



Original Article

Prevalence of Human Cytomegalovirus Infection in Pregnant Women in Yarim City, Yemen

Mohammed Ali Al Fakih, Hamid Mohammed Al-Gabr*

Department of Biology, Education College, Albaydah University, Yemen.

*Corresponding Author: han-chin@hotmail.com

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ABSTRACT

To determine the Seroprevalence of cytomegalovirus in pregnant women in Yarim, Ibb governorate. A cross-sectional study was conducted in different medical centers at Yarim, Ibb Governorate, During the period between 2022 to 2023. A total of 190 blood samples of pregnant women were collected and examined. Seroprevalence of human cytomegalovirus, immunoglobulin G and immunoglobulin M was determined by enzyme-linked immunosorbent assay. Out of the 190 pregnant women enrolled in the study, 154 were seropositive for cytomegalovirus infection with overall prevalence rate as 81.05%. Furthermore, out of 190 pregnant women participated in this study, 144(75.79%) were seropositive for CMV-IgG antibodies and 10 (5.26%) for CMV-IgM antibodies. Signification differences ($P<0.05$) were observed between seroprevalence rate and type of immunoglobulins. The highest CMV IgG seroprevalence rate 77.65% was recorded in pregnant women with age group between 20-30 years of age; whereas the lower rate 60% in pregnant women with age group of 31-40 years. Significant differences ($P<0.05$) were existed between IgG seroprevalence of and age groups of pregnant women tested. Similarly, the highest CMV IgM seroprevalence rate 10% was recorded in pregnant women with age group between 31-40 years of age; whereas the lower rate 4.71% in pregnant women with age group of 20-30 years old. Person`s Chi square analysis showed that there were statistically significant differences between the age and CMV-IgM. In Conclusion: Human cytomegalovirus infection is prevalent in pregnant women in study area. Proper hygienic environment, good diagnosis, introduction of vaccines and antiviral therapies could be helped in control of HCMV and related abnormalities in pregnant women and neonatal babies. Further study is required to study the epidemiology of HCMV in study area and other areas of Yemen as well.

INTRODUCTION

Human cytomegalovirus(HCMV) is a virus that infects the huge number of people wide world (Mahallawi et al., 2022; Alfaqih et al., 2023). Cytomegalovirus is a virus

belongs to the herpesvirid family and only develops within human cells. This virus is the larger than others in this family, the human herpes virus 5 has a 220 nm diameter and a

genome composed of 235,000 double-stranded DNA macromolecules. Its DNA assembles as circular DNA and replicates best within human fibroblasts (Bennett *et al.*, 2015).

The International Forum of Infectious diseases (IFID, 2019) has documented that the disease spreads by close interpersonal contact via body fluids like the saliva, blood, genital secretions, urine, and breast milk, or through the placenta of a pregnant woman. This virus has a lifelong latency in the cells of the premature myeloid lineage, particularly monocytes and granulocytes (Collins-McMillen *et al.* 2018, Elder *et al.*, 2019).

Following primary infection, infection could be associated or not with clinical manifestations (Alfaqih *et al.*, 2023). HCMV has a profound impact on the human body and can prevail for a long time. HCMV can lead to severe sickness such as fever, liver disease, pneumonitis, abdominal pain, diarrhea, and mononucleosis in healthy individuals (Hasannia *et al.*, 2016; AlMaghrabi *et al.*, 2019). HCMV reactivation episodes may occur repeatedly, HCMV reactivation can lead to life-threatening conditions and organ failure, and can lead to life-threatening conditions (Ljungman *et al.*, 2019; Sufiawati *et al.*, 2021).

The HCMV is one of the most common congenital infections that complicate pregnancies and the well-being of newborns (Leruez-Ville and Ville., 2020). When infected, the mother can vertically transmit the virus to the fetus through the placenta or to the newborn during labor and breastfeeding, the transplacental transmission rate varies with gestational age; hence, the mother and the fetus must be thoroughly evaluated (Leruez-Ville and Ville., 2020).

