# Prevalence of hepatitis B surface antigen and hepatitis C virus antibodies among blood donors in Alexandria, Egypt

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**معدَّل انتشار المستضدّ السطحي لفيروس الالتهاب الكبدي "بي" وأضداد فيروس الالتهاب الكبدي "سي" بين المتبرعين بالدم في الإسكندرية بمصر**

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**الخلاصة:** تمثِّل العدوى بفيروسي الالتهاب الكبدي "بي" و"سي" مضاعفاتٍ شائعةً وخطيرةً لنقل الدم. وقد جرى طوال ستة أشهر من عامي 2007/ 2008 – اختبارُ جميع عينات بنك الدم في مدينة الإسكندرية (وعددها = 3420) لتحرِّي المستضد السطحي لفيروس الالتهاب الكبدي "بي" (HBsAg) وأضداد فيروس الالتهاب الكبدي"سي" (HCV). وتبيّن أن 119 (3.5٪) من المتبرعين كانوا إيجابيين لأضداد فيروس الالتهاب الكبدي "سي"، وأن 47 (1.4٪) متبرعاً كانوا إيجابيين للمستضد السطحي لفيروس الالتهاب الكبدي "بي". وكان متوسط عمر المتبرعين الإيجابيين لفيروس الالتهاب الكبدي "سي" أكبر – على نحو يُعتدّ به إحصائياً – من عمر المتبرعين الإيجابيين لفيروس الالتهاب الكبدي "بي": 35.7 سنة (+ 8.3) مقابل 29.9 سنة (+ 7.4). وكان انتشار فيروسَيْ الالتهاب الكبدي "سي" و"بي" أعلى في الذكور (93.3٪ و93.6٪ بالترتيب)، وفي المناطق الحضرية (66.4٪ و80.9٪)، وبين أفراد العمالة اليدوية (64.7٪ و46.8٪). وكانت المعدلات أقل من مثيلاتها في الدراسات السابقة في مصر، وقد يرجع ذلك إلى إجراء التحري السابق للتبرع، الذي يستبعد مرتفعي اختطار الإصابة بالعداوَى المنقولة بالدم أو الذين لديهم موانع أخرى للتبرع بالدم.

ABSTRACT Hepatitis B and C virus infections are common serious complications of blood transfusion. Over a 6-month period in 2007/08 all samples from a blood bank in Alexandria, Egypt (*n* = 3420) were tested for hepatitis B surface antigen (HBsAg) and anti-hepatitis C virus (HCV) antibodies. A total of 119 donors (3.5%) were positive for anti-HCV and 47 (1.4%) for HBsAg. The mean age of HCV-positive donors was significantly higher than HBV-positive donors: 35.7 (SD 8.3) versus 29.9 (SD 7.4) years. HCV and HBV prevalence was highest among males (93.3% and 93.6% respectively), in urban areas (66.4% and 80.9%) and among manual workers (64.7% and 46.8%). The rates were lower than previous studies in Egypt, perhaps due to predonation screening which excludes those known to be at high risk of contracting bloodborne infections or who had other contraindications to blood donation.

**Prévalence de l'antigène de surface de l'hépatite B et des anticorps du virus de l'hépatite C chez les donneurs de sang à Alexandrie (Égypte)**

RÉSUMÉ Les infections par les virus des hépatites B et C sont des complications graves et courantes des transfusions sanguines. Pendant une période de six mois entre 2007 et 2008, tous les échantillons (n = 3420) de la banque du sang d'Alexandrie (Égypte) ont été analysés à la recherche d'antigènes de surface de l'hépatite B (Ag HB) et d'anticorps du virus de l'hépatite C (VHC). Au total, 119 donneurs (3,5 %) étaient positifs pour les anticorps anti-VHC et 47 (1,4 %) l'étaient pour les Ag HB. L'âge moyen des donneurs positifs pour les anticorps du virus de l'hépatite C était significativement plus élevé que celui des donneurs positifs pour l'hépatite B : 35,7 ans (E.T. 8,3) par rapport à 29,9 ans (E.T. 7,4). La prévalence des virus des hépatites B et C était supérieure chez les hommes (93,3 % et 93,6 % respectivement), dans les zones urbaines (66,4 % et 80,9 %) et chez les travailleurs manuels (64,7 % et 46,8 %). Les taux étaient inférieurs à ceux révélés par les études précédentes en Égypte, peut-être en raison du dépistage précédant le don qui a permis d'exclure les donneurs présentant de hauts risques d'infections à transmission hématogène ou qui avaient d'autres contre-indications au don de sang.

