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The Influence Of Maternal Socio-Economic And Nutritional Status On Foetal Malnutrition In Nigeria.

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Abstract

Objective: To determine the role of maternal socio-economic and nutritional status in the aetiology of foetal malnutrition in Nigeria.

Patients and Methods: This was a prospective study of the records of consecutive mothers who delivered singleton, term, live babies between January and August 2001 at the Wesley Guild Hospital, Ilesa, Nigeria. The socio-economic classes of the parents were determined; also the nutritional status of the mothers was determined using the body mass index (BMI). Foetal malnutrition/wasting was diagnosed using Clinical Assessment of Foetal Nutritional Status (CANS) and the score (CANSCORE) as adapted by Metcoff. 1 Babies were classified into those with foetal malnutrition (FM) and those without FM. The two groups were compared.

Results: Of the 473 studied, 89 [18.8%] had FM. The BMI of the mothers ranged between 16.47 and 44.15 kg/m^2. Twenty-five (5.4%) of the 473 mothers had low BMI (< 18.5 kg/m^2). The prevalence of low BMI (< 18.5 kg/m^2) was significantly higher among mothers whose infants had FM than in controls (72% versus 28%, $\chi^2 = 49.3$ p = 0.0000). Significantly higher proportions of babies with foetal malnutrition were delivered by mothers of lower social groups (class IV and V) $\chi^2 = 7.6$ p = 0.002. Thus, significantly greater numbers of babies with foetal malnutrition were delivered by mothers of the lower social group occupations for example petty trading (χ^2 =5.2, p< 0.02), subsistence farming (χ^2 = 7.0, p<0.01), messengers and similar unskilled labour jobs (χ^2 =5.2, p<0.02) compared with the higher social group occupation mothers.

Conclusion: Improvement in the socio-economic and nutritional status of mothers is likely to reduce the prevalence of FM in Nigeria.

INTRODUCTION

Clinical evidence of wasting in a newborn, known as foetal malnutrition (FM) indicates failure to acquire the normal quantum of or loss of fat and muscle mass during intrauterine growth. [1] Perinatal problems and/or central nervous system sequelae are known to occur in babies with FM whether they are appropriate for gestational age (AGA) or small for gestational age (SGA). [1] Adverse conditions like poverty, undernutrition, infections and infestations may promote unsatisfactory pregnancy outcome. [2,3]

Contributions of environmental factors to the aetiology of foetal malnutrition are varied and difficult to quantify but no doubt are influential on foetal growth. Previous reports have shown evidence of direct relationship between maternal physical work and birth outcome. [4,5] In relation to gestational age, pregnancy is divided into three trimesters of about 13 weeks with each trimester having a distinct pattern of growth. [1] The last trimester is characterized by rapid foetal growth. The most rapid period of normal foetal growth is in between 12 and 36 weeks gestation. Between 32 and 36 weeks, the rate of foetal weight gain reaches its peak at 200 to 225 grams per week and declines thereafter. [1] The aim of the present study was to examine the role of maternal socio-economic class and nutrition in the development of foetal malnutrition in Nigeria. The study was conducted at the maternity and neonatal units of the Wesley Guild Hospital (WGH), Ilesa, Southwestern Nigeria. This is the main referral health institution providing general and specialist Paediatrics and maternity services to the semi-urban Ijesa community of Osun State in Southwestern Nigeria.

METHODS

Maternal data including name, age, hospital number, date of last menstrual period (LMP), parity, place of antenatal care (ANC), number of clinic attendances, total duration of pregnancy, duration of pregnancy at booking, maternal height, booking weight and the last weight before delivery were obtained and entered into a research proforma designed for the study.. Nutritional status of the mother was determined by calculating the body mass index (BMI). [6] The socio-economic classes of the parents were derived from the occupation and the educational levels attained by both parents as described by Oyedeji. [7]

Each baby was weighed nude and gestational age assessed using Dubowitz score. [8] The diagnosis of foetal malnutrition was made using a simple, rapid and quantifiable method called Clinical Assessment of Foetal Nutritional Status (CANS) and the score (CANSCORE) adapted by Metcoff. [1] CANSCORE consists of nine ‘superficial' readily detectable signs of fetal malnutrition. This was based on inspection and hands–on estimates of loss of subcutaneous tissue and muscles. Hairs, Cheeks, Neck and Chin, Arms, Back, Buttock, Legs, Chest and abdomen were examined thus and then scored. The range of score for each varied between 1 and 4. 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 CANSCORE for the subject. The CANSCORE ranges between 9 (lowest) and 36 (highest). Babies with CANSCORE below 25 were diagnosed as having FM. Babies with CANSCORE of 25 and above were regarded as normal. Mothers of babies who had no sign of FM were used as controls and the findings in cases and controls were compared.

