



### Prevalence and Problems of Foetal Malnutrition in Term Babies at Wesley Guild Hospital, South Western Nigeria

*Prévalence du foetus et aux problèmes de malnutrition en terme bébés à l'hôpital de Wesley Guild, le Sud-ouest du Nigeria*

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#### ABSTRACT

**BACKGROUND:** Up to two-thirds of low birth weight babies delivered in the developing countries are also small for gestational age (SGA). Since SGA is common in West Africa, FM is expected to be common in the region.

**OBJECTIVE:** To determine the pattern, prevalence, and problems of FM among term babies delivered at a General Hospital.

**METHODS:** Subjects were consecutive, live, singleton; full term neonates delivered at the hospital over eight months and were assessed within 24 hours of birth. Each baby was examined for evidence of FM using the Clinical Assessment of Nutritional Status Score (CANSCORE) described by Metcoff. The babies were classified into those with and without FM and the two groups compared.

**RESULTS:** Four hundred and seventy three term singleton live born neonates consisting of 246 males and 227 (48%) females were assessed. Eighty-nine (52%). 18.8% of the 473 babies had FM. FM was commoner in SGA babies than AGA babies ( $p < 0.001$ ). A total of 47 (82.5%) of the 57 babies who were SGA had FM while 42 (10.6%) of 396 babies who were AGA had FM ( $p < 0.001$ ) and none of the 20 LGA babies suffered from FM. Severe birth asphyxia, respiratory distress, meconium aspiration, hypoglycaemia, high haematocrit and hypoalbuminaemia were significantly commoner in babies with FM. Infants with FM had significantly higher mortality and neurological sequelae in the first month of life.

**CONCLUSION:** FM is a major health problem in Nigeria with considerable morbidity and mortality. Using CANSCORE, the clinician can diagnose cases of FM which may be missed by using intrauterine growth chart. *WAJM 2007; 26(4): 278–282.*

**Keywords:** *Foetal Malnutrition, prevalence; CANSCORE; Morbidity; South Western Nigeria.*

#### RESUME

**CONTEXTE:** Jusqu'aux deux tiers des bébés de faible poids de naissance délivrés dans les pays en développement sont aussi petits pour l'âge gestationnel (SGA). Depuis la SGA est courante en Afrique de l'Ouest, FM devrait être courante dans la région.

**OBJECTIF:** Déterminer la structure, la prévalence et les problèmes de la FM chez les bébés terme prononcé à l'Hôpital général.

**MÉTHODES:** Les sujets étaient consécutives, live, singleton; mandat complet livré nouveau-nés à l'hôpital plus de huit mois et ont été évalués dans les 24 heures suivant la naissance. Chaque bébé a été examiné pour la preuve de FM en utilisant les cliniques d'évaluation de l'état nutritionnel Score (CANSCORE) décrite par Metcoff. Les bébés ont donc été classés dans ceux avec et sans FM et les deux groupes comparés.

**RÉSULTATS:** Quatre cent soixante trois terme des nouveau-nés nés vivants singleton composé de 246 hommes et 227 (48%) femmes ont été évaluées. Quarante-neuf (52%). (18,8%) des 473 bébés étaient FM. FM était en homme du SGA AGA que les bébés bébés ( $p < 0,001$ ). Un total de 47 [82,5%] des 57 bébés qui avaient été SGA FM tandis que 42 (10,6%) des 396 bébés qui ont été AGA avait FM ( $p < 0,001$ ) et aucun des 20 bébés LGA souffert de la radio FM. Asphyxie à la naissance sévères, détresse respiratoire, aspiration de méconium, hypoglycémie, hémocrite élevée et une hypoalbuminémie étaient nettement en homme du bébé avec la radio FM. Enfants with FM avait significativement plus élevés de mortalité et de séquelles neurologiques dans le premier mois de vie.

