NEUROLOGICAL STATUS OF THE VERY LOW BIRTH WEIGHT INFANTS AT SIX, NINE AND TWELVE MONTHS OF AGE

A DISSERTATION PRESENTED IN PART FULFILMENT

FOR THE DEGREE OF

MASTER OF MEDICINE (PAEDIATRICS)

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BY

KIROS .M. MEKONNEN.

DEDICATION

TO MY MOTHER AND FATHER.

DECLARATION:

This is my original work and has not been presented for a degree in any other University.

SIGNED ..... Date 15th of June, 1990.....

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ABBREVIATIONS

1.	A.N.C	Antenatal care
2.	A.P.H	Antepartum haemorrhage
3.	B.W	Birth weight
4.	C/S	Caeserian section
5.	F.E.T	Fisher's exact test
6.	G.A	Gestational age
7.	K.N.H	Kenyatta National Hospital
8.	N.C.H.S	National centre for health and statistics
9.	P.R.O.M	Prolonged rupture of membrane
10.	P.E.T	Preeclampsia toxaemia
11.	P.V/I.V.H	Periventricular/Intra ventricular haemorrhage
12.	R.R	Relative risk analysis
13.	R.D	Respiratory distress
14.	S.V.D	Spontaneous vertex delivery
15.	V.L.B.W	Very low birth weight
16.	W.H.O	World health organization
17.	95% C.I	95% confidence interval

CONTENTS

SUMMARY

A cross sectional study on neurological status was conducted on 73 VLBW infants between January to December 1989 inclusive at the KNH. These were compared with age and sex matched normal term infants. The prevalence of neurological sequelae among the VLBW infants was 8.2%, and none of them had major sequelae. All the infants with neurological sequelae had one or more preconceptual, prenatal, perinatal and neonatal risk factors which might have been related to their neurological outcome. The prevalence of obstetric risk factors among the VLBW infants was 73.34%. PROM (39.7%) followed by history of abortion (32.9%) were the commonest factors encountered in this study group. None of the normal term infants included into the study as controls had neurological sequelae or obstetric risk factors.

INTRODUCTION

Very low birth weight infant is defined by W.H.O as an infant who weighs 1500 grams or less at birth (1). These infants are further subclassified into three categories, based on their birth weight and gestational age, as appropriate, small and large for their gestational age. (2). Very low birth weight infant is small because of a short period of gestation, intrauterine growth retardation or both. The importance of classifying these babies is because their neonatal morbidities, survival rate and subsequently their long term physical growth and neurobehavioural outcome are largely determined by their gestational age and birth weight (2-6).

The incidence of very low birth weight infants and low birth weight in general parallels, the socio economic status of a community, such that the lower the socio economic status, the higher the incidence of very low birth weight infants. In developed countries, the incidence of VLBW is reported between 1 to 1.5% of total births (6,7) while Lekha (1989), has reported from Kenyatta National hospital to be of 4.7% of total births (8). Very low birth weight infants comprise a high proportion of babies admitted to a newborn unit. Kasirye (1984), reported that 24.5% of infants admitted to the KNH newborn unit were VLBW. (9)

Infants of VLBW are at greatest risk of high morbidity and mortality from respiratory distress syndrome, recurrent apnoeic attacks, periventricular/Intraventricular haemorrhage, metabolic

derangements like hypoglycaemia and hyperbilirubinaemia, feeding intolerance, infections, circulatory and thermal instability related to their immaturity. They are also at greatest risk for long term neurobehavioral abnormalities. They tend to have more post neonatal medical problems, particularly recurrent respiratory infections with frequent hospitalization. (10) Therefore the cost towards the care of the VLBW infants from the beginning is enormous in terms of money, time, and skilled manpower.

Before the last three decades the overall survival rate of the VLBW babies was less than 50% with a mortality rate for those less 1000 grams being almost one hundred percent. During the pioneering of the neonatal intensive care units (1963-1970), the survival rate of the VLBW babies started increasing to about 50-60%.. However, as the survival rate increased, there were alarming reports of a high prevalence (40-60%) of neurological sequelae among the survivors as evidenced by data on long term follow up (5,10,11). During the last two decades the survival rate of the VLBW infants has increased markedly, longitudinal studies also show that the proportion of survivors with long term major neurological sequelae has decreased from 40% to 60% to about 10-25% (4,11-17). Horbar et al. (18) in 1984 studied 1776 infants in eleven neonatal intensive care units in USA and United Kingdom and showed that the survival rate during the first 28 days of life was 85%, with a range of 80-95%.

In developed countries with neonatal intensive care centres, the current status of the VLBW infants is very encouraging. Even the extremely low birth weight babies have a survival rate of about 50-70% presently (11,13). This improvement in survival rate and lower prevalence of neurological sequelae among the survivors is not only due to an advanced obstetric and neonatal care, but also due to a change of socio-economic status, demographic shifts, better maternal education, improved antenatal care, and good nutritional status of the mothers (4,12,13,19,20,21,). At Kenyatta National hospital, Kasirye (9) reported in 1984 that 96.2% of 80 babies of less than 1000 grams and 51.3% of 150 infants with birth weight of 1000-1500 grams admitted to the newborn unit died during the neonatal period.

The overall survival rate was 33.4%. Mati et al. (1983) reported in the Nairobi birth survey that the twenty four hours perinatal mortality rate of the VLBW babies was 75%. (22). VLBW infants as mentioned earlier, are at greatest risk of having long term neurological sequelae due to various prenatal, perinatal, and neonatal risk factors. Prechtl (1967), in the United Kingdom reported that out of 102 VLBW infants without neurological sequelae during neonatal period, 80% were still normal on long term follow up, while out of 150 babies with neurological sequelae, 75% were still found with sequelae on long term follow up. (23). It would appear that most neurological sequelae seen in late infancy and childhood represent most likely

a continuum from the spectrum of prenatal, perinatal and neonatal events.

One of the most important factors for the high prevalence of neurological morbidities in the VLBW infants is due to the high incidence of intracranial haemorrhage, primarily the germinal layer matrix haemorrhage (periventricular/ intraventricular haemorrhage). A serial Computerized Tomography scan and/or cranial ultrasonography done in some centres on VLBW babies in the first week of life shows an incidence of periventricular/intraventricular haemorrhage (PV/IVH) in the range of 30-50% (24). This is because the vasculature of the germinal layer matrix of the premature, VLBW infants is anatomically immature, very fragile, and uniquely vulnerable to injury, mainly to circulatory flactuations, repeated apnoeic spells, seizures, hypercapnia and metabolic acidosis which are all associated with hypoxic-ischaemic brain damage and subsequently to periventicular / intraventricular haemorrhage.

The outcome of the PV/IVH depends on the degree and severity of the haemorrhage . In grade I and II haemorrhoges, the majority of them resolve or remain with minor neuromotor sequelae, while grade III and IV have 60-80% mortality rate while the survivors have a high prevalence of major neurological sequelaes (24-29).

Like most organ systems, the brain of the preterm, VLBW baby is anatomically and physiologically immature. The neurologic

functions in the first six months of life are largely of subcortical level, ie, at the brain stem and spinal cord level. The cerebral hemispheres show poor differentiation of gray and white matter. Majority of the neurones are present, however, there is poor myelinization, and axonal and synaptic connections of neurones are poorly developed. Cortical functions cannot be assessed reliably during the first six months of age. Neurological sequelae of cortical origin can subsequently be missed on assessement before the first six months of life. Neurological assessement of the VLBW preterm infants beginning from six months of age is thus, much more reproducible and has more predictive value than of early assessement (30).
In developing countries, VLBW infants have received little attention in terms of their long term neurological outcome. Most studies reported so far have been concerned primarily with neonatal morbidity and mortality patterns of the VLBW infants.

There is no data on record concerning with their neurological outcome. The author was thus prompted to carry out a cross-sectional study on the neurological status of the VLBW infants at six, nine and twelve months of age, using a standard neurological test for each age group, in an attempt to understand the extent of the neurological morbidity among the VLBW infants cared for at the Kenyatta National hospital.

HYPOTHESIS:-

The proportion of VLBW preterm infant survivors with neurological sequelae is 20%.

OBJECTIVES:

1. To determine the neurological status of the VLBW preterm suvivors at 6,9 and 12, months of age.

2. To relate some prenatal,perinatal and neonatal risk factors with neurological sequelae.

MATERIALS AND METHODS

STUDY DESIGN - A cross-sectional type of study.

SAMPLE SIZE:-

Was calculated to give a 95% confidence limit based on the formula-

$$M = \frac{Z^2 P(1-P)}{d^2}$$

where M = Minimum sample size which is 62.

