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Original Research Article

Postnatal growth in very low birth weight babies fed on exclusive human breast milk

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ABSTRACT

Background: Ideal preterm nutrition should sustain growth which mirrors the intrauterine fetal growth rate. Human milk provides complete nutrition to term infants and has been recommended as the exclusive source of feeding till first 6 months. Concern regarding growth faltering in preterms has precluded exclusive use of human milk for nutrition. The aim of this study was to document the growth rates of preterms fed exclusive human milk from birth to discharge from hospital.
Methods: This was a longitudinal cohort study in which all preterms admitted to neonatal intensive care unit (NICU) with very low birth weight (VLBW) and gestational age of ≤35 weeks were enrolled consecutively over a one-year period. Fluid, electrolyte and human milk intake was managed as per the NICU protocol. Vitamins and mineral supplements were added as per unit policy. Pre-feed weight, occipito-frontal circumference, and length was recorded at pre-determined intervals till discharge.
Results: Data of 37 infants was analysed. The most common morbidity was respiratory distress (29.73%) followed by birth asphyxia. Average time to regain birth weight was 13.61 days while mean increase in weight, length and OFC was 11.24 gm/kg/day, 0.60 cm/week and 0.59 cm/week respectively. The NICU length of stay varied from 9-76 days.
Conclusions: Exclusive use of human milk is reliable in achieving growth in preterm VLBW babies. Though the rate of growth is not comparable to intrauterine growth rates, nevertheless in the absence of accepted standards for postnatal growth in preterms on exclusive human milk, the results are reassuring.

Keywords: Growth rate, Human milk, Preterm infants, Very low birth weight

INTRODUCTION

Human milk provides complete nutrition to the term babies, and is associated with multiple benefits to the mother and baby. Both American Academy of Pediatrics (AAP) and World Health Organisation (WHO) recommend exclusive breastfeeding for the first 06 months.[1,2] Concerns about non-sustainability of desired growth rates is a hindrance to exclusive breast feeds in preterms. Ideal preterm nutrition should help the infants grow postnatally at a rate, which matches the corresponding intrauterine growth rate which is an increase in weight of 10-20 gm/kg/day, and head circumference and length of approximately 0.9 cm/week.[3] ESPGHAN 2010 guidelines recommend caloric, protein and mineral intake, which at times is in excess of what can be provided by preterm human milk.[4] Preterm human milk has advantages for growing preterm that include decreased incidence of late onset sepsis, NEC, chronic lung disease (CLD), and better neurodevelopmental outcome.[5-8] While adding human milk fortifier (HMF) may increase the growth rate in NICU, it provides no long-term neurodevelopmental and growth advantage.[9] AAP too recommends the use of preterm human milk for the preterm infants.[10] There are very few studies that have looked at the growth of preterm babies exclusively fed human milk during the postnatal hospital stay.[11,12]

It has been proposed that the postnatal growth of preterms should match intrauterine growth rates during third trimester of pregnancy, however, most neonates experience a growth lag during NICU stay, attributed to neonatal morbidities, inappropriate nutritional management and unfavourable NICU environment making it difficult to use intrauterine growth curves as ideal for monitoring growth. This study was carried out to monitor and document the growth parameters of preterm infants fed exclusive human breastmilk from birth to discharge from hospital.

METHODS

This was a longitudinal cohort study conducted over a period of one year from December 2013 to November 2014 at a level 3 Neonatal Intensive Care Unit (NICU) associated with Armed Forces Medical College, Pune.

Inclusion criteria

Inborn preterm VLBWs with gestational age of ≤35 weeks and/or birth weight of ≤1500 gm and admitted to the NICU were included as study subjects.

Exclusion criteria

Babies with congenital malformations, not fed human milk exclusively, and babies not surviving to discharge were excluded.

Measurable study parameters were weight gain in grams per kg per day, and change in head circumference and length in cm per week.

Sample size was calculated to estimate 95% confidence interval (CI) for the growth rate with respect to change in weight, length and head circumference. A standard deviation of 5, 0.3, and 0.2 was assumed for weight, length and head circumference which gave a sample size requirement of 15, 35 and 15 for each of the growth parameters hence a minimum sample of 35 was taken. Informed consent was taken from any one of the parents. They were screened for congenital anomalies by reviewing the antenatal ultrasonography records, and conducting a thorough head to toe examination immediately after birth. Additional workup for anomalies was carried out based on clinical indication. Gestation was assessed using New Ballard score and was also corroborated with last menstrual period (LMP) and first trimester USG.

