Original article

The prevalence of HBV, HCV and malaria parasites among blood donors in Amhara and Tigray regional states

Baye Gelaw[1,2], Yohannes Mengistu[2]

Abstract

Background: Blood serves as a vehicle for transmission of blood-borne pathogens including hepatitis viruses and hemoparasities. In northern parts of Ethiopia, screening of blood for blood-borne pathogens do not fulfill the standard protocols and screening for malaria parasites is not practiced. Determination of the prevalence of HBV, HCV and malaria parasites in a population in general, and blood-donors in particular will certainly help in reviewing the screening procedures and making health policy decisions.

Objective: To determine the prevalence of HBV, HCV and malaria parasites among healthy adult blood-donors in Gondar, Bahirdar, Dessie and Mekele blood banks.

Method: Blood samples were collected using cross sectional survey from blood-donors in Northern part of Ethiopia. The socio-demographic characteristics of blood-donors were assessed using structured questionnaire. The collected blood samples were screened for HBV, HCV and malaria parasites.

Results: The overall prevalence of HBV, HCV and malaria parasites were 6.2%, 1.7% and 1% respectively.

Conclusion: Screening blood donors for both HBV and HCV is indispensable for safe blood transfusion. Blood screening for malaria infection need to be included in daily donor selection programs in areas where malaria is endemic. In general, formulation of safe blood transfusion policy and implementation of standard screening protocols should be practiced. [*Ethiop.J.Health Dev.* 2007;22(1):3-7]

Introduction

During World War II and the immediate post war period the demand for blood and blood components in the USA increased substantially. This resulted in the establishment and growth of blood banks transfusion services and other blood laboratory support services (1). Despite its common occurrence, blood transfusion often raises concerns among patients and clinicians about potential infectious complications. Hepatitis B virus (HBV) infection is a global health problem. World wide about 350 million people are chronic carriers of hepatitis B virus (2). In Indonesia (1981), 10% of the blood donors were positive for HBsAg (3). In Kinshasa, Democratic Republic of the Congo, among 7,277 blood donors the incidence of HIV and HBsAg were 6.5% and 9.2% respectively (4). In Addis Ababa, in 1966 the mean prevalence of HBsAg among 1,260 households was 6.1% (5).

In 1995, Non-A Non-B hepatitis (NANB) was recognized as a separate entity (6). The natural targets of HCV are hepatocytes and, possibly, B-lymphocytes (7). The factors most strongly associated with infection by HCV are injection-drug use and receipt of a blood transfusion before 1990 (8). The prevalence of HCV infection varies throughout the world, the highest number of infection ranging from 6% to 28% in Egypt (9). The prevalence of antibody to HCV (anti-HCV) in healthy adult Ethiopian blood donors was 1.4% (10). Hepatitis C virus (HCV) prevalence was 0.9% for the total population and 1.3% for adult over 15 years of age in a study conducted on two blood banks in Addis Ababa. On the other hand, the prevalence of anti-HCV among Ethiopian patients with chronic hepatitis, cirrhosis of the liver and hepatocellular carcinoma (HCC) was found to be 21%, 36% and 46% in the study respectively (11).

Malaria is one of the most widespread infections globally and is undoubtedly responsible for some cases of transfusion transmitted diseases in the world. On a global basis, there may be 300 to 350 million cases of malaria the each year (12). According to 2001/2002 the Ministry of Health Report a total of 31,457 and 135,651 people were positive for malaria in Tigray and Amhara administrative regions respectively. Despite this prevalence, blood donors are not regularly screened for malaria parasites in Ethiopia. In addition, most blood banks do not screen for HBV and HCV. In this study, the prevalence of HBV and HCV among blood donors to measure the risk of malaria transmission through blood transfusion was investigated.

Methods

The study design was institution based cross-sectional study. The study subjects were blood donors who donated blood at blood banks from December 2002 to February 2003. The required sample size for the study was determined using single population proportion formula considering the prevalence of HBV, HCV and malaria parasites among blood donors.

