



## Seroprevalence of Cytomegalovirus infection among pregnant women in some selected hospitals in Lokoja Metropolis, Kogi State, Nigeria

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### ABSTRACT

Cytomegalovirus is one of the most common viruses which causes congenital defects in babies from infected mothers. Sensorineural hearing loss (SNHL) and neurodevelopmental delay are typical occurrences in childhood resulting from congenital defects which presents no symptoms at birth. The aim of this study was to determine the cytomegalovirus IgM infection among pregnant women attending antenatal clinics at KSSH and FMC in Lokoja metropolis, Kogi State, Nigeria. A total of 184 serum samples were collected and analyzed using CMV IgM ELISA kit diagnostic Automation, INC (USA). The study revealed that out of the 184 samples collected, 40 turned out positive for CMV IgM antibodies giving a prevalence of 21.7% while the negative sample result had a prevalence of 78.3%. a total of 92 samples each was collected from both hospitals; KSSH had 30 CMV IgM positive samples having a percentage 32.6% and FMC with 10 CMV IgM having a percentage of 10.86%. Based on the research, there was no significant association between the risk factors such as marital status, type of marriage, occupation and scarification related to the infection. This could be due to the limited number in sample size. Other socio-economic factors that had statistical significant  $p$  value with the infection were education (0.035), hand wash (0.027) and previous history of blood transfusion (0.003). The study has shown the need for sensitization of the populace especially to pregnant women, the need for constant and proper personal hygienic practices be done to reduce the risk of infection and possibly stop its transmission to fetus. In addition, inclusion of screening for cytomegalovirus antibodies among blood donors may be useful tool in preventing transmission of cytomegalovirus to blood recipients.

**Keywords:** Cytomegalovirus, Congenital defects, Seroprevalence, Antibodies

### Introduction

Cytomegalovirus (CMV) as derived from these Greek words “cyto” meaning cell and “megalo” meaning large. Cytomegalovirus is also known as the Human Herpes virus 5(HHV-5) that belongs to Herpesviridae and subfamily Betaherpesvirinae

which also includes the genera *Muromegalovirus* and *Roseolovirus* (HHV- 6 and HHV -7) (Staras *et al.*, 2006, Al.Baiati *et al.*, 2014, Musa *et al.*, 2014). All herpesviruses have a shared characteristic ability of exhibiting latency within the body over time, although they may be found throughout the human body (Moore *et al.*, 2007). Human cytomegalovirus (HCMV) infects more than 80%

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of the general population and up to 100% within some populations and/or geographic areas (Astegiano *et al.*, 2010, Yeroh *et al.*, 2014, Fowotade *et al.*, 2015 and Winter *et al.*, 2020). CMV infection is common over age 35 years and most people are exposed to CMV early in life and do not realize it because they are asymptomatic (Fowotade *et al.*, 2015).

Cytomegalovirus (CMV) is a ubiquitous herpes virus that generally causes asymptomatic or mildly symptomatic infections in immunocompetent hosts. In contrast, the CMV infection in immunocompromised patients carries high morbidity and mortality (Springer and Weinberg, 2004). All herpes viruses share a characteristic ability to remain latent within the body over a long period (Ryan and Ray, 2004, Musa *et al.*, 2014). Pregnant women infected for the first time with cytomegalovirus are likely to transmit the virus to their fetus (Hameed and Azeez, 2015). Nigeria is contends with inadequate funding in the health sector and managing conditions such as congenital CMV disease is an issue, hence the need to investigate the IgM level with a view to guiding policy makers and educating pregnant mothers on ways of preventing infection to reduce birth of otherwise helpless children (Hamid *et al.*, 2014).

Therefore, in view of this, the information gotten will instigate relevant bodies in the State health sector to educate the populace on the need to take precautionary methods against contracting the virus and managing its treatment in the case of an infection and if necessary, include it in the routine test screening for pregnant women.

## Materials and Methods

### The Study Area

The study was conducted in Lokoja, the State capital of Kogi State, Nigeria. Its coordinates are situated between latitude 7° 49' N and longitude 6° 45' E. It has a landmass area of 3,180km<sup>2</sup> with a

population of 195,261 at the 2006 census (Onuigbo *et al.*, 2017).

### Study Population

The study population were pregnant women attending antenatal clinics of both hospitals who consented to the use of their blood samples for the study.

### Study Design

The study design was laboratory based and cross sectional where equal number of blood samples (92 each) was collected from the population of consenting pregnant women attending the antenatal classes from each selected hospitals using simple random sampling technique. Ethical approval was obtained from Kogi State's Ministry of Health as well as Kogi State Specialist Hospital (KSSH) and Federal Medical Centre (FMC) Lokoja. A structured questionnaire was administered to each consenting pregnant woman in order to obtain the sociodemographic and possible risk factors relating to the infection. The selection of the hospitals were done based on the location and being a general hospital where there is an influx of patients seeking antenatal services from within and around the environs of Lokoja metropolis. The study was private -sponsored.

