

Investigation of Anti-B19V IgM Antibodies Seroprevalence among Blood Donors in a Blood Transfusion Center in Diyala Governorate, Iraq

Zainab Majed Mohammed¹, Asmaa Haseeb Hwaid^{1,*}, Zaki. M. Majed²

¹College of Education for Pure Sciences, University of Diyala, Iraq

²High Diploma in Pediatrics, Diyala Health Department, Diyala, Iraq

*Corresponding author: asmaa.haseeb@ymail.com

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Abstract Introduction: Parvovirus B19 [B19V] is a small DNA virus characterized by global circulation, the route of transmission of this virus through blood and its products has alarming health dimensions, especially for recipients who have medical conditions that require blood transfusion. **Objectives:** This study aims to enhance the safety of blood transfused to recipients by investigating the seroprevalence of B19V IgM antibodies in donors' blood. **Methodology:** One hundred and eighty-eight blood samples from donors were collected from the blood transfusion center (blood bank) in Diyala Governorate, Iraq, from both sexes, and using ELISA technique, the seroprevalence rate of B19V IgM antibodies was determined. **Results:** Anti-B19V IgM was detected in 11.2% (21/188) of the blood donor samples tested, the highest prevalence of anti-B19V IgM antibodies appeared among the age group 30–39. Male participants in this study showed a higher prevalence of IgM antibody to B19V compared to females. This study showed the presence of co-infections between B19V and hepatitis B Core, the serological test showed that 2 (22%) of the cases positive for the B19V IgM antibodies were also positive for the anti-HBC total Antibodies. **Conclusion:** The current study concludes that the seroprevalence of B19V IgM antibodies among blood donors is high, and poses a risk to sero-negative recipients who have healthy conditions and need blood transfusions. There is a need to conduct more future studies with a large sample size at the serological and molecular levels in cooperation and support provided by the health institutions in the country.

Keywords: Parvovirus B19 [B19V], IgM antibodies, blood donors, seroprevalence

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1. Introduction

Parvovirus B19 [B19V] is a single-stranded DNA, non-enveloped, small virus belong to the genus *Erythrovirus* in the *Parvoviridae* family. Clinical presentations associated with B19V infection vary greatly, depending on the age of the affected individual, the hematologic status represented by the degree of anemia, and the patients' immunologic status [1,2]. Phylogenetic analysis revealed the circulation three genotypes of B19V, genotype 1, 2, and 3, which showed 2% to 13% genetic differences. Genotype 1 is more prevalent compared to genotypes 2 and 3, which have a lower prevalence worldwide; studies have shown no clinical associations between clinical manifestations and virus genotype type [3]. Parvovirus B19 is a virus that usually causes viral infections that are common worldwide. It causes a wide range of important clinical complications, including erythema infectiosum, aplastic crisis, and hydrops foetal, the virus is generally benign to healthy people but

may be life-threatening in immunocompromised individuals such as sickle cell disease patients, cancer, and people with HIV, pregnant women [4]. Parvovirus B19 infection is spread worldwide, exhibits regional epidemiological differences, and affects more than half of the adult population. The prevalence of B19V antibodies in the population is age dependent, rising from 2-20% among children <5 years of age to 15-40% among children 5-18 years and from 40-80% in adults, depending on the different assays used and the population [5,6]. The infection is usually transmitted through various routes including respiratory transmission, vertical transmission from mother to fetus, and other transmission routes have also been recorded for example, organ transplantation and blood transfusion or blood-derived products The risk of infection increases with the presence of high concentrations of viral DNA [viral load] in the blood of infected individuals [7]. Acute B19V infection occurs through the presence of a high viral load (>10¹⁰ copies per ml), and the presence of B19V DNA slowly disappears from the blood of asymptomatic individuals after decreased viral titers [8,9].

