BRIEF COMMUNICATION

A THREE-YEAR RETROSPECTIVE STUDY ON THE PREVALENCE OF HBV, HCV, AND HIV AMONG BLOOD DONORS AT THE UNIVERSITY OF GONDAR HOSPITAL BLOOD BANK, NORTH WEST ETHIOPIA

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ABSTRACT

Background: *Although life saving, the use of blood can also lead to serious unwanted effects which may be immunological (transfusion reaction), as well as transmission of blood transmissible infections (TTI), such as hepatitis B, hepatitis C, and HIV.*
Objective: *The objective of this study was to determine the prevalence and associated risk factors of hepatitis B virus, hepatitis C virus and HIV infection among blood donors at the University of Gondar Hospital Blood Bank.*
Methods: *A retrospective blood donors' registration-book-based study was conducted in the University of Gondar Hospital Blood Bank. All blood-donors donated blood between July, 2005 and December, 2007 was included in the study. Data was collected from blood donors' registration book and analyzed using the SPSS version 13 computer software.*
Results: *Between 2005 and 2007, 4842 blood donors were screened for HBsAg, anti-HCV and anti- HIV using enzyme linked immunosorbent assay. The prevalence was 4%, 0.9%, and 3.5% for HBV, HCV, and HIV, respectively. Co-infection prevalence was 0.3%, 0.1%, and 0.0% for HBV & HIV, HCV & HIV and HBV & HCV, respectively. The prevalence of disease markers among replacement blood donors was 4% for HBV, 3.6% for HIV and 0.9% for HCV while the prevalence among volunteer blood donors was 3.1% for HBV, 2.6% for HIV and 1% for HCV. Eight percent of the blood donors were positive for at least one of the three disease markers. The highest prevalence of HBV and HCV was observed among males compared to females (OR=2.08 and 3.3, respectively). Unlike the hepatitis virus markers, HIV prevalence was higher among females compared to males (OR=1.23).*
Conclusions: *The prevalence of HBV, HCV, and HIV among blood donors, though lower than previous studies made in Gondar and other studies in the country, is still significant. So, screening blood donors for HBV and HCV along with HIV should get attention in blood banks throughout the country. Replacement blood donation needs to be changed by voluntary blood donation system, since replacement blood donation encourages commercial blood donation.*

Key words: *Hepatitis B virus, Hepatitis C virus, Human immune deficiency virus, Blood Donors.*

INTRODUCTION

Blood transfusion is one of the indispensable aspects of health care delivery system, and it involves the administration of blood from an individual to another person (allo transfusion) or to the same individual (auto transfusion). Although blood transfusion is one of the known therapeutic interventions that involve a number of clinical disciplines, the practice is not without risks. The use of blood can lead to serious unwanted effects which may be immunological (transfusion reaction) as well as transmission of blood transfusion transmissible infections (TTI) (1).
The hepatitis B virus (HBV) discovered in 1966, is one of the TTIs which infects more than 350 million people worldwide. It is the leading cause of chronic hepatitis, cirrhosis, and hepatocellular carcinoma, accounting for 1 million deaths annually (2). Of 350 million chronic carriers of HBV worldwide, 78% are in Asia, 16% in Africa, 3% in Europe, North America, and Oceania combined (3).Hepatitis C (originally "non-A non-B hepatitis") is caused by a virus with an RNA genome that is a member of the Flaviviridae family. Hepatitis C virus may lead to a chronic form of hepatitis, culminating in cirrhosis. It

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can remain asymptomatic for 10-20 years (4). Global estimates of the number of individuals infected with HCV range upwards of 170 million people out of which the infection becomes chronic in about 85% of individuals, and of these, 20% develop severe complications such as cirrhosis and hepatocellular carcinoma (5).

The estimated number of persons living with HIV worldwide in 2007 was 33.2 million [30.6-36.1 million](6). In 2007 the number of people living with HIV/AIDS in Ethiopia was 977,394 with a national adult prevalence rate of 2.1% (7).

