Nature and Science

Websites:
http://www.sciencepub.net/nature
http://www.sciencepub.net

Emails:
naturesciencej@gmail.com
editor@sciencepub.net

MARSLAND PRESS
Multidisciplinary Academic Journal Publisher

Human Cytomegalovirus Immunoglobulin G (IgG) Antibodies Among Females of Reproductive Age in Port Harcourt, Rivers State, Nigeria

*Okonko Iheanyi Omezuruike, Chinda Rosemary Ibuuchi, Tochi Ifeoma Cookey and Innocent-Adiele Hope Chioma

Virus Research Unit, Department of Microbiology, University of Port Harcourt, Choba, P.M.B. 5323, Port Harcourt, Rivers State, 500102 Nigeria.
*Corresponding author: Tel. +2348035380891, E-mail address: iheanyi.okonko@uniport.edu.ng

Abstract: The study aimed to determine the prevalence of cytomegalovirus immunoglobulin G (IgG) antibodies among females of reproductive age in Port Harcourt, Rivers State, Nigeria. Five millilitres of whole blood were collected from 100 participants. The serum anti-CMV IgG antibodies were assessed using a long incubation enzyme-linked immunosorbent assay (ELISA) kit. Of the 100 females of reproductive age recruited in this study, 91.0% were seropositive IgG antibodies. Age-specific CMV IgG seropositivity rate was highest (41.0%) among females aged 26-31 and least (4.0%) among those aged 38-42. The highest prevalence (97.0%) was observed in married women than in singles (3.0%). The prevalence of CMV IgG antibodies with occupation was highest (97.4%) among homemakers and least (66.7%) among professionals. The prevalence of CMV IgG antibody based on education was 55.0% for females with tertiary education and 36.0% for those with secondary education. The seroprevalence of CMV IgG antibodies in this study is high, underscoring the importance of continually adopting strategies to eliminate possible transmission of CMV through blood transfusion.
[Okonko Iheanyi Omezuruike, Chinda Rosemary Ibuuchi, Tochi Ifeoma Cookey and Innocent-Adiele Hope Chioma. **Human Cytomegalovirus Immunoglobulin G (IgG) Antibodies Among Females of Reproductive Age in Port Harcourt, Rivers State, Nigeria.** *Nat Sci* 2022;20(8):51-56]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature. 05. doi:10.7537/marsnsj200822.05.

Keywords: Cytomegalovirus, prevalence, female, blood donors, Port Harcourt

1.0 Introduction

Human cytomegalovirus (HCMV), also known as *human betaherpesvirus 5* (HHV-5), has become a public's primary health concern. HCMV has been established as one of the leading causes of mortality and morbidity in pregnancy and among immunocompromised patients like recipients of organ transplants, HIV-infected persons, cancer patients on therapy and neonates (Alao *et al.,* 2009). It is associated with hypertension and has been linked with the pathogenesis of increased arterial blood pressure (BP) (Li et al., 2017). Foetus infection usually occurs at the initial infection of the mother or reactivation and reinfection in HIV-positive or immunocompromised mothers (Sian *et al.,* 2005).

CMV is found worldwide and affects between 50% and 85% of all adults in the developed world by the age of 40 years (Fredrick *et al.,* 2005; Pass, 2001). The prevalence rate increases with age and decreasing socioeconomic status (Ahmed and Baltazar, 2005; Hilllayer *et al.,*2009; Pass, 2001). In immunocompetent individuals, CMV is not defeated by the immune system; instead, it remains latent for an extended period in leucocyte cells and becomes reactivated when the immune system is compromised. During this latent period, the virus can be transmitted to an unsuspecting recipient through blood or blood products (Brian and Tim, 2005). Before transfusion, CMV-safe blood or blood products are obtained from CMV seronegative individuals or leukoreduced blood products (Brian and Tim, 2005).

Transmission of CMV occurs in humans of every race, every socioeconomic status and all age groups around the world (Gaytant *et al.,* 2002; Yeroh *et al.,* 2015; Li et al., 2017). In Asia, Malaysia recorded 84.0% (Saraswathy *et al.,* 2001). So far, the highest IgG prevalence rate of CMV has been reported in Africa. For instance, Egypt and Western Sudan recorded 96.0% and 72.2%, respectively (Hamdan *et al.,* 2011). Similar studies in Lagos, Sokoto, Ebonyi and Bida (all in Nigeria) showed a CMV IgG rate of 98.7%, 97.2%, 11.3% and 84.2%, respectively (Ahmad *et al.,* 2011; Akinbami *et al.,* 2011; Okwori *et al.,*2008). Nevertheless, no such studies have been conducted in Rivers State, Nigeria. Thus, the study aimed to determine the prevalence of cytomegalovirus immunoglobulin g (IgG) antibodies among females of reproductive age in Port Harcourt, Rivers State, Nigeria.