**CONCLUSION:** FM est un problème majeur de santé au Nigeria avec beaucoup de morbidité et de mortalité. Utilisation CANSCORE, le clinicien peut diagnostiquer les cas de FM, qui peut être manquée par l'utilisation de croissance intra-utérin. *WAJM 2007; 26(4): 278–282.*

**Mots-clés:** *malnutrition fœtale, la prévalence; CANSCORE; Morbidité; Sud-Ouest du Nigeria.*

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**Abbreviations:** AGA, appropriate for gestational age; ANC, antenatal care; CANSCORE, clinical assessment of nutritional status score; FM, foetal malnutrition; HDN, haemolytic disease of the new born; IUGR, intrauterine growth restriction; LGA, Local Government Area; SGA, small for gestational age.

## INTRODUCTION

Foetal malnutrition (FM) is defined as failure to acquire adequate quantum of fat and muscle mass during intrauterine growth.<sup>1-4</sup> It is a term coined by Scott and Usher<sup>5</sup> to describe infants who show evidence of soft tissue wasting at birth irrespective of the specific aetiology<sup>6</sup> and it is independent of birth weight and gestational age.<sup>1,2,5-7</sup> It is not synonymous with either smallness for gestational age (SGA), (birth weight below 10th percentile for gestational age on the intrauterine growth chart)<sup>1,2</sup> or intrauterine growth restriction (IUGR). In FM, the subcutaneous tissues and underlying muscles are diminished and the skin of arms, legs, elbows, knees and interscapular regions is very loose. A terminology commonly used synonymously with fetal malnutrition is small for gestational age (SGA) babies. However a SGA baby may or may not have suffered from intrauterine growth restriction (IUGR)<sup>7</sup> and not all SGA babies have foetal malnutrition.<sup>5-8</sup> Since the diagnosis of SGA is usually based on the use of a pre-determined intrauterine growth chart, some babies with FM who are not SGA may be missed using traditional classification system. Perinatal problems and/or central nervous system sequelae are known to occur primarily in babies with FM whether appropriate for gestational age (AGA) or SGA but not among those who are simply SGA but not malnourished.<sup>6</sup>

Since the delivery of SGA babies is common in Nigeria and similar countries, FM is expected to be common because it is known to be commoner among the SGA than other babies.<sup>1</sup> Prevailing adverse conditions of poverty, under-nutrition, infections and infestations in many developing nations are some of the possible reasons that may promote unsatisfactory pregnancy outcome. Although several studies have been done on FM in the developed countries<sup>1,5-7</sup> very little has been done on it in the developing countries where cases are often grouped together as SGA infants.<sup>8,9</sup>

It is, therefore, important that the magnitude of FM and factors causing it be determined for our community since causes may vary from community to community or vary with time in the same

community. This may encourage measures to be developed which can prevent this potentially fatal condition. The present study was undertaken at Wesley Guild Hospital, Ilesa, Nigeria which is unit of the Obafemi Awolowo University Teaching Hospital Complex and is the main referral health institution providing specialist paediatrics and maternity services to the semi-urban Ijesa community of Osun State in Southwestern Nigeria. It also receives referrals from Ondo and Ekiti States of Nigeria. To our knowledge, there is no previous work from Nigeria on FM using CANSORE.

## SUBJECTS AND METHODS

Subjects were consecutive, singleton, live birth, term (37-42 weeks gestation) neonates delivered at the maternity unit of the Wesley Guild Hospital, Ilesa, in South Western Nigeria. Excluded from the study were term babies with obvious congenital malformations or stigmata of chromosomal anomaly. Ethical clearance was obtained from the Research and Ethical Committee of the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife. Informed consent was obtained from the mother or both parents. The study was conducted from January 2001 to August 2001 inclusive, a period of eight months.

