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Maternal Risk Factors Associated with Low Birth Weight Neonates: A Multi-Centre, Cross-Sectional Study in a Developing Country

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Abstract

Background: Low birth weight (LBW) deliveries contribute to high neonatal mortality rates (NMR) in developing countries. Several maternal risk factors are associated with LBW newborns. Appropriate interventions will help to reduce the incidence of LBW deliveries in these countries and improve neonatal survival outcomes. This study aims to identify maternal risk factors associated with LBW in Enugu, South-east Nigeria.

Subjects and Methods: A multi-centre, cross-sectional study of 506 consecutive live newborns delivered between September 1st and December 31st 2011 was conducted in a south-east Nigerian city. Maternal data included last menstrual period, history of illnesses such as hypertensive disorders and anaemia during pregnancy, delivery date and time. The weights of the newborns were measured at birth. Data were analyzed with the Statistical Package for Social Sciences (SPSS) version 18.0. The relative risk of having a LBW newborn with maternal factors was calculated.

Results: There were a total of 72 LBW newborns, giving an incidence rate of 14.2%. Eighteen (25%) of the mothers with LBW deliveries had malaria in pregnancy while 4 (5.6%) tested positive for human immuno-deficiency virus (HIV). The relative risk of having a LBW newborn was high in maternal HIV (RR=3.25, C.I=1.51-6.97), hypertension in pregnancy (RR=3.07, C.I=1.52-6.22), ante partum hemorrhage (APH) (RR=7.20, C.I=5.79-8.95), as well as primiparity (RR=1.35, C.I=0.88-2.08).

Conclusion: Common maternal risk factors for LBW babies in Enugu, south-east Nigeria include APH, HIV, hypertension in pregnancy, and primiparity.

Keywords: Maternal risk factors; Low birth weight newborns; Nigeria

Introduction

Low birth weight (LBW) has been defined by the World Health Organization (WHO) as weight at birth of less than 2500 g irrespective of gestational age [1]. This practical cut-off for international comparison is based on epidemiological observations that infants weighing less than 2500 g are approximately 20 times more likely to die than their heavier counterparts [2]. LBW is either caused by preterm birth (birth before 37 completed weeks of gestation) or intrauterine growth restriction (IUGR) [2]. In the developed countries, the predominant cause of LBW is preterm birth whereas in most developing countries it is IUGR [3]. LBW increases the morbidity and mortality in newborns [3,4], and has largely contributed to the high neonatal mortality rates (NMR) in these countries.

The incidence of LBW in developing countries ranges from 5 to 33% with an average of 16.5% which is more than double the rate of 7% noted in developed regions [5]. For instance, the average incidence rate of LBW in Nigeria is 12% [6], but the actual incidence of LBW in developing countries may be difficult to determine because many deliveries occur in rural areas where health care is inaccessible and the newborns are not routinely weighed [7].

Several studies in developing countries have reported the following maternal risk factors for LBW; primiparity [8,9], preterm rupture of fetal membranes [10], maternal hypertension [8,10-12], antepartum haemorrhage and anaemia in pregnancy [8-11], short inter-pregnancy interval [8,9] and maternal malnutrition [11,12]. Other factors include maternal age under 20 and above 35 years old [9,12,13], low socio-economic status [9,11], exposure to tobacco [11,14], inadequate antenatal care [8,11], as well as maternal height below 145 cm and non-pregnant weight less than 40 kg [9]. Appropriate interventions will help to reduce the incidence of LBW deliveries in these countries and improve neonatal survival outcomes.

This study therefore aims to identify the maternal risk factors associated with LBW in Enugu, South-east Nigeria.

Subjects and Methods

A cross-sectional and descriptive study was conducted at the University of Nigeria Teaching Hospital (UNTH), Enugu, Enugu State

University Teaching Hospital (ESUTH), Enugu and Mother of Christ Specialist Hospital (MCSH), Enugu. The UNTH and ESUTH are tertiary health-care facilities that serve Enugu State and surrounding States. They are equipped with requisite infrastructure for all specialties including Obstetrics and Paediatrics. The MCSH is a secondary health-care facility owned by the Roman Catholic Mission which also offers Obstetric and Paediatric care. Ethical approval was obtained from the Health Research and Ethics Committees of these selected hospitals.

