MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2023.8.121.125

OPEN ACCESS

**Key Words**
Preterm, small for gestational age (SGA), appropriate for gestational age (AGA)

**Corresponding Author**
Soyeb Azizkhan Pathan
Department of Pediatrics, GMERS Medical College, Gotri, Vadodara, India

**Author Designation**
[1]Junior Resident
[2]Associate Professor
[3]Professor and Head

**Received:** 17 August 2023
**Accepted:** 3 September 2023
**Published:** 4 September 2023

**Citation:** Soyeb Azizkhan Pathan, Ritesh N. Parmar and Nimisha Pandya, 2023. Nutritional Outcomes of Preterm Babies Post Discharge over 12 Months Follow up. Res. J. Med. Sci., 17: 121-125, doi: 10.59218/makrjms.2023.8.121.125



# Nutritional Outcomes of Preterm Babies Post Discharge over 12 Months Follow up

[1]Soyeb Azizkhan Pathan, [2]Ritesh N. Parmar and [3]Nimisha Pandya

*[1-3]Department of Pediatrics, GMERS Medical College, Gotri, Vadodara, India*

**ABSTRACT**

The World Health Organisation (WHO) defines preterm birth as any birth before 37 completed weeks of gestation. Preterm birth is further classified as extremely preterm (<28 weeks), very preterm (28 to <32 weeks) and moderate (32 to <34 weeks) to late preterm (34 to <37 weeks). Advances in neonatal care have greatly increased the chances of survival of even the smallest babies. A significant impact of survival of these preterm babies is seen as growth faltering. VLBW babies are particularly vulnerable to these adverse outcomes. Assess nutritional outcomes of preterm babies in form of weight, height, MUAC, HC post discharge at 3, 6, 9 and 12 months of corrected gestational age. Prospective Observational hospital based Cohort time bound study. We had randomly selected two groups, preterm SGA babies and preterm AGA babies. They were called for follow up 3 monthly till 1 year of age. Total 70 patients are included in this study. Mean weight gain in all preterm newborn during follow up at 3, 6,9,12 months of age was 11.6, 13.3, 12.6, 13.5 g $day^{-1}$, respectively. Mean increase in length of all preterm infants at 3, 6, 9 and 12 months of follow up was 0.9, 0.5, 0.2 and 0.16 cm $week^{-1}$ respectively. Mean head circumference values at 3, 6, 9 and 12 months was 35.9, 40, 41.5 and 43.4 cm, respectively. There was no statistically significant difference observed in WAZ and LAZ score between SGA/AGA infants but statistically significant difference ($p<0.001$) was observed in WLZ score at the end of 1 year of follow up.

## INTRODUCTION

The World Health Organisation (WHO) defines preterm birth as any birth before 37 completed weeks of gestation. Preterm birth is further classified as extremely preterm (<28 weeks), very preterm (28 to <32 weeks) and moderate (32 to <34 weeks) to late preterm (34 to <37 weeks[1].

The term low birth weight (LBW) refers to an absolute weight of <2500 g regardless of gestational age. Small for gestational age (SGA) refers to new-borns whose birth weight is less than the 10th percentile for gestational age. Growth restriction may be symmetric or asymmetric. Low birth weight is further categorized into very low birth weight (VLBW<1500 g) and extremely low birth weight (ELBW<1000 g).

Preterm neonates can be classified based on gestational age, birth weight and gestational age and birth weight combined as Preterm AGA, preterm SGA and preterm LGA.

Preterm birth is the leading cause of mortality in children under 5 years[1]. In the first weeks of life, there is a significant risk of survival due to physiological immaturity of respiratory, cardiovascular and gastrointestinal systems. Preterm babies have feeding problems due to immature organ systems, small gastric capacity, poor gag reflex, incompetent gastroesophageal sphincter, weak sucking reflexes in VLBW babies and poor suck-swallow coordination till 34 weeks. of gestation[2].

Advances in neonatal care and treatments for preterm babies have greatly increased the chances for survival of even the smallest babies.

A significant impact of survival of these preterm babies is seen as growth faltering attributed to inadequate nutrient intake and lack of standardization in feeding practices. Very-low-birth-weight (VLBW) infants are particularly vulnerable to the adverse outcomes[3].

