

Questioning the Acceptability of Mothers' Age as a Determinant of Passive Measles Immunity in Newborn Infants

¹U.A. Baba, ²M.B. Lawan, ²A.G. Farouk, ²Y. Machoko, ²H.U. Ibrahim and ²H.A. Elechi

¹Department of Paediatrics, Federal Medical Centre, Yola, Adamawa State, Nigeria

²Department of Paediatrics, University of Maiduguri Teaching Hospital, Maiduguri, Nigeria

Abstract: Maternal Measles Antibodies (MMA) are primarily IgG₁ and are actively transferred through the placenta from mother to fetus. It protects infants from measles during the early critical months of infancy. As with maternal antibodies to other antigens, MMA declines and it is typically absent by the end of the 1st year of life. Several factors like race, parity and age have been put forward as a possible cause of variation of MMA within different populations of the world. Researchers investigated maternal age as a predictor of MMA in newborn infant in Maiduguri. One hundred and eighty mother-infant pairs were enrolled into this study using the Systematic Random Sampling Method between 10th January and 21st March 2010 and tested for MMA. The 92 (51.1%) of the newborn infants were males and 88 (48.9%) females, giving an approximate male to female ratio of 1.05:1. Maternal measles antibodies were measured using Enzyme Linked Immunosorbent Assay (ELISA) and correlated with maternal age. Significant correlation existed between mean maternal age and mean MMA of newborn infants at birth ($r = 0.784$, $t = 20.89$, $p = 0.000$). Advancing maternal age was associated with increased MMA in newborn infants at birth.

Key words: Maternal age, maternal measles antibodies, newborn infants, population, Maiduguri

INTRODUCTION

Measles is the principle cause of vaccine-preventable deaths in infants in the world. An estimated one million children die annually of measles and millions more have its sequelae which include diarrhea, pneumonia, encephalitis and malnutrition (Caceres *et al.*, 2000). Infants are protected from measles by MMA transferred to them by their mothers.

Variation in the prevalence of MMA in newborn infants at birth exists and reasons for this have not been studied in many countries (Caceres *et al.*, 2000). Previous reports were conflicting because increased maternal age was associated with lower MMA in the newborn infants in one of the studies (Eghafona *et al.*, 1987). While in another, no significant relationship existed between increased maternal age and MMA in newborn infants at birth (Caceres *et al.*, 2000). Learning about the influence of maternal age on the levels of MMA in newborn infants is important because of the significant impact it may have on the initial passive measles immunity of the newborn infants. This study, therefore was undertaken to address mothers' age as determinant of MMA in newborn infants at birth.

MATERIALS AND METHODS

Mothers who consented to this study at the University of Maiduguri Teaching Hospital (UMTH) Maiduguri, Nigeria were enrolled. Demographic and retrospective antenatal data were obtained by questionnaire and from the antenatal health card. The subjects were selected using Systematic Random Sampling Method where the first of every 3 mothers was picked as they presented to the labour ward. Where the first mother did not fulfil the inclusion criteria the immediate next mother that qualified was selected. All consenting mothers who delivered at the labour ward of UMTH together with their newborn infants within the study period fulfilled the inclusion criteria. The study protocol was reviewed and authorised by the Medical Research and Ethics Committee of the UMTH.

Collection of sera: About 3 mL of venous and umbilical cord blood were obtained from mother-infant pairs at delivery using sterile disposable 5 mL syringe under aseptic technique. These blood samples were placed in sterile plain bottles and serum was separated after centrifuging the blood samples at 5000 revolutions

per min (rpm) for 5 min. The serum obtained was stored in a refrigerator at -20°C until the time of measles IgG assay by Enzyme Linked Immuno Sorbent Assay (ELISA) in units per millilitre (U mL⁻¹).

Laboratory assays for measles antibodies: Maternal measles antibodies were measured by ELISA (Demeditec diagnostic GmbH Kiel Germany) in accordance with the manufacturer's instructions. The ELISA well plates were coated with Edmonston Measles Virus (MV) strain and results were presented in units per millilitre (U mL⁻¹). The MMA levels <8 U mL⁻¹ were classified by the manufacturer as negative, equivocal with levels of 8-12 U mL⁻¹ and positive when levels are >12 U mL⁻¹. On the basis of these recommendations, protective titres for MMA were defined as the levels of MMA>12 U mL⁻¹ and unprotective titres as levels of MMA≤12 U mL⁻¹ similar to another publication else where (Joshi and Gambhir, 2003).

