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Growth Monitoring of VLBW Babies in NICU

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Abstract:- A child that was born with a veritably low birth weight (VLBW) is more likely to have stunted growth as a result of particular intrauterine circumstances, exposure to unfavourable extrauterine environments, and unmet nutritional needs. Despite advancements in newborn care, extrauterine growth slows down in VLBW kids due to early immaturity and a growth stop during the neonatal period.(EUGR). Numerous studies have demonstrated catchup growth during these periods, but others have established little or no catchup growth. As there are numerous concerns regarding the particular nutritional conditions of these newborns and evidence of variances amongst NICUs in terms of nutritive operation of these babies, there is continuous discussion in connection to defining suitable nutritive input for these infants. The stark disparities in how NICUs are set up among them provide evidence for the connection of nutrient supply and growth. According to the predominant idea, preterm infants in the NICU receive inadequate nourishment, which causes slow growth in the first few weeks of life. This study aims to characterize, validate, and analyse any differences, if any, between those born small for gestational age or otherwise between VLBW infants while they are in the NICU.(AGA or SGA). SGA newborns exhibited significantly lower mean Z scores at delivery for weight, length, and head circumference compared to AGA babies, indicating a significant intrauterine growth retardation. Premature birth increases the risk of SGA babies by twofold, as does slow growth in the early postnatal period. This study examined the goods of parenteral nutrition and trophic feeds on the weight gain of VLBW babies from day 1 of life. All babies entered an average calorie input of 132 kcal/ kg/ day and endured a quotidian weight gain of19.3 g/ kg/d. Average weight gain per day is lower in SGA babies(18.14 ±1.11) compared to AGA(21.021.52) babies, but this is statistically not significant(p = 0.178). KMC babies gained farther weight per day by discharge than controls and had a larger head circumference at 6 months corrected age than controls. For every 250 g order on Ehrenkranz's charts, postnatal growth fell within reference lines, with the exception of individuals with birth weights below 1000 g. This study shows the growth patterns of very low birth weight (VLBW) infants in an environment with a high frequency of low birth weight and growth restriction. It made it possible for early trophic feeding, a shorter duration of parenteral nutrition, successful abstinence from nutritive enteral feeds, a shorter stay in the hospital, and better weight growth in the first few days of life. However, there was a noticeable growth stop during the NICU stay, and HC and length grew disproportionately slowly. babies withco- morbidities like NEC and feed sectarianism showed a significant decline in growth haste. ELBW babies swerved significantly from the reference growth charts due to advanced morbidity.

Keywords: *SGA Infants, Weight Gain, Post Natal Growth, Gutbrod, Birth Weight, VLBW Infants, Sanket.*

I. INTRODUCTION

The truly low birth weight (VLBW) kid, whose birth weight is less than 1500 g, is more likely to experience stunted growth as a result of specific intrauterine circumstances, exposure to adverse extrauterine environments, and poorly understood nutritional conditions. VLBW kids continue to experience growth stop during the neonatal period and early childhood despite advancements in neonatal care. It has been demonstrated that growth tracking is a helpful and cost-effective technique in primary healthcare, although it is confounded by a number of issues. The origins of impaired growth begin during the first numerous weeks of life. VLBW babies will witness some loss of birth weight in the immediate postnatal period, but the period between nadir of weight loss and return to birth weight is largely variable. Once birth weight is reacquired, they witness slow rates of weight gain performing in shy growth during the first numerous weeks of life, leading to extrauterine growth retardation(EUGR). ultimate of these babies substantiation catch up growth important subsequently, by 8- 20 times. Catchup growth during their early times has been shown in a number of studies, but some studies have set up little or no catchup growth. Poor growth may be predictive of poor neurodevelopmental outgrowth, particularly in those children with lower head sizes.(, 2) various factors may impact the postnatal growth of VLBW babies, analogous as maturity and growth status at birth, perinatal clinical conditions, socio-provident factors, heritable background, feeding practices and feeding problems. The understanding of the association between these factors and postnatal growth is important for assessing, predicting and preventing growth problems. As there are many concerns about the unique nutritional conditions of these newborns and evidence of disparities amongst NICUs in terms of these babies' nutritional functioning, there is continuous discussion in connection to defining suitable nutritional input for these infants. Additionally, growth problems within a single NICU can differ according on the neonatologists' various philosophies towards commencing and progressing nutritional supply. The large configuration

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variations amongst NICUs demonstrate the dependency between nutritional input and growth.() The prevailing theory holds that many preterm infants in the NICU suffer from undernourishment. Variable advancement and prolusion of both parenteral and enteral nutrition lead to substantial cumulative protein and sugar shortages over time, which slow growth during the first few weeks of life. The most common anthropometric indicator of growth is weight increase, but over time, changes in length and/or head circumference provide additional evidence of extrauterine growth retardation. Although the definitions of their ideal nutrition and postnatal growth pattern are still debatable, the accurate assessment of these babies' postnatal development is currently of utmost importance. This research seeks to describe and validate the growth patterns of VLBW babies while they are in the NICU and to identify any differences between those born small for gestational age or otherwise. (AGA or SGA). (6)

II. MATERIALS AND METHODS

➢ *Inclusion Criteria:*
- All modes of delivery
- Term gestation or preterm gestation
- Inborn and outborn

➢ *Exclusion Criteria:*
- Birth weight greater than or equal to1500 gms
- Passing away before medical discharge
- Transfer to a different facility before being released
- Infants with chromosomal anomalies and major congenital malformations
- Outborn infants admitted after 24 hours of birth
- Infants who stayed for less than 10 days in the NICU

➢ *Method of Evaluation*

From delivery until discharge, VLBW infants admitted to the neonatal ferocious care unit at Manipal Hospital in Bangalore between June 2011 and December 2012 were prospectively monitored. If first trimester ultrasonography was not accessible, the date of the last menstrual period was used to determine the gravid age. Every day up until discharge, weight was recorded using a computerised importing scale. Length and head circumference (HC) measurements were taken initially over a period of 12 to 24 hours, as well as weekly up until release. Every precaution was taken twice, and the average of these compliances was noted.8

The difference between the minimum weight and the birth weight was used to determine the maximum weight loss. Calculations were made for the age at which weight loss peaks and the amount of time needed to regain birthweight. The time from recovering birthweight to discharge was used as the denominator for the computation of diurnal weight increase.

➢ *Fluid And Dietary Guidelines:*

To facilitate physiological weight reduction, 80 mL/kg/d of fluid were given to VLBW infants on their first day of life. If the patient's hemodynamics were stable, enteral feeds were started as soon as feasible. Mortal milk was chosen, and Raptakos, Brett & Co.'s Lactodex HMF was added to boost the calories to 80 kcal per 100 ml and add 0.6 g of fresh protein per kilogramme per day. Parenteral nutrition (PN) was begun in infants who weren't expected to be on total enteral feeds within the first five days of life with a protein input of 3 g/kg/d and a lipid input of 1 g/kg on the first day. Based on means and standard deviations from Fenton's reference data, mean Z scores for weight, length, and HC for each gravidity were computed. The cohort was divided into three gravid age groups—less than 30 weeks, 30-34 weeks, and more than 34 weeks—for further research. Additionally, the infants were divided into groups of 250g birthweight intervals and their Ehrenkranz development angles were combined for comparison.