The diagnosis of CMV infections is rarely performed in the common population, but it is necessary during pregnancy and in immunosuppressed patients. Multiple testing methods are nowadays available,

such as antibody serum detection, direct detection from human fibroblast cultures, and quantitative real-time polymerase chain reaction (PCR) for the detection of viral DNA (Bennett *et al.*, 2015; Alfaqih *et al.*, 2023).

HCMV infection has been associated with numerous effects in the patients, especially in infants and immunocompromised individuals. It is therefore necessary to prevent rather than to treat the disease. This could be achieved by avoiding transplantation of CMV seropositive blood, fluid or organ to seronegative patients (BTS, 2011). Developing vaccines against HCMV have met many setbacks because of inherent genetic variability among HCMV strains. Recently, DNA capable of generating antibody response in healthy individuals has been produced (BTS, 2011; Ifeanyi and Ogbonnaya, 2017).

Globally, the HCMV seroprevalence varies widely among geographical regions, with a seroprevalence of 66% in the European region, 75% in South and North America, 86% in the Southeast Asian region, 88% in Africa and the Western Pacific, and 90% in the Eastern Mediterranean region (Zuhair *et al.*, 2019).

In Yemen, a few studies have investigated the prevalence of HCMV infection among pregnant women in the Northern Governorates; Sana'a, Hodeida, which found a seroprevalence of 100%, 98.7 % respectively (Yeroh *et al.*, 2014, Alghalibi *et al.*, 2016). whereas in southern Governorates; in Ad-Dhale'e city, the seroprevalence was as 97.6%.

The current study was designed to determine the seroprevalence of immunoglobulin G (IgG) and IgM anti-HCMV antibodies among pregnant women in Yarim, Ibb governorate, Yemen. The study findings might assist in the prevention of HCMV transmission to pregnant women in study areas.

MATERIALS AND METHODS

Study area and setting

The study was carried out in Medical Centers (Modern Diagnostic Laboratories) at Yarim district, Ibb Governorate between the years of 2022- 2023. Yarim located in Ibb governorate Yemen. Ibb located at an elevation of 1956.47 meters (6418.86 feet) above sea level, Ibb has a Subtropical desert climate. The city's yearly temperature is 24.76°C (76.57°F) and it is -0.77% lower than Yemen's averages. It's typically receives about 202.99 millimeters (7.99 inches) of precipitation and has 207.9 rainy days (56.96% of the time) annually (Anonymous, 2023).

Study population

The study population were pregnant women (age range, 20 to 40 years) attending to Medical centers (the antenatal clinics, Modern Diagnostic Laboratories) at Yarim district, Ibb governorate, Yemen for routine examination.

Inclusion criterion

The study included pregnant women aged between 20-40 years attending medical centers (the antenatal clinics) at Yarim district, Ibb Governorate, who consented to participated in the study.

Exclusion criterion

The study excluded non-pregnant women, women <20 years or above 40 years, pregnant women whose ages fell within the acceptable age group but did not consent to participate in the study.

study design

This is a cross-sectional was conducted during the period between 2020-2023, it was performed on pregnant women (age range, 20 to 40 years) attending medical center (antenatal clinics) Yarim district, Yemen.

Collection of samples and processing

Five milliliters of venous blood sample were collected from each participant using a needle and syringe. The blood was transferred into a test tube and labeled properly with patient's identification number. The samples were collected in laboratory under aseptic condition. The sera were separated from the whole blood and stored in the freezer until usage. The sample size was calculated based on previous studies with 95% confidence interval (P) and ±5% precise error. The sera were tested for IgG and IgM antibodies at a dilution of 1:100. Detection of CMV using an enzyme-linked immunosorbent assay (ELISA) technique using DRG kit manufacturer DRG International Inc US and keys given by Lamarre et al. (2016).

Semi-quantitative estimation of antibody concentration: the optical densities of the standards against their concentration were plotted and a line was drawn through the points. Sample values below 3 IU/ml were labeled as negative; whereas, values above 3 IU/ml were considered as positive. Samples giving values above 30 IU/ml were re-assayed at a higher dilution as technique described by Kumar et al. (2017).

