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Seroprevalence and Risk Factors Of Cytomegalovirus and Rubella Virus Infections amongst Pregnant Women Attending Some Hospitals in Maiduguri Metropolis, Nigeria

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Abstract

This study was designed to determine the seroprevalence of CMV and Rubella virus infections in pregnant women attending antenatal clinics in Maiduguri Nigeria and to identify possible risk factors associated with the transmission and spread of the two diseases using ELISA tests and a structured questionnaire. A total number of 300 blood samples from pregnant women was collected to detect IgM and IgG antibodies against the two viruses .An overall CMV and Rubella virus seroprevalence of 40% and 18.7% respectively was observed among the pregnant women in the study area. Distribution of the positive samples in the different hospitals showed CMV has 14.3 % IgG at UMTH (University of Maiduguri Teaching Hospital) while Rubella virus IgG seroprevalence was 8.7% in state specialist hospital ($p<0.05$). Also, CMV has 2.3% IgM, 35.0% IgG and 3.0% mixed IgM and IgG antibody classes, while Rubella virus seroprevalence showed 8.3% IgM, 6.7% IgG and 3.7% mixed IgM and IgG antibody classes. A significant difference ($p<0.05$) was observed in the IgM and IgG prevalence of CMV alone and CMV and rubella virus concurrent infections. The age distribution of CMV IgM and Rubella IgG showed a gradual decrease in prevalence with increase in age of the subjects. Significantly higher ($p<0.05$) rubella virus IgM (25.9%) was noted among the 25 - <35 years age bracket. There was a significant difference ($p<0.05$) in the distribution of CMV and Rubella virus infections in the different trimesters among the pregnant women in the study area. The CMV and Rubella virus IgM were higher (4.3% and 23.4% respectively) in the second trimester of pregnancy. There was no statistically significant difference ($p>0.05$) in the prevalence of the two viruses with respect to either educational level of occupation of the subjects under study. Using binary regression model, educational levels for CMV and pregnancy stage and educational levels for Rubella were observed as possible risk factors associated with infections of the two viruses. This study has shown evidence that CMV and Rubella viruses are still in circulation amongst pregnant women

in Maiduguri Metropolis. Therefore, there is the need for preventive and control measures to reduce the spread and transmission of the two diseases in the study area.

Key words: rubella virus infection. Risk factor, cytomegalo virus, seroprevalence, pregnant women, some hospital in Maiduguri, Nigeria

Introduction

Maternal Cytomegalovirus (CMV) is the commonest viral infection observed in prenatal period and it is the leading cause of congenital CMV infection resulting in a permanent hearing, vision loss and neurological impairment amongst infants at birth (Alford *et al*., 1990). Cytomegalovirus (CMV), a member of the subfamily *betaherpesvirinae* in the family *herpesviridae*; is known as Human *herpesvirus* v (HHV-5). The name means "*cell very big virus*" (Manicklal *et al*., 2013).The virus has a characteristic ability to remain dormant within the body system over a long period, hence the ability to establish latent infections. Initial CMV infection, which may have few symptoms, is always followed by a prolonged, in apparent infection during which the virus resides in cells without causing detectable damage or clinical illness (Cannon *et al*., 2010). *Rubella virus* infection is caused by a member of the family *togaviridae* and the only member of the genus *Rubivirus* and humans are the only known natural host, it is commonly known as 'German measles' . The name is derived from a Latin word meaning little red and was coined by German physician in the mid eighteen century (Lee and Bowden, 2000). The virus has a positive stranded(+tve RNA) genome and a glycolipid envelope.This disease is often mild and attacks often pass unnoticed. The diseases can last one to three days hence the term '3-day's measles'. Children recover more quickly than adults. Infection of the mother by *Rubella virus* during pregnancy can be serious if the mother is infected within the first 20 weeks of pregnancy, the child may be born with *Congenital Rubella Syndrome* (CRS), which entails a range of serious incurable illnesses. Spontaneous abortion occurs in up to 20% of cases (Souza *et al.*, 2010). The major public health concern by Rubella is its teratogenicity, with maternal infection early in pregnancy leading to the congenital Rubella syndrome (CRS) in infants (Haas *et al*., 2005).Primary CMV infection occurs in 0.15 to 2.0% of all pregnancies and may be transmitted to the fetus in up to 40% of cases resulting in symptomatic congenital disease at birth, and 10 to 15% of those born with asymptomatic congenital CMV will develop significant clinical sequelae in infancy (Stagno *et al*.,1986).Rubella infection is a common cause of exanthamatous disease predominantly of

