

# Prevalence of hepatitis B and C infections and associated factors among blood donors in Aden city, Yemen

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## معدّل انتشار عدوى التهاب الكبد "بي" و"سي" والعوامل المرتبطة بها بين المتبرعين بالدم في مدينة عدن في اليمن علي الوليدي، يوسف صالح خضر

الخلاصة: وقد حددت هذه الدراسة معدّل انتشار كل من فيروس التهاب الكبد "بي" وفيروس التهاب الكبد "سي" وعوامل الاختطار المرتبطة بهما بين المتبرعين بالدم في مدينة عدن في اليمن. وقد اختار الباحثان عينة منهجية مكونة من 469 ذكراً من المتبرعين بالدم الذين راجعوا خدمات بنك الدم الوطني في عدن في ما بين شهري حزيران/ يونيو وتشرين الأول/ أكتوبر 2007. وجميع الباحثون المعطيات بواسطة استبيان وعينات دموية. ومن بين المشاركين الـ 469، كان 24 منهم (5.1%) إيجابيين للمستضد السطحي لالتهاب الكبد "بي"، و6 منهم (1.3%) إيجابيين لمضاد فيروس التهاب الكبد "سي". ووجد الباحثون بالتحليل المتعدد المتغيرات، تبين أن السوابق الآتية: نقل الدم (OR = 22.8)، وعلاج الأسنان (OR = 3.6)، الحجامة (OR = 3.9)، والعدوى بالمalaria (OR = 6.8) هذه السوابق كانت مترابطة على نحو يُعتدّ به بالإيجابية للمستضد السطحي لالتهاب الكبد "بي". على أن من كان لهم سوابق تبرع بالدم كانوا أقل احتمالاً بكونهم إيجابيين لأضداد فيروس التهاب الكبد "سي" (OR = 0.05)، في حين أن من تلقوا نقل دم سابقاً كانوا أكثر احتمالاً بكونهم إيجابيين (OR = 6.65). وقد دلّت هذه النتائج على أن معدّل انتشار التهاب الكبد بالفيروس "بي" والتهاب الكبد بالفيروس "سي" مازال مرتفعاً بين المتبرعين بالدم في اليمن مقارنة بالبلدان الأخرى.

**ABSTRACT** This study determined the prevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) and associated risk factors among blood donors in Aden city, Yemen. A systematic sample of 469 male blood donors was selected from those attending the national blood bank service in Aden between June and October 2007. Data were collected by questionnaire and blood samples collected. Of the 469 participants, 24 (5.1%) were positive for HBsAg and 6 (1.3%) for anti-HCV. In multivariate analysis, history of: blood transfusion (OR = 22.8), dental treatment (OR = 3.6), cupping (OR = 3.9) and malaria infection (OR = 6.8) were significantly associated with being positive for HBsAg. Those with history of blood donation were less likely to be positive for HBsAg (OR = 0.17). Those with a history of blood donation were significantly less likely to be positive for anti-HCV positivity (OR = 0.05), while those with history of blood transfusion were more likely to test positive (OR = 65.6). The prevalence of HBV and HCV among blood donors in Yemen is still high compared to many other countries.

## Prévalence des infections par les virus de l'hépatite B et C et facteurs associés chez des donneurs de sang dans la ville d'Aden (Yémen)

