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RESEARCH ARTICLE

THE ASSOCIATION BETWEEN HEPATITIS B VIRUS INFECTION WITH ABO AND RHD BLOOD GROUPS

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Abstract

Background: ABO and Rh blood types are associated with a higher risk of disease and are essential for clinical practice and blood transfusion safety. The findings of earlier research on the relationship between blood types and HBV infection are still up for debate. There is no study conducted on the study population to reveal the relationship between ABO and RhD blood groups and infection with hepatitis B virus.
Aims: This study aimed to identify the relationship between blood types and hepatitis B virus infection in blood donors at Jiblah University Hospital in Jiblah town, Yemen
Methods: A hospital-based cross-sectional study was conducted. Venous blood samples were drawn from 120 blood donors and tested for hepatitis B core antigen (anti-HBc) using commercial kits (Roche Diagnostics GmbH, United Kingdom). ABO and Rh blood groups were determined by the cell pooling method. The results were analyzed using SPSS v.20.
Results: This study reported that the most frequent blood types were O positive and A positive 57 (47.5%) and 28 (23.3%) respectively, followed by B positive 14 (11.67%) and O negative 13 (10.83%). The overall phenotypic frequencies of ABO and RhD blood groups were O+>A+>B+>O->A->AB+>B->AB-. The prevalence of hepatitis B virus was 12 (10%). No statistical association was detected between ABO and RhD blood groups and hepatitis B infection.
Conclusions: High prevalence rates of hepatitis B virus infection among blood donors were identified in this study. There was no statistical association between ABO and RhD blood groups and hepatitis B infection.
Keywords: Blood group, Hepatitis B infection, Jiblah, RhD, Yemen.

INTRODUCTION

Blood donation has a critical role in almost every area of clinical practice[1,2]. Although blood donation is important for a safe life, there are many blood-borne diseases that can be transmitted by healthy blood donors in both developed and developing countries[3]. The World Health Organization (WHO) recommends that all blood donors should be tested for blood-borne diseases, such as hepatitis B infection, hepatitis C infection, HIV, and syphilis[4]. HBV infection remains a major concern in blood transfusion practice[5]. Hepatitis B virus infection is a global public health concern and is the tenth leading cause of death in the world, with 1.2 million deaths annually[4,6,7]. About 1.5 million people were newly infected with HBV[8]. Different ABO-Rh blood group systems in humans play an important role in saving human life[9]. Blood antigens are important ligands and receptors or co-receptors for bacteria, viruses and parasites[1,10,11]. In recent years, many studies have been conducted and found a link between ABO blood types and chronic infections such as diabetes mellitus type 2[12], several malignancies, such as gastric cancer and pancreatic cancer[1], infectious diseases, such as cholera and dengue fever[12] and blood-borne illnesses, such as viral hepatitis[13].
In previous studies, ABO blood types have been documented as a risk factor for infection with HBV and HCV[13,14]. Hroob AMA *et al.*, revealed a association between HBV and blood group O, but no relationship between blood types and HCV was reported[10]. Lao *et al.*, reported that HBV prevalence was higher in blood group O (10.2%), but lower in blood AB (9.1%), group B (9.6%)[15]. In a study carried out in Tehran, Iran, it was reported that the rate of infection with HBV was lower in donors with blood type O[16]. Various reports

indicate the importance of ABO and Rh antigens in individual susceptibility to HBV infection[9].

Yemen is a developing country and has been suffering from political conflict since 2015. Several studies carried out in Yemen revealed that frequency of HBV among general population varies from the intermediate (2–8%) to high endemicity (>8% infection rate)[17]. In 2022, a study carried out in the city of Jiblah, Yemen, showed that the incidence of HBsAg was 3.33%[8]. Regarding the recurrence of HBV infection among blood donors, several studies were conducted in Hodeidah, Jiblah, Aden, and Sana'a reported that HBV represents a major public health problem among blood donors and that the infection rate of HBV ranges from 2.1% to 6.56%. From these findings, HBV infection remains a major health problem in Yemen. O+ blood type is the dominant type in Yemen[18]. To date, the frequency of HBV and the prevalence of ABO and RhD blood groups in the study have not yet been studied. Therefore, the current study aims to identify the relationship between blood types and HBV infection among blood donors at Jiblah University Hospital in the city of Jiblah, Yemen.

MATERIALS AND METHODS

This cross sectional study was performed among blood donors attending the blood bank, Jiblah University Hospital in Jiblah town, Yemen. A convenience sample of blood donors was included in the study. All ethical considerations (reference number 80-9/2023) were considered, and confidentiality was maintained. Ethical and institutional approval for the study was obtained from Jiblah University for Medical and Health sciences. All required data for the target population including socio-economic data were collected using a structured questionnaire. Blood samples were obtained from all eligible donors and tested for the presence of HBV. Hepatitis B infection was diagnosed by the detection of total antibody to hepatitis B core antigen (anti-HBc) by using commercial kits (Roche Diagnostics GmbH, UK). The ABO and Rh blood type was determined by cell grouping method. Rh-negative blood groups were confirmed by the antiglobulin technique.