Five milliliters of venous blood was collected using sterile test tubes from each blood donor. Serum was separated from cells by centrifugation at a speed of 3500

[1]Department of laboratory technology Gondar College of Medicine and Health Sciences, University of Gondar, P.O. Box 196, Ethiopia; [2]Department of Microbiology, Immunology and Parasitology, Faculty of Medicine, Addis Ababa University, P.O. Box 9086, Addis Ababa

revolutions per minutes (rpm) for 5 minutes and 2ml of serum was collected from each sample using sterile plastic vials. The collected sera were transported to the then Gondar College of Medical Sciences Laboratory from each site and then to Addis Ababa using an icebox cold chain apparatus. Each blood donor's serum was tested from HBsAg and anit-HCV antibody by ACON one-step insert rapid chromatographic immunoassay test strips (IHBSG u-301, USA, 2003). Thick blood smear was prepared from each blood donor and after the smear was dried, each smear was stained with Giemsa's stain solution for 10 minutes. The stained slides were investigated microscopically using the oil immersion objective for the presence of malaria and other haemoparasites at each health institution.

The socio-demographic characteristics; age, sex, marital status, history of hepatitis and malaria infection, history of repeated blood donation and the life time number of sexual partners was assessed using structured questionnaire. EPI Info version 6, computer software package was used for data analysis. Odds ratio and p-value were used to assess the strength of the association and statistical significance. Test procedure quality was assured using both positive and negative control samples obtained from the Ethiopian Health and Nutriation Research Institute (EHNRI).

Ethical approval was obtained from the Facility Research and Publication Committee and from each health institution where the study was conducted. Informed consent was obtained from each donor and confidentiality was maintained.

Results

The socio-demographic characteristics of the study subjects show that 578 blood donors were males and 22 of them were females (Table 1). The median age of the blood donors was 25 years and the highest blood donation age category was between 19 to 28 years (357/600(59.5%)) followed by 29 to 39 years of age (113/600 (18.8%)). One hundred ninety-six (32.7%) blood-donors were married, 374 (62.3) single and 30 (5%) divorced. Daily laborers accounted for 45.5% (271/600) followed by farmers 24.2% (145/600), students 21.8% (131/600) and others 8.8% (53/600).

Table 1: **Socio-demographic characteristics of blood donors in Gondar, Bahirdar, Dessie and Mekele blood banks, December 2002 to February 2003**

Variables	Frequency	
	Number (n)	Percent (%)
Sex		
Male	578	96.3
Female	22	3.7
Total	**600**	**100%**
Age groups		
<18	64	10.7
19-28	357	59.5
29-38	113	18.8
39-48	49	8.2
59-68	11	1.8
69+	1	0.2
Total	**600**	**100%**
Marital status		
Married	196	32.7
Single	374	62.3
Divorced	30	5.0
Total	**600**	**100%**
Occupation		
Student	131	21.8
Farmer	145	24.5
Daily laborer	271	45.2
Merchant	20	3.3
Other	33	5.5
Total	**600**	**100%**

The overall prevalence of HBsAg, HCV anti-body and malaria parasite among the blood donors in the four blood banks was 6.2% (37/600), 1.7% 10/600) and 1% (6/600) respectively (Table 3). Institutionally, the prevalence of HBsAg, was 4.7% (14/300) for Gondar College of Medical Sciences, 6% (6/100) for Bahirdar Hospital, 3% (3/100) for Dessie and 14% (14/100) for the Mekele hospital blood banks. The prevalence of HCV anti-body was 2.3% (7/100) and 3% (3/100) for Gondar and Bahirdar, respectively, while 0% (0/200) for Dessie and Mekele Hospital blood banks (Table 2).

Table 2: **Prevalence of HBV, HCV and malaria parasites among blood donors in Gondar, Bahirdar, Dessie and Mekele blood banks, December 2002 to February 2003**

Town	No. of donors	HBV Positive In No (%)	HCV Positive in No (%)	Malaria parasite Positive in No (%)	Or (95% CI)
Gondar	300	14 (4.7%)	7 (2.33%)	1 (0.33%)	22
Bahirdar	100	6 (6%)	3 (3%)	5 (5%)	14
Dessie	100	3 (%)	0 (0%)	0 (0%)	3
Mekele	100	14 (14%)	0 (0%)	0 (0%)	14
Total	**600**	**37 (6.2%)**	**10 (1.7%)**	**6 (1%)**	**53**