The maternal data obtained included the age, date of last menstrual period (LMP), parity, place of antenatal care (ANC), number of clinic attendances, duration of pregnancy, gestational age at booking, height, booking weight and the last weight before delivery. Also, any preceding illnesses during pregnancy were noted and recorded, especially, anaemia, malaria, pregnancy induced hypertension, ante partum haemorrhage, history of rash or jaundice. Drugs taken during pregnancy, exposure to irradiation and the past medical history were also documented. Nutritional status of the mother was also determined by calculating the body mass index (BMI). The details have been previously described.<sup>10</sup> Labour charts were examined for evidence of foetal distress. Time of onset and duration of labour, duration of drainage and characteristics of liquor and mode of delivery were all documented.

APGAR score at 1 and 5 minutes and time of initiation of respiration were noted. Every neonate then had a complete physical examination noting the activity, presence of congenital anomaly and stigmata of chromosomal disorder. The rectal temperature (°C), heart and respiratory rates of each baby were recorded. The presence of any abnormal sign was noted. Primitive reflexes were elicited and their status recorded.

The gestational ages (GA) in weeks were determined by using the mothers' dates and Dubowitz gestational assessment chart which has previously been found to be reliable in Nigerian neonates.<sup>12,13</sup> Where there was a discrepancy of more than 2 weeks, 'Dubowitz' score was used. The anthropometric assessment of the babies was carried out within the 24 hours of life using standard methods.<sup>9,14</sup> Babies were classified into small for gestational age, (SGA), appropriate for gestational age (AGA), and large for gestational age (LGA) using the international standards of Brenner et al.<sup>15</sup>

**Assessment of nutritional status:** All the babies were assessed and scored by the same researcher within the 24-hour time limit for the study. The nutritional status of each baby was assessed using a simple, rapid and quantifiable method, the Clinical Assessment of Foetal Nutritional Status (CANS) and the score (CANSORE) adapted by Metcalf.<sup>1,2</sup> CANSORE consists of nine 'superficial' readily detectable signs of foetal malnutrition. This was based on inspection and hands-on estimates of loss of subcutaneous tissue and muscles. Hair, cheeks, neck and chin, arms, back, buttock, legs, chest and abdomen were examined and then scored. The range of score for each varied between 1 and 4. A maximum score of 4 was awarded to each parameter with no evidence of malnutrition and lowest score of 1 was awarded to parameter with the worst evidence of malnutrition. The total rating of the nine CANS sign is the CANSORE for the subject. The CANSORE ranges between 9 (lowest) and 36 (highest). Babies with CANSORE below 25 were diagnosed as having FM. Babies with CANSORE of 25 and above were regarded as normal.

Blood samples were taken from each neonate at the first assessment for plasma glucose, protein and venous haematocrit estimation. Babies who had no sign of FM were used as controls. Neonates who had problems like asphyxia, meconium aspiration, and hypoglycaemia were admitted into neonatal unit for appropriate management.

Results for babies with FM were compared with the results obtained from controls. The results were fed into a computer using EPI Info 6 version 6.02 [1994] software, and then exported to and analyzed using SPSS for Windows version 11. Means and standard deviations were determined for continuous variables like weight and these were compared between controls and neonates with FM using analysis of variance and Students' t-test. Proportions and percentages were compared using chi-square ( $\chi^2$ ) test. P values, <0.05 was taken as statistically significant.

## RESULTS

### Characteristics of the Babies

A total of five hundred and forty nine babies were delivered in the hospital during the period of study (January to August 2001). Four hundred and seventy three of them met the inclusion criteria. Excluded from the study were 52 preterms, 13 babies who were products of multiple births, 2 babies with obvious congenital abnormalities and 9 babies with inadequate data.

There were 246 (52.0%) males and 227 (48.0%) females giving a male: female ratio of 1.08:1. Gender distribution was similar in all the gestational age groups ( $p = 0.49$ ). The mean gestational age for males was similar to that of females ( $39.11 \pm 1.35$  weeks versus  $39.01 \pm 1.39$  weeks,  $t = 0.8$ ,  $df = 1$ ,  $p = 0.71$ ).