2.0 Material and Methods

2.1 Study Area

This study was a cross-sectional study conducted between May 2013 and July 2013 among females of reproductive age presenting at Braithwaite Memorial Specialist Hospital (BMSH), now Rivers State University Teaching Hospital (RSUTH)). BMSH is located in the old Government Residential Area (old GRA) of Port Harcourt City Local Government Area of Rivers State, which comprises 21 wards. Port Harcourt lies 4.78^0N and 7.01^0E. The city is characterized by a moderate level of sanitation, improper waste management, moderate housing and potable water.

2.2 Study population and inclusion and exclusion criteria.

All females of reproductive age who presented to the General Outpatient (GOPD) clinic within the study period were consecutively recruited. Only those with normal blood pressure, pulse rate, body temperature, and haemoglobin level>12.5g/dl who were neither pregnant, menstruating, nor breastfeeding were enrolled. Like other parts of the world, commercial sex workers and individuals with a history of chronic illness and intravenous drug users, pregnant and breastfeeding women were excluded.

2.3 Sampling method.

Consecutive females of reproductive age who consented to participate in the study, aged 21-40 years, weighed more significant than 50 kg, with haemoglobin of 12.5g/dl for females, respectively, were recruited till a total of 100 samples was achieved.

2.4 Specimen collection

Approximately 5mls of whole blood were collected from 100 participants. Bio-data of participants were collected alongside the blood collection.

2.5 Serological analysis

Haemoglobin was estimated using hemocue Hb 301 haemoglobin meter. The serum anti-CMV IgG antibodies were assessed using long incubation enzyme-linked immunosorbent assay (ELISA) techniques. ELISA Kit (IgG for Cytomegalovirus) manufactured by DIA.PRO Diagnostic Bioprobes Srl Milano- Italy was used for this analysis following the manufacturer's instructions.

2.6 Data Analysis

Data were analyzed using Microsoft Excel 2019 version.

3.0 RESULT

A hundred females of reproductive age were recruited for this study. Table 1 shows the bio-data of the participants. The majority of the participants were within the age group of 26-30 (43) and 31-35 (35), with the lowest among ages 36-40 years (04). A total of 97 respondents were married, and 3 (3%) were single. Half of the respondents were traders (40%), and 3% were Artisans. All participants attained a level of education where 38% had secondary education as their highest level while 62% had Tertiary education.

Table 1: Demographical characteristics/ parameters of females of reproductive age

Parameters		No. tested	Percentage (%)
Age	21-25	18	**18**
	26-30	43	**43**
	31-35	35	**35**
	36-40	4	**4**
Marital status	Married	97	**97**
	Single	3	**3**
Occupation	Housewife	19	**19**
	Traders	40	**40**
	Students	15	**15**
	Civil servants	14	**14**
	Artisans	3	**3**
Educational status	No education	0	**0**
	Primary education	0	**0**
	Secondary education	38	**38**
	Tertiary education	62	**62**

3.1 Prevalence of CMV IgG antibody

A total of 100 blood samples were collected and examined for this study. Of the 100 blood samples tested for CMV IgG antibody, about 91 (91.0%) were positive, and 9 (9.0%) were negative, as shown in Table 2.

Table 2: Prevalence of CMV

Serology	Frequency	Percentage
CMV IgG positive	91	91
CMV IgG negative	9	9

3.2 Prevalence of CMV IgG antibody according to age

Figure 1 shows the prevalence of CMV IgG antibodies concerning age groups. Most females of reproductive age (43 out of 100) were within the age bracket of 26-31years, and the highest prevalence (41.0%) occurred in this age group. However, the lowest prevalence is 4.0%, as observed in 38-42years of age.

