

## Demography and seroprevalence of cytomegalovirus infection in blood donors in Mashhad in 2009

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**Abstract:** Cytomegalovirus is a member of the human herpesvirus family. CMV is a common virus that infects most of people at some time during their lives. CMV infection is usually asymptomatic but in immunocompromised patients is associated with serious morbidity and mortality. CMV is transmissible through transfusion of blood components. In this study serprevalence of CMV infection and the correlation with demographic variables were examined in blood donors in Mashhad. In this cross-sectional descriptive study, demographic characteristics of 1008 donors were imported in the questionnaire. Simultaneous to the routine screening tests, the donated bloods in this study were tested in terms of anti-CMV antibodies using the ELISA method. The results were analyzed by using SPSS -17 software. Anti-CMV IgG positivity was not associated with age. 99.2% of the subjects had a history of infection and past exposure to the virus. IgM seroprevalence in women was significantly higher in men ( $P < 0.001$ ). There was no association between IgG and IgM positivity and age of donors. The overall seroprevalence of CMV infection was 99.2%. Although it is thus unnecessary to test blood donors routinely for CMV, immunodepressed and other risk subjects should receive CMV-negative or leukocyte-depleted blood.

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### 1. Introduction

Human Cytomegalovirus (CMV) is the most important member of the herpes virus family which prevalently infects humans. CVM can create various clinical symptoms; however, it commonly ocures asymptotically in immunocompetent people. The virus is usually hidden in immunocompetent people till the end of life in the host cells, specifically leucocytes. CMV is also the most common congenital and infantile viral infection agent throughout the world (1, 2). CMV infection is somewhat worldwide; however, the prevalence and transmission pattern is different as the infection rate varies from 45 % in the developed countries to 100 % in the some developing. Because of the high level individual and social hygienic patterns as well as the specific cultural-social behaviors when treating with children, infection cases with CMV is rare in children younger than 5 years. In comparison, the majority of the people in developing countries are infected with CMV before the age of 5 (2). Although viral transmission to the healthy people is mainly asymptomatic and is not accompanied with serious consequent problems, its transmission to the seronegative receptors with immunodeficiency can lead to the severe and life-threatening consequences such as cytopenia, hemolytic anemia, hepatitis, pneumonia, and meningo encephalite. The virus can

be transmitted through the saliva, sexual contacts, placenta, blood transfusion, and transplantation. CMV can also be transmitted through the complete blood and blood products containing the cell (4). The virus can be separated from blood, urine, saliva, tear, milk, semen, amniotic liquid, and vaginal fluid samples of the infected people. To detect CMV in asymptomatic adults, typically the serologic techniques are applied. The antibody produced in the human serum prevents reinfection with the previous strains; however, it does not stop activation of the hidden viral infection or infection with new viral strain (5). Donors screening in terms of anti-CMV antibodies, injection of the seronegative products to the endangered patients, using the filtered and low-leucocyte blood are among the techniques for reducing the viral transmission to the blood product receptors and preventing transfusion-transmitted-CMV (1, 6).

Due to the fact that no previous study had been conducted on prevalence of this viral infection in donors of Mashhad and lack of sufficient information about that, Also, the seroprevalence of the CMV and demographic characteristics of blood donors can reflect the prevalence and demography of society, this study was conducted to determine the frequency of the JgG and JgM antibodies in blood donors of Mashhad Blood Transfusion Center.

## 2. Material and Methods

This descriptive-local study was conducted in March 2009 in Mashhad Blood Transfusion Center on 1008 (970 male and 38 female) healthy blood donors with age range of 18 to 64 years. Simultaneous to the routine screening tests, the donated bloods in this study were tested in terms of anti-CMV antibodies using the ELISA technique. To recognize anti-CMV antibodies from IgG and IgM, a specific detection kit (Radim: fabricated in Italy) was used. These tests were conducted according to the procedure of the manufacturer, the cut offs were determined, and the specialized anti-CMV IgG and IgM antibodies were studied in the serum samples and then the results of IgG and IgM anti-CMV were reported as negative and positive determination of antibody titer. Moreover, the studied donors were asked to complete a questionnaire indicating their age, gender, and occupation. Next, the data were imported to SPSS17 software, the results were analyzed, and statistical comparisons were made using the Chi-square test.

