



# Growth Pattern of Low Birth Weight Babies in the First Year of Life

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## ABSTRACT

**Objective:** To compare the growth parameters (Weight, Length, HC) of low birth weight babies ( $\leq 2500$ ) versus normal weight babies ( $> 2500$ ) till the age of 1 year.

**Design:** 1 year longitudinal observational follow up study

**Methods:** As per inclusion criteria 50 cases ( $\leq 2500$  gms) and 50 control were selected for the study.

Low birth weight babies delivered at Prathima Institute Of Medical Sciences or admitted to NICU of the same were enrolled by purposive sampling technique. This cohort was categorized into four groups based on birth weight. Babies in each sub group were entering a follow-up programme that includes measurement of anthropometric variables (weight, length and head circumference etc.) at 1.5, 2.5, 3.5 months  $\pm$  3 days and at 6, 9, 12 months  $\pm$  7 days.

**Results & Conclusion:** From the above study we found that lower the birth weight, higher is the increment in all the three parameters (Weight, Length, HC). Head circumference had catch-up growth with the control by the end of 1 year. Length and weight had no catch-up growth in spite of rapid increment. Head circumference of Preterm AGA babies had maximum catch-up growth and almost caught-up with the control babies at the end of the study period.

**Key words :** Low birth weight , Growth pattern , Longitudinal follow up

## I. INTRODUCTION

During the last few decades, the increase in the number of low birth weight (LBW) infants and their improved survival rate has raised the problem of correct evaluation of their post natal growth. There are not many studies on this subject from India. The only study done was in 2002. Many previous studies used cross-sectional data gathered from separate group of subjects, often in the early months of life. However, only longitudinally collected growth data on the same subject measured at different age for an extended

period allow calculation of growth velocity. Hence this is an attempt being made to determine the growth pattern in LBW infants during the first year life.

## AIMS AND OBJECTIVES

1. To assess the growth parameters viz; weight, length and head circumference of babies  $\leq 2500$  gm delivered in Prathima Institute Of Medical Sciences.

2. To compare the growth parameters of Preterm Small for Gestational Age (SGA) and Preterm Appropriate for Gestational Age (AGA) in low birth weight babies.

## MATERIALS AND METHODS

### SOURCE OF DATA

Cases: 50 Low birth weight ( $< 2500$  gm) babies delivered at Prathima Institute Of Medical Sciences or admitted to NICU during the study period.

Control: Term babies with weight  $\geq 2500$  gm

Type of Study: Prospective comparative cohort study.

### Inclusion criteria:

All the babies born/ admitted at Prathima Institute Of Medical Sciences with Birth weight  $< 2500$ gms

### Exclusion Criteria:

- Babies with congenital anomalies
- Babies with severe birth asphyxia
- Severe birth trauma
- Chromosomal anomalies
- Babies weighing  $< 1$  kg
- Babies not completing 1 year of follow up

### Method of Collection Of Data

As per inclusion criteria 50 cases ( $\leq 2500$  gms) and 50 control were selected for the study. Low birth weight babies delivered at Prathima Institute Of Medical Sciences or admitted to NICU of the same were enrolled by purposive sampling technique. This cohort was categorized into four groups based on birth weight.



Group	Birth Weight (grams)
I	1000-1500
II	1501-2000
III	2001-2500
IV	>2501

Statistical analysis:  
 Collected data were analyzed by ANOVA (Analysis of Variance) and by chi-square test.

## II. RESULTS AND ANALYSIS

Of the total 50 cases, 30 were male and 20 were female.

Of the total 50 controls, 35 were male and 15 were female.

Mean Gestational Age in each Groups-Group1, group-2, group-3, group-4 are 31,33.9,37,38.1wks GA respectively.

### Weight:

Table No.12: Mean Increment and S.D.at 3 month interval in weight of all the groups

Weight	0-31/2mo.	P-value	31/2-6mo.	P-Value	6-9mo	P-Value	9-12mo	P-Value
Group1	1.3 □ 0.54	<0.001	1.6 □ 0.53	>0.05	1.6 □ 0.51	>0.05	0.8 □ 0.16	>0.05
Group2	2.1 □ 0.52	>0.05	1.9 □ 0.46	>0.05	1.1 □ 0.27	>0.05	0.9 □ 0.21	<0.01
Group3	2.27 □ 0.57	>0.05	2.1 □ 0.42	<0.005	1.0 □ 0.35	<0.001	0.8 □ 0.31	>0.05

In our study when mean increment in the weight at three monthly intervals was taken, we found that:

- At 31/2 months group-1 babies had no catch-up growth with the control which is quite significant (p<0.001), group-2 and group-3 babies had catch-up growth with the control and were not significant (p>0.05).
- At 6 months group-1 and group-2 babies had catch-up growth with the control and was not significant (p>0.05). Group-3 babies had no catch-up growth with the control and was

significant (p<0.05).

