Seroepidemiology of Hepatitis B and C Virus Infections: A Five-Year Retrospective Study Among Blood Donors in Saboba District in the Northern Region of Ghana

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Abstract

Background and Objectives: Chronic hepatitis B and C infections are capable of progressing to liver cirrhosis and hepatocellular carcinoma. Globally, it has been estimated that over 2 billion and 170 million people are living with hepatitis B and C infections, respectively. Ghana remains one of the highly endemic countries challenged by continues spread of these viral agents in Africa. This study aimed to determine the seroprevalence and trend of Hepatitis B and C coinfections among blood donors in Saboba District of the Northern Region of Ghana.

Methods: A five-year hospital based retrospective study was carried out among 8,605 blood donors comprising 8517 males and 88 females using data on blood donors from Saboba Assemblies of God Hospital located in the Saboba District in the Northern Region of Ghana from 2013 to 2017. Blood bank records on HBV and HCV potential blood donors who visited the hospital to donate blood was retrieved. Donor demographic details, i.e. age and gender were also recovered. Donors who were registered to the hospital but were not residents of the Northern Region were excluded from the study. Donors with incomplete records were also excluded from the study. The data was managed using Microsoft Excel spreadsheet 2016 and analysed using GraphPad Prism statistical software.

Results: The overall prevalence of asymptomatic viral hepatitis B and C infection in the general adult population was 9.59% and 12.71%, respectively, with an HBV/HCV coinfection rate of 2.23%. The number of donors generally declined with advancement in years from 2038 (23.68%) since 2013 to as low as 1169 (13.59%) in 2016, except for 2017 where a sharp increase of 1926 (22.38%) was observed. The first and second highest proportions of donors fell within the age categories of 20-29 [51.53% (4434)] and 30-39 [32.90% (2831)]. Seroprevalence rate of HBV, HCV and HBV/HCV coinfection rates were generally higher among the female group than observed among the male category. The year-to-year variation in HBV, HCV and HBV/HCV infection was statistically significant. The highest year-to-year HBV seropositivity rate was 11.48% in the year 2013, while that for HCV and HBV/HCV coinfection was 16.24% and 5.85% respectively both documented in the year 2014. HBV and HBV/HCV coinfection rate was highest among donors aged <20 years old, while HCV seroprevalence was highest among donors aged 50-59 years old.

Conclusion: Seroprevalence of HBV and HCV among donors in the Saboba District of the Northern Region of Ghana is endemic. The HBV/HCV coinfections rate also raises serious concern owing to its high prevalence rate among the younger age. Intensive public health education coupled with mobile screening and mass vaccination of seronegative individuals is advised so as to help curb further spread of the infection and in effect help safeguard the health status of potential donors in the district.

Introduction

Hepatitis, the viral type to be specific, refers to the inflammation of the hepatocytes as a result of viral infection. Types A, B, and C of the viral hepatitis are the three common types among the five types of the

