Original Research

Seroprevalence of Rubella Viral Infection in Women of Childbearing Age in Lokoja, Nigeria

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Abstract	Article Information
The study aims to investigate the prevalence of Rubella IgG and IgM with reference to parity status among women of childbearing age attending Federal Medical Center, Lokoja Nigeria. Socio-demographic data were obtained using structured questionnaire before blood sample collection from the subjects. Rubella screening was done using IgG captured ELISA kits. IgG positive samples were further screened for IgM to ascertain current or past infection. Of the 240 evaluated serum samples, 231 (96.25%) were positive, 3 (1.25%) had borderline and 6 (2.5%) were negative to Rub-IgG. Rub-IgM assays revealed 4(1.7%) positivity. Most of the subjects had acquired immunity before age 30. 202(91.0%) of 210(94.6%) monogamous and all recorded subjects with polygamous were positive to rubella IgG (p=0.789) while 3(1.4%) and 1(0.5%) respectively had positive result for rubella IgM (p=0.224). 186(83.6%) of 193(86.9%) and 27(12.2%) of 29(13.1%) within the parous and nulliparous group were positive to Rub-IgG (p=0.266) 4(1.9%) positive and all the subjects under nulliparous group had no current infection (p=0.694). In addition to other risk factors, parity also plays a role in exposure to the virus because it increases frequency of contact with the environment and although immunity is high among the subjects. It is therefore imperative to advocate for Rubella vaccination to avoid near miss or near death experience of the fetus.	***Corresponding Author:** Olatunji M. Kolawole **E-mail:** omk@unilorin.edu.ng tomak7475@gmail.com

INTRODUCTION

Several viruses and bacteria belong to the dreaded group of infectious disease, some of which, although preventable are transmitted both vertically and horizontally. They either cross the placenta to cause congenital infections to fetus, abortion, intrauterine death, preterm labor or infect the baby prenatally as it passes through the birth canal of the mother or in postnatal life.

Rubella virus is among the microorganisms that can be transmitted from mother to child (Mehta and Thomas, 2002: WHO, 2000). It's a non-sexually transmittable viral infection with mild febrile symptoms and a rash in adults and children with occasional outbreaks. This is an RNA virus; it's self-limiting in most cases and rarely causes complications. Nevertheless, it causes congenital rubella syndrome (CRS) when the infection occurs during the first trimester of gestation. In utero, infection of the fetus may result in congenital deformity or other consequences of congenital rubella syndrome. Complications of CRS may include miscarriage and severe abnormalities or deformities of the fetus e.g. cataracts, retinopathy, heart defects, neurological deficits, and deafness. No antiviral drugs are available for treating rubella or preventing transmission to the fetus. Vaccination programs are regarded as an effective tool to eliminate rubella and congenital rubella (Ching-Chiang et al., 2010). As per the World Health Organization estimate worldwide; more than 100,000 children are born with congenital rubella syndrome (Vijayalakshmi et al., 2004). Before the introduction of vaccine in countries such as Australia, United States of America, the United Kingdom and European Countries, rubella epidemics occurred in cycles of 6-9 year interval (Onakewhor and Chiwuzie, 2011).

Rubella usually begins with malaise, low-grade fever, and a morbilliform rash appearing same day. The rash starts on the face, extends over the trunk and extremities, and rarely last more than 3 days. No feature of the rash is pathognomonic or particular for rubella. Unless an epidemic occurs, the disease is difficult to diagnose clinically, as the rash caused by other viruses (e.g.enteroviruses) is similar (Geo, 2004: Wolinsky and Knipe, 1996).