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childhood and its importance in public health relates to the teratogenic effects in pregnant women (Hermann, 1980).The risk of congenital malformations in the fetus is up to 90%, in case of primary Rubella infection during the first trimester of pregnancy.Congenital Rubella syndrome has been associated with congenital, deafness, mental retardation and cardiac defects (Best and Banatvalaj,2004). The risk of fetal transmission is 30% to 40% in pregnancies following primary maternal infection, whereas this ratio is less than 2% after recurrent maternal CMV infection (Stagno *et al.,* 1986). Intrauterine damage caused by CMV is more severe in infections occurring during the first half of pregnancy. CMV infection frequently causes sensor neural hearing loss and mental retardation (Wong *et al.,* 2000).In Nigeria there have been few studies on Rubella infection and available studies shows that Nigerians lack Rubella immunity (Onyenekwe *et al.*,2000) as compared to the 95% immunity in developed countries (Ukkonem and Borsdonff,1988). The seroprevalence of CMV have been reported among pregnant women in Nigeria (Akinbami *et al.*,2011). Most healthy people who acquire CMV after birth experience few or no symptoms and no long-term sequelae. Some experience a mononucleosis-like syndrome with symptoms including malaise, persistent fever, myalgia, cervical lymphadenopathy and less commonly, pneumonia and hepatitis after the primary infection (Nelson *et al.,* 1995). The virus becomes dormant and exists in a latent state from which it can be reactivated, leading to recurrent (secondary) infection. In addition, there seem to be several strains of CMV that infect humans, so reinfection can occur even in immunocompetent individuals (Buxmann *et al.,* 2009). Therefore, secondary infection defined as intermittent excretion of the virus in the presence of host immunity may be due to either reactivation of an endogenous virus or exposure to a new virus strain from an exogenous source. Differentiation between these two kinds of secondary infection is not possible by serology but only by molecular analysis of virus isolates (Kimberlin *et al.,* 2008). Seroconversion occurs in 1% to 4% of all pregnancies and is higher in women who are of low socioeconomic status or who have poor personal hygiene. CMV still remains a major public health in sub-saharan Africa, particularly in Nigeria, where viral diagnostics suffer a serious setback. However, there is currently a periodic national survey for CMV among Nigerian population, but yet no vaccine is available hence individuals especially pregnant women and children are at high risk of contracting the disease on the other hand *Rubella virus* also pose an important public health problem because of its frequency and association of congenital abnormalities, primary maternal infections during pregnancy are responsible for cases of rubella congenital syndrome, therefore this study is designed to determine the seroprevalence, socio - demographic and possible risk factors associated with the transmission and spread of CMV and *Rubella virus* infection in the study area which does not exist.

Materials and Methods

This study was carried out in Maiduguri the capital of Borno State and a commercial nerve centre in the Northeast region of Nigeria. It lies between latitude 11^0 51"N and longitude 30^0 05"E at an altitude of 345 meters above the sea level (Gisilambe, 1990). Three hospitals used were University of Maiduguri Teachin8g Hospitalwhich has a 560 bed capacity established in 1979, Nursing Home of a200 bed capacity built in 1959 and the State Specialist Hospital (General Mamman Shuwa Memorial Hospital)a 500 bed capacity hospital commissioned since 1964(Borno State Hospital Management Board Bulletin, BSHMBB, 2010).

Study population and sample size determination

Pregnant women numbering three hundred (300) that were visiting the three hospitals of University of Maiduguri Teaching Hospital, General Mammam Shuwa Memorial Hospital, and State specialist Hospital, were enrolled into the study from Oct 2014 to Jan 2015.

The sample seize was obtained using the formula for sample size calculation =n/(1-(1/population size)), where $n=Z^2pq/d^2$n= number of pregnant women blood sample required in the survey, Z= normal standard deviation at 1.96, (which corresponds to 95% confidence interval), p= prevalence of CMV and *Rubella virus* in pregnant women in Maiduguri, which for this study shall be taken at 79.1% for CMV (Babayo *et al*., 2014) for *Rubella virus* p=97.9% (Mohammed *et al*., 2010). q= 1-p and d= degree of accuracy which was taken as 0.05 for this study (Naing *et al.*, 2006). $\frac{z^2p(1-p)}{d^2}$

Sample size for CMV = $\frac{3.84 \times 0.791 \times (0.209)}{0.0025} = 253$

Sample size for Rubella = $\frac{(1.96)^2 \times 0.979 \times (0.021)}{(0.05)^2} = 32$

The least number of samples to be collected for the study was calculated to be 253 (for CMV) and 32 (for Rubella), hence three hundred (300) samples were collected for the study.140 samples from UMTH, 70 samples from Manman Shuwa and 90 from State Specialist.

