

Determination of Hepatitis B Virus Carriers among Voluntary Blood Donors in Some Parts of Nigeria

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Abstract

Original Research Article

This study was designed to determine the prevalence of hepatitis B virus carriers among voluntary blood donors in some parts of Nigeria. A total of 183 blood samples were collected from subjects in North Central and consisted of 137 males and 46 females; 176 blood samples were collected from subjects in North East and consisted of 129 males and 47 females, while 173 blood samples were collected from subjects in South-South region and consisted of 123 males and 50 females. The mean age of the study population were 34.89 ± 9.19 years, 39.81 ± 9.60 years and 39.92 ± 9.27 year in North Central, North East and South-South regions respectively. The specimens were tested for hepatitis B surface antigen, Hepatitis C and HIV to rule out co-infection with hepatitis, using enzyme-linked immunosorbent assay. The results were analyzed using statistical analysis system (SAS STAT 15.1) and p-values < 0.05 were considered significant. Overall, the percentage prevalence of HBsAg negative by gender was 63.16% for males and 23.87% for the females while the prevalence of HBsAg positive by gender was 9.96% for the males and 3.01% for the females. The percentage prevalence of HBsAg negative irrespective of sex for the three zones combined was 87.03% while the percentage prevalence of HBsAg positive was 12.97%. The distribution of viral load shows that North Central zone has a viral load of 31.8439 ± 12.784 IU/mol $\times 10^4$ for male subjects and 0.3378 ± 28.008 IU/mol $\times 10^4$ for the female subjects while in the North East zone, mean viral load values were 0.3454 ± 16.171 IU/mol $\times 10^4$ and 0.0561 ± 28.008 IU/mol $\times 10^4$ for the male and female subjects respectively. The mean viral load values for male and female subjects from the South South zone were 0.7583 ± 16.738 IU/mol $\times 10^4$ and 0.7976 ± 25.568 IU/mol $\times 10^4$ respectively. These findings indicate the percentage of asymptomatic hepatitis B virus carriers in the population is high implying that progression of these carriers into the full hepatitis B infection in the event of interactions between host and environmental factors is a possibility.

Keywords: Viral load, surface antigen, prevalence, hepatitis, geo-political zones.

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INTRODUCTION

The reduction of public health burden is the goal of many intervention strategies in the health sectors of countries. Several infectious agents such as hepatitis B virus (HBV) can constitute major public health problems particularly in Sub-Saharan Africa and other developing countries of the World. Hepatitis B is a viral infection which causes acute and chronic hepatitis leading to thousands of deaths per year and it is considered one of the major public health issues worldwide [1, 2]. It affects the liver resulting into inflammatory conditions [3]. Hepatitis B virus is a DNA virus which belongs to the hepadna virus family. Viruses in this family are unique in that they replicate from an RNA file involving reverse transcriptase and they are liable to developing mutant strains [3]. Although majority of individuals recover from the acute

infection, those who progress to chronic hepatitis B infection are at great risk of developing serious complications such as cirrhosis, hepatocellular carcinoma, liver failure and eventual death [4].

Hepatitis B virus (HBV) attacks liver parenchyma cells (hepatocytes) and cause hepatitis which may be acute or chronic. The chronic phase may involve complications leading to cirrhosis, hepatocellular carcinoma, liver failure and death [4]. It is estimated that hepatitis B virus infection causes about two hundred and fifty thousand death worldwide in a year, while about two billion persons are chronically infected [1]. It is therefore considered one of the major public health burdens [1, 2].

The burden of hepatitis B virus is high in Africa and sub-Saharan Africa including Nigeria, which has an average nation prevalence of 11% and an estimated chronically infected person of 20 million according to the Federal Ministry of Health [5]. It is also estimated that in Nigeria, more cases of HBV infection occur in males than in females in the ratio 62.6% to 37.4% [5]. Moreover, Nigeria accounts for 8.3% of the global burden of chronic HBV [5]. The prevalence of hepatitis B infections varies greatly in different parts of the world, but it is higher in tropical regions causing both acute and chronic liver diseases. In Nigeria, prevalence was recorded for Maiduguri, Lagos, Port Harcourt and Zaria as 4.3%, 13.8%, 4.3% and 8.3% respectively [6-9]. Forbi *et al.*, [10] reported 17.1% for female sex workers in Nigeria. Also studies conducted on surgeons and blood donors indicated prevalences of 25.9% and 14.9% respectively