**RÉSUMÉ** La présente étude a déterminé la prévalence des infections à hépatite B et C et les facteurs de risque associés chez des donneurs de sang dans la ville d'Aden (Yémen). Un échantillon systématique de 469 donneurs de sang de sexe masculin a été sélectionné à partir de donneurs fréquentant le service national de la banque de sang dans la ville d'Aden entre juin et octobre 2007. Des données ont été recueillies par questionnaire et des échantillons de sang ont été prélevés. Parmi les 469 participants, 24 étaient positifs pour les antigènes de surface du virus de l'hépatite B (5,1 %) et 6 pour les anticorps contre le virus de l'hépatite C (1,3 %). Dans une analyse multivariée, les antécédents de transfusion sanguine (O.R. = 22,8), de traitement dentaire (O.R. = 3,6), d'application de ventouses (O.R. = 3,9) et de paludisme (O.R. = 6,8) étaient fortement associés à la positivité aux antigènes de surface du virus de l'hépatite B. Les personnes ayant déjà fait don de leur sang avaient moins de risque d'être positives pour les antigènes de surface du virus de l'hépatite B (O.R. = 0,17). Ces dernières avaient aussi beaucoup moins de risque d'être positives pour les anticorps contre le virus de l'hépatite C (O.R. = 0,05), contrairement aux personnes ayant reçu des transfusions sanguines (O.R. = 65,6). Par rapport à de nombreux autres pays, la prévalence de l'infection par les virus de l'hépatite B et C chez les donneurs de sang reste élevée au Yémen

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## Introduction

Infection with hepatitis B virus (HBV) and hepatitis C virus (HCV) causes considerable morbidity and mortality worldwide [1,2]. In Yemen, chronic hepatitis is an important cause of cirrhosis and liver cancer but studies on the prevalence of these viruses in the general population are scarce [3]. Among Middle Eastern countries, Bahrain, Islamic Republic of Iran and Kuwait have low HBV endemicity; Cyprus, Iraq and United Arab Emirates have intermediate endemicity; while Egypt, Jordan, Oman, Palestine, Yemen and Saudi Arabia have high endemicity [4]. In 1988 a sero-epidemiological survey of hepatitis A, B and D was performed in the Yemen [5]. The prevalence of hepatitis B surface antigen (HBsAg) was 12.7%. Using multivariate analysis, age, past history of jaundice, and combined history of blood transfusion and surgery were independent predictors of hepatitis B infection [5].

The prevalence rates of HBsAg among volunteer blood donors in developing countries are much higher than that reported in developed countries [6]. This reflects the efficacy of blood donor selection policies, effective screening and very low HBV prevalence in the general population in these countries. Volunteer blood donors are generally regarded as a healthier segment of any community, as blood banks usually have strict selection criteria. [7]. The proportion of donors with hepatitis and the risk factors associated with the disease among these healthy individuals may reflect the magnitude of chronic HBV and HCV infection in the general population.

The awareness of the importance of blood safety for controlling the transmission of HBV and HCV has helped to decrease the spread of these viruses. Public health interventions and strategies have been shown to be effective method of preventing

such infection. Any strategy to prevent these infections must therefore be based on accurate data, including information about prevalence and risk factors of these infections. Therefore, this study was conducted to determine the prevalence of HBV and HCV and their associated factors among blood donors at Aden city, Yemen. Such information may raise awareness regarding the need for urgent action to prevent HBV and HCV transmission in Yemen.

## Methods

### Study population

This study was conducted among all blood donors who attended the national blood bank service in Aden in Yemen between June and October 2007. Blood donation operates on an exchange basis in which relatives and friends of patients are requested to donate blood for their clinical management. A systematic sample was obtained by selecting all blood donors attending the national blood bank every other day. For cultural reasons, only males who consider themselves healthy donate blood. The staff at the national blood bank informed donors about their infectious status and those who were found to be infected were counselled and referred to seek medical attention.

### Data collection

A structured self-administered questionnaire was used to collect data. The questionnaire was filled through face-to-face interview by a trained public health specialist (first author) for those who could not read and write. The questionnaire sought information about personal characteristics such as age, gender, level of education, marital status, number of wives, number of children, residency, occupational history, previous blood donation, and history of: blood transfusion, haemodialysis, cupping, travel outside the country,

malaria, hepatitis B vaccination, surgical procedures and dental treatment. History of malaria infection was determined by asking the participants whether they had ever had physician-diagnosed malaria.

### Laboratory testing

Blood samples were routinely collected from blood donors at the national blood bank. Testing of specimens was performed at the laboratories of virology unit of the national blood bank. Blood was screened for HBsAg using a hepatitis B antigen detection kit/enzyme immunoassay (PRC, Germany). Hepatitis C infection was measured with IMx HCV version 3.0 (Abott, Germany). Manufacturer's instructions were followed.