Preventing the transmission of infectious disease through blood transfusion in developing countries is difficult given that the resources required are not always available, even when policies and strategies are in place (8). Between 5% and 10% of HIV infections worldwide are transmitted through the transfusion of contaminated blood products. Many more recipients of blood products are infected by hepatitis B and C viruses, syphilis and other infectious agents (9). Monitoring time trends in infectious disease rates among the blood donor population provides a mechanism to assess the safety of the blood supply and the effectiveness of blood donor deferral criteria and other screening measures (10).The purpose of this study was to assess the prevalence and associated risk factors of hepatitis B virus, hepatitis C virus and HIV among blood donors at the University of Gondar Hospital Blood Bank.

METHODS

A retrospective study was conducted on donors that donated blood between July 2005 and December 2007 in the University of Gondar Hospital Blood Bank. The University of Gondar hospital is a teaching hospital situated in Gondar town, located at 737 Km from Addis Ababa. Gondar town has a projected population of 271,000 by the year 2008 (Gondar Zonal Statistics Office). The hospital gives different inpatient and outpatient services to the population surrounding Gondar town and the adjacent regions. The blood bank service in the hospital is recently run under the support of the Zonal Red Cross Society. All blood donated at this center was screened using Enzyme Linked Immunosorbent Assay (ELISA) method for HBV, HCV and HIV. A 4th generation ELISA with a sensitivity and specificity of 100% and 99.9% for HIV (Vironostika HIV Uni-form II Ag/ Ab,Biome′rieux bv, Boseind 15, 5281 Boxtel, the Netherlands), 99.5%(Linear Chemicals S.L, Joaquin costa, n^0 18, 2^a plana 08390 Montgat-Barcelona, Spain) and 99% (DIALAB, ELISA HCV antibody Micro well method). For HBV and HCV were used in the University of Gondar Hospital Blood Bank during 2005 to 2007.

A total of 4842 healthy blood donors were included in the study. Data on age, sex, marital status, occupation, and serostatus for HIV, HBV and HCV was collected from the blood bank laboratory registration books. Age, sex, and occupation were the independent variables whereas the HBsAg, anti -HCV and anti -HIV antibodies were the dependent variables for this study.

Data was collected from the blood bank laboratory registration book by four final year laboratory technology students. Each of the three students was assigned to collect data from each of the three year laboratory registration book and finally re-cheeked by another student blindly and finalized by the principal investigators. Data was analyzed using the SPSS version 13 computer soft ware. The strength of association was determined using the odds ratio. Confidentiality was maintained by allowing the student to collect the data under the supervision of the blood bank head so that documents were being used only in the blood bank in a separate room.

Permission was obtained from the Department of Medical Laboratory Technology and the hospital director. Moreover, the blood bank was communicated using letters obtained from the Department of Laboratory Technology which was also approved by the Dean's Office of the College of Medicine and Health Sciences, University of Gondar.

RESULTS

Of 4842 blood donors, 4174/4842 (86.2%) were males and 668/4842 (13.8%) females with a mean age of 28.95 years. Blood donors between the ages of 18-27 years accounted for 2715/4842 (56.1%) 28-37 years for 1099/4842 (22.7%). The least number of blood donors was observed between the age category of 58-67 and under 18 years of age, 87/4842 (1.8%) and 55/4842 (1.1%), respectively (Table 1). Farmers accounted for 1318/4842 (27.2%) followed by students 885/4842 (18.3%), unemployed 636/4842 (13.1%) and daily laborers 613/4842 (12.7%). Civil servants, merchants, health professionals, and others also contributed significantly to the number of blood donor groups (Table 1).

The type of blood donation shows that 4646/4842 (96%) were replacement blood donors while the rest 196/4842 (4%) were volunteers. The majority of the blood donors, 3417/4842 (70.6%), were new and the rest, 1425/4842 (29.4%) were repeat blood donors (Table 1).