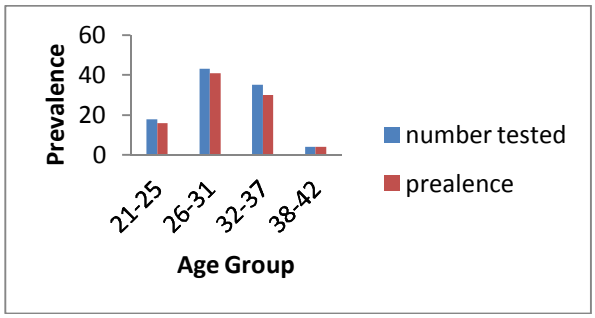

Fig. 1: Prevalence of CMV IgG antibody according to age

3.3 Prevalence of CMV IgG Antibody According to Marital Status

Figure 2 shows the prevalence of CMV IgG antibodies with marital status. The highest prevalence was observed at 97% in married women than in singles (3%).

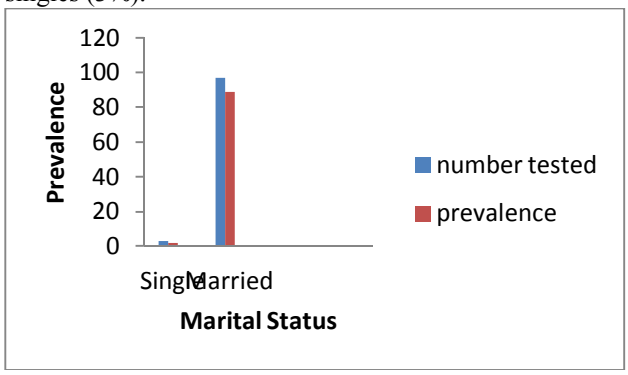

Fig 2: Prevalence of CMV IgG antibody according to marital status

3.4 Prevalence of CMV IgG Antibody According to Occupation

Figure 5 shows the prevalence of CMV IgG antibodies with occupation. It is shown that homemakers had the highest prevalence of 97.4%, while professionals had the lowest prevalence of 66.7%.

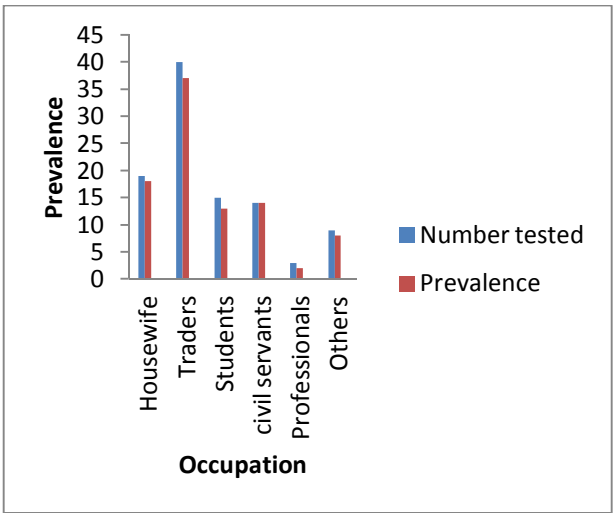

Fig. 3: Prevalence of CMV IgG Antibody According to Occupation

3.5 Seroprevalence of CMV IgG Antibody According to Educational Status

Regarding educational status, 91.0 were positive, and 7.0 were negative. It was observed that females with tertiary education had the highest prevalence of 55.0%, followed by 36.0% of females with Secondary education.