Z^2 = Volume obtained from tables of standard normal distribution at 5% significance level = 1.96.

P = Anticipated prevalence of neurological sequelae. This was taken from reports of other studies.

d^2 = Absolute precision and anticipated on either

STUDY AREA:

Subject to approval of the protocol by the KNH research ethical committee, the study was carried out at the new born follow up clinic, Kenyatta National hospital, which is a referal centre as well as a university teaching hospital of Kenya. Infants who require follow up at the clinic are mainly those who have been admitted to the newborn nursery unit with birth weight of less than 2000 grams and some other high risk babies who require special care at the newborn nursery unit during neonatal period. The clinic is run on regular basis, once a week. An average of forty infants are attended to on every clinic day. They are reviewed at an interval of two to eight weeks as appropriate.

INCLUSION CRITERIA:

All VLBW infants who came to the clinic at ages of 6, 9 and 12 months plus or minus two weeks, corrected for gestation and who were born and had neonatal care at the Kenyatta National hospital.

EXCLUSION CRITERIA:

All VLBW infants with severe congenital malformations.

CONTROLS:

Were recruited from the KNH child welfare clinic. They were term, appropriate for gestational age infants who were born at KNH with no perinatal or neonatal morbidities and were matched for age and sex.

STUDY POPULATION:

All the VLBW infants recruited for neurological assesement.

SOURCE POPULATION:

All the VLBW infants attending the KNH, newborn follow up clinic.

REFERENCE POPULATION:

All the VLBW infants cared for at the KNH, newborn nursery unit.

The cases and controls were recruited on the same clinic days of the study period. In both groups, consecutive children fulfilling the inclusion criterias were selected.

The VLBW infants who were recruited into the study were identified with the help of their hospital files or hospital discharge summaries they came with to the clinic while the controls were identified from their growth charts they come with to the child welfare clinic. After an informed consent was obtained, the mothers were interviewed using a standard questionaire (Appendix II). Their obstetric and /or neonatal files were also reviewed for any antenatal, perinatal or neonatal events.

The growth patterns of the cases and controls were assessed using anthropometric measurements (weight, length and head circumference).

a) Weight- measurement was obtained using a Seca balance no 62076 made in West Germany which measures to the nearest 10 grams. Accuracy of the machine was ascertained by the

investigator before recruitment starts. All infants were weighed nude.

b) Length- A crown to heel measurement was taken with the infant supine and both legs extended in a measuring device containing a built in centimeters rule.

c) Head circumference: was taken using an ordinary tape measure, at the largest occipitofrontal measurement obtained from two trials and an average of the two was recorded.

Their growth curves for weight and length were compared with the standard growth charts of the NCHS (31), while for the head circumferences were compared with the international and interracial composite graph by Nellhaus G.(39).

Their neurological status was assessed using a standard neurological test, by Dubowitz and Griffiths (Appendix III and IV) (36,37).

STATISTICAL ANALYSIS

Results were analysed statistically using X^2 test, student's t-test, Fisher's exact test and relative risk analysis where applicable. Statistical significance was set at $P<0.05$ with 95% confidence limit.

RESULTS

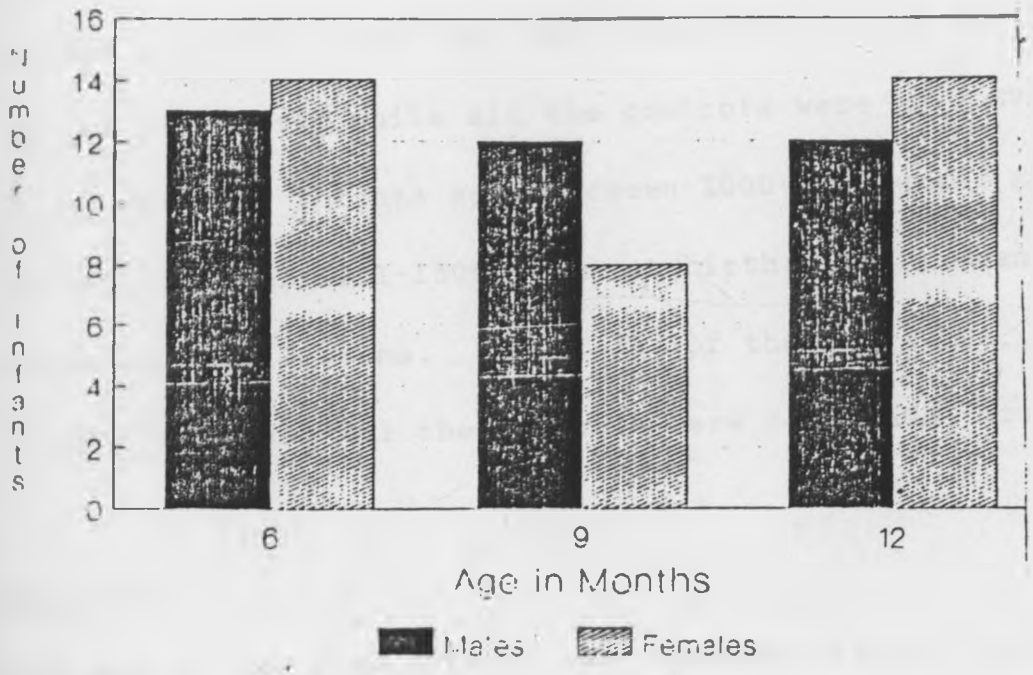
The study was carried out in the months of February to December 1989 inclusive. Seventy three of VLBW infants were recruited during the study period. These were compared with the same number of normal, term infants which were matched for age and sex. Table I and figure I show the age and sex distribution of the VLBW infants and the controls.

Table I

AGE AND SEX DISTRIBUTION OF THE VLBW INFANTS VERSUS THE CONTROLS.

	MALES		FEMALES		
AGE	VLBW	CONTROLS	VLBW	CONTROLS	TOTAL
6MO	13	13	14	14	54
9MO	12	12	8	8	40
12MO	12	12	14	14	52
TOTAL	37	37	36	36	146

FIGURE I AGE AND SEX DISTRIBUTION OF THE VLBW INFANTS.



MODE OF DELIVERY AND BIRTH WEIGHT DISTRIBUTION:

Among the VLBW infants, 50 (68.5%) were born SVD, 12 (16.4%) by C/S and 11 (15.1%) breech while all the controls were born SVD. 21 (28.7%) of the VLBW infants were between 1000-1250 grams and 52 (71.7%) were between 1251-1500 grams at birth. Their mean birth weight was 1356.2 grams. 64 (87.7%) of them were AGA, and 9 (12.3%) were SGA while all the controls were term, AGA infants.

GESTATIONAL AGE

Gestational age of the VLBW infants was assessed within the first 24 hours of birth, using the Dubowitz scoring system and it ranged from 28-36 weeks with a mean G.A score of 30.57 weeks. Sixty two (84.90%) of them were born at a gestational age of <=32 weeks.

Table II.

GESTATIONAL AGE DISTRIBUTION OF VLBW INFANTS

G.A (weeks)	NO	%
28-30	35	47.9
31-32	27	37.0
33-35	8	11.0
36-37	3	4.1
TOTAL	73	100

APGAR SCORE:

Sixty three of the VLBW infants had their 5 minutes apgar score recorded. Among these, 14 (22.2%) had perinatal asphyxia. This could not be compared with the controls because their 5 minutes apgar score could not be obtained. However, they all cried immediately after delivery, did not require resucitation and / or admission to nursery and were all discharged from the maternity unit within 24 hours.

Table III.

5 MINUTES APGAR SCORE DISTRIBUTION OF THE VLBW INFANTS

Score	Number	%
< = 6	14	22.2
> = 7	49	77.8
TOTAL	63	100

Among the VLBW infants 69 (94.5%) had one or more neonatal morbidities while only 4 (5.5%) of them had no problems at all. Respiratory distress followed by jaundice were the commonest problems encountered in this study group. Clinically suspected neonatal sepsis, patent ductus arteriosus, anaemia which required blood transfusion and repeated apnoeic attacks were also common problems. None of the controls had neonatal morbidities.

