



Prevalence of Rubella Specific IgM Antibodies among Expectant Mothers in Two Tertiary Hospitals in Rivers state, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors IOO and NNO designed the study, performed the statistical analysis and wrote the protocol. Authors CCA, TS and LOA managed the analyses of the study. Authors IOO, NNO and CCA managed the literature searches and wrote the first draft of the manuscript. Authors NNO, IOO, TS and LOA supervised the whole study which, author CCA used as part of her PhD thesis in the Department of Microbiology, Rivers State University, Port Harcourt, Nigeria. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Rubella virus screening in pregnancy has not been recommended during antenatal clinic days in Nigeria and most African countries. However, Rubella virus has been widely accepted as one of the viral aetiology of congenital transmission. Circulation of Rubella virus in the environment would increase the risk of maternal infection and possibly, congenital rubella syndrome. This study aims to determine the population of pregnant women, who are anti-Rubella virus IgM seropositive, thus understanding the burden of acute Rubella infections circulating in Rivers State.

Methods: Two hundred and seventy sera from the pregnant women were screened by Enzyme-linked Immunosorbent Assay (ELISA) for Rubella virus IgM antibody. These pregnant women were attending antenatal clinics of University of Port Harcourt Teaching Hospital (UPTH) and Rivers

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State University Teaching Hospital, both in Rivers State, Nigeria. A structured questionnaire was used to collect participants' sociodemographic data.

Results: A total of 44 out of 270 (16.3%) subjects were anti- Rubella virus IgM positive and 226 out of 270 (83.7%) were negative. There was no significant difference between IgM seropositivity and age groups, education level, gestation stage and parity. However, there was a statistical association of seropositivity rates with respect to location and occupation.

Conclusion: Findings from our evaluation indicated that many pregnant women were anti-Rubella IgM seropositive, hence the cases of acute infection were relatively high. This condition poses danger to their unborn fetuses in the absence of appropriate preventive measures.

Keywords: IgM antibody; rubella; pregnant women; seropositive; antenatal screening.

1. INTRODUCTION

Rubella virus causes a mild infection that is usually characterized by fever and rash which last about 2 to 3 days [1]. Rubella can cause miscarriage or serious birth defects in a developing baby if a woman is infected while she is pregnant [2]. The severity of the effects of rubella virus on the fetus depends largely on the time of gestation at which infection occurs [3]. Pregnancy in the first trimester, particularly before 8 weeks, is likely to result in a generalized and persistent infection with the multi-system disease [4], especially Congenital Rubella Syndrome (CRS).

Congenital infection with rubella virus can affect virtually all organ systems causing damage to the fetus, premature delivery or may lead to fetal death [3]. The Infection is highly contagious but is preventable with a vaccine.

Serological surveys may be used to detect the footprints that a virus leaves in a population. They are particularly useful for viruses because most viral infections leave an imprint on all infected individuals [5]. The presence of immunoglobulin M (IgM) antibody, is the test of choice for demonstrating current infection [6,7]. A rubella test detects and measures rubella antibodies in the blood that are produced by the body's immune system in response to immunization or an infection by the rubella virus. Acute rubella infection can be serologically confirmed by the presence of serum rubella IgM [8].

Currently, there is no specific treatment for the virus [9]. However, its burden can be minimized through the use of the live attenuated rubella vaccine [10,11]. The control of rubella and congenital rubella syndrome (CRS) relies on a high population level of immunity [12].

In Africa, previous studies among pregnant women have shown IgM seropositivity to be 5.0% in Cameroun [13], 9.5% in Ethiopia [10], 6.59% in Ghana [14] and 0.3% in Tanzania [15] while in Nigeria, past studies have revealed 4.3% prevalence of anti-rubella IgM in Zaria [16], 37.8% in Maiduguri [17], 3.9% in Makurdi [18], 38.8% in Zaria [9] and 7.8% in Rivers State [19].

Rubella surveillance is not well-established in Nigeria, like in many developing countries, hence, there is no national program to vaccinate children and women against rubella [20]. This study aimed to determine the prevalence of rubella virus-specific IgM antibodies among expectant mothers in Rivers State, Nigeria, hence estimating the burden of acute rubella infection among these women in the State.

