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Full Length Research Paper

Correlation of maternal albumin and birth weight of babies in a Nigerian Teaching Hospital

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Poor nutrition is high in population residing mostly in developing countries. Maternal albumin deficiency could have influence on birth weight of babies. This study looked at the correlation of maternal albumin and birth weight of babies at the University of Maiduguri Teaching Hospital. Ninety eight mother-baby pairs were selected using systematic random sampling method. Maternal albumin was determined using the Bromocresol Green method and birth weight of baby's was assessed using the bassinet weighing scale. The relationship between maternal albumin and birth weight was investigated by correlation analysis, and analysis of variance (ANOVA) was used to test for significance of data. There were 52 (53.1 %) male and 46 (46.9 %) female babies. Most mothers 86 (87.8%) had acceptable albumin levels. Mean (SD) of birth weight of babies and maternal albumin were 3.01(0.60) and 38.92 (6.07) respectively. A positive correlation coefficient was found between maternal albumin and mean birth weight of babies, however, this was not significant (r = 0.483, p = 0.227). Maternal albumin varies directly with mean birth weight of babies; however, this relationship was not significant in this study. Further work in this regard is hereby recommended.

Key words: Maternal albumin, babies weights, mother-baby pairs, teaching hospital, Nigeria.

INTRODUCTION

Birth weight of babies correlated between half siblings of the same mother but not of the same father because of possible contribution of maternal albumin (Stephenson et al., 2002). It has been argued that the likely effects of maternal albumin deficiency on birth weight of babies depend on the stage of gestation. Lumey (1998) reported that birth weight of babies was normal in mothers who suffered from malnutrition that could lead to low levels of maternal albumin during the first trimester of pregnancy. Stephenson et al. (2002) in the United Kingdom, however, reported that poor maternal nutrition, which may give rise to low maternal albumin in late gestation, was associated with reduced birth weight in babies. There is a large body of literature showing that low birth weight (LBW) is an important determinant of infant mortality and morbidity worldwide (Eltahir et al., 2008).

While in industrialized countries the majority of LBW babies do well, thanks to the advances of modern obstetric and neonatal care (Grimmer et al., 2002); the chances for intact survival of LBW babies is much lower in African and other developing countries due to inadequate or limited medical care including proper antenatal care (Simiyu, 2005).

In Africa there are much higher percentages of women living in poverty, as such, these women have increased tendencies of having poor albumin status (Eltahir et al., 2008). These women could have an increased risk of adverse reproductive outcomes including LBW and preterm birth. The identification during pregnancy of such mothers is therefore important in order to determine the level of care and priorities for referral to centers where reasonable obstetric and neonatal care are available. The aims of this study were twofold: 1) to determine maternal albumin levels of mothers who delivered at the labor ward of University of Maiduguri Teaching Hospital (UMTH) 2) to correlate maternal albumin levels of these mothers with birth weights of their respective babies. To our knowledge, no such comprehensive study was performed before in Maiduguri, Borno State.

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MATERIALS AND METHODS

Study area

The study was carried out at the Department of Paediatrics, Obstetrics unit and Chemical pathology of the UMTH, North-Eastern Nigeria. Apart from being the largest health facility in the area, UMTH serves as a referral centre for the six North-Eastern States and neighboring countries of Chad, Cameroon and Niger Republics.

Study design

The study was a cross-sectional randomized descriptive study that was carried out on mother-baby pairs at the Paediatrics and Obstetrics units of the UMTH, between 15th July to 30th August, 2010.

Ethical considerations

The study protocol was reviewed and authorised by the Medical Research and Ethics Committee of the UMTH. The approval was on the agreement that patient anonymity must be maintained, best clinical practice be ensured, and that every finding would be treated with utmost confidentiality and for the purpose of this research only. All work was performed according to the international guidelines for human experimentation in clinical research (World Medical Association Declaration of Helsinki, 2000).

