



**COMPARATIVE STUDY OF WEIGHT GAIN PATTERN BETWEEN VLBW BABIES  
WITH BREAST FEEDING ALONE AND BREAST FEEDING WITH HMF**

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**ABSTRACT**

Increase in the incidence of low birth weight (LBW) infants In addition to higher risk of morbidity and mortality and in India tThese very low birth weight babies nutritional requirements are different from babies with weight >1500grms, and exclusively breast fed VLBW babies may not meet the nutritional requirements, so fortification of breast milk with HUMAN MILK FORTIFER. Hospital based Comparative study There were 117 babies with GA ≤32 weeks (17.6% of admitted babies), after drop out from follow-up, and 100 babies were followed up till the end of the study. mean growth velocity attained on exclusive breast feeding was 11g/kg/day, on fortification is 11.03g/kg/day.

**KEYWORDS:** Low birth weight, Breast milk, Human milk fortifiers, growth velocity.

**INTRODUCTION**

During the last few decades, increase in the incidence of low birth weight (LBW) infants and their improved survival rate has raised the problem of proper evaluation of their postnatal growth.<sup>[1]</sup> In addition to higher risk of morbidity and mortality and in India these babies constitutes of 8 millions of which 30% babies are of Very low birth weight babies, with birth weight between 1000-15000 grams, gestational age between 28-32 weeks show a pattern of growth different from the normal term babies. These very low birth weight babies nutritional requirements are different from babies with weight >1500grms and exclusively breast fed VLBW babies may not meet the nutritional requirements, so fortification of breast milk with HUMAN MILK FORTIFER proposed in many studies.<sup>[2]</sup> Fortification of breast milk may influence the growth velocity in the vulnerable group, has been shown to decrease in morbidity, hospital stay and nosocomial infections.<sup>[3]</sup>

Studies carried out so far on growth of VLBW infants are not homogenous in criteria of inclusion, number, and frequency of observations and length of follow-up.<sup>[2,3]</sup> Only few studies have considered only weight as the criterion without taking into consideration about feeding status and fortification.

Often these studies did not have a control group of breast milk fortification<sup>[4]</sup>

**AIMS AND OBJECTIVES**

To determine the weight gain pattern of VLBW babies with breast feeding alone with breast feeding and HUMAN MILK FORTIFER, at the NICU, Dept. of Pediatrics, S.V.R.R.G.G. Hospital, TIRUPATI.

The specific objectives are to determine

1. Study of weight gain among VLBW babies with breast feeding
2. Study of weight gain among VLBW babies with breast feeding and HMF
3. Comparative study between both groups of VLBW babies

**METHODOLOGY**

**STUDY DESIGN:** A Hospital based Comparative study.

**STUDY SETTING**

NICU, Department of Pediatrics, Sri Venkateswara Ramnarain Ruia Government General Hospital, TIRUPATHI, both inborn and outborn VLBW babies born annually, i e babies weighting from 1000 grams to 1500 grms.

**STUDY PERIOD** From September 2014 to August 2015

**Table: 1: Mean weekly weight in grams in babies with exclusive breast feeding.**

Gestational Age in Weeks					
Post natal age (weeks)	28	29	30	31	32
Birth	1044	1177	1240	1354	1464
1	973	1078	1181	1237	1307
2	1005	1100	1260	1300	1409
3	1081	1188	1429	1424	1512
4	1183	1271	1560	1566	1608
5	1308	1438	1789	1713	1857
6	1525	1700	1860	1920	2133
7	1600	1933	2140	2169	
8	1750	2153			
9	1950				
10	1950				
11	2125				

**Table: 2 Mean weekly weight in grams in babies with exclusive fortified group**

Gestational Age in Weeks					
Post natal age (weeks)	28	29	30	31	32
Birth	1029	1087	1180	1340	1464
1	950	982	1081	1204	1299
2	1001	1118	1179	1321	1418
3	1094	1209	1369	1410	1557
4	1201	1310	1513	1574	1679
5	1294	1415	1694	1693	1878
6	1428	1506	1800	1818	2130
7	1597	1799	2144	2183	
8	1678	1984			
9	1729	2160			
10	1918				
11	2105				

**Table: 3 Target weight gain postnatal in both groups**

Gestational age	Breast feeding group	Fortification group	p value
28	10-11 weeks	11 weeks	<0.005
29	8 weeks	8 weeks	<0.005
30	7 weeks	7 weeks	<0.005
31	7 weeks	7 weeks	<0.005
32	6 weeks	6 weeks	<0.005