Table 1. Socio-demographic characteristics and types of blood donors in the University of Gondar Hospital Blood Bank, from July 2005 to December 2007.

Variables	Frequency (n)	Percent (%)
Sex:		
Male	4174	86.2
Female	668	13.8
Total	**4842**	**100.0**
Age in years:		
<18	55	1.1
18-27	2715	56.1
28-37	1099	22.7
38-47	580	12.0
48-57	306	6.3
58-67	87	1.8
Total	**4842**	**100.0**
Occupation:		
Farmer	1318	27.2
Student	885	18.3
Unemployed	636	13.1
Daily laborer	613	12.7
Civil servant	538	11.1
Merchant	380	7.8
Health professional	68	1.4
Others	404	8.3
Total	**4842**	**100.0**
Type of donor:		
Replacement	4646	96.0
Volunteer	196	4.0
Total	**4842**	**100.0**
Number of donation		
New	3418	70.6
Repeat	1424	29.4
Total	**4842**	**100.0**

Comparable prevalence of HBV was observed among new blood donors 136/3417 (4%) and repeat blood donors 56/1425 (3.9%). Unlike HBV, the prevalence of HCV was higher among new blood donors 36/3417 (1.1%) compared to repeat blood donors 7/1425 (0.5%). Almost comparable prevalence of HIV was observed among new blood donors 117/3417 (3.4%) and repeat blood donors 54/1425 (3.8%). The prevalence of disease markers among replacement blood donors was 186/4646 (4%) for HBV, 166/4646 (3.6%) for HIV and 41/4646 (0.9%) for HCV while the prevalence among volunteer blood donors was 6/196 (3.1%) for HBV, 5/196 (2.6%) for HIV and 2/196 (1%) for HCV.

The prevalence of disease markers among blood donors was 192/4842 (4%), 43/4842 (0.9%), and 171/4842 (3.5%) for HBV, HCV and HIV, respectively (Table 3). Co-infection prevalence was 15/4842 (0.3%) for HBV & HIV, 4/4842 (0.1%) for HCV & HIV and 0.0% for HBV & HCV, respectively. Three-hundred and eighty-seven (8%) (n=4842) of the blood donors were positive for at least one of the three disease markers.

The prevalence of HBsAg was 3.2% in 2005, 4.7% in 2006 and 4% in 2007. Similarly, HCV prevalence was 0.8%, 0.5% and 1.2% in 2005, 2006 and 2007, respectively. Unlike the prevalence of HBV and HCV, there was a steady decline in HIV prevalence from 4.7% in 2005, 3.3% in 2006 to 3.2% in 2007 (Table 2).

The highest prevalence of HBV infection was observed among males 178/4174 (4.2%) (p= 0.008, OR=2.08) compared to females which accounts for 14/668 (2.1%). Similarly males showed higher prevalence of HCV (41/4174) compared to females (2/668) (p=0.08, OR=3.3). On the other hand, HIV prevalence was higher among female blood donors 28/668 (4.19%) compared to males, 143/4174 (3.43%) (OR=1.23) (Table 2).

The distribution of HBV was the highest among the age group of 28-37 (56/1099) followed by 18-27 years old (101/2715) and less than 18 years old (2/55). On the other hand, HCV prevalence was the highest among blood donors aged 48-57 (7/306) followed by 38-47 (11/580). Merchants, health professionals, and farmers showed a high prevalence of HBV 20/380 (5.26%), 3/68 (4.41%) and 17/1318 (4.21%), respectively. The Hepatitis C virus prevalence was 8/538 (1.48%), 14/885 (1.06%) and 4/380 (1.05%) among civil servants, students, and merchants, respectively. The prevalence of HIV was 24/538 (4.46%), 3/68 (4.41%), 16/380 (4.21%) and 17/404 (4.21%) for civil servants, health professionals, merchants and others, respectively (Table 3).