The number of blood donors that was positive for HBs Ag in the age category of 19-28 was 23/37 (62.2%) and in the age category 29-38 was 9/113 (24.3%). Single blood donors were more positive for HBs Ag (75.7% (28/374)) compared to the married ones (OR=1.9; 95% CI=0.8-4.6). However, anti-HCV positivity was higher

for the married blood donors (6/10) compared to the single and the divorced blood donors (3/10) and (/10) respectively. Daily laborers accounted for 62.2% (23/37) for the HBs Ag positivity followed by farmers and students 13.5% (5/370) for each. Anti-HCV prevalence for farmers was 7/10 followed by daily laborers 3/10, merchants and other occupational groups were negative for HCV anti-body (Table4).

Overall, less than 5% of blood-donors at Bahirdar Hospital and Gondar College of Medical Sciences hospital blood banks were positive for malaria parasites. Both *Plasmodium falciparum* and *Plasmodium vivax* were detected. All malaria positive blood donors claimed that they had a history of malaria between 2001 and 2003.

Table 3: **HBV and HCV prevalence among different age groups of blood donors in Gondar, Bahirdar, Dessie and Mekele blood banks, December 2002 to February 2003**

Age Group	HBV		OR (95% CI)	HCV		OR (95% CI)
	Positives	Negatives		Positives	Negatives	
<18	3	61	1.00	0	64	1.00
19-28	23	334	42.0 (0.38-6.05)	5	352	0.89 (0.1-20)
29-38	9	104	5.11 (0.41-8.6)	2	111	1.14 (0.08-32)
39-48	2	47	0.87 (0.1-6.7)	1	48	1.3 (0.0-49)
49-58	0	11	1.85 (0.0-24)	2	9	14 (0.8-439)
59-68	0	1	20.33 (0.0-10.7)	0	1	63 (0.0-15148)
Total	37 (6.2%)	563 (93.8%)		10 (1.7%)	590 (98.3%)	

Table 4: **Marital status and occupation versus HBV and HCV prevalence among blood donors in Gondar Bahirdar, Dessie and Mekele blood banks, December 2002 to February 2003**

Variables	HBV		OR (95% CI)	HCV		OR (95% CI)
	Positives No (%)	Negatives No (%)		Positives No (%)	Negatives No (%)	
Marital status						
Married	8 (21.6)	188 (33.4)	1.00	6 (50)	190 (32.2)	1.00
Single	28 (75.7)	34 (61.5)	1.90 (0.81-4.63)	3 (30)	371 (62.9)	0.26 (0.05-1.16)
Divorced	1 (2.7)	29 (5.2)	0.81 (0.07-1.42)	1 (10	29 (4.9)	1.09 (0.03-1.13)
Total	**37 (6.2)**	**563 (93.8)**		**10 (1.7)**	**590 (98.3)**	
Occupation						
Student	5 (13.5)	126 (22.4)	1.00	0 (0.0)	131 (22.2)	1.00
Farmer	5 (13.5)	140 (24.6)	0.9 (0.22-3.69)	7 (70)	138 (23.4)	6.64 (0.81-1.45)
Daily worker	23 (62.2	248 (44.0)	2.34 (0.82-7.19)	3 (30)	268 (45.4)	1.47 (0.13-37)
Merchant	3 (8.1)	17 (3.0)	4.45 (0.76-24.4)	0 (0.0)	20 (3.4)	6.55 (0.252)
Others	1 (2.7)	36 (6.0)	0.7 (0.03-6.52)	0 (0.0)	33 (5.6)	3.4 (0-150)
Total	**37 (6.2%)**	**563 (93.8%)**		**10 (1.7%)**	**590 (98.3%)**	

Discussion

The overall prevalence of HBsAg in four blood banks was 6.2% (n=600)), which is far lower than the 1984 finding (11%) reported among blood donors of the Red-Cross Blood Bank in Addis Ababa (10). However, institutionally the prevalence of HBsAg was higher in Mekele Hospital Blood Bank (14%, n=100) compared to the 1984 Addis Ababa prevalence.