## 3. Results

In this work 1008 blood donors (970 (96.2 %) male and 38 female (3.8 %) samples) were studied. Among the subjects studied for anti-CMV antibody from class IgG, 962 (99.1 %) male and 38 female (100 %) donors were reported as positive (table 1). Besides, 8 (0.8 %) of the samples were reported as negative to anti-CMV antibody, which were all males from class IgG. The positive IgG titer had no relationship with factors such as the gender and age of the blood donor, as 99.2 % of the subjects had previous infection and contact history with this virus; indicating high prevalence of this virus in the society. As shown in table 2, the maximum (344 cases) and minimum (44 cases) number of positive anti-CMV class IgG cases is for age group of 20-29 years and age group below 20 years, respectively. Anti-CMV antibody of class IgM was reported as positive in 16 samples (1.6 %); 12 samples (1.2 %) for male and 4 samples (10.5 %) for female subjects (table 1). Moreover, the maximum 6 cases) and minimum (2 cases) number of positive Anti-CMV antibody of class IgM was reported for age groups of 30-39 and below 20 years, respectively (table 2). Furthermore, 8 (0.8 %) serum don or indicated no specialized anti-CMV antibody of classes IgM or IgG. In this work, no significant relationship was observed in IgG prevalence in two species, but IgM prevalence in the females was notably higher as compared to the males ( $P < 0.001$ ). In addition, no significant relationship was observed between

positive rates of IgG and IgM infection and the age of donors. Co-infection with other viruses can be seen in Table 3.

**Table 1.** Frequency distribution of CMV antibodies in terms of donors' gender of Mashhad

Positive anti-CMV antibodies	Gender	
	Male	Female
Antibody type		
IgG (%)	962 (99.1)	38 (100)
IgM (%)	12 (1.2)	4 (10.5)

**Table 2.** Frequency distribution of the anti-CMV antibodies in terms of age groups

Positive anti-CMV antibody		Age group
IgG (%)	IgM (%)	
2 (4.5)	44 (100)	≤ 20
4 (1.1)	344 (98.9)	20-29
6 (1.8)	324 (98.8)	30-39
4 (1.4)	288 (100)	> 40
Total	1000 (99.2)	16 (1.6)

**Table 3.** Co-infection with other viruses

Status donation	Age group	Gender	Co-infection	row
First time	20-29	male	HTLV-1	1
First time	> 40	male	HTLV-1	2
First time	> 40	male	HTLV-1	3
First time	30-39	female	HTLV-1	4
First time	30-39	male	HTLV-1	5
First time	20-29	male	HTLV-1+HBsAg	6
First time	30-39	male	HBsAg	7

## 4. Discussions

In the present research, the overall prevalence of anti-CMV IgG virus in the blood donors was determined as 99.2 % (99.1 % for the male and 100 % for the female donors) and no significant difference in terms of antibody prevalence with gender, age, and occupation of the donors was observed. Besides, prevalence rate of anti-CMV IgM in the male and female donors was determined as 1.2 % and 10.5 %, where no significant difference was observed between antibody prevalence in these two genders. In a study (2004) performed in healthy blood donors of the Kashan Blood Transfusion Center, the prevalence of CMV-IgM was reported as 2.3 %, which corresponds with the results of the present work (7). Besides, in a work conducted in Tehran, the prevalence of anti-CMV antibodies types IgG and IgG in the donors was reported as 89.6 % and 0.04 %, respectively; which is less than the values reported in the present research (8). In a study conducted in Tabriz (1994) on healthy blood donors, the prevalence rate of anti-CMV antibodies of types