**Table: 4 Average weekly growth velocity in g/kg/day in breast feeding group**

Gestational Age in Weeks						
Post natal age (weeks)	28	29	30	31	32	Weekly Average
Birth - 1	-11.8	-14.9	-10	-11.3	-16.2	-12.89
1 - 2	3.3	6.5	9.4	8	10.9	7.62
2 - 3	9	11.4	15.8	10	12.1	11.66
3 - 4	12.5	6	13.8	11.6	14.6	11.7
4 - 5	16.5	15.2	13.2	10.7	12.3	13.58
5 - 6	12.5	13.6	10.5	20	15.4	14.4
6 - 7	5	14	14	18.1	12.4	12.7
7 - 8	13	8.5	11.6	17.4	15.2	13.14
8 - 9	15.4	29.6	11.1	9.1		16.3
9 - 10	17.2	15.9	11.8			14.9
10 - 11	12.4	14.1				13.25
11 - 12	8.7					8.7

**Table: 5 Average weekly growth velocity in G/Kg/Day in fortified group**

Post natal age (weeks)	Gestational Age in Weeks					Weekly Average
	28	29	30	31	32	
Birth – 1	-12.1	-15.2	-11.9	-12.1	-16.9	-13.6
1 – 2	3	6.1	8.9	8.1	10.3	7.28
2 – 3	9.1	11	15.2	11.4	12.2	11.78
3 – 4	13.1	6.4	14.1	12.1	14.7	12.08
4 – 5	16.7	15.9	13.9	11	12.9	13.98
5 – 6	12.9	13.9	11.8	20	16.1	14.94
6 – 7	5.4	14.1	14.6	18.9	13	13.2
7 – 8	13.3	8.9	12.1	18.3	15.7	13.56
8 – 9	5.9	30.1	11.4	9.8		16.8
9 – 10	17.8	16.1	12.1			15.33
10 – 11	12.9	14.4				13.65
11 – 12	8.9					8.9

**Table: 6 Comparison of the baby parameters and the feed characteristics between the fortified and unfortified groups**

Parameters	Study Group [EBM] (n=50)	Study Group [EBM+HMF] (n=50)	P Value
Gestational Age	29.2±1.17	29±1.38	P<0.05
Birth Wt.	1430±0.26	1420±0.36	P<0.05
T f 100* (Days)	10.08±1.08	12.84±0.85	P<0.05
T f full ** (Days)	15.62±1.25	17.96±1.34	P<0.05
V max (Ml) +	168.6±5.3	171.6±8.0	P<0.05

Tf 100\*- Average number of days to achieve 100ml/kg/day feeds

Tf Full\*\* - Average number of days to achieve maximum feeds

V max - Volume of maximum feeds

### SAMPLE SIZE

A purposive sampling technique was applied. All consecutively delivered babies, with gestational age less than 32 weeks admitted into the Neonatal Intensive Care Unit, over the study period that meet the study criteria.

### INCLUSION CRITERIA

All preterm babies admitted in the NICU with birth weight of 1000-1500gms and Gestational age of 28-32 weeks within the first 24 hours of life for care.

### EXCLUSION CRITERIA

1. Babies with major congenital anomalies.
2. VLBW Babies diagnose with metabolic disorders.
3. VLBW Babies not reaching at least 100 ml/kg/day for 24 hrs of enteral feeds.

### DATA COLLECTION PROCEDURES Weight

For in-born babies, the weights were obtained immediately after birth in the labour ward. Although this is routinely measured, the investigator ensured the standardization of the labour ward weighing scale on a weekly basis using known weights. For babies admitted directly to the NICU, the admission weight obtained within the first 24 hours of life was regarded as the birth weight<sup>6</sup>. The same type of digital weighing scale, were used in both the labour ward and the NICU, and they were both standardized using the same set of known weights on a weekly basis. Lowest measurable weight is 5 grams.

Subsequently, babies were weighed daily for the first week of life and then weekly until discharge from the NICU or until a weight of 2000grms. Babies were weighed naked on the scale after proper calibration.

### Occipitofrontal Circumference (OFC)

Occipitofrontal circumference was measured across the widest part of the skull. The land marks used were at a point 1cm above the glabella and around the widest part of the occiput.<sup>[7]</sup> This measurement was carried out within the first 24hrs of life and subsequently weekly. Measurements were done using a non-expandable flexible tape with centimetre marking clearly inscribed across one end. This meter tape is able to read to 0.1cm.

### Length

Length was first measured within 24hrs of life and then, weekly. Length was measured using an improvised infantometer. It has a stationary end where the infants' feet were placed and the opposite end is adjustable. The 0cm mark was at the stationary end.