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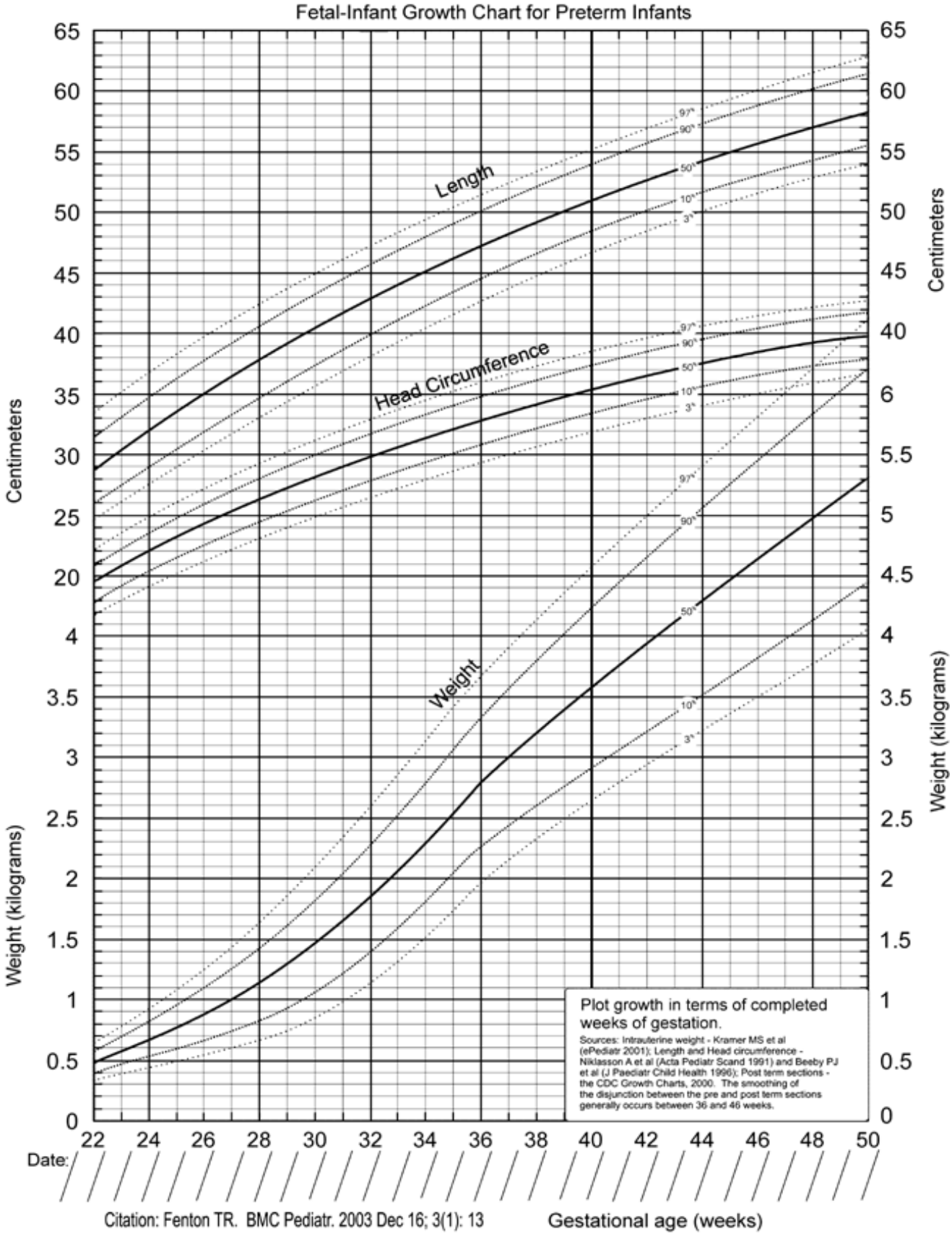

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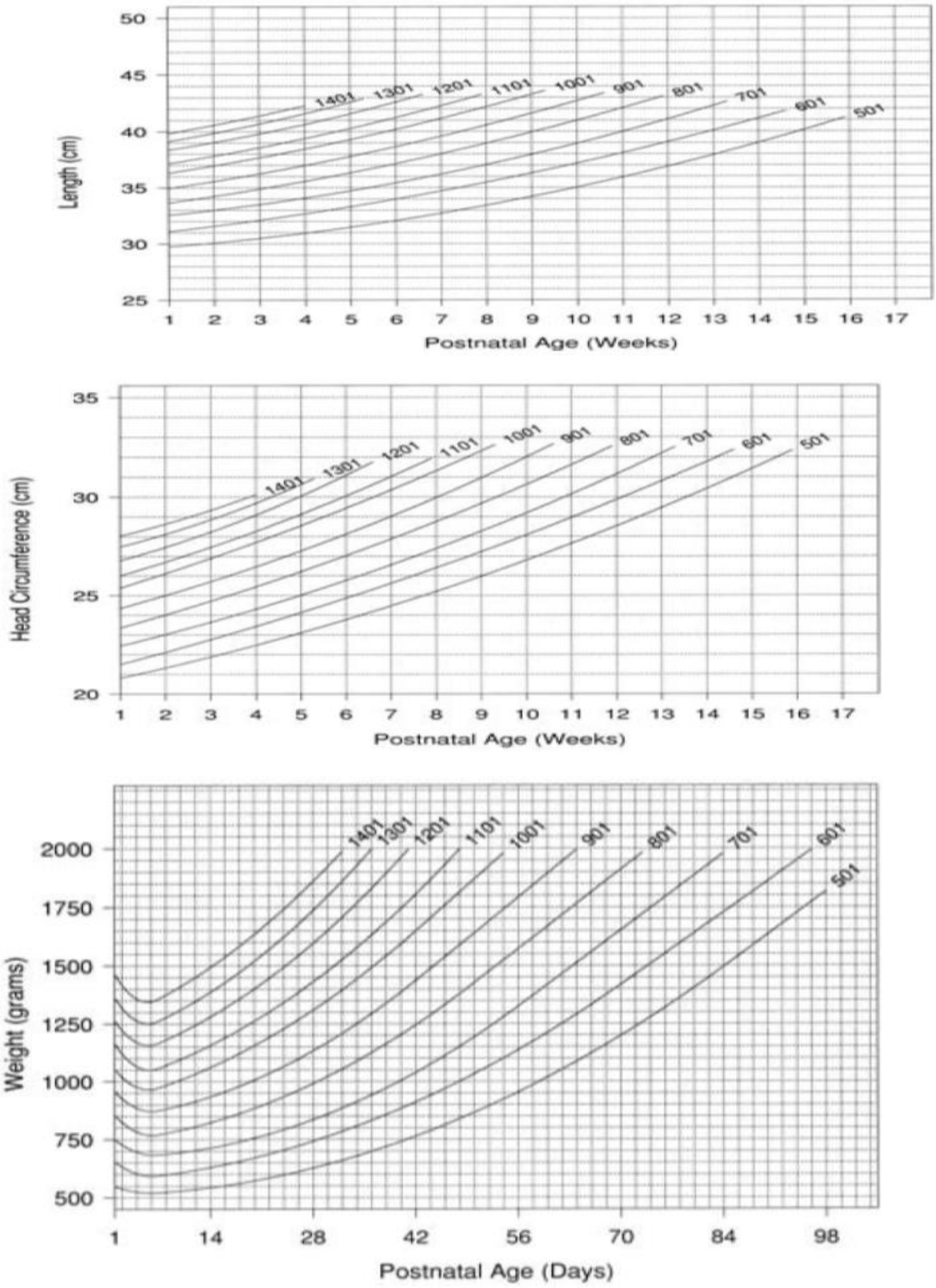

Fig 1 Fatal Infant Growth Chart for Preterm Infants

➢ *Statistical Methods:*

In the current research, descriptive and deducible statistical analysis has been done. Results on categorical measures are presented in Number, while those on nonstop measures are displayed on Mean SD(Min- Max).(). Five positions of significance are used to evaluate relevance. On the basis of the information, the following assumptions are made:

- Dependent variables must have a normal distribution.
- Samples drawn at random from the community must have independent cases.

The significance of research parameters on a continuous scale between two groups (inter group analysis) has been determined using the Student t test (two tailed, independent). Fisher | Chi-square The significance of research parameters on a categorical scale between two or more groups has been determined using an exact test.

➢ *Student t Test (Two Tailed, Independent):*

Assumptions: Each subject is divided into one of two categories at random. The means under comparison have normal distributions with identical variances.

- Test: The following theories will be compared between two separate groups:
- Ho: u1 = u2 (means of the two groups are equal)
- Ha: u1 u2 (means of the two group are not equal)

The test statistic is t, which has n1 plus n2 - 2 degrees of freedom. N1 and N2 are the sample sizes for groups 1 and 2, respectively. If the p-value for this result is low (less than 0.05, for instance), there is reason to believe that the alternative hypothesis is more likely than the null hypothesis. Or, there is evidence that the difference in the two means are statistically significant.

The test statistic is as follows
t-Test: Two-Sample Assuming Equal Variances

$$S_P = \sqrt{\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2}}$$

In all work with two-sample t-test the degrees of freedom or df is:

$$df = n_1 + n_2 - 2$$

The formula for the two sample t-test is:

$$T = \frac{\overline{X} - \overline{Y}}{S_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

Pre-test: Test for variance assumption: A test of the equality of variance is used to test the assumption of equal variances. The test statistic is F with n_1-1 and n_2-1 degrees of freedom.

t-Test: Two-Sample Assuming Unequal Variances

$$T = \frac{\overline{X} - \overline{Y}}{\sqrt{\frac{S_X^2}{n_1} + \frac{S_Y^2}{n_2}}}$$

Note in this case the Degree of Freedom is measured by

$$df' = \frac{\left(\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}\right)^2}{\frac{\left(\frac{S_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{S_2^2}{n_2}\right)^2}{n_2 - 1}}$$

and round up to integer.

Results of the t-test: If the p-value for the t-test is low (0.05), there is reason to believe that the option is more likely than the null hypothesis. In other words, there is proof that the means differ substantially at the p-value-indicated level of significance. The null hypothesis cannot be rejected if the p-value for the t-test is greater than 0.05, and you draw the conclusion that there is sufficient proof to support the equality of the means.

➢ *Chi-Square Test17:*

To ascertain the association between two variables in a population, use the chi-square test for independence. Independence here denotes a lack of a connection between the two elements. In the chi-square test for independence the degree of freedom is equal to the number of columns in the table minus one multiplied by the number of rows in the table minus one

$\chi^2 = \frac{\sum (Oi - Ei)^2}{Ei}$, Where Oi is Observed frequency and Ei is Expected frequency

With (n-1) df

- The Chi-square test's premise
- The following presumptions apply to the chi square test when it is applied with the common estimate that a chi-square distribution is appropriate:
- Random sample - A sampling at random of the data from a community or fixed distribution.