### Sample Size

The sample size was determined using a prevalence of 10.5% as obtained from Edward *et al.*, 2015 using the formula;  $N = z^2Pq/d^2$  (Naing *et al.*, 2008). The calculated sample size was 144.40. However, 184 blood samples were collected to obtain an increased chance of positivity for the assay.

### Collection of Sample and Processing

One hundred and eighty four samples was obtained from consenting pregnant women who met the criteria of being pregnant and attending antenatal classes at the selected hospitals. A three-milliliter (3ml) of whole blood was collected from each consenting pregnant woman by venipuncture into

sterile anticoagulant-free plain bottles by a qualified and certified Medical Laboratory personnel. Each respondent's arm was first swabbed with 70% alcohol and blood collected was transferred into sterile anticoagulant-free bottle or plain bottle to clot. The clotted blood sample was centrifuged at 3,000 rpm for five (5) minutes, and the serum (the supernatant) was transferred using micropipettes into microtubes and stored at -20°C until required for use.

### ***Processing of the Sample***

The serum sample was tested for CMV-specific IgM antibodies using IgM ELISA kit Diagnostic Automation, INC (USA). All the samples, reagents and calibrators were brought to room temperature at 25°C an hour before the test for thawing to take place. The ELISA assay test was run as specified by the manufacturer's instructions using the manual. The optical density was read at 450nm with microtitre plate using the ELISA reader within 10 minutes. The cut-off optical density (O.D) obtained was in accordance with the manufacturer's instructions. The CMV index of the samples was calculated by dividing the O.D value of each of the samples (S) with the obtained Cut-off O.D value (C.OD).

### ***S/C.OD Interpretation***

CMV index of < 0.90 reads Negative

CMV index of 1.0 and above reads Positive

### ***Data Analysis***

Data obtained from the questionnaires were analysed using SPSS version 20 and the Pearson chi-square test was to test the level of significance in the occurrence of cytomegalovirus and other variables. The level of significance was at 0.05 level.

## **Results**

One hundred and eighty four (184) blood samples were collected from the selected hospitals in which ninety-two (92) blood samples were obtained from each hospital. From KSSH, thirty (30) samples were positive for ELISA IgM while ten (10) samples were positive for ELISA IgM from FMC. The over all seroprevalence of IgM obtained from the study area among the study population was 21.7%. Table 1 presented the categorized ages as a risk factor in obtaining CMV and it presented the respective percentage as obtained. Among the 184 pregnant women sample examined, percentage positivity was given as 15.63%, 23.08%, 23.53% and 0% for the age ranges (15-24, 25-34, 35-44 and 45-54) respectively. The *p* value was not statistically significant (*p* = 0.7607) hence there was no significant relationship between age as a risk factor and CMV IgM infection among the participants in this study.

The study showed no significant difference between the infection and marital status (*p* = 1.000), type of marriage (*p* = 0.325) and scarification (*p* = 0.653). However, the study established a 100% prevalence among participants with primary education and a 40% prevalence with those who have an informal education while those with tertiary education had a prevalence of 18.2%. The *p* value was however significant for this category (*p* = 0.035). For the occupational status category, the unemployed group presented a 30% prevalence while the self - employed and civil - servant groups had a 26.2% and 13.1% prevalence respectively. The *p* value was not statistically significant (*p* = 0.138).

Based on the research studies, a large significant proportion of the participants had no knowledge of Cytomegalovirus before this study (176 participants) while only 8 participants had a vague knowledge of the virus bringing the percentage positivity to 22.2% and 12.5% respectively.

The percentage positivity of the group with first pregnancy had a 14.1% to those who answered “yes” while those who answered “no” had a 27.4% percentage positivity and thus with a significant  $p$  value of 0.046.

The analysis of CMV infection in relation to trimester for the study showed no significant difference ( $p = 0.814$ ). The pregnant women at the 3<sup>rd</sup> trimester showed the highest percentage positivity of 25% while 1<sup>st</sup> trimester showed 21.1% with the 2<sup>nd</sup> trimester having the lowest positivity percentage of 19.1%. This is shown in table 2.

The pregnant women having toddlers had a 25.6% while those who did not have toddlers had 18.4% positivity. Mothers who gave birth to babies who were deformed had a 100% prevalence as compared to mothers who did not have deformed babies. There was a significant  $p$  value of 0.045.

The pregnant women who practiced frequent hand wash after using the toilet or after changing a toddler’s diaper had a lower percentage positivity value of 16.1% as compared to those who did not practice frequent hand wash with a prevalence of 30.6% thereby giving the  $p$  value to 0.027. The pregnant women who had undergone blood transfusion had a higher percentage positivity value of 57.1% as compared to those who did not have a blood transfusion with a value of 18.8%, thereby having a significant  $p$  value of 0.003.