The fluid, electrolyte and human milk intake was managed as per the NICU protocol and was documented on daily basis on a structured data sheet. Intravenous fluids were commenced on day 1 at 80-100 ml/kg/day of 5-10% dextrose enriched with electrolyte (calcium 4 ml/kg). Enteral feeds with expressed human milk were started usually on day 2 of life at 10-20 ml/kg/day. Increase in feeds was individualized depending on tolerance and as decided clinically by the attending neonatologist. Intravenous fluids were tapered off to achieve the desired total fluid rate. Mode of feeding was determined according to maturation of feeding skills. Vitamins and mineral supplements were given as per the NICU protocol, mixed with feeds (dosage: calcium- 140 mg/kg/day, vitamin D- 400 IU/day and Zn- 1.5 mg/kg/day).

Daily morning pre-feed weight of the babies was recorded using an electronic weighing scale (accuracy ±5 gm) after removing all clothing. Babies who were unstable or on respiratory or hemodynamic support were weighed whenever possible. Occipito-frontal head circumference (OFC) was measured at 48 hours of life, and then weekly by cross tape method using a non-expandable flexible tape. Length was measured weekly by an infantometer after placing head on the fixed end and legs towards the adjustable end. Length and OFC velocity was calculated by subtracting parameter being studied at discharge from birth length or OFC respectively, divided by duration of NICU stay in weeks. Thorough asepsis was maintained during the acquisition of growth parameters. Babies were discharged from NICU based on the clinical decision of the neonatologist. Data analysis was carried out using Microsoft excel and detailed analysis was carried out using software MedCalc version 9.1.0.1 by MedCalc Software, Belgium.

RESULTS

A total of 41 preterm infants were enrolled in the study and were assessed for meeting eligibility criteria (Figure 1).

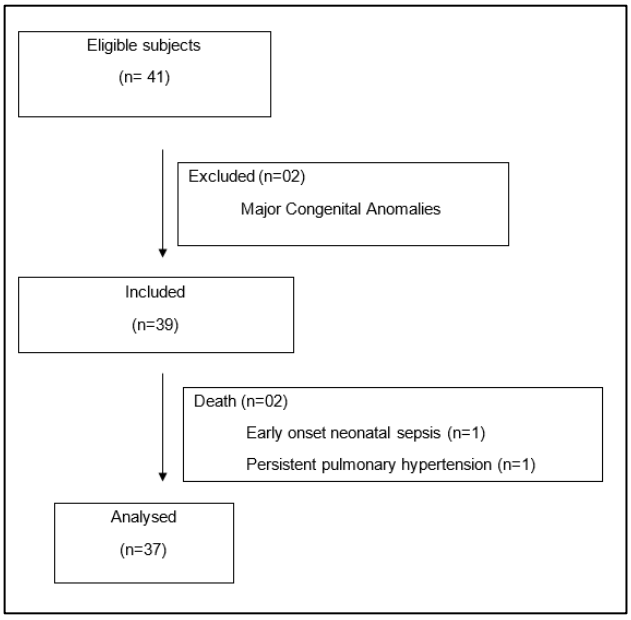

Figure 1: Study flow chart.

Demographics of the study population was analysed in terms of gender, period of gestation, single or multiple

pregnancies, anthropometric parameters at birth and duration of NICU stay and is depicted in Table 1.

Table 1: Baseline demographic and clinical characteristics of study subjects.

Demographic characteristics	Value	Range
Gender (n*=37)		
Male	18	-
Female	19	
Multiple pregnancy (n)	4	-
SGA newborns (n)	5	-
Received antenatal steroids (n)	29	-
Gestational age (mean±SD*)	31.2±2.1	27-35
Birth weight in grams (mean±SD)	1181.4±191.1	755-1500
Length at birth in cm	37.7±2.3	33-42.5
OFC at birth in cm	26.8±2.1	21-31.5
Duration of NICU stay (mean±SD)	29.6±16.3	9-76

*SD=standard deviation *n=number of infants

Table 2: Morbidities encountered during hospitalization.