hepatitis viruses vis-à-vis hepatitis A, B, C, D, and E. Hepatitis B virus (HBV) infection is a major public health problem worldwide infecting about 30% of the world's population [1, 2]. This infection has been ranked the 15th cause of death in all cases of global mortality [3]. HBV infection is associated with an increased risk of cirrhosis, hepatic decompensation and hepatocellular carcinoma (HCC) in 15%-40% of infected subjects [4, 5]. The World Health Organization (WHO) has estimated that 2 billion people worldwide have been infected with HBV and that about 350-400 million of these people are chronically infected, approximately 65 million of which are projected to die from liver disease due to the infection [2, 4, 6]. The disease has been documented to cause between 600,000 to 800,000 deaths every year [3, 7-10]. In Sub-Saharan Africa, about 8% of the population are chronic carriers of HBV with the highest rate of 2.8% in the West African sub-region including Ghana where an estimated national prevalence of 12.3% in a systemic review has been documented [11]. Infection with Hepatitis C virus (HCV) and the associated pathological outcome are analogous to those of HBV infection. When not detected early for treatment, HCV infection can lead to complications such as liver cirrhosis and hepatocellular carcinoma (HCC), which have been tagged as the principal cause for a liver transplant in the United States [12]. Of global concern is the fact that Shepard and colleagues in their study implicated HCV infection as a major potential cause of substantial morbidity and mortality in the future [13]. According to the WHO, 170 million of the world's population are chronically infected with HCV [14], 5.3% of which has been reported in Sub-Saharan Africa [15, 16]. In their report, Madhava and colleagues indicated that Central African has the highest estimated HCV prevalence of 6% whilst 2.4% and 1.6% were reported in West Africa and Southern and Eastern Africa respectively [15]. The prevalence of HCV in the general population in Africa ranges between 0.1% and 17.5%; the highest prevalence in Egypt (17.5%), 13.8% in Cameroon and 11.3% in Burundi with lower prevalence rates recorded in Zambia, Kenya, Malawi and South Africa among others [17]. Regional prevalence of chronic HCV infection was determined for Ashanti region as 1.5 % to 1.9 % and Greater Accra region as 6.4 % to 8.6 % [18]. In Ghana, there is no published literature on the prevalence of HBV & HCV coinfection in the Northern region, particularly the Saboba District. This study therefore sought to determine the prevalence and yearly trend of hepatitis B and C coinfection among blood donors in Saboba District, Ghana.

Materials And Methods

Study Design/Eligibility Criteria

A five-year hospital-based retrospective study was carried out among 8,605 blood donors comprising 8517 males and 88 females using data on blood donors from Saboba Assemblies of God Hospital located in the Saboba District in the Northern Region of Ghana from 2013 to 2017. The hospital is a 124-bed capacity facility made up of Adult Male ward (30 beds), Children’s ward (33 beds), Neonatal Intensive Care Unit (19 beds), Maternity ward (20 beds), female ward (22 beds) and a theatre, laboratory, radiography unit, the Outpatient Department (OPD), consulting rooms, the dispensary and an administration block. Blood bank records on HBV and HCV potential blood donors who visited the

hospital to donate blood was retrieved. Donors demographic details i.e., age and gender were also retrieved. Test kits/strips employed for the serological diagnosis of the two viral infections were those produced from the following companies: DiaSpot (cassette type) in 2013 and 2014, ACON (strips) in 2015, ABON (strips) in 2016 and OneStep HIGHTOP (strips) from 2017 till date. Donors who were registered with the hospital but were not residents of the Northern Region were excluded from the study. Donors with incomplete records were also excluded from the study.

Data Collection and Analysis

Due to the large volume of data, a fit-for-purpose Microsoft Excel form was employed to capture the data into Microsoft Excel spread sheet version 2016. The data after capturing using the Excel software was checked for completeness and then transferred into IBM SPSS for statistical software for statistical analysis. Results are presented in the form of tables and figures. Chi-square (x^2) test was employed to determine statistical significance among variables under review. P-value ≤ 0.05 were considered statistically significant.

Ethical Considerations

Ethical clearance was obtained from the Research Ethics Committee (REC) of the University of Health and Allied Sciences (UHAS) with Ethical Clearance Certificate Number UHAS-REC A.4 [218] 18-19. Written permission to undertake this study was obtained from the hospital administration post thorough explanations and clarification on the purpose of the study.

Results

Of the overall 8,605 prospective blood donors recruited in this study, 9.59% (825/8605), 12.71% (1094/8605) and 2.23% (192/8605) reported positive for HBV, HCV and HBV/HCV coinfection respectively. Number of donors generally declined with advancement in years from 2038 (23.68%) since 2013 to as low as 1169 (13.59%) in 2016 except for 2017 where a sharp increase of 1926 (22.38%) was observed. Seropositive HBV prevalence has also been on a downward trajectory since 2013 with 11.48% rate to 7.61% in 2016 but saw a slight upsurge of 8.20% in the year 2017 compared to 2016. Seroprevalence rates of HCV infection on the other hand has been somewhat wavy over the five-year period with the highest prevalence rate of 16.24% occurring in 2014 and the lowest, 7.78% in 2016. The second and third highest HCV prevalence rates over the five-year period was observed in the years 2013 and 2017 respectively. HBV/HCV was 1.18% in 2013 until a sharp increase of 5.85% was observed in 2014 followed by a constant decline to as low as 0.99% in 2017. The year-on-year prevalence rates of HBV, HCV and HBV/HCV coinfection were significantly different over the period ($p<0.05$) (Table 1).