- Sample size (entire table) - It is believed that the sample is sufficiently large. A chi square test will produce an incorrect inference if it is performed on a population that is too small. The researcher could make a Type II error by using the chi square test on small groups.
- Expected Cell Count - Sufficient expectations for the number of cells. Some call for 5 or more, while others call for 10 or more. Every cell in a 2-by-2 table should have a value of 5, and 80% of cells in bigger tables should also have a value of 5, but there should be no cells with a value of 0. Yates' adjustment or the Fisher Exact test are used when this presumption is not true.

➢ *Fisher Exact Test:*

This test examines a contingency table that shows how various treatments have resulted in various results. Its null hypothesis states that the two variables are independent and that treatments do not impact outcomes. If p is "small," reject the null hypothesis and infer that treatment affects outcome.

The usual approach to contingency tables is to apply the χ^2 statistic to each cell of the table. One should probably use the χ^2 approach, unless you have a special reason. The most common reason to avoid χ^2 is because you have small expectation values.

Table 1 Contingency Table

	Class1	**Class2**	**Total**
Sample1	a	b	a+b
Sample2	c	d	c+d
Total	a+c	b+d	N

2x2 Fisher Exact Test statistic=

$$\sum p = \frac{(a+b)!(c+d)!(a+c)!(b+d)!}{n!}\frac{1}{\sum a!b!c!d!}$$

➢ *Fisher Exact test (rxc Tables):*

Let there exist two such variables X and Y, with m and n observed states, respectively. Now form an $m \times n$ matrix in which the entries a_{ij} represent the number of observations in which $x = i$ and $y = j$. Calculate the row and column sums R_i and C_j, respectively, and the total sum

$$N = \sum_i R_i = \sum_j C_j$$

of the matrix. Then calculate the conditional probability of getting the actual matrix given the particular row and column sums, given by

$$P_{\text{cutoff}} = \frac{(R_1!\,R_2!\cdots R_m!)\,(C_1!\,C_2!\cdots C_n!)}{N!\prod_{i,j} a_{ij}!},$$

which is a multivariate generalization of the hyper geometric probability function.

➢ *Z Score:*

A Z-score (standard deviation score) is the difference between a person's value and the median value of a reference population, split by the reference population's standard deviation:

Z-score = (observed value) - (median reference value).(standard deviation of reference population)

For kids of a certain age, a fixed Z-score suggests a fixed height or weight difference. A key benefit of Z- score metamorphosis for population- based operations is that it enables the computation of the mean and standard deviation for a collection of Z- scores. The average disparity between the growth measures of the VLBW population and the standard of the reference population is represented by a mean Z-score in the unit of standard division.

thus, the change of mean Z- score over age allows us to assess the change of growth status of VLBW babies over age during the experimental period. The reference populations used for the present study was from the Fentons study.5

➢ *Significant Figures:*

- + Suggestive significance (P value: 0.05<P<0.10)
- Moderately significant (P value:0.01<P ≤ 0.05)
- ** Strongly significant (P value : P≤0.01)

➢ *Statistical Software:*

The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1 ,Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

III. OBSERVATION AND RESULTS

91 VLBW babies were eligible at the morning of the study out of which 41 babies were barred because of various reasons(death, shifted to other sanitorium,), 50 babies were included in the study group(Table 1).8 All the VLBW babies were divided into AGA and SGA according to birth weight and enceinte age, out of which AGA constitute 64 and SGA babies constitute 36(Table 2). The

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birth and discharge characteristics and the neonatal morbidities of the babies in our study are mentioned in Table 3 and 4. The mean birth weight of the babies in our study was 1180 ± 214gms and the mean enceinte age at admission was30.8 ±2.43 weeks. Average weight at discharge was 1660 ± 180 gms and average duration of sanitorium stay was42.2 ±20.9 days. 72 of the babies in our study had respiratory torture, 18 of the babies had culture proven sepsis, 16 had feed sectarianism and 10 had habitual lung complaint, 8 had Necrotising enterocolitis.11, 14 Based on the information from Fenton's sources, the mean Z scores for weight, length, and HC at birth and discharge in all subjects were calculated.(Table 5). At delivery, the mean Z scores were individually -1.08, -1.32, and -0.93. These decreased individually by discharge to -2.46, -2.23, and -1.33, which is significant (p 0.01). The mean z scores at birth were significantly lower in SGA babies than in AGA babies for all the parameters, indicating that SGA babies had considerable intrauterine growth retardation.12 SGA babies under 30 weeks have a lower average weight increase per day than AGA babies (19.06 1.64), but this difference is not statistically significant (p = 0.25).(Table 6). There is no significant difference in the average weight gain between AGA(23.22 ±2.5) and SGA(19.01 ±1.61) babies in the other group between 30- 34 weeks(p = 0.216). There is no significant difference in the average proliferation in head circumference and length per week between AGA and SGA babies in all the three groups(p = 0.795 for HC and0.708 for length). Maximum weight loss in chances significantly lower in SGA babies(5.98 ±0.73) compared to AGA babies(8.78 ±0.78) which is statistically significant(p = 0.02) and age to regain birth weight is significantly lower in SGA babies(11.67 ±0.97) compared to AGA babies(14.75 ±0.79) which is statistically significant(p = 0.02).15 Average weight gain per day in SGA babies is nearly similar to AGA babies in all the three groups lower than 1 kg(SGA-14.04 ±-13.32 ±1.88, P = 0.764), 1 kg –1.25 kg(SGA-20.54 ±1.07, AGA-21.55 ±2.39, P = 0.779),1.25 kg-1.50 kg(SGA-19.83 ±2.50, AGA-23.42 ±2.26, P = 0.361) according to 250 gms birth weight orders(Table 7). There is no significant difference in the average proliferation in head circumference and length per week between AGA and SGA babies in all the three groups(p = 0.795 for HC and0.708 for length). Maximum weight loss in chance is more in babies with RDS(8.53 ±0.64) compared to babies without RDS(5.60 ±1.16) which is statistically significant(p = 0.02)(Table 8). There is no significant difference in weight gain per day in babies with RDS(19.15 ±1.43) and without RDS(20.19 ±1.33)(p = 0.68). There is no significant difference in HC and length proliferation between babies with and without RDS. There is no significant difference in the all the growth parameters between babies with sepsis and without sepsis(Table 9). Average weight gain per day is lower in babies with NEC(12.58 ±2.11) compared to babies without NEC(20.18 ±1.17) which is statistically significant(p = 0.04) and average weight gain per day is lower in babies with feed sectarianism(14.48 ±3.02) to babies without feed sectarianism(20.36 ±1.15) which is statistically significant(p = 0.05)(Table 10 & 11).18, 19 Postnatal growth of VLBW babies in our study was superimposed on Ehrenkranz reference charts(Fig. 3) for comparision which shows that postnatal growth of babies lower than 1250 gms is swinging from reference angles with ELBW babies sprucely swinging from the reference angles. The postnatal growth of VLBW babies above 1250 gms was matching the reference growth angles.16

Table 2 Patient Details

DETAILS	NO OF NEONATES
TOTAL	91
DEATH	17
SHIFTED TO OTHER HOSPITAL	20
CONGENITAL ANOMALIES	4
STUDY GROUP	50

- *Table 2 Classification of Babies Into AGA and SGA*

Table 3 According to Gestational Age

Gestation age	AGA	SGA	Total
<30 weeks	16(32.0%)	2(4.0%)	18(36.0%)
30-34 weeks	16(32.0%)	11(22.0%)	27(54.0%)
>34 weeks	0	5(10.0%)	5(10.0%)
Total	32(64.0%)	18(36.0%)	50(100.0%)

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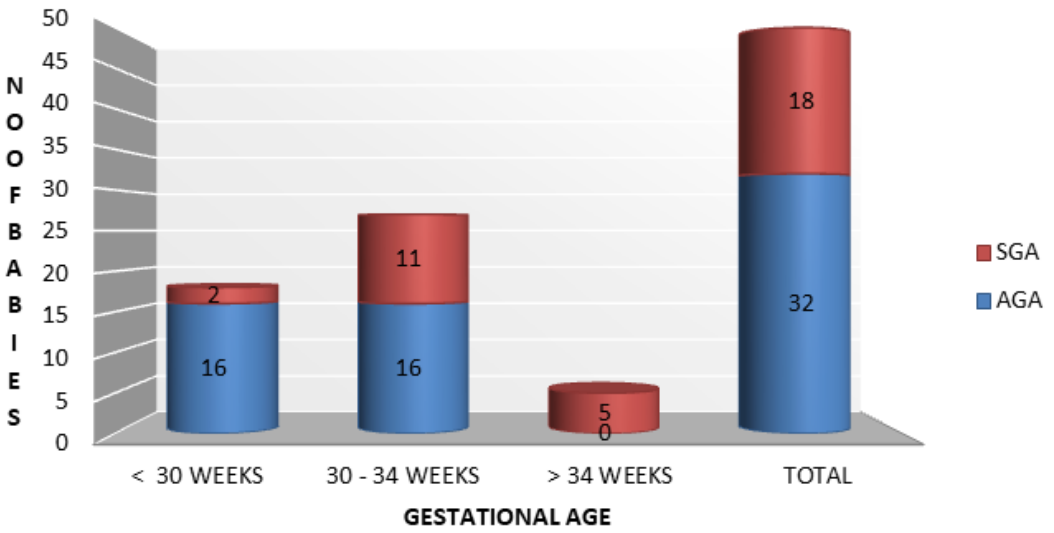

