56.5)	24±1.9	6–72
> 24	40(43.5)		
Sex			
Male	42(45.7)	——	——
Female	50(54.3)		
Anthropometry			
Weight (gm)	——	1208±66	1050–1465
Length (cm)	——	39.8±2.5	34–44
OFC (cm)	——	28.3±1.7	24–32

neonates were admitted within 72 hours of birth with median age at admission being 24 hours. Females were slightly higher (54.3%) than the males (45.7%) (Table-1).

The anthropometric characteristics of the neonates at admission are illustrated in Table1. The mean weight at admission was 1208 kg and the lowest and the highest weight were 1050 and 1465 kg respectively. The mean length and OFC were 39.8 cm and 28.3 cm respectively.

Anthropometric characteristics

At 1st follow up

Anthropometric measurements at 1st follow up (during a median follow up of 2 months) are furnished in Table-2. Neonates fed on EBM + infant formula achieved the weight (3697 ± 318 gm) nearly similar to those who were fed on only EBM (3377 ± 565 gm). Both groups were better than infant formula group (3282 ± 274 gm; P = 0.002). In terms of length attainment neonates having mixed formula and expressed breast milk exhibited significantly better growth than the neonates fed on infant formula ($p < 0.001$). Increase in occiputo-frontal circumference (OFC) was also significantly better in mixed formula and EBM group than those in infant formula group ($p < 0.001$).

At 2nd follow up

Anthropometric measurements at 2nd follow up (median follow up time 4 months) showed that infants in mixed feeding group attained highest weight (5507 ± 371) followed by infants on EBM (5472 ± 378) and infant formula (5223 ± 298) groups. However, there was no significant difference among the three groups with respect to increase in length and OFC ($p = 0.189$ and $p = 0.054$ respectively; Table-1).

Table-2: *Comparison of anthropometric indices at 1st, 2nd and 3rd follow up among the three study groups*

Anthropometric indices	Feeding pattern			F	p-value
	Expressed breast milk (n = 21)	Mixed feeding (n = 36)	Infant formula (n = 12)		
1st follow up					
Weight (gm)	3377 ± 565	3697 ± 318	3282 ± 274	6.855	0.002
Length (cm)	52.3 ± 0.8	52.5 ± 1.1	50.6 ± 0.9	18.229	< 0.001
OFC (cm)	35.6 ± 0.8	35.8 ± 0.7	34.8 ± 0.5	9.712	< 0.001
2nd follow up					
Weight (gm)	5472 ± 378	5507 ± 371	5223 ± 298	6.855	0.017
Length (cm)	58.3 ± 1.4	57.8 ± 2.4	57.5 ± 1.1	18.229	0.189
OFC (cm)	38.5 ± 0.9	38.6 ± 0.9	37.9 ± 0.9	9.712	0.054
3rd follow up					
Weight (gm)	6565 ± 503	6683 ± 395	6235 ± 351	6.855	0.001
Length (cm)	63.5 ± 1.1	63.7 ± 1.3	63.1 ± 1.3	18.229	0.293
OFC (cm)	41.3 ± 0.6	41.4 ± 0.6	40.7 ± 0.7	9.712	0.003

Data were analysed using ANOVA statistics and were presented as mean ± SD; # p-value refers overall difference among the three groups. In 2nd and 3rd follow up in mixed feeding groups n = 33 and 32 respectively

Table-3: *Comparison of co morbidities encountered and health service utilization during the period between discharge from the hospital and 3rd follow up visit*

	Feeding pattern			χ^2	p-value
	Expressed breast milk (n = 20)	Mixed formula (n = 32)	Infant formula (n = 12)		
Co-morbidity					
RTI	4(19.0)	11(30.6)	7(58.3)	5.488	0.064
Diarrhoea	7(33.3)	5(13.9)	4(33.3)	3.655	0.161
Anaemia	0(0.0)	3(8.3)	4(25.0)	6.024	0.049
Health services received					
Visit to physician	8(38.1)	16(44.4)	11(91.7)	9.956	0.007
Hospital admission needed	0(0.0)	8(22.2)	7(58.3)	15.284	< 0.001

Data were analysed using Chi-square (χ^2); # p-value refers overall difference among the three groups.

