

## Seroprevalence of Cytomegalovirus among Blood Donors at Omdurman Teaching Hospital, Omdurman, Sudan

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### Abstract:

*Background: Cytomegalovirus (CMV) is known to be a significant cause of morbidity and mortality following blood transfusion in children and immunocompromised adults. In Sudan, it is not mandatory to screen donated blood for CMV in blood banks. Very few studies have been conducted in Sudan to estimate the seroprevalence of this infection in voluntary blood donors.*

*Aim: The goal of this study was to estimate the seroprevalence of Cytomegalovirus among blood donors attending Omdurman Teaching Hospital Blood Bank, Omdurman- Khartoum State–Sudan.*

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*Methods: Ninety males (90) voluntary blood donors' sera were collected and analyzed for detecting CMV IgG and IgM antibodies by Enzyme linked immunosorbent assay (ELISA).*

*Result: Out of 90 voluntary blood donors tested, 82 (91.1%) were seropositive for CMV IgG and 12 (13.3%) were positive for CMV IgM and, the overall seroprevalence was 93.3%. The result showed highest seroprevalence (37.8% for IgG) among group age (25-31) year. There was no statistically significant difference in seropositivity of CMV based on distribution of age.*

*Conclusion: Since about 93.3% of blood donors in Sudan are seropositive for CMV, it would seem redundant to screen blood donors for CMV, as very few seronegative blood units would be available for transfusion. Other preventive strategies, such as leuko-reduction, etc., could be more appropriate and cost-effective for the prevention of transmission of CMV through infected blood to immunosuppressed individuals.*

**Key words:** Cytomegalovirus, Blood Donors, ELISA, Omdurman Teaching Hospital, Sudan

## **Introduction**

Cytomegalovirus (CMV) is a member of  $\beta$ -Herpesviridae family. It is the largest member (150-200nm) of the family and it cannot be differentiated from other members morphologically.<sup>1</sup> This pathogenic virus has a widespread distribution and can infect individuals at any age.<sup>1</sup> Acute primary infection in the immunocompetent children and adult is self-limiting, followed by virus latency in CD34+ haemopoietic progenitor cell in bone marrow and CD13+; CD14+ peripheral blood monocytes.<sup>2</sup> The virus has the ability to enter latency after asymptomatic infection in immunocompetent individuals.<sup>3</sup> Transfusion-transmitted cytomegalovirus infection is associated with considerable morbidity and mortality in at risk populations such as AIDS patients, CMV seronegative neonates and organ transplant recipients.<sup>3</sup> CMV infection is widespread in

developing countries and areas where socio-economic conditions are poor.<sup>3</sup> CMV is one of the most common causes of congenital malformations resulting from viral intrauterine infection in developed countries.<sup>4</sup> The prevalence of CMV tends to be lower in developed countries than in developing countries.<sup>5</sup> CMV is a globally-occurring infection with a high prevalence (50-90%) in all human populations.<sup>6</sup> In developing countries, the rates are generally higher, and the infection is acquired at younger age.<sup>6</sup> Virus transmission occurs via body fluids (blood, saliva, breast milk, semen, and cervical secretions), and since the virus is labile, intimate contact with a person with primary or reactivated infection is needed.<sup>6</sup> Therefore, transmission mainly occurs within families, between sex partners, and in groups of small children.<sup>6</sup> Children acquiring CMV at a pre-school age shed the virus for extended period and therefore constitute a major societal reservoir of virus.<sup>6</sup> The description of cytomegalovirus transmission by blood transfusion and body fluids has provoked a greatly heightened emphasis on two fundamental objectives: safety and protection of human life.<sup>7</sup> Transfusion transmissible infections (TTIs) are a very serious complication of blood transfusion.<sup>7</sup> These infections continue to pose a great challenge to transfusion medicine, especially in Africa, due to a high transfusion demand.<sup>7</sup> The aim of this study was to estimate the seroprevalence of Cytomegalovirus Immunoglobulin G (IgG) and immunoglobulin M (IgM) among voluntary blood donors at Omdurman Teaching Hospital Blood Bank.

## **Materials and Methods**

### **Study design:**

This is a descriptive across-sectional study, consisted of 90 males voluntary blood donors aged between (18-50) years old with mean age 26.7 years old, conducted during March 2015 at Omdurman Teaching Hospital Blood Bank, Omdurman-Sudan.

### **Sampling:**

Three (3) milliliters of blood samples were collected from ninety (90) males blood donors and the sera were separated and stored at -20 C° until analysis.

### **The inclusion criteria:**

Donors age was between 18 and 50 years; weight >45 kg; hemoglobin >12.5g/dl; normal blood pressure (BP), pulse, and temperature. Not belonging to any high-risk group, and no history of any severe current or chronic illnesses.

### **Ethical consideration:**

Ethical clearance was obtained from the hospital's research and ethics committee.

### **Processing of the samples:**

All sera were tested for IgM and IgG CMV by the Enzyme Linked Immunosorbent Assay (ELISA) test. The CMV-specific IgM/IgG antibodies were analyzed by the commercial (Chemux BioScience, Inc.USA) according to the manufacturer's instructions.

The serum samples and kits components were brought at room temperature, all samples, calibrators, negative and positive controls were diluted at the ratio 1:40 by taking 5µl of sample with 200 of the sample diluent. 100µl of diluted samples, and calibrators and controls were added into each of CMV antigen coated wells except for A1 well which is used for blank by adding 100µl of sample diluent, and incubated at room temperature for 30 minutes, after washing three times, 100µl of the enzyme conjugate was added into each well, and incubated at room temperature for 30 minutes, after washing the TMB chromogen was added into each well, after 15 minutes of incubation stop solution (sulphuric acid) was added into each well. And the optical densities (O.D.) have been read using ELISA microwell plate reader at filter of 450 nm.