Fig 2 Classification into AGA and SGA According to Gestational Age

Table 4 According to Birth Weight

Birth weight	AGA	SGA	Total
<1 kg	5(10.0%)	6(12.0%)	11(22.0%)
1-1.25kg	12(24.0%)	6(12.0%)	18(36.0%)
1.25-1.50kg	15(30.0%)	6(12.0%)	21(42.0%)
Total	32(64.0%)	18(36.0%)	50(100%)

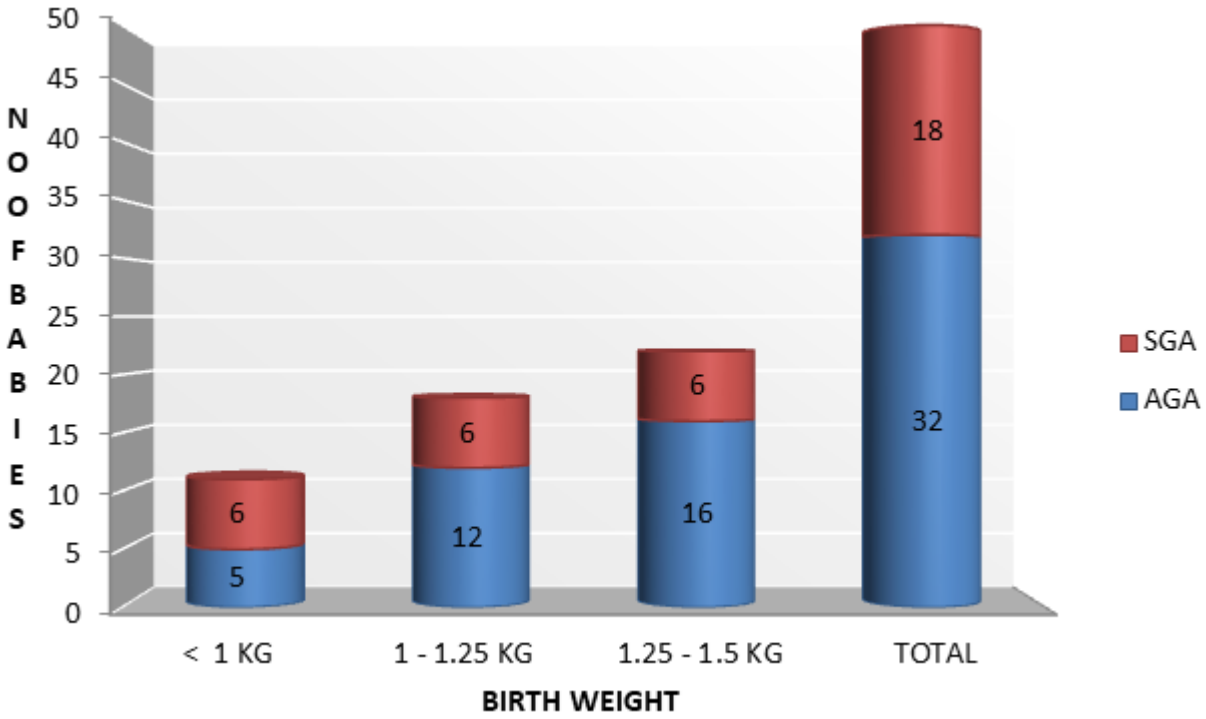

Fig 3 Classification into AGA and SGA According to Birth Weight

Table 5 Birth and Discharge Characteristics

Parametres	Mean
Birth weight	1180 g
Gestational age at birth	30.8 wks
Weight at discharge	1660 g
Age in days at discharge	42.2

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Table 6 Neonatal Morbidity

NEONATAL MORBIDITY	AGA (n=32)	SGA (n=18)	Total (n=50)
RDS	27(84.4%)	9(50%)	36(72%)
AOP	9(28.1%)	3(16.7%)	12(24%)
ANEMIA	1(3.1%)	4(22.2%)	5(10%)
FEED INTOLERANCE	4(12.5%)	4(22.2%)	8(16%)
PDA	8(25%)	2(11.1%)	10(20%)
SEPSIS	6(18.8%)	3(16.7%)	9(18%)
CLD	4(12.5%)	1(5.6%)	5(10%)
CHOLESTASIS	0(0%)	2(11.1%)	2(4%)
UTI	1(3.1%)	1(5.6%)	2(4%)
NEC	1(3.1%)	3(16.7%)	4(8%)

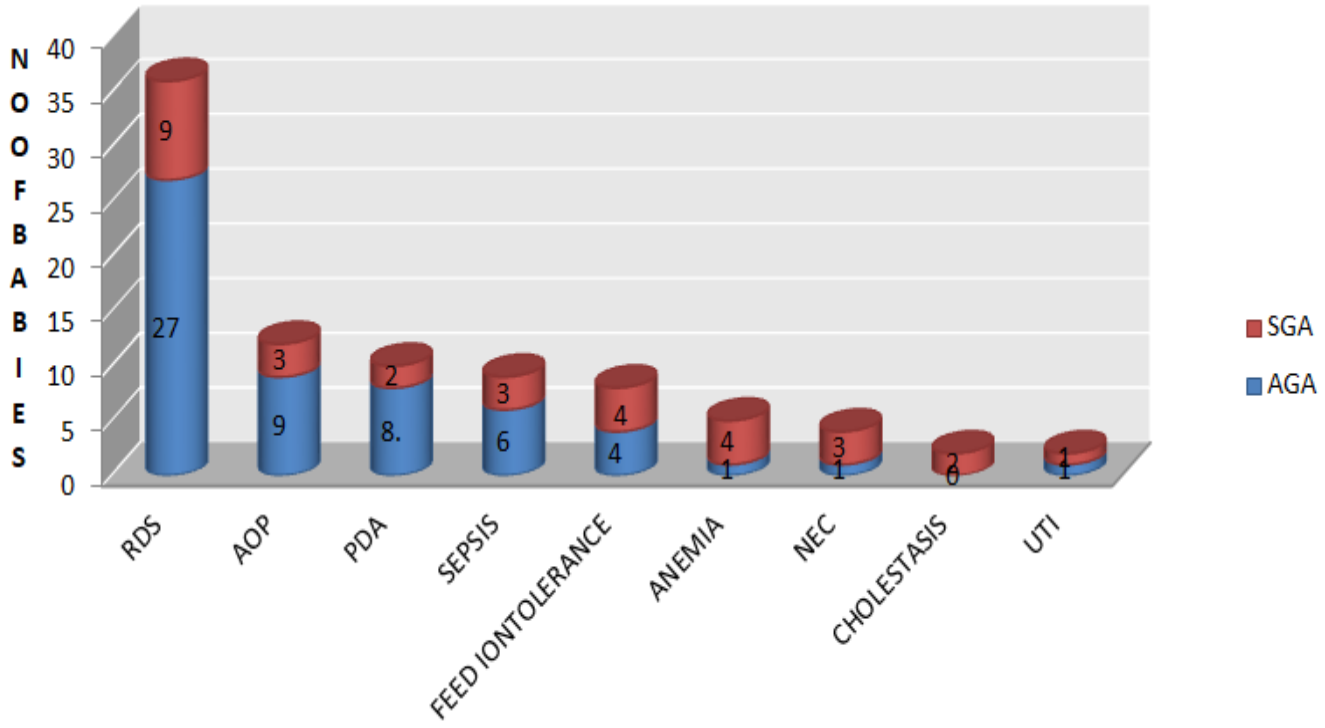

Fig 4 Neonatal Morbidity

Table 7 Mean Z Scores at Birth and Discharge and Comparision between AGA and SGA

Z score	AGA(n=32)	SGA(n=18)	Total(n=50)
Birth weight			
• At birth	-0.54	-2.03	-1.08
• At Discharge	-2.07	-3.16	-2.46
• P value	0.001**	0.001**	0.001**
Length			
• At birth	-0.55	-2.32	-1.32
• At Discharge	-1.64	-3.27	-2.23
• P value	0.001**	0.003**	0.001**
Head circumference			
• At birth	-0.53	-1.64	-0.93
• At Discharge	-1.01	-1.9	-1.33
• P value	0.03*	0.22	0.002**