Table 2. Prevalence of HBV, HCV and HIV among blood donors in the University of Gondar blood bank, from July 2005 to December 2007.

Year	Number of donors (%)	Number of HBV positive (%)	Number of HCV positive (%)	Number of HIV positive (%)
2005				
Male	786(81.8)	28(3.6)	7(0.9)	35(4.5)
Female	178(18.2)	3(1.7)	1(0.6)	10(5.7)
Total	**961(100)**	**31(3.2)**	**8(0.8)**	**45(4.7)**
2006				
Male	1527(86.9)	73(4.8)	9(0.6)	49(3.2)
Female	230(13.1)	3(1.3)	0(.0)	9(3.9)
Total	**1757(100)**	**76(4.3)**	**9(0.50)**	**58(3.3)**
2007				
Male	1861(87.6)	77(4.1)	25(1.3)	59(3.2)
Female	263(12.4)	8(3.0)	1(0.4)	9(3.4)
Total	**2124(100)**	**85(4.0)**	**26(1.2)**	**68(3.2)**
Overall				
Male	4174(86.2)	178(4.3)	41(1)	143(3.4)
Female	668(13.8)	14(2.1)	2(0.3)	28(4.4)
Total	**4842(100)**	**194(4)**	**43(0.9)**	**171(3.5)**

Table 3. Distribution of disease markers by age groups and occupation among blood donors in the University of Gondar Hospital Blood Bank, from July 2005 to December 2007.

	HBV		**HCV**		**HIV**	
Variables	**Positive No (%)**	**Negative No (%)**	**Positive No (%)**	**Negative No (%)**	**Positive No (%)**	**Negative No (%)**
Age						
<18	2 (3.6)	53(96.4)	0(0.0)	55(100)	1(1.8)	54(98.2)
18-27	101(3.7)	2614(96.3)	18(0.7)	2697(99.3)	88(3.2)	2627(96.8)
28-37	56 (5.1)	1043(94.9)	7(0.6)	1092(99.4)	42(3.8)	057(96.2)
38-47	20 (3.4)	560(96.6)	11(1.9)	569(98.1)	26(4.5)	554(95.5)
48-57	10 (3.3)	296(96.7)	7(2.3)	299(97.7)	12(3.9)	294(96.1)
58-67	3 (3.4)	84(96.6)	0(0.0)	87(100)	2(2.3)	85(97.7)
Total	**192(4)**	**4650(96)**	**43(0.9)**	**4799(99.1)**	**171(3.5)**	**4671(96.5)**
Occupation						
Unemployed	21(3.30	615(96.7)	5(0.8)	631(99.2)	24(3.8)	612(96.2)
Daily laborer	23(3.8)	590(96.2)	4(0.7)	609(99.3)	20(3.3)	593(96.7)
Health professional	3(4.4)	65(95.6)	0(0.0)	68(100)	3(4.4)	65(95.6)
Civil servant	18(3.3)	520(96.7)	8(1.5)	530(98.5)	24(4.5)	514(95.5)
Farmer	56(4.2)	1262(95.8)	14(1.1)	1304(98.9)	46(3.5)	1272(96.5)
Student	34(3.8)	851(96.2)	6(0.7)	879(99.3)	21(2.4)	864(97.6)
Merchant	20(5.3)	360(94.7)	4(1.1)	376(98.9)	16(4.2)	364(95.8)
Others	17(4.2)	387(95.8)	2(0.5)	402(99.5)	17(4.2)	387(95.8)
Total	**192(4)**	**4650(96)**	**43(0.9)**	**4799(99.1)**	**171(3.5)**	**4671(96.5)**