In some African Countries, 80% of children have been found to be positive for rubella antibodies by the age of 10 years (Lawn, 2000). Post-epidemic rubella antibody prevalence in Ghana has been found to be 92% among pregnant women, with susceptibility associated with a younger age. In Eritrea, the prevalence of antibodies to rubella has been reported to be as high as 99% in some female population (Sallam et al., 2003). In Nigeria, rubella

antibody prevalence in women of child bearing age has been reported to be 77% (Clarke, 1980), a seroprevalence of 16.3% of antenatal rubella virus infection was recorded in Ilorin, Nigeria (Agbede *et al.*, 2011), an annual occurrence of 150–250 new cases of congenital eye defect in the Federal Capital Territory (Babalola and Babalola, 2004), a 68.5% prevalence in Ibadan (Bamgboye *et al.*, 2004), 76% in Lagos (Onyenekwe *et al.*, 2000) and a 54.1% prevalence of rubella infection in pregnant women observed in Maiduguri (Bukbuk *et al.*, 2002). Some of these studies have reported an early age of exposure to rubella (Lawn, 2000). The highest seroprevalence has been seen in age group as young as 5-9years and in preschool children (WHO, 1999).

To the best of our knowledge, there are little or no data on the seroprevalence of Rubella viral infection in women in this part of North Central Nigeria. This study therefore investigates the seroprevalence of Rubella viral infections in women of childbearing age and the influence of parity status on acquisition of immunity.

MATERIALS AND METHODS

Study area
The study was carried out in Federal Medical Center, Lokoja. Lokoja is the capital of Kogi state in North Central Nigeria.

Subjects and Sample collection
Sample size was calculated using Fishers formula (Araoye, 2004), 5ml of blood was aseptically drawn from 240 consenting females of childbearing age with recognition to their parity status and other socio-demographic data was obtained via a structured closed ended questionnaire. Sera was separated and stored at -20^0C for assay.

Assay
This was carried out using Enzyme Linked Immunosorbent Assay method (ELISA) which has been shown to be a sensitive and reliable procedure for detection of antibodies to rubella with diagnostic sensitivity of 98% and diagnostic specificity of ≥ 98%. The IgG seropositive cases were regarded as exposed

(previous or current), while the IgM seropositive cases were regarded as acute or active infection. IgG results were expressed in international units (IU), with calibration performed against reference standards of 10, 25, 50, 100, and 1000 IU/mL according to the manufacturer's instruction while confirmation of IgM was performed by an indirect ELISA assay. This was done using RT-2600C Microplate washer and RT-2100C Microplate reader. Analysis and interpretation of samples sero status was according to the manufacturer's instruction (Rapid Labs Limited united kingdom) were samples with <15 is negative, 15-20 is equivocal and >20 is regarded positive for IgG while <0.90 is negative, 0.91-1.10 is equivocal and >1.1 A.I is positive for IgM. All the controls and calibrators passed the validation test that was recommended by the manufacturer.

Data Analysis
Results was analysed using Statistical package for the Social Science (SPSS) version 17 software package and level of significance was determined at *P*<0.05.

Ethical Consideration
The ethical clearance was granted by the Federal Medical Center Ethical Review Committee. Informed consent was obtained from subjects after careful explanation of the study.

RESULTS
A total of 240 subjects were enrolled for this research and out of this consenting patient, only 6 (2.50%) subjects tested negative to Rubella IgG after assay (i.e. have not been exposed to the virus), 3 was equivocal while the remaining 231 IgG positive subjects were assayed for Rub-IgM and 4 was positive. Based on marital status, 98.2% of married and 88.8% of single women were positive to rubella IgG while all the four subjects undergoing a current infection (IgM positive) were all married. Highest Rub-IgG sero positivity was recorded amidst 20-25 and 26-30 age groups having 94.9% & 96.7% respectively (Table 1). Four samples from the six IgG positive subjects was found to be amidst 36-40 age group and were also nulliparous. Of the four IgM positive subjects, the former age group had 75% (3) while the later had 25% (1).