Table 1: Year -on-Year Trend of HBV and HCV Infection Among Blood Donors in Saboba District

Parameter	Donors	HBV	HCV	Coinfection
Total	8605 (100.00)	825 (9.59)	1094 (12.71)	192 (2.23)
2013	2038 (23.68)	234 (11.48)	307 (15.11)	24 (1.18)
2014	1983 (23.04)	197 (9.93)	322 (16.24)	116 (5.85)
2015	1489 (17.30)	147 (9.87)	145 (9.74)	21 (1.41)
2016	1169 (13.59)	89 (7.61)	91 (7.78)	12 (1.03)
2017	1926 (22.38)	158 (8.20)	2229 (11.94)	19 (0.99)
P-value		<0.0001	<0.0001	0.0010

Data is presented as frequency with corresponding percentages in parenthesis. HBV: hepatitis B surface antigen. HCV: Hepatitis C Virus. p is significant at <0.05

The age-based stratification of donors revealed the first and second highest proportions of donors falling in the age categories of 20-29 [51.53% (4434)] and 30-39 [32.90% (2831)]. Blood donation is less patronized by individuals aged < 20 (5.66%) and ≥ 50 (1.49%) years old. HBV seropositive prevalence generally decreases significantly (p-v <0.0001) with advancement in age, with the highest prevalence rate documented among donors aged <20 years old (16.84%) followed by 10.37%, 7.81%, 7.72% and 5.17% among donors aged 20-29, 30-39, 40-49 and 50-59 years old respectively. No donor 60 years and above was diagnosed with HBV infection. HCV infection was surprisingly highest among the extreme age categories vis-a-via the highest 18.10% among participants aged 50-59 years followed by 17.86%, 17.79%, and 16.67% among donors aged <20, 40-49 and ≥ 60 years old respectively. The HCV seroprevalence is significantly different among the various age groups studied. Donors aged <20 years recorded the highest HBV/HCV coinfection rate of 4.93%, while those aged 50-59, 40-49, and 20-29 recorded comparable prevalence rates of 2.59%, 2.21% and 2.10%. HBV/HCV coinfection rate in this study were statistically significant across the age categories (Table 2).

Table 2: Year -on-Year Trend of HBV and HCV Infection Among Blood Donors of the Various Age Groups in Saboba District.

Parameter	Donors (n=8605)	HBV	HCV	Coinfection
<20	487 (5.66)	82 (16.84)	87 (17.86)	24 (4.93)
20-29	4434 (51.53)	460 (10.37)	516 (11.64)	93 (2.10)
30-39	2831 (32.90)	221 (7.81)	339 (11.97)	56 (1.98)
40-49	725 (8.43)	56 (7.72)	129 (17.79)	16 (2.21)
50-59	116 (1.35)	6 (5.17)	21 (18.10)	3 (2.59)
≥60	12 (0.14)	0 (0.00)	2 (16.67)	0 (0.00)
P-value		0.0032	<0.0001	<0.0001

Data is presented as frequency with corresponding percentages in parentheses. HBV: hepatitis B surface antigen. HCV: Hepatitis C Virus. p is significant at 0.05.

Overall, HBV prevalence rate of 11.36% among females was documented, higher than the 9.57% prevalence in their male counterparts. This study generally saw a consistently higher HBV prevalence rate among females than observed among the males except for the year 2013 where HBV prevalence was highest among males (11.53%) than observed among females (8.00%). The year 2014 saw in proportion the highest HBV prevalence rate of 20.00% among females higher than the 9.86 percent documented among their male counterparts in the same year. The years 2015 and 2016 saw a general steady decline in the seroprevalence rates of HBV followed by a slight increase in the year 2017. Of note, however, is the fact that the rate of infection over the period has remained comparable between the two gender categories (Figure 1).

