Libyan Journal of Medical Research
www.ljmr.ly/
eISSN:2413-6096

Original Article

Seroprevalence of Human Cytomegalovirus IgG Antibodies and Risk Assessment of the Virus Infection among Pregnant Women in Tripoli, Libya

Ali M. Albasheeri[1], Khadija Amara[2], and Noura Almagrabi[3]

1. *Department of Medical Laboratory, High Institute of Medical Sciences and Technology/ Abusalim, Tripoli, Libya.*
2. *Department of Virology, Reference Medical laboratory—Tripoli, Tripoli, Libya.*
3. *Department of hormonology, Reference Medical laboratory—Tripoli, Tripoli, Libya.*

Corresponding author: Ali Mustafa Albasheeri: e-mail: ali.m.albasheeri@gmail.com

Received: 12/12/2024 | Accepted: 01/03/2025 | Published: 10/4/2025 | DOI: https://doi.org/10.54361/LJMR.19.1.22

ABSTRACT

Background: HCMV infection is the most prevalent congenital viral infection around the world and the leading cause of sensorineural hearing loss in infants and young children. In Libya, only a few studies investigated the prevalence of HCMV infection among pregnant women. Due to these reasons, the purpose of this study is to identify the seroprevalence of anti-HCMV IgG in pregnant women who attended the reference medical laboratory—Tripoli. Additionally, to determine risk factors linked to HCMV IgG positivity in these pregnant women.

Material and methods: A total of 97 serum samples were collected from pregnant women. The socioeconomic characteristics and risk factors for HCMV infection of every pregnant woman were collected via a questionnaire. Using the VIDAS CMV IgG (CMVG) assay, the sera of the pregnant women were tested for anti-HCMV IgG. The Statistical Package for Social Sciences (SPSS) version 26.0 statistical program was used to analyze the results.

Results: Out of 97 pregnant women who participated in the study, 93 tested positive for an anti-HCMV IgG, yielding a seroprevalence of 95.8%. The seroprevalence of anti-HCMV IgG has no significant association with the type of ABO system, presence of antigen D, age group, place of residence, educational level, occupation, monthly income, gestational age, parity, abortion, stillbirths, and blood transfusion.

Conclusion: The seroprevalence of anti-HCMV IgG among pregnant women in Tripoli, Libya, is high (95.8%), consistent with previous studies from underdeveloped nations. There was no significant association between HCMV IgG positivity and any risk factors associated with it An awareness program regarding HCMV infection, its potential risks, and transmission route is recommended.

Keywords: Human cytomegalovirus, Seroprevalence, IgG, Pregnant women, Tripoli, Libya.

How to cite this article: Albasheeri, A. M., Amara, K., Almagrabi, N. Seroprevalence of Human Cytomegalovirus IgG Antibodies and Risk Assessment of the Virus Infection among Pregnant Women in Tripoli, Libya
Libya: 2025:19.1-22

INTRODUCTION:

The Human cytomegalovirus (HCMV) was first identified by Ribbert in 1881 when he found large intracellular inclusion bodies in the kidney of a stillborn child. Using monolayer cell culture, Enders, Robbins, and Weller (1954) isolated the virus for the first time, and the name "cytomegalovirus" was proposed because of the virus's cytopathic activity (large intracellular inclusion bodies) [1].

With a diameter of roughly 230 nm, HCMV is the largest human herpesvirus. The genome of HCMV is 236 kb in length and is made up of linear double-stranded DNA. The viral DNA is enclosed in an icosahedral capsid. The nucleocapsid is covered by an amorphous proteinaceous layer known as the tegument, which includes regulatory proteins that aid in the infection process of the host cell. The tegument is surrounded by an outer lipid envelope [2, 3]. Various human cell types, such as fibroblasts, endothelial cells, and epithelial cells, are susceptible to infection by various strains of HCMV [4]. *Alpha*, *beta*, and *gamma herpesvirinae* are the three subfamilies of the *Orthoherpesviridae* family. HCMV, also known as human herpesvirus 5, is a member of the *Betaherpesvirinae* subfamily [3, 5]. According to previous research, most immunocompetent individuals with HCMV primary infections are asymptomatic; however, mononucleosis may arise from the primary infections [6, 7].