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Table 8 Comparison of Weight Gain, Max Weight Loss, Age to Regain Birthweight, HC Increment, Length Increment between AGA and SGA According to Gestational Age of Neonates Studied

Variables	<30 weeks			30-34 weeks			>34 weeks			Total		
	AGA	SGA	P value	AGA	SGA	P value	AGA	SGA	P value	AGA	SGA	P value
Total number of babies	16	2	-	16	11	-	0	5	-	32	18	-
Weight gain (gm/day)	19.06± 1.64	13.39± 0.16	0.250	23.22± 2.5	19.01± 1.61	0.216	-	18.1± 3.1	-	21.14± 1.52	18.14± 1.11	0.178
Maximum weight loss (%)	10.28± 1.28	2.82± 0.84	0.063	7.29± 0.76	6.28± 0.66	0.356	-	6.58± 4.7	-	8.78± 0.78	5.98± 0.73	0.021*
Age to regain birthweight (days)	16.25± 1.26	6.5± 0.5	0.017*	13.25± 0.83	12.27± 0.95	0.452	-	12.40± 5.7	-	14.75± 0.79	11.67± 0.97	0.020*
HC increment (cm/wk)	0.69± 0.06	0.65± 0.15	0.837	0.94± 0.05	0.81± 0.08	0.145	-	0.96± 0.31	-	0.81± 0.04	0.83± 0.07	0.795
Length increment (cm/wk)	0.58± 0.03	0.68± 0.13	0.290	0.79± 0.05	0.63± 0.06	0.050*	-	0.73± 0.18	-	0.69± 0.03	0.66± 0.04	0.708