Sample collection and processing

Blood

Blood samples of three hundred pregnant women (from the three hospitals) were collected from October 2014 – January – 2015 using a 5 ml sterile syringe. Blood was collected by applying soft pressure to enable the vein to be felt and seen. The site was cleaned using methylated spirit and allowed to air dry for sterility.The needle was inserted to the selected straight vein with the bevel of the needle directed upward in the line of the vein. Slowly, the plunger of the syringe was withdrawn until 5ml of blood obtained. The tourniquet was loosed and the needle removed from the punctured vein. Pressure was applied to the punctured vein to secure haemostasis. The needle was removed from the syringe and the blood transferred into a clean, dry and well labeled plain vacutainer tube. The blood samples were centrifuged at 1500rpm for five minutes and the sera

collected into a clean and dry plain cryo-tubes using clean and dry pasteur pipettes and stored at -20^{o}C until needed for analysis.

Serology

Enzyme linked immunosorbent Assays(ELISAs)DRG® CMV IgM /IgG(EIA)-1797), Axiom anti –RV IgG produced by Axiom diagnostics Germany and DRG Rubella IgM (DRG- Intl USA) were used to assay for both specific IgM/IgG antibodies against CMV and *Rubella virus*es. Manufacturers' instruction were duly followed

Principle of ELISA

The serum to be tested is added to the already purified CMV antigen coated micro-plates and incubated for a short time. If specific antibodies are present, they bind to the antigen. To detect the antigen antibody reaction, the ELISA uses anti-HGG (antibody that reacts with any human immunoglobulins) chemically coupled with an enzyme label such as peroxidase. This binds to the test antibody, excess labeled anti-HGG is washed away, and chromogen is added. Chromogen is a colourless substrate that produces a coloured end product when acted on by an enzyme such as peroxidase. This colour changes can be measured quantitatively using OD values generated by spectrophotometry and is directly related to the amount of antibody bound (Nester *et al.*, 2004).

Assay Procedure for CMV

The plates for the CMV antibody ELISA (DRG® CMV IgM /IgG(EIA)-1797), Axiom anti –RV IgG produced by Axiom diagnostics Germany and DRG Rubella IgM (DRG- Intl USA) Batch No 70831 with expiration date Dec. 2015) were supplied pre-coated with purified CMV Antigen. Diluted sera were added to the wells, and the CMV IgM and IgG specific antibodies, if present, binds to the antigen. All unbound materials were washed away. Horse Reddish Peroxidase (HRP) conjugate which binds to the antibody-antigen complex was then added. Excess HRP-conjugate was washed off and a solution of TMB added. The enzyme conjugate catalytic reaction was stopped at 20 mins. The intensity of the colour generated in the sample was proportional to the amount of virus specific-antibody (IgM or IgG) in the samples. The results were read by a microwell reader and compared in a parallel manner with calibrator and controls at 450nm.

Reagents:

CMV: Materials provided with the kit

Data Analysis

Data obtained from the study was analyzed using SPSS statistical software version 20.0 chi-square.

Results

The results of seroprevalence of cytomegalovirus (CMV) and *Rubella virus* among pregnant women attending some hospitals in Maiduguri are presented in tables 4.1 and 4.2. An overall

seroprevalence of 40.3% and 18.7% were observed for the CMV and *Rubella virus* respectively (Table 4.1). Distribution of thesero-positives showed CMV IgM antibody only of 2.3%, IgG only 35.0%, and concurrent IgM and IgG of 3.0%; while the *Rubella virus* has IgM only of 8.3%, IgG only of 6.7% and concurrent IgM and IgG of 3.7%. A significant difference ($p<0.05$) was observed between the prevalence of the two viruses. No significant difference ($p>0.05$) was observed in the distribution of the Rubella antibody types among the pregnant women in this study. Table 4.2 showed the distribution of the viruses based on the hospitals in the study area. The occurrence of single or multiple infections with the two viruses showed CMV infection only has1.7% and 36.3% for IgM and IgG antibodies respectively and *Rubella virus* has9.3% and 7.0% IgM and IgG respectively, while concurrent CMV and *Rubella virus* has1.7% and 3.0% IgM and IgG antibodies respectively (Table 4.3). There was statistically significant difference ($p<0.05$) in the occurrence of CMV IgG as compared to Rubella IgG in the studied population.However ,there was no significant difference ($p>0.05$) observed in the occurrence of concurrent infections with the two viruses in terms of IgM and IgG antibody types even though a significant difference was observed between CMV and Rubella in terms of IgG.