Statistical Analysis

SPSS (version 20) was used to analyze the collected data. Chi-square test was used to find the significance of the probability level. A p value <0.05 was considered statistically significant.

RESULTS

This study was conducted on 120 blood donors who attended to the blood bank at Jiblah University Hospital in Jiblah town, Yemen. All participants in this study were males 120 (100%).

Table 1: Seroprevalence of hepatitis B virus infection among study participants.

Factor	NO. (%)	Anti-HBc		*p** value
		Positive NO. (%)	Negative NO. (%)	
Age (years)				0.968
19-28	42 (35)	5 (11.9)	37 (88.1)	
29-38	38 (31.7)	3 (7.9)	35 (92.1)	
39-48	30 (25)	3 (10)	27 (90)	
≥ 49	10 (8.3)	1 (10)	9 (90)	
Marital status				0.114
Single	20 (16.7)	16 (80)	4 (20)	
Married	100 (83.3)	92 (20)	8 (80)	
Education Level				0.653
Illiterate	9 (7.5)	1 (11.1)	8 (88.9)	
Basic	29 (24.2)	2 (6.9)	27 (93.1)	
Secondary	41 (34.2)	6 (14.6)	35 (85.4)	
Graduated	41 (34.2)	3 (7.63)	38 (92.7)	
Monthly income				0.472
≤. 50 USD	34 (28.33)	3 (8.8)	31 (91.2)	
> 50 – 150 USD	50 (41.67)	7 (14)	43 (86)	
> 150 USD	36 (30)	2 (5.6)	34 (94.4)	
Occupation				1.000
Labor/ farmer	58 (48.3)	6 (10.3)	52 (89.7)	
Solider	11 (9.2)	1 (9.1)	10 (90.9)	
Government employee	26 (21.7)	3 (11.5)	23 (88.5)	
Self/ private	21 (17.5)	2 (9.5)	19 (90.5)	
Student	4 (4.4)	0 (0.0)	4 (100)	
Previous donation				0.045
Yes	83 (69.2)	78 (94)	5 (6)	
No	37 (30.8)	30 (8.1)	7 (18.9)	
Shaving tools				0.081
New/Sterilized	102 (85.5)	8 (7.8)	94 (92.2)	
Reused	18 (15.5)	4 (22.2)	14 (77.8)	
Knowledge of HBV				0.123
Yes	47 (39.2)	2 (4.3)	45 (95.7)	
No	73 (60.8)	10 (13.7)	63 (86.3)	

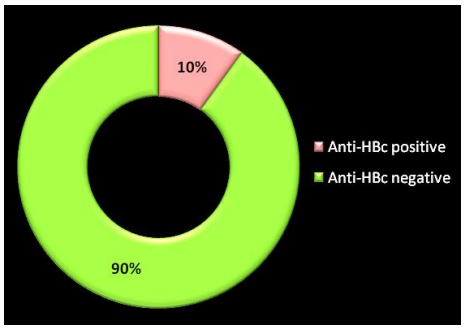

Figure 1: Frequency of anti-HBc among study subjects.

Among all participants, 12 (10%) tested positive for HBV as shown in Figure 1. The prevalence of anti-HBc decreased with age, from 11.90% in the age group of 19–28 years to 10% in the age group >48 years. The difference was not statistically significant (p<0.986). The difference between HBV infection and previous donation was found to be statistically significant (p< 0.045). In this study, no statistical association was detected between HBV infection and marital status, education level, monthly income, occupation, shaving tools and HBV knowledge (Table 1). The most common blood type in the current study was O 69 (57.5%) and the least common was AB 3 (2.5). The frequency of ABO blood groups among subjects was O>A>B>AB. However, Rh blood types distribution in this study showed that 85.0% of donors were Rh positive (Table 2). The overall phenotypic pattern of ABO and RhD blood types were O+>A+>B+>O->A->AB+>B->AB. This finding shows the order of blood types frequency in the current study. Based on the analyzed data which are shown in the Table 3, there was no significant association between ABO and RhD blood types and HBV infection (p<0.678) (p <0.209), respectively. The seroprevalence rate of HBV infection investigated in the present study based on the blood group and Rh factor of donors are indicated in (Table 3). O+, A+, and B+ were the most widespread blood groups among the people with positive HBV. Moreover, AB+, O-, A-, B-, and AB- were the least prevalent blood groups among people with positive HBV. No significant association was found between ABO and Rh blood systems and HBV infection (p<0.826).

DISCUSSION

Viral hepatitis is a major health problem with huge health and economic burdens on countries[19]. Globally, hepatitis B virus and hepatitis C virus represent a major public health burden, especially in developing countries. During 2019, WHO estimated that 296 million people worldwide were infected with HBV. HBV infection is usually transmitted through direct blood contact, blood and blood product transfusions, intravenous injections, and unprotected sex[6].