As a life-saving fluid, blood transfused to patients is critical to saving the lives of many patients [especially those undergoing surgery], however, there are viruses transmitted through blood and its derivatives, even in cases where viral inactivation is performed, studies have proven that the B19 virus can be transmitted through blood transfusion, and since there are no specific questionnaires and tests in blood donation centers to identify and diagnose infected or suspected asymptomatic blood donors who can carry the virus. In addition, B19V particles are extremely small and lack an envelope, so this virus is an infectious agent that is difficult to eliminate by conventional methods (detergent, extreme pH, heat, and filtration). Transmission of the virus, immune seroconversion, symptomatic and asymptomatic infections in patients treated with different blood products including plasma and platelet concentrations obtained from healthy donors have been documented [10,11,12]. Recently, the most common methods used for the detection of B19V included immunoassays tests such as (ELISA) for detection of anti-B19V-IgG, anti-B19V-IgM as well as, the most accurate methods which include [molecular tests] such as nucleic acid assays (NAT) [13]. To our knowledge, no previous studies have been conducted in Iraq in general, nor in Diyala Governorate in particular on the detection of B19V in healthy donors, in addition to the fact that the examination of donors for the detection of the virus is not included in the examination schedules for blood donors yet in Iraq in general and Diyala Governorate in particular. Therefore, there is a need to investigate the virus among blood donors to avoid possible effects on recipients. This study was conducted, which aims to investigate the seroprevalence of IgM antibodies in the blood of donors.

2. Study Design, Participants and Methods

In a simple, non-random selection method based on several variables included in the questionnaire prepared by the researcher and adapted from the published articles as well, such as gender, age, residence, number of donation times, previous receipt of blood, and other serological tests such as (hepatitis B Core (HBC)), hepatitis B surface antigen (HBsAg), anti-HCV antibody, anti-HIV antibody and anti-syphilis antibody tests] that conducted by the blood bank [Blood Transfusion Center in Diyala Governorate] for blood donors, 188 samples were collected from blood donors of both sexes, and according to the approved study proposal, this study was conducted in Diyala Governorate, Iraq, for the period from 24/October/2021 to 28/July/2022, The ages of the study participants ranged between 17-58 years, arithmetic mean and standard deviation 33.8±9.1. It is worth noting that the samples were collected after obtaining the written and official approval documented by the Research Ethics Committee in the Diyala Directory of Health and under the direct supervision of the specialists at the Blood Donation Center and the approval of the study participants. [3,4,5] milliliters of venous blood were withdrawn from all study participants using medical syringes, as well as directly from blood bags for collecting blood from donors. Blood samples were placed in Gel and

Clot Activator Tubes and EDTA Tubes after numbering and then centrifuged to obtain serum and plasma. An ELISA test kit for detection the (immunoglobulin M (IgM)) antibodies specific to VP1-s proteins of Parvovirus B19 (Demeditec / Germany) was used according to the manufacturer's instructions [14]. Statistical analysis of the data collected and the results obtained was done using the SPSS-27 (Statistical Packages for Social Sciences-version 27). The difference of percentages (qualitative data) was tested using Pearson Chi-square test (χ^2 -test) and the *P*-value was considered statistically significant when it was equal to or less than 0.05 [15].

3. Results

The results presented in this part depended on the statistical analysis of the primary data collected during the study period, which extended from 24/October/2021 to 28/July/2022. Table 1 shows that the prevalence of IgM antibodies to Parvovirus B19 among the study participants of blood donors was 21(11.2%), while 167(88.8%) showed negative results represented by the absence of those antibodies with a statistically significant difference (*P*=0.000).

Table 1. Prevalence rate of anti- Parvovirus B19 IgM antibodies

Status	No	%	χ^2
Anti-Parvovirus B19 IgM Positive	21	11.2	113.383
Anti-Parvovirus IgM B19 Negative	167	88.8	<i>P</i> -value 0.000
Total	188	100%	[S]

Pearson's Chi-Square, *P*-value.

