

# Prevalence of rubella antibody in pregnant women in Ibadan, Nigeria

\*A. E. Bamgboye<sup>1</sup>, K. A. Afolabi<sup>2</sup>, F. I. Esumeh<sup>3</sup> and I. B. Enweani

<sup>1</sup>Institute of Advanced Medical Research and Training,

College of Medicine, University of Ibadan, Ibadan,

<sup>2</sup>Department of Obstetrics and Gynaecology, Adeoyo General Hospital, Ibadan,

<sup>3</sup>Department of Microbiology, Ambrose Alli University, Ekpoma

## Summary

**Background:-** There is a dearth of information on the incidence and prevalence of rubella infection in Nigeria. The risk of congenital rubella in sero-negative pregnant women has been found to produce congenital abnormalities even in developed countries.

**Objective:-** The aim of this study is to determine the prevalence of rubella virus antibody in pregnant women.

**Setting:-** The place of study is the antenatal care clinic of Adeoyo State Hospital, Ibadan.

**Design:-** This is a cross-sectional study of primigravida women attending the antenatal care facilities in a general hospital. The rubella IgG antibody of the women was detected in sera using the RUB IgG Test kit. This is a quantitative ELISA technique.

**Result:-** The prevalence of rubella antibody in 159 pregnant women that participated in this study was 68.5% with a confidence interval of 64.8% - 72.2%. Women living in rural -urban areas have statistically significant higher prevalence of antibody than those in urban areas.

**Conclusion:-** This prevalence of rubella antibody in pregnant women suggests 1 in 4 pregnant woman is susceptible and the foetus at risk of congenital rubella malformation.

**Keywords:** Rubella, IgG antibody, ELISA, Pregnant women, Prevalence, Optical density.

## Résumé

**Introduction:-** Il y a la pénurie de l'information sur les cas et la fréquence de l'infection de la rubéole au Nigeria. Le risque de la rubéole congénitale chez une femme enceinte séronégative a été noté de anomalie congénitale même dans les pays développés.

**Objectifs:-** L'objet de cette étude est de décider les cas des anticorps virus de la rubéole chez des femmes enceintes.

**Cadre:-** Le lieu de cette étude est la clinique des soins anténataux de l'Hôpital d'Etat Adeoyo, Ibadan.

**Plan:-** Il s'agit d'une étude en coupe transversale des femmes primigravida qui vont au centre des soins anténataux dans un hôpital général. La rubéole IgG anticorps des femmes était trouvée dans sera avec l'utilisation d'équipement du RUB I Gg test. Il s'agit d'une technique ELISA quantitative.

**Resultats:-** Les cas d'anticorps de la rubéole chez 159 femmes enceintes qui ont participé dans cette étude étaient 68,5% avec l'intervalle de confiance de 64,8% - 72,2%.

Des femmes qui habitent au milieu rural/urban ont une fréquence d'anticorps plus statistiquement élevés que celles dans un milieu urbain.

**Conclusion:-** Cet anticorps de la rubéole chez des femmes enceintes évoque 1 parmi 4 femmes enceintes est susceptible au syndrome congénital de la rubéole. C'est nécessaire d'avoir un programme national sur la vaccination pour la rubéole

dans ce pays.

## Introduction

Rubella infection is mild and self-limiting but it is commonly a contagious virus. Humans are the only known host of the rubella virus, which is also known to have a teratogenic effect in women particularly when contacted during the first trimester of pregnancy.<sup>7</sup> It has been reported that rubella infection produces congenital malformation in the fetus when the infection occurs during the first trimester of pregnancy. The triad of anatomical abnormalities includes cataracts, deafness and congenital heart disease which is referred to as congenital rubella syndrome (CRS). Also, spontaneous abortions and stillbirths are known vital events associated with pregnancy complicated by rubella virus.<sup>5</sup>

The prevalence of rubella immunity varies in different geographical areas of the world.<sup>1</sup> However the differences are attributed to the immunization policy on rubella in the different countries with high immune responses.<sup>1</sup> In Nigeria, there have been few studies on rubella infection and available studies showed that 20 - 60% of Nigerians lack rubella immunity<sup>2, 3, 8</sup>. This is in sharp contrast to the situation in developed countries of Northern Europe and USA where the prevalence of rubella immunity has been reported to be as high as 95%.<sup>11</sup>

There is a dearth of information on the incidence and prevalence of rubella infection among pregnant women in Nigeria. Since the burden of this disease is not known, one is not surprised that there is no general immunization policy against rubella in Nigeria. Whereas, the risk of infants with congenital abnormalities in sero-negative pregnant women has been estimated to be about 4 per 100 live births.<sup>10</sup> Therefore, the aim of this study is to estimate the prevalence of rubella virus infection in pregnant women.

