

# Seroprevalence of Parvovirus B19 Infection and its Attributable Factors Among Blood Donors in Diyala Governorate, Iraq

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## Abstract

**Background:** Human Parvovirus B19V is one of the smallest viruses responsible for a wide range of clinical complications in humans, and it can be transmitted through the blood during blood donation, which presents a real problem for recipients, especially patients with blood disorders, pregnant women, and immunocompromised. **Objective:** This study aimed to detect the seroprevalence of Parvovirus B19 in blood donors in Diyala Governorate and to investigate the effect of some socio-demographic factors. **Methods:** This study was carried out in Diyala Governorate - Iraq for the period from October 24, 2020 to November 28, 2021. Blood samples (n = 188) were collected from Iraqi blood donations at the Central Blood Bank in Diyala. The age range was 17-58 years. A questionnaire form has been prepared to collect patient data, including demographic and social factors. An ELISA test kit for detection of Parvovirus B19 IgG (Demeditec / Germany) was used. The approval of the Scientific Research Ethics Committee was obtained from the Diyala Health Department in addition to the oral consent of the patients. SPSS version 27 was used to perform the statistical analysis, and the P-value was considered statistically significant when it was equal to or less than 0.05. **Results:** The current results of this study showed that the anti-Parvovirus B19 among unpaid blood donors in Diyala province was 62(33.0%). The higher positivity rate was among the 40-49 years (P = 0.494). Females had insignificantly higher positivity rate compared to males (P= 0.800). The results also showed a higher rate of anti-Parvovirus B19-IgG positivity with the increase in the number of blood donations (P= 0.370). Furthermore, there was a statistically significant association between the anti-Parvovirus B19-IgG and the anti-HBC total antibody (P= 0.028). **Conclusion:** This study, for the first time, gave a light on the prevalence of the virus among this critical group of blood donors. The Seroprevalence of anti-Parvovirus B 19 among blood donors in Diyala Governorate is age depends on possible associated with hepatitis B virus, Future studies to explore the common genotypes of B19 and viral load among this group are necessary.

**Keywords:** Parvovirus B19, Blood donors, Diyala Governorate

## 1. Introduction

Human Parvovirus B19 was first observed by electron microscopy by Australian virologist Cossart in 1975 in serum samples of patients infected with hepatitis B, It is a non-enveloped virus, consisting of a linear, single-stranded DNA genome, the smallest virus with a size (20 to 25 nm) in diameter, and it belongs to the genus Erythroparvovirus and the Parvoviridae family (Cotmore et al., 2014). Despite the common modes of transmission such as the respiratory route and vertical transmission from the pregnant mother to the fetus, transmission through blood transfusion is a major health problem due to the persistence of the virus and its resistance to procedures for blood treatment and its products, as well as the high viral load during early acute infection (Young and Brown, 2004; Qiu et al., 2017; Slavov et al., 2019). The virus is characterized by global circulation and causes a wide range of clinical manifestations, most of which remain asymptomatic or show a mild clinical course in immunocompetent individuals. Most of the clinical manifestations of B19V infection are observed frequently in children with a common clinical

presentation known as fifth disease or erythema infectiosum, clinical manifestations depend mainly on the immunological and hematological status of patients (Weissbrich et al., 2007; Bonjoch et al., 2015; Zavattón et al., 2016; Das et al., 2019). In immunocompromised patients B19V infection may become chronically infected (Hasan et al., 2013; Slavov et al., 2016). Parvovirus B19 infection shows differences at the regional epidemiological level, with more than half of the overall adult population affected. The prevalence of B19V antibodies in the blood depends on age, increasing from (2 to 20%) among children under 5 years of age to (15 to 40%) among children aged 5 to 18 years to (40 to 80) percentage) among adults, depending on the techniques used in the diagnosis and the nature of the population (Mossong et al., 2008; Adam et al., 2015; Zhang et al., 2016). Neutralizing IgG antibodies are highly effective in eliminating the virus in the bloodstream after developing about two weeks after infection (Qiu et al., 2014).

Of the effective diagnostic methods in detecting the presence of the virus are molecular methods in addition to immunological tests such as ELISA to

detect antibodies anti-B19V (IgG) and anti-B19V (IgM) antibodies (Corcoran and Doyle, 2004; Marano et al., 2015). The presence of B19V as a potential contaminant of donated blood, as published studies regarding viral clearance indicated that much solvent- and detergent-treated plasma containing >107 IU/mL of viral DNA could be transmitted B19 to patient recipients and seronegative volunteers (Stramer et al., 2009). Continuing to donate blood, especially when viral DNA persists for several months and remain detectable with low titer (<103IU/ml) or high titer (>104IU/ml) requires survey research to reduce the actual risk of virus transmission among recipients (Juhl and Hennig., 2018). By reviewing the scientific literature, no previous studies have been conducted in Iraq in general or in Diyala Governorate on the detection of B19V in healthy donors, therefore, this study aimed to determine the seroprevalence of B19V among blood donors.