Table 1: Rubella IgG and IgM status in relation to Age and Marital status of respondents

		RUBELLA IgG			RUBELLA IgM			
		Negative (%)	Positive (%)	Equivocal (%)	Negative (%)	Positive (%)	Equivocal (%)	*P* values
AGE	20-25	3(1.3)	94(39.2)	2(0.8)	93(39.7)	3(1.3)	0(0)	0.963,0.708
	26-30	2(0.8)	89(37.1)	1(0.4)	88(37.6)	1(0.4)	1(0.4)	
	31-35	1(0.4)	42(17.5)	0(0)	42(17.5)	0(0)	0(0)	
	36-40	0(0)	6(2.6)	0(0)	6(2.6)	0(0)	0(0)	
Marital Status	Single	2(0.8)	16(6.7)	0(0)	15(6.4)	0(0)	1(0.4)	0.047,0.001
	Married	4(1.7)	215(89.6)	3(1.3)	214(91.5)	4(1.7)	0(0)	

P< 0.05 is statistically significantly

Out of 210(94.6%) subjects with monogamous marriage, 202(91.0%) were positive and 2(0.9%) was equivocal. All 12(5.4%) with polygamous marriage tested positive to rubella IgG (p=0.789). 3(1.4%) and 1(0.5%) of monogamous and polygamous group respectively had a positive result when assayed for rubella IgM (*P*=0.224). Of 193(86.9%) samples within the parous group on Table 2,

186(83.6%) were positive and 27(12.2%) out of 29(13.1%) in nulliparous group was positive to rubella IgG (p=0.266). 4(1.9%) positive and 1(0.5%) equivocal out of 189(87.5%) parous group was recorded for rubella IgM while all the samples under nulliparous group were negative to rubella IgM (*P*=0.694). (Table 2)

Table 2: Rubella IgG and IgM status in relation to marriage type, parity information, educational level and occupation of subjects

		RUBELLA IgG			RUBELLA IgM			
		Negative Sample (%)	Positive Sample (%)	Equivocal Sample (%)	Negative Sample (%)	Positive Sample (%)	Equivocal Sample (%)	P value
Type of marriage	Monogamy	6(2.5)	219(91.3)	3(1.3)	218(90.8)	3(1.3)	1(0.4)	0.789,0.224
	Polygammy	0(0)	12(5.0)	0(0)	11(4.6)	1(0.4)	0(0)	
Parity Status	No	2(0.8)	34(14.2)	0(0)	34(14.2)	0(0)	0(0)	0.266.0.694
	Yes	4(1.7)	191(79.6)	3(1.3)	189(78.8)	4(1.7)	1(0.4)	
Number of children`	None	2(0.8)	128(53.3)	1(0.4)	126(52.5)	2(0.8)	1(0.4)	0.026, 0.931
	One	0(0)	27(11.3)	0(0)	26(10.8)	1(0.4)	0(0)	
	Two	3(1.3)	55(22.9)	0(0)	54(22.5)	1(0.4)	0(0)	
	Three	1(0.4)	21(8.8)	2(0.8)	23(9.6)	0(0)	0(0)	
Educational level	No education	0(0)	2(0.8)	0(0)	2(0.8)	0(0)	0(0)	0.427, 0.444
	Primary	1(0.4)	50(20.8)	0(0)	48(20.0)	2(0.8)	0(0)	
	Secondary	5(2.1)	129(53.8)	1(0.4)	129(53.8)	1(0.4)	0(0)	
	Tertiary	0(0)	50(20.8)	2(0.8)	50(20.8)	1(0.4)	1(0.4)	
Occupation	Housewife	2(0.8)	47(19.6)	0(0)	46(19.2)	1(0.4)	0(0)	0.648, 0.790
	Civil servant	0(0)	61(25.4)	1(0.4)	60(25.0)	1(0.4)	1(0.4)	
	Business woman	4(1.7)	106(44.2)	2(0.8)	106(44.2)	2(0.8)	0(0)	
	None of the above	0(0)	17(7.1)	0(0)	17(7.1)	0(0)	0(0)	