## Materials and methods

The study which took place over a period of six months between March 2002 and October 2002 adopted a cross sectional design. The study sample was all primigravida apparently healthy women attending the Antenatal Care Clinic of Adeoyo State Hospital, (a secondary health care facility), in Ibadan, Nigeria. The study plan was to screen the primigravida women at the first trimester of their pregnancy for the presence of IgG antibody.

The women were categorized into living in rural-urban area if they come from the high density areas of Ibadan such as Foko, Agagu and others. Those from low density areas such as Bodija and other reservation areas are categorized to living in urban area.

Blood samples were collected from all apparently healthy, pregnant women at their first visit to the Antenatal Care Clinic (ANC) of the hospital. The samples were collected aseptically,

\*Correspondence

processed and sera samples were stored at -20°C until used.

The rubella IgG antibody was detected in sera of these subjects using RUB IgG test kit. The test is an Enzyme Linked Immuno Sorbert Assay (ELISA) technique. The solid phase is the microplates that were coated with inactivated rubella antigens that capture specific IgG present in the diluted sample during the first incubation. After washing out all other unbounded components from the sample, the bounded anti rubella IgG was detected by adding peroxidase labeled human IgG.

The enzyme captured on the solid phase will act on the substrate/chromogen mixture to develop a blue colour. The colour development was stopped after 25 minutes using 0.3M H<sub>2</sub>SO<sub>4</sub>. The intensity of the colour developed was proportional to the amount of anti Rub IgG antibodies present in the sample. The optical density (OD) was read at 450nm.

#### Validation of results

The results were validated by using the calibration curve obtained by plotting the optical density of ready to use standards provided in the kit (0 - 10 - 20 - 50 - 100 - 250iu/ml) WHO std.) This was used to determine the concentration of the OD obtained from the test samples.

#### Reading and interpretation of the results

The calibration curve obtained from the standards was used to calculate the concentration from the optical density of each test samples. When the assay is used to monitor pregnancy, the cut off is set at 20IU, the concentration at which the patient is considered protected. The demographic and fertility characteristics of the women as well as the result of other laboratory analysis were recorded in a structured

questionnaire.

#### Statistical analysis

Simple descriptive statistics such as proportions, means and standard deviations were used to summarize the data. The rubella antibody level was classified into positive ( $\geq 21$ ), borderline (19.1-20.9) and negative (1-19) according to the IgG antibody level. The significance of association between rubella antibody level and other demographic characteristics was investigated by the chi-square test. All tests were at the 5% probability level.

#### Results

Table 1 shows the demographic characteristics of the 159 apparently healthy pregnant women whose levels of rubella IgG antibody were determined. The age distribution was nearly normal with a mean of 23.6 years, median of 23years and a mode of 22years. The majority of the women (76.1%) were aged between 20 and 30 years while 10% were above 30 years of age. The others (13.8%) were below 20 years.

A sizeable proportion of the women (62.9%) were from the rural-urban area of Ibadan and 81.8% were married. Only 4.4% had no formal education while 51.6% had secondary education and those with tertiary education were 17%. In spite of the fact that less than 30% had primary education, the vast majority of the women (77.4%) were low income earners - traders or engaged in other semi skilled jobs.

The result also showed that 23.3% of the women were not aware of immunization while 22.0% reported a history of previous induced abortion. The prevalence of rubella antibody in the pregnant women was 68.5% with a 95% confidence interval of 64.8% to 72.2%. The result also showed

63% to be borderline cases, and 25.2% with no antibody. The distribution of rubella IgG antibody level by the demographic characteristics of the women is also shown in table 1. There was a gradual increase in the proportion of pregnant women with rubella IgG antibody immunity with increase in age until 35years, but this association or trend was not statistically significant ( $X^2 = 9.86$ ,  $p > 0.2$ ).

