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THE ROLE OF MATERNAL ANTHROPOMETRY ON MATERNAL MEASLES ANTIBODIES IN MOTHER-BABY PAIRS AT BIRTH

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ABSTRACT

Maternal measles antibodies of mother-baby pairs have been studied in relation to measles virus infections. However, gap in knowledge on the role of maternal anthropometry on MMA (Maternal Measles Antibodies) in mother-baby pairs at birth still remains. Therefore, this paper studied the role of maternal anthropometry, that is, weight and height on MMA in mother-baby pairs at birth. One hundred and seventy mother-baby pairs were enrolled in current study using systematic random sampling. Corrected maternal weight using correction formula was measured, maternal height and maternal measles antibodies of mother-baby pairs were also assessed and their means compared using ANOVA (Analysis of Variance). Correlation coefficients of maternal weight, height and maternal measles antibodies of mother-baby pairs were also determined. Despite that a significant correlation was found between maternal measles antibodies of mother-baby pairs at birth ($r = 0.216$, $p = 0.005$); correlation of maternal weight, height and maternal measles antibodies of mother-baby pairs was not significant. Contrary to measles or measles immunization, maternal anthropometry may not be a strong determinant of measles antibodies in mother-baby pairs. More studies on this topic are therefore recommended.

Keywords: Corrected Maternal Weight, Maternal Height, Maternal Measles Antibodies, Mother-Baby Pairs

INTRODUCTION

Maternal anthropometry most especially weight (WT) could be linked to the first principle of thermodynamics, which states that energy is neither created nor destroyed but is converted from one form to another **[1]**. One may therefore speak of an energy balance between caloric intake and energy output. Mothers are said to be in positive caloric balance if caloric value exceeds their energy output, and the converse would give negative caloric balance **[1]**. Positive caloric balance would bring about anabolism resulting to weight gain, whereas, negative caloric balance could lead to catabolism and weight loss. In 1995, Abrams and Selvin, have shown that, maternal height (HT) and pre-pregnancy WT possibly determine placental volume, which in turn enables effective utero-placental flow of substrates to the foetus **[2]**. This is achieved by recruitment of utero-placental unit as a result of increased maternal WT and or HT, because reduction of feto-placental units yielded less substrate transfer to foetus **[3]**.

Hay in 1991, argued that, metabolic and endocrine functions of the placenta are the major determinants of placental homeostasis and possibly substrates transfer to foetus **[4]**. However, Anthony et al, in 1995 added that, the placental capacity needed for effective transfer of substances in mother-foetal pair is crudely related to the weight of the placenta **[5]**. Thus, theoretically, maternal WT may be a marker of substance availability to the foetus through the feto-placental units. Positive relationship between maternal anthropometry and foetal nutritional substrates has been reported by Thame *et al*., in 2001 **[6]**. However, there is limited information on the role of maternal anthropometry and maternal measles antibodies (MMA) in mother-baby pairs at birth. Thus, the aim of this work was to study the role of maternal anthropometry, that is, WT and HT on MMA in mother-baby pairs at birth.

MATERIAL AND METHODS

Study Area

The study was carried out 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 **[7]**.

Design

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

Ethical Issues

The study protocol was reviewed and authorised by the Medical Research and Ethics Committee of UMTH, and informed consent from parents was also obtained. 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 **[7]**. Parents had unlimited liberty to deny consent without any consequences and confidentiality was also maintained.

Sample Size and Collection of Specimens

The minimum sample size was determined using the Browner's formula **[8]**, which compared mean of MMA of mother baby pairs of known values at effect size of 0.2, alpha levels of 0.05 and power of 95%. However, 30% of the calculated minimum sample was added to maximize power. Therefore, the sample size for this study was one hundred and seventy mother-baby pairs.

Data Collection Procedure

Mother-baby pairs were enrolled in this study using the systematic random sampling method where the first of every three mother-baby pair was picked at the labour ward. Women who suffered from measles in the past, or had measles immunization were excluded. Also those that delivered preterm babies, stillborns or had received blood transfusion during pregnancy were excluded because of the tendencies for blood transfusion to elevate MMA. Where the first mother did not fulfil the inclusion criteria the immediate next mother 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. Mothers WT and HT were measured using Salter weighing scale and stadiometer in Kilogram (kg) and metre (m) respectively. Pre-pregnancy body WT of mothers was calculated using a correction formula: Pre-pregnancy BW = (1.07 x pregnancy WT (kg)) - 148 x (pregnancy WT^2 / (100 x $HT(m)^2$) **[9]**.

Collection of Samples

Three millilitres (mls) of maternal venous blood and babies cord blood were obtained from mother-baby 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 were used for the analysis of MMA using enzyme linked immunosorbent assay (ELISA) **[10]**. All

blood samples collected were stored in a refrigerator at -20°C until the time of MMA assay.

Statistical Analysis

The data obtained from the study were entered into a computer for statistical analysis using SPSS statistical software version 16, Illinois, Chicago USA. Values were expressed as mean ± standard deviation (SD). Correlations coefficients variables were determined and ANOVA was used to compare means. A p value < 0.05 was considered significant. Tables were used appropriately for illustrations.

RESULTS

One hundred and seventy mother-baby pairs were enrolled in this study. There were 87 (51.2%) males and 83 (48.8%) female babies. The ratio of male to female babies is 1.05:1. **Table 1** shows mean MMA levels of mother-baby pairs in a ratio of 1:1.3.

Table 2 shows distribution of group and mean maternal WT with mean MMA of mother-baby pairs. Comparison of mean maternal WT and mean MMA of mother-baby pairs was not significant (p = 0.893) for mothers and (p = 0.565) for babies.

