Original Article

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Does Increase in Feed Volume from 150 Ml/Kg/Day to 200 Ml/Kg/Day Accelerate Growth in VlBW Babies without Significant Added Risk

Gaurav Machale*; Umesh Vaidya; Sunil Mhaske*****

*Assistant Professor, PDVVPF's Medical College & Hospital, Ahmednagar, ** In-Charge Neonatologist & IAP Neonatology Fellowship Co-Ordinator, KEM NICU, Pune,***Professor and Head, Department of Paediatrics, Padmashree Dr. Vitthalrao Vikhe, Patil Medical College, Ahmednagar, Maharashtra (INDIA)- 414111.

Abstract

Extra-uterine malnutrition is common in preterm very low birth weight (VLBW) newborns in spite of fortification with available human milk fortifiers. Hypothesizing that increasing the volume of feed would be safe and will lead to better postnatal weight gain we randomized 96 babies with birth weight less than 1500 gm after reaching the full feeds (i.e.150 ml/kg/day), to continue feeds at 150 ml/kg/day (standard volume) or to increase to 200 ml/kg/day (high volume) of expressed breast milk or preterm formula feed. Expressed breast milk was fortified with available fortifier. There was significantly higher daily weight gain in high volume group as compared to standard volume group. Appropriate for gestational age (AGA) babies showed significantly higher weight gain as compared to small for gestational age (SGA) babies, both in high and standard volume group. Incidence of feed intolerance did not differ significantly between two feeding groups. High volume feeds at 200 ml/kg/day was safe and resulted in better daily weight gain than standard volume feeds i.e.150 ml/kg/day in preterm very low birth weight babies.

Key words: Very low birth weight; Nutrition; Growth; Feeding volume.

Introduction

Optimizing the growth of very low birth weight babies is extremely important. Poor postnatal growth has been associated with increased risk of poor neuro-developmental out come at 18 months of age.[1] Current practice includes restriction of feed volume to 150 ml/kg/day in VLBW babies. Extra uterine malnutrition is common problem in VLBW babies on feeding volume of 150 ml/kg/day suggesting that it may be insufficient for adequate catch up growth. Fortification of milk is one of the available options to increase the nutritional value of feed. But proper fortification is not always possible in view of unavailability of good quality human milk fortifier. Fortification with routinely available human milk fortifier (Lactodex HMF) alone is insufficient to meet nutritional demands and to avoid extra uterine malnutrition in VLBW babies. High volume feeds have been shown to be safe in volumes up to 250 to 300ml/kg/day in some studies.[2,3,4] Increasing the enteral feeding volume from 150 to 200 ml/kg/day in addition to fortification with available fortifier (Lactodex HMF) would increase the caloric intake from 122 to 164 kcal/kg/day. We hypothesized that increase in milk volume along with routine fortification would be safe and will lead to better postnatal growth.

Corresponding Author: Dr. Gaurav Machale, Assistant Professor in Pediatrics, Padmashree Dr. Vithalrao Vikhe Patil Medical College, Ahmednagar 414111, Maharashtra, India. Email: gauravmachale@yahoo.com