The mean weight for the males was  $3.173 \pm 0.523$  Kg while that of the females was  $2.977 \pm 0.461$  Kg. The overall mean weight for the males was significantly higher than that of the females ( $p = 0.00001$ ). The mean length for males and females were  $49.365 \pm 2.369$  cm and  $48.740 \pm 2.254$  cm respectively. The overall mean length for boys was therefore significantly higher than that of the girls ( $t = 2.9$ ,  $p = 0.003$ ). There was a fairly progressive increase in weight and length

with advancing gestational age for both genders.

Table 1 shows the distribution of the babies by SGA, AGA and LGA in relation to gestational age. The overall frequency of SGA was 12.1% while that of LGA was 4.2%. There was a fairly progressive increase in the proportion of SGA babies with increasing GA. This was matched by a corresponding decrease in AGA babies.

### Babies with Foetal Malnutrition

Eighty-nine (18.8%) of the 473 babies fulfilled the criteria for the diagnosis of

FM. The 89 consisted of 43 (17.5%) males and 46 (20.3%) females giving a male: female ratio of 1:1.09 among babies with FM. This was similar to the overall male/female ratio of 1.08:1 ( $p = 0.75$ ).

Of the 89 babies with FM, 47 (52.8%) were also SGA while 42 (47.2%) were AGA and 5 were LGA. There was no baby with FM among the LGA babies. This is compared with 384 babies without FM (made up of 10 SGA, 354 AGA and 20 LGA). The difference in the percentages of babies with or without FM was not significant ( $\chi^2 = 173.23.0$ ,  $p = 0.00001$ ).

**Table 1: Distribution of the Babies by Brenner's Standards of Intrauterine Growth and Gestational Age.**

Gestational age (weeks)	Number (%) by Brenner's standards			Total
	*SGA	*AGA	*LGA	
37	5(9.4)	47(88.7)	1(1.9)	53(11.2)
38	14(10.4)	116(85.9)	5(3.7)	135(28.5)
39	11(9.2)	99(83.2)	9(7.6)	119(25.2)
40	15(16.3)	74(80.4)	3(3.3)	92(19.4)
41	6(14.0)	36(83.7)	1(2.3)	43(9.1)
42	6(19.4)	24(77.4)	1(3.2)	31(6.6)
Total	57(12.1)	396(83.7)	20(4.2)	473(100.0)

$\chi^2 = 9.3$ ,  $df = 10$ ,  $p = 0.504$  SGA = Small for gestational age; AGA = Appropriate for gestational age; LGA = Large for gestational age.

**Table 2: Comparison of the Perinatal Problems in the Babies with or without Foetal Malnutrition (FM) admitted into the Neonatal Ward.**

Feature	Number (%)			$\chi^2$	p value
	Babies with FM	Babies without FM	Total		
Admissions	39(43.8)	71(18.5)	110(23.3)	26.0	0.0000
Meconium staining	15(16.9)	23(6.0)	38(8.0)	11.5	0.001
Grade of asphyxia					
Severe	20(22.5)	29(7.6)	49(10.4)	17.3	0.0000
Moderate	11(12.4)	25(6.5)	36(7.6)	3.5	0.061
Respiratory distress	18(20.2)	20(5.2)	38(8.0)	17.7	0.0000
Seizures	5(5.6)	5(1.3)	13(2.7)	3.7	0.054†
Hypoglycaemia	13(9.0)	10(2.6)	23(4.9)	17.2	0.0000
Anaemia (PCV <36%)	4(4.5)	18(4.7)	22(4.7)	0.0	1.000†
Polycythaemia (PCV >65%)	7(7.9)	4(1.0)	11(2.3)	9.9	0.002†
Neonatal sepsis (suspected)	21(23.6)	35(9.1)	56(11.8)	14.5	0.0000
Neonatal sepsis (confirmed)	3(3.4)	16(4.2)	19(4.0)	0.0	1.000†
HDN	1(1.1)	3(0.8)	4(0.8)	0.0	1.000†
Ophthalmia neonatorum	2(2.2)	6(1.6)	8(1.7)	0.0	1.000†
Neonatal jaundice	15(16.9)	31(8.1)	46(9.7)	6.3	0.012
Total*	89	384	473		