RESULTS

BABIES, SEXES, PLACES OF ANTENATAL CARE AND DELIVERY

Four hundred and seventy three [473] term, singleton, live babies were studied. 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 ± 1.35 weeks versus 39.01± 1.39 weeks, t = 0.8, df = 1, p = 0.71). The distribution of mean weight and mean length of males and females in relation to gestational age is shown in Table I. The overall mean weight for the males was significantly higher than that of the females (p = 0.00001). Eighty-nine [18.8%] of the 473 babies studied fulfilled the criteria for the diagnosis of FM.

The distribution of foetal malnutrition in relation to gestational age and sex is shown in Table II. Forty-three (17.5%) males and 46 [20.3%] females had features of FM, giving a male: female ratio of 1:1.09 among babies with FM. This was not a significant departure from the overall male/female ratio of 1.08:1 (p = 0.75).

Figure 1

Table 1: Mean weight and length of 473 babies in relation to gestational age.

	Males			Females		
GA (weeks)	N	Mean Weight ± SD (kg)	Mean Length ± SD (cm)	N	Mean Weight ± SD (kg)	Mean Length ± SD (cm)
37	21	2.947±0.429	48.761±1.974	32	2.800±0.435	48.525±1.974
38	74	3.045±0.466	49.195±1.660	61	2.9205±0.435	48.532±2.686
39	64	3.275±0.527	49.620±2.064	55	3.035±0.496	48.632±1.964
40	48	3.234±0.583	49.527±2.091	44	3.015±0.428	48.727±2.111
41	21	3.262±0.548	49.761±2.552	22	3.065±0.470	49.495±2.519
42	18	3.336±0.499	49.000±1.255	13	3.176±0.461	49.461±1.761
TOTAL	246	3.173±0.523	49.365±2.368	227	2.976±0.461	48.740±2.253

For weight: t = 4.3, *p* = 0.00001 when males are compared with females
For length: t = 2.9, *p* = 0.003 when males are compared with females
GA = Gestational age; N = Number of subjects
SD = Standard deviation

Figure 2

Table 2: Distribution of foetal malnutrition in relation to gestational age and sex.

	Males		Females	
Gestational age[weeks]	Total N_1	Babies with FM n (% of N_1)*	Total N_2	Babies without FM n (% of N_2)*
37	21	5 [23.8]	32	8 [25.0]
38	74	14 [18.2]	61	13 [21.3]
39	64	8 [12.5]	55	12 [21.8]
40	48	7 [14.6]	44	8 [18.2]
41	21	5 [23.8]	22	3 [13.6]
42	18	4 [22.2]	13	2 [15.4]
TOTAL	246	43 [17.5]	227	46 [20.3]

χ^2 =2.7, df =5 *p* = 0.75; N_1 and N_2 = Total number of boys and girls in the gestational age
*Figures in the parenthesis are percentages of total in each row.
FM = Foetal Malnutrition.

Among the 473 mothers, 394 had antenatal care in various health units. These were in the Wesley Guild Hospital (321), maternity centres (32), primary health centres (25), other government hospitals (6), and private clinics (10). Twenty-two (27.8%) of the 79 mothers who did not have antenatal care had babies with FM compared with 67 (17.0%) of 394 babies of mothers who received antenatal care (χ^2 p< 0.025).