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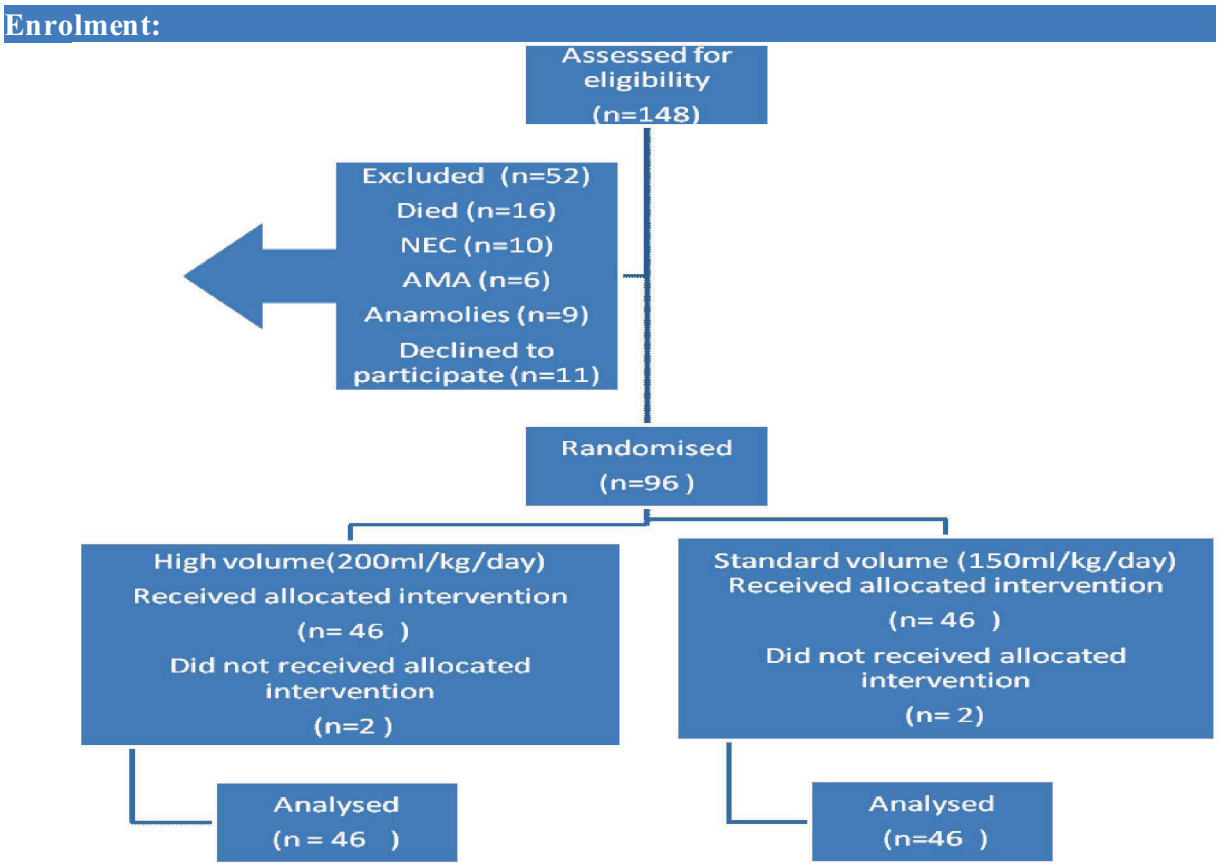


Materials and Methods

This prospective randomized control trial was carried out in the neonatal unit of KEM hospital, Pune. Newborn infants weighing d"1500 gm at birth were eligible for enrolment once they achieve full feeds (150 ml/kg/day). Babies with major congenital anomalies and gastrointestinal malformations, on ventilator support, necrotizing enterocolitis (NEC) stage II and III and symptomatic patent ductus arteriosus (PDA) were excluded. Parent's consent was obtained and babies were randomized into two groups using simple randomization. In the high-volume group, feeds were increased by 20 ml/kg/day till 200 ml/kg/day and in the other (control) group, feeds were continued at 150 ml/kg/day. All the babies were fed with expressed breast milk+ formula feed through the nasogastric tube, fortification were done in all babies after reaching feeds of 100 ml/kg/day (HMF /Simyl MCT) and other interventions in both groups were as per the unit's protocol. Weight were checked twice weekly by an electronic weighing machine. The primary outcome studied was weight gain in g/kg/day from enrolment till discharge. The secondary outcomes were complications like feed intolerance [defined as _2 episodes of vomiting/ increased aspirates (>50% of previous feed volume)], tachypnea (respiratory rate >60/min), NEC (Stage 2a or more). Babies were monitored daily for possible complications. All data were recorded in standard forms. Babies were analyzed at the time of discharge irrespective of what treatment they received. Appropriate for gestational age (AGA) and small for gestational age was categorized based on Fenton fetal infant growth chart for preterm infants.[5]

