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Full Length Research Paper

Extrauterine growth restriction occurring in babies with gestational ages equal to and less than 32 weeks managed at the University of Ilorin Teaching Hospital

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ABSTRACT

Preterm babies, due to problems uniquely related to their preterm status, suffer an extrauterine growth restriction. To determine the degree of extrauterine growth restriction in babies with gestational ages ≤ 32 weeks managed at the University of Ilorin Teaching Hospital, babies with gestational ages ≤ 32 weeks, who survived till the 7th day of life, and who were exclusively breastfed, were recruited. Anthropometric indices were measured till a post menstrual age of 40 weeks. 117 babies with gestational ages ≤ 32 weeks were admitted during period of study; 61babies were followed up till completion of the study. Z scores in all gestational age groups were normal at birth, but Z scores at 40 weeks post menstrual age was found to be below 10th percentile in majority of babies. All babies weighed less than the 50th percentile at a postmenstrual age of 40 weeks. Most exclusively breastfed babies delivered at gestational age ≤32 weeks remained significantly under grown at 40th week post menstrual age.

Keywords: Preterm, extrauterine growth restriction, Z-scores.

INRTODUCTION

Babies delivered before term have an increased risk of neonatal morbidity and mortality with the risk being inversely proportional to both gestational age and birth weight (Lemons et al., 2001), but more so to the birth weight (Gutbrod et al., 2000).

Preterm deaths contribute 28% of the 4 million newborns who die yearly worldwide (Saving Newborn Lives in Nigeria, 2011). Ninety nine percent of these babies are born in developing countries. Nigeria has the second highest neonatal mortality rate, with 47 neonatal deaths per 1000 live births (Saving Newborn Lives in Nigeria, 2011), and contributions to 8% of global neonatal death (Saving Newborn Lives in Nigeria, 2011). Preterm babies constitute 30% of admissions into our Neonatal Intensive Care Unit, with babies of gestational age ≤ 32 weeks making up between 8% - 11% of total admissions.

Studies carried out in the developed world have repeatedly reported growth delays occurring in preterm infants, with more severe delays in the more immature babies (Bloome, 2003; Clark et al., 2003; Ehrenkranz et al., 1999; Ehrenkranze et al., 2006). Preterm babies have unique problems which relate directly to the immaturity of their organs and systems. Initial problems relate directly with respiratory system immaturity, and this may later be compounded by or replaced with difficulties associated with feeding and infections. Thus, the institution of enteral feeds and subsequent increment to reach the baby's daily caloric requirement becomes difficult and eventually growth failure ensues.

There is a paucity of data originating from this part of the world detailing/describing the growth of preterm babies. Most studies only describe their contribution to neonatal mortality (Saving Newborn Lives in Nigeria, 2011), and not their extrauterine growth pattern or indeed eventual outcome. This study hopes to describe the pattern of growth in babies with GA ≤ 32 weeks in this region and assess the presence and severity of extrauterine growth restriction that ensues.

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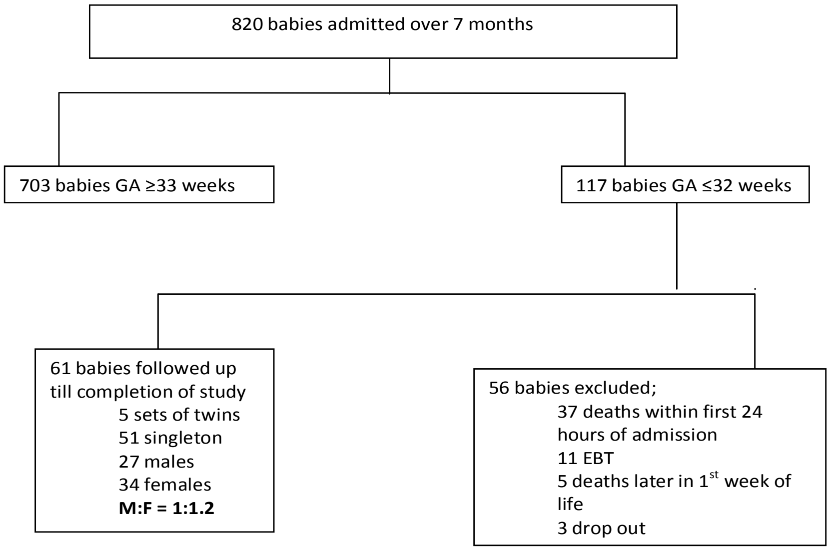