Morbidities	Number of babies (total=37)	Percentage
SGA	5	13.51
Birth asphyxia	5	13.51
Resp. distress	11	29.73
Late onset sepsis	4	10.81
NEC	4	10.81
Total	29	76%

Table 3: Summary of assessed velocity of anthropometric parameters.

Parameter	Range	Mean±SD	95% CI of mean
Weight Velocity (gm/kg/day)	-10.30-51.50	11.24±12.24	5.48 to 12.36
Length velocity (cm/week)	0.00-1.20	0.60±0.27	0.51 to 0.69
OFC velocity (cm/week)	0.20-1.90	0.59±0.31	0.48 to 0.69
Days to regain birth weight (n=33)	1-44	13.61±7.78	

The most common morbidity observed was respiratory distress (29.73%) followed by birth asphyxia and SGA (13.51%) each (Table 2). The assessed velocity of various anthropometric parameters is depicted in Table 3. The NICU length of stay varied from 9-76 days. Two babies were in the NICU for 76 days. Correlations of weight velocity with duration of NICU stay shows decreasing trend of weight gain velocity (r of -0.42) with longer length of stay. This observation was statistically significant with P value of 0.009. Frequency of distribution of velocity of anthropometric parameters is depicted in Figure 2.

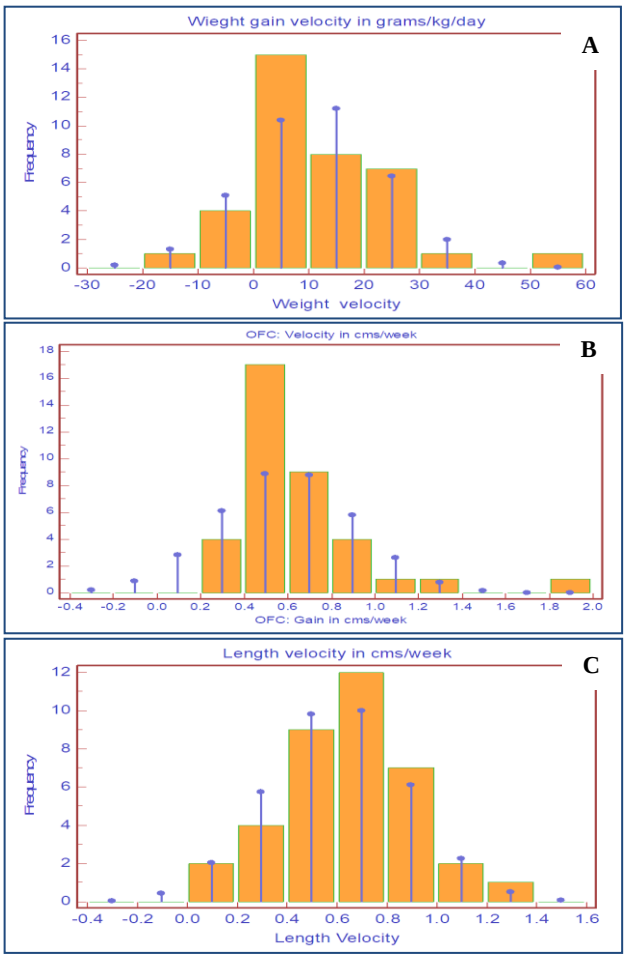

Figure 2: Frequency polygon showing distribution of velocity of anthropometric parameters; A) weight gain velocity in gm/kg/day; B) OFC: velocity in cm/week; C) length velocity in cm/week.