Panel 2 of table 1 showed that the proportion of women with positive rubella IgG antibody was higher among women living in rural-urban area than those in the urban settlements (79.7%) vs 62.0%)  $p < 0.05$ . However, there was no significant difference in the proportion of borderline cases in women from these two populations. A low frequency of women had no formal

**Table 1 The distribution of rubella IgG antibody by demographic characteristics**

Age (years)	Rubella IgG antibody				X <sup>2</sup>	P.value
	Positive 21+	Bordeline 19.1-20.9	Negative 1-19	Total		
15 - 19	14(63.6)	1(4.5)	7(31.8)	22(13.8)	9.86	0.275
20 - 24	56(70.0)	4(5.0)	20(25.0)	80(50.3)		
25 - 29	29(70.7)	3(7.3)	9(22.0)	41(25.8)		
30 - 34	9(75.0)	2(16.7)	1(8.3)	12(7.5)		
35 - 39	1(25.0)	0(0.0)	3(75.0)	4(2.5)		
<b>Place of residence</b>					6.74	0.035
Urban	47(79.7)	4(6.8)	8(13.6)	59(37.1)		
Rural-Urban	62(62.0)	6(6.0)	32(32.0)	100(62.9)		
<b>Marital status</b>					1.01	0.67
Married	87(66.9)	9(6.9)	34(26.2)	30(81.8)		
Single	22(75.9)	1(3.4)	6(20.7)	29(18.2)		
<b>Education</b>					3.49	0.725
None	6(85.7)	0(0.0)	1(14.3)	7(4.4)		
Primary	33(76.7)	2(4.7)	8(18.6)	43(27.0)		
Secondary	52(63.4)	6(7.3)	24(29.3)	83(51.6)		
Tertiary	18(66.7)	2(7.4)	7(25.9)	27(17.0)		
<b>Occupation</b>					3.73	0.713
Unemployed	4(80.0)	0(0.0)	1(20.0)	5(3.1)		
Seni-skilled	86(69.9)	8(6.5)	29(23.6)	123(77.4)		
Skilled	10(55.6)	2(0.5)	7(30.8)	19(11.9)		
Student	9(75.0)	0(25.0)	3(25.0)	12(7.5)		

education, but the proportion with rubella IgG antibody was highest among this category, and the civil servants have the lowest proportion with positive antibody (52.9%). However, there was no statistically significant association between positive rubella IgG antibody and the type of occupation of the women ( $p>0.5$ ).

The gestational age of the women was between 1 month and 6 months. The majority of the women (89.3%) were already in the 2nd trimester of pregnancy, while only 10.7% were in the 1st trimester of pregnancy. However, the proportion of positive IgG antibody was higher in women in their 1st trimester of pregnancy than those in the second trimester (76.4% vs 67.6%) but it was not statistically significant ( $p>0.2$ ).

Also that there was no statistically significant association between the gestational age of the pregnancy and rubella antibody. This could be attributed to the small sample of pregnant women of three months and below. But it is surprising that 28% of the women in their 4 months of pregnancy and 24.4% of those in their 5 months of pregnancy had no immunity and are at risk of having babies with congenital rubella malformations.

There was no statistically association between rubella immunity and history of previous abortions in immunization against other infections.

## Discussion

The findings of an immune response of 68.5% among pregnant women in this study is similar to the 73.0% reported by Odelola<sup>6</sup> and Olusanya and Blomberg.<sup>8</sup> But one should note that the populations of the study sample in the two earlier studies were not the same. While the Odelola study was on all women irrespective of pregnancy status, Olusanya reported on hospital workers including men. However, the 76% prevalence of rubella antibody reported by Onyenekwe et al among 63 pregnant women was still higher than the figure from our present study. One possible reason that could be attributed to the differences in the prevalence of rubella antibody could be the different methods used for the detection of rubella antibody. Since the technology is daily improving, the technique used in this study appears to be the latest and has a very high sensitivity and specificity. However, if the 6.3% borderline cases were to be taken into consideration and added to women with immune response, the resultant figure of 74.9% will not be too discrepant from the earlier reports. However, the sample size of pregnant women in the present study is the highest sample size of women ever reported upon and therefore the estimate would be statistically more reliable.

The finding of a sizeable proportion of our women presenting at the ANC at five months deserves attention. Pregnant women are expected to seek antenatal care latest at their first trimester of the pregnancy.

This study like other previous studies have shown that

**Table 2** Prevalence of IgG antibody by other characteristics

Characteristics	Positive 21+	Borderline 19.1-20.9	Negative 1-19	Total	X2	P.value
<b>History of immunization</b>						
Yes	80(65.0)	9(7.4)	33(27.0)	122(76.7)	2.41	>0.2
No	29(78.4)	1(2.7)	1(18.9)	37(23.3)		
<b>Gestational age</b>						
1 - 3 months	13(76.4)	2(11.8)	2(11.8)	17(10.7)	2.44	>0.2
4 - 6 months	96(67.6)	8(5.6)	38(26.8)	142(89.3)		

a high proportion of our population has rubella immunity suggesting exposure to previous rubella attacks. But this observed prevalence or rubella immune response is much lower than the 95% or more reported in developed countries who already have vaccination policy on rubella. Rubella virus has been reported not only to cause miscarriage but congenital rubella syndrome.