TABLE IV

DISTRIBUTION OF NEONATAL MORBIDITIES OF THE VLBW INFANTS

MORBIDITY	NO	%
RESPIRATORY DISTRESS	55	75.3
JAUNDICE	42	57.5
SUSPECTED NEONATAL SEPSIS	17	23.3
PATENT DUCTUS ARTERIOSUS	9	12.3
ANAEMIA	6	8.2
REPEATED APNOEIC ATTACKS	5	6.8
NONE	4	5.5

The prevalence of neorologica sequelae among the VLBW infants was 8.2% which disagrees with the hypothesis. Gross motor (66.6%) followed by fine motor (22.2%) were the commonest neuromotor delays observed in this study group. Others were pyschosocial (5.6%) and convulsive disorders (5.6%). All the neuromotor delays observed in this study group are of the minor types (Table V). None of the control groups had any neurological sequelae.

TABLE V

SUMMARY OF NEUROLOGICAL SEQUELAE OBSERVED

INFANT	GROSS MOTOR	FINE MOTOR	PSYCH.SOCIAL	SEISURES.
K.C	NO ATTEMPT TO ROLL BUT LIFT HIS HEAD.	DOES NOT TRANSFER OBJECT FROM HAND TO HAND.	NO SOCIAL RESPONSE TO A STRANGER.	-
6MO	DOES NOT SIT WITH TRUNK SUPPORT,TENDS TO FALL BACK WARDS. PARTIAL WT BEARING.	DOES NOT BRING OBJECT FROM HAND TO MOUTH FOR ORAL EXAM.		
9MO 2.A.N	DOES NOT CRAWL.	PARTIAL PINCER GRASP.	-	-
3.J.W 9MO	CANNOT CRAWL CANNOT SIT WITHOUT SUPPORT PARTIAL WT BEARING	PARTIAL PINCER GRASP		OCCASIONAL
4. S.G 9MO	DOES NOT CRAWL.	-	-	-
5.L.A 9MO	DOES NOT CRAWL. PARTIAL WT BEARING (INTERMITTENT STANDUNG).	PARTIAL PINCER GRASP	-	-
12MO 6.R.A	NOT ABLE TO STAND NOT ABLE TO CRAWL	-	-	-

TABLE VI: SUMMARY OF THE VLBW INFANTS WITH NEUROLOGICAL SEQUELAE

	AGE (MO)	IP.NO.	SEX	MAT. AGE	EDUC. STATUS	MARITAL STATUS	ANC	OBST. RISK	MODE OF DELIVERY	B.W.	G.A.	APGAR SCORE	NEONATAL PROBLEMS
1.	6/mo	928224	M	20	Form IV	Single	NO	-PROM	SVD	1060	27	8	- R.D.
2.	9/mo	916275	M	24	Form IV	Married	YES	-PROM Abort. TWIN	SVD	1450 (SGA)	34	10	-
3.	9/mo	903681	F	21	Form IV	Single	NO	-PROM -APH	SVD	1400	30	5	-
4.	9/mo	898549	F	19	Form IV	Single	YES	-PROM	BRECH	1480	30	-	- R.D. Jaundice
5.	9/mo	892633	M	25	-	Single	NO	-	SVD	1200	28	10	- R.D.
6.	12/mo	897674	F	20	St.6	Married	YES	-	SVD	1200	31	8	- R.D. Jaundice -PDA

Table VI Shows that all the VLBW infacts with neurological sequelae had one or more preconceptual, prenatal, perinatal and/or neonatal risk factors which might have been directly or indirectly related to their neurological outcome.

TABLE VII RISK FACTORS VERSUS NEUROLOGICAL SEQUELAE

		VLBW WITH SEQUEL	NORMAL VLBW	F.E.T P.V.	R.R	95% C.I.
1. MODE OF DEL.	SVD	5	45	0.71	1.18	0.14<RR<8.51
	BREECH	1	10			
2. BWT	1000-1250	3	18	0.23	2.48	0.54<RR<11.3
	1251-1500	3	49			
3. NEONATAL MORBID.	YES	4	65	0.03	0.12	0.03<RR<045
	NO	2	2			
4. APGAR SCORE	< = 6	1	13	0.69	0.88	0.11<RR<7.21
	> = 7	4	45			
5. MARITAL STATUS	SINGLE	4	13	0.23	6.6	1.32<RR<32.9
	MARRIED	2	54			
6. ANTENATAL CARE	NO	3	18	0.23	2.48	0.54<RR<11.3
	YES	3	49			
7. GEST. AGE (WEEKS)	28-30	4	31	0.03	2.17	0.42<RR<11.1
	> = 31	2	36			
8. PRIMARY CHILD'S CARE TAKER	MOTHER	4	44	0.67	1.84	0.2<RR<5.3
	OTHERS	2	23			

Table VII shows that neonatal morbidities and marital status are significantly related to the neurological sequelae observed in this study group.

NUTRITIONAL STATUS:

Nutritional assessment was done on both the VLBW infants and the normal term infants using anthropometric measurements of weight, length and head circumference. These were compared with the standard growth curves for each sex and age group.

Figures II to VI show that growth patterns of both the VLBW infants and the normal term infants lie within the normal range of the standard growth curves, except for the length of the VLBW male infants which is just below the nornal range but parallels the standard curve. The VLBW infants were generally smaller for their ages than their counterparts of normal term infants.

FIGURE II: MEAN WEIGHTS FOR AGE OF THE VLBW INFANTS VERSUS CONTROLS.

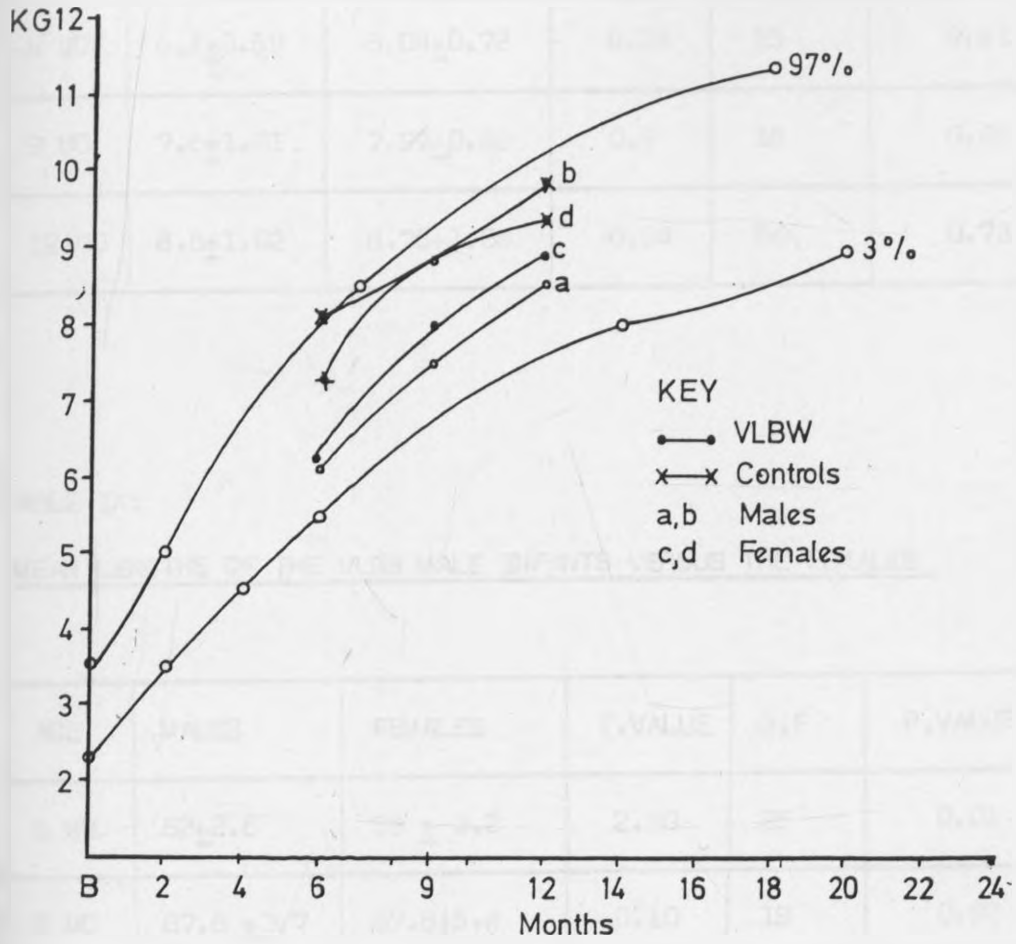


TABLE VIII:

MEAN WEIGHT (KG) OF THE VLBW MALE INFANTS VERSUS THE FEMALES

AGE	MALES	FEMALES	T.VALUE	D.F	P.VALUE
6 MO	6.1±0.59	6.04±0.72	0.24	25	0.81
9 MO	7.6±1.01	7.97±0.82	0.9	18	0.48
12 MO	8.6±1.02	8.76±1.36	0.34	24	0.73

TABLE IX:

MEAN LENGTHS OF THE VLBW MALE INFANTS VERSUS THE FEMALES

AGE	MALES	FEMALES	T.VALUE	D.F	P.VALUE
6 MO	62±2.6	59 ± 3.2	2.70	25	0.01
9 MO	67.6 ±3.7	67.8±5.4	0.10	18	0.92
12 MO	70.7±3.6	70.9±3.8	0.14	24	0.88

Fig II, Tables VIII and IX show that among the VLBW infants, females are taller and heavier than the males at the ages of 9 and 12 months but there was no statistical significance.