### Ethical considerations

Written consent was obtained from the respondents who agreed to participate in this study. The respondents were assured about the confidentiality of the information and that the laboratory results would not be disclosed to any other persons.

### Statistical analysis

Data are presented as frequency distributions for categorical variables. Differences in the prevalence of hepatitis between patients according to the variables examined were tested with the Pearson chi-squared test. Multivariate analysis using binary logistic regression was used to identify factors associated with HBsAg and anti-HCV. Data were analysed using SPSS, version 11.5. A *P*-value of less than 0.05 was considered statistically significant.

## Results

### Participant's characteristics

A total of 495 male blood donors who attended the national blood bank service of Yemen (Aden) between June and October, 2007 were approached

and invited to participate in this study. Of those, 469 (94.7%) agreed to participate in this study. Of the 469 participants, 27 (5.8%) were interviewed face to face because there were illiterate. The age of participants ranged between 18 and 59 years with a mean of 29.3 years. Their sociodemographic, clinical, and relevant characteristics are shown in Table 1. More than half of the participants (56.3%) had less than high school education. About 76% were living in Aden and 24.1% were living in other governorates. About two-thirds (64%) were donating blood for the first time.

### Prevalence of HBV and HCV

Of the 469 Yemeni blood donors, 24 (5.1%) were positive for HBsAg and 6 (1.3%) were positive for anti-HCV. The prevalence of positive HBsAg and positive anti-HCV according to sociodemographic and relevant characteristics is shown in Table 2. There was no difference in the prevalence of hepatitis B and hepatitis C in donors according to their sociodemographic status. The prevalence of hepatitis B and hepatitis C was significantly lower among those with history of blood donations ( $P = 0.01$ ) and higher among those with a history of blood transfusion ( $P = 0.01$ ), dental treatment ( $P = 0.01$ ), cupping ( $P = 0.04$ ) and malaria infection ( $P = 0.04$ ).

### Multivariate analysis

In the multivariate analysis (Table 3), after adjustment for all other variables, history of blood transfusion (OR = 22.8), dental treatment (OR = 3.6), cupping (OR=3.9) and malaria infection (OR = 6.8) remained significantly associated with increased odds of being positive for HBsAg. Those with history of blood donation were significantly less likely to be positive for HBsAg.

The odds of having positive anti-HCV differed significantly between participants according to the history of blood donation and history of blood

transfusion. Frequent blood donors were less likely to test positive for Anti-HCV whereas those with history of blood transfusion were more likely to test positive for anti-HCV.

## Discussion

The prevalence of hepatitis B among blood donors at the national blood bank service in Aden Governorate, Yemen found in this study was 5.1%. Much higher rates (7.1%, 9.8%, 15% and 6.7%) have previously been reported among Yemeni blood donors [8–10]. These differences in the prevalence rates might be explained by the geographical differences in the availability of services and programmes or might reflect a true

reduction in prevalence over time. The prevalence of HBsAg in the general population seems to be relatively high in Yemen. In a seroepidemiological survey of hepatitis in Yemen in 1988, Scott et al. reported a prevalence of HBsAg of 12.7% [5]. Although it is difficult to compare the prevalence rates reported in our study (among blood donors) with that reported by Scott et al. (among the general population), it seems that the rate of HBsAg has decreased dramatically. Introducing hepatitis B vaccine within the national immunization programmes, improvement of the people's knowledge about hepatitis risk factors through educational programmes, and the availability of measures to diagnose hepatitis in health centres and blood banks might