A study conducted by Motta *et al*.[4] shows mean weight gain, weight and length velocity, WAZ, LAZ, WLZ, are significantly affected in preterm and growth restricted infants as compared to term AGA infants at 12-15 months age. Compared with term AGA infants, the risk of being stunted, wasted and underweight is elevated in preterm with the highest magnitude of risk in preterm with growth restriction.

Children born weighing 1,500-2,499 g had 29 times higher chance of being at nutritional risk at 12 months of life than those whose birth weights had been >2,500 g (p<0.001)[4].

## MATERIALS AND METHODS

**Study type:** Prospective Observational hospital based Cohort time bound study. We had randomly select two groups, Preterm SGA babies and preterm AGA babies. They were called for follow up 3 monthly till 1 year of age.

**Study settings:** NICU and HRC clinic at Department of Paediatrics, GMERS Medical College.

### Subjects

**Inclusion criteria:** All Inborn and out born preterm babies admitted in NICU.

**Exclusion criteria:**

- Congenital malformations
- Inborn errors of metabolism
- Chromosomal disorders
- Consent denied

## RESULTS

In our study, 31 (44.35%) newborns were SGA and 39 (55.75%) newborn were AGA by intergrowth 21st standards. In our study, 56 (80.0%) preterm babies were exclusively breast fed for 6 months. While 14 (20%) preterm were on formula feed for initial months. Value of p<0.001. The result is significant at p<0.05 (Table 1).

Growth velocities of AGA and SGA preterm infants were compared 3 monthly till 1 year of age. Growth velocity was similar in all four quarters at the end of 1 year of life. Growth velocities in AGA was higher as compared to SGA preterm infants but there was no statistical difference in growth velocities.

Growth velocities of AGA and SGA preterm infants were compared 3 monthly till 1 year of age. Mean lengths of babies in both the groups (SGA/AGA) grew by parallel increments. Mean length of all preterm infants at 3, 6, 9 and 12 months of follow up was 52.1, 58.2, 61.3 and 65.7 cm (Table 2).

Table 1: Distribution of subjects association to weight for gestational age

| Association to weight for gestational age | Frequency | Percentage |
|---|---|---|
| SGA | 31 | 44.35 |
| AGA | 39 | 55.75 |
| Total | 70 | 100.00 |
| **Exclusive BF for 6 month** | | |
| No | 14 | 20.00 |
| Yes | 56 | 80.00 |
| Total | 70 | 100.00 |

Table 2: Comparison of mean wt gain with reference to weight/ga at 3, 6, 9 and 12 months

| WT/GA | At 3 months | At 6 months | At 9 months | At 12 months |
|---|---|---|---|---|
| AGA | 11.7g day$^{-1}$.99 | 13.8 g day$^{-1}$±3.33 | 12.7 g day$^{-1}$±4.07 | 13.8 g day$^{-1}$±3.65 |
| SGA | 11.5 g day$^{-1}$±1.82 | 12.6 g day$^{-1}$±2.13 | 12.4 g day$^{-1}$±2.90 | 13.7 g day$^{-1}$±3.45 |
| p-value | 0.7676 | 0.1021 | 0.8111 | 0.6727 |
| **WT/GA** | | | | |
| SGA | 52.5cm±4.15 | 58.4cm±4.39 | 61.4cm±4.29 | 65.7cm±4.35 |
| AGA | 52.5cm±3.37 | 58.5cm±3.36 | 61.5cm±3.31 | 65.8cm±3.51 |
| P-lue | 1.00 | 0.87 | 0.87 | 0.88 |

## DISCUSSIONS

Preterm Low birth weight infants often gain weight poorly and demonstrate growth failure during the initial hospitalization and post discharge. Extra uterine growth retardation is a common problem in preterm, very-low-birth-weight (VLBW) babies.

During the study period, 100 preterm new-born admissions (inborn and out-born) at GMERS Hospital, Gotri were enrolled after taking informed consent from parents or guardians. The subjects were followed up at 3, 6, 9 and 12 months of corrected age to assess the nutritional outcomes. Of these, 70 participants were included in the final analysis. The majority of the participants were females 38 (54.3%).

The mean birth weight, length and head circumference of all preterm infants was 1.4 kg±0.3SD, 41.2 cm±3.5SD, 30.2cm±1.9SD, respectively.

In our study (55.7%) were AGA preterm infants while (44.3%) were SGA by inter growth 21st standards. Selection of patients was random among the study group.

56 (80.0%) preterm babies were exclusively breast fed for 6 months, while 14 (20%) preterm were on formula feed for initial months.