Table 3 shows distribution of group and mean maternal HT with mean MMA of mother-baby pairs. There was insignificant comparison between mean maternal HT and mean MMA of mother-baby pairs (p = 0.401) for mothers and (p = 0.502) for babies.

Table 4 below shows correlation coefficient of maternal WT, HT and MMA of mother-baby pairs. Correlation coefficient of MMA of mother-baby pairs at birth was found to be significant (p = 0.005).

DISCUSSIONS

Babies had elevated levels of MMA than their corresponding mothers in this study, even though both mother-baby pairs had MMA at protective levels. This is consistent with studies carried out by other workers elsewhere **[11, 12]**. Previous investigators had found more efficient transfer of MMA which can be linked to active transfer of these antibodies in mother-baby pairs **[13]**. Not only is placental capacity that is related to maternal weight needed for this effective transfer of MMA in mother-foetal pair, but augmenting effect of metabolic and endocrine activities of placenta would be required as well **[4, 5]**. On the contrary, authors in Nigeria and Taiwan had found that placental transfer of MMA was less efficient in babies residing mostly in developing countries **[14, 15]**. This may not be unconnected with coexisting infections like malaria and human immunodeficiency virus that are associated with decreased levels of MMA in babies **[12]**.

Although an inverse correlation between maternal anthropometry and MMA existed in this work, comparing the effects of these variables were not significant on our subjects. This corroborates past study that was conducted in Haiti **[16]**. Several studies have shown that weak and ineffective comparison of MMA of mother-baby pairs may exist if MMA are derived from other sources other than from measles virus infection **[12]**. Of note, however, is that indirect correlation could still be found between maternal weight, height and MMA. Increased maternal weight and height produces more of energy-rich compounds, which may in turn increase the basal metabolic rate (BMR) of individuals **[1]**. In this vein, substrates needed for MMA production may be converted in to energy compounds in order to support rising maternal BMR.

Many investigators had reported the possibility of a direct significant relationship between maternal weight, height and MMA **[12]**. The most likely explanation for this would be that maternal weight and height could adjust in favor of immunologic functions similar to other physiologic adjustments that correlates bodily activities appropriately **[1]**. With this in mind, increased maternal weight and height would elevate MMA and vice-versa if maternal weights and heights are low.

Limitation of the Study

Our study population is residing in measles endemic environment that makes them prone to boosting effect of measles virus. This constitutes a drawback and may affect adequate comparison of MMA of mother-infant pairs with maternal weight and height.

CONCLUSION

Unlike measles virus infection or measles immunization, maternal weight and height may not be a strong determinant of measles antibodies in mother-baby pairs, however, more studies on this topic is hereby recommended.

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Competing interests

All authors have certified that we have no commercial associations for example, consultancies, stock ownership, equity interests, patent-licensing arrangements etc that might pose a conflict of interest in connection with the submitted article. All authors also declare that they have no conflict of interest.

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Contributors

BUA conceived and designed the study. BUA and BF assessed and interpreted the data and wrote the draft of the report. All authors were also involved in the critical revision of the paper.

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Table 1: Mean Maternal Measles Antibody Distribution of 170 Mother-Baby Pairs at Birth

Mother-Baby Pairs	Maternal Measles Antibodies (U/ml)	
	Mean ± SD	95% CI
Mothers	134.91 ± 93.51	120.75 – 149.06
Babies	180.84 ± 89.26	167.32 – 194.35
p value	P< 0.0001	-

NOTE: SD = Standard Deviation; CI = Confidence Interval

Table 2: Distribution of Group and Mean Maternal Weight with Mean Maternal Measles Antibodies of Mother-Baby Pairs

Group MWT (kg)	Mean MWT (kg)	Mean Maternal Measles Antibodies ± SD (U/ml)	
		Mothers	Babies
40 – 50	45	167.40 ± 91.13	194.30 ± 85.44
51 – 61	56	128.99 ± 91.91	180.07 ± 88.36
62 – 72	67	120.33 ± 96.42	170.09 ± 97.09
73 – 83	78	147.89 ± 91.98	190.25 ± 83.86
84 – 94	89	191.50 ± 102.86	177.50 ± 108.74
95 – 105	100	131.60 ± 86.95	182.00 ± 93.18

NOTE: MWT = Maternal Weight

Table 3: Distribution of Group and Mean Maternal Height with Mean Maternal Measles Antibodies of Mother-Baby Pairs

Group MHT (m)	Mean MHT (m)	Mean Maternal Measles Antibodies ± SD (U/ml)	
		Mothers	Babies
1.5-1.59	1.55	142.00±90.05	182.72±95.04
1.6-1.69	1.65	139.21±95.97	180.1688.62
1.7-1.79	1.75	88.86±86.73	175.93±98.23
1.8-1.89	1.85	121.00±70.42	194.14±71.75

NOTE: MHT = Maternal Height

Table 4: Correlation Coefficient of Maternal Weight, Height and Maternal Measles Antibodies of Mother-Baby Pairs

		Maternal WT (kg)	Maternal HT (m)	Maternal MA (U/ml)	Babies MA (U/ml)
Maternal WT (kg)	r		0.385	- 0.004	- 0.023
	P value		0.000*	0.955	0.762
Maternal HT (m)	r			- 0.102	- 0.093
	p value			0.186	0.230
Maternal MA (U/ml)	r				0.216
	p value				0.005*
Babies MA (U/ml)	r				
	p value				

NOTE: WT = Weight; HT = Height; MA= Measles antibodies; r = Pearson's correlation; coefficient; *= p value < 0.05 (significant)