Maternal physical and laboratory profile: The effects of maternal pregnancy body mass index and maternal albumin on maternal measles antibodies of mother-neonatal pairs at birth

*Baba Usman Ahmadu, ** Farouk Garba, ** Lawan Maryah Bukar, * Nzolaningi Tendimadi, *Elegberun Nancy Ojo, *Ekeh Ikechukwu Philip

*Department of Paediatrics, Federal Medical Centre, Yola, Adamawa state, Nigeria.
**Department of Paediatrics, University of Maiduguri Teaching Hospital, Maiduguri, Nigeria.

*Corresponding author E-mail: ahmadu4u2003@yahoo.com.

Accepted 26 October 2012

Background: Anabolic effect of pregnancy is associated with increased maternal body mass index and maternal albumin. These physiological events were linked to some immunological response of mothers during pregnancy. However, little is known on the relationship between these physiological changes in pregnancy and maternal measles antibodies of mother-neonatal pairs. This paper, therefore, studied the effects of maternal pregnancy body mass index and maternal albumin on maternal measles antibodies of mother-neonatal pairs at birth.

Methods: One hundred and fifty mother-neonatal pairs were enrolled using systematic random sampling. Body mass index formula was used to calculate maternal pregnancy body mass index using maternal weight and height. Maternal measles antibodies of mother-neonatal pairs at birth were estimated and correlation coefficients of these antibodies, maternal pregnancy body mass index, and maternal albumin were determined.

Results: Significant correlation existed between maternal measles antibodies of mother-neonatal pairs at birth (p = 0.015). Positive correlation was observed between maternal pregnancy body mass index and maternal measles antibodies of mother-neonatal pairs. This, however, was not significant (p = 0.912) for mothers and (p = 0.719) for neonates.

Conclusion: Correlation of maternal pregnancy body mass index and maternal measles antibodies of mother-neonatal pairs were positive, however it was not significant. Likewise no significant correlation was found between maternal albumin and maternal measles antibodies of mother-neonatal pairs. Further study on this is therefore recommended.

Key words: Maternal pregnancy body mass index, maternal albumin, maternal measles antibodies, mother-neonatal pairs.

INTRODUCTION

The body mass index (BMI) is a heuristic proxy for human body fat based on an individual's weight and height. The pregnant woman undergoes dramatic physiologic changes in anticipation and in support of fetal growth. Addo in (2010) at Kumasi, Ghana, documented that changes in BMI among others are directly related to the alterations of maternal physiology that must occur for a foetus to be healthy. For instance, maternal pregnancy BMI may be associated with elevated plasma concentration of some globulins and albumin reflecting increased hepatic synthesis (Gabbe et al., 1991). Increased maternal BMI during pregnancy is associated with expansion of intravascular compartment which could have variable outcomes. In Kenya, Scott et al. (2005) found low haemoglobin in mothers, which was possibly due to haemodilution from increased extracellular fluid volume associated with elevated pregnancy BMI. Increased red cell mass was observed in another study, which probably resulted from anabolic effect of pregnancy (Gabbe et al., 1991). Kalhan (2000) also
reported low maternal albumin in connection with changes in maternal pregnancy BMI, which may not be unconnected to protein accretion effect of pregnancy. Although earlier research explored the relationship between maternal pregnancy BMI with other maternal and foetal outcomes (Kumari, 2001 and Ekblad et al., 1992), none of them associated maternal BMI and albumin with maternal measles antibodies (MMA) of mother-neonatal pairs at birth. Therefore, there is a gap in knowledge on this subject matter especially in Nigeria where measles is associated with six percent under-five mortality; and measles immunization is low put at 35 % (WHO, 2006). This study was done to find out the effects of maternal pregnancy BMI and albumin on MMA of mother-neonatal pairs at birth.

MATERIAL AND METHODS

Study site

The study was conducted at the Department of Paediatrics, Immunology and Obstetrics unit of the University of Maiduguri Teaching Hospital (UMTH), Nigeria. The UMTH is a tertiary centre located in North-Eastern Nigeria and a centre of excellence for infectious diseases and immunology. It also serves as a referral site for the six North-Eastern States and neighboring countries of Chad, Cameroon and Niger Republics (Ampofo et al., 1987).

Study design

The study was a hospital-based randomized comparative study of mother-infant pairs recruited from the labour ward of the UMTH.