2. MATERIALS AND METHODS

2.1 Study Design

A cross-sectional study was conducted from June 2019 to June 2020 among pregnant women attending antenatal care clinic of Rivers State University Teaching Hospital (RSUTH) and University of Port Harcourt Teaching Hospital (UPTH) both in Rivers State, Nigeria.

2.2 Study Population

Two hundred and seventy (270) pregnant women attending antenatal care clinic of the Rivers State University Teaching Hospital and University of Port Harcourt Teaching Hospital, both in Rivers State, Nigeria, were randomly examined.

2.3 Blood Sample Collection and Processing

Three millilitres (3 ml) of blood were collected from each 270 consenting pregnant women by venipuncture. The blood was allowed to clot and centrifuged at 3000 rpm for 5 minutes. The sera

were carefully aspirated into plain bottles and stored at -20°C until analyzed [21].

2.4 Laboratory Analysis of Blood Samples for IgM Antibodies

Laboratory analysis was carried out in the Virus Research Unit of the Department of Microbiology, University of Port Harcourt, Choba, Rivers State, Nigeria. The samples were analyzed for rubella virus IgM antibodies using the commercially available ELISA kit (manufactured by DIA.PRO Diagnostic Bioprobes, Milano, Italy). The micro-plates were washed 5 cycles with an automated washer (Biotek ELx 50, USA). The coloured reaction product was measured by using a spectrophotometric plate reader (Biotek ELx808i, USA) at an absorbance [22] of 450-630 nm. Every stage of the ELISA process was done following the manufacturer's instructions. Test results were interpreted as a ratio of the sample OD450 nm and the Cut-Off value (or S/Co) following the manufacturer's instructions. Samples with S/Co < 1.0 were considered negative for Rubella virus IgM antibodies while samples with S/Co > 1.2 were considered positive for Rubella virus IgM antibodies.

2.5 Data Analysis

The data obtained from questionnaires and laboratory analysis were entered into Microsoft Excel, analyzed using Statistical Package for Social Sciences version 21. Pearson Chi-square was calculated at 95% confidence interval and p-value < 0.05 was considered significant to determine the association between the presence

of the antibodies to the virus and other parameters [23,9].

3. RESULTS AND DISCUSSION

3.1 Results

Out of the 270 sera samples collected from expectant mothers and tested for Rubella IgM antibodies, an overall seropositivity rate of 16.3% (44/270) was observed, while 83.7% (226/270) of the expectant mothers tested negative for Rubella IgM antibodies (Fig. 1).

Higher seropositivity of Rubella IgM antibodies was observed among the expectant mothers from RSUTH, Rivers State, Nigeria (28.9%), compared to their counterparts from UPTH, Rivers state, Nigeria (3.7%). A significant difference ($P = 0.00$) was observed about their locations (Table 1).

From Table 2, age group 30-39 had the highest seropositive subjects, 29 (17.4%), while IgM seropositivity was least among pregnant women greater than 41 years, 1 (5.6%). There was no statistical relationship between age distributions of anti-Rubella virus IgM seropositivity among pregnant women (P -value = 0.435).

About their level of education, pregnant women with tertiary education had the most Rubella virus IgM seropositivity, 39 (18.9%), while only 1 (0.6%) of those with primary education was seropositive (Table 3). There was no statistical relationship between educational level and anti-Rubella virus IgM seropositivity among pregnant women (P -value = 0.107).

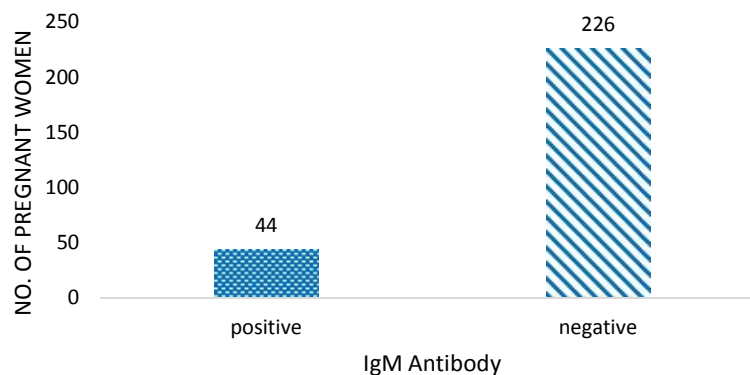


Fig. 1. Rate of rubella IgM seropositivity and seronegativity among expectant mothers