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## Introduction

Worldwide about 350 million people have chronic hepatitis B virus (HBV) infection, and about 125 million have been infected with hepatitis C virus (HCV), putting viral HBV and HCV infection among the world's greatest infectious disease problems. These diseases are therefore important candidates for public health measures aimed at prevention, early diagnosis and treatment [1]. Based on the prevalence of HBV chronic carriers among adults in the general population—i.e. individuals positive for hepatitis B surface antigen (HBsAg)—the majority of countries in the Eastern Mediterranean region are defined as intermediate or high endemicity. The prevalence of HBsAg varies among countries of the region: 3%–11% in Egypt, 4%–5% in Iraq, 2.6%–10% in Jordan, 2%–6% in the Libyan Arab Jamahiriya, 2.3%–10% in Oman, 5%–6% in Palestine,7.4%–17% in Saudi Arabia, 16%–20% in Sudan, 6.5% in Tunisia, 2%–5% in United Arab Emirates and 12.7%–18.5% in Yemen [2,3].

Although direct percutaneous inoculation is the most direct mode of transmission of HCV and HBV, several studies have demonstrated that sexual, household, occupational and vertical transmission may also be of importance [4,5]. Blood is one of the major sources of transmission of HBV, HCV, human immunodeficiency virus (HIV) and many other diseases, and physicians and patients are becoming more concerned about safe transfusion of blood [6].

The problem of chronic infection with HCV may be greater than generally recognized. While effective vaccines currently exist for HBV, a fully protective HCV vaccine is not yet available and current treatment methods for HCV infection are not highly effective or globally applicable. Public health interventions, therefore, continue to be the only effective method of preventing HCV infection [7]. Any strategy to prevent HCV infection must therefore be based on accurate data, including information about its incidence and prevalence. Such information is at present lacking in many developing countries [8].

The aim of the present study was to measure the prevalence of HBsAg and anti-HCV among blood donors in Alexandria, Egypt and to identify the sociodemographic profile of the positive cases.

## Methods

### Sample

A cross-sectional study was carried out at the blood bank in University of Alexandria, Egypt for 6 months from October 2007 to March 2008. During this period, all donated samples ($n$ = 3420) were tested for HBV and HCV. Blood donations in Alexandria are obtained from voluntary unpaid donors. The selection procedure excludes people who are outside the age range 18–60 years, known to be at high risk of contracting bloodborne infections or those who have any medical condition that contraindicates blood donation [9].

Sociodemographic information about the donors was obtained by interview using a structured questionnaire..

### Serology

Samples were tested using enzyme linked immunosorbent assay (ELISA) for hepatitis B (Abbott Murex HbsAg, version 3) and hepatitis C (Abbott Murex anti-HCV, version 4). Initially reactive samples were retested by ELISA. According to the manufacturer's instructions for the Murex anti-HCV kit (version 4) diluted samples are incubated in microwells coated with highly purified antigens which contain sequences from the core NS3, NS4 and NS5 regions of HCV. For the Murex HBsAg kit (version 3), the samples are pre-incubated in microwells coated with a mixture of mouse monoclonals specific for different epitopes on the "a" determinant of HBsAg.

### Statistical analysis

The data were coded, tabulated and analysed using *SPSS*, version 13. The following statistical analyses were carried out [10,11]. The chi-squared test was used for categorical data or the Monte Carlo exact test when the number of cases was small. Student $t$-test was used for comparison of the mean age of HCV- and HBV-positive cases. $P < 0.05$ was used as the cut-off level of significance.

## Results

The present study included samples from 3420 donors who attended the blood bank of the University of Alexandria for blood donation. A total of 119 donors (3.5%) were positive for anti-HCV antibodies and 47 (1.4%) were positive for HBsAg. The cut-off level was detected among 2.1 % and 0.8 % of samples for anti-HCV and HBsAg respectively (the cut-off values for HCV was 0.668 at 450 nm and for HBsAg was 0.100 at 450 nm).