IgM and IgG was reported as 82 % and 5 %, respectively (9). In the present work, 99.2 % of the subjects were reported as positive in terms of prevalence of anti-CMV-IgG; implying their previous contact with this virus and the broad expansion and prevalence of the infection in the studied society in the past. Blood examination of 500 donors in Zanjan Province revealed that 17 (3.4 %) and 446 (89.2 %) of the donors are positive anti-CMV-IgM and anti-CMV-IgG, respectively (10). In a work conducted on 360 donors in Shiraz, 98.9 % and 4.4 % of the donors were seropositive IgG and IgM, respectively. This work indicated no significant relationship between gender, age, number of children, and education level of the donors and prevalence of serum antibody against CMV (11). In a study conducted in Uremia on 180 blood donors, 100 % and 2.8 % of the donors indicated anti-CMV types IgG and IgM, respectively and no relationship was observed between the age, gender, and living location of the donors (12). By 1950, when prevalence of this virus infection was observed after blood transfusion followed by cordial surgery, CMV infection was considered as a blood transfusion problem in patients with immunodeficiency (4).

Infection with CMV has a global prevalence and is considered as a basic health problem in various societies (5). Considering the importance and high prevalence of the infection with this virus in the world, several studies have been conducted around the world about it, where the results reveal high frequency of infection in several parts of the world, particularly the developing countries. Many studies show that prevalence of this virus is related to factors such as age, gender, geographical living location, healthcare service and economic status, and education level of the families (2). In study performed in New Delhi, among the 200 donors 95 % of them were reported as positive to CMV-IgG but none of them were CMV-IgM positive (13). In addition, a work conducted in China revealed that 94.45 % and 4.65 % of the donors are CMV-IgG and CMV-IgM, respectively (14). Furthermore, their prevalence rate in the donors in Taiwan was 92.7 % and 93.31 %, respectively (15, 16). In a work performed in Ghana, among the 264 blood donors, 246 were positive to CMV-IgG but none of them were positive to CMV-IgM. Also, the total prevalence infection to the virus in the donors was measured as 93.2 % which is similar to the results of the work conducted in India (17). The studies conducted in the developed countries with higher health and economy different results are reported. In a work conducted in Canada, prevalence of anti-CMV antibodies classes IgG and IgM in the blood donors was reported as 40.5 % and 0.9 %,

respectively (18). Another work carried out in the USA showed that IgG prevalence in the ages above 6 years is 58.9 %. Besides, serum prevalence gradually increases from 36.3 % in the age group of 6-1 year to 90.8 % in the age group above 80 year (19).

In a research done in France, 97.4 % of the donors were positive to anti-CMV-IgG and prevalence rate was higher in the female donors (98.57 %) as compared to the male donors (95.71 %) (20). According the work performed in Spain on a population with age range of 2 to 60 years, prevalence rate was reported as 58.4 % and 66.7 % for the males and females, respectively; and the female population indicated higher prevalence of infection with CMV virus. Also, a significant positive correlation was observed in this work between the prevalence rate and age. Besides, the academic education served as a more effective factor for protection from CMV virus infection (21). In 1991, a research on a 420-member population in England revealed that CMV infection is related with both age and gender (22). The study conducted in Australia (2006) showed that there is no significant difference between females and males in terms of CMV infection and the overall prevalence of antibody was as 57 % (23). The different results reported in these works implies the relationship between the infection prevalence and economic-social conditions, geographical and climatic conditions of the housings, and health level in different places. The high prevalence of anti-CMV-IgG virus in the present work emphasizes the expansion and high prevalence of the infection with this virus in the society and necessity of using filtered and low-leucocyte blood products for preventing transfusion transmitted CMV (TT-CMV) infection for the endangered groups.

Considering the high prevalence of infection with CMV among the blood donors, viral screening of the donated blood for detecting seronegative people and their encouraging for constant donation for having a sustainable storage of the prepared products of the seronegative donors is recommended. In this case the receptors of the transplantation and seronegative blood can use such products. Once this approach is not possible, using the low-leucocyte and filtered blood products for the seronegative patients, particularly for those with immunodeficiency and multi-transfusion, can be a suitable alternative.

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