Sample size calculated was 48 (in each group) babies giving 80% power ,5% type one error probability and group one to two ratio being 1:1. We used software called PS: power

Table 1: The comparison of birth parameters between two feeding groups

Parameters	Standard vol. group 150ml/kg/day (n=46)	High vol. group 200ml/kg/day (n=46)	P-value
Sex			
Male	23 (50.0)	25 (54.3)	0.676
Female	23 (50.0)	21 (45.7)	
SGA / AGA Status			
SGA	25 (54.3)	27 (58.7)	0.674
AGA	21 (45.7)	19 (41.3)	
Birth weight (g)	1162.8 ± 234.8	1232.3 ± 181.6	0.116
Gestational age (wks)	30.9 ± 2.6	31.6 ± 2.2	0.199

Figure 1a: The distribution of sex between two feeding groups

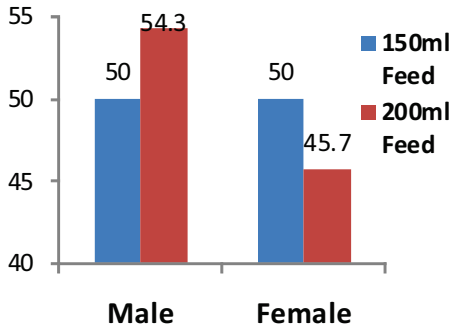


Figure 1b: The distribution of SGA/AGA status between two feeding groups

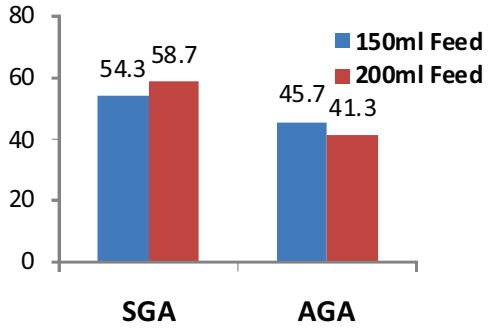


Figure 1c: The distribution of birth weight between two feeding groups

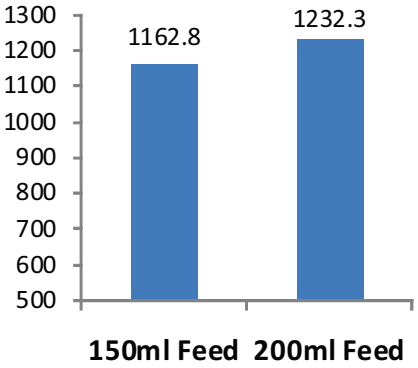
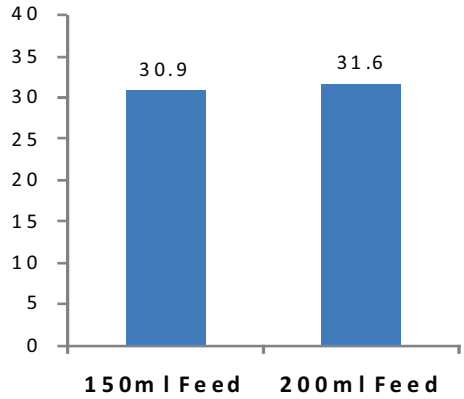


Figure 1d: The distribution of gestational age between two feeding groups



sample size calculation software to detect sample size.

Data analysis was by intention to treat. Of the 48 babies who were randomized to high volume feeds 4 did not achieve the targeted feed volume of 200 ml/kg/day.