\*Multiple diagnoses were made in some of the babies. †Yates Correction applied. FM = Foetal malnutrition; PCV = Packed cell volume; HDN, haemolytic disease of the newborn Hypoglycaemia = Plasma glucose level less than 40mg/dl (2.21 mmol/l).

### Associated Neonatal Problems

Table 2 shows the perinatal problems among the babies with and without foetal malnutrition. A total of 110 (23.3%) of the 473 babies had problems and were admitted into the neonatal ward for management. The 110 babies consisted of 39 (43.8%) of the 89 babies with FM and 71 (18.4%) of the 384 controls ( $\chi^2 = 26.0, p = 0.00001$ ). The problems found to be associated with FM at the statistically significant levels shown in Table 2 are meconium staining, severe birth asphyxia (Apgar score = 3 at 1 minute), respiratory distress, polycythaemia (venous PCV > 65%), hypoglycaemia (plasma glucose = 2.21 mmol/l) and neonatal jaundice. Other problems like moderate birth asphyxia (Apgar score 4 or 5 at 1 minute), neonatal seizures, neonatal septicaemia, haemorrhagic disease of newborn and ophthalmia neonatorum were not associated up to statistically significant levels with FM.

Table 3 shows the laboratory findings among babies with and without FM. Babies with FM were found to have significantly higher haematocrit and lower plasma albumin than babies without FM ( $p = 0.002$  and  $p = 0.000$  respectively).

control group was severe birth asphyxia associated *Staphylococcus aureus* septicaemia.

### DISCUSSION

The overall prevalence rate of foetal malnutrition of 18.8% in the present study is higher than 10.9% recorded by Metcoff<sup>1</sup> in America but similar to 19.0% obtained in a 1998 Indian study<sup>2</sup> which also used the CANSORE method. The differences between the American and other studies referred to may be partly due to differences in the nutritional status in the communities of study. Thus, 12.1% of our subjects compared with 9.5% of the American<sup>1</sup> were small for gestational age (SGA). Our 12.1% prevalence for SGA as well as a similar rate of 12.8% in another Nigerian study<sup>16</sup> would seem to lend support to the general belief that SGA prevalence rates are higher in developing than in the industrialized countries.<sup>14-18</sup>

The higher prevalence rate of FM in Nigeria compared with the rate in a developed country like America may likely be due to higher Nigerian rates of factors causing or associated with FM such as hypertension, diabetes mellitus, renal, cardiac diseases and malaria. The poorer

SGA in one community may fall within appropriate gestational age weight range in another community. The advantages of using the CANSORE to identify foetal malnutrition include the fact that it cuts across levels of development and is neither tied to a percentage of total births nor to the use of local or international standards.

Foetal malnutrition was found to be far commoner among SGA than AGA babies. This is to be expected since both of them are related to gaining, maintaining and or losing fat and muscle mass. However, it is of interest that 10.6% of AGA babies had features of FM. These babies would have been missed if identification of FM was limited to babies whose birthweights were below the 10<sup>th</sup> percentile on the intrauterine growth chart. Similarly, 17.5% of SGA did not meet the criteria of FM but would have been wrongly classified as malnourished if CANSORE had not been used.

We see then that CANSORE was able to diagnose FM more precisely, through on the spot clinical examination than using intrauterine growth charts and curves as suggested by other authors.<sup>1-5,7</sup> Using intrauterine growth standards, many of the 42 (47.2%) out of the 89 babies with foetal malnutrition babies who had complications associated with FM like hypoglycaemia would have been missed. Since the procedure of CANSORE is simple, systematic, scientific and objective, it will be very useful as routine screening of babies for anticipatory care.