Figure 1. General characteristics of the study population

DESIGN AND METHODS

This longitudinal cross sectional study was carried out in the Neonatal Intensive Care Unit of the University of Ilorin Teaching Hospital, with the approval of the Ethical Review Committee of the institution. The hospital is located in the north central zone of Nigeria. The NICU admits between 1200-1500 neonates annually, receiving referrals from the labour ward within the hospital, and from peripheral hospitals in Kwara State, and its environs.

Consecutively admitted babies with GA ≤ 32 weeks; who presented within the first 24 hours of life, survived beyond the first seven days of life, and were able to tolerate oral feeds within the first two weeks of life, were included in the study. Exclusion criteria included overt congenital anomalies, exchange blood transfusion, and babies whose caregiver refused consent.

Anthropometric Indices

Babies had their anthropometric indices (weight, occipitofrontal circumference (OFC), and length) measured within the first 24 hours of life or at admission as was appropriate. Subsequently, measurements for weight were taken daily, and for OFC and length, taken weekly till a corrected post menstrual age/corrected post conceptional age of 40 weeks. Indices measured in the first 24 hours of life were considered as birth anthropometric indices.

Growth Assessment

Intrauterine growth was assessed using the standards derived by Lubchenco et al (Lubchenco et al., 1963). Newborns with anthropometric parameters between the 10^{th} and 90th percentiles were regarded as appropriate for gestational age (AGA), and those with anthropometric parameters below the 10^{th} percentile were considered small for gestational age (SGA). Babies whose measurements fell above the 90^{th} percentile were classified as large for gestational age (LGA).

The Fenton (Fenton, 2003) growth chart and Fenton Growth Calculator (Infant Z scores and percentiles based on Fenton preterm and infant growth chart) were used to calculate Z scores. The Z score (standard deviation score) relates the child’s weight/length/OFC to the median reference weight/length/OFC for that gestational age. A Z score of <-2 was regarded as SGA, while that >2 was used to define LGA. Extrauterine growth restriction was defined as having a growth value that was ≤ 10^{th} percentile of intrauterine growth expectation based on post menstrual age of 40 weeks (Ehrenkranz et al., 1999).

Gestational age estimation

Gestational age (GA) was calculated from the last menstrual period (LMP), which remains the gold standard. Additionally, all babies had gestational age assessment done using the Ballard (Ballard et al., 1979) chart [this had been previously validated in the unit (Mokuolu et al., 2010)]. Where the difference between the LMP and Ballard exceeded two weeks, the baby was excluded from the study.

Feeding

All babies were fed mother’s milk as soon as they could tolerate enteral feeds. None of the subjects received

Table 1. Distribution of babies according to gestational age and intrauterine growth status

Gestational Age (weeks)	Classification AGA	SGA	LGA	Total Number
26	4	-	-	4
27	4	-	-	4
28	5	1	-	6
29	12	-	-	12
30	11	1	-	12
31	8	1	-	9
32	8	6	-	14
Total	52	9	-	**61**

Table 2. Mean Z score and percentile ranges of birth parameters

Gestational age (weeks)	OFC		Length		Weight	
	Z score	percentile	Z score	percentile	Z score	percentile
26	0.3	61	-0.4	33	0.16	56
27	0.2	56	-0.1	45	-0.52	30
28	-0.1	47	-1.9	3	-0.32	37
29	-0.1	45	-0.7	26	-0.34	37
30	-0.4	36	-1.4	8	-0.49	31
31	-0.8	22	-0.9	17	-0.78	22
32	-0.50	30	-1.5	7	-0.98	16

parenteral nutrition or breast milk fortifiers as they are unavailable in Nigeria.