The risk of hepatitis B virus infection through unsafe blood is exceptionally high particularly in sub-Saharan Africa [11]. It is reported that relatively long viremic periods during which individuals remain asymptomatic and efficient transmission through contaminated blood products could contaminate blood supply and pose high risk of serious disease manipulation to recipients [12]. Not only does hepatitis B virus infection cause a high morbidity, its effects also stress clinical resources and can also have economic consequences. The pathogenesis of hepatitis B virus infection can be enhanced by several factors which include the age at infection, level of viral replication and loss of immune responses [4].

Blood has the highest concentration of the virus, so transfusion of infected blood is the surest way to get infected [13]. Chronic asymptomatic carriers are reservoirs and are potential source of new infections [14]. Hepatitis B virus may be circulating in the blood stream for weeks to months, even years without causing an overt symptom; therefore, apparently healthy carriers may pass blood donation selection criteria and accepted as suitable to donate.

Provision of safe blood is of paramount importance and it is the responsibility of the National Blood Transfusion Service and indeed all Units in both public and private health institutions to ensure that safe blood is made available for the purpose of transfusion to patients. For administrative purposes, Nigeria has been divided into six geopolitical zones of North East, North West, North Central, South West, South East and South South. Data on HBsAg status of donors at the various National Blood Transfusion Service in the six geopolitical zones of Nigeria is sparse. There is, therefore, need to conduct a study to identify the HBsAg status of apparently healthy unpaid volunteer donors to ascertain the safety of blood that are received from them since it has been established that asymptomatic carriers have an increased risk of

progression to chronic hepatitis and cirrhosis, hepatocellular carcinoma and liver failure [4]. This study was thus designed to determine hepatitis B virus carriers among voluntary blood donors in North Central, North East and South-South geopolitical zones in Nigeria.

MATERIALS AND METHODS

Study subjects

The study subjects were prospective voluntary blood donors who had been certified fit to donate at the National Blood Transfusion Service after undergoing relevant medical checks and pre-donation counseling. They were aged between 18 years and 64 years. They weighed 50 kg and above.

The exclusion criteria included hemoglobin concentration lower than 13.0g/dl in males and 12.5g/dl in females; Blood pressure systolic \geq 140 mm/Hg, Diastolic \geq 100 mm/Hg; pulse $>$ 100 beats per minute; age $<$ 18 years; pregnant or nursing mothers; co-infection with HIV, or HCV.

Ethical Approval

This study was approved by the National Health Research Ethic Committee. Approval was also obtained from the National Blood Transfusion Service for the use of its platform to recruit voluntary blood donors for the study and informed consent was obtained from all the study participants.

Collection of blood specimen and testing

Blood specimens were collected from the voluntary blood donors (after donating a unit of blood) into an EDTA specimen containers. EDTA specimen was centrifuged and the plasma used in determination of hepatitis B surface antigen (HbsAg). Enzyme linked immunosorbent assay technique (ELISA) using Monolisa HBsAg ULTRA kit was used. The assay is a qualitative one-step enzyme immunoassay technique of sandwich type for the detection of HBsAg in human serum or plasma and it is intended for screening of blood donations and for diagnostics [15].

RESULT

Sociodemographic Characteristics and distribution of HBV status of the study population

A total of 532 voluntary unpaid blood donors participated in the study, out of which North Central geopolitical zone had 183 participants, North East geopolitical zone had 176 participants and South-South geopolitical zone had 173 participants. The study population of voluntary blood donors in the North Central geo-political zone was 183 with mean age of 34.89 ± 9.19 years out of which 154 (84.15%) were negative to hepatitis B (HBsAg), while 29 (15.85%) participants were HBsAg positive. Among the population of HBsAg negative in the zone, 113 were males with means age of 41.91 ± 9.25 years, while 41