Table 4.1: Seroprevalence of CMV and *Rubella virus* among pregnant women attending some hospitals in Maiduguri, Nigeria

Virus type	**No. tested**	**Total No. (%) pos.**	**IgM only (%) pos.**	**IgG only (%) pos.**	**IgM + IgG (%) pos.**
CMV	300	121 (40.3)	7 (2.3)	105 (35.0)	9 (3.0)
Rubella	300	56 (18.7)	25 (8.3)	20 (6.7)	11 (3.7)

$X^2 = 57.213$, df = 2, p-value = 0.001

Table 4.2 Distribution Of CMV And Rubella Viruses Of Pregnant Women With Respect To Various Hospitals.

Hospitals	No tested	CMV		RUBELLA	
		IgM	IgG	IgM	IgG

University of maiduguri teaching hospital	140	3(1.0)	43(14.3)[a]	15(5.0)	25(8.3)[a]
Mamman shuwa memorial hospital	70	2(0.7)	17(5.7)	6(2.0)	9(3.0)
State specialist hospital	90	2(0.7)26(8.7)[b]		14(4.7)15(5.0)[b]	

CMV: X^2= 0.0853 n= 92 df= 2

RUB: X^2= 0.662 n= 84 df= 2

Values with different superscripts in the same Colum are significantly different

Table 4.3: Distribution of single or multiple infections with CMV and *Rubella virus* among pregnant women attending some hospitals in Maiduguri, Nigeria

Antibody type	**No. tested**	**No. (%) pos. CMV only**	**No. (%) Pos. *Rubella virus* only**	**No. (%) Pos. CMV and *Rubella virus***
IgM	300	5 (1.7)	28(9.3)	5 (1.7)
IgG	300	109 (36.3)	21 (7.0)	9 (3.0)

X^2 = 36.217, df = 2, p-value = 0.001

The age distribution of CMV and Rubella antibodies among pregnant women attending some hospital in Maiduguri was presented in (Table 4.4). A gradual decrease in the seropositivity of CMV IgM prevalence with increase in age down the age brackets was observed (Table 4.4), whereas the CMV IgG was highest (63.5%) in the 25 - <35 years age group and thereafter decreased with increase in age. The highest (25.9%) Rubella IgM prevalence rate was observed in the 25 - <35 years age groups and the Rubella IgG prevalence rates showed a gradual decrease with increase in age of the studied subjects. A significant difference ($p<0.05$) was observed in the age distribution of the seroprevalence rates of the two viruses among the subjects tested in the study area. The elderly (45 years and above) have consistently exhibited lower seroprevalence to either viruses especially the IgG antibodies.

Table 4.4: Age distribution of CMV and *Rubella virus* infections among pregnant women attending some hospitals in Maiduguri, Nigeria.

Age group	No. Tested	No. (%) Pos. for CMV		No. (%) Pos. for Rubella	
		IgM	IgG	IgM	IgG
15 - <25	60	4 (6.7)	22 (36.7)	5 (8.3)	12 (20.0)
25 - <35	85	2 (2.4)	54 (63.5)[c]	22 (25.9)[d]	5 (5.9)
35 - <45	75	1 (1.3)	27 (36.0)	3 (4.0)	2 (2.7)
45 - <55	80	0 (0.0)	11 (13.8)	5 (6.3)	2 (2.5)

$X^2 = 28.249$, df = 9, p-value = 0.001

The distribution of CMV and *Rubella virus* prevalence rates among pregnant women of different trimesters is presented in (Table 4.5). Both CMV *Rubella virus* IgM prevalence ratesof 4.3%and 23.4% were observed in the second trimester. The *Rubella virus* IgG prevalence rates exhibited a gradual decrease from the first to the third trimester. There was significant difference ($p<0.05$) in the prevalence rates of the two viruses among the subjects under study with relation to the stage of the pregnancy.