TABLE X: MEAN WEIGHTS (KG) OF THE VLBW INFANTS VERSUS THE CONTROLS

	MALES					FEMALES				
AGE	VLBW	NORMAL	t value	d.f.	p value	VLBW	NORMAL	t value	d.f	p value
6 mo	$6.05^{+}0.59$	$8.15^{+}1.15$	5.86	24	0.0001	$6.04^{+}0.72$	$7.4^{+}0.64$	5.32	26	0.0001
9 mo	$7.6^{+}1.01$	$8.8^{+}1.3$	2.01	22	0.057	$7.97^{+}0.82$	$8.77^{+}0.98$	1.77	14	0.098
12 mo	$8.61^{+}1.02$	$9.75^{+}0.9$	2.90	22	0.008	$8.76^{+}1.36$	$9.3^{+}0.99$	1.20	26	0.24

Fig II and Table X Show that the VLBW male infants weigh less than the normal term, male infants and it was statistically significant at the ages of 6 and 12 months. The VLBW female infants also weigh less than their female counterparts but was only statistically significant at 6 months of age.

FIG. III MEAN LENGTHS FOR AGE OF THE VLBW MALE INFANTS VERSUS THE CONTROLS

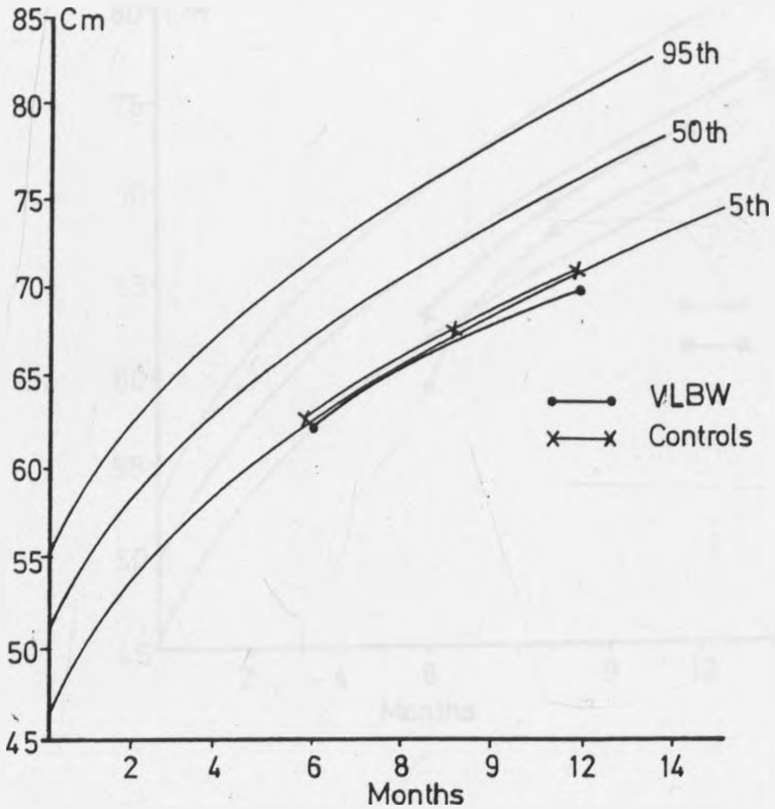


FIG. IV MEAN LENGTHS FOR AGE OF THE VLBW FEMALE INFANTS VERSUS THE CONTROLS

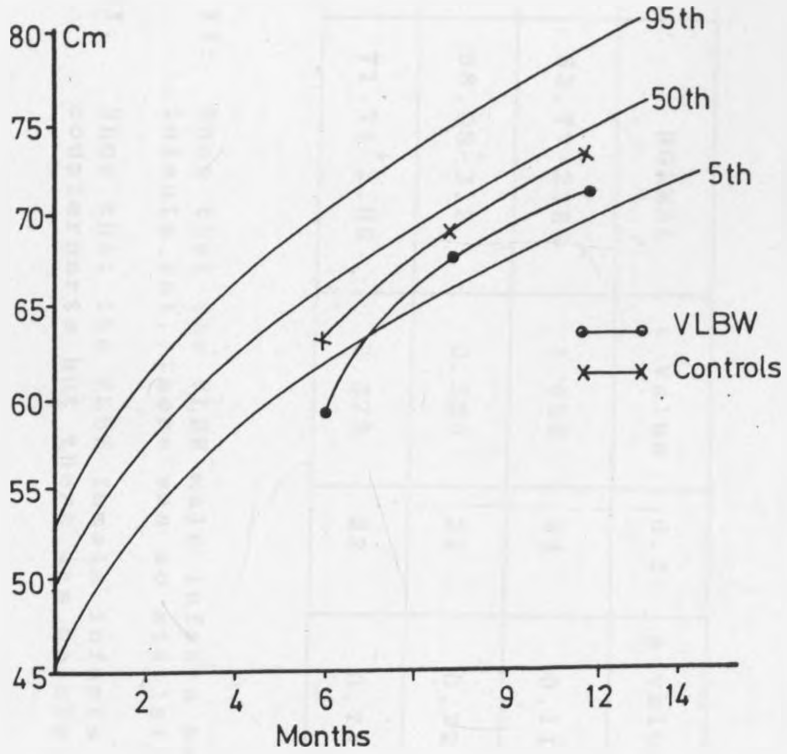


TABLE XI: MEAN LENGTHS(CM) OF THE VLBW INFANTS VERSUS THE CONTROLS

	MALES					FEMALES				
AGE	VLBW	NORMAL	t Value	d.f.	p value	VLBW	NORMAL	t-value	d.f	p Value
6 mo	62 ± 2.58	63.77 ± 2.86	1.656	24	0.11	59.18 ± 3.21	62.64 ± 1.82	3.51	26	0.001
9 mo	67.58 ± 3.65	68.08 ± 3.2	0.356	22	0.72	67.75 ± 5.4	69.31 ± 3.65	0.67	14	0.15
12 mo	70.66 ± 3.58	71.14 ± 2.66	0.373	22	0.71	70.93 ± 3.38	73.03 ± 2.83	1.78	26	0.086

Fig. III and Table XI: Show that the VLBW male infants mean lengths are smaller than the normal term, male infants but, there was no statistical significance.

Fig. IV and Table XI: Show that the VLBW female infants mean lengths are also smaller than their female counterparts but there was no statistical significance, except at 6 months of age.