- At 9 months, group-1 and group-2 babies had catch-up growth with the control and was not significant (p>0.05). Group-3 babies continued to have no catch-up growth which is quite significant (p<0.001).
- At 12 months, group-1 and group-3 babies had catch-up growth with the control and was not significant (p>0.05). Group 2 babies had no catch-up growth with the control and was significant (p<0.01).

### Length:

Table No. 13: Mean Increment and S.D. at 3 month interval in length of all the groups

Length	0-31/2mo.	P-value	31/2-6mo.	P-Value	6-9mo	P-Value	9-12mo	P-Value
Group1	10.7 □ 4.60	>0.05	8.9 □ 3.15	<0.001	6.1 □ 1.98	>0.05	3.8 □ 1.25	>0.05
Group2	10.7 □ 2.40	<0.02	7.4 □ 2.14	>0.05	4.9 □ 1.94	>0.05	4.4 □ 1.22	>0.05
Group3	10.4 □ 2.23	<0.01	6.8 □ 2.1	<0.01	5.3 □ 1.64	>0.05	4.1 □ 1.07	<0.001

In our study we found that:

- At 31/2 months, group-2 and group3 babies had no catch-up growth with the control and was significant (p<0.02 & <0.01 respectively). Group-1 babies had catch-up growth with the control and was not statistically significant (p>0.05).
- At 6 months, group-1 and group-3 babies had no catch-up growth with the control and was

statistically quite significant (p<0.001 in both the groups). Group-2 babies had catch-up growth with the control and was statistically not significant (p>0.05).

- At 9 months, babies in all the 3 groups had catch-up growth with the control and was statistically not significant (p>0.05).
- At 12 months, group-3 babies had no catch-up growth with the control and was statistically



quite significant ( $p < 0.001$ ). Group-1 and group-2 babies had catch-up growth with the control

and was statistically not significant ( $p > 0.05$ ). [Table no.13]

**Head Circumference:**

**Table No. 14: Mean Increment and S.D. at 3 month interval in head circumference of all the groups**

Head circumference	0-31/2mo.	P-value	31/2-6mo.	P-Value	6-9mo	P-Value	9-12mo	P-Value
Group1	5.8 $\pm$ 2.27	$>0.05$	4.6 $\pm$ 1.28	$<0.001$	3.0 $\pm$ 1.19	$<0.01$	1.8 $\pm$ 0.70	$>0.05$
Group2	6.9 $\pm$ 1.83	$<0.001$	3.0 $\pm$ 0.81	$>0.05$	1.8 $\pm$ 0.81	$<0.05$	1.6 $\pm$ 0.40	$>0.05$
Group3	5.9 $\pm$ 1.11	$<0.001$	3.4 $\pm$ 0.63	$<0.001$	1.9 $\pm$ 0.85	$<0.001$	1.6 $\pm$ 0.53	$<0.001$

In our study we found that:

- At 3 months, group-2 and group-3 babies had no catch-up growth with the control and was statistically quite significant ( $p < 0.001$ ). Group-2 babies had catch-up growth with the control and was statistically not significant ( $p > 0.05$ ).
- At 6 months, group-1 and group-3 babies had no catch-up growth with the control and was statistically quite significant ( $p < 0.001$ ). Group-2 babies had catch-up growth with the control and was statistically not significant ( $p > 0.05$ ).
- At 9 months, babies in all. The three groups had no catch-up growth with the control and was statistically quite significant ( $p < 0.01$ ,  $< 0.05$  &  $< 0.001$  respectively).
- At 12 months, group1 and group 2 babies had catch –up growth with the control and was statistically not significant ( $p > 0.05$ ). Group 3 babies had no catch-up growth with the control was statistically quite significant ( $p < 0.001$ ).

were well motivated at the time of discharge from NICU and wards. Reminders were sent as and when required It is difficult to compare the result of present study with previously published data of this subject of growth especially of premature.

- 1) Besides prematurity growth of a child is affected by many factors such as environmental influence, genetic factors, nutrition, social background etc. In the midst of diversity of these factors it is impossible to have unity in growth pattern of babies with different birth weight.
- 2) 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.
- 3) The studies that are published have bias of the population from which data is arrived. Hence standards of growth may be difficult to postulate.
- 4) Correction of prematurity is not done in many of the studies.

From the above findings we found that babies with lower birth weight have higher increments in all the four parameters i.e. weight, length and head circumference at subsequent follow up. As our sample size is small and follow up period is less we could not come to any conclusive decision and needs further study for a longer period.