Another striking finding in this study is the high immune response rate among the rural-urban dwellers as compared to urban dwellers who are supposed to enjoy higher socio-economic standards. But, the finding is consistent with previous studies by Olusanya<sup>8</sup> and Black<sup>1</sup>. The possible explanation could be the relatively poor hygienic environments of the rural-urban dwellers, which might expose them more to rubella virus infection. Thereby developing more natural immunity compared to their urban dwellers. It has been reported that all immune Nigerians acquired their immunity by natural infection<sup>6</sup>. In fact this is a reasonable assumption as no vaccination policy is in place in Nigeria at the moment. However, the proportions of urban dwellers (13.6%) with no detectable rubella IgG antibody in this study is similar to the 14.4% reported by Olusanya.<sup>8</sup>

This study also showed that there was no significant association between the prevalence of IgG antibody and mothers' age, although there was slight increase of positivity with age up to 35 years. This finding is similar to previous findings and possible reasons has been persistent natural immunity. The findings that history of abortion has no association with non-immune response of rubella virus may be due to the fact that the abortions reported were induced rather than miscarriages.

This study has indicated 25.2% as negative to rubella IgG antibody suggesting that 1 in 4 of pregnant women will be susceptible to rubella virus infection and risk of C. R. S.

## Acknowledgements

The authors are grateful to Prof. J. A. Mingle of Department of Medical Microbiology, Medical School, Korlebu-University of Ghana and Dr. Osei-Kwesi Mubarak of the Noguchi Memorial Institute Accra, Ghana for their valuable contributions to the planning of this work. They are also grateful to Dr. O. G. Ademowo of IMRAT and Dr. O. G. Arinola of (Immunology Unit) both from College of Medicine, University of Ibadan for reading through the manuscript. Also thanks to Mr. Y. Sijuade and Mr. M. O. Odusan for their technical advice during the course of the study. Finally we express our appreciation to Prof. E. Afolabi Bamgboye, of EMSEH for his statistical advice and

constructive criticisms.

#### References

1. Black FL, Bermman LL and Borgono JM: Geographical variation in infants loss of maternal measles antibody and in prevalence of rubella antibody. *American J. of Epidemiology*: 1986; 124: 442 - 452.
2. Onyenekwe CC, Kehinde TA and Adeyangi US: Ofor. Prevalence of rubella IgG antibody in women of childbearing age in Lagos, Nigeria. *West Afr.J. Medicine*. 2000; 19: 23 - 26.
3. Gomwalk NE and Ahmed AA: Prevalence of rubella antibodies on the African continent *Rev. Infect Dis*. 1959;11: 116 - 121.
4. Lennette EH and Schmidt NJ: Diagnostic procedures for vital and rickettsial infections. *Am Public Health Asso*. 1969; 38 - 41, 391 - 398.
5. Mason MM, Logan WPD and Ly RM: Rubella and other virus infections during pregnancy. Ministry of Health London 101. 1960
6. Odelola HA: Rubella haemogglutination-inhibition antibody in females of child-bearing age in Western Nigeria. *Journal of hygiene, epidemiology, microbiology and immunology*. 1978; 22: 190 - 194.
7. Ojala P, Vesikari T and Elo O: Rubella during pregnancy as a cause of congenital hearing loss. *American J. Epidemiology* 1973; 98: 395 - 401.
8. Olusanya O and Blomberg J: Antibody prevalence against rubella among hospital personnel in Nigeria. Implication for health care system and immunization policy. *Acta tropical* 1990; 1991; 101 - 107.
9. Oyedeji GA: Socio-economic and cultural background of hospital children in Ilesa, Nigeria *J. Peadiatrics* 1985; 12: 111 - 117.
10. Stay-Perterson B: Economic evaluation of different vaccination programmes to prevent congenital rubella NIPH. *Annals* 1982; 5, 69-83.
11. Ukkonem P and Borsdonff CH: Rubella immunity and mortality. Effect of vaccination in Finland. *Scard J. infect. Dis*. 1988; 20: 255 - 259.