Table 4.5: Distribution of CMV and *Rubella virus* prevalence among pregnant women at different stage of pregnancy in Maiduguri, Nigeria

Pregnancy stage	No. Tested	No. (%) Pos. for CMV		No. (%) Pos. for *Rubella virus*	
		IgM	IgG	IgM	IgG
First trimester	156	2 (1.3)	50 (32.1)[a]	8 (5.1)	14 (9.0)
Second trimester	94	4 (4.3)	40 (42.6)	22 (23.4)[b]	6 (6.4)
Third trimester	50	1 (2.0)	24 (48.0)	5 (10.0)	1 (2.0)

$X^2 = 28.506$, df = 6, p-value = 0.000

The distribution of CMV and *Rubella virus* seroprevalence among pregnant women of various educational levels attending some hospitals in Maiduguri, Nigeriais presented in table 4.6. No significant difference ($p<0.05$) was noted in the distribution of the two viruses based on the educational backgrounds of the pregnant women in this study. The distribution of CMV and *Rubella virus* seroprevalence based on occupation among pregnant women attending some hospitals in Maiduguri, Nigeria as presented in table 4.6 did not reveal any statistical significance ($p<0.05$).

Table 4.6: Distribution of CMV and *Rubella virus* seroprevalence among pregnant women of various educational levels attending some hospitals in Maiduguri, Nigeria

Educational level	**No. tested**	**No. (%) positive for CMV**		**No. (%) positive for *Rubella virus***	
		IgM	**IgG**	**IgM**	**IgG**
No formal Edu.	55	1 (1.8)	8 (14.5)	2 (3.6)	1 (1.8)
Primary	85	3 (3.5)	35 (41.2)	7 (8.2)	9 (10.6)
Secondary	102	2 (2.0)	49 (48.0)[a]	17 (16.7)[b]	5 (5.0)
Tertiary	58	1 (1.7)	22 (38.0)	9 (15.5)	6(10.3)

$X^2 = 7.699$, df = 9, p value = 0.565

Table 4.7: Distribution of CMV and *Rubella virus* seroprevalencebased on occupation among pregnant women attending some hospitals in Maiduguri, Nigeria

Occupation	**No. tested**	**No. (%) positive for CMV**		**No. (%) positive for *Rubella virus***	
		IgM	**IgG**	**IgM**	**IgG**
House wife	85	1 (1.2)	25 (29.4)	8 (9.4)	4 (4.7)
Trader	58	2 (3.4)	21 (36.2)	6(10.3)	6 (10.3)
Civil servant	105	3 (2.9)	45 (42.9)[a]	15(14.3)[b]	7 (6.7)
Farmer	52	1 (1.9)	23 (42.2)	6 (11.5)	4 (7.7)

$X^2 = 3.151$, df = 9, p value = 0.958

Table 4.8 presents binary logistic regression model of the possible risk factors associated with transmission and spread of CMV infection among pregnant women in this study. Analysis using the binary logistic regression model of the possible risk factors for CMV infection showed only the educational level (p= 0.010) of the pregnant women under study having significant association with susceptibility to CMV infection. Table 4.9 presents the analysis using the binary logistic regression model of the possible risk factors for *Rubella virus* infection showing pregnancy stage (p= 0.016) and educational level (0.001) of the pregnant women under study having significant association with susceptibility to *Rubella virus* infection.

Table 4.8: Variables associated with susceptibility to CMV using binary logistic regression model

Risk variables	**ODDS Ratio**	**95% CI**	**P-value**
Age	1.06	0.87 – 1.29	0.541
Pregnancy stage	1.32	0.98 – 1.78	0.068
Educational level	0.76	0.61 – 0.94	0.010*
Occupation	1.08	0.91 – 1.29	0.359

* MeanSignificant $p \leq 0.0$

Table 4.9: Variables associated with susceptibility to *Rubella virus* using binary logistic regression model

Risk variables	**ODDS Ratio**	**95% CI**	**P-value**
Age	1.06	0.87 – 1.40	0.687
Pregnancy stage	1.56	1.08 – 2.25	0.016*
Educational level	0.62	0.48 – 0.82	0.001*
Occupation	0.85	0.67 – 1.07	0.165