DISCUSSION

The prevalence of HBV infection in this study was 194/4842 (4%). A previous (1994-1995) survey conducted among blood donors in Gondar was 14.4%. The current prevalence is almost in line with a cross-sectional study conducted in the same area by the year 2002-2003 (4.7%) (11,12,13). On the other hand, it is less than a study conducted in Mekele and Bahirdar which were 14% and 6%, respectively by the year 2003 (14). According to WHO classification, HBV prevalence in Gondar, though lower than in previous studies, is still high (Greater than 2%) (15).The reason for this preponderance is not obvious, especially as the practice of men having sex with men and men having sex with men and women is rare or nil in the community. It could also be a result of the paucity of samples from females compared to males (668 versus 4174 respectively).

However, W. Thomas London and Jean S. Drew suggested the hypothesis that there is a similarity (cross-reactivity) between HBsAg and antigen on the surface of male cells. Whether or not this is the mechanism of susceptibility, the fact that males are likely to retain the virus longer than females may contribute to the greater risk males have of developing chronic liver disease associated with hepatitis B virus infection. That is, males are more likely to become chronic carriers of HBV and as a consequence more likely to develop chronic hepatitis, post-necrotic cirrhosis and primary hepatocellular carcinoma (16). The hepatitis B virus prevalence among blood donors between 2005-2007 in Gondar is higher than that of a study conducted on blood donors in Rio de Janeiro, Brazil, and New Delhi, India which was 0.27% and 2.23%, respectively (17, 18). This result is by far less than a community based study conducted in southern Taiwan (13.8%).The variation in prevalence in different study areas may be due to differences in screening criteria and socio-cultural variations.

A significantly higher prevalence of HBV (p=0.008) was observed among males 178/4174 (4.2%) compared to females which was 14/668 (2.1%).This was supported by another study that HBV sero-prevalence rate was higher among male blood donors than in female blood donors (0.65% versus 0.25%, respectively (15). The distribution of HBV was highest among blood donors with the age group of 28-37 which accounts for 56/1099 (5.1%) followed by 18-27 years old 101/2715 (3.72%) and <18 years old 2/55 (3.63%). This may be associated with the transmission mode of HBV which is sexually transmitted as a result; younger (sexually active) blood donor groups were more affected (4). However, the sexual transmission of HBV in Ethiopia is not of much importance. Vertical transmission as well as cultural practices such as traditional surgery, uvulectomy, ritual scarring etc.., are known to contribute considerably to the spread of HBV infection, possibly HCV -infection too, particularly among rural populations and often at the age preceding sexual activity (19). Even though there was no statistically significant (p=0.84) association between occupation and all the three disease markers, variable prevalence was observed among different occupational categories. Merchants, health professionals, and farmers showed a high prevalence of HBV which was 20/380 (5.26%), 3/68 (4.41%), and 17/1318 (4.21%), respectively.

Previously, the highest prevalence rate of HBsAg was seen in farmers in Gondar (18.8%), followed by soldiers (16.3%), and the daily workers (9.5%) (19). Another study conducted in Addis Ababa showed that drivers and mechanics accounted for higher prevalence (28%) followed by students, civil servants and merchants, (20%, 15% and 15%, respectively) (10).

The prevalence of HCV in the study area was 43/4842 (0.9%) which was greater than a study conducted in Dessie and Mekele with 0.0% prevalence, and in some other areas such as New Delhi, India (0.66%) (18,19). But the prevalence of HCV infection among the Gondar blood donors is by far lower than that of Southern Taiwan (17%), USA (1.6%), Nigeria (4.3%), and the 2002-2003 study conducted in Gondar and Bahirdar which revealed 2.33% and 3%, respectively (13, 14,18, 20). It is found to be similar with studies conducted in France and Rio de Jeneiro, Brazil, with a prevalence of 0.84% and 0.96%, respectively (12, 18).