Statistical analysis

The data collected from this study were analyzed using SPSS version 20 software. To establish the connection between age variable information and prevalence rates, the Pearson Chi-square test was employed with a 95% confidence interval and a significance level set at 0.05.

Ethical considerations

Ethical approval was obtained from the Research and Ethical Committee (REC), Albaydah University. Before commencing the study, the nature and purpose of research was explained to each participant using an informed consent form for literate participants and verbal explanation for illiterate participants.

RESULTS

In this study, 190 serum samples were collected from pregnant women from different Medical centers in Yarim, and examined, 154 were found seropositive for cytomegalovirus infection with overall seroprevalence rate 81.05 % as presented in Table 1. Furthermore, out of 190 pregnant women participated in this study, 144(75.79%) were seropositive for CMV-IgG antibodies and 10 (5.26%) for CMV-IgM antibodies. Significant differences (P=0.0122) were observed between seroprevalence rate and type of immunoglobulins as depicted in Table 2. In the current study, the highest CMV IgG seroprevalence rate (77.65%) was recorded in pregnant women with age group between

20-30; whereas the lower rate (60%) in pregnant women with age group of 31-40 years old. Significant differences (P=0.0122) were existed between IgG seroprevalence of and age groups of pregnant women tested. Similarly, the highest CMV IgM seroprevalence rate (10%) was recorded in pregnant women with age group of 31-40 years old; whereas the lower rate (4.71%) in pregnant women with age group of 20-30 years old. Person`s Chi square analysis showed that there was significant association between the age and immunoglobulins type as presented in Table 3.

Table. 1. Overall Seroprevalence of cytomegalovirus infection in pregnant women in Yarim, Ibb Governorate

No. of subjects examined	No. subjects seropositive	Seroprevalence%	95%CI
190	154	81.05	

Table 2. Seroprevalence of cytomegalovirus IgG and IgM among all pregnant women(n=190)

CMV IgG		CMV IgM		P valu
Positive	Negative	Positive	Negative	P=0.0122
144 (75.79%)	46 (24.21%)	10 (5.26%)	180 (94.74%)	

Table 3. Seroprevalence of anti-cytomegalovirus IgG and IgM among different age groups of pregnant women

Age group	No. of subjects screened	CMV IgG		CMV IgM		P value
		+Ve	-Ve	+ve	-Ve	
20-30	170	132 (77.65%)	38 (22.35%)	8 (4.71%)	162 (95.29%)	0.0153
31-40	20	12 (60%)	8 (40%)	2 (10%)	18 (90%)	
Total	190	144	46	10	180	

+ve= seropositive, -ve=seronegative

DISCUSSION

Human Cytomegalovirus (HCMV) is a ubiquitous virus which is transmitted either vertically and/or horizontally. The virus is incriminated as an opportunistic infection in many parts of the world (Hamid et al., 2014).

Occurrences of CMV in pregnant women have been reported. Infection of pregnant women may bring about devastating effects on the fetus, including reduced growth, enlargement of liver and spleen, jaundice and central nervous system disorder, retinitis, neurological damage, gastrointestinal problems, hepatitis, pneumonitis and adrenalitis (Springer and Weinberg, 2004; Hamid et al., 2014).

The prevalence of CMV varies and depends upon the socioeconomic status, living conditions, and hygienic practices. In developing countries, the prevalence rate is higher than 90% in children and adults as well as in low socioeconomic groups in developed countries. In developed countries the rate is from 40% to 70% in adults in high socioeconomic groups (Colugnati, et al., 2007; Binsaad. and Taleb). In this research work was carried out on pregnant women selected from different areas of Yarim district, Ibb Governorate with main objective to determine the seroprevalence rate infections of Cytomegalovirus in relation to age.