Results

I) The comparison of birth parameters between two feeding groups

Values on Sex and SGA/AGA Status are n (%) whose p-values are obtained using Chi-Square test. Values on birth weight and gestational age are mean ± standard deviation whose p-values are obtained using independent sample 't' test.P-value<0.05 is considered to be statistically significant.

Comments

1) The sex distribution did not differ significantly between two feeding

Table 2: The comparison of weight gain between two feeding groups

	Standard vol. group 150ml/kg/day (n=46)	High vol. group 200ml/kg/day (n=46)	P-value
Weight gain (g/kg/day)	13.9 ± 1.2	18.0 ± 3.6	0.001

Figure 2: The distribution of weight gain between two feeding groups

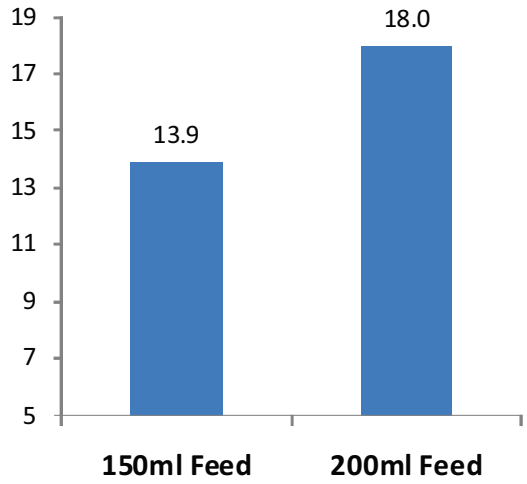
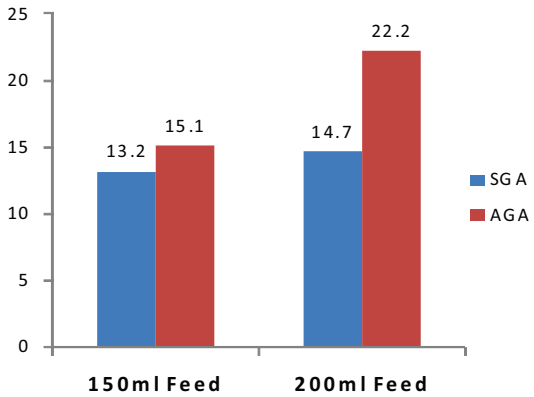


Figure 3: The comparison of weight gain according to SGA/AGA status in each feeding group



groups.

2) The SGA/AGA distribution did not differ significantly between two feeding groups.

3) The average birth weight did not differ significantly between two feeding groups.

4) The average gestational age did not differ significantly between two feeding groups.

II) The comparison of weight gain between two feeding groups

Values are mean ± standard deviation whose p-values are obtained using independent sample't' test. P-value <0.05 is considered to be statistically significant.

Comments

1) The average weight gain differs significantly between two feeding groups.

2) The high volume feeding group showed significantly higher weight gain compared to low volume feeding group.

III) The comparison of weight gain according to SGA/AGA status in each feeding group

Values are mean ± standard deviation whose p-values are obtained using independent sample't' test. P-value <0.05 is considered to be statistically significant.

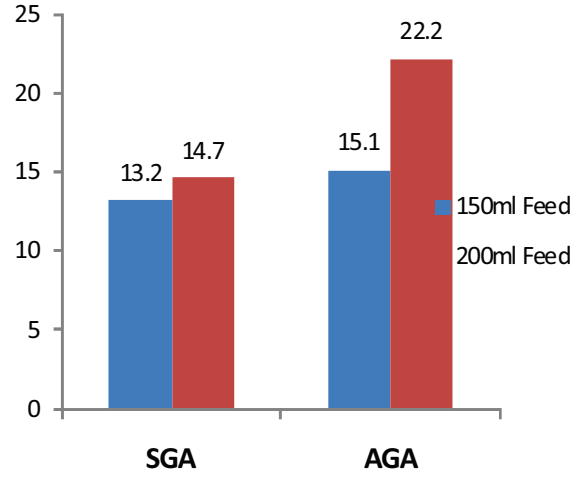
Table 3: The comparison of weight gain according to SGA/AGA status in each feeding group