* Mean significant $p \leq 0.05$

Discussion

The prevalence of CMV and *Rubella virus* IgM and IgG antibodies among pregnant women attending some hospitals in Maiduguri, Nigeria was investigated using ELISA tests. It was observed that infections with the two viruses exist among the pregnant women in this environment. These two viruses are worldwide major public health concerns posed by adverse neonatal outcomes. Congenital intrauterine infections have been associated with poor pregnancy outcome ranging from spontaneous abortions, still births, congenital malformations, intrauterine growth restriction, fetal deaths, developmental delay and many other sequels that can be seen later in life. An overall CMV and *Rubella virus* seroprevalence of 40.3% and 18.7% respectively was observed among the pregnant women in the study area. This reveals that these subjects understudy are infected with the viruses. As women are not routinely vaccinated against the two viruses in the study area, the seroprevalence observed could only have arisen from natural infection. The CMV seroprevalence observed in this study is lower than the 96% reported by Emovan *et al.* (2013) among pregnant women in southern Nigeria, 96.2% in Minna Nigeria (Bawa, 2014). Also the *Rubella virus* seroprevalence observed in this study is lower than the 68.5% among pregnant women in Ibadan Nigeria (Bamgboye *et al*., 2004), 70.4% among pregnant women in Italy (Calimeri*et al*., 2012) and 92.2% reported in Iran (Soleimanjahi *et al*., 2005). Concurrent infections with the two viruses revealed 1.7% IgM and 3.0% IgG antibody prevalence rates. Kwofie *et al*. (2015) had earlier reported seroprevalence rate of multiple infections with CMV and *Rubella virus* of 29.2% among pregnant women in Ghana. The CMV antibodies detected were mostly of the IgG class with only 2.3% IgM and 3.0% concurrent IgG and IgM. This shows a low incidence of CMV infection among the women in the study area within the study period. The CMV IgG antibodies detected among pregnant women in this study is lower than the reported 91.1% in Kano (Hamid *et al*., 2014), 92% in Southern Nigeria (Emovon *et al*., 2013), 94.8% in Kaduna (Yeroh *et al*., 2015), 96.2% in Minna (Bawa 2014), 75% among HIV patients in Lagos (Olajimoke *et al*., 2014), 95.6% in Ghana (Kwofie *et al*., 2015), 97.5% in Sudan (Khairi *et al*., 2013), 97.3% in Turkey (Uyar *et al*., 2008) and 78.04% in Tanzania (Mirambo *et al*., 2016), 96% in Egypt (El-Nawawy *et al*., 1996), 98.1% in Korea (Seo *et al*., 2009), and 95.6% in China (Meng *et al*., 2011) . These differences could be due to geographical location, season and sociocultural background of the subjects studied. On the other hand the anti-CMV IgM of 2.3% is similar to the reports of 2.3% from Brazil (Souza *et al*., 2010), 2.6% in Minna, Nigeria (Bawa, 2014), 2.5% from Sudan (Hamdan *et al*., 2011) and