**Table 1 Sociodemographic characteristics of male blood donors in Aden and their relevant history**

Variable	No.	% (n = 469)
<b>Age (year)</b>		
< 25	132	28.1
25–30	143	30.5
> 30	194	41.4
<b>Marital status</b>		
Single	194	41.4
Married	275	58.6
<b>Occupation</b>		
Health worker	31	6.6
Military	99	21.1
Other	339	72.3
<b>Education</b>		
< High school	264	56.3
≥ High school	205	43.7
<b>Residence</b>		
Aden	356	75.9
Other governorates	113	24.1
<b>History of:</b>		
Travel outside the country	98	20.9
Previous blood donations	301	64.2
Chronic disease	36	7.7
Blood transfusion	41	8.7
Dental treatment	167	35.6
Cupping	88	18.8
Surgical procedures	24	5.1
Malaria infection	90	19.2

**Table 2** Prevalence of hepatitis B and C among 469 male blood donors in Aden according to sociodemographic characteristics and relevant history

Variable	Hepatitis B		P-value	Hepatitis C		P-value
	No No. (%)	Yes No. (%)		No No. (%)	Yes No. (%)	
<b>Age group (years)</b>			0.42			0.80
< 25	127 (96.9)	4 (3.1)		127 (99.2)	1 (0.8)	
25–30	133 (94.3)	8 (5.7)		133 (98.5)	2 (1.5)	
≥ 30	179 (93.7)	12 (6.3)		179 (98.4)	3 (1.6)	
<b>Marital status</b>			0.68			0.68
Single	183 (95.3)	9 (4.7)		183 (98.9)	2 (1.1)	
Married	256 (94.5)	15 (5.5)		256 (98.5)	4 (1.5)	
<b>Occupation</b>			0.41			0.77
Health worker	28 (90.3)	3 (9.7)		28 (100.0)	0 (0.0)	
Military	92 (93.9)	6 (6.1)		92 (98.9)	1 (1.1)	
Other	319 (95.5)	15 (4.5)		319 (98.5)	5 (1.5)	
<b>Education</b>			0.53			0.77
< High school	246 (94.3)	15 (5.7)		246 (98.8)	3 (1.2)	
≥ High school	193 (95.5)	9 (4.5)		193 (98.5)	3 (1.5)	
<b>Residence</b>			0.27			0.57
Aden	336 (95.5)	16 (4.5)		336 (98.8)	4 (1.2)	
Other	103 (92.8)	8 (7.2)		103 (98.1)	2 (1.9)	
<b>History of:</b>						
Previous blood donation			0.02			0.01
No	149 (91.4)	14 (8.6)		149 (96.8)	5 (3.2)	
Yes	290 (96.7)	10 (3.3)		290 (99.7)	1 (0.3)	
Chronic disease			0.35			0.38
No	407 (95.1)	21 (4.9)		407 (98.8)	5 (1.2)	
Yes	32 (91.4)	3 (8.6)		32 (97.0)	1 (3.0)	
Blood transfusion			0.01			0.01
No	415 (97.4)	11 (2.6)		415 (99.5)	2 (0.5)	
Yes	24 (64.9)	13 (35.1)		24 (85.7)	4 (14.3)	
Dental treatment			0.01			0.01
No	294 (97.7)	7 (2.3)		294 (99.7)	1 (0.3)	
Yes	145 (89.5)	17 (10.5)		145 (96.7)	5 (3.3)	
Cupping			0.01			0.04
No	364 (96.3)	14 (3.7)		364 (99.2)	3 (0.8)	
Yes	75 (88.2)	10 (11.8)		75 (96.2)	3 (3.8)	
Surgical procedures			0.82			0.56
No	416 (94.8)	23 (5.2)		416 (98.6)	6 (1.4)	
Yes	23 (95.8)	1 (4.2)		23 (100.0)	0 (0.0)	
Travel outside the country			0.13			0.83
No	350 (95.6)	16 (4.4)		350 (98.6)	5 (1.4)	
Yes	89 (91.8)	8 (8.2)		89 (98.9)	1 (1.1)	
Malaria infection			0.01			0.04
No	363 (96.5)	13 (3.5)		363 (99.2)	3 (0.8)	
Yes	76 (87.4)	11 (12.6)		76 (96.2)	3 (3.8)	