were females with mean age of 35.29 ± 9.52 years. The percentage distribution by age groups and sex in the North Central zone are; participants under age 25 years were males 6 (3.90%) and females 5 (3.25%); participants within age group 25-34 years were males 12 (7.79%) and females were 14 (9.09%). Participants within age group 35-44 years, males were 56 (36.36%) and females were 15 (9.74%); within age group 45-54 years, males were 28 (18.18%) and females were 5 (3.25%); From age group 55+ years, males were 11 (7.14%) and females were 2 (1.30%). Among the 29 participants who were HBsAg positive, 24 were males with mean age 39.42 ± 5.5 years, while 5 were females with mean age 31.60 ± 5.32 years. The percentage distribution by age groups and sex are under 25 years had males 1 (3.45%) and females 0 (0.00%); age group 35-44 years had males 19 (65.52%) and female 0 (0.00%). In age group 45-54 years, males were 3 (10.34%) and female 0 (0.00%). Within age group 55 years and above, no male participant tested positive to hepatitis B virus. The demographic characteristics of the study population is shown in Table-1.

In the North East geopolitical zone, 176 voluntary blood donors with mean age 39.81 ± 9.60 years participated in the study. Hepatitis B (HBsAg) negative participants were 156 made up of males 114 (73.08%) with mean age of 44.12 ± 7.35 years and females 42 (26.92%) with mean age of 28.05 ± 6.10 years. The percentage distribution of the HBsAg negative participants by age group and sex in the North East zone were age group under 25 years: males was 1 (0.64%) and females were 15 (9.62%); age group 25-34 years: males were 9 (5.77%) and females were 20 (12.82%); in age group 35-44 years, males were 46 (29.49%) and females were 7 (4.49%); in age group 45-54 years, males were 48 (30.77) and females were 0 (0.00%); within age group 55 and above years, males were 10 (6.41%) and females were 0 (0.00%). Among the 20 hepatitis B (HBsAg) positive participants in the North East geo-political zone, males were 15 with mean age of 42.13 ± 4.07 years, while females were 5 with mean age of 33.40 ± 2.61 years. The percentage distribution by age groups and sex are; age group under 25 years, males was 0 (0.00%) and females 0 (0.00%);

in age group 25-34 years, male was 1 (5.00%) and females 3 (15.00%), In age group 35-44 years, males were 10 (50.00%) and females were 2 (10.00%); in age group 45-54 years, males were 4 (20.00%) and females 0 (0.00%). Within age group 55 years and above no participant tested positive to hepatitis B virus.

In the South-South geopolitical zone, 173 voluntary blood donors with mean age of 39.92 ± 9.27 years participated in the study. Hepatitis B (HBsAg) negative subjects were 153 made up of males 109 (71.24) with mean age of 43.41 ± 8.13 years and females 44 (28.76%) with mean age of 31.45 ± 7.55 years. In age group 45-54 years, males were 4 (20.00%) and female 0 (0.00%). Within age group 55 years and above no participant tested positive to hepatitis B virus. In the South-South geopolitical zone, 173 voluntary blood donors with mean age of 39.92 ± 9.27 years participated in the study. Hepatitis B (HBsAg) negative subjects were 153 made up of males 109 (71.24) with mean age of 43.41 ± 8.13 years and females 44 (28.76%) with mean age of 31.45 ± 7.55 years. The percentage distribution of the HBsAg negative participants by age groups and sex are: age group under 25 years; males were 6 (3.92%) and females were 10 (6.54%). In age group 25-34 years; males were 6 (3.92%) and females were 18 (11.76%). In age group 35-44 years; males were 48 (31.37%) and females were 14 (9.15%); age group 45-54 years; males were 42 (27.45%) and females were 2 (1.31%); within age group 55+ years; males were 7 (4.58%) and female 0 (0.00%). The number of hepatitis B (HBsAg) positive participants in the South-South geo-political zone were 20 segregated into males $n=14$ (70.00%) with mean age of 42.00 ± 3.59 years and females $n=6$ (30.00%) with mean age of 33.67 ± 7.15 years. The percentage distribution of hepatitis B (HBsAg) positive participants by age group and sex are: Age group <25 years; male nil (0.00%), female 1 (5.00%). In age group 25-34 years; male nil (0.00%), females were 3 (15.00%); In age group 35-44 years; males were 11 (55.00%) and female was 1 (5.00%); In age group 45-54 years; males were 3 (15.00%) and females were 1 (5.00%). Within age group 55 years and above; there were no hepatitis B positive participant.