The reasons for not achieving exclusive breast feeding in them were prolonged NICU stay, maternal separation due to maternal conditions, sucking/ swallowing incoordination in ELBW babies and inadequate weight gain.

Good rates of exclusive breast feeding were observed due to strict NICU policy at our institute for BFHI policies, awareness about importance of exclusive breast feeding and nursing support.

Similar results were found in study conducted by Thakur *et al*.[5] where 59.8% were exclusively breast fed for 6 months while 37.2% on formula feed.

Contrasting results were found in study conducted by Taleghani *et al*.[6] where 83% were formula fed and 13% were exclusively breast fed.

In our study Complementary feeding was initiated at 6 months in 58 (84.0%) infants.

All babies were followed up for nutritional status and development in well baby clinic and HRC clinic. Regular follow up was ensured by telephonic reminders.

The universal policy of enforcing complementary feeding at 6 months is practiced at our institute leading to good complementary feeding practices.

Mean weight gain in all preterm new-born during follow up at 3, 6, 9, 12 months of age was 11.6, 13.3, 12.6 and 13.5 g $day^{-1}$, respectively.

The mean velocity of weight gain observed is 12.7 g $kg^{-1}$ $day^{-1}$, which is slower than that recommended by the WHO (15 g $kg^{-1}$ $day^{-1}$). On 3 monthly follow up from 3 to 6 months mean wt gain was 13.3 g $day^{-1}$ due to early initiation of exclusive breast feeding. The mean velocity was calculated according to corrected gestational age. Lowest mean velocity was recorded at initial 3 months due to prolonged NICU stay as a result of postnatal morbidities. A catch up in velocity (mean weight gain 13.5 g $day^{-1}$) was observed in last 3 months of follow up. In India, a higher mean growth rate of 15.18±1.7 g $kg^{-1}$ $day^{-1}$ was observed by study conducted by Saluja *et al*.[7] in VLBW babies in NICU of Sir Ganga Ram Hospital, New Delhi. Our feeding protocols in NICU are initiation of fortification to increase the calories to 80 kcal/100 mL of human milk with an additional protein intake of 0.6 g $kg^{-1}$ $day^{-1}$ after reaching enteral feeding 100 mL $kg^{-1}$ $day^{-1}$. In Nigeria a lower growth velocity of 8.2±3.3 g $kg^{-1}$ $day^{-1}$ was noted.73This lower velocity may be explained by the higher gestational ages of the participants enrolled in that study.

Growth velocities (mean wt gain) were compared for preterm AGA/SGA infants. Small for gestational age (SGA (birth weight below the 10th percentile) preterm infants are even more prone to develop postnatal growth retardation in the early neonatal period, as they do not have a large storage of protein/energy. It was observed that Growth velocities was similar in all four quarters at the end of 1 year of life. Higher growth velocities were observed in AGA infants as compared to SGA. Similar results were found in study conducted by Singh *et al*.[8] where mean growth velocities of both grew parallel to each other.

The weights of babies in both gestational group (AGA/SGA) grew uniformly parallel to each other. Mean wt gain was higher in AGA infants but not statistically significant.

Mean length of babies in both the groups (SGA/AGA) grew by parallel increments. Similar results were noted in a study conducted by Singh *et al*.[8] where mean length of both (SGA/AGA) grew parallel to each other.

Mean increase in length of all preterm infants at 3, 6, 9, 12 months of follow up was 0.9, 0.5, 0.2 and 0.16 cm $weak^{-1}$, respectively.

Length increased at rate of 0.9 cm $weak^{-1}$ for first 3 months which was maximum length velocity. This decreased over the year with minimum length velocity being observed at last 3 months of follow up which was 0.16 cm $weak^{-1}$.

Length velocities were compared for preterm AGA/SGA infants. Mean length gain was slightly higher in SGA infants as compared to AGA infants but difference was not statistically significant.

Mean growth velocities of length grew parallel among SGA/AGA infants.

Similar results found in study conducted by Sania *et al*.[9] shows mean growth velocities of both grew parallel to each other.

Mean head circumference values observed at 3, 6, 9 and 12 months of follow up was 35.9, 40, 41.5 and 43.4 cm, respectively.

Mean increase in head circumference in all preterms infants at 3, 6,9,12 months of follow up was 0.5, 0.3, 0.12 and 0.16 cm weak$^{-1}$, respectively.