Overall, HCV prevalence rate of 20.45% among females was documented, higher than the 12.63% prevalence in their male counterparts. The highest significant prevalence of infection (53.33%) was observed among females in the year 2014, the same year where the infection rate among their male counterparts stood at 15.95%. A sharp decline in the prevalence rate was observed among both genders in the year 2015 and then remained slightly on the upward course until 2017 (figure 2).

This study recorded an overall HBV/HCV coinfection rate of 20.00% and 9.29% among males and females, respectively, who reported to the blood bank for the purposes of donating blood. In the year 2013, HBV/HCV coinfection rate was as low as 1.19% and 0.00% among males and females, respectively. Immediately after 2013, a significantly sharp upsurge in the HBV/HCV coinfection rate was observed among the female group (12.00%), significantly higher than the male category (5.61%). A steady but way-like decline in the HBV/HCV coinfection rate after 2015 was observed till as low as 2017 where females recorded once again a 0.00% prevalence against 0.94% among their male counterparts (Figure 3).

Discussion

The live-saving medical interventions of blood transfusion therapy cannot be underestimated. However, recipients of transfusion risk becoming infected with blood-borne pathogens. Despite being a life-saving intervention, the challenges posed by the process continue to be a public health threat in most countries, particularly those in developing settings. This study focused on determining the seroepidemiology of hepatitis B and C virus infections among blood donors in Saboba District in the Northern Region of Ghana.

Of the overall 8,605 prospective blood donors recruited in this study, 9.59% (825/8605), 12.71% (1094/8605), and 2.23% (192/8605) reported positive for HBV, HCV and HBV/HCV coinfection respectively. Evidently, the prevalence of HBV and HCV are higher than the estimated global 7% (350 million) HBV and 3% HCV prevalence rate [19]. Recent studies showed higher prevalence rates of HBV than the HCV [20-22] contrary to the findings in this work. In Apollo Hospitals, Dhaka, low seroprevalence rate of HBV and HCV among all blood donors between 2007 and 2011 [23] was documented similar to that of South-eastern Nigeria [24]. Compared to findings from this study, a similar study conducted among blood donors in a rural Ghanaian community about a decade ago revealed a higher HBV, lower HCV and a lower HBV/HCV coinfection prevalence rates of 10.53%, 5.63% and 2.09% respectively [21]. The discrepancies in the results juxtaposed to findings from this study could be due to among many factors the geographical area, level of awareness among study subjects on issues of the infections and their mode of transmission as well as the detection methods employed in testing for the virus. Owing to the established age associated decline in the prevalence of both HBV and HCV infection [25], it was expected that seroprevalence rates of these viral agents would exhibit a downward trajectory with advancement in years. It was therefore not surprising to see a smooth decline in the seroprevalence rates of HBV from 11.48% to 8.20% and HCV from 15.11% to 11.94% despite the fact that the recorded prevalence rates of these infections remains very high [2, 21]. It appears however that efforts to aid combat the menace of these viral infections in recent times have been shifted more towards that of HBV infections than HCV. In fact, most public health educations and screening programs prioritizes HBV infection than HCV. This observations by authors over the years seems to justify the reason for the elevated HCV infections than HBV observed in this study. It is important to note that HCV is up to 4 times more infectious than Human Immunodeficiency Virus (HIV), requiring less exposure than HIV to cause infection [26] and therefore need to be given the needed attention as much as given other viral agents vis-à-vis HBV and HIV. In this study the HBV/HCV coinfection rate was 1.18% in 2013 until a sharp increase of 5.85% was observed in 2014 believed to be contributed by the spike in HCV infection in same year, 2014. The year-on-year prevalence rates of HBV, HCV and HBV/HCV coinfection were significantly different over the period ($p<0.05$).