RESULTS

Study Population

This study was conducted over a 7 month period during which 820 babies were admitted into the NICU, they were made up of 461 males and 359 females, with a male to female ratio of **1.3:1.** Figure 1 shows a schematic representation of the distribution of the babies: there were 117 babies with GA ≤32 weeks (14.3% of admitted babies), 37 died within the first 24 hours of admission and were immediately excluded, 19 more were later excluded on account of death later in the first week of life (deaths in this group accounted for 34.2% of overall deaths during the period of the study), exchange blood transfusions and drop out from follow-up, and 61 were followed up till the end of the study.

Table 1 shows the distribution of babies according to gestational age and intrauterine growth status. The gestational ages (GA) of babies studied ranges from 26 weeks to 32 weeks, and birth weights from 850g – 2050g. Lengths ranged from 33.5cm – 43cm, and occipitofrontal circumference ranged from 24.3cm – 31cm.

Table 2 shows the mean Z score and percentile of birth parameters of the babies recruited. Mean Z scores for weight at birth were lowest among babies GA 32 weeks and highest among babies GA 26 weeks.

Postnatal growth patterns among babies

Figures 2 to 4 show the mean weekly weight, occipitofrontal circumference and lengths of the babies recruited into the study. Weight curves are biphasic, with an initial period of weight loss, followed by a gentle and progressive increase in weight. Increase in head size was faster in babies GA 26 - 28 weeks, but especially so in babies GA 26 weeks.

Mean weight and Z score at 40 weeks postmenstrual age

Table 3 shows the mean weight at 40 weeks post menstrual age, Z score, and percentile. Babies GA 27 and 26 weeks had the lowest weights at 40 weeks post menstrual age (1900±283g and 2130±311g), while babies GA 29 and 30 weeks had the highest weights at 40 weeks post menstrual age (2983±1005grms and