Table-1: Sociodemographic Characteristics and distribution of HBV status of the Study Population

Characteristic	N (%)	Treatment Groups							
		Hepatitis Negative				Hepatitis Positive			
		Male		Female		Male		Female	
		N	%	N	%	N	%	N	%
North Central	183 (100)	113	73.38	41	26.62	24	82.76	5	17.24
Age Group (yrs)									
< 25	12 (6.56)	6	3.90	5	3.25	1	3.45	0	0.00
25-34	31 (16.94)	12	7.79	14	9.09	1	3.45	4	13.79
35-44	91 (49.73)	56	36.36	15	9.74	19	65.52	1	3.45
45-54	36 (19.67)	28	18.18	5	3.25	3	10.34	0	0.00
55+	13 (7.10)	11	7.14	2	1.30	---	---	---	---
Age (Mean ± SD)	34.89±9.19	41.91±9.25	35.29±9.52	39.42±5.52	31.60±5.32				
North East	176 (100)	114	73.08	42	26.92	15	75.00	5	25.00
Age Group (yrs)									
< 25	16 (9.09)	1	0.64	15	9.62	---	---	---	---
25-34	33 (18.75)	9	5.77	20	12.82	1	5.00	3	15.00
35-44	65 (36.93)	46	29.49	7	4.49	10	50.00	2	10.00
45-54	52 (29.55)	48	30.77	0	0.00	4	20.00	0	0.00
55+	10 (5.68)	10	6.41	0	0.00	---	---	---	---
Age (Mean ± SD)	39.81±9.60	44.12±7.35	28.05±6.10	42.13±4.07	33.40±2.61				
South-South	173 (100)	109	71.24	44	28.76	14	70.00	6	30.00
Age group (yrs)									
< 25	17 (9.83)	6	3.92	10	6.54	0	0.00	1	5.00
25-34	27 (15.61)	6	3.92	18	11.76	0	0.00	3	15.00
35-44	74 (42.78)	48	31.37	14	9.15	11	55.00	1	5.00
45-54	48 (27.75)	42	27.45	2	1.31	3	15.00	1	5.00
55+	7 (4.05)	7	4.58	0	0.00	---	---	---	---
Age (Mean ± SD)	39.92±9.27	43.41±8.13	31.45±7.55	42.00±3.59	33.67±7.15				

Note: Percentages may not add up to exactly 100 due to rounding up.

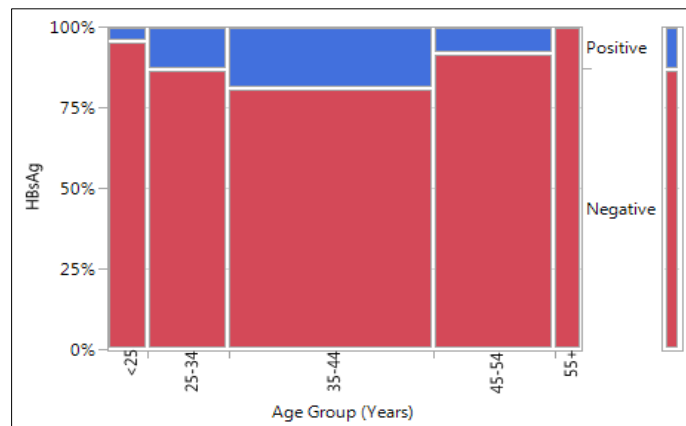
Distribution of HBsAg in the Study Population

The distribution of HBsAg in the study population was disaggregated by age groups, sex and the geo-political zones.

Distribution of HBsAg in the study population by Age groups

The distribution of HBsAg in the three Geopolitical zones by age of the voluntary blood donors is shown in Fig-1. The distribution showed that among the participants, about 95% of participants within age group under 25 years tested negative to hepatitis B virus (HBsAg) while about 5% tested positive to HBsAg. For

age group 25-34 years, about 85% of the participants were HBsAg negatives while about 15% were HBsAg positive. Within age group 35-44 years, about 80% of the research participants were HBsAg negative while about 20% of the participants were hepatitis B positive. Among age group 45-54 years, about 90% of the subjects were hepatitis B negative, while about 10% were positive. The participants within age group 55+ years were all hepatitis B negative. The Chi square analysis of the variation between positives and negatives is significantly different at $p = 0.0012$ (χ^2 value = 17.977).