Table 1 shows the sociodemographic profile of blood donors who were anti-HCV and HBsAg positive. The highest HCV seropositive rate was among those aged 30–< 40 years (37.9%), among males (93.3%), among those who lived in urban areas (66.4%) and among unskilled manual workers (64.7%). The rate of HBsAg positivity was similarly highest among males (93.6%), urban residents (80.9%) and manual workers (46.8%). However, by age, the highest rate was in the age group 20–< 30 years (48.9%).

A statistically significant difference was found in the mean age between donors who were anti-HCV and HBsAg positive [35.7 (SD 8.3) versus 29.9 (SD 7.4) years respectively] ($t$ = 3.93, $P$ < 0.05). A significantly higher proportion of manual workers were anti-HCV positive (64.7%) than HBsAg positive (46.8%) ($\chi^2$ = 9.70, $P$ < 0.05).

**Table 1 Comparison of anti-hepatitis C virus (HCV) and hepatitis B surface antigen (HBsAg) positive cases among blood donors by sociodemographic profile**

| Variable | Anti-HCV (*n* = 119) | | HBsAg (*n* = 47) | | Total (*n* = 166) | | Significance |
|---|---|---|---|---|---|---|---|
| ***Age group (years)*** | | | | | | | |
| 20– | 33 | 27.7 | 23 | 48.9 | 56 | 33.7 | |
| 30– | 45 | 37.8 | 19 | 40.4 | 64 | 38.6 | |
| 40– | 35 | 29.4 | 5 | 10.6 | 40 | 24.1 | |
| 50–60 | 6 | 5.0 | 0 | 0.0 | 6 | 3.6 | |
| Mean (SD) | 35.7 (8.3) | | 29.9 (7.4) | | 32.8 (7.8) | | $t = 3.93$; $P < 0.05$ |
| ***Sex*** | | | | | | | |
| Male | 111 | 93.3 | 44 | 93.6 | 155 | 93.4 | $P > 0.05$[a] |
| Female | 8 | 6.7 | 3 | 6.4 | 11 | 6.6 | |
| ***Residence*** | | | | | | | |
| Urban | 79 | 66.4 | 38 | 80.9 | 117 | 70.5 | $\chi^2_1 = 3.39$; $P > 0.05$ |
| Rural | 40 | 33.6 | 9 | 19.1 | 49 | 29.5 | |
| ***Occupation*** | | | | | | | |
| Manual worker | 77 | 64.7 | 22 | 46.8 | 99 | 59.6 | |
| Professional | 19 | 16.0 | 10 | 21.3 | 29 | 17.5 | |
| Student | 9 | 7.6 | 11 | 23.4 | 20 | 12.0 | $\chi^2_4 = 9.70$; $P < 0.05$ |
| Housewife | 7 | 5.9 | 2 | 4.3 | 9 | 5.4 | |
| Other | 7 | 5.9 | 2 | 4.3 | 9 | 5.4 | |

[a]*Monte Carlo exact test.*
*SD = standard deviation.*

## Discussion

HBV and HCV infections are common serious complications of blood transfusion. Prevention of transfusion-transmitted infections in developed countries has been achieved by reducing unnecessary transfusions, using only regular voluntary donors, excluding donors with specific risk factors and systematic screening of all donated blood for infection. By contrast, in many developing countries none of these interventions is applied uniformly and the risk of transfusion-transmitted infections remains high [12]. The current study presented the prevalence and some sociodemographic factors associated with HBV and HCV infection among blood donors of a blood bank in Alexandria.

The prevalence of HBsAg and anti-HCV antibodies was 1.4% and 3.5% respectively. These rates can be compared with other studies from Egypt, from the Eastern Mediterranean region and elsewhere. The overall prevalence of HBsAg and anti-HCV in Egyptian blood donors has been shown to be 2.1% and 7.1% respectively [13] and 4.3% and 2.7% respectively [14]. Another study found 13.6% of Egyptian blood donors were serologically confirmed to be infected with HCV [15]. Among blood donors in Turkey the seropositivity rates for HBsAg, and anti-HCV were 1.76% and 0.07% respectively [16]. In Saudia Arabia the prevalence of HCV infection in blood donors was 0.4% [17].