FIG. V MEAN HEAD CIRCUMFERENCES OF THE VLBW MALE INFANTS VERSUS THE CONTROLS

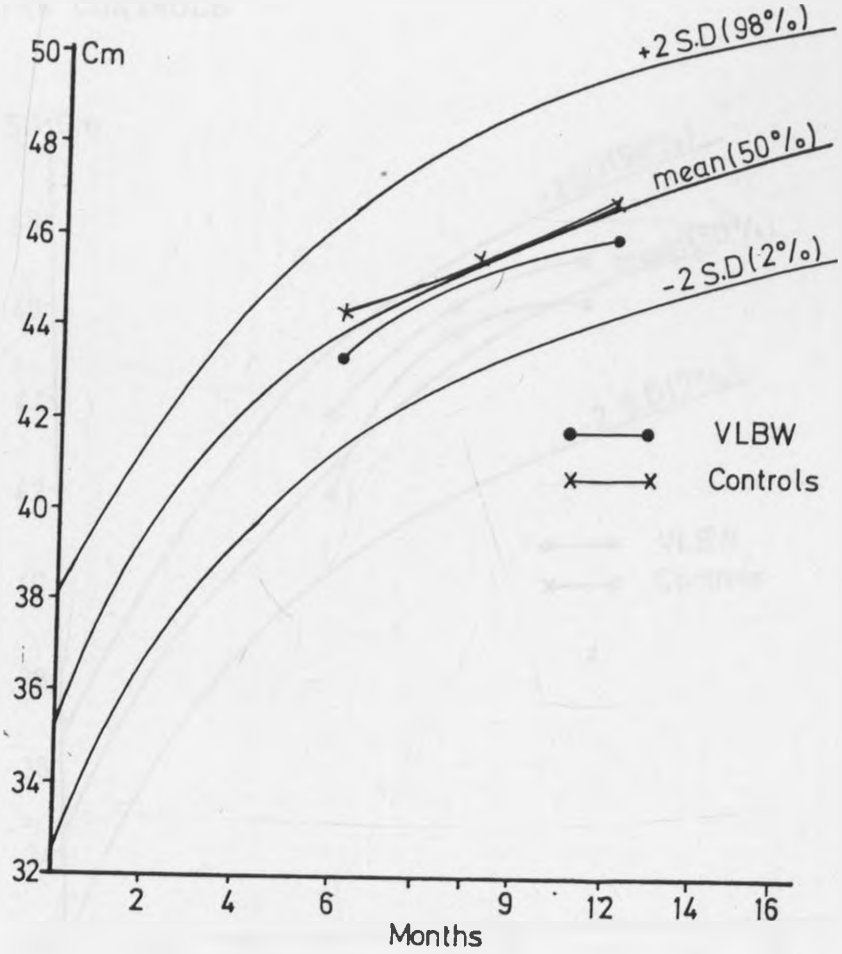


FIG. VI MEAN HEAD CIRCUMFERENCES OF THE VLBW FEMALE INFANTS VERSUS THE CONTROLS

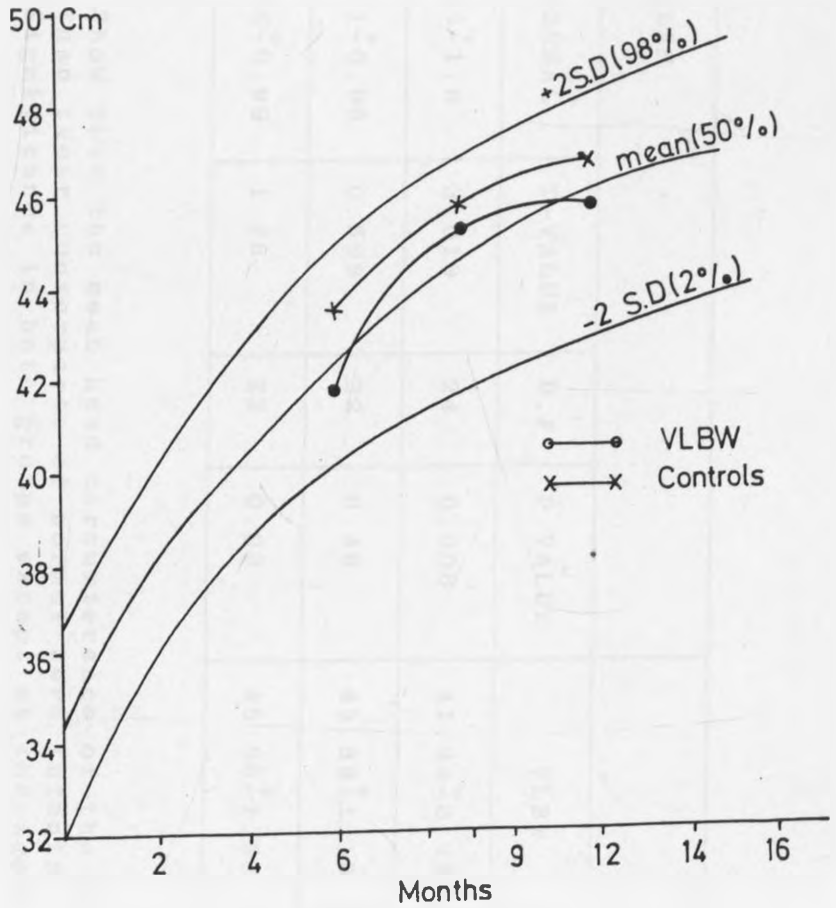


TABLE XII: MEAN HEAD CIRCUMFERENCE(CM) OF THE VLBW INFANTS VERSUS THE CONTROLS

	MALES					FEMALES				
AGE	VLBW	NORMAL	T-VALUE	D.F	P.VALUE	VLBW	NORMAL	T-VALUE	D.F	P VALUE
6 mo	$43.16^{+}_{-}1.17$	$44.54^{+}_{-}1.6$	3.019	24	0.006	$41.94^{+}_{-}0.78$	$43.43^{+}_{-}1.02$	4.34	26	0.0001
9 mo	$45.42^{+}_{-}0.9$	$45.71^{+}_{-}0.98$	0.699	22	0.49	$45.58^{+}_{-}1.15$	$45.6^{+}_{-}1.22$	0.186	14	0.85
12mo	$46.1^{+}_{-}1.36$	$46.94^{+}_{-}0.99$	1.76	22	0.09	$45.96^{+}_{-}1.38$	$46.9^{+}_{-}1.32$	1.53	26	0.139

Fig V, VI and Table XII Show that the mean head circumference of the VLBW male and female infants are smaller than their conterparts of normal term infants. However, there was no statistical Significance in both groups except at the age of 6 months.

MATERNAL AGE:

Maternal age for the VLBW infants ranged from 17 - 44 years with a mean of 24.85 years while for the term infants ranged from 19 - 39 years with a mean value of 26.68 years.

Chi square trend shows that mothers of VLBW infants tend to be younger than the mothers of the term babies.

TABLE XIII:

DISTRIBUTIONN OF MATERNAL AGE OF THE VLBW INFANTS VERSUS THE CONTROLS.

AGE (YRS)	VLBW	NORMAL	TOTAL
<= 20	12	2	14
21-26	42	38	80
27-32	17	26	43
>= 33	2	7	9
TOTAL	73	73	146

X^2 TREND = 9.55 P = 0.001

MARITAL STATUS:

Table XIV shows that there were significantly more single mothers among the VLBW infants than the mothers of the normal term infants.

TABLE XIV: MATERNAL DISTRIBUTION BY MARITAL STATUS

	VLBW	NORMAL	TOTAL
SINGLE	17	5	22
MARRIED	56	68	124
TOTAL	73	73	146

$x^2 = 6.48$ P = 0.01

R.R = 1.71

95% C.I = 1.27 < R.R < 2.31

MATERNAL EDUCATION:

Table XV shows a trend that mothers of the VLBW infants tend to have less educational status at a secondary and college / university level than those of the normal infants.

TABLE XV: DISTRIBUTION BY MATERNAL EDUCATION

LEVEL OF EDUCATION	VLBW	NORMAL	TOTAL
NIL	4	2	6
PRIMARY	24	11	35
SECONDARY	44	51	95
COLLEGE/ UNIVERSITY	1	9	10
TOTAL	73	73	146

X^2 Trend = 10.4 P = 0.001

INCOME:

Table XVI shows that more parents of the VLBW infants have no regular income than of the normal term infants.

TABLE XVI: DISTRIBUTION BY INCOME STATUS

REGULAR INCOME	VLBW	NORMAL	TOTAL
NO	9	1	10
YES	64	72	136
TOTAL	73	73	146

Fisher's exact test, p = 0.008

ANTENATAL CARE ATTENDANCE:

Table XVII shows that there is a significantly poor antenatal care attendance among mothers of the VLBW infants. All the mothers of the normal term infants had regular antenatal care attendance.

TABLE XVII: DISTRIBUTION BY ANTENATAL CARE ATTENDANCE

ATTENDED	VLBW	NORMAL	TOTAL
NO	21	-	21
YES	52	73	125
TOTAL	73	73	146

X^2 = 22. 4 D.F = 1 P = 0.0001

R.R = 2.40

95%/C.I = 1.95 < R.R < 2.96

OBSTERTRIC RISK FACTORS:

Fifty five (73.34%) mothers of the VLBW infants had one or more obstetric risk factors. PROM followed by history of abortion were the commonest risk factors encountered. Antepartum haemorrhage (APH), preeclampsic toxaemia (PET) and twin pregnancy were also major risk factors in this study group. None of the mothers of the normal infants had any risk factor.

TABLE XVIII: PATTERN OF OBSTETRIC RISK FACTORS

RISK FACTORS	NO	%
PROM	29	39.73
HISTORY OF ABORTION	24	32.88
APH DURING 2nd & 3rd TRIMESTER	15	20.60
TWIN PREGNANCY	13	17.80
PET	13	17.80
OTHERS	9	12.30

PARITY

Table XIX shows that there was no statistical difference between parity of the mothers of the VLBW infants and those of the normal term infants.