Results are Mean ± SE

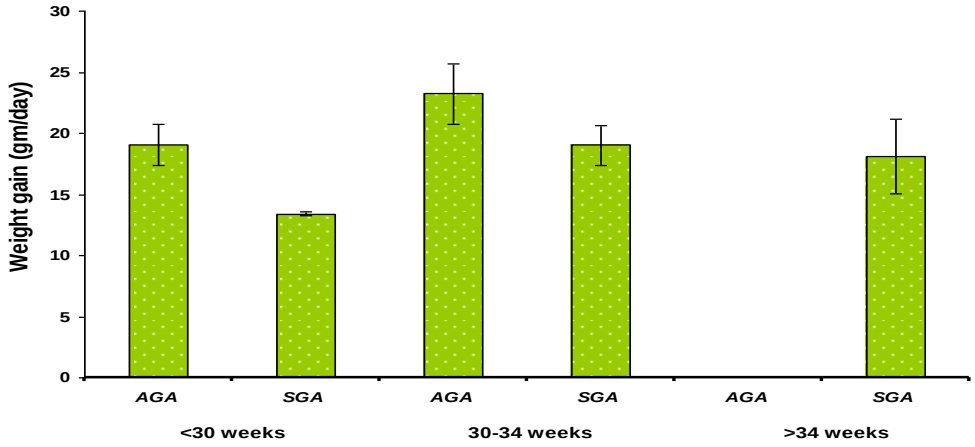

Fig 5 Average Weight Gain Per Day

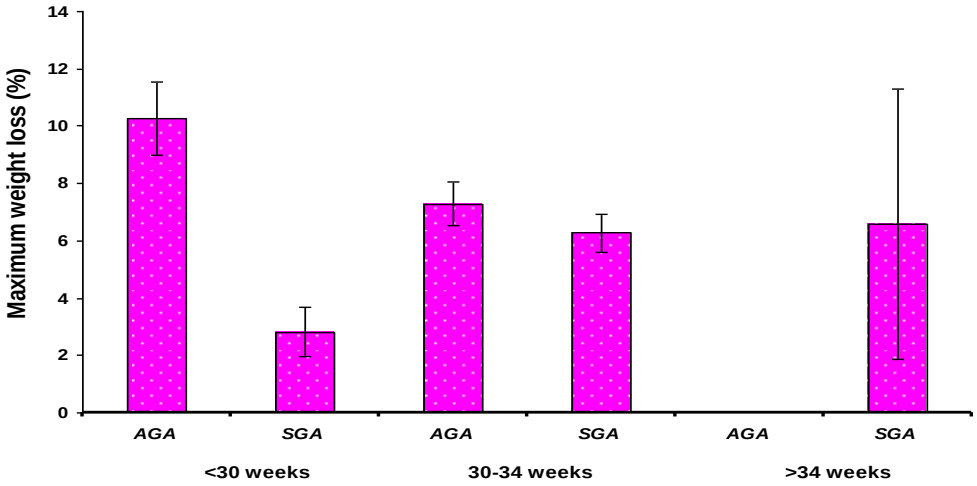

Fig 6 Maximum Weight Loss

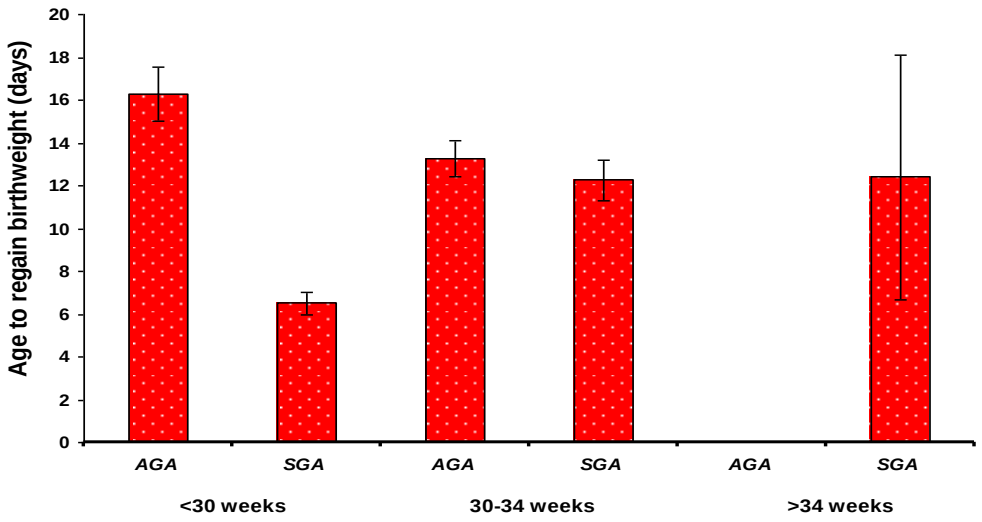

Fig 7 Age in Days to Regain Birth Weight

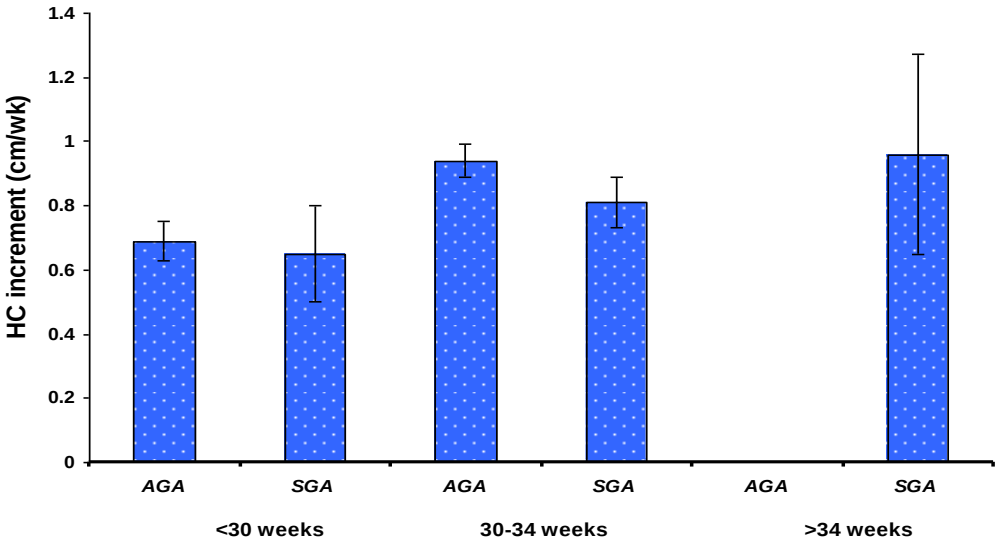

Fig 8 Increment in Head Circumference Per Week

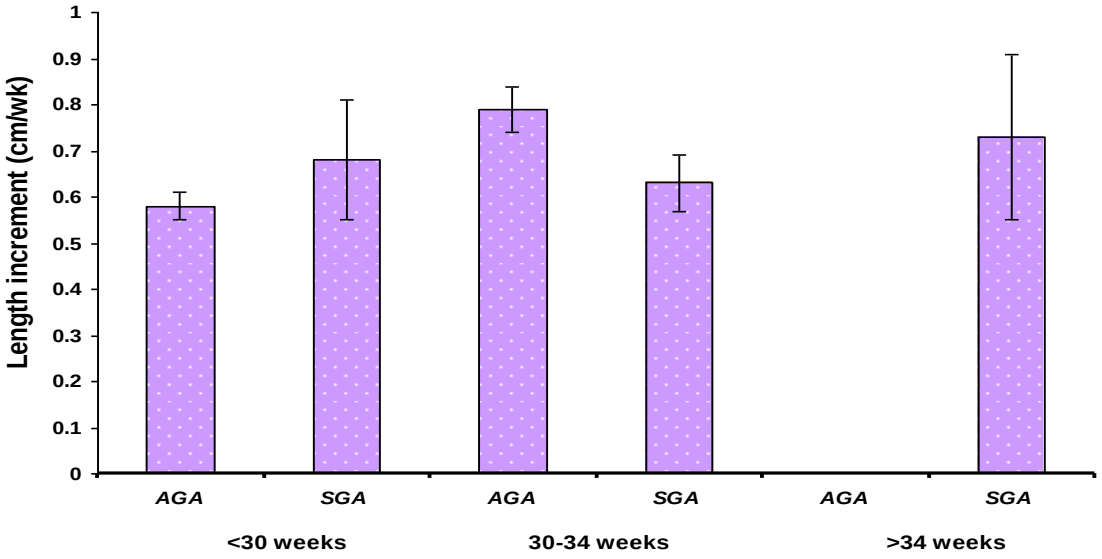

Fig 9 Increment in Length Per Week

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Table 9 Comparison of Weight Gain, Max Weight Loss, Age to Regain Birth weight, HC Increment, Length Increment between AGA and SGA According to Birth Weight of Neonates Studied

Variables	<1 kg			1.0-1.25kg			1.25-1.50kg			Total		
	AGA	SGA	P value	AGA	SGA	P value	AGA	SGA	P value	AGA	SGA	P value
Total number of babies	5	6	-	12	6	-	15	6	-	32	18	-
Weight gain (gm/day)	13.32± 1.88	14.04± 1.47	0.764	21.55± 2.39	20.54± 1.07	0.779	23.42± 2.26	19.83± 2.05	0.361	21.14± 1.52	18.14± 1.11	0.178
Maximum weight loss (%)	10.38± 2.58	6.12± 1.16	0.143	8.05± 1.3	5.46± 0.98	0.209	8.84± 1.04	6.37± 1.76	0.228	8.78± 0.78	5.98± 0.73	0.021*
Age to regain birthweight (days)	18.6± 3.01	11.33± 1.8	0.059+	13.83± 1.28	11.67± 1.38	0.311	14.2± 0.79	12± 2.11	0.237	14.75± 0.79	11.67± 0.97	0.020*
HC increment (cm/wk)	0.61± 0.07	0.67± 0.08	0.572	0.76± 0.07	0.94± 0.1	0.160	0.92± 0.05	0.88± 0.14	0.745	0.81± 0.04	0.83± 0.07	0.795
Length increment (cm/wk)	0.55± 0.04	0.58± 0.07	0.740	0.68± 0.05	0.69± 0.07	0.862	0.74± 0.06	0.72± 0.07	0.858	0.69± 0.03	0.66± 0.04	0.708