Maximum growth velocity observed in first 3 months may be due to early initiation of enteral feeding, minimum growth velocity observed in last 3 months which was 0.16 cm weak$^{-1}$.

Brain is only 70% developed at birth. Maximum brain development occurs in first 2 years of life. Therefore increase in head circumference is dependent on early weight gain. Mean head circumference at birth was 30.2 cm in our study. Increase in head circumference was appropriate due to early establishment of exclusive breast feeding and complementary feeding in 84% our preterm infants.

Growth velocities of head circumference were compared for AGA/SGA infants. Mean increase in head circumference was slightly higher in AGA infants as compared to SGA but not statistically significant.

Mean growth velocities (HC) of both group (AGA/SGA) grew parallel to each other in each quarters (3 months).

Similar results found in study conducted by Singh *et al*.[8] where mean growth velocities (HC) of both (AGA/SGA) grew parallel to each other.

Mean MUAC values of all preterm at 6, 9, 12 months of follow up was 10.6, 11.4 and 12.3 cm, respectively.

Normal MUAC values at 1 year of age around 13.5-14.5 cm.

MUAC <13.5 cm is considered as a sign of Malnutrition. Moderate Acute Malnutrition is diagnosed with MUAC between 11.5-12.5 cm and MUAC <11.5 cm is considered as a sign of severe wasting or Severe acute malnutrition (SAM).Total number of SAM infants were 27.1% out of which 21.4% had MUAC <11.5 cm at 1 year of age.

Mean MUAC was slightly higher in AGA infants in our study as compared to SGA but statistically not significant.

National Family Health Survey (NFHS-4) (2015/2016) conducted by MoH and FW shows 21% severe wasting and 35.7% underweight in under 5 years.

It was observed in our study that at the end of 1 year of age 27.1% preterm had severe wasting.

75% of preterm infants were underweight as per WHO charts but severe malnutrition was observed in 27.1% of study group. Wasting is an independent indicator and better for prediction of acute malnutrition or wasting.

Growth of our study participants, VLBW and ELBW at lower centile curves by W/A charts will be misinterpreted as severe malnutrition as catch up growth will be completed by 2.5-3 years. Decreased weight velocity were observed in our study resulting in high incidence of underweight but parallel pattern of growth velocity in length was also observed resulting in lower scores for reduced weight/length (27%).

Similar study conducted by Sania *et al*.[9] noted wasting and underweight in 22.4 and 22.7% preterm infants respectively at 18 months of follow up which was lower than as observed in our study.

It was observed in our study that at the end of 1 year of age 47.1% preterm were stunted, which a reflection of lower length velocity rates is observed in our study. There was no statistical difference with respect to length/age<-2SD Group, between SGA/AGA infant as a stunting outcome at the end of 1 year of age ($p = 0.83$).

National Family Health Survey (NFHS-4) (2015/2016)12 conducted by MoH and FW shows stunting rates to be 38.4%.

Sania *et al*.[9] reports stunting in 42.7% preterm infants after 18 months of follow up, which was lower than our study.

There was no statistical difference with respect to WT/AGE<-2SD group between SGA/AGA with reference to underweight as outcome at the end of 1 year of age. (p-value 0.14)

Statistically significant difference was observed with respect to WT/LENGTH<-3SD as outcome between SGA/AGA infants at the end of 1 year of age (p-value 0.008).

Similar results found in study conducted by Sania *et al*.[9] shows risk of wasting, stunting and underweight was more in SGA babies with comparison to AGA babies.

Significant statistical difference ($p<0.0001$) was found in terms of mean weight between groups (very preterm to late preterm) at birth to 3, 6, 9, 12 months of follow up.

Significant statistical difference ($p<0.0001$) was found in terms of mean length between groups(very preterm to late preterm) at birth to 3,6,9,12 months of follow up.

Significant statistical difference ($p<0.0001$) was found in terms of mean head circumference between groups(very preterm to late preterm) at birth to 3, 6, 9, 12 months of follow up.

These can be explained by the higher incidence of prolonged NICU stay, major neonatal morbidities, feeding difficulties due to sucking/swallowing incoordination, increased risk of infections in NICU as well as temperature instability.

Adverse feeding patterns may be associated with sepsis, respiratory, gastrointestinal morbidities and sepsis.

AGA infants had slightly better nutritional outcomes than SGA infants at the end of 1 year of age in our study.