TABLE XIX: DISTRIBUTION BY PARITY OF THE MOTHERS OF THE VLBW INFANTS VERSUS THE CONTROLS

PARITY	VLBW	NORMAL	TOTAL
0 - 4	64	66	130
> 4	9	7	16
TOTAL	73	73	146

$X^2 = 10.3$ P = 0.1

R.R = 0.88

95% C.I = 0.55 < R.R < 1.39

DISCUSSION

Fourteen (22%) of the VLBW infants with apgar score recorded had perinatal asphyxia that is an apgar score of 6 or less at 5 minutes. A 10 or 20 minutes apgar score would have been more useful as the perinatal asphyxia at 10 or 20 minutes is highly associated with neurological sequelae than the 5 minutes score. (4) However, these were not recorded in our study group as it is not a common practise in our maternity unit. Lekha (1989) from KNH reported that perinatal asphyxia at 5 minutes among those with birth weight of less or equal to 2000 grams was 37.5% (8). Kasirye (1984), from KNH has reported that perinatal asphyxia has been associated with 57% and 36% of neonatal mortality of infants with birth weight of less than 1000 grams and 1000 - 1500 grams - respectively (9). Therefore perinatal asphyxia is a major obstetric risk factor associated with a high perinatal and neonatal mortality rate in our set up.

94.5% of the VLBW infants had one or more neonatal morbidities. Respiratory distress (75%) and jaundice (57.5%) which required phototherapy were the main problems encountered. Worthington et al has also reported that respiratory distress (62%) was the commonest problem seen in the VLBW infants (20). The incidence of PV/IVH among the VLBW infants, its evolution and its association with specific perinatal and /or neonatal events is not known in our set up.

However, other studies indicate that PV/IVH is the most important risk factor related to neurological sequelae among the VLBW infants (4,12,13,14).

The prevalence of neurological sequelae among the VLBW infants was 8.2% and none of them had a major neurological sequelae. This is in contrast to reports from developed countries with neonatal intensive care centres which ranges from 10-25% only with major neurological sequelae. (4,12-17). However, it might be difficult to compare ours with other reports due to the following reasons:-

a) This study was cross-sectional while others was a long term follow up. It is known that some of the infants with minor sequelae can progress into major ones or even those without sequelae during infancy can manifest at later age of childhood. Minimum of three years and five to ten years is required to detect major and minor neuropsychiatric abnormalities respectively. (7,17).

b) Psychometric assessment was part of the long term follow up in other studies, but it was not done in this study because it is not a reliable predictor of neurological sequelae in infancy. (7,11)

c) The survival rate of the VLBW infants in our set up ranges between 25-50% (9,22). This is very low as compared to developed countries which ranges between 80-95% (18). Even the extremely low birth weight infants who have the

highest prevalence of neurological sequelae have a survival rate of 60-70% in some neonatal intensive care centres (11,13), while in our setup is between 0-5% (9,22). Therefore, the high survival rate in developed countries might be the reason for the high proportion of VLBW infant survivors with neurological sequelaes as opposed to our setup in which most of those with neurological complications might have died during neonatal period.

d) The author has observed that between December 1987 to May 1989 inclusive, 585 VLBW infants were admitted to the newborn nursery unit. (35) Out of these (313 (52.6%) survived and were discharged home. All of these were expected for neurological assessment during the study period. However only 73 (23%) turned up at their expected date for neurological assessment. It is not known how many of the defaulters survived after discharge home. Therefore, the low prevalence rate of neurological sequelae as opposed to other reports could have also been influenced by a selection bias.

All the VLBW infants with minor neurological sequelae had one or more preconceptual, prenatal, perinatal and neonatal risk factors which might have directly or indirectly been related to the neurological outcome. An attempt to relate these risk factors to neurological sequelae is made using Fisher's Exact test and relative risk analysis. The only significant factors related were neonatal morbidities and marital status .

This could be due to the high incidence of respiratory distress and Jaundice encountered in this group which agrees with Stewart et al that hypoxia due mainly to respiratory distress, and jaundice were the most common risk factors related to the long term neurological sequelae (12). marital status was significantly related to the neurological outcome which agrees with others that marital status especially with the young unmarried mothers is indirectly associated with high incidence of LBW and subsequently with their neurological outcome (16,38).

However, the number of VLBW infants with neuromotor delay in this study group are too small for a meaningful conclusions to be drawn about the cause of neuromotor delays. In addition it is known that in most instances, the neurological sequelae is an additive process of multiple factors which when statistical analysis is attempted for each risk factor, significant result might not come out especially when the numbers are small like in this study group.

Nutritional assessment using anthropometric measurements of weight, length and head circumference was conducted on both the VLBW and the normal term infants, as malnutrition is one of the confounding factors for neurological assessment. The growth patterns of both groups lie within the normal range of the standard growth curves except for the length of the VLBW male infants which lie below but parallels the standard curve. The VLBW infants in this study group were generally smaller for their age than the normal term infants. This agrees with Binkin et al

(1988) who has studied a group of children up to the age of five years with different birth weights and observed that infants with LBW are likely to remain smaller for their age than the normal or large birth weights (32). This has also been observed by Babson (33). Among the VLBW infants females were heavier and taller than the males at the ages of 9 and 12 months which is in contrary to findings by Drillien and Fitzhardinge (10,34). At the moment there is no explanation for these findings. However, these were not statistically significant.

Mothers of the VLBW infants were significantly younger and less educated. The VLBW infants also tend to come from the lower income class than those of the normal term infants. 28% of the mothers of the VLBW infants did not have antenatal care, while all of those of the normal term infants had one or more antenatal clinic visits. Mati et al (1980) in the Nairobi birth survey has observed that 40% of mothers of the LBW infants did not attend antenatal clinic (29). Lekha (1989) from K.N.H reported that 40% of mothers of babies with birth weight of less or equal to 2000 grams did not have antenatal care (8). These show that inadequate or lack of antenatal care is still a major problem in our setup which is one of the main contributing factors for the high incidence of LBW and prematurity. There were also more single mothers in the VLBW infants than their counterparts ($p<0.01$). All these findings agree with others that young maternal age, single mothers, low socio-economic and educational status and poor antenatal care increase the incidence of LBW and

prematurity and subsequently the neonatal morbidity by two to four fold (1,8,9,16,22).

Fifty five (73.34%) of the mothers of the VLBW infants had one or more obstetric risk factors while none of the mothers of the control group had any risk factor. PROM (37.7%) followed by a previous history of abortion was the commonest risk factor observed. This agrees with others that PROM is the commonest risk factor associated with prematurity. It has been observed in the United States that among the VLBW infants 75%, have history of PROM (7). Mati et al in the Nairobi birth survey reported that the incidence of PROM among all pregnant mothers was found to be 32.5% (22). This figure might even have been higher had the observation been only for the VLBW infants. Antepartum haemorrhage, preeclampsia toxaemia, and twin pregnancy were also major risk factors encountered in this group. Others were previous history of still birth, neonatal death, or prematurity and febrile illnesses.

CONCLUSIONS

1. The prevalence of neurological sequelae among the VLBW infants was 8.2% and none of them had major sequelae.

2. All the infants with neurological sequelae had one or more preconceptual, prenatal, perinatal and neonatal risk factors which might have been related to their neurological outcome.

3. The prevalence of obstetric risk factors among the VLBW infants was 73.34%. PROM (39.7%) followed by history of abortion (32.9%) were the commonest factors encountered.

4. The VLBW infants were smaller for their ages than the normal term infants, in terms of their weights, lengths and head circumferences. However, between the male groups, the weights were statistically significant at the age og 6 and 12 months while their head circumference only at the age of 6 months. There was no statistical significance between their mean lengths. Between the female groups, there were statistical differences in their weights, lengths and head circumferences only at the age of 6 months.