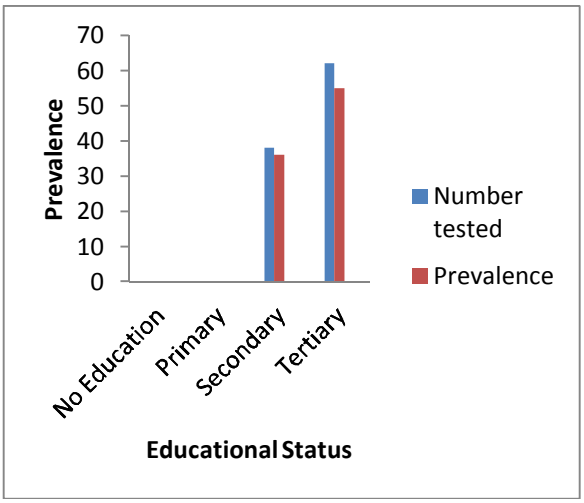

Fig 4: Prevalence of CMV IgG Antibody According to Educational Status

4.0 Discussion

The present study investigated the seroprevalence of IgG among females of reproductive age in Port Harcourt, Rivers State. The prevalence of CMV IgG in this study was 91.0%, which is high but consistent with values reported in other studies in Nigeria. In Edo State, Nigeria, the same region in which the present study was conducted, Ojide *et al*. (2012) reported a prevalence of 96.8% for CMV IgG antibodies. In southwest Nigeria, Bolarinwa *et al*. (2014) reported a 97.0% prevalence of CMV IgG among blood donors in Osun State, while Akinbami *et al.* (2011) found a CMV IgG rate of 98.7% among donors in Lagos State. In the North Western State of Sokoto IgG rate of 97.2% was reported (Ahmad *et al.* (2011). In the North Central State of Niger, 84.2% and 96.2% were reported in two separate studies in Bida and Minna, respectively (Okwori *et al.,* 2008; Bawa *et al*., 2019). This study's high prevalence further confirms that Africa has the highest CMV infection. For instance, studies in Kenya, Egypt and Sudan recorded 97.0%, 96.0% and 72.2%, respectively (Njeru *et al*., 2009; Hamdan *et al.,* 2011).

Some studies in India found seroprevalence as high as reported in Africa (Kothari *et al*., 2002; Chaudhari and Bindra, 2009). A study conducted in Brazil reported high seropositivity of 97.0% (Souza *et al*., 2010). Poor hygiene conditions facilitate the spread of CMV, as infants shed the virus through saliva and urine, which could be transmitted to adults (Uyar *et al*., 2008; Matos *et al.,* 2010).

High seroprevalence of CMV threatens blood safety and increases the chances of transfusion-transmitted CMV. It has been reported that in a population with 50% seroprevalence, the risk of transmission to the foetus can be very high (Rahav *et al*., 2007; Townsend *et al*., 2013; Muldoon et al., 2017). The risk of transmission of CMV through blood transfusion has been reduced by the introduction of leukocyte reduction of blood products before transmission (Abu-Nader and Patel, 2000; Ljungman, 2004; Cannon and Davis, 2005). This strategy substantially removes the potential for CMV infection. However, the transmission of seronegative blood is recommended for patients at risk of transfusion-transmitted CMV (Ziemann and Hennig, 2014).

Cytomegalovirus infection has been consistently linked with foetal and neonatal infections (Sian *et al*., 2005; Uyar *et al*., 2008). Although the present study did not survey pregnant women, it focused on women of childbearing age. The presence of high IgG within the population suggests a high chance of transmission from mother to child in the event of pregnancy. The highest prevalence (41.0%) occurred among subjects aged 25-31, followed by those aged 32-37 (30.0%), while the least occurred in those aged 38-42 (4.0%). This finding is similar to another study with the highest prevalence in ages 20-29 and least among older persons, although the study included both male and female subjects (Bawa *et al*. (2019). Contrary to our findings, Bolarinwa *et al*. (2014) reported that the likelihood of CMV infection is higher in females older than 35. Age is a significant factor in the prevalence of CMV, and cumulative exposure to the virus increases the prevalence with age (Cannon *et al*., 2010; Anoh et al., 2017).

All the females in this study had up to secondary school level of education. Females with a tertiary level of education had a higher CMV IgG prevalence (55.0%) compared to those with secondary education (36.0%). This difference in the two studies could be because of the subjects captured in this study which did not include those with educational qualifications below secondary school or without formal education. Contrary to the finding of this study, Bolarinwa et al. (2014) reported that donors with low educational status are more likely to be positive for CMV antibodies.

Bolarinwa *et al*. (2014) reported a high CMV rate among participants with low socioeconomic status. In this study, persons within the high-income bracket (professionals) had the least CMV rate of 66.7%, while homemakers had the highest (97.4%). In contrast to this study, Bawa *et al*. (2019) reported that persons of high-income level were more likely to have CMV infection.

All females of childbearing age risk having CMV infection during pregnancy (Cannon and Davis, 2005). Also, CMV IgG antibodies occurred in married (97.0%). This finding contrasts with Bolarinwa *et al*. (2014), who found the highest prevalence (96.4%) among singles and zero prevalence among married donors.

5.0 Conclusion

This study revealed a high seroprevalence of CMV IgG antibodies among females of reproductive age, thus, representing a very high rate in the general population. Proactive measures must be in place to limit possible transfusion-transmitted CMV, including transfusion of leukoreduced blood products and promoting a hygienic culture such as hand washing (Park et al., 2017) since no effective intervention exists for CMV.