Data analysis: Statistical analyses were performed by use of SPSS Statistical Software Version 16, Illinois, Chicago USA. Values were expressed as mean±Standard Deviation (SD). The means correlations coefficients were compared using the Student t-test. A p<0.05 was considered significant.

RESULTS AND DISCUSSION

One hundred and eighty mother-infant pairs were enrolled into this study. Of which 92 (51.1%) of the newborn infants were males and 88 (48.9%) females, giving an approximate male to female ratio of 1.05:1. The mean MMA levels of mother-infant pairs was 135.8994.00 (95% CI, 122.20–149.58) U mL⁻¹ for mothers and 181.5489.08 (95% CI, 168.44–194.64) for their newborn infants, giving a ratio of 1:1.3 (Table 1). Correlation of MMA of mother-infant pairs at birth was found to be significant (p = 0.005). Table 2 shows the distribution of mean maternal age and mean MMA of the newborn infants. Comparison of mean maternal age and mean MMA of the newborn infants was significant (t = 20.89, p = 0.000). A positive correlation was also observed between mean maternal age and mean MMA of newborn infants (Table 3).

High protective levels of MMA were observed in mother-infant pairs at birth in current study with newborn infants having higher protective levels of MMA than their corresponding mothers. Similar observation was made by other researchers which was attributed to active placental

Table 1: Mean maternal measles antibody distribution of mother-infant pairs at birth

Mother-infant pairs	Maternal measles antibodies (U mL ⁻¹)	
	Mean±SD	95% CI
Mothers	135.89±94.00	122.20±149.58
Newborn infants	181.54±89.08	168.44±194.64

SD = Standard Deviation; CI = Confidence Interval

Table 2: Comparison between mean maternal age and mean maternal measles antibodies of the newborn infants at birth

Group maternal age (years)	Mean maternal age (years)	Mean MMA of newborns±SD (U mL ⁻¹)
17-21	19	180.0±992.59
22-26	24	183.81±86.20
27-31	29	169.68±91.74
32-36	34	203.62±78.17
37-41	39	221.00±41.01

t = 20.89; p = 0.000; MMA = Mean Maternal Measles Antibodies; SD = Standard Deviation

Table 3: Correlation of mean maternal age and mean maternal measles antibodies of the study group

Correlation	Mean MA	Mean MMA
Mean MA		
r	-	0.784
p	-	0.000*
Mean MMA		
r	0.784	-
p	0.000*	-

MA = Maternal Age; MMA = Maternal Measles Antibodies *p<0.05 (significant); r = Pearson's correlation coefficient

transfer of MMA from mothers to their foetuses (Caceres *et al.*, 2000). Mean MMA of newborn infants at birth was higher with increasing maternal age in the present study. This finding was contrary to that of another study where poor MMA transfer in mother-infant pairs were observed (Sinha, 1980). Boosting effect by Measles Virus (MV) might be responsible for higher MMA in older mothers as found in this study (Tapia *et al.*, 2005; WHO, 2006). More so, measles is endemic in Nigeria and repeated encounter over time with MV may generate more MMA as passive immunity for measles (Tapia *et al.*, 2005; WHO, 2006).

Past outbreaks of measles related to ignorance, social and cultural beliefs of caregivers could also lead to high MMA in ageing mothers and may confer on them lifelong immunity (Ambe *et al.*, 2001; Ampofo and Omotara, 1987; Ashir *et al.*, 2009).

Reported outbreaks of measles in mothers has been documented in Mexico (PAHO, 2004). Therefore, infants of these mothers are likely going to have high MMA from transplacental transfer. Mothers having vaccine MMA however may lose this passive immunity to measles with advancing age due to shorter half-life which may not be lifelong (Griffin and Bellini, 2001).

CONCLUSION

Advancing maternal age was associated with rising MMA in newborn infants at birth.

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