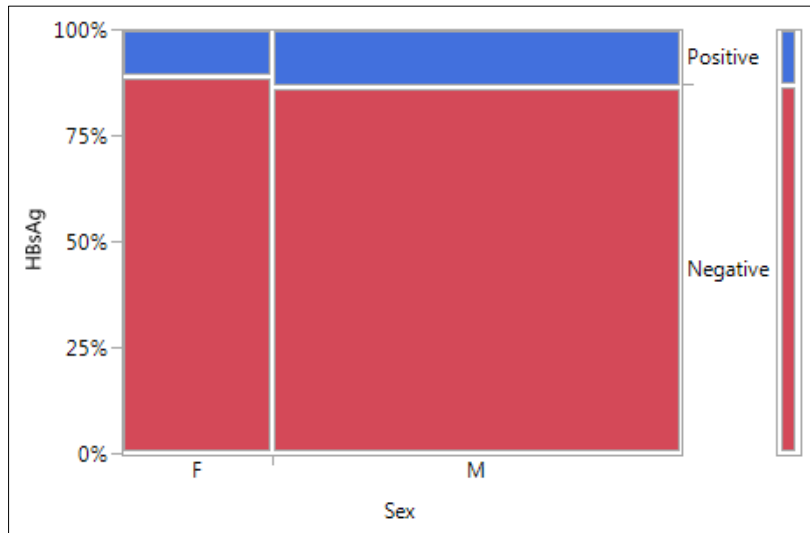
χ^2 Value=17.977; $p=0.0012$ ***

Fig-1: Distribution of HBsAg in the study population by Age groups

The distribution of HBsAg in the three geopolitical zone by the sex of volunteer blood donors

The distribution of hepatitis B (HBsAg) in the three geopolitical zones disaggregated by sex of the volunteer blood donors is shown in fig. 2. The distribution shows that among the male participants about 85% were hepatitis B virus negative, while about

15% were hepatitis B positive. Similarly, among the female participants about 90% were hepatitis B negative and 10% were hepatitis B positive. Chi square analysis of the variation between positive and negative is not significant at ($P=0.4585$; χ^2 value = 0.550).



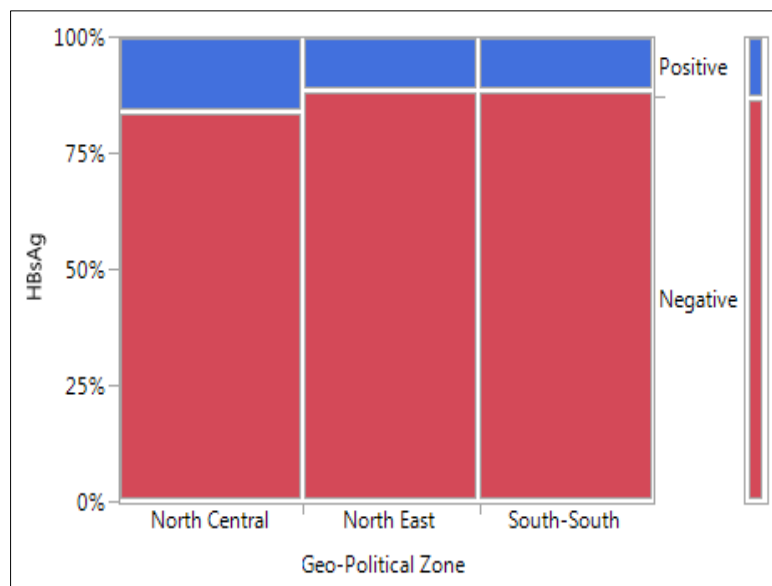
F= Female, M = male, X^2 Value=0.550; $p=0.4585^{ns}$

Fig-2: The distribution of HBsAg in the three geopolitical zone by sex of voluntary blood donors

Distribution of HBsAg among the volunteer blood donors by geo-political zones

The distribution of HBsAg by geopolitical zone of the voluntary blood donors is shown in Fig-3. From the figure, the percentage of participants in North Central geopolitical zone who were hepatitis B virus (HBsAg) negative were about 80% while those who were hepatitis B positive were about 20%. In the North East geopolitical zone, about 85% of the participants

tested negative to hepatitis B whereas 15% were positive. In the South-South geopolitical zone, the distribution showed that about 85% of the participants were hepatitis B negative, whereas 15% of the participants were hepatitis B positive. Chi square analysis of the variation between positives and negatives was statistically not significant at $P=3590$ (χ^2 value = 2.049).