The results of this study revealed that the overall seroprevalence of Cytomegalovirus infection among pregnant women was 81.05 %. These results are lower than findings of previous studies performed for determination of CMV in pregnant women in different regions of the world and Yemen (Neirukh et al., 2013; Hamid et al., 2014; AlMaghrabi et al., 2019; Al-Arnoot et al., 2020; Gorun et al., 2020; Akele et al., 2023) who reported the prevalence rates ranged from 87.9-98.7%), and higher than seroprevalence rate recorded by Edrees (2010); Bagheri et al. (2012) and Lamarre et al. (2016) who reported the prevalence rates

ranged from 40.1 % - 72.1%. Furthermore, Alghalibi et al. (2016) cited the prevalence rate of CMV in Arab, African and Asian countries was as following: in Saudi Arabia (92.1%), Qatar (96.5%), Bahrain (100%), Iraq (100%), Palestine (99.6%), Egypt (100%), Sudan (97.5%), and Tunisia (96.3%); and also Turkey (100%), Iran (98.8%), and the African countries Nigeria (94.8%), **Ethiopia** (88.5%), and Benin (100%). The discrepancy between results of current study and findings of above studies could be attributed to the endemicity, differences in the living and hygienic standards, differences in environmental conditions, socioeconomic statuses, social habits, lack of personal and community hygiene, and different in educational levels of the studied populations (Yeroh et al., 2014). In addition, it was reported that variations in CMV seroprevalence among women could be based on ethnical and/or racial groups (Colugnati et al., 2007).

The IgG immunoglobulin was reflected the previous infection. The presence of it doesn't prevent the re-infection or reactivation of latent infection, but may reduce the severity of pathogenesis; While, IgM immunoglobulin was considered as evidence of recent or acute infection which is formed immediately after infection and disappeared after short period 16-20 weeks (Al-Baiati et al., 2014).

Screening of pregnant women for CMV IgM antibodies is necessary so that the gynecologist or pediatrician can be alerted about the risk of infection to the newborn. Newborns in such cases can be tested for CMV IgM antibodies which will help in timely therapy of the infected neonate and will also prevent the spread of infection to other children. In addition, primary infection in pregnancy poses a higher risk of producing symptomatic congenital infection and fetal loss. However, infected newborns can be asymptomatic at birth with the development of late sequelae such as visual and auditory

defects in 10- 15% of the cases (Wong et al., 2000).

In the present study, out of 190 pregnant women participated in this study, 144(75.79%) were seropositive for CMV-IgG antibodies and 10 (5.26%) for CMV-IgM antibodies. Significant differences were observed seroprevalence rate and type of immunoglobulins. These results are in agreement with findings of Akele et al., (2023) and Fowler et al., (2022) who recorded a high seroprevalence of CMV IgG antibodies and low CMV IgM antibodies in pregnant women. The higher seroprevalence rate of IgG and lower rate of IgM could be explained in view of Akele et al., (2023) who suggested that the high prevalence rate of CMV IgG in the population may be due to a high herds immunity to work towards a possible elimination of CMV from the community. This is necessary because presence of CMV IgM suggest that there is still an ongoing infection and reinfection among the population.

In this study, the CMV seroprevalence was gradually decreased in the elderly age groups, these results are in agreement with findings of Alghalibi et al. (2016) and in contrary with previous study of (Binsaad and Taleb, 2022) in which the seroprevalence was increased with age. The reason behind differences in seroprevalence in between age groups may be related to the sexual activity in young age group, as sexual contact is significant source of CMV transmission (Pass, 2004; Yeroh et al., 2014). In addition, mother-to-child transmission during pregnancy is very important as infected children shed virus in their saliva and urine for years, providing an opportunity for virus spread to their parents, other family members, and other groups of children (Fields, 2002; Binsaad and Taleb, 2022). In addition, Al-Jiffri et al. (2013); Binsaad and Taleb, (2022) reported the CMV seroprevalence was reduced in women of the age group of 35-44 years old in their

study. The reason could be attributed to the waning immunity in old age.

