

Study of the Effect of Human Milk Fortification in Preterm and VLBW Neonates in Jharkhand-A Hospital Based Study

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Abstract:

Background: Poor weight gain and postnatal growth of preterm and VLBW neonates continues to be a major problem. Breast feeding with HMF fortification show positive effect on growth.

Objective: To compare the growth between fortified and unfortified human milk fed preterm and VLBW neonates.

Methodology: This is an observational study conducted in NICU, Department of Pediatrics and Neonatology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, for assessing the weight gain pattern in preterm and VLBW neonates supplemented with HMF.

Results: Maximum number of babies supplemented with HMF achieved the targeted weight in 8-14 days (34.0%) followed by those who attained this weight within 15-21 days (29%), 22-28 days (19.3%), <7 days (14.5%) and >28 days (3.2%) respectively.

Conclusion: We concluded that the supplementation with HMF, can result in a significant increase in growth of preterm and VLBW neonates. We demonstrated that fortification of human milk, with HMF did not cause any measured adverse effects in preterm and VLBW neonates.

Keywords: HMF, Fortification, preterm and VLBW

Date of Submission: 07-04-2019

Date of acceptance: 22-04-2019

I. Introduction

Poor weight gain and postnatal growth of preterm and VLBW neonates continues to be a major problem. Intrauterine growth retardation is an additional risk factor in the growth of preterm infants.

Breast milk is considered as the best food for the neonates due to its several nutritional and immunologic advantages but this has been well established that human milk is an inadequate source of protein, minerals and calories for growing premature babies.^{1,2} Very low birth weight babies need higher calories, protein and minerals to achieve adequate catch up growth.³

Nutritional management influences immediate survival as well as subsequent growth and development of preterm and VLBW infants. Even simple interventions such as early initiation of breastfeeding and avoidance of pre-lacteal feeding have been shown to improve their survival in resource restricted settings.⁴ Early nutrition could also influence the long term neurodevelopmental outcomes; malnutrition at a vulnerable period of brain development has been shown to have deleterious effects in experimental animals.⁵ Since intrauterine accretion of nutrients occurs mainly in the later part of the third trimester, preterm and VLBW infants (usually born before 32 weeks gestation) have low body stores at birth. Hence, they require supplementation of various nutrients.⁶

These infants who are usually born before 32-34 weeks gestation have inadequate body stores of most of the nutrients. Expressed breast milk has inadequate amounts of protein, energy, calcium, phosphorus, trace elements (iron, zinc) and vitamins (D, E and K) that are unable to meet their daily recommended intakes. Hence, these infants need multi-nutrient supplementation till they reach term gestation (40 weeks postmenstrual age). After this period, their requirements are similar to those infants with birth weights of 1500-2499 grams.

On the basis of available literature exclusive breast feeding with HMF fortification or exclusive breast feeding with individual supplementation of MCT oil, vitamins and minerals show positive effect on growth. For HMF fortification frequent expression of milk is required prior to the feed with katori spoon, whereas expression of breast milk is not needed in individual supplementation. Good hygiene is required in HMF while it is not required in individual supplementation. Human milk remains the preferred feeding for preterm infants given its protective properties and beneficial prevention effects (such as necrotizing enterocolitis and sepsis). Since human milk remains nutritionally inadequate, especially for preterm and VLBW infants, it has to be

fortified. In present study, we study the weight gain pattern in preterm and very low birth weight babies supplemented with HMF.

II. Methodology

This observational study was carried out in NICU, Department of Pediatrics and neonatology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, between April 2018- September 2018 for assessing the weight gain pattern in preterm and VLBW neonates supplemented with HMF. Written and informed consent was taken from parents/guardians. The study protocol was reviewed and approved by Ethics Committee of Rajendra Institute of Medical Sciences, Ranchi, Jharkhand.

Infants were eligible if born 31 to 34 completed weeks gestation and 1100- 1500 grams birth weight; their mothers intended to provide breast milk and parents or guardians provided written informed consent. It was important that the infants were in-patients for enough time for the intervention to affect growth rate. Preterm infants normally remain in hospital to term or close to, so it was reasonable to assume that these infants would be in hospital for three to four weeks. All infants in the NICU were screened for eligibility. A detailed antenatal, natal and postnatal history from the mother was taken and thorough clinical examination was done. Risk factors for sepsis were assessed as per detailed history. Neonate with major congenital malformation, gastrointestinal abnormalities, critically ill or hemodynamically unstable were excluded. After including in the study HMF was started to all neonates. Fortifier is mixed with expressed breast milk (EBM) before it is administered to the neonate. The fortified EBM is then fed to the infant via orogastric tube or as katori spoon feeding. The fortifiers were started when the infant's enteral intake reached at least 100ml/kg/day and continued till the infant achieved weight of 1600gm. Feed was started at 80ml/kg/day and gradually increased upto 180ml/kg/day. The primary outcome of the study was rate of weight gain as gm/kg/day.

III. Results

In the present study, 62 preterm and VLBW newborns were studied. Birth weight of babies ranged from 1100 to 1490 gm. Among the study group 27.7% had birth weight 1200-1290 gm followed by 25% each in birth weight 1300-1390 gm and 1400-1490 gm category and only 22.3% with birth weight 1100-1190 gm. Majority of babies were males. Proportion of females was 43.5%. GA at birth ranged from 31 weeks to 33 weeks 6 days.

Majority of babies had gestational age ≤ 32 weeks at birth. Overall, a total of 58.0% babies had gestational age ≤ 32 weeks at birth whereas remaining 42.0% babies had gestational age > 32 weeks at the time of birth. Majority of cases were SGA. There were 45.2% AGA. These data are shown in Table 1.

Table 1: Distribution of babies according to sex and GA.