The study population consisted of 506 live newborns delivered between September 1st and December 31st 2011, at the study centres, irrespective of gestational age, sex or mode of delivery. Newborns of parents who declined consent were excluded from the study.

All new-born babies who met the study criteria were recruited by consecutively within the first 24 hours of delivery. Maternal data included last menstrual period, history of illnesses such as hypertension and anemia during pregnancy, delivery date and time. The educational attainment and occupation of the parents were also obtained as well as weights of the newborns.

To ensure reliability and avoid inter-observer bias, all measurements were taken by one of the researchers (IKN) alone. All the newborns were weighed naked on a Waymaster infant spring weighing scale (Precision Engineering Co. {Reading} Ltd., England) to the nearest 50 g. It was set to zero point before use and standardized at weekly intervals using known weights. Social class was assigned to each neonate using the socioeconomic index scores designed by Oyedeji- based on parental educational attainment and occupation [15].

Data were recorded and analysed using the Statistical Package for Social Sciences (SPSS) version 18.0. Continuous variables were reported as means + standard deviation while categorical variables were reported as the number or percentage of subjects with a particular characteristic. The relative risk (RR) of having a LBW newborn with the different maternal factors was calculated. Results were presented in tables.

Results

A total of 506 live births occurred at the three centres during the study period, of which a total of 72 were LBW newborns, giving an incidence rate of 14.2%. The LBW neonates comprised 31 males and 41 females, giving a Male: Female ratio of 1: 1.3. Their weights ranged from 650 g to 2450 g with a mean of 2044.4 ± 427 g. Thirty-one (43.1%) of them were pre term, while the rest (56.9%) were term. The gestational ages of the neonates ranged from 24 to 41weeks with a mean gestational age of 36.43 ± 3.75 weeks (Table 1).

	N	Percentage	Mean GA
Pre term (< 37 weeks)	31	43.1	33.06 ± 3.21
Term (≥ 37 weeks)	41	56.9	38.98 ± 1.31
Total	72	100	36.43 ± 3.75

Table 1: Classification of the LBW babies by gestational age.

The demographic characteristics of the mothers are shown in Table 2. The mothers were aged between 20 to 42 years with a mean age of 27.47 ± 4.25 years. All the mothers received antenatal care. None of the mothers of the LBW newborns had diabetes and severe anaemia (Hb <7 g/dl). Eighteen (25%) of the mothers in the LBW category had malaria in pregnancy while 4 (5.6%) tested positive to HIV. Other associated maternal risk factors for LBW are shown in Table 3. The relative risk (at 95% confidence interval) of having a LBW neonate was high in maternal HIV (RR=3.25, C.I=1.51-6.97), hypertension in pregnancy (RR=3.07, C.I=1.52-6.22), ante partum hemorrhage (APH) (RR=7.20, C.I=5.79-8.95), as well as primiparity (RR=1.35, C.I=0.88-2.08).

Age (years)	≤ 20	21 – 25	26 – 30	31 – 35	≥ 36
Frequency (%)	1(1.4)	23 (31.9)	36 (50.0)	10(13.9)	2(2.8)
Parity	1	2	3	4	> 4
Frequency (%)	32(44.4)	24 (33.3)	10 (13.9)	6 (8.3)	0
Socioeconomic Class	Class 1	Class 2	Class 3	Class 4	Class 5
Frequency (%)	5 (6.9)	15 (20.8)	42 (58.3)	10 (13.9)	0
Mother's Occupation	Senior public servant	Intermediate grade public servant	Junior public servant	Petty trading	Unemployed
Frequency (%)	5 (6.9)	10 (13.9)	45 (62.5)	2 (2.8)	10 (13.9)

Table 2: Mothers' socio-demographic characteristics.

Discussion

The incidence of LBW in this study was 14.2% with a female preponderance. This figure is similar to the incidence of 14.6% obtained in a study in Ethiopia [16], and comparable to the average estimate of 16.5% LBW rate for many sub-Saharan African countries [16]. However, it is lower than the incidence rate reported in an Indian study (24.5%) [17]. The difference may be explained by geographical and racial variations [18]. The incidence of LBW in developing countries ranges from 5 to 33% with an average of 16.5% which was more than double the rate of 7% in developed regions [5]. Interestingly, the incidence obtained in this study is consistent with the overall incidence of 12% in Nigeria [6]. In addition, the female preponderance is tandem with the pattern observed in other studies [11,19,20]. This gender predominance is attributable to the greater lean body mass and less body fat seen in male newborns than in females, possibly due to the effects of fetal testosterone production [21].