P< 0.05 is statistically significant

Seroprevalence of rubella virus in relation to the number of children revealed that 128(53.3%) of 131(54.6%) subjects without any child, 27(11.3%) of 27(11.3%) in the group of one child, 55(22.9%) of 58(24.2%) in the group of two children and 21(8.8%) of 24(10.0%) amidst the group with three children were positive to rubella IgG respectively (*P*=0.026). While 2(0.9%) of 129(55.1%) in the group with no child, 1(0.4%) of 27(11.5%) among the group with a child and 1(0.4%) of 55(23.5%) within the group of two children tested positive to rubella IgM (*P*=0.931). (Table 2)

Seroprevalence by educational level revealed that 2 (0.8%) subjects without a form of education, 50(20.8%) of 51(21.3%) that attended only primary school, 129(53.8%) of 135(56.3%) that attended only secondary school and 50(20.8%) of 52(21.7%) that had tertiary education were positive for rubella IgG respectively (*P*=0.427) while only 2(0.9%) from primary, 1(0.4%) among secondary and 1(0.4%) in tertiary group tested positive to rubella IgM (*P*=0.444).

The recorded rubella IgG positivity among the subjects occupation are (Table 2), 47(19.6%)-housewife, 61(25.4%)-civil servants and 106(44.2%)-bussines women (*P*=0.648). Assay for rubella IgM showed that 1(0.4%) of 47(20.1%), 1(0.4%) of 62(26.5%) and 2(0.9%) of 108(46.2%) among the housewives, civil servants and bussines women respectively were positive (*P*=0.790).

DISCUSSION

The prevalence of Rubella IgG virus in the target locality can be said to be 96.25% from the resulting evidence proven by this research work. This result conforms to the research by Obijimi *et al* (2013) that reported 96.6% prevalence in Osun state. 97.7% prevalence of anti-RV IgG was detected in Ibadan and this is consistent with similar high prevalence of 94.2% reported by Adesina *et al.* (2008) in women of childbearing age. High O.D values was noticed in most positive subjects which could be attributed to re-infection

due to continuous transmission of the virus in the society leading to higher production of the corresponding antibody. The possible chance of re-infection or chance of new infection (transmission) is not strange considering the cluster nature or crowdedness at O and G section of the hospital and most part of the city since the main chain of spread or transmission of this virus is by contact with respiratory secretion either directly or via fomites i.e. objects or beddings carrying infections. The Crowded nature of most part of the city could be related to its location i.e. been a confluence state and close to state capital and thus a commercial trade center but with little land mass. Transmission of the virus via fomites can't be ruled out as the respiratory component provides a kind of temporary home or protection for the virus till a susceptible host comes in contact with it. Although reasonable percentage of Nigerians might be immune, cases of Rubella infection leading to CRS is still been encountered e.g. In 2006, a case of confirmed CRS was reported in Port Harcourt in a three month old male with heart failure (Otaigbe *et al.,* 2006). The result also shows that a significant number of the population is still at risk of infection and if Infection should occur during pregnancy especially within the first trimester, it could be very consequential for the fetus resulting in to different organogenesis and life threatening conditions because development would be commencing at that stage. Such condition is referred to as congenital rubella syndrome. It was noticed that most of the subjects had acquired immunity before 36-40 age group thus conforming to Agbede *et al.*(2011), Adesina *et al.* (2008) and Kolawole *et al.* (2014) but in contrary to research by Pennap *et al.* (2009) were she reported no age preponderance within her target subject. IgM result also showed that all subjects with current infection are below age 30. The age distribution data also supports a fact that most women attain seropositivity before or during their childbearing age were the former could be safer than the later and also that the general immunity percentage to the virus increases as maternal age increases. This statement also conforms to Kolawole *et al.* (2014) about the deduction that the

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percentage of immune women increase with increased maternal age (Bukbuk *et al.*, 2002: Kolawole *et al.,* 2014).