References

[1]. Abu-Nader, R., Patel, R. Current Management Strategies for the Treatment and Prevention of Cytomegalovirus Infection in Solid Organ Transplant Recipients. BioDrugs 13, 159–175 (2000). https://doi.org/10.2165/00063030-200013030-00002

[2]. Ahmad, R.M., Kawo, A.H., Udeani, T.K.C., Manga, S.B., and Ibrahim, M.L. (2011). Seroprevalence of Cytomegalovirus antibodies in pregnant women attending two selected hospitals in Sokoto state, Northern Nigeria. *Bayero Journal of Pure and Applied Science*. 4: 63-66.

[3]. Ahmed, S.A. and Baltazar, G. (2005). Sentinel surveillance of HIV and STDs in Kenya. In: NASCOP and MOH report. 3: 16-35.

[4]. Akinbami, A.A., Rabiu, K.A., Adewunmi, A.A., Wright, K.O., and Dosunmu, A.O. (2011). Seroprevalence of Cytomegalovirus antibodies amongst normal Pregnant Women in Nigeria. *International Journal of Women's Health* 3: 423-428.

[5]. Alao, O.O., Joseph, D.E., Mamman, A., and Banwat, E.B. (2009). The seroprevalence of cytomegalovirus antibodies among prospective blood donors in Jos. *Nigerian journal of medicine: Journal of the National Association of Resident Doctors of Nigeria*.17(2):200-2**.**

[6]. Anoh, A., Mossoun, A., Akoua-Koffi, C., Couacy-Hymann, E., Pauly, M., Leendertz, S.-A., Kouakou N'goran, E., Schubert, G., Weiss, S., Hofmann, J., Leendertz, F., & Ehlers, B. (2017). Seroprevalence of Cytomegalovirus Infection Among a Rural Population of Côte d'Ivoire. Viral Immunology, 30(1), 54.

[7]. Bawa M.K., Mannan, A., M Olayinka, A., Gidado, S., Waziri, A.M., Balogun, M.S., Getso, K.I., Dalhat, M.M., Nsubuga, P., ALIYU, N., Bala, H., Mohammed, H., Haladu, S., Shehu, U.L., Nguku, P.M. (2019). *Pan Afr Med J*. 32(Suppl 1): 6.

[8]. Bolarinwa, R. A., (2014). Prevalence and associated characteristics of cytomegalovirus (CMV) immunoglobulin antibodies among blood donors at a University Teaching Hospital in Nigeria. *East African Medical Journal*. 91(11): 385-390.

[9]. Brian, M. and Tim, W. The effective and safe use of blood components. In: Practical transfusion medicine, 2nd edition. 2005; 6: 67-84.

[10]. Cannon, M.J., Davis, K.F. (2005). Washing our hands of the congenital cytomegalovirus disease epidemic. *BMC Public Health*. 5: 70.

[11]. Cannon M.J., Schmid D.S., Hyde T.B. (2010). Review of cytomegalovirus seroprevalence and demographic characteristics associated with infection. *Rev Med Virol*. 20(4): 202-13.

[12]. Chaudhari, C.N., Bindra, MS (2009). Seroprevalence of cytomegalovirus among voluntary blood donors. *Med J Armed Forces India*. 65(3): 252-254.

[13]. Fredrick, R.A., Gordon, L.A., Nicholas, J.B. (2005). Cytomegalovirus. In: Dennis, L.K., Eugene, B., Anthony, S.F., et al. 16 ed: Harrison's Principles of Internal medicine. 6: 571-576.

[14]. Gaytant, M.A., Steegers, E.A.P., Semmekrot, B.A., Merkus, HMMW, and Galama, J. (2002) Congenital Cytomegalovirus Infection: Review of the Epidemiology and Outcome. *Obstetrical and Gynaecological survey*. 57: 4.

[15]. Hamdan, H.Z., Abdelbagi, I.E., Nasser, N.N., and Adam, I. (2011). Seroprevalence of Cytomegalovirus and Rubella among Pregnant Women in Western Sudan. *Virology Journal.* 18: 217-218. https://doi.org/10.1186/1743-422X-8-217

[16]. Hillayer, D.C., Shaz, B.H., Zimring, J.C. and Abshire, T.C. (2009). Transfusion Medicine and Haemostasis. Clinical and Laboratory Aspects. 1st edition. Elsevier, New York.

[17]. Kebede W, Abebe G, Gudina EK, Van Rie A. The value of lateral flow urine lipoarabinomannan assay and empirical treatment in Xpert MTB/RIF ultra negative patients with presumptive TB: a prospective cohort study. Sci Rep. 2021 Dec 24;11(1):24428. DOI: 10.1038/s41598-021-04090-1.