GENDER	Number	Percentage
Male	35	56.5
Female	27	43.5
GA (WEEKS)		
<32 weeks	36	58.0
>32 weeks	26	42.0
SGA	34	54.8
AGA	28	45.2

Majority of cases (62.0%) achieved full feed within 2-5 days. Time taken to achieve weight of 1600 gm ranged from 6 to 37 days. Maximum number of babies achieved the targeted weight in 8-14 days (34.0%) followed by those who attained this weight within 15-21 days (29.0%), 22-28 days (19.3%), <7 days (14.5%) and >28 days (3.2%) respectively. (Table 2).

Table 2: Distribution of babies according to time taken to achieve weight of 1600 gm.

Time taken (days)		
	No.	%
≤ 7 days	9	14.5
8-14 days	21	34.0
15-21 days	18	29.0

In this study the overall mean weight growth rate was 14.43g/kg/day.

IV. Discussion

The present study was carried out in NICU, Department of Pediatrics and Neonatology, Rajendra Institute of Medical Sciences, Ranchi, between April 2018- September 2018. In this study a total 62 neonates were analysed. During the recruitment period, inclusion and exclusion criteria were strictly followed. Primarily the purpose of this study was to compare the weight gain of preterm and VLBW neonates when they were fortified with HMF. Human milk contains numerous immune-protective components that protect the premature infant from sepsis and necrotizing enterocolitis. Because of these protective effects, human milk is the feeding of choice for the premature infant. However, human milk does not provide adequate amounts of most nutrients for premature infants and must therefore be supplemented (fortified) with nutrients.¹¹ With the rapid development of medical technology, the number of premature newborns with small gestational age and low birth weight continues to rise, and clinicians face challenges in providing proper nourishment for these infants. Research has confirmed that breast milk fortifiers can improve short term growth.¹² Commercially available fortifiers provide energy and most nutrients in adequate amounts.¹³ Human milk has the dual functions of supporting and complementing the preterm infant's developing immune system, and of providing the nutrients needed for growth and development. As a source of nutrients, however, human milk is inadequate, necessitating nutrient supplementation (fortification).¹⁴ There are different methods of fortifying expressed breast milk. When fortifiers were introduced in the 1980s, a substantial number of studies were conducted to assess their effectiveness. Collectively these studies conducted between 1987 and 1999 showed that fortifiers improved growth and various indicators of nutritional status.⁹ Keeping that in mind all the preterm babies in this study were given fortified expressed breast milk with HMF and we didn't take a control group of unfortified expressed breast milk only. The aim of fortification is to raise the concentrations of specific nutrients in relation to energy to such levels that nutrient needs are met whenever energy needs are met. Fortification also increases the caloric density of milk, which helps to keep feeding volumes low. Fortifiers achieve this by including carbohydrate(s) and/or lipids.

In present study, on analysis of data, we found that the overall mean weight gain of new borns who received HMF fortified maternal milk was 14.43 g/kg/day. Martins EC et al compared the weight and height gain and the frequency of clinical complications in preterm new borns weighing less than 1,500 g, exclusively fed human milk or fortified human milk until reaching 1,800g.¹⁵ Prospective double-blind randomized controlled trial involving 40 preterm infants weighing <1,500 g at birth and ≤ 34 weeks of gestational age. Daily weight gain, weekly length and head circumference gain, nutritional variables and clinical complications were compared. Human milk fortification resulted in better growth, the weight gain was 24.4 and 21.1 g/day ($p = 0.075$). There were no significant clinical complications.

Mukhopadhyay K et al studied the effects of human milk fortification on 166 infants (Preterm infants weighing ≤ 1500 grams and ≤ 34 weeks of gestation) on short term growth and biochemical parameters in preterm very low birth weight (VLBW) appropriate for gestation (AGA) and small for gestation (SGA) babies.¹⁶ Primary outcome measures were Short-term growth (daily weight, length and head circumference (HC) weekly) till discharge or 2 Kg. Fortification resulted in better growth in preterm VLBW babies as compared to control group. Weight gain (15.1 and 12.9 g/kg/d, $P < 0.001$), length (1.04 and 0.86 cm/week, $P = 0.017$) and HC (0.83 and 0.75cm/week, $P < 0.001$) increased significantly in fortified group. The results found in the present study are similar to those found in the literature. There is great difficulty in keeping mothers in a hospital setting, with maternal milk available for manual expression during the whole period of hospital stay, and this was only possible in the present study because mothers were offered accommodations during the whole period of study, in addition to nutritional and psychological follow-up provided by the multi-professional and interdisciplinary team. There were few limitations to our study. One of the limitation of our study was small sample size. The small study populations are evidenced by the wide confidence intervals. Such small numbers may not allow high enough power to detect differences in, for example, NEC incidence. A study with larger sample size is needed for further validation of results. A multi centric study with a large sample size will be able to overcome these limitations.

In summary, fortified human milk has tremendous benefits in improving the growth and short term outcomes for the premature infant. Mother's own milk has clear advantages due to its composition. Premature infants need fortification of human milk to achieve growth as recommended. Based on the results of this study, we concluded that the supplementation with HMF, can result in a significant increase in growth.

Despite the favourable results regarding the use of HMF, further studies are needed to improve and individualize the nutrition of very low birth weight preterm infants, taking into consideration the composition of maternal milk and each new-born's needs.

V. Conclusion

We concluded that the supplementation with HMF, can result in a significant increase in growth of preterm and VLBW neonates. We demonstrated that fortification of human milk, with HMF did not cause any measured adverse effects in preterm and VLBW neonates.

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Dr. Partha Kumar Chaudhuri. "Study of the Effect of Human Milk Fortification in Preterm and VLBW Neonates in Jharkhand-A Hospital Based Study." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 18, no. 04, 2019, pp 07-10.