SOCIAL CLASSES OF MOTHERS

There were 34 mothers in social class I and 95 in class II whilst 123 were in class III; one hundred and forty five in class V and 76 in class V. Fifty (22.6%) of the babies of the 221 mothers in lower social classes IV and V had FM compared with 39 (15.5%) of the babies of the 252 mothers in social class I, II and III (χ^2 p= 0.047). Thus, 50 (56.2%) of the entire 89 babies with FM were delivered by 221 mothers in lower social classes IV and V and the remaining 39 by the 252 mothers in the higher social classes I to III. There was no baby with FM in social class I.

MATERNAL NUTRITIONAL STATUS

Table III shows the comparison of maternal Body mass index (BMI) in relation to whether the babies had or did not have FM. The BMI of the mothers varied between 16.47 and 44.15 kg/m^2 Significantly higher proportion of mothers of babies with FM than of controls had BMI <18.5 kg/m^2 (χ^2 = 49.3 p<0.0001). Also, lower proportion of mothers with BMI in the overweight range (BMI greater than 25 kg/m^2) had babies with FM (χ^2 =19.4, p<0.0005).

Figure 3

Table 3: Comparison of maternal Body mass index (BMI) in relation to whether the babies had or did not have FM.

BMI kg/m² Class*	Mothers of Babies with FM n (%)#	Mothers of Babies without FM n (%)#	Total n (%)#	p value
<18.5	18(20.7)	7(1.9)	25(5.4)	<0.0001
18.5-24.9	34(39.1)	157(41.5)	191(41.1)	NS
25.0-29.9	23(26.4)	143(37.8)	166(35.7)	<0.0005
>30.0	12(13.8)	71(18.8)	83(17.8)	NS
Total	87(100.0)	378(100.0)	465(100.0)	

Key: # Figures in parenthesis are percentages of total in the column
NS - (p >0.05), not statistically significant
* World Health Organization consultation on obesity. Classification according to Body Mass
Index [BMI]. Geneva; 1997: 6.

EDUCATION OF MOTHERS

Table IV shows the distribution of the babies in relation to the educational levels attained by their mothers. The prevalence of FM increased with decreasing educational levels among the mothers of babies with FM .Thus, 20(22.5%) of babies with FM belong to the mothers without formal education.

Figure 4

Table 4: The distribution of babies with or without FM in relation to education of the mothers.

Levels Attained by Mothers	Babies with FM n (%)#	Babies without FM n(%)#	Total N (%)*
University Bachelor's, Master's and Doctorate degrees	2 (6.3)	30(93.7)	32(6.8)
Ordinary or advanced level school certificate plus polytechnic, teaching, nursing or other professional qualifications	13(13.3)	85(86.7)	98(20.7)
Ordinary level secondary school and Grade 2 teacher's certificate	15(16.9)	74(83.1)	89(18.8)
Primary six plus uncompleted secondary school education	16(16.8)	79(83.2)	95(20.1)
Primary six	23(21.1)	86(78.9)	109(23.0)
Below primary six or no formal education	20(40.0)	30(60.0)	50(10.6)
Total	89(18.8)	384(81.2)	473(100.0)

Key: df = 5, χ^2 = 20.8, p = 0.001.
Figures in parenthesis are percentages of total in the row
* Figures in parenthesis are percentages of total in the column
FM = Fetal malnutrition

OCCUPATIONS OF MOTHERS

Table V shows the occupation of the mothers and the prevalence of FM. The main occupations were teaching, trading, public services, farming, tailoring and hairdressing. The occupations which were significantly associated with the development of FM were the lower social classes ones like petty trading (χ^2 =5.2, p< 0.02), farming (χ^2 =7.0, p<0.01) and being messengers (house-maids, cleaners, messengers in private small- scale establishments), (χ^2 =5.2, p<0.02). Mothers who engaged in large scale businesses and the professionals had significantly lower proportions of babies with FM.