In developed nations, the seroprevalence of HCMV infection approximates 60%, while in underdeveloped nations, it is more than 90% [8]. The latency and recurrent reactivation of HCMV occur after primary infection, as in the case of all herpes viruses. However, a previously infected individual may become reinfected with a distinct new strain of the virus [9]. There are several routes by which HCMV can spread: vertical transmission, blood transfusion, transplantation, and person-to-person contact with bodily fluids such as urine, semen, saliva, and breast milk [10, 11].

According to a meta-analysis of studies conducted around the world, HCMV infection is the most prevalent congenital viral infection, with a pooled birth prevalence of 0.67% [12, 13]. Due to its prevalence and relation to sensorineural hearing loss in infants and young children, congenital cytomegalovirus infection continues to be a public health problem [14, 15]. The most frequent adverse outcome of congenital HCMV infection is sensorineural hearing loss, which affects 32 to 41% of infants who exhibit symptoms and roughly 7-10% of infants who do not [16].

Finding the seroprevalence and factors potentially associated with HCMV infection could be essential to avoiding its complications. In Libya, only a few studies investigated the prevalence of HCMV infection among pregnant women. Due to these reasons, the purpose of this study is to identify the seroprevalence of anti-HCMV IgG in pregnant women who attended the reference medical laboratory—Tripoli. Additionally, to determine risk factors linked to HCMV IgG positivity in these pregnant women.

MATERIAL AND METHODS:

Study area, design, and population:

The study was performed in Tripoli, the capital of Libya. During June and July of 2024, a descriptive cross-sectional study was carried out among pregnant women who attended the reference medical laboratory—Tripoli in order to perform medical laboratory tests.

Data collection:

A questionnaire sheet was designed to assess the demographic and other factors associated with HCMV infection. Pregnant women were interviewed in person in order to fill out the questionnaire. Age, blood group, place of residence, level of education, occupation, family monthly income, gestational age, parity, stillbirths, abortion, and blood transfusion are the independent variables that were included in the questionnaire.

Sample collection:

Using a venipuncture, a five ml blood specimen was drawn from the pregnant woman, transferred into an anticoagulant-free sterile bottle, and left to clot. After centrifugation of the clotted blood sample (3000 rpm/min), the serum was transferred into an Eppendorf tube and kept at -20 C until required for use.

Ethical considerations:

Ethical approval was obtained from the reference medical laboratory—Tripoli. Each participant gave their informed consent after being fully explained the objectives of the study and given the opportunity to ask any related questions.

Serologic testing:

The serologic testing was done in the hormonology department at the reference medical laboratory—Tripoli. Serum samples were tested for HCMV IgG using the VIDAS CMV IgG (CMVG) assay.

Principle of the procedure:

The VIDAS CMV IgG (CMVG) assay is an enzyme-linked fluorescent immunoassay (ELFA) that is performed in an automated instrument. All assay steps and assay temperature are controlled by the instrument.

Statistical Analysis:

Microsoft Excel 2010 was used to enter the data that the pregnant women provided on the questionnaire, and SPSS version 26 was used to analyze them. Descriptive statistics such as frequency and percentage were calculated. Demographic and other factors were analyzed as independent variables, whereas HCMV IgG positivity was analyzed as a dependent variable. The chi-square test was used to assess the statistical significance of the association between the dependent and independent variables. A *P*-value < 0.05 was considered an indicator of statistical significance.

RESULTS:

Characteristics of the study populations and seroprevalence of anti-HCMV IgG positivity:

There were 97 pregnant women enrolled in this study during June and July 2024. Their ages ranged from 18 to 44, with a mean age of 32.19. The distribution of pregnant women among the demographic and other factors associated with HCMV infection is presented in Table 1. It was found that 93 pregnant women tested positive for an anti-HCMV IgG, yielding a seroprevalence of 95.8%.

Analysis of the seroprevalence of anti-HCMV IgG and factors potentially associated with HCMV infection:

According to the distribution of the HCMV IgG positivity among the blood groups of the pregnant women, it was found that the highest seroprevalence of the anti-HCMV IgG (100%) was found in the pregnant women with antigen AB. In comparison, the lowest HCMV IgG positivity (92.3%) was found in pregnant women with antigen B. There is no association between the pregnant women's ABO system and the seroprevalence of anti-HCMV IgG (Table 1).