**III. DISCUSSION**

The amazing advances in the neonatal care in the past decade have improved the survival of premature babies with very low birth weight.

For any longitudinal study, a good follow-up is extremely important. Parents of the babies

In our study we had enrolled 50 cases and 50 controls. Correction for gestational age (GCA) was not used in our study. Our LBW babies included term SGA, Preterm SGA & Preterm AGA.

The accelerated growth velocity noted in the first year was perhaps only an illusive one as due to a lower birth weight, lesser weight was required for doubling and trebling. The true growth rate, particularly in later years is almost similar to heavier babies and hence the handicap amongst these continues in later years. The need for better psycho-social understanding as well as a true growth potential of these children required further studies, particularly because an increasing number



of these infants are likely to survive.

The early and temporary increase in rate of increase in head circumference by premature infants allows these infants to approach and even to surpass the projected curve for fetal head growth at a corresponding gestational age. This apparent “catch-up” in head size appears to coincide with the unrigidging of the sutures. The exaggerated increase in head circumference in the small premature infant between one and two months of postnatal age can on occasion give the clinician the false impression of developing hydrocephalus.

The head growth in the undergrowth infants of term gestation does not show this early exaggerated increase in size. Yet during the first year head size increases at a faster rate than in either the normal sized term or in premature infants when measured from an age equivalent to that of “term”. An increase in the increment of head growth from birth to four years of age has been shown in a larger group of moderately under-sized infants at birth when compared to full-sized control infants.

Bhargava V.<sup>11</sup> did a study on growth pattern in babies of extreme low birth weight for 2 years. They found that premature babies, though initially had a slight handicap compare to the small for date babies, gradually catch up later by 6 to 9 months and then over take them in all the three parameters i.e. weight, length and head circumference.

In our study we found that SGA babies do not catch-up with the preterm AGA babies in all the three parameters. The reason is our study included preterm SGA and term SGA babies, where as in the Bhargava V study they had term SGA babies. In our study SGA babies had a lower mean birth weight. Our preterm AGA and SGA babies’ values were higher when compared to the other study.

Bhargava did a study on the longitudinal study of linear physical growth of infants with birth weight 1500g or from birth to six years. The sample size included 25 VLBW which included preterm AGA and term SGA. This was compared with the control (>2500gm) group at 3, 6, 9 & 12 months  $\pm$  1week and every 6 month  $\pm$  2 weeks thereafter. They found that the VLBW infants were significantly lighter in weight shorter in height and had smaller head circumference as compared with the control group during the entire study period. The growth velocities in the two groups were almost the same and VLBW weight did not show any catch-up growth.

In our study we found that there was no catch-up growth in the weight at all as Bhargava

study. There was some catch-up growth in the length at the end of one year, and the margin of difference was reduced. Head circumference had maximum catch-up growth with the margin of difference almost narrowing at the end of one year. If at all our study period was extended further then mostly length and head circumference would have caught up with control group. The reason that our babies had a catch-up growth with the control group is may be because our study group had less VLBW babies, whereas in Bhargava study the cases included were of VLBW only. Our control group had higher weight gain at subsequent follow-up when compared to Bhargava et. al. study control group. Our babies were on exclusive breast feeding.

Goram Babson<sup>13</sup> did a study on growth of low birth weight infants for one year. Totally 36 babies were selected who met the inclusion criteria. The babies were divided into 3 groups according to the weight and gestational age. Group A- very premature AGA with gestation 27-29 weeks and birth weight 0.95 to 1.30 kg. Group B- moderately premature AGA with gestation 31-33 weeks, and birth weight 1.4 to 2kg. Group C - full term SGA babies with birth weight <2kg. When the composite curves of growth in the study groups were collected for their differences in gestational age, the following observation were made:

- 1) Curve for length and weight in these low birth weight infants were parallel but remained below the curves of growth considered normal for the fetus and infant, with those of the undersized group of infants being reduced the most.
- 2) Head circumference in the groups of premature, after an initial lag, increases at an accelerated rate so that their growth curves may approach or temporarily surpass the expected mean curve for fetal growth. Thereafter, head circumference follows the expected pattern observed in normal infants.
- 3) In the under grown infant, head circumference at birth is reduced proportionately to length. The curve for head size appears to approach that seen in infants of normal size, but the difference existing at birth is only partly reduced.

In our study we found the values equal to that of Babson study in all the three parameters. In our study we had not split the babies according to gestational age as Babson study. We had also not used correction for gestational age. In Babson’s study babies in all the groups in addition had received formula feeds. Group-A and group-B infants received at an average calorie intake of 115/kg /day and 3.2gm/kg/day proteins during the



study period. Group C infants were fed in an unrestricted manner.