The highest prevalence of B19 IgM antibodies as shown in the Table 2, was among the age group [30-39], those antibodies appeared within this group at a rate of 8 (10.4%), but without the appearance of a statistically significant difference (*P*=0.585). The male participants in this study showed the highest prevalence of IgM antibodies to Parvovirus B19, which was 20 [11.0%], with a statistically insignificant difference (*P* = 0.790) compared to females. In addition, Table 2, showed that there was no significant difference (*P*=0.939) in the prevalence of IgM antibodies to Parvovirus B19 between the study participants from donors who live in urban areas and those who live in rural areas.

Table 2. B19 IgM seroprevalence among study participants according Socio-demographic factors

Variables	Positive		Negative		<i>P</i> -value	
	No.	%	No.	%		
Age	<20years	-	-	5	100	0.585 [NS]
	20---29	5	9.3	49	90.7	
	30---39	8	10.4	69	89.6	
	40---49	7	17.9	32	82.1	
	50---59	1	7.7	12	92.3	
Mean ± SD [Range]		35.5±7.4 [25-51]		33.6±9.3 [17-58]	0.380	
Gender	Male	20	11.0	161	89.0	0.790
	Female	1	14.3	6	85.7	[NS]
Residence	Urban	11	11.3	86	88.7	0.939
	Rural	10	11.0	10	89.0	[NS]

Pearson Chi-square test [χ^2 -test] at 0.05 level.
Students-t-test at 0.05 level.

Concerning Table 3, there is no statistically significant difference ($P=0.082$) in the prevalence of IgM antibodies to Parvovirus B19 among the study participants of blood donors who donated blood once and who donated more than once. Also, all those who showed seropositivity for IgM antibody to Parvovirus B19 among the study participants were donors who had not previously received blood from other donors with a statistically insignificant difference ($P= 0.422$). The present study showed for the first time that 2(22.2%) of blood donors showed seropositivity for IgM antibodies to Parvovirus B19, they also showed seropositivity of anti-HBC total antibodies with a statistically insignificant difference ($P=0.281$). However, none of the participants were positive for other viral markers including HBs Ag, anti-HCV antibody, anti-HIV antibody and anti-syphilis antibody.

Table 3. Anti-Parvovirus B19 IgM seropositivity according to variables

Variables		Positive		Negative		P-value
		No.	%	No.	%	
No. of blood donation	Once	2	4.3	45	95.7	0.082 [NS]
	> than once	19	13.5	122	86.5	
Previous receipt of blood	Yes	-	-	5	100	0.422 [NS]
	No	21	11.5	162	88.5	
Core HBC	Positive	2	22.2	7	77.8	0.281 [NS]
	Negative	19	10.6	160	89.4	

Pearson Chi-square test [χ^2 -test] at 0.05 level.
Students-t-test at 0.05 level.

4. Discussion

The importance of this study is highlighted by its uniqueness in Diyala Governorate, as it is the first survey that targets blood donors at a time when Parvovirus B19 test was not included in the screening programs in blood donation centers. Human Parvovirus B19 is a worldwide virus that is transmitted mainly through Respiratory system as well as through blood transfusion and organ donation from donor blood positive for the virus, and this transmission may have a problem and severe consequences, especially in patients with immunodeficiency or anemia and pregnant women. The main objective of the study was to enhance the safety of blood transfused to recipients. The most representative age group in this study was between 30 and 39 years, and with 41.0% of the number of samples, males constituted the largest percentage of 18 (9.3%). At a time when the participation of women in donating blood was low compared to men because of the progress of men in the first row in those situations because of the physical strength that the man possesses and his bearing the responsibility that is governed by the oriental nature of the Arab man, especially the Iraqi man, in addition to the physiological nature of the woman's body and what accompanies it in many. Sometimes the fact that a woman may be pregnant or breastfeeding or other physical conditions were the reason for the lack of women's participation in donating blood, and this is what the author of the current article agrees with what was published by the author of the article for the study that was conducted in Congo [16]. The results of the current