Sampling technique/study population

The minimum sample size was determined using a statistical formula that compares mean and standard deviation of maternal albumin at effect size of 0.2, alpha levels of 0.05 and power of 95% (Browner, 2001). However, 50% of the calculated minimum sample was added to maximize power. Therefore, the sample size for this study was ninety eight mother-baby pairs. A woman was eligible for participation in the study if she delivered at the labor ward of UMTH and met the following study inclusion criteria: (i) had an uncomplicated singleton birth at term that is gestational age from 37 completed to less than 42 completed weeks (based on fundal height or Naegale's rule by Basket et al., 2000) (ii) had no known underlying chronic illness and not on drugs other than the ones used for routine antenatal care (ANC). Mothers who smoke cigarette and drink alcoholic beverages or coffee were also excluded from this study. Mother-baby pairs were enrolled in this study using the systematic random sampling method where the first of every four mother-baby pairs were picked at the labour ward. Where the first mother-baby pair did not fulfil the aforementioned inclusion criteria, the immediate next mother-baby pair that qualified was selected.

On enrolment of the mother-baby pairs, study proforma were administered to the mothers to collect information on their bio-data, pregnancy history and antenatal care history. Information was also obtained on the delivery outcome which included sex and clinical state of the babies. The birth weight of babies in kilogram was determined using the bassinet weighing scale which has a sensitivity of 50 g immediately after child birth. Babies weighing < 2.5 kilograms were regarded as LBW and those weighing ≥ 2.5 kg were regarded as acceptable birth weight for this study.

Two milliliters of maternal venous blood were collected using sterile disposable five milliliters syringe under aseptic technique, and placed in sterile plain bottles. Sera were separated from maternal venous blood by centrifuging these blood samples at 5000 revolutions per minute (rpm) for five minutes. The sera were used to estimate maternal albumin in gram per litre using the Bromocresol Green method (John et al., 1976). All sera collected were pooled in a refrigerator at -20°C until the time of maternal albumin assay.

Statistical analysis

Means and standard deviations (SD) were calculated for maternal albumin and birth weight of babies. The 95% confidence intervals of the means were calculated as described by Hanley et al. (1982). Analysis of variance (ANOVA) was used to investigate the effect of mean maternal albumin on birth weights of babies. The relationship between maternal albumin and birth weight was investigated by correlation analysis. Statistical analysis was performed using statistical package for social science (SPSS) statistical software version 16, Illinois, Chicago USA. Statistical significance was defined as a p value <0.05. Tables were used for illustrations.

RESULTS

Table 1 shows sex and maternal albumin distribution of mother-baby pairs. Ninety eight mother-baby pairs were enrolled in this study. There were 52 (53.1%) male babies and the male to female ratio was 1.1:1. Most of the mothers 86 (87.8 %) had acceptable levels of albumin.

Table 2 shows baby's birth weight and maternal albumin profile of the study group. The mean birth weight of babies in this study was 3.01 ± 0.60 (95% CI, 2.89 to 3.13).

Seventy four babies (75.5%) had acceptable birth weights and their mothers were having acceptable albumin levels, only 13 (13.3 %) babies were found to

Table 1. Sex and maternal albumin profiles of the study population.

Parameters	Frequency	Percentage (%)
Sex of babies		
Male	52	53.1
Female	46	46.9
Maternal albumin (g/l)		
Acceptable (35-50)	86	87.8
Low (< 35)	12	12.2

Table 2. Mean birth weight of the babies and mean maternal albumin level.

Variable	Mean ± SD	95% CI
BBW (kg)	3.01 ± 0.60	2.89 – 3.13
Mat albumin (g/l)	38.92 ± 6.07	37.70 – 40.14

BBW= Babies birth weight, Mat= Maternal, SD = Standard deviation, CI = Confidence interval.

Table 3. Maternal albumin and birth weight profile of the babies.

Mat albumin (g/l)	Birth weights (kg)		Total
	LBW (< 2.5) n (%)	ABW (≥ 2.5) n (%)	
Acceptable (35-50)	13 (13.3)	74 (75.5)	87 (88.8)
Low (< 35)	1(1.0)	10 (10.2)	11(11.2)
Total	14 (14.3)	84 (85.7)	98 (100)

Mat= Maternal, LBW = Low birth weight, ABW = Acceptable birth weight.

Table 4. Babies mean birth weight distribution according to their maternal albumin levels.