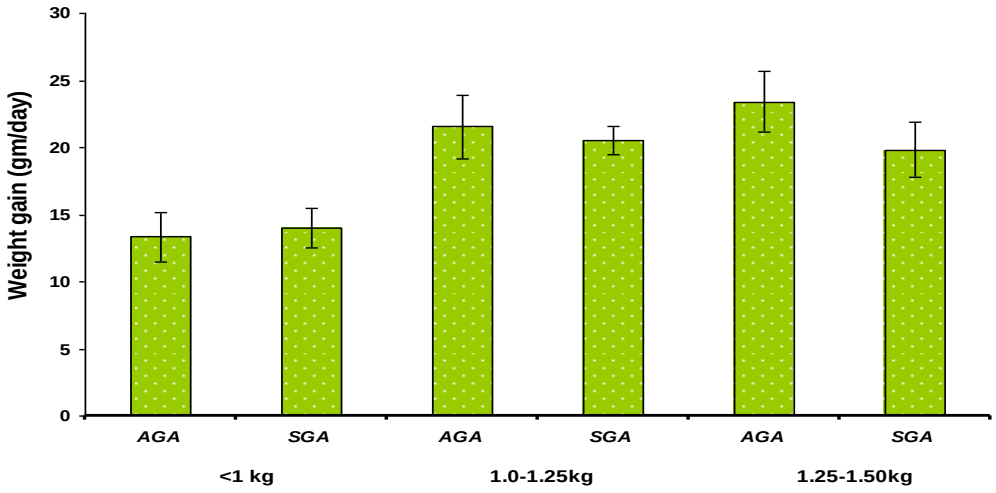

Fig 10 Average Gain in Weight Per Day

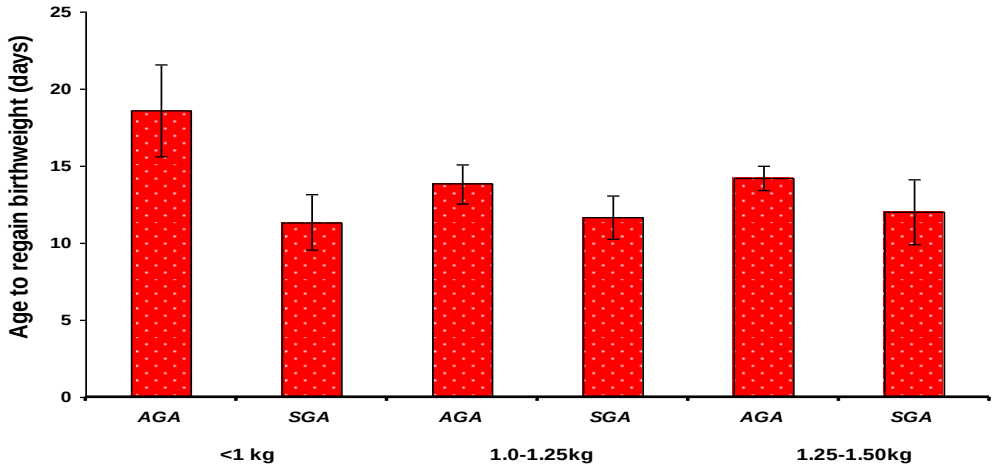

Fig 11 Age in Days to Regain Birth Weight

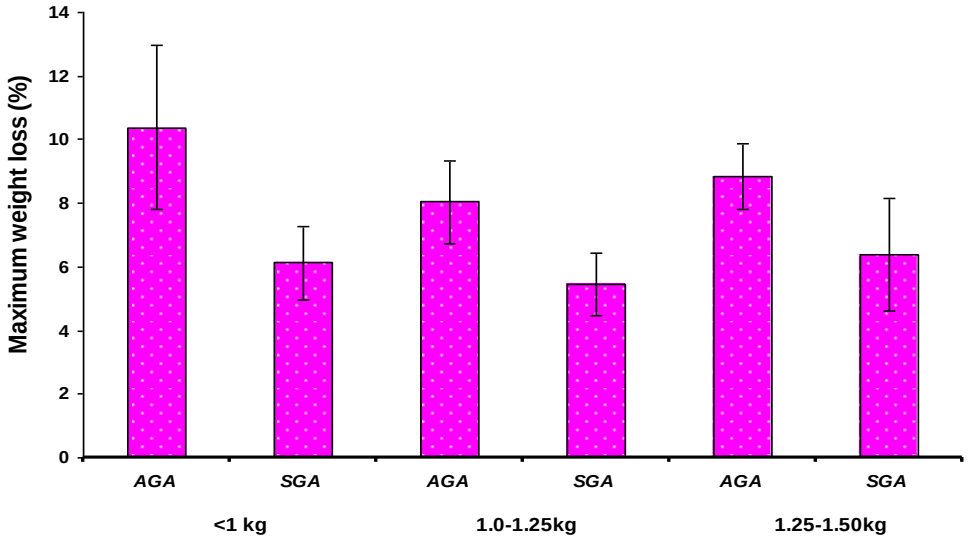

Fig 12 Maximum Weight Loss

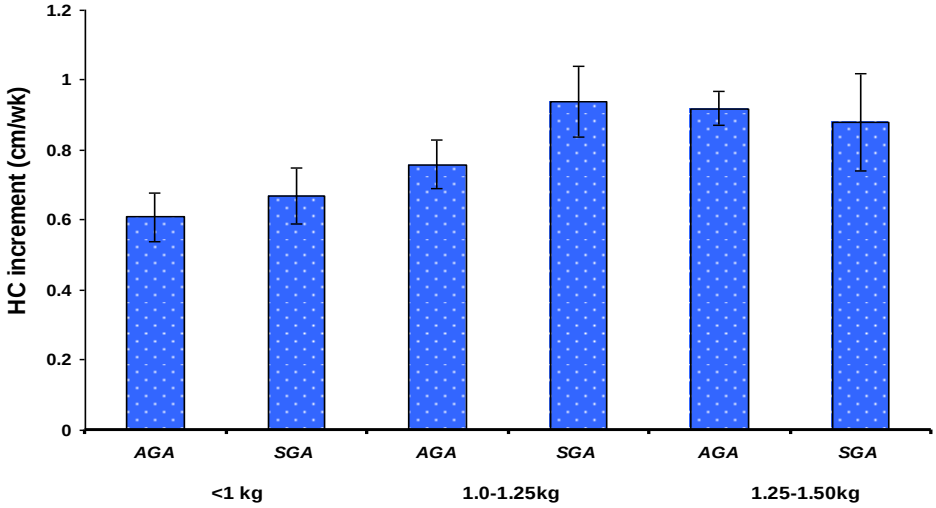

Fig 13 Increment in Head Circumference Per Week

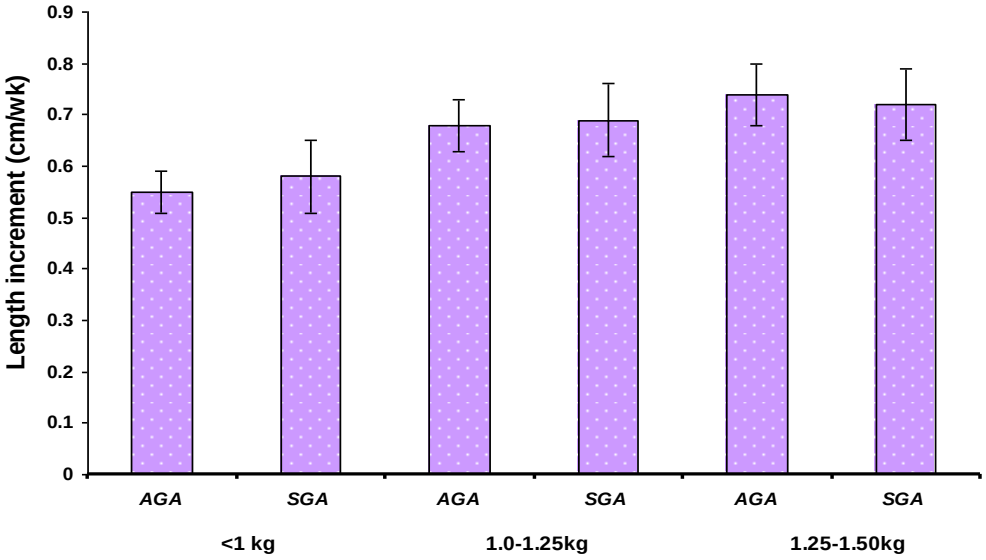

Fig 14 Increment in Length Per Week

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Table 10 Comparision of Growthparamerters in Babies with RDS and Without RDS

Variables	AGA			SGA			Total		
	With RDS	Without RDS	P value	With RDS	Without RDS	P value	With RDS	Without RDS	P value
Total number of babies	28	4	-	9	9	-	37	13	-
Weight gain (gm/day)	19.85±1.82	22.61±2.62	0.58	16.97±1.39	19.12±1.49	0.30	19.15±1.43	20.19±1.33	0.68
Maximum weight loss (%)	9.18±0.80	5.97±2.67	0.17	6.52±0.64	5.43±1.31	0.41	8.53±0.64	5.60±1.16	0.02*
Age to regain birthweight (days)	15.07±0.86	12.5±1.71	0.12	10.25±1.20	11.55±1.65	0.22	14.32±0.73	11.84±1.23	0.08
HC increment (cm/wk)	0.66±0.03	0.67±0.13	0.91	0.57±0.04	0.67±0.05	0.13	0.64±0.02	0.67±0.05	0.50
Length increment (cm/wk)	0.76±0.04	0.69±0.14	0.55	0.73±0.09	0.66±0.07	0.54	0.75±0.03	0.85±0.07	0.13

Table 11 Comparision of Growthparamerters in Babies with Sepsis and without Sepsis

Variables	AGA			SGA			Total		
	With sepsis	Without sepsis	P value	With sepsis	Without sepsis	P value	With sepsis	Without sepsis	P value
Total number of babies	6	25	-	3	15	-	9	41	-
Weight gain (gm/day)	20.86±3.68	20.12±1.92	0.86	16.39±3.0	18.37±1.19	0.66	19.37±2.63	19.46±1.27	0.97
Maximum weight loss (%)	8.99±2.55	8.78±0.82	0.91	4.26±1.51	6.32±0.81	0.30	7.41±1.87	7.86±0.62	0.97
Age to regain birthweight (days)	17±3.0	14.36±0.71	0.09	7±0.57	12.73±1.00	0.02	13.66±2.56	13.75±0.58	0.95
HC increment (cm/wk)	0.66±0.08	0.67±0.04	0.91	0.71±0.08	0.60±0.04	0.27	0.68±0.05	0.68±0.02	1.0
Length increment (cm/wk)	0.88±0.17	0.78±0.04	0.38	0.76±0.14	0.76±0.06	1.0	0.84±0.11	0.77±0.03	0.39

Table 12 Comparision of Growthparamerters in Babies with NEC and without NEC

Variables	AGA			SGA			Total		
	With NEC	Without NEC	P value	With NEC	Without NEC	P value	With NEC	Without NEC	P value
Total number of babies	1	31	-	4	14	-	5	45	-
Weight gain (gm/day)	8.31±0	21.58±1.64	-	13.64±2.36	19.30±1.04	0.02*	12.58±2.11	20.18±1.17	0.04*
Maximum weight loss (%)	19.31±0	8.44±0.74	-	5.86±1.83	6.01±0.82	0.93	8.55±3.04	7.69±0.58	0.66

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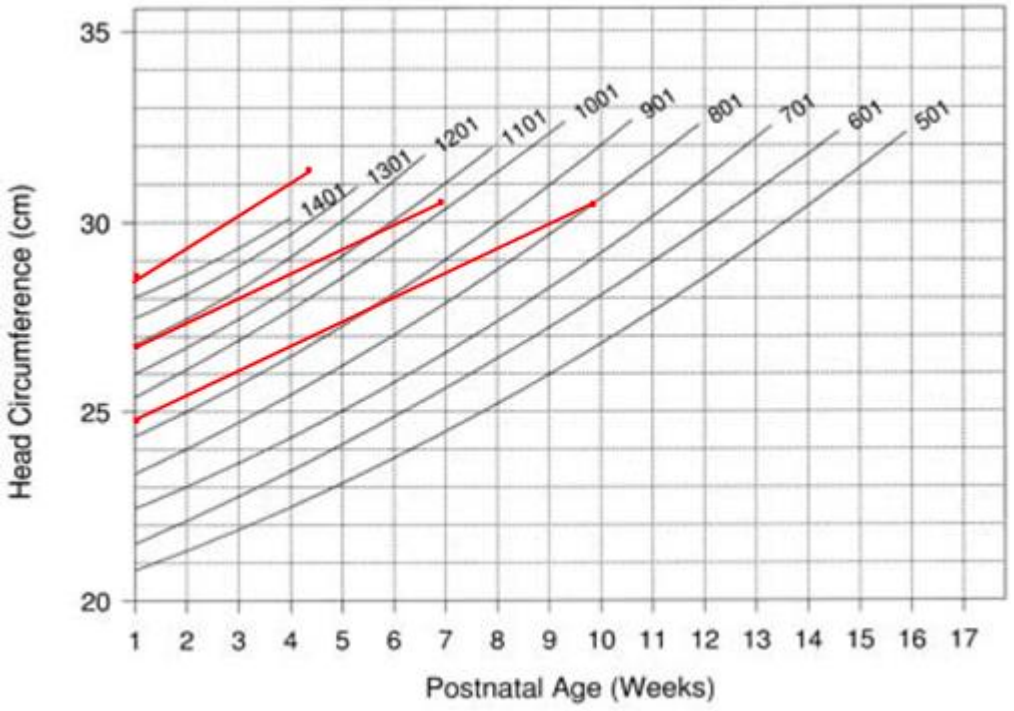
Age to regain birthweight (days)	21±0	14.54±0.80	-	9.75±1.93	12.35±1.12	0.28	12±2.70	13.86±0.66	0.39
HC increment (cm/wk)	0.42±0	0.67±0.03	-	0.53±0.12	0.64±0.04	0.27	0.51±0.09	0.66±0.03	0.12
Length increment (cm/wk)	0.42±0	0.80±0.04	-	0.63±0.14	0.80±0.06	0.22	0.59±0.11	0.80±0.03	0.35

Table 13 Comparision of Growth Paramerters in Babies with Feed Intolerance and without Feed Intolerance