According to data from subject's educational level, it can be concluded that the risk of infectivity increases as the educational level gets higher because contact rate also increases. The increased positivity within the primary and secondary level of education noticed can be linked to the well established fact about the low cleanliness level and self awareness nature common within the group. It was noticed that all subjects with tertiary level of education were positive to Rubella IgG which may be due to the contact at earlier stages of education or the crowdy settlement nature of most areas in Lokoja were they reside, this statement conforms to Adesina *et al.* (2008) were he reported that poor hygiene, overcrowding and poverty among other factors could increase spread and outcome of Rubella viral infection in our locality. In addition, there was no significant statistical difference between the tertiary and primary level of education and this conforms partly to a recent study by Kolawole *et al.* (2014) on seroprevalence of Rubella IgG in pregnant women in Oshogbo which reported no significant statistical difference level of education of test subjects. A significant statistical difference was recorded in the occupational group of subjects were those involved in one form of trade or the other (business women or merchant) had highest Rub-IgG result. This difference noticed could be attributed to uneven exposure to environment due to their occupation.

In general, deduction from parity status of subjects showed high overall immunity in both groups, 97.9% immunity was recorded in the parous group while 94.4% immunity was noticed amidst the nulliparous group and this is in line with the earlier quoted statement from Kolawole *et al.* (2014) and also to a statement from a research by Onakewhor and Chiwuzie (2011) that deduced that nulliparous women are more likely to have rubella infection than parous ones.

It can be suggested that younger women at childbearing age that are multigravid could attain immunity faster than their nulliparous age group and likewise older women could have attained immunity and still be nulliparous due to exposure to the virus by other means rather than child birth or pregnancy. This is supported by 4 subjects amidst the nulliparous group with age 36-40 that tested positive to Rubella IgG. It was also noticed that been nulliparous doesn't confer or guarantee immunity to Rubella virus because most immunity to the virus had been acquired at early age, mostly earlier than childbearing age. This conforms to a study by Kolawole *et al.* (2014), Lawn, (2000) and another study by Sallam *et al.* (2003) to determine the prevalence of rubella antibodies and age of exposure to rubella among 323 Yemeni schoolgirls of age 11-21 years; he reported 91.64% rubella IgG antibody sero-positivity, indicating that a majority of the girls were naturally immune by age 11-21 years. Cross tabulation of Rubella IgG & IgM status with number of children of subjects deduced that multigravidity only increases chances of contact with environment and thus acquisition of immunity along the line after exposure to the virus not that increase in children number confers a special immunity.

CONCLUSIONS

Rubella virus is most certainly present in this location and continuous localized transmission is inevitable and thus in support to other researchers, it's imperative for Nigerian government to add Rubella vaccination to her immunization policy to cull the virus once and for all like other countries and protect the rest population that are at the mercy of the virus because it is not of strange event were virus undergoes mutation and becomes more virulent and resistant due to the different host immunity reactions to the invading antigen and the continuous localized transmission within the society

Conflict of Interest
Conflict of interest none declared.

REFERENCE

Agbede, O.O., Adeyemi, O.O., Olatiwo, A.W.O., Salisu, T.J., Kolawole, O.M. (2011). Seroprevalence of antenatal rubella in UITH. *The Open Public Health Journal* 4:10-6.

Araoye, M.O. (2004). Research methodology with statistics for health and social science. Sample size determination. *Nathadex publishers*; p. 118-21.

Adesina, O.A., Adeniji, J.A., Adeoti, M.O. (2008). Rubella IgG antibody in women of child-bearing age in Oyo State. *African Journal of Clinical and Experimental Microbiology* 9(2): 78-81.

Babalola, O.E., Babalola, B.I. (2004). Congenital eye diseases in Abuja, Nigeria. *Nigerian Journal of Ophthalmologists* 12(2): 46-49.

Bamgboye, A.E., Afolabi, K.A., Esumeh, F.I., Enweani I.B. (2004). Prevalence of rubella antibody in pregnant women in Ibadan, Nigeria. *West African Journal of Medicine* 23: 245-8.

Bellini, W., Icenogle, J. (2007). Measles and rubella virus. In. Murray P, Baron E eds. Manual of Clinical Microbiology. 9th ed. *Washington DC: ASM Press*; p. 1378-91.