Mat albumin (g/l)	Birth weight of babies (kg)	
	Mean ± SD	95% CI
10-20	3.10 ± 0.95	0.73 - 5.47
21-31	-	-
32-42	2.98 ± 0.60	2.84 - 3.12
43-53	3.06 ± 0.48	2.80 - 3.31
54-64	3.85 ± .07	3.21 - 4.49
p value [a]	0.227	-

p value [a] = Analysis of variance (ANOVA), Mat = Maternal, SD = Standard deviation, CI = Confidence interval.

have LBW (Table 3).

Table 4 reveals the relationship between maternal albumin and mean birth weight of babies that formed the study population. Although a positive correlation coefficient was found between maternal albumin and mean birth weight of babies, this was not significant (r = 0.483, p = 0.227).

DISCUSSION

The relationship between maternal albumin and birth weight outcome of babies is of major public health importance in developing countries like Nigeria, where malnutrition and LBW are alarmingly high (Hamidu et al., 2003; Okolo, 2009). In this study, majority of babies and

mothers had acceptable birth weight and maternal albumin respectively. The mean maternal albumin and mean birth weight of babies were also within acceptable values in current study. Similar observation was made by other investigators where they attributed normal maternal albumin levels and normal birth weight of babies to be good indicators not only of mother's health and nutritional status, but also of the outcome for survival, growth, long-term health and psychosocial development of babies (Goldenberg et al., 1998; Hack, 1998).

Recent study indicated that 13.3% of babies had LBW. This corroborated findings of Paediatric Association of Nigerian Conference (Okolo, 2009). Malnourished mothers are likely to have low albumin levels and are at greater risk of given birth to LBW babies. Low birth weight babies' face greatly increased risk of dying; in fact, LBW is the main contributor of neonatal, infant and under five mortalities mostly in Sub-Saharan Africa (Eltahir et al., 2008). Those who survive have impaired immune function and have increased risk of early onset of adulthood diseases like diabetes and heart disease later in life, as per Barker hypothesis and the fetal origin of adulthood disease (FOAD) hypothesis (Stein et al., 1996; Eriksson, 2005). They are also likely to remain malnourished and may have lower intelligent quotient and cognitive disabilities leading to school failure and learning difficulties (Goldenberg et al., 1998; Hack, 1998). There is also growing evidence that those adults born with LBW suffer an increased risk of coronary artery disease and non insulin dependent diabetes mellitus (NIDDM), high blood pressure, obstructive lung disease, high blood cholesterol and renal damage (Stein et al., 1996).

Furthermore, LBW babies are easily tilted into a state of severe malnutrition because of recurrent infections and inappropriate feeding habits. If optimum catch up growth is not achieved by at least two years of age, these children may add to the pool of cases of malnutrition. Growth faltering and developmental delay would be found in those who continue to be malnourished. The stress of hypoxia and infection while in the neonatal units deplete the already limited stores of nutrients in babies with LBW (Eltahir et al., 2008). In addition, some LBW babies may have ongoing medical problems such as chronic lung disease, which increase nutrient requirements but chewing and swallowing difficulties may decrease their nutrient intake. Mothers with low albumin could also have their babies having low serum albumin; again this is a source of concern as it may lead to reduced oncotic pressure and carrier proteins in affected babies. Such babies are at risk of developing intravascular volume contraction and metabolic impairments.

Although a positive correlation was observed between maternal albumin and birth weight of babies this, however, was not significant in the present study. This concurred finding of a study that was conducted abroad (Kramer, 1993). The most likely explanation for this could be that majority of our subjects had acceptable levels of albumin, which could have been counter-balanced by babies having acceptable birth weights. In particular, the robust findings of a strong association between maternal weight gain and fetal growth may partly reflect a non nutritional effect mediated by such factors as expanded maternal plasma volume and increased placental blood flow (Kramer, 1993). Undoubtedly, maternal weight gain from expanded maternal plasma volume and increased placental blood flow would cause increase in weight of babies. Contrastingly, Kafatos et al. (1989) in Greece found that the risk of having LBW babies in mothers with presumably adequate albumin levels may be low. This might not be unconnected to the fact that albumin is a protein and could be associated with high turnover of cells needed for tissue growth and repair in babies.