However, 100% of the pregnant women with Rh-negative blood tested positive for anti-HCMV IgG, while 95.4% of the pregnant women with Rh-positive blood tested positive for anti-HCMV IgG. There is no association between the presence or absence of antigen D and the seroprevalence of anti-HCMV IgG (Table 1).

This study found that the highest seroprevalence of anti-HCMV IgG (100%) was found in pregnant women belonging to the age group ≤24 years old, while the lowest seroprevalence of anti-HCMV IgG (93.7%) was found in pregnant women belonging to the age group 35-45 years old. There is no association between the age groups of pregnant women and the seroprevalence of anti-HCMV IgG (Table 1).

The place of residence of pregnant women was divided into two categories; it was found that the highest seroprevalence of anti-HCMV IgG (100%) was found in pregnant women who were rural residents, while the lowest seroprevalence of anti-HCMV IgG (95.5%) was found in pregnant women who were urban residents. The present study found no association between place of residence and anti-HCMV IgG positivity (Table 1).

The highest seroprevalence of anti-HCMV IgG (100%) was found in pregnant women who had no education and those who had preparatory or less education. In comparison, the lowest seroprevalence of anti-HCMV IgG (90.9%) was found in the pregnant women with intermediate education. There is no association between the educational level and the seroprevalence of anti-HCMV IgG (Table 1).

The highest seroprevalence of anti-HCMV IgG (100%) was found in pregnant women who were students, while the lowest seroprevalence of anti-HCMV IgG (95.1%) was in employees. This study found no association between the occupation of pregnant women and the seroprevalence of anti-HCMV IgG (Table 1).

This study found that the highest seroprevalence of anti-HCMV IgG (98.5%) was found in pregnant women who had a monthly income of (500-2000), while the lowest seroprevalence of anti-HCMV IgG (88.88%) had (<3500). There is no association between the value of the monthly income and the seroprevalence of anti-HCMV IgG. The gestational age of pregnant women was divided into three categories: first, second, and third trimesters. It was found that the highest seroprevalence of anti-HCMV IgG (100%) was found in pregnant women who were in the first and second trimesters, while the lowest seroprevalence of anti-HCMV IgG (95.7%) was in the third trimester. There is no association between gestational age and seroprevalence of anti-HCMV IgG (Table 1).

Regarding the number of births of the pregnant women, it was found that the highest seroprevalence of anti-HCMV IgG (100%) was found in pregnant women who had >4 births, while the lowest seroprevalence of anti-HCMV IgG (95.1%) had 1-4.

Table1: Prevalence of HCMV IgG antibodies and univariate analysis of factors associated with HCMV infection in pregnant women, Tripoli, Libya.

Factor	No. tested [1]	No. HCMV IgG + [2]	% HCMV IgG + [3]	Chi-Square	df [4]	*P*-value
ABO System				0.657	3	0.883
O	46	44	95.6			
A	37	36	97.2			
B	13	12	92.3			
AB	1	1	100			
Antigen D				0.427	1	0.514
Negative	9	9	100			
Positive	88	84	95.4			
Age groups				0.965	3	0.810
≤ 24	11	11	100			
25- 34	54	52	96.2			
35- 45	32	30	93.7			
Place of residence				0.324	1	0.569
Urban	90	86	95.5			
Rural	7	7	100			
Educational level				1.872	4	0.759
No formal education	2	2	100			
Preparatory or less	2	2	100			
Intermediate	22	20	90.9			
Collage degree	70	68	97.1			
Postgraduate degree	1	1	100			
Occupation				0.360	2	0.835
Housewife	49	47	95.9			
Student	7	7	100			
Employee	41	39	95.1			
Monthly income				4.069	2	0.131
500-2000	68	67	98.5			
2000-3500	20	18	90			
>3500	9	8	88.88			

(Continued)

Table 1: (Continued).