The age-based stratification of donors revealed the first and second highest proportions of donors falling in the age categories of 20-29 [51.53% (4434)] and 30-39 [32.90% (2831)]. Blood donation was less patronized by individuals aged < 20 (5.66%) and ≥ 50 (1.49%) years old. While HBV seroprevalence generally decreases significantly (p-v <0.0001) from as high as 16.84% among donors aged <20 years to

5.17% and 0.00% among donors aged 50-59 and ≥ 60 years respectively with advancement in age, HCV seroprevalence demonstrated a rather wavy-like trend of infection mostly on the high with donors aged 50-59 years recording the highest prevalence rate of 18.10% followed closely by 17.86% (<20 years), 17.79% and 16.67%. This finding served as a confirmatory information buttressing the argument that little attention is given to HCV infection in Ghana. It is important to note that home-based delivery is a common practice in Northern Ghana mostly as a result of 1. difficulties in assessing the nearest health facilities for antinatal and post-natal care in the district and 2. preference for local birth treatment to that of health facilities by gravid women. This therefore exposes the newly born to these viral agents after delivery as well as failure on the part of parents to subject the newly born to laboratory tests to ensure early diagnosis of these infections for appropriate treatment to commence upon a positive test. Relevant health officials and stakeholders need therefore to go back to the drawing board and ensure that discussion on infection prevention are rekindled, paying key attention to that of HCV to prevent a future pandemic of the viral agent among the life-saving donor population which is already a struggle by blood bank donor organizers in Ghana to come by. Another worrying development is an HBV/HCV coinfection rate of 4.93% among donors aged <20 years in this study. Authors consider this situation worrying owing to the fact that the occurrence of coinfection of HBV with other viruses such as HIV, and HCV most often than not triggers an accelerated progression of liver disease with adverse clinical outcomes [27]. This does not only threaten to worsen the general health status of the population in the catchment area and the country at large but may also cause a reduction in the eligible donor population of the region.

This study reveals a higher burden of viral hepatitis infections among females than observed among their male counterparts comparable to that of Nkrumah and colleagues [21]. In contrast, Alomatu and Walana recorded in their works a higher prevalence of viral hepatitis B and C among males compared to their female counterparts [20, 22]. It is not quite clear from the present study what exactly could account for the female preponderance to viral infectivity but Lokpo and colleagues [11] indicated that the high infectivity of the virus could include early onset of sexual activity, wider surface area of the vagina, longer semen-vaginal contact, lower level of education, iatrogenic infection in health facilities where women are more often admitted than men especially during pregnancy and at delivery, occupation as well as lower standard of living. The high female prevalence rate in this study could also be as a result of the small number of female blood donors, i.e., 88 out of the 8605 total donors recruited in this study as a single infection in the female population could be significant compared to the male population. This study recorded an overall HBV/HCV coinfection rate of 20.00% among males higher than 9.29% recorded among females. However, Except for 2013 where the HBV/HCV coinfection rate was as low as 1.19% and 0.00% among males and females, respectively, a significantly sharp upsurge in the HBV/HCV coinfection rate of 12.00% for the year 2014 and 4.00% for the years 2015 and 2016 was observed among the female group higher than the 5.61% 0.99% and 0.55% prevalence rate among the male category for the years 2014, 2015 and 2016 respectively.

Conclusion

Seroprevalence of HBV and HCV among donors in the Saboba District of the Northern Region of Ghana is endemic. The HBV/HCV coinfection rate also raises serious concerns owing to its high prevalence rate among the younger age.

Limitations

Owing to the fact that data used in this study was obtained from the local repository (book storage) of the hospital, undetected entry errors might affect the final outcome of the study.

Recommendations

Intensive public health education coupled with mobile screening and mass vaccination of seronegative individuals is advised to help curb further spread of the infection and in effect help safeguard the health status of potential donors in the district. Pregnant women within the district and the country at large must be educated on the importance of delivering in a health facility.