2.2% from Ilorin, Nigeria (Fowotade *et al*., 2013), but higher than the 1% in Sokoto, Nigeria (Saidu *et al*., 2015), 0.5% in Tanzania (Mirambo *et al*., 2016), 1% in Turkey (Uyar *et al*., 2008) and 1.7% in Korea (Seo *et al*., 2009) and lower than the 4% in Southern Nigeria (Emovon *et al*., 2013), 25% among HIV patients in Lagos (Olajimoke *et al*., 2014). Infected women are a critical group because the risk of congenital CMV infection was much higher during primary infection in the mother (Griffiths *et al*., 2001; Fowler and Boppana, 2006).This study revealed a low (18.7%) seroprevalence of *Rubella virus* infection with no significant difference in the IgG, IgM and IgG + IgM antibody classes among pregnant women in this study.A number of studies have reported *Rubella virus* seroprevalence of 54.1% in Nigerian (Bukbuk *et al*.,2002), 76% in Sri Lankan (Palihawadana*et al*.,2003), 77.5% in Russian (Odland*et al*., 2001), 95.2% In Haitian (Desinor *et al*.,2004), in Ghanian (Kwofie *et al*., 2015) and 93% in Eritrean (Tolfvenstam *et al*.,2000) pregnant women. Rubella seroprevalence of between 86.5% and 100.0% among pregnant women in Turkey has been reported over a five year period (Uyar*et al*., 2008). No plausible reason could be deduced as for the wide difference between the prevalence in the present study and those from other parts of the world. This is rather worrisome as the number of uninfected and level of infection among the pregnant women is high. This observed prevalence is lower than that reported in Ghana (Kwofie *et al*., 2015). The anti-Rubella IgM prevalence (9.3%) observed in this study is similar to the 10.7% observed among children with febrile illness and rashes in south-eastern Nigeria by Umeh and Onyi (2014); and 6.6% among pregnant women in Ghana (Kwofie*et al*., 2015), but higher than 3.4% reported by Hamdan *et al*. (2011) in Western Sudan. Also the IgG prevalence of 8.7% observed in this study is lower than the 65.3% (Hamdan *et al*., 2011) and 87.6% (Kwofie *et al*., 2015) reported among pregnant women in Sudan and Ghana respectively. High seroprevalence of *Rubella virus* infection amongst the pregnant women in this study may have serious consequences on children in the study area because immunity to Rubella in pregnant women can indirectly hint at the risk of acquiring congenital Rubella syndrome (CRS). The IgG + IgM antibody prevalence of 3.0% for CMV observed in this study is lower than the 38.5% reported for CMV among pregnant women in Ghana, but the 5.3% for *Rubella virus* is similar to the 6.7% in Ghana (Kwofie *et al*., 2015). This study indicates the magnitude of co-infection of CMV and *Rubella virus* with potential for congenital infection among pregnant women. The prevalence of co-infections of Rubella and CMV among pregnant women observed in this study is alarming considering the possible consequences as it relates to the severity of congenital anomalies. The prevalence of the two viruses appeared highest among the most active age group of 15 to 35 years. This agrees with the report of Koki *et al*. (2014) among pregnant women in Kano Nigeria; and that of Singh *et al*. (2004) on *Rubella virus* prevalence among pregnant women in India. This finding differed from the report of Emovon *et al*. (2013) who observed no difference in CMV immunity between age groups of pregnant women.

The anti-CMV IgG and IgM showed gradual decline with increase in age with the anti-CMV IgG appearing highest at 25 -<35 years age group. This disagrees with the findings of Olajumoke *et al*. (2014) who observed no statistical difference in seroprevalence of CMV and *Rubella virus* infections among the different age groups of HIV positive pregnant women in Lagos, Nigeria. These difference could be due to the difference in the health status of the different populations in the two studies, or may be due to either reactivation of the virus (CMV) or emergence of a variant strain. Anti-CMV and Anti-*Rubella virus* antibodies were detected in all the trimesters among the subjects under study. The active CMV infection (anti-CMV IgM antibodies) occurred more in the second trimester and IgG in the third trimester. This is contrary to the reports by Emovon*et al*. (2013) and Yeroh *et al*. (2014) who observed no statistical significance in the prevalence of CMV in all the three trimesters among pregnant women in parts of Nigeria.
The *Rubella virus* IgM antibodies was highest in the second trimester and the IgG in the first trimester. This is contrary to the report by Yahaya *et al*. (2015) that showed *Rubella virus* IgM to be highest in the third trimester among pregnant women in Kano. If Rubella is contracted within the first trimester of pregnancy, it can infect the fetus and cause CRS. The level of education attended by the subjects under this study is shown to have a significant association with susceptibility to CMV infection. Also the stage of pregnancy and level of education of the subjects in this study are observed to have statistically significant association with susceptibility to *Rubella virus* infection.The occupation of the pregnant womenfrom the results obtained on the occurrence and distribution of CMV and *Rubella virus* has no bearing to infectivity. Binary regression model analysisof the data showed that the educational level of the pregnant women was a significant risk factor for CMV infection and this may be associated with the route of transmission of the two viruses. Also the education level and stage of pregnancy of the pregnant women were a significant risk factor for *Rubella virus* infection which may also be related to the mode of spread of the virus or lack of routine vaccination by all pregnant women.

Conclusion

The present study has demonstrated low prevalence of *Rubella virus* (18.7%) and CMV (40.3%) antibodies (IgM and IgG) among pregnant women attending some hospitals in Maiduguri, Nigeria. Infections with the two viruses and co-infections were observed among the study subjects. This indicates the possible persistence and risk of transmission of such infections to children. Infections with the two viruses were observed more in the second trimester and there is need for taking preventive measures based on the associated risk factors to reduce the spread. Level of education (CMV) and stage of pregnancy (*Rubella virus*) were two risk factors found to be associated with infections of the two viruses.

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