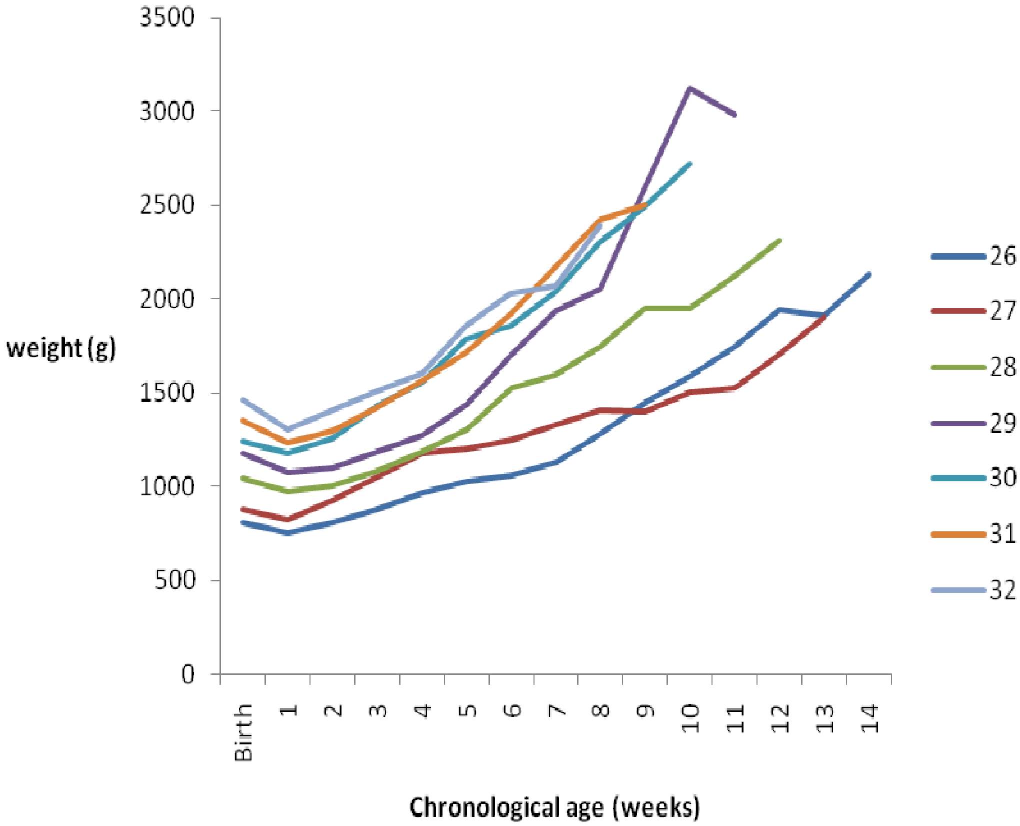

Figure 2. Trend of postnatal weight in babies GA 26 – 32 week

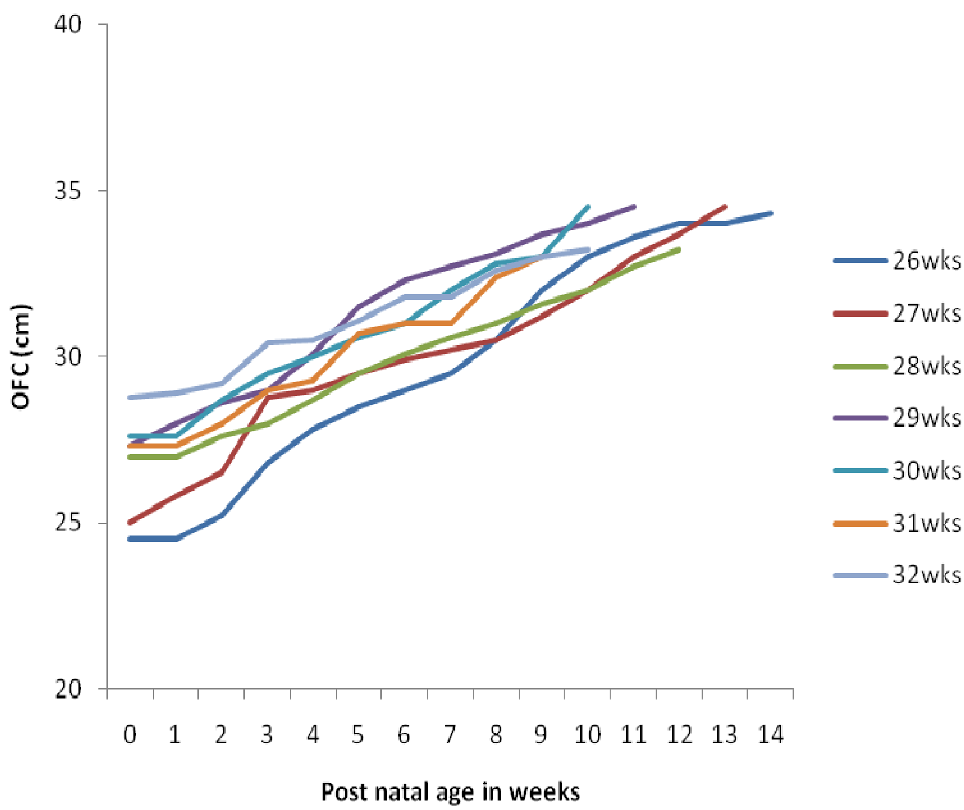

Figure 3. Trend of postnatal OFC increase in babies

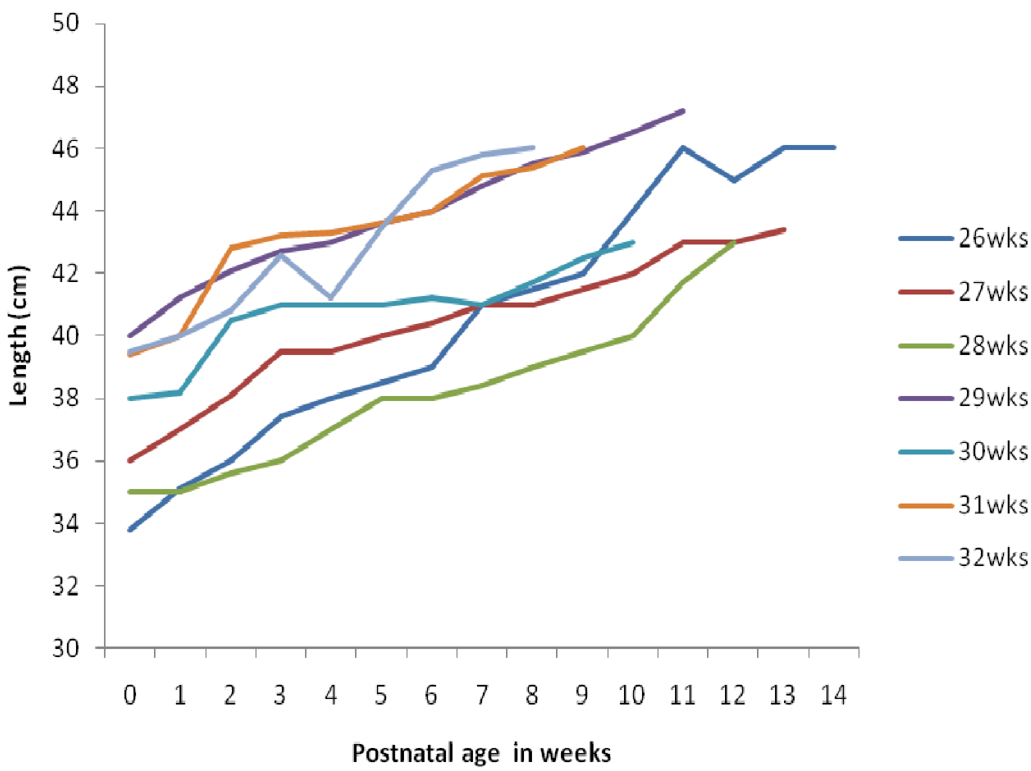

Figure 4. Trend of postnatal length increase

Table 3. Mean weight at 40 weeks post menstrual age, Z score and proportion with weight below 90th percentile.

Gestational Age (weeks)	Mean weight at 40 weeks (grams)	Z score	Percentile	% with weight below 10th percentile
26	2130±311	-2.75	Below 3rd	100%
27	1900±283	-3.22	Below 3rd	100%
28	2315±322	-2.43	Below 3rd	83%
29	2983±1005	-1.15	11th	33.3%
30	2722±887	-1.65	10th	33.3%
31	2500±418	-2.07	3rd	40%
32	2393.1±804	-2.28	Below 3rd	54%

2722±887grms). (Figure 5),

The proportion of babies in each GA group who weighed less than the 10th percentile (when compared with babies delivered at a post menstrual age of 40 weeks) was found to be 100% in babies GA 26 and 27 weeks, 83% in babies GA 28 weeks, and 33.3% in babies GA 29 and 30 weeks. About half the babies with GA 32 weeks had weights below the 10th percentile. All babies had weights that were below the 50th percentile at a post menstrual age of 40 weeks.

DISCUSSION

Babies with gestational age equal to or less than 32 weeks accounted for 117 out of 820 (14.3%) admissions and 41 out of 120 (34.2%) mortalities during the period of this study. Mean Z scores at birth were normal across all GA groups.

Growth curves were plotted were biphasic, with initial weight loss and subsequent weight gain. It is thought that the initial loss in weight is as a result of reduced fluid intake in the first week of life (Anchieta et al., 2004). In addition to this, the preterm baby has thinner skin and a relatively larger body surface area and this predisposes her/him to greater amounts of fluid loss (Embleton et al., 2011). Increases in length and occipitofrontal circumference were less dramatic.

Mean weights attained by the 40th post menstrual week was low in all GA groups, with the highest Z score of -1.15 attained by babies GA 29 weeks. Their mean weight of 2983g only placed them on the 10th percentile.