Declarations

Conflict of Interest Statement

All authors declare no conflict of interest

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Figures

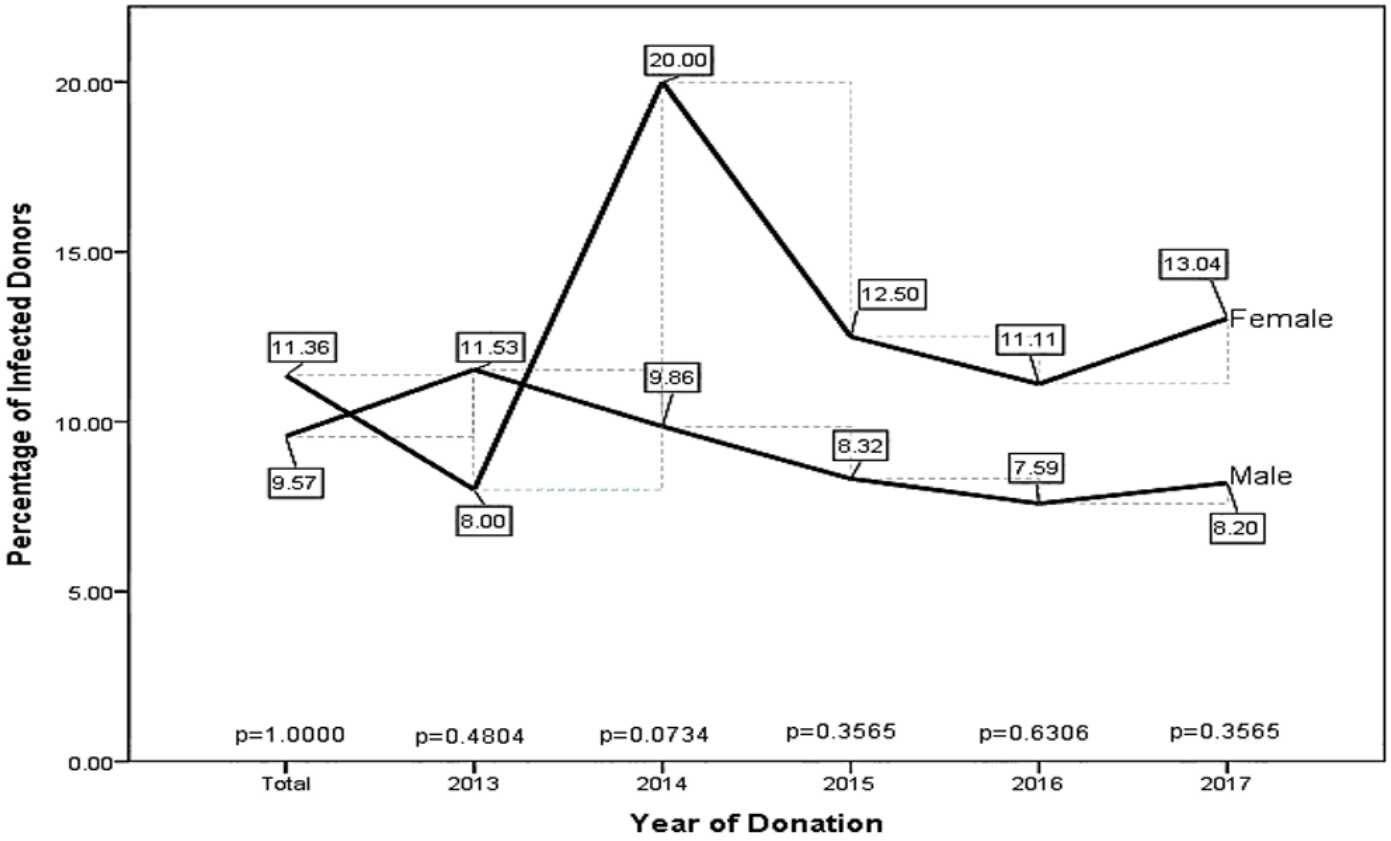

Figure 1

Gender Distribution for the Trend of HBV Infection for the Five-Year Period.