Figure 5

Table 5: The distribution of babies with or without FM in relation to occupation of the mothers

Maternal Occupation	Babies with FM n (%)#	Babies without FM n(%)#	Total N (%)*	p value
Petty traders	19(29.7)	45(70.3)	64(13.5)	p<0.02
Artisans	14(14.1)	85(85.9)	99(20.9)	NS
Farmers	13(35.1)	24(64.9)	37(7.8)	p<0.01
Teachers	15(16.7)	75(83.3)	90(19.0)	NS
Students	7(31.8)	15(68.2)	22(4.7)	NS
Unemployed	7(26.9)	19(73.1)	26(5.5)	NS
Intermediate grade public servants	7(14.3)	42(85.7)	49(10.4)	NS
Messengers	4(50.0)	4(50.0)	8(1.7)	p<0.02*
Large scale traders and business women	3(7.1)	39(92.9)	42(8.9)	p<0.05
Senior grade public servants, professionals	0(0.0)	36(100.0)	36(7.6)	p<0.005
Total	89(18.8)	384(81.2)	473(100)	

df =9, χ^2= 34.48, p=0.000
Key: # Figures in parenthesis are percentages of total in the row
* Figures in parenthesis are percentages of total in the column
FM = Fetal malnutrition
Yates' correlation applied

DISCUSSION

The overall prevalence of fetal malnutrition (FM) in the present study was 18.8%. This is higher than 10.9% observed by Metcoff [1] (1994) in America but similar to the 19.6% in an Indian study [9] which used the CANSCORE method also used in the present study. The differences in the prevalence rates of FM in these communities may be due to differences in the nutritional status in communities of study.

Foetal malnutrition (FM), results from intrauterine difficulties in the baby and may lead to high risk delivery and perinatal problems. [1,9,10,11] It is known to affect body composition and impair brain development and behaviour in experimental animals. Cohort studies years after birth have revealed that babies with FM have significantly lower intelligence quotient (IQ) scores and performance than well-nourished infants. [11,12] Foetal malnutrition has also been found to be a predisposing factor to the development of handicaps, including spastic diplegia, seizures, visual problems, learning disabilities or mental retardation at a later years. [12,13]

Mothers who engaged in low social group occupations viz: farming, messenger work and petty trading had significantly higher proportion of babies with FM. Often two or more adverse factors associated with lower social class may coexist. For example, the role of low socioeconomic status is intertwined with those of ignorance, the use of crude and energy sapping methods of farming, low nutritional status, inadequate rest and prolonged standing.

Maternal Body mass index of less than 18.5 kg/m ^{2} was associated with FM in the present study ($p<0.0001$). Low maternal BMI is caused by chronically low energy intake due to inadequate food supply at the household level. [10] Previous reports about foetal malnutrition have suggested multiple factors responsible for its aetiology. [9,11] Thus, direct relationship has been demonstrated between physical work and birth outcome. [4,14] Manual workers and mothers working standing most of the time have a higher chance of delivering SGA babies. [4] On the average, a baby born at 28 weeks gestation weighs about 1000 grams. Between 28 weeks and 40 weeks [the third trimester], the baby triples its weight. This is evidence that considerable body growth takes place during this period. [1] This however is the period when most mothers becomes busier at work after the body has adjusted to the initial symptoms of hormonal changes in pregnancy.

The effect of prolonged standing on the baby has been hypothesized to be a result of diversion of blood from the feto-placental unit to the active muscles during strenuous movement/activity or reduction in venous return and blood volume during standing. [4,5] Prolonged and strenuous work may also affect the nutritional intake of the mothers because many may be too busy to have adequate rest and nutrition. This may partly explain why FM was generally found to be significantly commoner among the mothers in low social class ($p<0.05$) in the present study.

There is agreement among workers that maternal undernutrition is one of the causative factors of FM. [10,15] Improving maternal nutritional status in situations of poverty and starvation will therefore improve foetal outcome and reduce the prevalence of FM. [10] We note that, dietary supplementation during pregnancy has been shown to be highly effective in improving pregnancy outcomes and reducing perinatal mortality. [15] Also, it has been shown that some mothers who smoked during pregnancy but received nutritional supplementation from mid-pregnancy period had babies who were significantly heavier than babies of smokers who were not supplemented. [4] Improvement in values of BMI has been used as an index to monitor improvement in the nutritional status of pregnant mothers undergoing such dietary supplementation. [16] Aaron et al [17] similarly reported good pregnancy outcome when food supplementation during pregnancy was carried out in the rural villages of Guatemala. Chronic infusions of glucose and / or amino acids given to pregnant women to augment impaired foetal growth or nutrients added to the amniotic fluid have been shown to have apparent improvement of foetal growth. [1,16] It is therefore believed that food supplementation (as a foetal survival strategy), may be of immense benefit to the foetuses at risk of FM. [18,19] For better results, appropriate actions to improve maternal nutrition should be commenced early by improving the nutrition of the female child and adolescent. [21] Nonetheless, FM may be encountered among some high social class mothers in executive positions who work to the last days to their time of delivery, it is much commoner among babies of the low social class and illiterate mothers.