At 3rd follow up:

Anthropometric measurements at 3rd follow up (median follow up time 6 months) demonstrated that infants of mixed feeding and EBM groups had the almost similar gain in weight (6683±395, 6565±503). Infants fed with infant formula alone had much lower wieght gain then the above two groups (6235±351, p=0.001). Increase in OFC was also observed significantly faster in EBM and mixed feeding groups than that in infant formula group (p=0.003), although increase in length was almost identical in all the three groups (p = 0.293).

Feeding pattern and comorbidity

Respiratory tract infection (at least one episode) was significantly higher among infants of infant-formula group (58.3%) compared to that of mixed feeding (30.6%) and EBM groups (19%, p = 0.064). Anaemia was significantly higher among neonates of infant formula group (25%) than those in mixed feeding group (8.3%, p = 0.049). No significant association was observed regarding feeding pattern and diarrhea (at least one episode; p= 0.161; Table-3).

Visit to physician and hospital admission

Neonates on infant formula made highest visits to physicians followed by mixed feeding and EBM groups (p=0.007). Need for hospitalization was also highest in infants of formula fed group (58.3%) followed by mixed feeding group (22.2%). None of the neonates of EBM group needed hospitalization (p<0.001;Table-3).

Causes of hospital admission

In mixed formula, RTI and anemia were prime causes of hospitalization of neonates, while in infant formula group, the main cause of hospitalization was RTI (57.1%) followed by diarrhoea (42.9%).

Discussion

Conventionally preterm infants are discharged from the hospital when they reach a prefixed weight, although no published studies support the benefit of attaining a specific weight before discharge. Several published studies dating from as early as 1971 have presented data supporting earlier nursery discharge.[1-4, 6,7,12,13] These studies have put emphasis on infant's capabilities related to maturity rather than weight as discharge criteria. All have selected infants on the basis of their ability to feed and maintain body temperature. In the present study as well the infants were selected at discharge on the basis of their ability to maintain body temperature outside incubator, able to suck and gain weight on oral intake with no symptoms of systemic illness. No clear-cut feeding policy was suggested, though breast milk was encouraged. The neonates after discharge fed on three types of feeding regimens at home. The study demonstrated a steady growth of the infants up to a median age of 6 months with EBM and mixed feeding compared to infants fed on formula only. However, all the three groups of neonates experienced RTI, diarhoea and anaemia to some extent with breast feeding group suffering less

frequently than the infant formula and mixed formula groups. The frequency of visits to physician and hospital admission were significantly lower in the EBM group than the other two groups. Frequency of health service utilization was less in EBM group indicating less severity of infections in this group than their two other counterparts.

The World Health Organization (WHO) recommends mothers' milk alone during the first six months of life irrespective of their birth weight.[1,9] But, research data from industrialized countries suggest otherwise. VLBW infants require higher nutritional density than is available in unmodified mothers' milk if they are to achieve the recommended growth during the first month of life. Lucas and others in a large multi centre randomized trial in 1984 reported that infants fed on Preterm Formula (PTF) grew significantly better than those fed on breast milk alone or in combination with PTF.[2,3,10,11] Another study conducted by Lucas 15 years later found that VLBW infants fed on enriched milk during the first month of life grew faster with better neuro-developmental scores during the subsequent years.[12-15]

The present study showed that breast milk alone was adequate to achieve a targeted growth for VLBW infants. Higher frequency of breast feeding lowered the chance of infection and its severity. The study, therefore, concludes that VLBW infants, discharged on the basis of their behavioral criteria, grow well provided their feeding regimen is nutritionally sound.

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