## SUMMARY AND CONCLUSION

This study was a prospective observational hospital based time bound study performed on preterm babies admitted in NICU of GMERS HOSPITAL, GOTRI FROM MAY 2021 to MAY 2022.100 preterm babies were enrolled out of which 70 babies completed all follow up visits and therefore included in final analysis. Nutritional outcomes with respect to WAZ , LAZ, WLZ scores, WT, LENGTH, HC and MUAC were to be assessed at 12 completed months. 38 preterm were female, 39 babies were AGA. 80% preterm babies were exclusively breast feeding for 6 months and 84% started complementary feeding after 6 months. Mean anthropometry (weight, length, head circumference) of all preterms at birth were 1.4 kg, 41.2 cm and 30.2 cm, respectively. Mean anthropometry (weight, length, head circumference) of all preterm infants at the end of 1 year of age was 6.1 kg, 65.7 cm, 43.4 cm, respectively. Incidence of stunting, wasting and underweight in all preterm babies enrolled in this study at the end of 1 year of follow up was 47.1, 27.1 and 75%, respectively. Mean wt gain was slightly higher in AGA infants in our study as compared to SGA. Mean length gain was slightly higher in AGA infants in our study as compared to SGA. Mean increase in head circumference was slightly higher in AGA infants in our study as compared to SGA. Mean MUAC was slightly higher in AGA infants in our study as compared to SGA. There was no statistically significant difference observed in WAZ and LAZ score between SGA/AGA infants but statistically significant difference ($p<0.001$) was observed in WLZ score between SGA/AGA infants at end of 1 year of follow up. Significant statistical difference observed ($p = 0.001$) in mean anthropometry (mean wt, length, head circumference)among group (very preterm to late preterm) at birth to 3 monthly follow up to 1 year of age.

## RECOMMENDATIONS

Targeted interventions with proven efficacy like the promotion of early and exclusive breastfeeding, proper management of diarrhoeal and respiratory infections, balanced protein energy supplementation, KMC etc should be incorporated in the care of preterm babies. Minimization of postnatal growth failure will decrease the need for catch up growth and thereby decrease the risk of developing metabolic syndrome.

## REFERENCES

1. Liu, L., S. Oza, D. Hogan, Y. Chu and J. Perin *et al*., 2016. Global, regional and national causes of under-5 mortality in 2000-15: An updated systematic analysis with implications for the sustainable development goals. Lancet, 388: 3027-3035.
2. Joshi, S., 2014. Low birth weight babies feeding., https://www.pediatriconcall.com/articles/nutrition/low-birth-weight-babies-feeding/low-birth-weight-babies-feeding-patient-education
3. Ramakrishnan, U., 2004. Nutrition and low birth weight: From research to practice. Am. J. Clin. Nutr., 79: 17-21.
4. Motta, M.E.F.A., G.A.P. da Silva, O.C. Araújo, P.I. Lira and M.C. Lima, 2005. Does birth weight affect nutritional status at the end of first year of life? J. Pediatr., 81: 377-382.
5. Thakur, S.K., S.K. Roy, K. Paul, M. Khanam, W. Khatun and D. Sarker, 2011. Effect of nutrition education on exclusive breastfeeding for nutritional outcome of low birth weight babies. Eur. J. Clin. Nutr., 66: 376-381.
6. Taleghani, N.T., M. Fallahi, Z. Soltanttooyeh, A.R. Shamshiri and M. Radfar, 2019. Post-discharge follow-up of preterm infants at high-risk neonatal follow-up clinic of a maternity hospital. J. Compr. Pediatr.s, Vol. 11, No. 1. 10.5812/compreped.93379
7. Saluja, S., M. Modi, A. Kaur, A. Batra, A. Soni, P. Garg and N. Kler, 2010. Growth of very low birth-weight Indian infants during hospital stay. Indian Pediatr., 47: 851-856.
8. Singh, D., N. Devi and T.R. Raman, 2009. Exclusive breast feeding in low birth weight babies. Med. J. Armed Forces India, 65: 208-212.
9. Sania, A., D. Spiegelman, J. Rich-Edwards, E. Hertzmark, R.S. Mwiru, R. Kisenge and W.W. Fawzi, 2014. The contribution of preterm birth and intrauterine growth restriction to childhood undernutrition in Tanzania. Maternal Child Nutr., 11: 618-630.