Factor	No. tested [1]	No. HCMV IgG + [2]	% HCMV IgG + [3]	Chi-Square	df [4]	*P*-value
Gestational age				0.133	2	0.936
First	2	2	100			
Second	1	1	100			
Third	94	90	95.7			
Parity				0.704	2	0.703
None	21	20	95.2			
1—4	62	59	95.1			
>4	14	14	100			
Abortion				2.252	1	0.133
Yes	34	34	100			
No	63	59	93.6			
Stillbirths				0.427	1	0.514
Yes	9	9	100			
No	88	84	95.4			
Blood transfusion				0.275	1	0.600
Yes	6	6	100			
No	91	87	95.6			

[1] No. tested = total number of tested pregnant women; [2] No. HCMV IgG + = number of HCMV IgG positive pregnant women; [3] % HCMV IgG + = percentage of HCMV IgG positive pregnant women; [4] df = degree of freedom.

The present study found no association between the number of births and the seroprevalence of anti-HCMV IgG. The findings of this study revealed that the highest seroprevalence of anti-HCMV IgG (100%) was among pregnant women who had a previous abortion. In comparison, the lowest seroprevalence of anti-HCMV IgG (93.6%) had no abortion previously. There is no association between abortion and the seroprevalence of anti-HCMV IgG-positivity (Table 1).

This study found that the highest seroprevalence of anti-HCMV IgG (100%) was among pregnant women who had previous stillbirths, while the lowest seroprevalence of anti-HCMV IgG (95.4%) was among pregnant women who had no previous stillbirths. There is no association between stillbirths and the seroprevalence of anti-HCMV IgG. Regarding the blood transfusion, pregnant women who had never received a blood transfusion before had the highest HCMV IgG positivity (100%).

In comparison, the lowest seroprevalence of anti-HCMV IgG (95.6%) had a previous blood transfusion. There is no association between blood transfusion and the seroprevalence of anti-HCMV IgG (Table 1).

DISCUSSION:

The current study was conducted to determine the seroprevalence and risk factors associated with anti-HCMV IgG positivity among pregnant women in Tripoli, Libya. To our knowledge, this is the first report regarding the seroprevalence of anti-HCMV IgG among pregnant women in Tripoli, Libya. The anti-HCMV IgG positivity differs from one country to another around the world. Several risk factors, including age, work environment, race, hygiene, safe sexual contacts, socioeconomic status, and geographic area, influence the seroprevalence of anti-HCMV IgG [10, 17, 22].

Our anti-HCMV IgG seroprevalence (95.8%) is consistent with the majority of the previous studies conducted in underdeveloped nations, such as Brak Al-Shati, Libya (95.6%) [18], River Nile State, Sudan (87.1%), Kassala State, Sudan (97.8%) [19], Yemen (98.7%) [20], Nigeria (97.20%) [21], and Pakistan (99.04%) [22]. Compared to the seroprevalence of this study, a lower anti-HCMV IgG seroprevalence (42%) was established by a study carried out in Benghazi, Libya [23]. Our anti-HCMV IgG seroprevalence is higher than that of developed countries such as Madrid, Spain (62.2%) [24], Germany (42.3%) [25], Poland (62.4%) [26], and Ireland (30.4%) [27]. The higher hygiene standards in developed nations compared to Libya may partially explain this difference in seroprevalence.

The present study revealed no significant association between anti-HCMV IgG positivity and the risk factors associated with HCMV infection. These results are consistent with those of other studies conducted in Brak Al-Shati, Libya [18], Yemen [20], Pakistan [22], and Nigeria [21]. The findings of our study and other studies may be attributed to the high seroprevalence of anti-HCMV IgG among pregnant women in these populations.

Many studies conducted among pregnant women found a significant association between anti-HCMV IgG positivity and risk factors associated with HCMV infection. A study conducted in Benghazi, Libya, found that HCMV IgG positivity differed significantly between age groups, educational levels, residences, and parities of pregnant women. Notably, the pregnant women with urban residence had more anti-HCMV IgG seroprevalence (84.13%) than those with rural residence (15.87%); also, it was found that HCMV IgG positivity increased with increasing parity [23].

In another study conducted in Poland, it was found that the seroprevalence of HCMV IgG differed significantly between age groups of pregnant women. The Polish study also showed that HCMV IgG positivity was significantly associated with educational level, with HCMV IgG seroprevalence declining as levels of education increased. Additionally, the Polish study found that the pregnant women with and without children had significantly different levels of anti-HCMV IgG; women with children had a 1.56 times greater HCMV IgG seroprevalence than women without children [26].