DISCUSSION

This longitudinal cohort study was conducted to determine the postnatal growth rate till discharge of inborn very low birth weight preterm babies with weight <1500 gm, fed exclusively on human milk. The study found a growth rate in weight of 11.24 gm/kg/day with a SD of 12.24, while that in length was 0.60 cm/week with SD of 0.27 and that of OFC was 0.59 cm/week with SD of 0.31. Studies done earlier have explored the role of human milk in LBW infants but literature on exclusively feeding human milk in VLBW babies is scarce. In utero, the fetus grows at approximately 16 gm/kg/day of body weight and 0.9 cm/week in terms of OFC and length from 23 to 35 weeks of gestation.[13-15]

Early initiation of enteral feeds with expressed milk and progressive advancement of these feeds along with concomitant use of electrolyte enriched IV dextrose is advocated as the standard of care in NICU. Parenteral nutrition is reserved for the infants unable to tolerate enteral feeds. Most objective way to justify such feeding practice would be to actually study the growth pattern and velocity without significant disadvantage to the babies in a controlled setting with daily monitoring. However, there is paucity of literature regarding nutritional support strategies for this population.

Growth can be monitored adequately among babies by measurement of body weight, length and OFC. Weight is a good indicator of total body composition. It however fluctuates in the short term with hydration status and contraction of the total water in different body compartments postnatally. Length on the other hand is more reliable as it is seldom influenced by variations in hydration status or fluid compartment of the body. It represents an increase in the lean tissue mass and so is considered a better indicator of long term growth. This study was aimed for the outcome till discharge hence weight gain was considered as the most important study outcome parameter.

The mean birth weight recorded in our study is 1181.35 gm which when plotted on Fenton weight chart for preterm babies corresponds to a value between 3rd and 10th centile. There were 5 babies with weight <1000 gm at birth and 4 sets of twins with non-representative intra-uterine growth, which possibly led to skewing of observations towards a lower mean value.

The pattern of postnatal growth in the preterm infant shares initial similarity with term infants with a period of weight loss, but subsequently there are major differences potentially due to morbidities present in the former. Analysis of the morbidity pattern revealed that respiratory distress was commonest (30%) followed by birth asphyxia (14%). These observations are consistent with other studies from India and abroad.[16,17] All the babies recovered favourably and went on discharge except one who developed PPHN.

Weight velocity is calculated in gm/kg/day by using 2 point time interval (birth weight model) by calculating the difference in discharge weight and birth weight in grams, divided by the duration of NICU stay in days multiplied with birth weight (in kg). The mean weight velocity in our study group of infants is 11.24 gm/kg/day, though lower as compared to Fenton charts, is consistent with the studies in Indian literature.[15,18] Since the babies recovered well and were discharged the mean positive weight velocity is encouraging. The wide range over which the weight velocity is spread is due to multiple factors, prominent amongst them being gestational age, weight <1000 gm, associated morbidities, delayed readiness for enteral feeds and non-fortification of the feeds.

Length velocity range of 0.00 to 1.20 cm/week and OFC velocity range of 0.20 to 1.90 cm/week was recorded in our study. Ideal postnatal length and OFC velocity is appproximately 0.9 cm/week. Our study cohort had length velocity of 0.60 cm/week (0.60±0.27), and OFC velocity of 0.59 cm/week (0.59±0.31). The low means which have been observed is due to inclusion of the initial stabilisation period for calculation of the above-mentioned growth parameters. Though not truly representative of only the phase in which growth is occurring, but it seems more practical as it gives an indication of what can be expected if factors such as initial unstable phase and morbidities are kept in mind. Despite these limitations and shorter interval of timed measurement in few babies who went on discharge early, a mean weight gain velocity of >11 gm/kg/day while on human milk is encouraging, particularly so as majority of the VLBW babies in this study went on discharge.

There was a negative correlation between the duration of NICU stay (time taken for discharge) and the weight velocity. The correlation was statistically significant ($p<0.009$). Plausible explanation for this could be that babies with morbidity tend to have longer stay as stabilisation and discharge readiness is delayed. Moreover babies have to be completely stable before being on full feeds. Morbidities also lead to frequent feed inturruptions, change over to transient i.v. fluids, longer stay and reduced weight gain over a given time interval.

In a resource limited setups as seen in our country, with NICU care being unaffordable to a significant proportion of parents, measures to initiate early feeding with breast milk or breast feeding has enormous cost effectiveness and long term benefits. Our study highlights definite positive growth in the weight, length and OFC, with feeding exclusive unfortified breast milk.

Limitations of the study include a small sample size of relatively stable babies, short duration of observation, and limited data points, hence the recommendations are reserved to a particular setting which can be validated by conducting larger studies.