Variables	**AGA**			**SGA**			**Total**		
	With Feed intolerance	**Without Feed intolerance**	**P value**	**With Feed intolerane**	**Without Feed intolerance**	**P value**	**With Feed intolerance**	**Without Feed intolerance**	**P value**
Total number of babies	4	28	-	4	14	-	8	42	-
Weight gain (gm/day)	12.68±6.12	21.27±1.59	0.08	16.27±1.75	18.55±1.31	0.40	14.48±3.02	20.36±1.15	0.05*
Maximum weight loss (%)	10.55±3.01	8.52±1.55	0.63	6.6±0.87	5.79±0.92	0.66	8.58±1.63	7.62±0.64	0.55
Age to regain birthweight (days)	16.5±1.66	14.5±2.83	0.79	15.5±2.10	10.71±0.97	0.03*	16±1.25	13.23±0.71	0.11
HC increment (cm/wk)	0.60±0.12	0.67±0.09	0.77	0.49±0.06	0.66±0.04	0.05*	0.55±0.06	0.67±0.03	0.11
Length increment (cm/wk)	0.77±0.13	0.79±0.13	0.95	0.65±0.07	0.79±0.07	0.32	0.71±0.07	0.79±0.04	0.41



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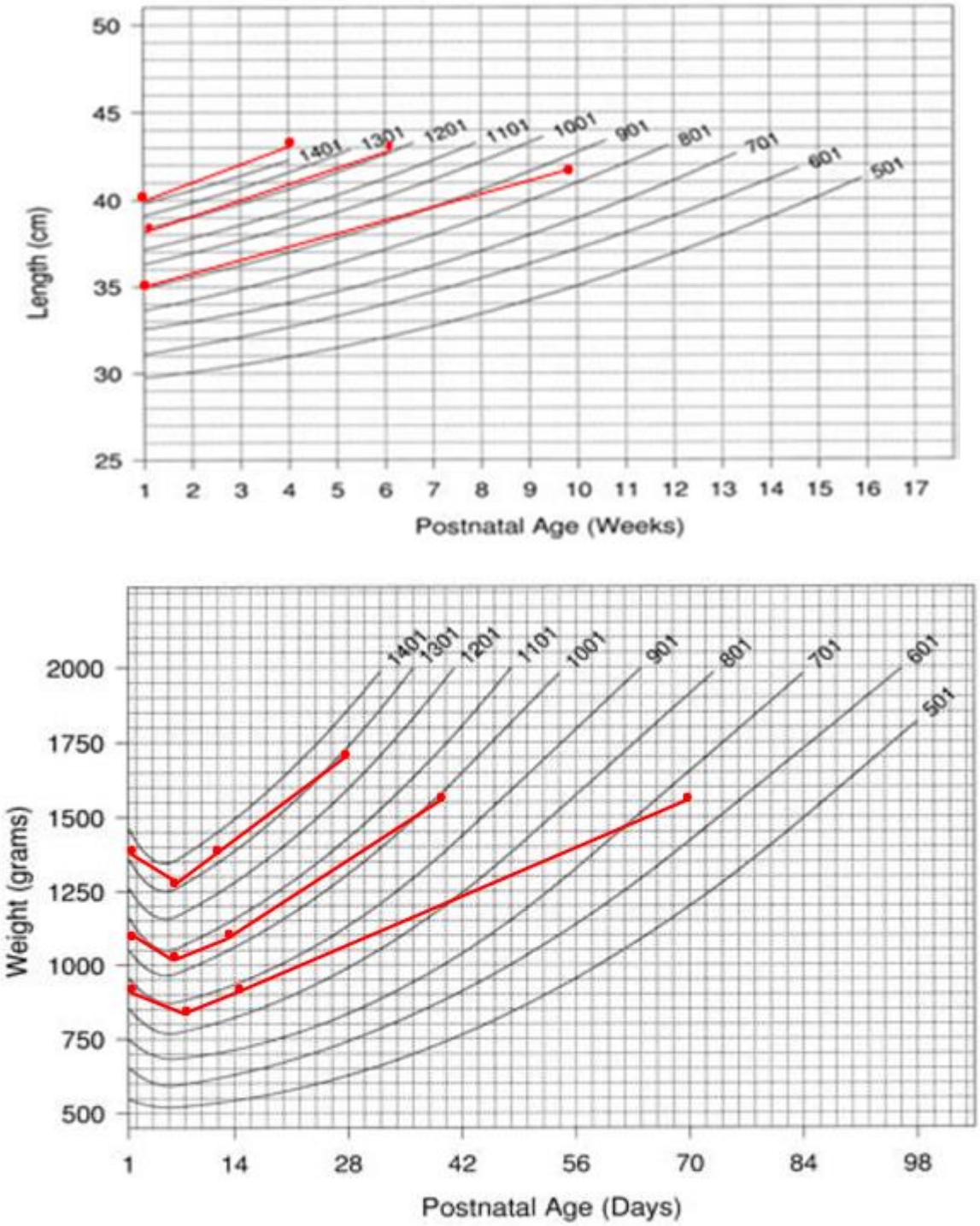

Fig 14 Postnatal Growth of VLBW Infants Categorized by 250 Gm Birth Weight Superimposed on Ehrenkranz Reference Charts

IV. DISCUSSION

91 VLBW babies were eligible at the morning of the study out of which 41 babies were barred because of various reasons(death, shifted to other sanitorium,), 50 babies were included in the study group(Table 1).8 All the VLBW babies were divided into AGA and SGA according to birth weight and enceinte age, out of which AGA constitute 64 and SGA babies constitute 36(Table 2). The birth and discharge characteristics and the neonatal morbidities of the babies in our study are mentioned in Table 3 and 4. The mean birth weight of the babies in our study was 1180 ± 214gms and the mean enceinte age at admission was30.8 ±2.43 weeks. Average weight at discharge was 1660 ± 180 gms and average duration of sanitorium stay was42.2 ±20.9 days. 72 of the babies in our study had respiratory torture, 18 of the babies had culture proven sepsis, 16 had feed sectarianism and 10 had habitual lung complaint, 8 had Necrotising enterocolitis.11, 14 Based on the information from Fenton's sources, the mean Z scores for weight, length, and HC at birth and discharge in all subjects were calculated.(Table 5). At delivery, the mean Z

scores were individually -1.08, -1.32, and -0.93. These decreased individually by discharge to -2.46, -2.23, and -1.33, which is significant (p 0.01). The mean z scores at birth were significantly lower in SGA babies than in AGA babies for all the parameters, indicating that SGA babies had considerable intrauterine growth retardation.12 SGA babies under 30 weeks have a lower average weight increase per day than AGA babies (19.06 1.64), but this difference is not statistically significant (p = 0.25).(Table 6). There is no significant difference in the average proliferation in head circumference and length per week between AGA and SGA babies in all the three groups(p = 0.795 for HC and0.708 for length). Maximum weight loss in chances significantly lower in SGA babies(5.98 ±0.73) compared to AGA babies(8.78 ±0.78) which is statistically significant(p = 0.02) and age to regain birth weight is significantly lower in SGA babies(11.67 ±0.97) compared to AGA babies(14.75 ±0.79) which is statistically significant(p = 0.02).15 Average weight gain per day in SGA babies is nearly similar to AGA babies in all the three groups lower than 1 kg(SGA-14.04 ±-13.32 ±1.88, P = 0.764), 1 kg –1.25 kg(SGA-20.54 ±1.07, AGA-21.55 ±2.39, P = 0.779),1.25 kg-1.50 kg(SGA-19.83 ±2.50, AGA-23.42 ±2.26, P = 0.361) according to 250 gms birth weight orders(Table 7). There is no significant difference in the average proliferation in head circumference and length per week between AGA and SGA babies in all the three groups(p = 0.795 for HC and0.708 for length). Maximum weight loss in chance is more in babies with RDS(8.53 ±0.64) compared to babies without RDS(5.60 ±1.16) which is statistically significant(p = 0.02)(Table 8). There is no significant difference in weight gain per day in babies with RDS(19.15 ±1.43) and without RDS(20.19 ±1.33)(p = 0.68). There is no significant difference in HC and length proliferation between babies with and without RDS. There is no significant difference in the all the growth parameters between babies with sepsis and without sepsis(Table 9). Average weight gain per day is lower in babies with NEC(12.58 ±2.11) compared to babies without NEC(20.18 ±1.17) which is statistically significant(p = 0.04) and average weight gain per day is lower in babies with feed sectarianism(14.48 ±3.02) to babies without feed sectarianism(20.36 ±1.15) which is statistically significant(p = 0.05)(Table 10 & 11).18, 19 Postnatal growth of VLBW babies in our study was superimposed on Ehrenkranz reference charts(Fig. 3) for comparision which shows that postnatal growth of babies lower than 1250 gms is swinging from reference angles with ELBW babies sprucely swinging from the reference angles. The postnatal growth of VLBW babies above 1250 gms was matching the reference growth angles.16

V. CONCLUSION

➢ *We can Draw the Following Conclusions from our Study:*

- Compared to intrauterine growth maps, VLBW infants experienced a significant growth pause during their NICU stay, and they showed disproportionately slow growth of their head circumference and length.
- There is no discernible difference between AGA and SGA babies in terms of development haste.
- Compared to infants without these co-morbidities, babies with co-morbidities like NEC and feed dogmatism exhibit a substantial decline in growth haste.
- Because of their advanced morbidity, ELBW babies' growth greatly differs from the reference growth maps.

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