X^2 Value = 2.049; $p=3590^{ns}$

Fig-3: Distribution of HBsAg in the study population by Geo-political zone

DISCUSSION

Provision of safe blood is of paramount importance and it is the responsibility of the National Blood Transfusion Service and indeed all Units in both public and private health institutions to ensure that safe blood is made available for the purpose of transfusion to patients. Hepatitis B is a major health problem world wide and is associated with life-threatening complications. As a result, it is recommended each blood unit of blood has to be tested for hepatitis B infection [16]. In our study among the 532 blood donors screened, the overall seroprevalence of HBsAg positive from the three geopolitical zones was observed to be 12.97% (total 53 cases) which is quite high when compared with similar study conducted by Remya *et al.*, [17] and Shah *et al.*, [18] in India. Studies in the seventies among apparently healthy Iraqi population showed that the prevalence of HBsAg in blood donors and military personnel blood donors was 3.6% and in normal population it was 3.3% while in eighties it was 4.3% in normal population and 4.1% in blood donors [19]. Comparing these values with the data obtained from this study, it is obvious that much needed to be done to avert complications that could arise from patients receiving “screened blood” from our hospitals. In our study, most of the HBsAg positive donors were relatively young within the age range of 32-41 years. This age range is comparable with that reported in the studies conducted by Baba *et al.*, in 2000 [20], Taseema *et al.* in 2008 [21], Quadri *et al.*, in 2013 [22], and Remya *et al.*, [17].

It is known that maintained high levels of HBV DNA are associated with progressive liver disease. Serum DNA levels are a prognostic factor, and contribute to define the phase of chronic hepatitis B infection, the treatment indication, and allow an assessment of the efficacy of antiviral therapy. High levels of HBV DNA are an independent risk factor for cirrhosis [23]. Patients with low HBV-DNA levels, between 300 and 10^4 copies/mL, have, although a very low one, a risk of progression to cirrhosis and HCC [24]. The DNA levels obtained in this study for HBsAg positive volunteer blood donors in the three geopolitical zones ranged between 561 – 31,844 copies/mL. These DNA values in these asymptomatic carriers are high enough to trigger a progression in the Hepatitis B infection among these subjects since multi-factorial processes including interaction between host and environmental factors has been shown to greatly enhance manifestation of hepatitis B infection [25]. The HBV DNA were higher in the male than in the female HBsAg positive subjects in both the North central and North East zones except in the South South zone it was higher in the female HBsAg positive subjects. The highest HBV DNA value was recorded in the HBsAg positive males in the North Central zone.

The study was done to evaluate Hepatitis B virus seropositivity among voluntary blood donors in

North Central, North East and South-South geopolitical zones in Nigeria. Our study found that the mean age of voluntary blood donors in the North Central, North East and South-South geo-political zones were 34.89 ± 9.19 , 39.81 ± 9.60 and 39.92 ± 9.27 years respectively. The mean age of the voluntary donors in the three geopolitical zones were similar and they agreed with the World Health Organization [11] guidelines for eligibility of age in voluntary blood donation. The study also found similar finding in mean age of male subjects of both hepatitis B virus negatives and hepatitis B virus positives. The mean age of the hepatitis B virus negative male subjects were 41.91 ± 9.25 years, 44.12 ± 7.35 years and 43.41 ± 8.13 years for North Central, North East and South-South geopolitical zones, while the mean age of hepatitis B positive subjects in the three geopolitical zones were 39.42 ± 5.52 years, 42.13 ± 4.07 years and 42.00 ± 3.59 years respectively. These values of mean ages conform with the standard for age requirement for voluntary blood donations [11, 26].

Among the female subjects, the study found the same patterns of similarity in mean ages of the two treatment groups. The mean age of the hepatitis B virus negative female subjects were 35.29 ± 9.52 years, 28.05 ± 6.10 years and 31.45 ± 7.55 years for North Central, North East and South-South zones respectively, while the mean age for hepatitis B virus positive female in the three geopolitical zones were 31.60 ± 5.32 years; 33.40 ± 2.61 years and 33.67 ± 7.15 years respectively. The mean ages of the female subjects also conformed with age requirements for voluntary blood donation as specified by the World Health Organization [11] and American Association of Blood Banks [26]. On distribution of the voluntary donors by age groups, the study found similarity in the percentage of subjects for age groups (< 25), (25-34) and (55+) years across the three geopolitical zones.