study showed that only 21 out of 181 donors showed acute infection or the so-called primary infection. This risk group was represented by a percentage 11.1% that is likely to transmit the virus to recipients who need transfusion for critical health conditions and who are often considered one of the most important groups At-risk [such as pregnant women during cesarean delivery, those suffering from haematological disorders, chronic anemia and immunosuppressed, To our knowledge, the incidence of antibodies indicating a recent infection was higher than what was shown by most other studies conducted in different area of the world which ranged from (0%, 0.7% to 7.5%) [10,13,16-22]. On the other hand, it was less than what was shown by the previous study that was conducted by Ibraheim, [23], in Basra Governorate, which was 51.1%.

The seropositivity of antibodies was higher in the age group 30-39 years, this study agrees with the results that were conducted in Argentina, the Congo and Nigeria, however, all of those studies did not show a statistically significant effect of age on the seropositivity of B19 IgM [16,24,25]. Although there was no statistically significant difference in the effect of gender on the prevalence of anti-B19 IgM antibodies in this study and for reasons mentioned above, the males showed the highest prevalence of those antibodies in their sera compared to females, and results was shown by other studies, such as the study conducted in the Kinshasa province of Congo, which it showed a high prevalence of anti-B19 IgM antibodies with a highly significant statistical difference, and the study that was conducted in Zambia, but without a significant statistical difference [16,26].

Regarding the number of donors, the appearance of IgM antibody in more than one time donors was higher compared to the one time donors, this result contrasts with the results of the study conducted in Argentina, which showed the equal detection of B19 IgM antibodies between donors for the first time, and frequent donors, in which the researcher attributed to the nature of transmission through the respiratory system, which is logical and sound [25], while the reason can be attributed in this study to the high detection of these antibodies between repeat donors to the large numbers of donors who donated more than once included compared to the other group. One of the important results obtained in this study is the detection of co-infection between hepatitis B Core and B19V among blood donors through the appearance of seropositivity of anti-HBC total Antibodies among those with seropositivity for anti-B19 IgM antibodies, this observation contradicts the study conducted in Argentina, which did not show a co-infection between B19V case positive and HBs Ag, HCV, HIV and syphilis among blood donors [25]. The presence of a co-infection between Hepatitis B virus and Parvovirus B19 in the blood of donors may worsen the health status of the recipients, especially since the recipients were critically ill that necessitated a blood transfusion for them. The results of the current study could be the basis for further investigation and research on the type of interaction between these two viruses and the synergistic effect on infected liver cells in hepatitis patients. One of the most important determinants of the current study is the small size of the samples included in the study, which is a major determinant facing researchers in different parts of the

world, especially Iraqi researchers, for financial reasons and lack of funding. On the other hand, the limitations of bias in the gender factor, as the number of males was greater compared to females as the main donors in this study and this is what other studies record [4,27,28,29].

5. Conclusion

The current study concludes that the seroprevalence of B19 IgM antibodies among blood donors is high, and poses a risk to sero-negative recipients who have healthy conditions and need blood transfusions. There is a need to include the Human Parvovirus B19 examination with other transfusion center testing programmers. Finally, there is a need to conduct more future studies with a large sample size at the serological and molecular levels to confirm the current results in this study and in cooperation and support provided by the health institutions in the country.

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Authors' Contribution

Conceptualization and data curation, Asmaa H. Hwaid.; Methodology, Zainab Majed Mohammed.; writing-an original draft preparation Asmaa H. Hwaid and; writing-review and editing, Asmaa H. Hwaid and Zaki M. Majed; supervision, Asmaa H. Hwaid, All participant authors have read and agreed to the published version of the article.

Competing Interest

The authors declare that they have no competing interest.

Abbreviations

B19V: Parvovirus B19
ELISA: Enzyme-linked immunosorbent assay
HCV: hepatitis C Virus
HIV: human immunodeficiency virus

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