RECOMMENDATIONS

1. A long term follow up of the VLBW infants is advocated to assess their neurological and psychometric outcome.

2. A study on the incidence of PV/IVH is desirable in our set up.

3. There is a need for all pregnant mothers to have adequate antenatal care.

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APPENDIX I

DEFINITIONS

1. Very low birth weight (VLBW):- Infants who weigh <=1500 grams at birth. (1)

2. Extreme low birth weight (ELBW):- Infants with birth weight of <=1000 grams.

3. Low birth weight (LBW):- Infants with birth weight <=2500 grams.

4. Preterm:- Infants born before 37 completed weeks of gestation from the first day of last menstrual period.

6. Appropriate for gestation age (AGA):- Birth weight between 10th and 90th percentile of Lubchenco's norms (2).

7. Small for gestational age (SGA):- Birth weight below 10th percentile of Lubchenco's norms.

8. Large for gestational age (LGA):- Birth weight above 90th percentile of Lubchenco's norms.

9. Respiratory distress (RD):- Expiratory grunting, nasal, flaring, cyanosis in room air, tachypnea (RR>50/min), chest in drawing. (7)

10. Premature rupture of membrane (PROM):- When membrane ruptures >= 24 hours before labour starts. (7).

11. Preeclampsia toxaemia:- Pregnancy induced hypertension with BP >= 140/90 mmhg + oedema + proteinuria.

12. Apnoea:- Cessation of breathing for more than 20 seconds or long enough to produce cyanosis or bradycardia. (7,31)

13. Perinatal Asphyxia:- Infants with Apgar score of <=6, five minutes afer birth. (7,31)

14. INCOME:- Regular earning of the mother or father or both not less than Ksh 500 a month.

15. Neurological Sequelae:

    i) Minor:- hypotonia, hypertonia, or generally mild distortion of gross and/or fine motor integration, delay in neuro motor development, IQ 70-85 or occasional attacks of seizures. (16)

    ii) Major:-

    - cerebral palsy of any type.
    - severe visual and hearing inpairement.
    - IQ <70.
    - hydrocephalus.

- Frequent attacks of seizures. (16)

16. HANDICAP:-

i) Minor:-

-disability that does not or is unlikely to prevent the child from going to a normal school, or to interfer with normal life in society. (14)

ii) Major:-

- Disability of body, interllect, or personality that is significantly severe to prevent or is likely to prevent the child from going to normal school or causes a serious interference with normal function in his/her society. (14)

17. IQ (Intelligent quotient):- Ratio of mental age to -chronological age multiplied by 100. (31)

18. Mental retardation:- If the IQ is more than two standard deviation below the mean for his/her age on a standard psychometric test for IQ. (31)

a) 70-85 = Borderline

b) 55-70 = mild

c) 35-55 = moderate

d) 20-35 = Severe

e) < 20 profound.

19. PV/IVH (periventricular/intraventricular haemorrhage) Intracranial haemorrhage of subependymal matrix origin. a) grade I - subependymal haemorrhage only

b) grade II - IVH without ventricular dilatation

c) grade III - IVH with ventricular dilatation

d) grade IV - IVH with parenchymal involvement and ventricular enlargement with or without periventricular cyst (24).

Appendix II.

STUDY FORMAT NO..... DATE .....

Mother's Name ..... IP.NO..... Age .....

Infant's Name..... IP.NO..... Age ..... Sex .....

Address .....

1) MATERNAL VARIABLES

Social and Family history

i) marital status - single / married

ii) parity _

iii) level of maternal education _

illiterate/primary/secondary/college or university

iv) Avearge income per month

a) mother Ksh _

b) father Ksh _

2) Chronic maternal disease

- Diabetes mellitus Yes/No
- Hypertension Yes/No
- Renal problem Yes/No
- Epilepsy Yes/No
- Chronic cough Yes/No
- Chronic diarrhoea Yes/No
- Weight loss Yes/No
- Others (specify) .....

3) History of exposure to toxins during pregnancy like

a) Alcoholism Yes/No

b) Cigarette smoking Yes/No

c) Drugs Yes/No

4) Attendance of Antenatal care Yes/No

5) Obstetric risk factors:-

- History of still birth / abortions neonatal death/ prematurities
- Antepartion haemorrhage Yes/No
- Preeclampsia toxaemia Yes/No
- Acute febrile illness/infections Yes/No

if Yes specify _

- Prolonged labour Yes/No
- Fetal distress (meconium stained liquor, FHR<110 or >160/min, irregular) Yes/No
- Cord prolapse Yes/No
- Malpresentation Yes/No

if Yes specify .....

II INFANT VARIABLES

1) Place of birth ..... DOB .....

2) Single/Twin

3) Birth weight.....

4) Gestational age..... AGA / SGA / LGA

5) Resusitative measures:

- Suction and /or bagging only
- I.V adrenaline
- Intubation
- Extra cardiac massage
- Adrenaline
- I.V Na HCO3
- I.V destrose
- Others specify

6) Neonatal and / or postneonatal morbidities

- RD Yes/No
- Repeated apnoeic attacks Yes/No
- Infections Yes/No

if Yes, Specify .....

- Anaemia which required blood transfussion Yes/No
- Hypoglycaemia cerca Yes/No
- Seizure disorder Yes/No
- Birth injuries Yes/No

if Yes, specify .....

- Others, specify .....

7) Nutritional Assessment:-

Wt.....length ..... HC ..... MAC .....

Growth faltering Yes/No

8) Neurological and Milestone assessment:-

a) History of convulsion Yes/No

b) Milestones assessment

i) at 6 months Age:

- Social response to a strange Yes/No.
- In prone position, raises head and chest off couch Yes/No.
- Rolls from prone to supine position and vice versa Yes/No.
- Head support without lag Yes/No.
- Sits with trunk support Yes/No.
- Orientates entire body towards desired object Yes/No.
- Brings object to mouth for oral examination Yes/No.
- Has palmar grasp Yes/No.
- Laughs at pleasurable social contacts Yes/No.
- Supine position = can lift head up spontannously Yes/No.
- On standing position = can bear full weight on the leg Yes/No.
- Can transfer object from hand to hand Yes/No.

ii) At 9 months Age:

- Can crawl Yes/No.
- Stands with hand hels Yes/No.

- Sits without support Yes/No.

- Transfer object from hand to hand Yes/No.

- Waves bye-bye (imitate) Yes/No.

- Says ba-ba, ma-ma, da-da Yes/No.

- Has Radial - Palmar grasp Yes/No.

- Turn head consistently to locate source of sound Yes/No.

- Begins to go for object with index finger. Yes/NO.

iii) At 12 months of Age:

- Release object on demand Yes/No.

- Has pincer grasp Yes/No.

- Walks with one hand supported Yes/No.

- Plays simple games a toy and immitates games Yes/No.

- Obeys simple requests "Give me shoes" etc Yes/No.

- Says three clear words Yes/No.

c) Neurological Assessment

See attached format by L. Dubowitz , V. Dubowitz and Griffiths (Appendix III and IV).