In order to reduce the prevalence of FM in African societies, the improvement of the socio-economic and nutritional status of women, female education, improved agricultural practices and assistance to pregnant mothers should receive much better attention than at present.

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References

1. Metcoff J. Clinical assessment of nutritional status at birth. Fetal malnutrition and SGA are not synonymous. Pediatr Clin North Am 1994; 41: 875 - 91
2. Ebrahim GJ. Perinatal Priorities in Developing Countries. In: Paediatrics Practice in Developing Countries. London, Macmillian Press 1987; 194-202.
3. Dawodu A. Neonatology in developing countries: Problems, practices and prospects.Ann Trop Paediatr 1998; 78: 573 - 79.
4. Tafari N, Naeye RL and Gobezie A. Effects of maternal undernutrition and heavy physical work during pregnancy on birth weight. Br J Obstet Gynaecol 1980; 87: 222-26.
5. Lenore JL, Jose V, Edgar K and Mercedes-de O. The effect of maternal work on fetal growth and duration of pregnancy: a prospective study. Br J Obstet Gynaecol; 1990; 97: 62 -70.
6. World Health Organization consultation on obesity.

Classification according to Body Mass Index [BMI]. Geneva; 1997: 6.
7. Oyedeji GA. Socio-economic and cultural background of hospitalized children in Ilesa. Nig J Paediatr 1985; 12: 111-117.
8. Dubowitz LMS, Dubowitz V and Goldberg C. Clinical Assessment of gestational age in the newborn infant. J Pediatr 1970; 77: 1-10.
9. Jayant D and Rajkumar J. Study of the prevalence and high risk factors for fetal malnutrition in term newborns. Ann Trop Paediatr 1999; 19: 273 - 77
10. World Health Organization. The Newborn infant. In: World Health Organization Physical Status: The use and interpretation of Anthropometry. Report of a WHO Expert Committee. WHO Technical Report Services 1995; 854: 121-158.
11. Scott KK and Usher RH. Epiphyseal development in fetal malnutrition syndrome. N Engl J Med 1964; 270: 822-24
12. Hill RM, Verniaud WM, Deter RL, Tennyson LM, Rettig GM, Zion TE et al. The effects of intrauterine malnutrition on the term infants. A 14-year progressive study. Acta Paediatr Scand 1984; 73: 482-487.
13. Wynn M and Wynn A. The importance of nutrition around the time of the fetus at different stages of gestation. In: Bateman EC (ed). Applied Nutrition. London, Libby, 1981: 12-19.
14. Oni GA. The effects of maternal age, education and parity on birth weight in a Nigerian community: The comparison of results from bivariate and multivariate analyses. J Trop Pediatr 1986; 32: 295-300.
15. Sana Mc, Andrew MP, Timothy JC, et al. Effects on birth weight and perinatal mortality of maternal dietary supplements in rural Gambia: 5 year randomised controlled trial. BMJ 1997; 315: 786-790.
16. Harding JE and Charlton V. Treatment of the growth - retarded fetus by augmentation of the substrate supply. Semin Perinatol 1989; 13: 211-223.
17. Aaron L, Jean-Pierre, Herman D, Robert EK, Charles Y and Reynaldo M. Effects of food supplementation during pregnancy on birthweight. Pediatrics 1975; 56: 508-19.
18. Apte SV and Iyengar L. Composition of the human fetus. Br J Nutr 1972; 27:305-312.
19. Scott KK and Usher RH. Fetal malnutrition: Its incidence, causes and effects. Am J Obstet Gynaecol 1966;94: 951-63
20. World Health Organization. Pregnant and Lactating Women. In: World Health Organization Physical Status: The use and interpretation of Anthropometry. Report of a WHO Expert Committee. WHO Technical Report Services 1995; 854: 37-120.

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