Even though Males showed higher prevalence of HCV which accounts for 41/4174 (0.98%) compared to females 2/668 (0.3%), it was not statistically significant. On the other hand, HCV prevalence was highest among blood donors aged 48-57 which was 7/306 (2.28%) followed by 38-47 with 11/580 (1.89%). The hepatitis C virus infection was more prevalent among the elderly in the previous studies which may be due to the chronic nature of the disease (5). The highest prevalence of HCV was observed among civil servants 8/538 (1.48%), students 14/885 (1.06%), and merchants 4/380 (1.05%).

The prevalence of HIV in this study was 171/4842 (3.5%) which is by far greater than that of a study conducted in New Delhi, India (0.56%) and in Nigeria (2.7%) , but this result is by far less than a previous (1995 to 2002) study conducted in Gondar which was 9.9% (21,22). This high prevalence may be due to the high national prevalence rate of the disease. On the other hand, the decrease in prevalence from the previous study in the same area may be due to a substantial effort made to prevent the disease in Gondar.

HIV prevalence was higher among female blood donors 28/668 (4.19%) compared to males 143 (3.43%). The prevalence of HIV was high among civil servants 24/538 (4.46%), health professionals 3/68 (4.41%), merchants 16/380 (4.21%) and others 17/404 (4.21%). Previous reports show that the prevalence of HIV infection was also higher in female blood donors (9.7%) than in males (8.3%). Seropositivity was higher among merchants, bar ladies, truck drivers, military personnel, daily laborers and house wives, while it was relatively lower in students, civil servants, and farmers (23).

The relative high prevalence of disease markers (HBV=4% and HIV=3.6%) among replacement blood donors compared to the prevalence among volunteer blood donors (HBV= 3.1% and HIV= 2.6%) is also supported by the crude seroprevalence of major blood borne pathogens (HIV, HBV, HCV, and syphilis) among commercial blood donors (56.6%), voluntary blood donors (17.6%) and replacement blood donors (53.6%) at Felege Hiwot Referral Hospital, Bahirdar, Ethiopia (24)**.** In India, Hepatitis B surface antigen was found in 1.37% and 2.96% of the voluntary and replacement donors, respectively (25). By another study, the HIV seroreactivity among voluntary donors was 1.56% and 2.11% in replacement donors. The HBsAg seroreactivity was 2.78% in voluntary blood donors and 4.84% in replacement blood donors (26).

The co-infection prevalence was 15/4842 (0.3%), 4/4842 (0.1%), and 0.0% for HBV & HIV ($p<0.0001$), HCV & HIV ($p=0.039$) and HBV & HCV, respectively. The non-existence of co-infection by HBV and HCV is suggested to be the suppression of HCV by HBV. On the other hand, a super infection with hepatitis C may even induce the clearance of Hepatitis B. This can be due to the dominant role of HCV in eliciting an immune response. It is also documented that the two viruses are mutually exclusive (14, 27). In a survey on the current testing strategies against transfusion transmissible infection (TTI) in the national blood supply system of Ethiopia by the year 2007 (22), a total of 56 health institutions in 11 administrative regions were assessed. Sixteen district hospitals collected blood from donors and used the rapid assay screening method. Though they collect blood, the screening system differs from hospital to hospital. Eleven district hospitals screen blood donors by Determine Rapid Test Kit for HIV infection only. The prevalence of HBV, HCV and HIV among blood donors in this study is quite significant. Moreover, there is a significant association between HIV and the hepatitis viruses (HBV and HCV).

Therefore, screening blood donors by adhering to the national blood transfusion protocol for HBV, HCV, and syphilis should get emphasis along with HIV to reduce the risks of TTIs in Gondar in particular and in the country in general. In addition, repeated blood donation (29.4%) might also include commercial blood donors since the blood bank has little mechanism to reject such donors. Replacement blood donation needs to be changed by voluntary blood donation system since the former encourages commercial blood donation.

The incomplete data registration and the absence of computer based data recording system to retrieve even the available information in the area were the limitations of this study.

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