### Feeding

All babies were fed mother's milk as soon as they could tolerate enteral feeds. Babies who do not have adequate weight gain, weight loss of >10% at the end of 1<sup>st</sup> postnatal week and passage of urine < 7 to 8 times a day are identified and given milk fortification i.e., breast feeds with HMF, but this is seldom

administered, after babies reaching an enteral feeds of 100ml/kg/day. None of the subjects had parenteral nutrition.

### Gestational Age Assessment

All babies had gestational age assessment done using the Ballard chart.

### Growth Velocity

Growth velocity<sup>[9]</sup> (in g/kg/day) was calculated using the formula described by Patel

$$\text{Growth Velocity} = \frac{W_{n+1} - W_n \times 1000}{\left[ \frac{W + W + 1}{2} \right]}$$

Where;

$W_n$  = weight in grams on day n

$W_{n+1}$  = weight in grams on the following day

It is well known that preterm breast milk expressed from the infant's own mother is the milk of choice. However babies with adequate weight gain with only breast feeding itself are not given HMF.

The plan was to introduce HMF along with breast feeding in situations where there is no adequate weight gain and urine output of 6 to 7 times a day.

Babies who were admitted with weights greater than 1200g were discharged home when they were deemed to have overcome all initial problems and mothers had demonstrated sufficient proficiency in asepsis, feeding, handling and keeping baby warm.

### DATA ANALYSIS

Data collected on the proforma were entered using numeric codes. Where necessary, data was analysed using EPI-info version 3.5.2 software.

Chi – square tests, Student t test and ANOVA were performed as indicated.

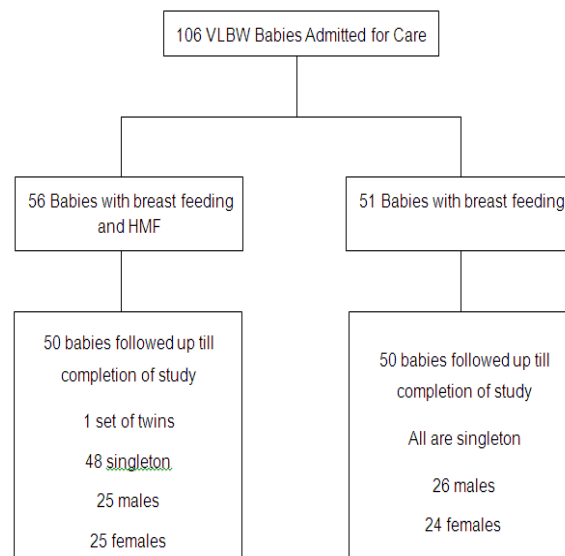
A p-value of <0.05 was considered significant.

### ETHICAL CLEARANCE

Ethical clearance was obtained from the Ethics Review Committee of the Informed consent was also obtained from one or both parents of the baby before subject recruitment.

### OBSERVATIONS AND RESULTS

During the study period, 2060 babies were admitted into the NICU, S.V.R.R.G.G.H, Tiriupati. There were 117 babies with GA ≤32 weeks (17.6% of admitted babies), after drop out from follow-up, and 100 babies were followed up till the end of the study.



**Figure 1: General characteristics of the study population**

### POSTNATAL GROWTH PATTERNS AMONG BABIES

As babies are made into two groups which are selected by computer generated randomized numbering system. First group has given only breast feeds another group given breast feeding with HMF, on the basis of weight loss at end of first post natal week babies whose weight loss is more compare to other group babies are given fortification of milk and also considering, urine output not more than 7 times a day.<sup>[10]</sup>

### DISCUSSION

Human milk feeding has potentially significant immunologic, nutritional and psychological advantages for the preterm VLBW babies, and there is increasing scientific evidence supporting its value in neonatal care. However, the low phosphorus content of human milk may be inadequate for bone mineralization during and after hospitalization, and previous studies have shown improved bone mineralization and growth in premature infants fed fortified mother's milk and higher prevalence of osteopenia and rickets in the VLBW infants without mineral supplementation, estimates of calcium and phosphorus needs for infants <1800 grams and GA of 28-32 weeks are 140-180mg calcium and 70-90 mg phosphorus/kg/bodyweight/day.

Many studies in the past have focused on various aspects of fortifier enriched milk for preterm infants. The last reported by Schanler et al<sup>[11]</sup>, focused on effects on growth, feed intolerance and health of participating infants who were fed fortified human milk, in comparison with those who were fed exclusively with preterm formula.