Our finding of a statistically insignificant greater number of females than males with FM is consistent with that of Scott and Usher.<sup>6</sup> In fact, the male babies in our study were also significantly heavier and longer than the females. This may be due to the non-defined influence of the Y-chromosome.<sup>21</sup>

Multiple perinatal problems in the babies were significantly associated with FM in the present study. The main indications for admission into the neonatal unit among the babies were birth asphyxia, presumed sepsis, neonatal jaundice and respiratory distress and FM was significantly associated with severe birth asphyxia, meconium stained liquor, respiratory distress, seizures, hypo-

**Table 3: Comparison of Laboratory Results of Babies with and without Foetal Malnutrition**

Variable*	Mean (SD)		p value
	Babies with FM	Babies without FM	
Packed cell volume	54.88(8.12)	52.45(6.07)	0.002
Plasma glucose (mmol/l)	3.35(1.24)	3.54(0.79)	0.071
Plasma total proteins (g/l)	65.77(7.37)	66.58(8.02)	0.38
Plasma albumin(g/l)	36.24(4.90)	38.16(4.57)	0.000
Plasma globulin(g/l)	29.32(5.53)	28.46(6.51)	0.25

Figures in bracket are one standard deviation of the mean. \*Mean age of assessment was  $5.33 \pm 3.99$  hours. FM = Foetal malnutrition

### Mortality

A total of four babies died. These consisted of three babies with FM and one control. However the numbers were too small for a meaningful statistical analysis. The causes of death in the three babies with FM were severe respiratory distress associated with severe birth asphyxia and meconium aspiration while the cause of the only death among

quality of antenatal care available in Nigeria may also be contributory. Although, intrauterine growth standards for a given population can identify babies whose birthweights fall below 10<sup>th</sup> percentile for that community, they are not sufficiently sensitive to identify all infants with FM. The very use of local growth standards to identify SGA babies means that the weight of a baby identified to be

glycaemia, polycythaemia and suspected neonatal sepsis. It is suggested that babies with these problems be screened for FM. Previous studies have documented high prevalence of perinatal asphyxia among the FM babies.<sup>1,7</sup> It is also known that SGA babies are more prone to asphyxia and acidosis and FM is common among SGA babies. Generally, perinatal deaths in babies with FM whether or not they are growth retarded are associated with foetal distress, meconium aspiration, asphyxia, postpartum hypoglycaemia and hyper-viscosity syndrome.<sup>1,7</sup> Scott and Ushers<sup>6</sup> have previously recorded a higher prevalence rate of birth asphyxia among the babies with FM and observed that growth retardation without wasting (FM) was not associated with an increase in prevalence of peripartum asphyxia.<sup>1,6</sup>

Of the 473 babies, 110 (23.3%) required admission to the neonatal unit. This is a high admission rate for babies born at term. A possible reason for this is that the babies were born to high-risk population of pregnant women who are likely to be confined in a tertiary referral centre like ours. The significantly higher admission rate of 43.8% among the babies with FM compared with 18.4% among controls shows increase predisposition to morbidity from various causes. We also note that 3 of the 4 babies who died had FM. This is not surprising considering the neonatal problems associated with FM. However, larger studies will be necessary to assess the contribution of FM to neonatal mortality.

The results of the present study suggest that FM may be a major health problem in Nigeria and similar developing countries and that the morbidity and mortality associated with it could be enormous. Foetal malnutrition should be diagnosed at birth by routine use of CANSCORE and affected babies

managed to prevent and/or treat possible perinatal problems. Of course the ultimate aim must go beyond the rhetorics of identifying FM in babies and selecting them for anticipatory care and be directed on finding the causes with a view to preventing them and promoting safe motherhood.

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