Our findings in the present study could have significant implications for both clinical practice and public health policy. On the basis of available evidence from this study, clinicians should not expect that a rise in albumin from protein diet, let alone advice to pregnant women to increase their protein intake will have a large beneficial impact on the birth weight outcome of their babies. Similarly, public health policymakers should not place undue expectations on protein supplementation programs for undernourished pregnant women. Rather policy makers should perhaps shift their focus toward potentially more fruitful avenues for improving maternal and child health.

This study has also pointed to several significant inconsistencies and gaps in the evidence that should be addressed in future studies. These include focusing attention on maternal weight gain during pregnancy and maternal prepregnancy anthropometric profile including obesity.

Conclusion

Maternal albumin was observed to be directly proportional to birth weight of babies; however, this relationship was not significant in this study. There is the need for further work in this regard.

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REFRENCES

Basket TF, Nagele F (2000). Nagele's rule: a reappraisal. BJOG, 107(11): 1433-1435.

Browner WS (2001). Estimating sample size and power. In Hulley SB, Cummings SR, Grady D, Hearst N,

Newman TB eds. Designing Clinical Research, 2nd ed. Philadelphia: Lippincott Williams & Wilkins. pp. 65-84.
Eltahir ME, Gerd S (2008). The effect of maternal anthropometric characteristics and social factors on gestational age and birth weight in Sudanese newborn infants. BMC. Pub. Health, 8: 244-251.
Eriksson JG (2005). The fetal origins hypothesis-10 years on. BMJ, 330: 1096-1097.
Goldenberg RL, Hoffman HJ, Cliver SP (1998). Neuro-developmental outcome of small-for -gestational age infants. Eur. J. Clin. Nutr., 52: 54-58.
Grimmer I, Buhrer C, Dudenhausen JW, Stroux A, Reiher H, Halle H, Obladen M (2002). Preconceptional factors associated with very low birthweight delivery in East and West Berlin: a case control study. BMC. Pub. Health, 2: 10-18.
Hack M (1998). Effects of intrauterine growth retardation on mental performance and behavior: outcomes during adolescence and adulthood. Eur. J. Clin. Nutr., 52(1): 65-71.
Hamidu JL, Salami HA, Ekanem AU, Hamman L (2003). Prevalence of protein-energy malnutrition in Maiduguri, Nigeria. Afr. J. Biomed. Res., 6: 123-27.
Hanley JA, McNeil BJ (1982). The meaning and use of the area under a receiver operating characteristic (ROC) curve. Radiology, 143: 29-36.
John M, Geraldine H, Meena S, Robert E (1976). Measurement of total protein and albumin in serum. Clin Chem., 22: 1102-1104.
Kafatos AG, Vlachonikolis IG. Codrington CA (1989). Nutrition during pregnancy: the effects of an educational intervention program in Greece. Am. J. Clin. Nutr., 50: 970-979.
Kramer MS (1993). Effects of energy and protein intakes on pregnancy outcome: an overview of the research evidenced from controlled clinical trial. Am. J. Clin. Nutr., 58: 627-635.
Lumey LH (1998). Compensatory placental growth after restricted nutrition in early pregnancy. Placenta. 19: 105–112.
Okolo A (2009). Overview of Neonatal Mortality – Global Perspectives. PANCONF. S1-S43.
Simiyu DE (2005). Neonatal septicaemia in low birth weight infants at Kenyatta National Hospital, Nairobi. East. Afr. Med. J., 82: 148-52.
Stein CE, Fall CH, Kumaran K, Osmond C, Cox V, Barker DJ (1996). Fetal growth and coronary heart disease in south India. Lancet., 348: 1269-1273.
Stephenson T, Symonds ME (2002). Maternal nutrition as a determinant of birth weight. Arch. Dis. Child. Fetal. Neonatal. Ed., 86: 4-6.
World Medical Association Declaration of Helsinki (2000). Ethical principles for medical research involving human subjects. World Medical Association. Available at http://www.wma.net/e/policy/b3.htm. Accessed June 15, 2005.