Age group under 25 years represent mainly subjects who are either in tertiary schools or young graduates. They are active in life but most of them are yet to sign up for voluntary blood donations on regular basis, probably because of economic constraints which inadvertently affect their standard of living. The percentage of subjects in the age groups 25-34 years were (16.94%), (18.75%) and (2715.61%) in the North Central, North East and South-South geopolitical zones respectively. The trend for donation was similar across the three geopolitical zones for this age group which represent individuals who are in their active reproductive years. The finding demonstrates that similar levels of awareness and social influence may play prominent roles in motivating the subjects in this age group to donate blood. This age group (25-34 years) did not show the highest frequency of voluntary blood donors in this study, and this contradicts the report of Burgdorf *et al.*, [27] which states that age-specific prevalence of blood donation peaked at 25 years for females and 30 years for males. It is also at variance with the findings of Elias *et al.*, [28] which reported that

majority of voluntary blood donors in Tanzania were aged between 24 and 35 years.

The age groups 35-44 years recorded highest frequency of voluntary blood donors in the three geopolitical zones. This finding is in agreement with the report of Shaz *et al.*, [29] on demographic patterns of blood donors and donations in a large metropolitan area, which state that individuals within age group 40-49 years donate the highest percentage of blood units. The higher frequency in this age group could be attributed to the fact that the subjects have internalized the message of voluntary blood donations for adequacy of blood supply. They may have also accepted it as a social responsibility and personal norms. The highest frequency 91(49.73%) recorded in the North Central geopolitical zone points to an increased media mobilizations and stakeholder's engagement within the Federal Capital Territory and its environs.

The age group 45-54 years followed next to age group 35-44 years in the percentage of voluntary blood donors. This result is in harmony with the report of American Association of Blood Banks report which stated that 60% of donated blood comes from people over 40 years of age. The high percentage of volunteer donors within this age group could be explained by high awareness, positive attitude and high intention to donate blood voluntarily. The study found low number and percentage of voluntary blood donors within age group 55 and above years. This finding is at variance with Shaz *et al.*, [29] who found that mean blood donation frequencies increased with increasing age in Atlanta, Georgia-USA.

In Nigeria, and other sub-Saharan Countries, individuals within this age group shows declining productivity, as most public and organized private sector workers approach the mandatory retirement age of 60 years in the civil service and 65 years in tertiary educational institutions. With exception of a few individuals, most individuals in this age group have stopped donating blood. Considering the effect of sex in the socio-demographic characteristics of the two treatment groups (hepatitis B virus negatives and positives), our study found that the percentage of male voluntary blood donors were more than females in the treatment groups. In the North Central zone, we had 73.38% of HBV negative males and 26.62% HBV negative females. The prevalence of HBV positive males was also higher than HBV positive females (17.24%). The findings in the North East geopolitical zone was 73.08% of HBV negative females. Among the HBV positive group, we observed 75% males as against 25% female subjects.

A similar trend was found in the South-South geo-political zone which prevalence was 71.24% for HBV negative male subjects and 28.76% for HBV negative females. Likewise, the HBV positive subjects were 70% males and 30% females. These findings are

in agreement with the World Health Organization [11] report on blood safety and availability that worldwide, 32% of blood donations are given by women and that in some countries, less than 10 % are donated by females. Our observation also agrees with that of Shaz *et al.*, [29] who reported that the mean donation frequency was higher among males than females. There is also concurrence between this finding and that of Okoroiwu *et al.*, [30] which states that male blood donors constituted majority of prospective donors. Other studies have also supported this observation. This trend can be explained by cultural myths that women should abstain from blood donation owing to child birth and their monthly blood loss through menstruation. More importantly, the World Health Organization guidelines prescribe that a female can donate blood once in every four months, whereas a male can donate blood once in every three months.

CONCLUSION

In conclusion, the study reveals that the percentage of asymptomatic hepatitis B virus carriers in the population is high implying that progression of these carriers into the full hepatitis B infection in the event of interactions between host and environmental factors is a possibility.

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