Babies in our study did not receive any formula feed and were mainly an exclusive direct breast feed. With only DBF our babies were gaining weight and when compared with Babson study they were almost equal. From this we postulate that exclusive direct breast feeding in LBW babies is enough for their growth. But in our studies we had no babies weighing less than 1kg and also VLBW babies in our study was very less in whom feeding may be difficult and formula might be necessary.

Srivastava et.al 12 did a longitudinal study of physical growth and morbidity pattern of small for date babies from birth to six months of age. Their sample size included 50 term SGA babies and 50 term AGA babies. The babies were followed every month  $\pm 7$  days and at each visit all the 4 parameters were recorded i.e., weight, length, head circumference & chest circumference. They found out that small for date babies, when compared to normal weight infants, retained the handicap with which they were born in weight, length, head circumference, chest circumference. The difference in mean of all four parameters in both groups at all specified age period were highly significant ( $p < 0.001$ ). They had also divided the babies into male and female. In their study, the babies were categorized according to the socio-economic status.

In our study also we found that LBW babies had not caught-up with the controls in all the four parameters by the end of six months. And our findings were similar to the Srivastava study. The mean monthly increment in both the studies was similar, except at 1st month where our babies had lower values than the other group. This could be due to that our mothers were new to LBW babies and not trained and also because of feeding difficulties experienced by the LBW babies. In our study, LBW babies and the control group were selected from the same socio-economic status. We had not split them according to their socio-economic status into different classes. Our LBW babies included both AGA babies and SGA babies. So, we postulated that LBW babies in spite of good increment every month in the first six months, they do not catch-up with the control babies in all the four parameters.

When comparison of mean increment at 3 month interval was done between our study and other study, we found that:

Our pre term babies had a higher increment at all periods when compared with Bhargava et. al. 1972 study. Our preterm babies

were exclusively on direct breast feed and no supplements were started. When our study was compared with Babson's study our babies had an increment almost equal to that of on the Babson's study. Formula feeding was used in their study. In our study our mothers practiced meticulous exclusive DBF. When our study was compared with Bhargava et. al. 1983 it was seen that our babies had similar increment values at 3, 9 and 12 months. At 6 months our babies had higher values. From the above comparison we conclude that exclusive breast feeding of LBW babies with an advice to the mother how to take care of the babies in order to prevent repeated infections and proper follow-up at regular intervals help to catch-up in the growth of LBW babies in attaining the growth pattern of control babies.

[Table no 24]

When increment in length and head circumference were compared with other studies, like Bhargava et. al. (1972), Babson et. al. 1970, Bhargava et. al. (1983), it was found that our study group had similar increment at subsequent follow-up. Our babies were on exclusive direct breast feed and no formula feeds were started.

#### IV. SUMMARY

From the above study we found that lower the birth weight, higher is the increment in all the three parameters (Weight, Length, HC).

Head circumference had catch-up growth with the control by the end of 1 year.

Length and weight had no catch-up growth in spite of rapid increment.

Head circumference of Preterm AGA babies had maximum catch-up growth and almost caught-up with the control babies at the end of the study period.

#### V. CONCLUSION

From the above study we came to following conclusion:

- 1) Mean weight of Group I, II, III LBW babies and control babies were 6.65kg, 7.95kg, 8.42 kg and 8.79kg respectively, at one year.
- 2) The rate of increase in weight of LBW babies was maximum in first three months i.e. 2.18kg.
- 3) The mean monthly increment in weight of LBW babies in first, second, third and last three months were 700gm, 600gm, 400gm & 200gm respectively.
- 4) Mean length of group I, II, III LBW babies and control babies were 69.43cm, 72.60cm, 73.64cm and 74.90cm respectively at one year.
- 5) The rate of increase in length of LBW babies was maximum in the first three months i.e. 10.7cm.



- 6) The mean monthly increment in length of LBW babies in first, second, third and last 3 months were 3.5cm, 2.5cm, 1.8 cm and 1.1 cm respectively.
- 7) Mean head circumference of group I, II, III LBW babies and Control babies were 43.14cm, 45.33cm, 45.53cm and 45.90-cm respectively at one year.
- 8) The rate of increase in head circumference was maximum in first three monthly i.e. 6.18cm.
- 9) The mean monthly increment in Head circumference of LBW babies in first, second, third and last 3months were 2.0cm, 1.cm, 0.8cm and 0.5cm respectively.
- 10) Babies with lower the birth weight have higher increment in all the four parameters.
- 11) LBW babies had no catch-up growth with the control group babies in weight and length throughout the study period.
- 12) Head circumference of LBW babies had maximum catch-up growth and almost caught-up with the control babies at the end of the study period.

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