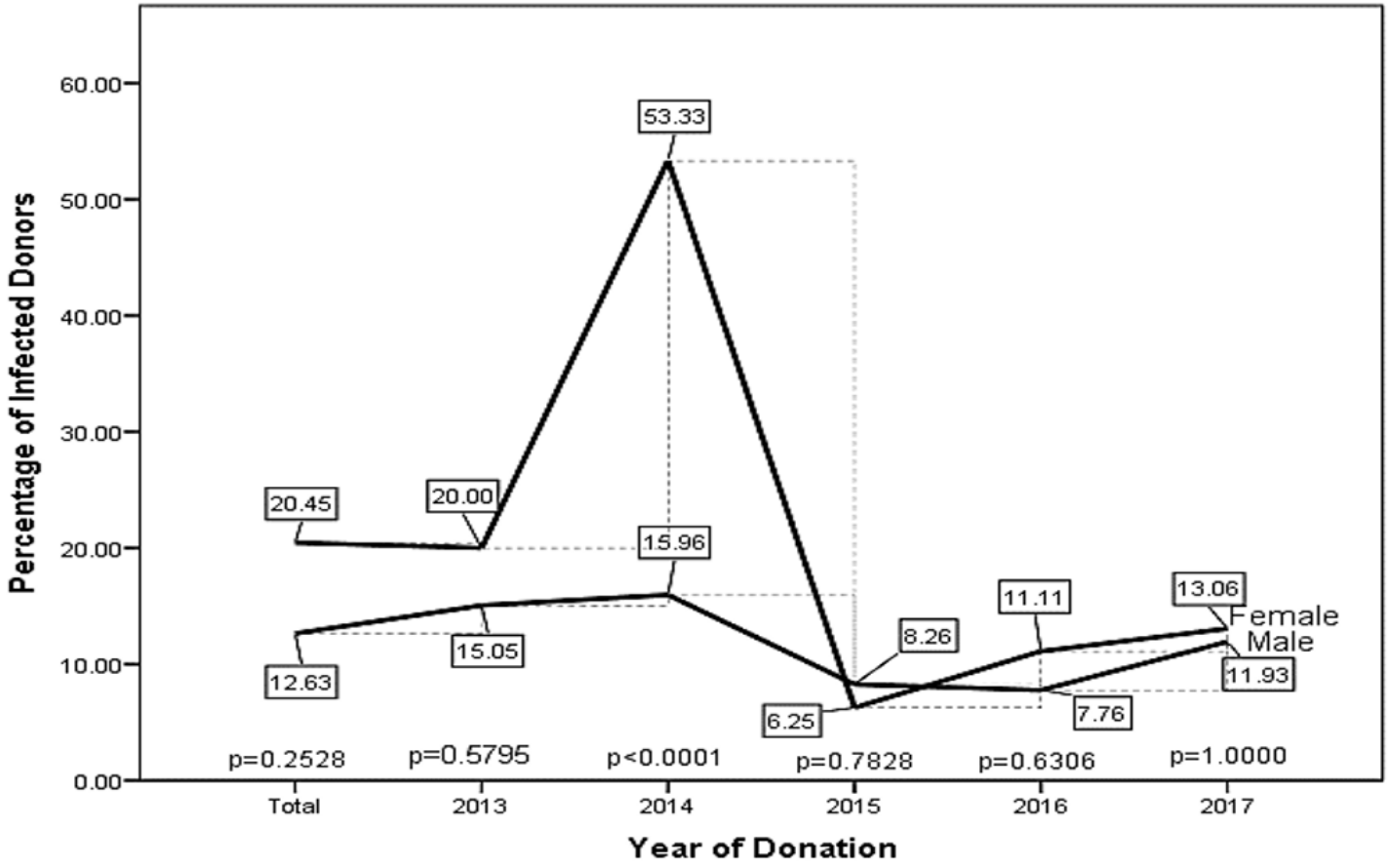

Figure 2

Gender Distribution for the Trend of HCV Infection for the Five-Year Period