	Standard vol. group 150ml/kg/day (n=46)			High vol. group 200ml/kg/day (n=46)		
	SGA (n=25)	AGA (n=21)	P-value	SGA (n=27)	AGA (n=19)	P-value
Weight gain (g/kg/day)	13.2 ± 0.9	14.7 ± 0.9	0.001	15.1 ± 1.0	22.2 ± 0.8	0.001

Table 4: The subgroup comparison of weight gain between two feeding groups in each group of weight for gestational age

	SGA (n=52)			AGA (40)		
	Standard vol. group 150ml/kg/day (n=25)	High vol. group 200ml/kg/day (n=27)	P-value	Standard vol. group 150ml/kg/day (n=21)	High vol. group 200ml/kg/day (n=19)	P-value
Weight gain (g/kg/day)	13.2 ± 0.9	15.1 ± 1.0	0.001	14.7 ± 0.9	22.2 ± 0.8	0.001

Figure 4: The subgroup comparison of weight gain between two feeding groups in each group of weight for gestational age

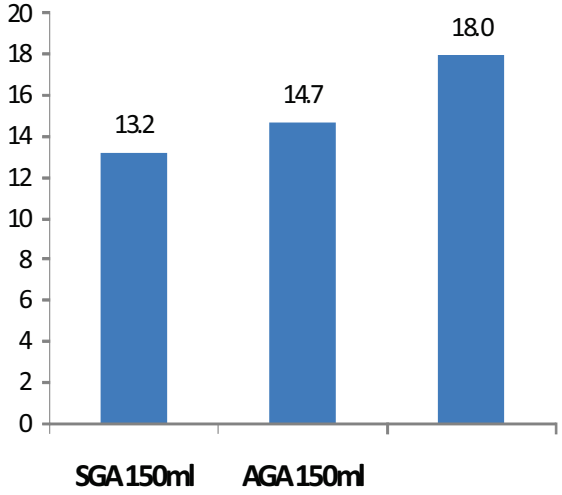


Comments

1) In low volume feeding group, the average weight gain is significantly higher among AGA cases compared to SGA cases.
2) In high volume feeding group, the average weight gain is significantly higher among AGA cases compared to SGA cases.

IV) The subgroup comparison of weight gain between two feeding groups in each group of weight for gestational age

Figure 5: The comparison of weight gain SGA and AGA of low volume group with whole high volume group



Values are mean ± standard deviation whose p-values are obtained using independent sample 't' test. P-value<0.05 is considered to be statistically significant.

Comments

1) High volume feeding SGA cases had significantly higher weight gain compared to the low volume feeding SGA cases.

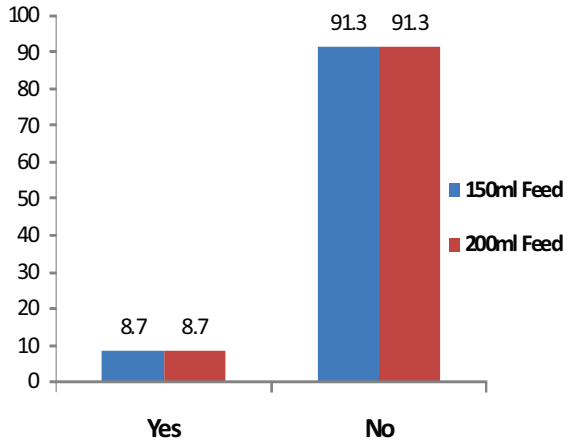
Table 5: The comparison of weight gain SGA and AGA of low volume group with whole high volume group