Table 1. Prevalence of rubella IgM antibodies based on location

Location	No analyzed	Rubella IgM positive (%)	Rubella IgM negative (%)	P value
UPTH	135	5(3.7)	130(96.3)	0.00
RSUTH	135	39(28.9)	96(71.1)	
Total	270	44(16.3)	226(83.7)	

Table 2. Age distribution of anti-rubella virus IgM seropositivity among pregnant women

Age group	No analyzed	Rubella IgM positive (%)	Rubella IgM negative (%)	P value
20-29	85	14(16.5)	71(83.5)	0.435
30-39	167	29(17.4)	138(82.6)	
≥40	18	1(5.6)	17(94.4)	
Total	270	44(16.3)	226(83.7)	

Table 3. Anti-rubella virus IgM seropositivity across education level of pregnant women

Education level	No analyzed	Rubella IgM positive (%)	Rubella IgM negative (%)	P value
Primary	10	1(10.0)	9(90.0)	0.107
Secondary	54	4(7.4)	50(92.6)	
Tertiary	206	39(18.9)	167(81.1)	
Total	270	44(16.3)	226(83.7)	

From Table 4, anti-Rubella virus IgM seropositivity among pregnant women in their second trimester was relatively higher (17.9%) than those in third (15.7%) and first trimester (12.8%). There was no statistical relationship between gestation stage and anti-Rubella virus IgM seropositivity among the pregnant women (P -value = 0.702).

From Table 5, pregnant women with three (3) parties had the highest anti-Rubella virus IgM seropositivity (24.3%). It was followed by those with 2 parities (15.9%), 1 parity (15.2%), 4 parities (14.7%). The lowest seropositivity was found among pregnant women with more than 5 parities (10.5%). There was no statistical relationship between parities and anti-rubella virus IgM seropositivity among pregnant women (P -value = 0.669).

For occupation, the highest seropositivity, 37.9% was obtained from the housewives followed by the traders (7.8%), the artisans (6.7%) and the civil servants (5.6%). It was observed that none of the pregnant women who were students was seropositive (Table 5). A significant difference (P = 0.00) was observed between the seropositivity rates and occupation.

3.2 Discussion

This study exclusively examined the proportion of pregnant women with acute Rubella infection by evaluating their seropositivity to anti-Rubella virus IgM antibodies. The overall seropositivity in

pregnant women was 16.3%. This falls within the range of acute rubella infection in Africa observed to vary from 0.3% in pregnant women in Mwanza, Tanzania; to 45.1% in children (1–10 years) in Jos, Nigeria [13,15,24].

There was no significant difference between IgM seropositivity and age groups, education level, gestation stage and parity. These findings align with previous studies [9,10,25,26]. However, there was a statistical association of seropositivity rates concerning location, which agrees with the reports of other workers [10,11]. Pregnant women from RSUTH had much higher IgM positivity rate than those from UPTH. Although further study of rubella virus transmission dynamics is needed, this difference in IgM positivity between the two settings might be due to differences in population density [10].

It was observed that the 16.3% IgM seropositivity obtained in this study was much higher than previous studies that have been reported in other African countries such as; Ethiopia (9.5%) [10], Cameroun (5.0%) [13], Tanzania 0.3% [15] and Southern Ethiopia (2.1%) [26]. In Nigeria, it was higher than 1.84% in Ibadan, 3.9% in Makurdi, 4.3% in Kaduna and 7.8% in Rivers State [27,18,16,19].

In comparison with the seropositivity in this study, some investigators in Nigeria have earlier reported a higher prevalence rate of IgM of 38.8% and 45.2% in Zaria and Jos respectively [9,28].

Table 4. Prevalence of IgM antibodies among pregnant women concerning t gestation stage

Gestation stage	No analyzed	Rubella IgM positive (%)	Rubella IgM negative (%)	P value
1 st Trimester	47	6(12.8)	41(87.2)	0.702
2 nd Trimester	134	24(17.9)	110(82.1)	
3 rd Trimester	89	14(15.7)	75(84.3)	
Total	270	44(16.3)	226(83.7)	

Table 5. Prevalence of IgM antibodies among pregnant women concerning parity

Parity	No analyzed	Rubella IgM positive (%)	Rubella IgM negative (%)	P value
1	92	14(15.2)	78(84.8)	0.669
2	88	14(15.9)	74(84.1)	
3	37	9(24.3)	28(75.7)	
4	34	5(14.7)	29(85.3)	
≥5	19	2(10.5)	17(89.7)	
Total	270	44(16.3)	226(83.7)	