**Table 3 Multivariate analysis of factors associated with hepatitis B and C infection among male blood donors in Aden**

Variable	Hepatitis B		Hepatitis C	
	OR (95% CI)	P-value	OR (95% CI)	P-value
<i>History of:</i>				
Blood donation	0.17 (0.06–0.50)	0.01	0.05 (0.005–0.517)	0.01
Blood transfusion	22.80 (7.20–72.30)	0.01	65.60 (9.40–459.80)	0.01
Dental treatment	3.60 (1.20–10.40)	0.02		
Cupping	3.90 (1.30–11.30)	0.01		
Malaria infection	6.80 (2.30–20.50)	0.01		

OR = odds ratio; CI = confidence interval.

explain this decrease. Many other studies in nearby countries have shown a lower prevalence of hepatitis B among blood donors, including Saudi Arabia (4.0%) [11], Egypt (4.3%) [12] and Pakistan (3.3%) [13]. This may be because there was insufficient protection for patients admitted to hospitals in Yemen. Sterilization, disinfection and general standards of training and proficiency are generally lacking in most hospitals in Yemen.

Our study demonstrated that no previous blood donation, history of blood transfusion, history of dental procedures, history of cupping and previous infection with malaria were associated with increased odds of hepatitis B infection. The significant association between HBsAg positivity and history of blood transfusion, cupping and dental treatment is consistent with the findings of other studies [14,15]. The association between previous infection with malaria and HBsAg positivity (OR = 6.8) may relate to impaired clearance of liver parasites in the presence of the reduced level of HLA class I antigen expression on hepatocytes infected by HBV [16]. In a case–control study in Gambia, the prevalence of HBV was significantly increased amongst children with severe *Plasmodium falciparum* malaria compared to matched controls [16]. Barcus et al. found a prevalence of HBV infection of 24% in adult Vietnamese patients admitted with severe *P. falciparum* malaria,

which was higher than the estimated 10% prevalence of HBV in that area [17]. Previous studies have shown that the prevalence rates of malaria in Yemen ranged between 12.8% and 18.6% [18–20] and males are more infected [20]. The association between HBV positivity and malaria may relate to impaired clearance of the liver-stage malaria parasites, as a result of HBV infection of the hepatocytes. Also, protein levels in the body may reflect the immunity status of an individual; hence, any adverse influence may increase the vulnerability to hepatitis B infection.

We found that 1.3% of the blood donors were positive for anti-HCV. A similar study among blood donors in Yemen reported that about 1.1% of the donors in Hajja Governorate were infected with hepatitis C [10]. Sallam et al. reported a prevalence of hepatitis C in 2003 of 0.2 % in Sana'a and 0.6 % in Aden [9]. The prevalence of hepatitis C among blood donors is higher than that reported from the neighbouring countries including Oman (0.5%) and Saudi Arabia (1.0%) [21,22]. Such small differences in prevalence rates may be explained by methodological differences between studies.

Only history of blood donation and blood transfusion were significantly associated with HCV infection in our study. First-time blood donors were 20 times more likely to have HCV infection compared with frequent donors. This association is

plausible since first-time blood donors have never been screened. The lack of an associations between HCV infection and other variables, including malaria, may be explained by the fact that only 6 people were positive for anti-HCV.

The seroprevalence rates of hepatitis B and hepatitis C are high in Yemen and nationwide efforts are required to identify infected individuals. Transmission of hepatitis B and C through unscreened blood transfusion, reuse of unsterilized syringes and medical equipment is well documented in the pertinent literature. Moreover, people having cupping, history of dental treatment, circumcision and shaving by barbers are also at increased risk due to reuse of equipment. Efforts should be made for the promotion of behaviour changes among the public and health care workers to use sterilized medical instruments and screened blood.

In conclusion, the prevalence of hepatitis B and C among blood donors in Yemen is still high compared to many other countries. Given the lack of information on the prevalence of hepatitis B and C in the general population in Yemen, we recommend a population-based study for the assessment of hepatitis B and C prevalence as a first step to implement control measures. Increased coverage of hepatitis B vaccination would further reduce that rate.

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