	SGA of Standard vol. group 150ml/kg/day (n=25)	AGA of Standard vol. group 150ml/kg/day (n=21)	High vol. group 200 ml/kg/day (n=46)	P-value	
				SGA 150ml/kg/day v/s Whole 200ml/kg/day	AGA 150ml/kg/day v/s Whole 200ml/kg/day
Weight gain (g/kg/day)	13.2 ± 0.9	14.7 ± 0.9	18.0 ± 3.6	0.001	0.001

Table 6: The comparison of incidence of feed intolerance between two feeding groups

	Standard vol. group 150ml/kg/day (n=46)	High vol. group 200ml/kg/day (n=46)	P-value
Feed Intolerance			
Yes	4 (8.7)	4 (8.7)	0.999
No	42 (91.3)	42 (91.3)	

Figure 6: The distribution of incidence of feed intolerance between two feeding groups



2) High volume feeding AGA cases had significantly higher weight gain compared to the low volume feeding AGA cases.

V) The comparison of weight gain SGA and AGA of low volume group with whole high volume group

Values are mean ± standard deviation whose p-values are obtained using one-way analysis of variance (AOVA) with Bonferroni's correction for multiple group comparisons. P-value<0.05 is considered to be statistically significant.

Comments

1) High volume feeding cases had significantly higher weight gain compared to the low volume feeding SGA cases.
2) High volume feeding cases had significantly higher weight gain compared to the low volume feeding AGA cases.

VI) The comparison of incidence of feed intolerance between two feeding groups.

Values are n (%) whose p-values are obtained using Chi-Square test. P-value<0.05 is considered to be statistically significant.

Comment

The distribution of incidence of feed intolerance did not differ significantly between two feeding groups.

Discussion

Growth velocity is much higher in preterm than in term babies but their nutrient stores are very little. Infants lose weight after birth and often regain birth weight in second week of life. Poor postnatal weight gain is common especially in SGA babies who form large portion of VLBW babies in countries like India. Maximizing postnatal weight gain is important in improving neuro-developmental outcome in VLBW babies. Fortification of feed is recommended to improve nutrition in preterm babies but often cannot be practiced in view of unavailability of good fortifier.

In our study sex distribution did not differ significantly in between two feeding groups. Similarly SGA and AGA distribution did not differ significantly between two feeding groups. Average birth weight and gestational age did not differ significantly between two feeding groups

We could find significant weight gain in VLBW babies (both groups SGA and AGA) secondary to use of high volume feeds (200 ml/kg/day) with fortification compared to standard volume feeding group (150 ml/kg/day) with fortification. Kuschel *et al* showed that infant fed with 200 ml/kg/day gained

weight better than those with 150ml/kg/day.[6] Mukhopadhyay *et al* comparing fortified and unfortified breast milk at 150 ml/kg/day demonstrated better weight gain in preterm babies fed fortified milk.[7] Similarly Lewis et al (250 ml/kg/day) showed that preterm infant gained weight at intrauterine rate without complications.[3]

In our study in subgroup analysis AGA babies showed significantly better weight gain in comparison to SGA babies in both groups. Niranjan Thomas *et al* showed that SGA babies with high volume feeds gained weight adequately but not as well as AGA babies.[2]

We also found that distribution of incidence of feed intolerance did not differ significantly in both groups. Similarly Niranjan Thomas *et al* did not find statistically significant difference in incidence of feed intolerance in both groups.[2] Lewis *et al* also mentioned that they could not find evidence of complication secondary to use of high volume feeds.[3] Valmen *et al* mentioned few complications using high volume feeds of 300ml/kg/day by continuous nasogastric drip. But all their patients thrived and SGA babies showed catch-up growth with high volume feeds.[4]

We demonstrated in this study that high volume feeds at 200 ml/kg/day with fortification were safe in preterm VLBW babies. Raising calorie and protein intake by giving high volume feeds led to better postnatal weight gain and can prevent extra uterine malnutrition. Long term nutritional and neuro developmental outcomes need to be studied.

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