CONCLUSION

Exclusive use of human milk as the only source of nutrition to preterm VLBW babies is feasible and reliable in achieving growth as measured by change in weight, length and OFC. Though the rate of growth is not comparable to intrauterine growth rates, studies monitoring long term growth along with neurodevelopmental outcomes at longer periods of time will establish the efficacy and utility of feeding exclusive human milk to preterm VLBW neonates.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Eidelman AI, Schanler RJ. Breastfeeding and the use of human milk. Pediatrics. 2012;129;e827.
2. World Health Organisation. Exclusive breastfeeding for six months best for babies everywhere: Statement 2011. Available at: https://www.who.int/news/item/15-01-2011-exclusive-breastfeeding-for-six-months-best-for-babies-everywhere#:~:text=WHO%20recommends%20mothers%20worldwide%20to,of%20two%20years%20or%20beyond. Accessed on 4 November 2020.
3. Schanler RJ, Hurst NM, Lau C. The use of human milk and breastfeeding in premature infants. Clin Perinatol. 1999;26(2):379-98.
4. Agostoni C, Buonocore G, Carnielli VP, De Curtis M, Darmaun D, Decsi T, et al. Enteral nutrient supply for preterm infants: commentary from the European Society of Paediatric Gastroenterology, Hepatology and Nutrition Committee on Nutrition. J Pediatr Gastroenterol Nutr. 2010;50(1):85-91.
5. Narayanan I, Prakash K, Murthy NS, Gujral VV. Randomised controlled trial of effect of raw and holder pasteurised human milk and of formula supplements on incidence of neonatal infection. Lancet. 1984;2(8412):1111-3.
6. Joneja JM. Breast Milk: a vital defence against infection. Can Fam Phys. 1992;38:1849-55.
7. Lucas A, Morley R, Cole TJ, Lister G, Leeson-Payne C. Breast milk and subsequent intelligence quotient in children born preterm. Lancet. 1992;339(8788):261-4.
8. Vohr BR, Poindexter BB, Dusick AM, McKinley LT, Higgins RD, Langer JC, et al. Persistent beneficial effects of breast milk ingested in the neonatal intensive care unit on outcomes of extremely low birth weight infants at 30 months of age. Pediatrics. 2007;120 (4):e953-9.
9. Kuschel CA, Harding JE. Multicomponent fortified human milk for promoting growth in preterm infants. Cochrane database Syst Rev. 2004;2004(1):CD000343.
10. Section on Breastfeeding. Breastfeeding and the use of human milk. Pediatrics. 2012;129(3):e827-41.
11. Muhudhia SO, Musoke RN. Postnatal weight gain of exclusively breast fed preterm African infants. J Trop Pediatr. 1989;35(5):241-4.
12. Cole TJ, Statnikov Y, Santhakumaran S, Pan H, Modi N. Birth weight and longitudinal growth in infants born below 32 weeks' gestation: a UK population study. Arch Dis Child Fet Neonat Ed. 2014;99(1):F34-40.
13. Adams-Chapman I, Hansen NI, Shankaran S, Bell EF, Boghossian NS, Murray JC, et al. Ten-year review of major birth defects in VLBW infants. Pediatrics. 2013;132(1):49-61.
14. Hack M, Fanaroff AA. Outcomes of children of extremely low birthweight and gestational age in the 1990s. Semin Neonatol. 2000;5(2):89-106.
15. Saluja S, Modi M, Kaur A, Batra A, Soni A, Garg P, et al. Growth of very low birth-weight indian infants during hospital stay. Indian Pediatr. 2010;47(10):851-6.
16. Stevenson DK, Wright LL, Lemons JA, Oh W, Korones SB, Papile LA, et al. Very low birth weight outcomes of the National Institute of Child Health and Human Development Neonatal Research Network, January 1993 through December 1994. Am J Obstet Gynecol. 1998;179(6):1632-9.
17. Owa JA, Osinaike AI. Neonatal morbidity and mortality in Nigeria. Indian J Pediatr. 1998;65(3):441-9.
18. Mathew G, Gupta V, Santhanam S, Rebekah G. Postnatal weight gain patterns in preterm very-low-birth-weight infants born in a tertiary care center in south India. J Trop Pediatr. 2018;64:126-31.

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