Approximately 60% of the LBWs in the present study were term neonates; a finding which agrees with the reports that IUGR is common among LBW deliveries in developing countries [8,11,14,22]. Other authors also corroborated this observation in a multi-regional study of the aetiology of LBW in developed and developing settings [23].

The risk of having a LBW baby was found to be relatively higher among mothers that had HIV, hypertension in pregnancy and ante partum haemorrhage (APH) as well as primiparous mothers. This is consistent with the findings from studies in other African countries [23-25].

The mechanism of LBW in HIV infected mothers seems unclear. However, it has been suggested that immune complex formation in HIV infection could impair placenta transfer of substances in mother-foetal pair, which may lead to IUGR [26].

Hypertension in pregnancy may be associated with IUGR as a result of vasospasm which leads to a decrease in utero-placental perfusion. Preterm delivery can result from an attempt to save the life of the mother with severe pregnancy- induced hypertension [27].

Malaria infection in pregnancy, which has been documented as a cause of LBW delivery [28], did not show a high risk for LBW in our study. This finding may be a reflection of the intermittent preventive therapy in malaria during the antenatal period which all the mothers in our study received.

One meta-analysis of 36 studies on the effect of alcohol in pregnancy reported that heavy alcohol consumption is associated with an increase in the risk of LBW while light alcohol consumption may not affect the birth weight of the baby [29]. In the current study, the mothers that consumed alcohol during pregnancy were all occasional drinkers- defined as consuming less than two bottles per week [30]. This may explain why the risk for LBW- following alcohol consumption- was low in our study.

Maternal condition	Proportion in LBW	Proportion in other babies	RR	95% CI	
	N = 72	N = 434		Lower	Upper
Primiparity	44.40%	35.90%	1.35	0.88	2.08
Malaria	25.00%	38.00%	0.59	0.36	0.97
HIV	5.60%	1.20%	3.25	1.51	6.97
Hypertension	6.90%	1.60%	3.07	1.52	6.22
APH	2.80%	0%	7.2	5.79.	8.95
Use of herbal products in pregnancy	8.30%	9.70%	0.87	0.4	1.89
Use of alcohol in pregnancy	6.90%	15.90%	0.44	0.18	1.05

Table 3: Maternal risk factors for development of LBW compared with other babies.

Less than 10% of all the mothers used herbal products during pregnancy. The frequency is rather low; given the widespread use of herbal products in our environment [31]. Regular antenatal visits may have influenced the infrequent use of these products by these mothers. Interestingly, the use of herbal products did not suggest an appreciable risk for LBW in the present study. However only a few attempts have been made to define the risk of specific herbal medicine products and those that have been published lack statistical power to produce conclusive results [32]. The evidence available to date indicates that some herbal medicine products are associated with risks and it is advised to consider all herbal medicine products contraindicated during pregnancy [33].

The proportion of LBW newborns may reflect the health status of the communities into which they are born; making maternal malnutrition an important risk factor for LBW especially in a developing country like the area of the current study. This is because birth weight is conditioned by the health and nutritional status of the mother as suggested by Barker [34]. Human foetuses while adapting to maternal undernutrition, permanently change their physiology and metabolism, and these changes may be the origin of a number of diseases in later life, including coronary heart disease, diabetes, and hypertension [34]. This has been corroborated by researchers in other parts of the world who have demonstrated an inverse relationship between birth weight and disease in adult life [35-37]. However, the current study did not assess maternal nutritional status; making it a limitation of the study.

Conclusion

The major maternal risk factors for LBW newborns in Enugu, south-east Nigeria include APH, HIV, and hypertension in pregnancy, as well as primiparity. Early identification of pregnant women with these risk factors and institution of appropriate interventions may reduce the incidence of LBW in our environment, and may also result in the reduction of the high NMR in this clime.

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