## 2. Subjects and Methods

After an approval of the Scientific Research Ethics Committee was obtained from the Diyala Health Department in addition to the oral consent of the patients, 188 blood samples were collected from blood donors attending the Central Blood Bank in Diyala Governorate for the period from October 24, 2020, to November 28, 2021. The age range of participants was 17-58 years. Using a special questionnaire, data on blood donors (demographic characteristics) including age, sex, residence, numbers of blood donation and previous receipt of blood and Core HBC examination conducted by the blood bank screening center was collected. 3-5 milliliters of venous blood were aspirated from each participant, and poured into gel and clot activator tubes, kept in room temperature for 15 minutes. For separation of sera, blood samples were centrifuged at 5000 rpm for 10 minutes. Sera were kept in cool box during delivery to the laboratory where they deep freed at -20 OC till tested. An ELISA test kit for detection the (immunoglobulin G (IgG)) antibodies specific to VP1-s proteins of Parvovirus B19 (Demeditec / Germany) was used according to the manufacturer's instructions. Statistical analysis of the data 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 ( $\chi^2$ -test) and the P-value was considered statistically significant when it was equal to or less than 0.05.

## 3. Results

In total, 188 samples were serologically tested using the ELISA technique to determine the seropositivity rate for the presence of B19V antibodies (anti-VP1 IgG) among the study participants of healthy blood donors. The results of the serological test showed that out of 188 participants, 62 (33.0%) showed seropositivity for these antibodies table (1). Table (2) revealed that the higher Parvovirus B 19 positivity

rate was among the 40-49 year, but without statistically insignificant differences (P= 0.494). Furthermore, females had insignificantly higher positivity rate compared to males (P= 0.800). Additionally, the seropositivity rate the anti- B19 IgG was similar among rularees and urbanees with insignificant difference (P= 0.997).

Status	No	%	$\chi^2$
Anti-Parvovirus B19 IgG Positive	62	33.0	<b>21.787</b>
Anti-Parvovirus IgG B19 Negative	126	67.0%	
Total	188	100%	<b>P-value</b> <b>0.000</b>

Pearson's Chi P-value.

Variables	Positive		Negative		P-value	
	No.	%	No.	%		
Age	<20years	2	40.0	3	60.0	0.494
	20---29	20	37.0	34	63.0	
	30---39	20	26.0	57	74.0	
	40---49	14	35.9	25	64.1	
	50---59	6	46.2	7	53.8	
Mean $\pm$ SD (Range)	33.7 $\pm$ 10.1 (17-57)		33.9 $\pm$ 8.7(18-58)		0.869	
Gender	Male	60	33.1	121	66.9	0.800
	Female	2	28.6	5	71.4	
Residence	Urban	32	33.0	65	67.0	0.997
	Rural	30	33.0	61	67.0	

Pearson Chi-square test ( $\chi^2$ -test) at 0.05 level.  
Students-t-test at 0.05 level.

The results in table (3) revealed that the anti-Parvovirus B19 IgG positivity rate was increased as the number of blood donation increased; However, it failed to show any statistical significance (P= 0.370). On the other hand, the positivity rate was insignificantly higher among individuals who never had a previous receipt of blood (P= 0.532). Furthermore, there was a significant association between the anti- B19V IgG and the anti-HBC total antibody (P= 0.028). However, none of the participants were positive for other viral markers including HBs Ag, anti-HCV antibody, anti-HIV antibody and anti-syphilis antibody.

Variables	Positive		Negative		P-value	
	No.	%	No.	%		
No. of blood donation	Once	13	27.7	34	72.3	0.370
	> than once	49	34.8	92	65.2	
Previous receipt of blood	Yes	1	20.0	4	80.0	0.532
	No	61	33.3	122	66.7	
Core HBC	Negative	62	33.0	126	67.0	0.028*
	Positive	6	66.7	3	33.3	

Pearson Chi-square test ( $\chi^2$ -test) at 0.05 level.  
Students-t-test at 0.05 level.