Study population

Mother-neonatal pairs who met the following inclusion criteria were recruited: mothers given birth at UMTH, neonates delivered to these mothers, and with informed consent given by at least one parent. Mothers who had stillborns or received blood transfusion during pregnancy were excluded because of the tendencies for blood transfusion to elevate MMA.

Ethical Issues

The study protocol was reviewed and authorised by the Medical Research and Ethics Committee of UMTH. Assistance of linguistics interpreters of informed consent form in local languages mainly (Kanuri and Babur) was sought for due to low literacy rate in Maiduguri (Ampofo et al., 1987). Parents had unlimited liberty to deny consent without any consequences while confidentiality was maintained.

Sample size and collection of specimens

The minimum sample size was determined using a statistical formula that compares mean and standard deviation of MMA of mother-neonatal pairs at effect size of 0.2, alpha levels of 0.05 and power of 90% (Browner, 2001). However, 40% of the calculated minimum sample was added to maximize power. Therefore, the sample size for this study was one hundred and fifty mother-neonatal pairs.

Mother-neonatal pairs were enrolled in this study using the systematic random sampling method where the first of every three mother-neonatal pair was picked at the labour ward. Where the first mother did not fulfil the inclusion criteria the immediate next mother that qualified was selected. On enrolment of the mother-neonatal pairs, study proforma were administered to the mothers to collect information on their bio-data, pregnancy history and antenatal care history. Maternal weight and height were measured using Salter weighing scale and stadiometer in Kilogram (kg) and metre (m) respectively, and pregnancy BMI (kg/m²) was calculated using the formula weight (kg) / height (m²) (Addo, 2010).

Three millilitres (mls) of maternal venous blood and neonatal cord blood were obtained from mother-neonatal pairs at birth using sterile disposable five mls syringe under aseptic technique, and placed in sterile plain bottles. Sera were separated after centrifuging these blood samples at 5000 revolutions per minute (rpm) for five minutes. The sera were used to estimate maternal albumin (g/l) and MMA (U/ml) by enzyme linked immunosorbent assay (ELISA). All sera collected were pooled in a refrigerator at -20°C until the time of maternal albumin and MMA assay.

Data analysis

Appropriate statistical methods were used to analyze the data obtained from this study using SPSS statistical software version 16, Illinois, Chicago USA. A p value < 0.05 was considered significant. Tables were used appropriately for illustrations.

RESULTS

One hundred and fifty mother-neonatal pairs were enrolled in this study (Table 1). While the ratio of male to female neonates is 1.03:1, majority of the neonates 111 (74 %) were term. 44 mothers (29.3 %) were from high socioeconomic class, 106 (70.7 %) of them belong to low
Table 1. Sex and gestational age distribution of the neonates.

<table>
<thead>
<tr>
<th>Sex of neonates</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>76</td>
<td>50.7</td>
</tr>
<tr>
<td>Female</td>
<td>74</td>
<td>49.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gestational age (weeks)</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm (&lt;37)</td>
<td>15</td>
<td>10.0</td>
</tr>
<tr>
<td>Term (≥37 &lt;42)</td>
<td>111</td>
<td>74.0</td>
</tr>
<tr>
<td>Post term (≥42)</td>
<td>24</td>
<td>16.0</td>
</tr>
</tbody>
</table>

Table 2. Mean maternal measles antibody distribution of mother-neonatal pairs.

<table>
<thead>
<tr>
<th>Mother-neonatal pairs</th>
<th>Maternal measles antibodies (U/ml)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers</td>
<td>134.27 ± 93.70</td>
<td>119.16 – 149.39</td>
</tr>
<tr>
<td>Neonates</td>
<td>188.61 ± 84.56</td>
<td>174.96 – 202.25</td>
</tr>
</tbody>
</table>

SD = Standard deviation  
CI = Confidence interval

Table 3. Correlation coefficients of maternal pregnancy body mass index, maternal albumin and maternal measles antibodies of mother-neonatal pairs.