According to an Irish study, having more children and belonging to a lower-middle socioeconomic category are independent, significant predictors of HCMV IgG positivity. The probability of an Irish pregnant woman having HCMV IgG is 1.66 times greater for those from lower-middle socioeconomic groups than for those from higher socioeconomic groups and 1.6 times higher for those with one or more children than for those without children [27].

CONCLUSION:

The seroprevalence of anti-HCMV IgG among pregnant women in Tripoli, Libya, is high (95.8%), consistent with previous studies from underdeveloped nations. There was no significant association between HCMV IgG positivity and any risk factors associated with it. An awareness program regarding HCMV infection, its potential risks, and transmission route is recommended.

REFERENCES:

1. Ho M. (2008). The history of cytomegalovirus and its diseases. *Medical microbiology and immunology*, *197*(2), 65–73.
2. Charles, O. J., Venturini, C., Gantt, S., Atkinson, C., Griffiths, P., Goldstein, R. A., & Breuer, J. (2023). Genomic and geographical structure of human cytomegalovirus. *Proceedings of the National Academy of Sciences of the United States of America*, *120*(30), e2221797120.
3. Tomtishen J. P., 3rd (2012). Human cytomegalovirus tegument proteins (pp65, pp71, pp150, pp28). *Virology journal*, *9*, 22.
4. He, L., Hertel, L., James, C. D., Morgan, I. M., Klingelhutz, A. J., Fu, T. M., Kauvar, L. M., & McVoy, M. A. (2024). Inhibition of human cytomegalovirus entry into mucosal epithelial cells. *Antiviral research*, *230*, 105971.
5. Taxonomy. (2024). International Committee on Taxonomy of Viruses (ICTV). Available at: https://talk.ictvonline.org/taxonomy/ (Accessed: 30 September 2024).
6. Griffiths, P., & Reeves, M. (2021). Pathogenesis of human cytomegalovirus in the immunocompromised host. *Nature reviews. Microbiology*, *19*(12), 759–773.
7. Nolan, N., Halai, U. A., Regunath, H., Smith, L., Rojas-Moreno, C., & Salzer, W. (2017). Primary cytomegalovirus infection in immunocompetent adults in the United States - A case series. *IDCases*, *10*, 123–126.
8. Zuhair, M., Smit, G. S. A., Wallis, G., Jabbar, F., Smith, C., Devleesschauwer, B., & Griffiths, P. (2019). Estimation of the worldwide seroprevalence