Bukbuk, D.N., EL-Nafaty, A.U., Obed, J.Y. (2002). Prevalence of rubella-specific IgG antibody in non-immunized pregnant women in Maiduguri, North Eastern Nigeria. *Central European Journal of Public Health* 10(1-2): 21-3.

Ching-Chiang, L., Chun-Yuh, T.Y., Ching-Tang, S., Bai-Hsiun., Yeou-Lih, H. (2010). Rubella Sero epidemiology and Catch-up Immunization among Pregnant Women in Taiwan: Comparison between Women Born in Taiwan and Immigrants from Six Countries in Asia. *American Journal of Tropical Medicine and Hygiene* 82(1):40-44.

Clarke, W.L. (1980). Epidemiological studies of rubella virus in a tropical African Community. *Bulletin of the World Health Organization* 58: 931-935.

Geo, F.B, Janet, S.B., Stephen, A.M. (2004). Rubella. International edition, *McGraw-Hill Companies, Asia* 23: pp. 566–568.

Kolawole, O.M., Anjorin, E.O., Adekanle, D.A., Kolawole, C.F., Durowade, K.A. (2014). Seroprevalence of Rubella IgG antibody in pregnant women in Osogbo, Nigeria. *International Journal of Preventive Medicine* 5: 287-292.

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Sci. Technol. Arts Res. J., Jan-March 2015, 4(1): 129-133

Lawn, J.E. (2000). Unseen Blindness, Unheard deafness, and unrecorded death and disability: Congenital rubella in Kumasi Ghana. *American Journal of Public Health* 90(15): 55–61.

Mehta, N.M., Thomas, R.M. (2002). Antenatal screening for rubella-infection or immunity? *BMJ* 325: 90-1.

Obijimi, T.O., Ajetomobi, A.B., Sule, W.F., Oluwayelu, D.O. (2013). Prevalence of rubella virus-specific immunoglobulin-g and -m in pregnant women attending two tertiary hospitals in Southwestern Nigeria. *African Journal of Clinical and Experimental Microbiology* 14(3): 134-139.

Onakewhor, J.U., Chiwuzie, J. (2011). Seroprevalence survey of rubella infection in pregnancy at the University of Benin Teaching Hospital, Benin City, Nigeria. *Nigerian Journal of Clinical Practice* 14:140-145.

Onyenekwe, C.C., Kehinde-Agbeyangi, T.A., Ofor, U.S., Arinola, O.G. (2000). Prevalence of rubella-IgG antibody in women of childbearing age in Lagos, Nigeria. *West African Journal of Medicine* 19(1): 23-6.

Otaigbe, B.E., Brown, T., Esu, R. (2006). Confirmed congenital rubella syndrome--A case report. *Nigerian Journal of Medicine* 15(4): 448-450.

Pennap, G., Amauche, G., Ajoge, H., Gabadi, S., Agwale, S., Forbi, J. (2009). Serologic survey of specific Rubella virus IgM in the sera of pregnant women in Makurdi, Benue State, Nigeria. *African Journal of Reproductive Health* 13: 69-73

Sallam, T.A., Raja'a, Y.A., Benbrake, M.S., Alshaibani, K.S., Al-Habani, A.A. (2003). Prevalence of Rubella Antibodies among school girls in Sana'a, Republic of Yemen. *Eastern Mediterranean Health Journal* 12: 1-4.

Vijayalakshmi, P., Anuradha, R., Prakash, K., Narendran, K., Ravindran, M. (2004). Rubella Sero-surveys at three Aravid Eye Hospitbbbals in Tamil Nadu, India. *Bulletin of World Health Organization* 82: 259-264.

Wolinsky, J.S., Knipe, D.M. (1996). Rubella in Fields 'Virology, ed. by Fields, Philadelphia, *Lippen Cott-Raven*. pp. 899–929.

World Health Organization (2000). Rubella vaccines. WHO position paper; *Wkly Epidemiological Records* 75: 161-975:161-9.

World Health Organization (1999). World Health Organization report on Infectious Disease: Removing Obstacles to Healthy Development. WHO Report on Infectious Diseases.