Calculation of IgG was by dividing the sample O.D. by the mean of two cut-off calibrators O.D.

CMV IgM index of each determination was by dividing the O.D values of each sample by cut-off calibrator O.D. value.

### **Interpretation: IgG and IgM**

Negative: CMV IgG index of 0.90 or less are seronegative for IgG antibody to CMV (<1.1IU/mL)

Equivocal: CMV IgG index of 0.91-0.99 or less are equivocal sample should be retested.

Positive: CMV IgG index of 1.00 or greater or IU value greater than 1.2 are seropositive, it indicate prior exposure to the CMV virus (>1.2 IU/mL)

The interpretation of IgM results is the same.

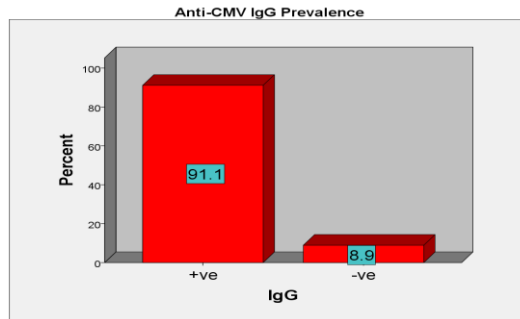
## **Results**

All of the ninety (90) healthy individuals selected for blood donation were males. The mean age of the individuals was 26.7 years (age range 18-50 years). Seropositivity was 82 (91.1%) and 12 (13.3 %) for CMV-IgG and CMV-IgM antibodies respectively. There was no statistically significant difference ( $p > 0.05$ ) in the CMV IgG status in different age group. The result showed highest seroprevalence (37.8% for IgG) among age group (25-31 year) - Table.1

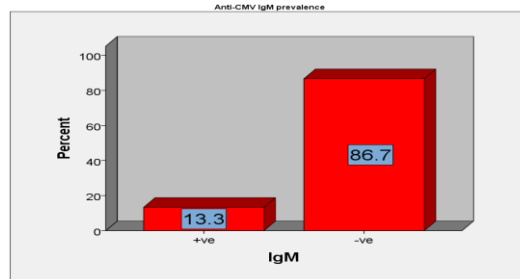
**Table 1 Cytomegalovirus serostatus and age distribution of blood donors**

Age group	Frequency -%	CMV IgG Positive %	CMV IgG negative %	CMV IgM Positive %	CMV IgM negative %	Total
18- 24	26 (28.9%)	24 (29.3%)	2 (25%)	3 (25%)	23 (29.5%)	26
25-31	34 (37.8%)	29 (35.4%)	5 (62.5%)	4 (33.3)	30 (38.5%)	34
32-38	13 (14.4%)	13 (15.9%)	0 (0%)	2 (16.7%)	11(14.1%)	13
39-45	11 (12.2%)	11 (13.4%)	0 (0%)	3 (25%)	8 (10.2%)	11
46-52	6 (6.7%)	5 (6.0%)	1 (12.5%)	0 (0%)	6 (7.7%)	6
Total	82 (100%)	82 (100%)	8 (100%)	12 (100%)	78 (100%)	90

**Figure 1 Anti-CMV IgG Prevalence**



**Figure 2 Anti-CMV IgM prevalence**



## Discussion

Due to the ubiquity of Cytomegalovirus and the risk of transmitting the virus through blood transfusion; several researches have been conducted in various countries among blood donors for detecting the prevalence of Cytomegalovirus antibodies, few studies have been conducted in Sudan.

This study results revealed that 91.1%, 13.3 were positive for Cytomegalovirus IgG and IgM antibodies respectively, The results showed an overall prevalence rate of 91.1% of CMV IgG suggestive of ubiquitous past exposure to infection. And prevalence rate of IgM was 13.3%.

When compared with other studies were found similar to (97% and 96%) reported in Tunisia and India, respectively. <sup>8-9</sup> However, the results showed high prevalence compared to those

reported among Sudanese blood donors (77%).<sup>10</sup> The high prevalence rate indicates the endemicity of infection, and this perhaps could be related to socio-economic, environmental, and climatic factors.<sup>11</sup>

The high prevalence rates observed in these countries contradict those of western nations which ranged from 38% to 75%.<sup>12</sup> Also it was related to results obtained as high as 90% has been recorded in Japan and Hong Kong; countries that are not regarded as developing nations.<sup>13</sup> Seroprevalence for CMV IgM antibody was found to be 13.3% representing the percentage of those that had active infection. Previous studies have reported rates of 0% and 19.5% in Ghana and Nigeria, respectively.<sup>14-15</sup>

It has been argued that CMV IgM positive blood is more infective than IgG positive blood.<sup>16</sup>

And in this study it showed the highest prevalence of IgM antibody levels among blood donors in Sudan ever before.

## **Conclusions**

There is high seroprevalence of anti-CMV IgG antibodies among the blood donors than the anti-CMV IgM antibodies, which is an indication of previous infections by the virus. And the presence of Immunoglobulin M to Cytomegalovirus suggests the presence of active infection. Strategies for protecting high risk individual are recommended, like screening blood for Cytomegalovirus antibodies, use of blood depleted leucocytes.

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