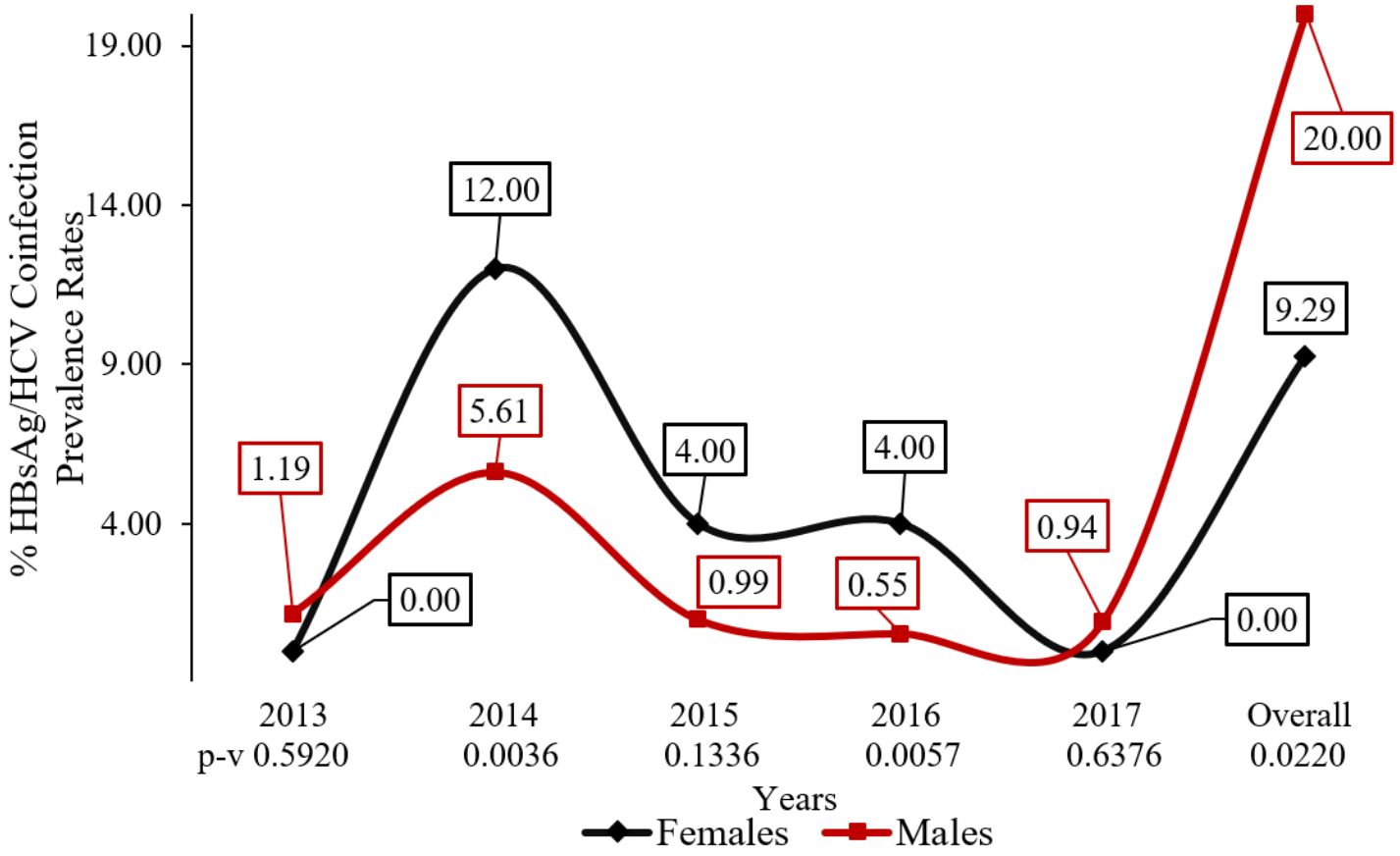

Figure 3

Gender Distribution for the Trend of HBV/HCV Coinfection for the Five-Year Period