[18]. Kothari A., Ramachandran V.G., Gupta, P., Singh B., Talwar, V. (2002). Seroprevalence of cytomegalovirus among voluntary blood donors in Delhi, India. *J Health Popul Nutr*. 20: 348-351.

[19]. Li, Z., Tang, Y., Tang, N., Qian, F., Zhong, H., Yong-min, L., La-mei, W., & He, F. (2017). High anti-human cytomegalovirus antibody levels are associated with the progression of essential hypertension and target organ damage in Han Chinese population. PLoS One, 12(8), e0181440.

[20]. Muldoon, K., Armstrong-Heimsoth, A., & Thomas, J. (2017). Knowledge of congenital cytomegalovirus (cCMV) among physical and occupational therapists in the United States. PLoS One, 12(10), e0185635.

[21]. Njeru D.G., Mwanda W.O.., Kitonyi, G.W., Njagi EC. (2009). Prevalence of cytomegalovirus antibodies in blood donors at the National Blood Transfusion Centre, Nairobi. *East Afr Med J*. 86(12): Supplement

[22]. Ojide, C.K., Ophori, E.A., Eghafona, N.O., and Omoti, C. (2012). Seroprevalence of cytomegalovirus (CMV) amongst voluntary blood donors in University of Benin Teaching Hospital (UBTH), Edo State, Nigeria. *British J Med Med Research*. 2: 15-20.

[23]. Okwori. A., Olabode, A., and Emumwen, E. (2008). Sero-epidemiological Survey of Cytomegalovirus Infection among expectant Mothers in Bida, Nigeria. *The International Journal of Infectious Diseases*. 6: 2.

[24]. Park, H., Kim, J., Zhang, M., Almanza, B., Fisher, J. J., & Ma, J. (2017). Hotel Key Cards: How Clean Is the First Thing Guests Touch on Their Way to Their Rooms? Journal of Environmental Health, 80(2), 16–19. https://www.jstor.org/stable/26329806

[25]. Pass, RF Cytomegalovirus. In: Knipe, D.M., Howley, P.M. editors. (2001). Fields Virology. Philadelphia: Lippincott Williams and Wilkins. 2675-2706.

[26]. Rahav, G., Gabby, R., Ornoy, A., Shechtman, S., Arnon, J., Diav-Citrin, O. (2007). Primary versus nonprimary cytomegalovirus infection during pregnancy, Israel. *Emerg Infect Dis*. 13(11): 332-6.

[27]. Saraswathy, T.S., Al-ulhusna, A., Ashshikin, R.N., Suriani, S., and Zainab, S. (2001). Seroprevalence of Cytomegalovirus infection in women and associated role in obstetric complication: a preliminary study. *South-East Asian Journal of Tropical Medicine. Public Health*. 42:320-322.

[28]. Sian, C.M., Daniel, T., Beverley, H., and William, D.R. (2005). Symptomatic infant characteristics of congenital cytomegalovirus disease in Australia. *Journal of Paediatrics and Child Health*. 41: 449-452.

[29]. Souza, M. A., Passos, A. M., Treitinger, A. and Spada, C. (2010). Seroprevalence of Cytomegalovirus antibodies in blood donors in Southern Brazil.Rev. Soc. Bras. Med. Trop, 43: 359-361.

[30]. Tookey, P.A., Ades, A.E., and Peckham, C.S. (1992). Cytomegalovirus prevalence in pregnant women: the influence of parity. Archives of *Disease* in Childhood. 67: 779-783.

[31]. Townsend, C.L., Forsgren, M., Ahlfors, K., Ivarsson, S.A., Tookey, P.A., Peckham, C.S. (2013). Long-term outcomes of congenital cytomegalovirus infection in Sweden and the United Kingdom. *Clin Inf Dis*. 56(9): 1232-9.

[32]. Uyar, Y., Balci, A., Akcali, A., Cabar, C. (2008). Prevalence of rubella and cytomegalovirus antibodies among pregnant women in northern Turkey. *New Microbiol*., 31(4), 451-455.

[33]. Yeroh, M., Aminu, M., and Musa, B.O.P. (2015). Seroprevalence of cytomegalovirus infection amongst Pregnant women in Kaduna State, Nigeria. *African Journal of Clinical and Experimental Microbiology*. 16: 37-44.

[34]. Ziemann, M., Hennig, H. (2014). Prevention of transfusion-transmitted cytomegalovirus infections: which is the optimal strategy? *Transfus MED Hemother*. 41(1): 40-44.

8/15/2022