Transfusion of blood and blood products is a risk factor for infection with hepatitis HBV. Therefore, WHO has recommended routine serological testing for transfusion-transmitted infections (TTIs) including HBV to reduce transmission of this infection[20].

Table 2: Frequency of Hepatitis B virus infection in relation to ABO and RhD blood groups.

Variables	NO. (%)	Anti-HBc		*p* value
		Positive NO. (%)	Negative NO. (%)	
ABO blood type				0.678
O	69 (57.5)	6 (8.7)	63 (91.3)	
A	33 (27.5)	5 (15.2)	28 (84.8)	
B	15 (12.5)	1 (6.67)	14 (93.33)	
AB	3 (2.5)	0 (00)	3 (100)	
Rhesus blood type				0.209
Positive	102 (85)	12 (11.8)	90 (88.2)	
Negative	18 (15)	00 (00)	18 (100)	

*p-value of < 0.05 was considered statistically significant.

The prevalence of HBV varies from country to country. The differences may be due to geographical and socioeconomic differences as well as the use of more than one marker such as HBsAg, anti-HBc and HBV DNA, which have been used in previous studies, may contribute to this difference[21]. The present study aims to determine the frequency of HBV infection among people who attend Jiblah University Hospital in Jiblah Town, Yemen, to donate blood. The seroprevalence of anti-HBc was 12 (10%). The results of this study reports that the prevalence of HBV was higher compared to findings previously detected in Yemen, which ranged from 2.1% to 6.7%[21]. Differences between these studies can be attributed to behavioral, environmental and host factors as well as differences in the selection of participants. Furthermore, the use of more than one marker such as HBsAg, anti-HBc and HBV DNA, which have been used in the previous studies, may contribute to these variations. The frequency of ABO blood groups among study subjects was O 69 (57.5%), A 33 (27.5%), B 15 (12.5%) and AB 3 (2.5%). A similar pattern has been reported by different studies carried out in different regions in Yemen such as Ibb, Sana'a and Dhamar[18]. The results of the present study were similar to studies conducted in Saudi Arabia and in different African and European countries[22]. The results of this study reported that the most prevalent Rh blood type was Rh positive 102 (85%) and the least prevalent Rh blood type was Rh negative 18 (15%). The results of studies conducted in the Arabian Peninsula were similar to the results of this study[22].

Table 3: Frequency of hepatitis B virus associated with ABO and RhD blood groups.

Variables	NO. (%)	Anti-HBc		*p** value
		Positive NO. (%)	Negative NO. (%)	
Blood type				0.862
O+	57 (47.5)	7 (12.3)	50 (87.7)	
O-	13 (10.8)	0 (00.0)	13 (100)	
A+	28 (23.3)	4 (14.3)	24 (85.7)	
A-	4 (3.3)	0 (00.0)	4 (100)	
B+	14 (11.7)	1 (7.1)	13 (92.9)	
B-	1 (0.8)	0 (00.0)	1 (100)	
AB+	3 (2.5)	0 (00.0)	3 (100)	
AB-	0 (0.0)	0 (00.0)	0 (00.0)	

*p-value of < 0.05 was considered statistically significant.

Globally, many studies have attempted to explain the relationship between ABO blood groups and Rh types and transmissions of infection. A previous study conducted in Iran showed that O+ blood group is the most common blood group associated with blood-borne infections. While this study indicated that there is no statistical relationship between HBV infection and blood type. The results of studies conducted in Yemen, Iraq, Saudi Arabia[10], Iran and Nigeria are consistent with the results of this study[7,17-22]. On the other hand, some studies reported that blood types B and AB were the most common among people infected with HBV[23]. While, a study conducted in Iraq revealed that infection with HBV was statistically related to the blood type of donors; HBsAg was found to be higher in donors with blood group O and lower in donors with blood group AB, while the frequency of RhD in HBV infected donors was higher among rhesus-positive donors[7]. In research conducted in Peshawar, Pakistan, it was indicated that HBV infection was more prevalent among people with blood type A[22]. However, a study in India reported that AB negative blood group was the most common blood group associated with HB infection[24].

Limitations of the study

This study had several limitations, the sample size and study period are small, which makes generalization based on the observed outcome difficult and does not accurately reflect the prevalence of HBV infection among participants.

CONCLUSIONS

The seroprevalence of 12 (10%) HBV patients was high according to the WHO classification. Previous donation has been identified as a modifiable risk factor for HCV infection. O+, A+, and B+ blood types were more common among participants with HBV infection. However, this study reported no significant association between the ABO and Rh blood systems and HBV infection. This study advises that further studies be conducted over a longer period and of a larger size to determine whether there is a real association between ABO blood groups and the RhD factor with hepatitis B virus infection in Yemen.

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AUTHOR'S CONTRIBUTION

Al-Mohani SKM: collection of samples, writing original draft, methodology, investigation. **Al-Nawd EAA:** formal analysis and conceptualization. All authors read and approved the final manuscript.

DATA AVAILABILITY

Data will be made available on reasonable request.

CONFLICT OF INTEREST

No conflict of interest is associated with this work.

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