As mentioned earlier, blood donors in our centre undergo predonation screening for risk factors, which may be the reason for the lower prevalence of anti-HCV antibodies in this study compared with the prevalence reported in other studies that have been conducted in Egypt [14,15, 18,19]. Another reason is that other studies were patient-based, including those with chronic liver diseases, or general population based. On the other hand, the prevalence of anti-HCV antibodies in the United States from 1999 to 2002 was much lower (1.6%) [9] than in the present study.

A higher rate of seropositivity for HBsAg (10.1%) among blood donors was reported in 1985 in Egypt, and a similar figure to our prevalence (2%) was reported later in 1993 [20,21]. The most probable explanation for that decrease in the prevalence of HBsAg among blood donors in Egypt was the introduction of the HBV vaccine. The prevalence rates of HBV in an Iranian study (1.83%) and Lebanese study (1.9%) were similar but slightly higher than that of the present study [22,23]. The prevalence of seropositivity for HBsAg was found to be much higher in Turkey and Saudi Arabia at 6.6% and 13.9% respectively [2,24,25].

Unfortunately the social and cultural context of Egypt has tended to deter researchers from attempting to obtain any information regarding sexual risk behaviour in relation to HBV/HCV infection. In addition, the selection procedure mentioned earlier in the methodology

limited the study of certain risk factors such as previous blood transfusion or surgery. Therefore our study focused on sociodemographic factors such as age group, occupation and urban/rural residency.

Our findings show that urban residents had higher rates of HBsAg than those in rural areas, which is similar to Al Falah et al.'s findings in Saudi Arabia [26]. The highest rate of HBsAg was among the age group 20–29 years, and the most common age group positive for anti-HCV antibodies was 30–39 years. Also males had considerably higher rates of HBsAg and anti-HCV antibodies than did females. Similar results were reported in Egypt in a cross-sectional survey in Upper Egypt, in which the prevalence of anti-HCV was higher among males than females and it was also highest among those > 30 years of age [27]. Similar figures were reported from a study in Pakistan in which the prevalence was 2.5% and 2.5% for anti-HCV antibodies and HBsAg respectively, and among them the majority of cases were males [6]. The most likely explanation for the higher prevalence among males than females is that males make more frequent visits to barber shops than females and may share shaving equipment; they also may be more likely to get wounded and have other risk factors than females. Similar results for the age groups most affected by hepatitis B and C were observed in the United States [9] and in Sana'a, Yemen [28].

In our study, the highest prevalence of both infections was found among manual workers, which may be due to their lower educational level and perhaps sharing and inconsistent use of clean shaving equipment. Our results are consistent with the findings of Darwish et al. among blood donors in Egypt, who found a higher rate of anti-HCV antibodies aged 30 years of age and among manual workers [29]. In contrast, in Sana'a, Yemen, the highest prevalence of HBV infection was found among teachers [28].

Variations in prevalence may also be due to the geographic and temporal locations associated with the incidence and prevalence of the infection, and to the type of kits and/or markers used in detecting antibodies [30,31].

Our study has some important limitations. First, the selected blood donors were chosen according to certain exclusion criteria which probably reduced the prevalence of both HBsAg and anti-HCV antibodies. Secondly, we did not perform additional laboratory tests of interest including anti-hepatitis B core antigen (anti-HBc), confirmatory testing for anti-HCV antibodies and HBsAg positive samples, and HCV-RNA was also not determined in any of the anti-HCV antibody-positive patients in order to differentiate between active and resolved infection. The presence of anti-HBc antibody is a lifelong marker of HBV infection, irrespective of whether a patient has recovered from or has an ongoing chronic infection [32,33]. Further studies are recommended among other blood donors and among different population groups in order to know the real prevalence and to study the epidemiology of both diseases. It is also recommended to perform confirmatory tests for both anti-HCV and HBsAg to confirm the rate of positive cases and cut-off values.

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