Our case control study focuses mainly on the subject for weight gain patter, growth velocity during the hospitalization and after discharge also. There is a

significant reduction in the duration of hospitalization because of faster growth rate in babies receiving fortification with economic and psychological benefits for the parents. The shorter duration of hospitalization may decrease exposure of these babies to nosocomial sepsis and thus contribute to the overall reduction of sepsis and the associated morbidity in VLBW babies. Similar observations have been made by Bhaseer *et al.*<sup>[12]</sup>, who found enhanced growth of preterm babies with human milk fortification and also by Schanler *et al.*<sup>[11]</sup>, who noticed that infants fed fortified milk human milk were discharged earlier and had less incidence of late onset sepsis and NEC. Babies receiving human milk fortifier, there was no significant difference in the frequency of feed intolerance and NEC, in the two groups. This may also be related to the fact that human milk fed babies have very low incidence of NEC, as compared to babies on artificial feeds<sup>[15]</sup> and fortified human milk, though marginally hyperosmolar than human milk alone,<sup>[16]</sup> does not predispose to the development of NEC, and may be better than hypertonic saline added to the feeds in situations of hyponatremia during recovery periods of these LBW infants.

## Comparison of weight gain pattern with other studies

Parameters	Geetha Gathwala et al <sup>[12]</sup>			Basheer Ahmed et al <sup>[13]</sup>			Present study		
	Study Group (n=30)	Control Group (n=30)	p value	Study Group (n=50)	Control Group (n=50)	p value	Study Group (n=50)	Control Group (n=50)	p value
Mean gestational age	33.38±1.38	32.83±1.17	P>0.05	29.5±2.1	29.3±2.1	<0.001	29±1.38	29.2±1.17	P<0.05
Birth weight	1670±129	1658±140	P>0.05	1245±191	1239±186	<0.001	1420±0.36	1430±0.26	P<0.05
Tf 100	3.84±0.85	4.08±1.08	P>0.05	7.96±0.98	8.04±1.09	<0.001	12.84±0.85	10.08±1.08	P<0.05
Tf full	7.96±1.34	8.32±1.25	P>0.05	10.34±1.96	11.25±1.36	<0.001	17.96±1.34	15.62±1.25	P<0.05
Vmax	171.6±8.0	168.6±5.3	P>0.05	161±9	167±7.8	<0.001	171.6±8.0	168.6±5.3	P<0.05

On above studies, Geetha Gathwala et al.<sup>[12]</sup> taken 30 subjects in each group and Basheer Ahmed et al.<sup>[13]</sup> had taken 50 subjects in each group, in our study we had taken 50 subjects, we had taken parameters same as above studies. Geeta Gathwala et al.<sup>[12]</sup> not significant with  $p$  value  $>0.05$  and in Basheer Ahmed et al.<sup>[13]</sup>, was significant with  $p$  value  $<0.01$ , in our study  $p$  value is  $<0.05$  which is significant. All these facts further points to the need for initiating fortification of human milk feeds in VLBW babies as soon as these tolerate enteral feeds. Though the current practice in most places is to initiate fortification at an enteral volume of 140ml/kg/day, some recent studies have encouraged the use of fortification beginning at an enteral volume of 100ml/kg/day.<sup>[17]</sup> The tolerance of fortified human milk can be further improved by the gradual increase to full strength fortification over a period of 3-4days. It is difficult to compare the result of present study with previously published data of this subject of growth especially in preterm.

Besides prematurity growth of a child is affected by many factors such as environmental influence, genetic factors, nutrition, social background<sup>[46]</sup> etc. In the midst of diversity of these factors it is impossible to have unity in growth pattern of babies with different birth weight.

Concept of classification of babies on gestational age and birth weight is quite recent and all the studies do not classify newborns on this basis as sample size decreases. Premature babies grow faster, on and after fortification, when the result is subjected to statistical analysis they reach significance at the  $<0.05\%$  probability level. It is very likely that widening curves may attain a statistical significance at a later age.

Although premature babies have found to have a slightly faster growth rates, the growth all attained statistical significance at the end of the study Thus the results may be conclusive if the follow-up period is longer and the number of babies is more.<sup>[18]</sup>

## CONCLUSIONS

1. Most of the exclusively breastfed and fortified preterm VLBW babies delivered at gestational ages  $\leq 32$  weeks remained (between 10<sup>th</sup> and 50<sup>th</sup> percentile) at 11 post natal age.
2. The mean growth velocity attained on exclusive breast feeding was 11g/kg/day, on fortification is 11.03g/kg/day
3. The babies had a mean weight loss of 8.18% in the first week of life (between 4.8 and 10.71%) in breast feeding group and a mean of 19.36% (between 7.6% and 11.2%) in fortified group with higher loss in weight, and tended to regain birth weight by the 3<sup>rd</sup> to 4<sup>th</sup> post natal week, in both groups
4. The slow growth velocity raises questions about the adequacy of exclusive breast feeding for preterm babies.

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