The result of this study was higher for HBsAg compared to the prevalence of HBsAg among blood donors in Italy (2.7%), lower than the prevalence found in Indonesia (8.8%) (3) and Kinshasa, Democratic Republic of the Congo (9.8%) (4). The HCV anti-body prevalence was 1.7%. This is relatively higher than the finding (1.4%) reported among healthy adult blood donors in Addis Ababa (10). There was no co-infection by hepatitis viruses (HBV and HCV) in this study. This is supported by a study conducted earlier among 238 patients (10) with HBV-infection; where anti-HCV anti-bodies were present in only one patient. Thus, HCV infection was uncommon on HBsAg positive blood donors. Some authors found an inhibition of hepatitis B virus by hepatitis C virus (12); other describes mutual inhibition, which may have a potential to change overtime (13).

The highest prevalence rate of HBsAg was seen in the daily-based workers (9.5%), which is different from other studies conducted in Gondar and Addis Ababa blood banks, i.e. (12%) and (5%) respectively (16). It has been documented that HBsAg prevalence was higher in farmers in Gondar (18.8) followed by soldiers (16.3%). The 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, 16). The anti-HCV anti-body prevalence was higher in farmers and daily-based workers in Northern Ethiopia blood donors (7/10 and 3/10) respectively).

The number of sexual partners was compared with HBsAg and anit-HCV prevalence and the maximum

number of positivity among donors with no sexual partners and with only one sexual partner. HBV and HCV routes of transmission is unlikely to be sexual intercourse in the study areas which is similar to the 1997 survey in Ethiopia (16), which suggested that 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 in rural populations and often at age before sexual activity (17).

The result of this study showed 1% malaria prevalence among blood donors, which is lower than the prevalence of the general population (2.8%) in Nazareth, South West Ethiopia (18). Five of the six malaria positive blood donors were from Bahirdar Hospital, an area like most parts of Ethiopia that has a period of rainfall between June to September. The possible reason for the low prevalence of malaria parasites among blood donors in this study is the sampling period (December 2002 to February 2003) as explained by the seasonal changes in mosquito density (20). However, it has been documented that perennial transmission prevails around lakes and swamps and it holds true for Bahirdar, a town near the Lake Tanna and Blue Nile River.

The limitations of the majority of serological tests were also considerable to the test kit used by this study. This particularly holds true for HCV-infection because the anti-HCV anti-body determination may not completely detect donors with HCV-infection at the window period. The prevalence of HBsAg in the blood donors, though lower than previous reports was still important. Determination of HBsAg alone may not exactly measure the overall prevalence of HBV infection in a given population as other markers such as anit-HBC and HBC antigen are indicators of the total infection rate. The carrier state of HBsAg is defined as persistence of this antigen in the blood for over 6 months. The carrier state of HBsAg is defined as persistence of this antigen in the blood for over 6 months. Thus, a single determination of HBsAg may not be the ideal way of defining the carrier state among blood donors particularly for the repeatedly and commercially blood donating individuals. Nevertheless, a prevalence of 6.3% for HBsAg and 1.7% for anit-HCV among healthy blood donors is still important and significant. Exclusion of HBV positive blood donors alone may not effectively reject blood donors that are infected with HCV as co-infection by these viruses were not found in this study.

Screening of blood donors for both HBV and HCV markers independently is recommended. Moreover, a 1% prevalence of malaria parasites in blood donors requires greater concern particularly in malaria endemic areas and it is also recommended that physicians or blood collectors need to ask blood donors for history of recent malaria infection and need to confirm negativity by laboratory tests according to the replay of the blood donor before donating blood. The failure of serological screening tests to identify recently infected blood donors requires the use of advanced tests to reduce the risk of transmitting hepatitis viruses through blood transfusion during the window period.

A prevalence of 6.2% HBsAg and 1.7% anti-HCV might warrant the introduction of screening of all blood donors for hepatitis viral markers (HBV and HCV) and should be instituted in the Amhara and Tigray regional states as well as in the country. In general, formulation of safe blood transfusion policy and implementation of standard laboratory screening procedures at all levels is strongly recommended.

Acknowledgments

We are very much grateful to the Addis Ababa University, School of Graduate studies for the financial support and the Promed Share Company for providing the test kit with a reduced price.