Table 6. Distribution of anti-Rubella specific IgM seropositivity across occupation of pregnant women

Occupation	No analyzed	Rubella IgM positive (%)	Rubella IgM negative (%)	P value
Civil servant	72	4(5.6)	68(94.4)	0.000
Student	19	0(0.0)	19(100)	
Housewife	87	33(37.9)	54(62.1)	
Artisan	15	1(6.7)	14(93.3)	
Trader	77	6(7.8)	71(92.2)	
Total	270	44(16.3)	226(83.7)	

The high IgM seropositivity rate in this study is very significant and indicative of recent infection. This implies that the infected pregnant women, especially those in their first trimester, have the potential to infect their unborn babies causing congenital rubella syndrome or fetal death [3,4]. Variations in the prevalence rate of rubella IgM antibodies in different localities may be influenced by population density, immunization status and level of herd immunity at the time of virus introduction [26,29]. Also, outbreaks which may go unrecognized due to the mild nature of the infection could account for variation in the prevalence of rubella IgM in various populations [30].

The higher prevalence rate was obtained among women who are 30-39-year-old. This was contrary to the reports of other workers [16] and [28] where the highest prevalence was obtained from women who are 21- 25 and 20-29-year-old respectively. However, it was in agreement with an earlier study carried out by Okonko et al. [19] in Rivers State. This may be because most of the mothers in this age group might have lived in endemic settings which exposed them to rubella virus infection at an early age [26]. This emphasizes the need for vaccination in this age group [19].

Findings from this study showed that IgM seropositivity rate was highest among the women with a tertiary level of education. This aligned with previous studies [9] and maybe as a result of a high level of exposure and contact with the virus which promotes rubella transmission.

The lack of association between rubella exposure and some of the sociodemographic characteristics such as gestation stage and parity in this study has also been reported in various studies [10,31]. The highest seropositivity was obtained from women in their second trimester of pregnancy. This agrees with the work of Olajide et al. [9] and Agbede et al. [31] but contrasts with the reports of Bamgboye et al. [21], Fokunang et al. [32] and Okonko et al. [19] which showed the highest prevalence in pregnant women in their first and third trimester respectively. The highest prevalence observed in the second trimester may have been because most of the pregnant women presented at the antenatal clinic in their fourth and fifth months of pregnancy [9]. The prevalence of rubella IgM antibodies was seen to slightly increase in parity. Higher seropositivity was obtained in multiparous women and these findings corroborate previous studies [9,33] but contrast the work done by Bukbuk et al. [33] which showed a higher prevalence in

primiparous women. This may be due to the longer duration of interaction with an infectious environment [34]. However, parity does not seem to affect the risk of infection despite the high endemicity of the virus in Rivers State.

There was a statistical association between the occupations of the pregnant women and anti-rubella IgM seropositivity. The highest seropositivity was recorded among mothers who were housewives. This result agrees with the report of Ogbonnaya et al. [25]. Nonetheless, a contrasting result was reported in a study conducted earlier in Rivers State by [19] which reported higher seropositivity among women who were traders. Kolawole et al. [34], and Ganjooie and Mohammadi [35] suggested that the high prevalence among housewives could result from living in crowded families with lower socioeconomic conditions.

4. CONCLUSION

From the study, 16.3% of pregnant women had acute rubella virus infections at the time of data collection. This implies that the virus is endemic in the study areas and therefore, predisposes their unborn babies to the risk of CRS. The proportion of IgM seropositivity and risk of rubella virus infection in pregnancy found in our study, therefore, calls for interventions that reduce the incidence of the infection. In this regard, serologic screening of women of childbearing age and pregnant women during antenatal care programs, the introduction of child immunization and women vaccination should be considered.

CONSENT

All authors declare that written informed consent was obtained from the patient (or other approved parties) for publication of this study.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the Hospital Research Ethics committees of University of Port Harcourt Teaching Hospital (UPTH) and Rivers State University Teaching Hospital (RSUTH) and have, therefore, been performed following the ethical standards laid down in the 1964 Declaration of Helsinki. Ethical approval was obtained from the Rivers State Health Research Ethics Committee. A structured questionnaire was administered randomly to consenting pregnant women to obtain

information on socio-demographic factors before sample collection.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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