## 4. Discussion

Screening of blood donors for Parvovirus B19 virus is

not routinely done in Iraqi blood banks as well as in many other countries (Hasanain et al., 2021). Therefore, Seroprevalence study to explore the prevalence of B19V and its common genotype is necessary (Li et al., 2021). In Iraq including Diyala Governorate, no previous studies were conducted to address this subject. Only two studies were conducted in Diyala Governorate, both were on children 1-14 years old; The first was designed to determine the B19V infection rate among thalassemia patients and the second is for patients who are clinically suspected of having erythema infectiosum (Hussein and Hasan, 2021a, b). Probably the main limitation of the current study is the small sample size due to financial reasons.

Using the ELISA technique, the current study found that the anti-B19V IgG among blood donors was 33%. Similar result was obtained by Chinese meta-analysis study (Li et al., 2021). However, the detection rate of B19V IgG among blood donors from Egypt and Qata were much higher (Hasanain et al., 2021; Abdelrahman et al., 2021). In northern India, a study of volunteer blood donors documented that 61.8% of them had B19V IgG antibodies (Oh et al., 2010). In the same context, studies of blood donors from Brazilians, Dutch, Koreans and Spaniards have reported IgG seroprevalence rates of 60%, 60.9%, 60.1%, and 64.7%, respectively (Munoz et al., 1998; Kishore et al., 2010; Kooistra et al., 2011; Slavov et al., 2012). B19V seroprevalence has been known to increase with age, 70% of the adult people is seropositive. (Kerr et al., 1999). IgG antibodies specific to anti-B19 can be detected 2 weeks after infection and are initially directed against both (linear and conformational epitopes) of viral capsid proteins and, to a lesser extent, against NS1 (Corcoran et al., 2004). The low detection rate of B19V IgG of the present study is consistent with that reported by Al-Danani et al. (2008) indicated seropositive of B19V IgG antibodies in Yemen decreased with increasing age (B19 IgG seropositivity independent of age). The prevalence could also be much higher, such as the 85% seroprevalence rate reported for 9 years (Wilding et al., 2007). On the contrary, age dependent pattern of the prevalence of B19V infection was reported in certain areas, affirming the existence of regional epidemiological differences (Adam et al., 2015; Zhang et al., 2016). In consistent with current results, other studies in Brazil and Australia demonstrated no gender differences in the anti-IgG antibodies prevalence (Nascimento et al., 1990; Kelly et al., 2000).

The results also showed that there was no association between the anti-PB19V IgG and donation or transfusing blood. The timing of infection with the virus (viremia) before rash symptoms appear, the high viral load, and the persistence of this non-enveloped virus all make the risk of transmission of the virus through blood or its derivatives such as plasma, blood cells and clotting factors (Schmidt et al., 2001). Comparisons between individuals who

have had blood transfusions and those who are not receiving blood transfusions have shown a significantly higher rate of seropositivity in individuals who have received blood transfusions (Rohrer et al., 2008; Ihara et al., 2013). Even if symptomatic Even if transfusion transmitted B19V infection is generally rare (Satake et al., 2011; Norja et al., 2012; Marano et al., 2015). However, the course of the viremia in asymptomatic donors demonstrates a short peak ( $>10^9$  copies parvovirus DNA/ml), followed by viremia below 10<sup>6</sup> copies/ml for about 2 weeks (Zaaijer et al., 2004). This is seeming to be the most plausible explanation for the negative association of PB19V IgG positivity and the blood transfusion. The significant association of anti-B19V IgG and the anti- HbC total positivity is an important and fascinating result in this study. However, this result is not unusual in Diyala community where high prevalence of hepatitis B virus (HBV) was documented as indicated by positive Hepatitis surface antigen (HBsAg) (Hasan, 2005; Hasan et al., 2005; Hasan et al., 2006). In addition to high rate of occult HBV infection (Hasan, 2012; Hasan et al., 2018). As the occult hepatitis B infection (OBI) is defined as the detection of hepatitis B virus DNA in serum or liver in HBsAg-negative patients with or without serological markers of prior viral exposure (Torbensohn and Thomas, 2002). No such association was referred to in previous studies. Since the two viruses are DNA viruses, so probably certain levels of interaction may occur between these viruses, a subject need further investigation.

Conclusion: This study, for the first time, gave a light on the prevalence of the virus among this critical group of blood donors. The Seroprevalence of anti-Parvovirus B 19 among blood donors in Diyala Governorate is age depend on possible associated with hepatitis B virus. Future studies to explore the common genotypes of B19 and viral load among this group are necessary.

## 5. Declaration

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### Author Contributions

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

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### Competing interest

The authors declare that they have no competing interest.

## Abbreviations

B19V: Parvovirus B19

NS: Nonstructural protein

OBI: occult hepatitis B infection

ELISA: Enzyme-linked immunosorbent assay

HBsAg: Hepatitis surface antigen

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