References

1. Tobler L, Busch M. History of post transfusion hepatitis. Clinical chemistry. 1997;43:1487-1493.
2. Hong KJ and Shinnehen D. Global control of hepatitis B virus infection. Lancent 2002;2:395-403.
3. Sulaiman H, et al. Prevalence of hepatitis B and C viruses in healthy Indonesian blood donors. Transactions of the Royal society of tropical medicine. 1995;89:167-170.
4. Mbendi N. et al. Prevalence of HIV and HBsAg in blood donors. Residual risk of contamination in east Kinshasa, Democratic Republic of the Congo. 2001;61(2):139-42.
5. Abebe A. et al. Sero-epidemiological study of hepatitis B virus in Addis Ababa, Ethiopia: transmission and control. Royal Society of tropical Medicine and Hygiene. 1996:6.
6. Chamberlan M. Emerging infections agents: Do they pose a risk to the safety of transfused blood and blood products? CDC, National center for infections disease, division of viral and Reckettsial disease. 2002;797-805.
7. Okyda M, HinoK, Korenaga m. et al. Difference in hyper variable region of HCV in human serum. Hepatology. 199?;29:217-22.
8. Alter M, Kruson M, Nainam O. The prevalence of hepatitis C virus infection in the USA, 1988 through 1994. N Engle J Med. 2001;345:41-52.
9. Georg M, Bruce D. Hepatitis C virus infection, N Engle J Med. 2001;345-41-52.
10. Tsega E. Epidemiology, prevention and Treatment of Viral hepatitis with emphasis on new developments. Review article. Ethiopian Medical Journal. 2000;38:131-141.

11. Workenesh A. et al Higher prevalence of anti-HCV antibodies among HIV positive compared to HIV negative inhabitants of Addis Ababa, Ethiopia Journal of Medical Virology. 2002;68:12-17.
12. endward L. et al. Reducing the risk of blood transfusion. Hematology 2001;20:433-442.
13. Tsega E, Mengesha B, Hansoon G, Lindberg J, Norden Feldt E. Hepatitis B virus infection among Volunteer Ethiopia blood donors. 1984:57-62.
14. Rahelenbek S, Yohannes G, Molla K, Reifen R, Assefa A. Infection with HIV, syphilis and hepatitis B virus in Ethiopia; a survey in blood donors. International Journal of STD and AIDS. 1997;8:261-264.
15. Assefa A, Rhelenbek S, Molla K, Alemu S. Sero prevalence of HIV-1 and syphilis antibodies in blood donors in Gondar, Ethiopia, 1989-1993. Journal of Acquired Immune deficiency syndrome 1994;7:1282-1285.
16. Alkan M, Maayan S, Belmark I, Arebeliya M, Benyshai F. Serological markers for hepatitis B and treponemal infections among HIV carriers from Ethiopia. ISR J Med Sci. 1993;29:390-392.
17. Gebreselassie L. Occurrence of hepatitis B surface antigen in various population groups in Ethiopia. Ethiopia Medical Journal. 1986;24:63-65.
18. Kefene H, Rapicette M. Rossi G, Bisanti L, Bekura D, Morace G, Palladino P. et al. Ethiopia National Hepatitis B Study. Journal of Medical Virology. 1988;24:75-83.
19. Tsega E, Nordnfelt and Hanson B. Hepatitis C virus infection and chronic liver disease in Ethiopia where hepatitis B infection is hyper endemic. Trans RSOC Trop Med Hyg. 1995;9:171-174.
20. Evenhart E, Bisceglie D, Murry A. et al. Risk for non-Anon-B hepatitis through sexual or household contract with chronic carrier. Annals of Internal Medicine. 1990;112-544-545.
21. Wongs S, Chang T, Yao W, Chou P. Comparison of hepatitis B Virus and hepatitis C Virus prevalence and the risk factors in a community based study. AMJ Trop Med Hyg. 2002;66:389-93
22. Reichen J. Co-infection by hepatitis B and C viruses. J Med Virology. 2003;46:258-64.
23. Pasquini P, Bisanti L, Soldol B. Hepatitis B infection in Arsi region of Ethiopia European Journal of Epidemiology. 1988;4:310-13.
24. Yohanes M, Petros B. Urban malaria in Nazareth, Ethiopia: parasitological studies Ethiopian Medical Journal 1996;34:83-91.
25. Nega A. Malaria in the Ecology of Health and disease in Ethiopia. Ethiopian Medical Journal. 1993;41-341-52.