<table>
<thead>
<tr>
<th>Maternal BMI (kg/m²)</th>
<th>Maternal ALB (g/l)</th>
<th>Mothers MA (U/ml)</th>
<th>Neonates MA (U/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td>p value</td>
<td>0.029</td>
<td>0.723</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.912</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.719</td>
<td></td>
</tr>
<tr>
<td>Maternal ALB (g/l)</td>
<td>r</td>
<td>-0.029</td>
<td>0.723</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>0.144</td>
<td>0.079</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.034</td>
<td>0.679</td>
</tr>
<tr>
<td>Mothers MA (U/ml)</td>
<td>r</td>
<td>0.009</td>
<td>0.912</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>0.144</td>
<td>0.079</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.198</td>
<td>0.015*</td>
</tr>
<tr>
<td>Neonates MA (U/ml)</td>
<td>r</td>
<td>0.030</td>
<td>-0.034</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>0.719</td>
<td>0.679</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.198</td>
<td>0.015*</td>
</tr>
</tbody>
</table>

BMI = Body mass index  
ALB = Albumin  
MA = Measles antibodies  
r = Pearson’s correlation coefficient  
* = p value < 0.05 (significant)

socioeconomic class; only 7 (4.7%) mother-neonatal pairs had low MMA. The mean MMA levels of mother-neonatal pairs were 134.27 ± 93.70 U/ml for mothers and 188.61 ± 84.56 for their neonates in a ratio of 1:1.4 (Table 2).

Mean ± standard deviation of maternal pregnancy BMI in kg/m² was 23.58 ± 4.3 (95% CI, 22.88 to 24.28), and that for maternal albumin in g/l was 38.97 ± 5.3 (95% CI, 38.11 to 39.83). Table 3 below shows correlation coefficients of maternal pregnancy BMI, maternal albumin and MMA of mother-neonatal pairs. Correlation coefficient of MMA of mother-neonatal pairs at birth was found to be significant (p = 0.015).

DISCUSSION

Neonates in the present study were having higher mean MMA than their corresponding mothers. Similar observation was made by other investigators indicating a more efficient placental transfer of MMA from mothers to their neonates; possibly from active placental transfer of MMA in mother-neonatal pairs (Arnaud et al., 2008, and Victor et al., 2000). Even though a positive correlation was found to exist between maternal pregnancy BMI and MMA of mother-neonatal pairs in current study, it was not significant. Similarly, no significant correlation was established between maternal albumin and MMA of
mother-neonatal pairs in this study. This conformed to observation made in Haiti and Bombay (Hasley et al., 1985 and Joshi et al., 2003). It could be that the anabolic effect of pregnancy is being overshadowed by the net increased in total body water (Butte et al., 2003). This would give rise to false lower values of MMA in mother-neonatal pairs. Several workers have reported immunological response associated with increased maternal pregnancy BMI (Germain et al., 2007). However, globulins that have more of endocrine functions are much more than those with immunological activity during pregnancy (Gabbe et al., 1991). In this regard, our findings above may not be surprising. Researchers have argued that though there is an increased synthesis of some globulins and albumin that formed part of maternal pregnancy BMI, overall turnover of these yielded lower values (Hyttten et al., 1991). This may not be unconnected to accretion of these globulins and albumin as part of total proteins that is needed for foetal growth. In this light, these substances preferably serve as substrates for foetal growth rather than for antibody formation. With this consideration in mind, the findings in our study would be anticipated. Nonetheless, this current work, however, shows that MMA in mother-neonatal pairs were directly proportional to each other. Similar observation was made by investigators abroad (Arnaud et al., 2008 and Joshi et al., 2003). Less impact of placental factors on MMA transfer from mothers to their foetuses coupled with increased placental receptors for MMA are some of the reasons proffered (Scott et al., 2005). Recent scaling up of health care services that has led to a decline in the prevalence of HIV and use of intermittent preventive therapy for malaria in pregnant women among others, could also explain this (Scott et al., 2005 and Milagritos et al., 2005). Current study has its limitations which should be addressed in future research. These include given attention to maternal measles immunization status and/or past measles infection of mothers, because these may influence MMA in mother-neonatal pair.

**Conclusion**

Positive correlation was observed between maternal pregnancy BMI and MMA in mother-neonatal pairs, which was not significant. Similarly, insignificant correlation existed between maternal albumin and MMA in mother-neonatal pairs. Therefore, further work on this could be rewarding.

**Contributors**

BUA conceived and designed this study. BUA, FG, and LMB assessed and interpreted the data; all authors were involved in critical revision of the paper and drafting of report.

**Acknowledgment**

We thank A. Adebayo and Drs. M Sandabe, J. Usman and N. Haruna for their untiring efforts and assistance during the course of this work.

**REFERENCES**

Addo VN (2010). Body mass index, weight gain during pregnancy and obstetric outcomes. Ghana Medical J., 44: 64-8