of cytomegalovirus: A systematic review and meta-analysis. *Reviews in medical virology*, *29*(3), e2034.
9. Ljungman, P., Boeckh, M., Hirsch, H. H., Josephson, F., Lundgren, J., Nichols, G., Pikis, A., Razonable, R. R., Miller, V., Griffiths, P. D., & Disease Definitions Working Group of the Cytomegalovirus Drug Development Forum (2017). Definitions of Cytomegalovirus Infection and Disease in Transplant Patients for Use in Clinical Trials. *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America*, *64*(1), 87–91.
10. Dioverti, M. V., & Razonable, R. R. (2016). Cytomegalovirus. *Microbiology spectrum*, *4*(4), 10.1128/microbiolspec. DMIH2-0022-2015.
11. Weisblum, Y., Panet, A., Haimov-Kochman, R., & Wolf, D. G. (2014). Models of vertical cytomegalovirus (CMV) transmission and pathogenesis. *Seminars in immunopathology*, *36*(6), 615–625.
12. Ssentongo, P., Hehnly, C., Birungi, P., Roach, M. A., Spady, J., Fronterre, C., Wang, M., Murray-Kolb, L. E., Al-Shaar, L., Chinchilli, V. M., Broach, J. R., Ericson, J. E., & Schiff, S. J. (2021). Congenital Cytomegalovirus Infection Burden and Epidemiologic Risk Factors in Countries With Universal Screening: A Systematic Review and Meta-analysis. *JAMA network open*, *4*(8), e2120736.
13. Fowler, K. B., Ross, S. A., Shimamura, M., Ahmed, A., Palmer, A. L., Michaels, M. G., Bernstein, D. I., Sánchez, P. J., Feja, K. N., Stewart, A., & Boppana, S. (2018). Racial and Ethnic Differences in the Prevalence of Congenital Cytomegalovirus Infection. *The Journal of pediatrics*, *200*, 196–201.e1.
14. Fowler K. B. (2013). Congenital cytomegalovirus infection: audiologic outcome. *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America*, *57 Suppl 4*(Suppl 4), S182–S184.
15. Cantey, J. B., & Sanchez, P. J. (2011). Overview of congenital infections: the prominence of cytomegalovirus. *Infectious disorders drug targets*, *11*(5), 426–431.
16. Kabani, N., & Ross, S. A. (2020). Congenital Cytomegalovirus Infection. *The Journal of infectious diseases*, *221*(Suppl 1), S9–S14.
17. Manicklal, S., Emery, V. C., Lazzarotto, T., Boppana, S. B., & Gupta, R. K. (2013). The "silent" global burden of congenital cytomegalovirus. *Clinical microbiology reviews*, *26*(1), 86–102.
18. Al-Ghani, S. A., Aljad, S. M., Abukhres, O. M., Mukhtar, I. A., Hawad, A. F., Al-Rasheed, H., & Shahlol, A. M. (2016). The Prevalence of Cytomegalovirus Infection in a Group of Pregnant Women in Brack Al-Shati, libya. *INTERNATIONAL JOURNAL OF APPLIED MEDICAL AND BIOLOGICAL RESAERCH*, *1* (1), 7-11.
19. Moglad, E. H., Hassan, A. O., Atta Elmanan, M. S., Saeed, S. M., Abdalla, W. M., Mohammedsalih, K. A., Ali, H. T., Abd Elaziz, M. S., & Ahmed, H. H. (2023). Seroepidemiological Survey of Cytomegalovirus Infection among Pregnant Women in Sudan. *Polish journal of microbiology*, *72*(3), 269–275.
20. Alghalibi SMS, Abdullah QYM, Al-Arnoot S, Al-Thobhani A (2016) Seroprevalence of Cytomegalovirus among Pregnant Women in Hodeidah city, Yemen. *J Hum Virol Retrovirol*, *3*(5): 00106.
21. Akinbami, A. A., Rabiu, K. A., Adewunmi, A. A., Wright, K. O., Dosunmu, A. O., Adeyemo, T. A., Osunkalu, V. O. (2011). Seroprevalence of cytomegalovirus antibodies amongst normal pregnant women in Nigeria. *International Journal of Women's Health*, *3*, 423–428.
22. Waseem, H., Ali, J., Jamil, S.U., Ali, A., & Jameel, S. (2017). Seroprevalence of Cytomegalovirus among pregnant women in Islamabad, Pakistan. *Journal of entomology and zoology studies*, *5*, 1788-1791.
23. Bozarida, W., Jadullah, D. (2023). Prevalence of Human Cytomegalovirus (CMV) among Pregnant Libyan Women. *Qurina Scientific Journal*, *2*(2), 32-46.
24. de la Calle, M., Rodríguez-Molino, P., Romero Gómez, M. P., & Baquero-Artigao, F. (2023). Cytomegalovirus seroprevalence in pregnant women in Madrid: First step for a systematic screening. *Enfermedades infecciosas y microbiologia clinica (English ed.)*, *41*(1), 55–56.
25. Enders, G., Daiminger, A., Lindemann, L., Knotek, F., Bäder, U., Exler, S., & Enders, M. (2012). Cytomegalovirus (CMV) seroprevalence in pregnant women, bone marrow donors and adolescents in Germany, 1996-2010. *Medical microbiology and immunology*, *201*(3), 303–309.
26. Wujcicka, W., Gaj, Z., Wilczyński, J., Sobala, W., Spiewak, E., & Nowakowska, D. (2014). Impact of socioeconomic risk factors on the seroprevalence of cytomegalovirus infections in a cohort of pregnant Polish women between 2010 and 2011. *European journal of clinical microbiology & infectious diseases : official publication of the European Society of Clinical Microbiology*, *33*(11), 1951–1958.
27. Knowles, S. J., Grundy, K., Cahill, I., Cafferkey, M. T., & Geary, M. (2005). Low cytomegalovirus sero-prevalence in Irish pregnant women. *Irish medical journal*, *98*(7), 210–212.