CONCLUSION

Human cytomegalovirus infection is prevalent in pregnant women in study area. Proper hygienic environment, good diagnosis, introduction of vaccines and antiviral therapies could be helped in control of HCMV and related abnormalities in pregnant women and their neonatal babies. Further studies are required to study the epidemiology of HCMV in pregnant women in study area and other geographic zones of Yemen as well.

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COMPETING INTERESTS

The Author declare that they have no competing interests.

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الانتشار المصلي لفيروس مضخم الخلايا بين النساء الحوامل في مدينة يريم، اليمن

محمد علي الفقيه وحמיד محمد الجبر*
قسم علوم الاحياء، كلية التربية، جامعة البيضاء، اليمن
* للمراسلة: han-chin@hotmail.com

الملخص

فيروس المضخم للخلايا أو (CMV) ويعرف أيضا باسم فيروس الهربس herpesvirus. ينتقل الفيروس (CMV) من الأم إلى الجنين أثناء الحمل بعد إصابة الأم بالفيروس، وقد يؤدي إلى حدوث عيوب خلقية للجنين مثل تأخر النمو أو موت الجنين داخل الرحم. هدفت هذه الدراسة إلى تحديد معدل الانتشار المصلي للفيروس المضخم للخلايا لدى النساء الحوامل في مدينة يريم بمحافظة إب. أجريت هذه الدراسة العرضية المقطعية في عدد من المراكز الطبية في يريم بمحافظة إب خلال الفترة ما بين 2022 إلى 2023. تم جمع وفحص ما مجموعه 190 عينة دم من النساء الحوامل المشاركات بالدراسة. تم تحديد نسبة الانتشار المصلي للفيروس والجلوبيولين المناعي G والجلوبيولين المناعي M بواسطة اختبار الامتصاص المناعي المرتبط بالإزيم. كشفت نتائج الدراسة ان من أصل 190 امرأة حامل تم معاينتهن، كانت 154 امرأة إيجابية المصل لعدوى الفيروس المضخم للخلايا وبنسبة انتشار كلي (81.05%). من بين 190 امرأة حامل شاركت في هذه الدراسة، كانت 144 امرأة (75.79%) إيجابية مصلياً للأجسام المضادة CMV-IgG و 10 (5.26%) للأجسام المضادة CMV-IgM. لوحظ فروق إحصائية ذو دلالة (P < 0.05) معنوية بين نسبة الانتشار المصلي ونوع الغلوبولين المناعي. سجل أعلى نسبة للانتشار المصلي (77.65%) لـ CMV IgG في النساء الحوامل اللاتي تتراوح أعمارهن بين 20-30 سنة؛ بينما أقل نسبة (60%) في النساء الحوامل اللاتي تتراوح أعمارهن بين 31-40 سنة. وبالمثل، تم تسجيل أعلى نسبة للانتشار المصلي (10%) لـ CMV IgM في النساء الحوامل اللاتي تتراوح أعمارهن بين 31-40 سنة، وأقل نسبة 4.71% لدى النساء الحوامل اللاتي تتراوح أعمارهن بين 20-30 سنة. لوحظت فروق ذات دلالة إحصائية (P < 0.05) بين نسبة الانتشار المصلي للفيروس وعامل العمر للنساء الحوامل اللاتي شاركت بالدراسة. خلصت الدراسة إلى إن عدوى الفيروس المضخم للخلايا البشرية منتشرة بين النساء الحوامل في منطقة الدراسة. يمكن أن تساعد البيئة الصحية المناسبة والتشخيص الجيد واستخدام اللقاحات والعلاجات المضادة للفيروسات في السيطرة على فيروس HCMV والتشوهات المرتبطة به عند الأطفال حديثي الولادة. يجب إجراء المزيد من الدراسات الوبائيات على فيروس HCMV في منطقة الدراسة والمناطق الأخرى في اليمن ككل.

الكلمات المفتاحية: الفيروس المضخم للخلايا، النساء الحوامل، الانتشار المصلي، يريم، اليمن

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