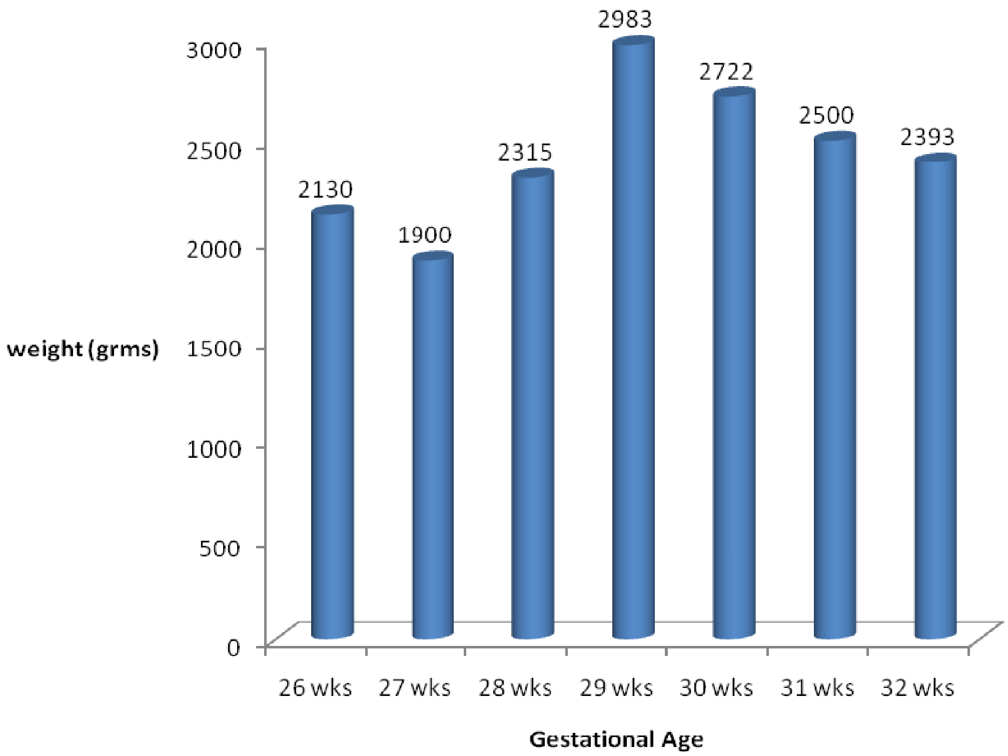

Figure 5. Mean weight at 40 weeks postmenstrual age

By definition, babies with weights for GA that are equal to or less than the 10th percentile are regarded as being extrauterine growth restricted (Clark et al., 2003). Babies GA 26 to 28 weeks demonstrated the lowest weights (2130±311g, 1900±283g and 2315±322), and Z scores of -2.75, -3.22 and -2.43 respectively. All babies fell below the 50th percentile at 40th week post menstrual age.

This problem of extrauterine growth restriction (EUGR) has been repeatedly documented by various authors (Clark et al., 2003; Ehrenkranz et al., 1999; Yu, 2005; Anchieta et al., 2004; Njokanma et al., 2008). Babies with EUGR were those with lower birth weight and lower GA. The growth in any individual arises as a result of interplay between the individuals' caloric intake and energy expenditure, and preterm babies have greater nutritional needs to achieve optimal growth in the neonatal period than at any other time of their lives. Gestational age at birth and severity of illness in the period immediately surrounding birth appear to be the major factors that determine the route of feeds and the rate of increase of feeds when administered enterally. In the younger GA infants, factors pertaining to immaturity of baby's gastrointestinal system and central nervous system, in addition to co-existing illness like respiratory distress, may make enteral feeding difficult. Additionally, although the composition of preterm milk secreted during the first two to four weeks of lactation (Yu, 2005) suits the nutritional requirement of the preterm baby, beyond this period the milk secreted lacks the nutrients required to meet up with growth (Schanler, 2001; Saarele et al., 2005; Narang et al., 2006). Premature infants fed exclusively unfortified human milk have been associated with poor rates of growth and nutritional deficits during and beyond hospitalization (Schanler, 2001). Evidence shows that early growth deficits have long term adverse effects, including short stature, poor neurodevelopment outcomes, and even cardiac problems (Ehrenkranz et al., 2006; Yu, 2005). Malnutrition at this vulnerable period of brain development has been shown to result in a decrease in the number of brain cells, as well as deficits in behaviour, learning and memory (Dobbing, 1981; Levitsky, Grantham-McGregor, 1995).

CONCLUSION

It will be reasonable to establish a policy that permits for the fortification of breast milk for the exclusively breast fed preterm infant delivered in Nigeria. Survival of babies in these GA groups appears to be on the increase in our environment. While this is laudable, we should in addition ensure the best quality of life possible.

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