APPENDIX III
6 MONTH NEUROLOGICAL

Co [redacted] 1 - 2 3 - 7 Scor

8	Eye Movements	No following A [0]	Follows horizontally only 9 [1]	Follows vertically only 53 [2]	Follows in arc #4 [3]	Sustained upwards gaze 10• [4]
9	Visual acuity	B No focus [0]	10 [1]	54 Regards brick [2]	#5 Regards raisin [3]	[4]
10	Eye appearance	Nerve palsy + pupil inequality C [0]	Strabismus 11 [1]	Questionable 55 [2]	Normal with convergence 86 [3]	[4]
11	Grasp of brick or rattle	No sustained grasp D [0]	2 handed grasp 12 [1]	1 handed grasp 56 [2]	Object in each hand 87 [3]	Transfers object 11• [4]
12	Hearing with bell	No response E [0]	Listens-no head turning 13 [1]	Hearing-slow localisation 57 [2]	Immediate response 88 [3]	[4]
13	Movements: Arm	Abnormal (specify) F [0]	Questionable, ie clumsy, over-pronates 14 [1]	58 [2]	Normal [illegible] [3]	[4]
14	Leg	G [0]	Jerky, very slow 15 [1]	59 [2]	Normal 90 [3]	[4]
15	Resistance to passive movements	Elbow extension < 100° H [0]	16 [1]	Up to 160° tight 60 [2]	Up to 180° 91 easily [3]	[4]
16		Hip abduction < 70° I [0]	70° + spasm 17 [1]	Up to 70° floppy 61 [2]	Up to 70° 92 easily [3]	[4]
17		Popliteal angle < 100° J [0]	18 [1]	Up to 100° tight 62 [2]	Up to 100° 93 easily [3]	[4]
18		Foot dorsiflexion < 90° K [0]	19 [1]	Up to 90°- tight 63 [2]	Up to 90° easily 94 [3]	[4]
19	Reflexes: Biceps	Def. absent exag. unequal L [0]	33 [1]	7ble/or mildly unequal 64 [2]	Normal 95 [3]	[4]
20	Adductor	Def. absent exag. unequal M [0]	34 [1]	7ble/mildly unequal 65 [2]	Normal 96 [3]	[4]
21	Knee	Def. absent exag. unequal Mc [0]	35 [1]	7ble/mildly unequal 66 [2]	Normal 97 [3]	[4]
22	Clonus	N Present [0]	36 Unsustained [1]	[2]	98 Normal [3]	[4]
23	Supine (pass by report)	Immobile no head lifting O [0]	Lifts head - no attempt to roll 37 [1]	Lifts head + attempts to roll 67 [2]	Rolls one way 99 [3]	Rolls both ways 12• [4]
24		[0]	Cannot get toes near head 38 [1]	Does not play with toes 68 [2]	Plays with toes 100 [3]	Toes to mouth 13• [4]
25	Pull to sitting a Head	Head lag or wobble P [0]	39 [1]	69 [2]	Normal 101 [3]	[4]
26	and b Body	No traction response Q [0]	40 Falls to stand or 41 poor tractn resp [1]	70 71 [2]	Normal 102 [3]	[4]
27	Sitting	Inability to sit supported R [0]	Jacknives backwards on strgtng legs 42 [1]	Tendency to fall backwards 72 [2]	Sits well supported 103 [3]	Sits without support 14• [4]
28	Protective Reflexes	[0]	Absent 43 [1]	Forwards present 73 [2]	Forwards + sideways 104 [3]	All present 15• [4]
29	Weight bearing	Absent S [0]	Prolonged straightening 44 [1]	Intermittently standing 74 [2]	Good weight bearing 1• [3]	Stands holding on 16• [4]
30	Prone (pushing up on arms)	No chest supt T [0]	45 [1]	Head + chest up 75 [2]	Sustained chest support 2• [3]	Pushes up and on to knees 17• [4]
31	Tone	U Abnormal [0]	46 [1]	76 Questionable [2]	3• Normal [3]	[4]
32	Laterality	V Marked [0]	47 [1]	77 Minimal [2]	4• None [3]	[4]
33	Hands	W Always fisted [0]	48 Mostly fisted [1]	78 [2]	5• Open [3]	[4]
34	Rapport (with examiner)	X Cplt apathetic [0]	49 Unresponsibe [1]	79 Short atten-span [2]	6• Alert & respsve [3]	6•Gd atten-span [4]
35	Behaviour (by report)	[0]	50 Inconsolable 51 Undemanding [1]	80 Irritable/jittery 81 Poor sleeper [2]	Normal 7• [3]	[4]
36	Language	Mute/monotone Y [0]	51a [1]	82 [2]	Mama/dada syllables 8• [3]	Imitative response 19• [4]
37	Anticipation	None Z [0]	52 [1]	Antcpts feeds 83 [2]	Antcpts being lifted 9• [3]	[4]
	PROFILE TOTALS	38-39	40-41	42-43	44-45	46-47

Mobility Absent/Present (nought) — COMMENT (U) if anything of note — ALL TOTALS 48-50 [ ][ ][ ]

If abnormal test primary reflexes

1	2	3	4	COL 78	1	2	3	4	5	6	7	8
A	B	I	O									
Abn	PAbn	PN	N		<65	65-69	70-74	75-79	80-84	85-89	90-94	95+

[ ] [ ]

Modified from L. Dubowitz, V. Dubowitz and Griffith (36, 37)

9 - 12 MONTH NEUROLOGICAL

Serial No (1 - 2) | Identification No (3 - 7)

COL						SCORE
9	Eye Appearance	A Nerve palsy 0	9 Strabismus 1	52 Questionable 2	84 Normal 3	4
8	Visual fields	B Definite unilateral defect 0	10 Doubtful 1	53 2	N5 3	4
10	Visual acuity	C No regard 0	11 Regards brick 1	54 Regards raisin 2	86 Regards minute object 3	4
11	Hearing (localisation)	D No localisation 0	12 Vague localisation 1	55 Localises directly at ear level 2	87 Localises in directly above ear level 3	10+ Localises directly above ear level 4
12	Grasp of raisin	E No grasp 0	13 Partial Pincer 1	56 True Pincer 2	88 Pointing 3	4
11	Manipulation	F Cannot hold object in each hand 0	14 1	57 Picks up two bricks 2	89 Bangs bricks together in imitation 3	11+ Tower of two bricks 4
14	Movements a arm	G Abnormal 0	15 Over pronation 1	58 Clumsy 2	90 Normal 3	4
15	b trunk & leg	H Abnormal 0	16 1	59 Awkward 2	91 Normal 3	4
16	Balance	I Needs support sitting 0	17 Balance poor sitting 1	60 Sits well 2	92 Sits & turns round for objects 3	12+ Stoops with support 4
17	Upward progression	J Does not get to sitting 0	18 Gets to sitting 1	61 Pulls up to knees 2	93 Pulls up to stand 3	13+ Climbs onto things 4
18	Weight Bearing	K No weight bearing 0	19 Some weight bearing 1	62 Stands holding on 2	94 Stands alone momentarily 3	14+ Stands alone well > 1 min 4
19	Mobility	L Immobile 0	33 Purposeful with no achievement 1	63 No motivation 2	95 Purposeful with achievement 3	4
20	Walking	0	34 No stepping reaction 1	64 Walks with both hands held 2	96 Walks round furniture 3	15+ Walks well 4
21	Prone	M Head up only 0	35 Arm/chest support 1	65 Up on to knees 2	97 Crawls or turns to sitting 3	4
22	Resistance to passive movements	Mc Arm extensn <160° 0	36 1	66 To 130° just 2	98 To 180° easily 3	4
23		N Hip abduction < 70° 0	37 1	67 To 70° with spasm 2	99 Up to 70° easily 3	4
24		O Popliteal angle < 100° 0	38 1	68 100° tight 2	100 Up to 100° easily 3	4
25		P Foot dorsiflexn < 90° 0	39 1	69 To 90° tight 2	101 Up to 90° easily 3	4
26	Reflexes: Biceps	Q No response 0	40 1	70 ble/unequal 2	102 Normal 3	4
27	Adductor	R No response 0	41 1	71 ble/unequal 2	103 Normal 3	4
28	Knee	S No response 0	42 1	72 ble/unequal 2	104 Normal 3	4
29	Clonus	T Sustained 0	43 Unsustained 1	2	1+ Absent 3	4
30	Myotonia	U Def. present 0	44 1	73 Questionable 2	2+ None 3	
31	Support (with examiner)	V Completely apathetic 0	45 Unresponsive 1	74 Short attention 2	1+ Alert and responsive 3	Great attention span 4
32	Response to dressing	0	46 vely no help 1	75 Doubtful 2	4+ vely helpful 3	4
33	A Language verbal	W Does not say mama/ dada 0	47 1	76 Non-spec mama/ dada (vowel snd) 2	5+ Multi-syllable babble 3	4 clear words other than mama 4
34	Understanding	X No anticipation 0	48 Obvious anticipation 1	77 Cries on scolding or sympathy 2	6+ Understands NO 3	12+ Obeys one step command then 4
35	Non-verbal	Y Mute/monotone 0	49 1	78 Sings 2	7+ Indicate wants 3	13+ Shakes head no 4
36	Laterality	Z Marked 0	50 1	79 Minimal 2	8+ None 3	4
37	Sleep	0	51 Woken regularly inconsolable 1	80 Woken regularly easily settled 2	9+ Sleeps through night 3	4
	PROFILE TOTALS	38-39	40-41	42-43	44-45	46-47

Personality: Quiet, undemanding, whining/demanding, alert/active, overactive

If abnormality, tests: Plantare Parachute

Hearing: (Punch 0 if abnormal)

	NORMAL	ABNORMAL
Bell		
Foot and spoon		
Paper		

COMMENT (C) if anything of note

Col. 77.

1	2	3	4
A	B	C	D
Abn	?Abn	IN	N

COL 78

1	2	3	4	5	6
<65	65-69	70-74	75-79	80-84	85-89

ALL TOTALS 48-50

Modified from L. Dubowitz, V. Dubowitz and Griffiths (36, 37)

APPENDIX V

MEAN WEIGHTS (KG)

	MALES		FEMALES	
AGE	VLBW	CONTROLS	VLBW	CONTROLS
6 MO	6.1	8.2	6.04	7.4
9 MO	7.6	8.8	7.97	8,8
12 MO	8.6	9.7	8.8	9,3

MEAN LENGTHS (CM)

	MALES		FEMALES	
AGE	VLBW	CONTROLS	VLBW	CONTROLS
6 MO	62	63.8	59.3	62.6
9 MO	67.6	68.1	67.8	69.3
12 MO	70.7	71.1	70.9	73.0

MEAN HEAD CIRCUMFERENCES (CM)

	MALES		FEMALES	
AGE	VLBW	CONTROLS	VLBW	CONTROLS
6 MO	43.2	44.5	41.9	43.4
9 MO	45.4	45.7	45.6	45.7
12 MO	46.1	46.9	46.0	46.9