The pregnant women who had an underlying disease of diabetes had a 0% positivity while those who did not have diabetes as an underlying disease had 21.9% positivity value. This difference was statistically not significant ( $p = 1.000$ ).

**Table 1:** The Seroprevalence of Cytomegalovirus with respect to age among pregnant women in Lokoja Metropolis, Nigeria

Age(years)	No. Examined	CMV Positive (%)	Degree of Freedom (df)	Chi Square	$p$ - value
15-24	32	5(15.63)	3	1.168	0.761
25-34	117	27(23.08)			
35-44	34	8(23.53)			
45-54	1	0(0)			
<b>Total</b>	184	40 (21.7)			

Key: df = degree of freedom \*  $p < 0.05$  is considered significant

**Table 2:** The Seroprevalence of Cytomegalovirus with respect to Educational status among Pregnant Women in Lokoja Metropolis, Nigeria.

Educational status	No. Examined	CMV Positive (%)	Degree of Freedom (df)	Chi Square	$p$ - value
Tertiary	148	27(18.2)	3	8.014	*0.035
Secondary	30	10(33.3)			
Primary	1	1(100.0)			
Informal	5	2((40.0)			
<b>Total</b>	184	40 (21.7)			

**Table 3:** The Seroprevalence of Cytomegalovirus with respect to some risk factors in relation with Pregnant Women in Lokoja Metropolis, Nigeria

Risk Factors	No. Examined	CMV Positive (%)	Degree of Freedom (df)	Chi Square	p- value	Odds Ratio
<b>Wash hands</b>						
Yes	112	18(16.1)	1	5.404	*0.027	0.435
No	72	22(30.6)				
<b>Undergone transfusion</b>						
Yes	14	8(57.1)	1	11.164	*0.003	5.750
No	170	32(18.8)				
<b>Diabetes patient</b>	1	0(0.0)	1		1.000	1.280
Yes	183	40(21.9)		0.279		
No						

## Discussion

From the study, the over all seroprevalence of CMV IgM in the study location was 21.7%. This shows that IgM antibodies is high among the pregnant women in the study location indicating an acute infection. This is higher in comparison to the study done by Kolo *et al.*, (2013) with a prevalence of 18%, Edward *et al.* (2015) who had a prevalence of 10.5%. and Ndako *et al.* (2016) with a prevalence of 18%. In effect, the seroprevalence from our study can be attributed to the fact that lower socio economic conditions and geographical locations has an increased effect of a high seroprevalence among the study population. In addition, there is an influx of pregnant women seeking antenatal services from within an around the study locations.

Sociodemographic and risk values from our study indicated that the age range of 35-44 years had the highest seroprevalence closely followed by the age range of 25-34 years this can be explained that both age ranges are individuals who are sexually matured and active individuals. This agreed with the works of Okwori *et al.*, (2008), Akinbami *et al.*, (2011), Yeroh *et al.*, (2015) and Umelo *et al.*, (2017).

Educational status was shown to be a risk factor as indicated from the studies, this is in agreement with the works of Umelo *et al.*, (2017) that individuals of low educational background are at a higher risk of contracting CMV due to lower enlightenment/awareness and inadequate/poor hygienic practices.

A significant association was shown between Cytomegalovirus infection and pregnant women in washing of hands as a risk factor, with a *p* value of 0.027. this can be explained that with higher hygienic practices such as hand washing especially in developing countries such as Nigeria will reduced the risk of women acquiring CMV IgM and transmitting it to their fetus which is in consonance with the works of Nasir *et al.*, (2016), Edward *et al.*, (2015) and Anuma and Umeora (2017).

There was an association with women who had a previous history of blood transfusion and the infection giving a significant *p* value of 0.003. The pregnant women with a previous history of blood transfusion were likely to be CMV IgM positive as screening for cytomegalovirus is not common especially in developing countries. Furthermore, Similar studies conducted by Akinbami *et al.* 2011, Nasir *et al.* 2015 and Prennap *et al.* 2016)

stated that, in an infected patient, CMV could be present in a latent state. Therefore, following blood transfusion, a seropositive blood donor can transmit the latent virus to the recipient and the latent virus is reactivated which may cause active CMV infection in the recipient.

There was no significant association between pregnant women having diabetes as an underlying disease condition and cytomegalovirus infection probably due to the limit of the sample size.

### Conclusion

This study has demonstrated from the overall seroprevalence obtained that, cytomegalovirus among pregnant women in Lokoja metropolis is present and the likelihood for transmission to the fetus is possible. It therefore calls for the need for sensitization of the populace especially to pregnant women, the need for constant and proper personal hygienic practices be done to reduce the risk of infection and possibly stop its transmission to fetus. Hence, the need for screening of pregnant women for CMV who come to register for antenatal class will enable early detection and proper management. Furthermore, inclusion of screening for cytomegalovirus antibodies among blood donors may be useful tool in preventing transmission of cytomegalovirus to blood recipients.

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### Conflict of Interest

None to declare

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