

Assessment of Lipid Profile and Atherogenic Indexes of Hepatitis B Virus Carriers amongst Volunteer Blood Donors in Nigeria

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Abstract

Introduction: Infectious agents such as hepatitis B virus can constitute major public health problems as it affects the liver resulting into inflammatory conditions. This study was designed to assess plasma lipid profile and atherogenic indexes of hepatitis B virus carriers among voluntary blood donors in North Central, North East and South-South regions of Nigeria. **Materials & Methods:** A total of 183 blood samples were collected from subjects in North Central consisting of 137 males and 46 females; 176 blood samples from the North East consisting of 129 males and 47 females and 173 blood samples from subjects in South-South region consisting of 123 males and 50 females. The mean ages of the subjects were 34.89 ± 9.19 years, 39.81 ± 9.60 years and 39.92 ± 9.27 years for North Central, North East and South-South regions respectively. The specimens were tested for hepatitis B surface antigen using enzyme-linked immunosorbent assay. All specimens were analyzed for total cholesterol, HDL-C, LDL-C and triglycerides with standard biochemical procedures. The atherogenic indexes were computed using established ratios. The data was analyzed statistically and p-value < 0.05 was considered significant. **Results:** The mean values of total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol, and triglycerides did not vary significantly ($p > 0.05$) between the hepatitis B positive carriers and hepatitis B negative subjects across the geo-political zones studied although in some of the parameters the values were on the high normal range between the male and female subjects. The AIP and CRR-1 and CRR-11 of the blood donors in the zones in both the HBsAg positive and negative subjects were within the reference range. The atherogenic coefficient value of >3.0 was obtained for some HBsAg negative and positive subjects in some of the zones. **Conclu-**

sion: The findings thus indicate that asymptomatic HBV infection may be associated with low risk of dyslipidaemia in the population.

Keywords

Hepatitis, Atherogenic Indices, Lipoproteins, Cardiovascular Disease, Blood Donors

1. Introduction

Transfusion of blood and blood products as a specialized modality of patient management has been saving many lives. It is well known that there are complications that can occur due to blood transfusion. Some are only trivial and others are life-threatening, demanding for meticulous pretransfusion screening, and testing. The infection that could be transmitted by transfusion of unscreened blood includes Hepatitis B Virus (HBV) infection is a global public health problem. Hepatitis B Virus (HBV) infection is a global health menace with over 2 billion people living with the virus worldwide, and 257 million people suffering from the chronic stage infection [1]. WHO estimated that about 1.34 million HBV infected patients in 2015 died due to chronic hepatitis, cirrhosis, and hepatocellular carcinoma, and other liver-related complications, and the infection has been found to cause epidemics in most parts of Asia and tropical African countries [1].

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 [2] [3]. Similarly, 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. It affects the liver resulting in inflammatory conditions [4]. Although majority of individuals recover from the acute infection, those who progress to chronic hepatitis B infection are at greater risk of developing serious complications such as cirrhosis, hepatocellular carcinoma, liver failure and eventual death [5].

The liver is the main target of hepatitis B infection which could be acute or chronic [4]. Acute hepatitis involves sudden injury on the hepatocytes and is of short duration, usually less than six months, while chronic hepatitis is characterized by persistent inflammatory damage to hepatocytes and is of a longer duration more than six months [6].

The clinical outcome in both acute and chronic hepatitis B infection is strongly dictated by age and immune status of the patient. However, about 30% to 50% of adolescents and adults develop jaundice [6]. Symptoms of acute hepatitis may include low grade fever, joint and muscle pain, loss of appetite and stomach pain. Some patients may present with more severe symptoms such as

bloated stomach, jaundice, nausea and vomiting. Chronic hepatitis B infected individuals are at risk of developing persistent liver inflammation including hepatocellular destruction leading to cirrhosis and hepatocellular carcinoma [7]. Symptoms of chronic HBV infection may not be obvious for months or years. However, commonly observed symptoms are dark urine, joint pain, loss of appetite, weakness, jaundice, anorexia, fatigue and rash.

Although, the effect of HBV on lipid profile and dyslipidaemia has been extensively studied on HBV patients and experimental models, the association between Hepatitis B Virus (HBV) and lipid metabolism in apparently healthy volunteer blood donors in Nigeria has been rarely reported. This study was, therefore, designed to assess the lipid profile and atherogenic indexes of HBV carriers among voluntary blood donors in three geo-political regions in Nigeria. The geopolitical zones are South-South, North Central and North East in Nigeria.

2. Materials and Methods

2.1. 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 haemoglobin concentration lower than 13.0 g/dL in males and 12.5 g/dL in females, blood pressure systolic ≥ 150 mm/Hg, Diastolic ≥ 100 mm/Hg; pulse > 100 beats per minute; age < 18 years; pregnant or nursing mothers; co-infection with human immunodeficiency virus (HIV), or hepatitis B virus (HCV).

2.2. Sample Size Calculation

The study was a cross sectional one. The sample size for the study was determined using the formula for cross sectional studies [8]. The study sample size required from each geopolitical zone was 150 subjects.

2.3. Ethical Approval

This study was approved by the National Health Research Ethics Committee. Approval was also obtained from the National Blood Transfusion Service in the three geopolitical zones for the use of their platforms to recruit voluntary blood donors for the study and informed consent was obtained from all the study participants.

2.4. Collection of Blood Specimen and Testing

Blood specimens were collected from the voluntary blood donors (after donating a unit of blood) into ethylene diamine tetra acetic acid (EDTA) specimen containers. After an overnight fast, blood specimens were collected again into lithium heparin containers from the subjects. EDTA specimen was centrifuged

and the plasma used in determination of hepatitis B surface antigen (HbsAg) and viral load in HBs Ag positive samples.

2.5. 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 during donation and for diagnostics [9].

2.6. Determination of Hepatitis B Virus DNA (Viral Load)

Hepatitis B virus DNA determination in human plasma was done the Cobas Ampliprep/CobasTaqMan HBV test version 2.0 which is a molecular assay designed for the quantification of HBV DNA [10]. The test is based on two major processes which include specimen preparation to isolate HBV DNA and simultaneous PCR amplification of target DNA and detection of cleaved dual-labeled oligonucleotide detected probe specific to the target. It is a real-time molecular assay which permits automated sample preparation, automated PCR amplification and detection of HBV Quantitation Standard (QS).

2.7. Determination of Biochemical Parameters

Serum lipid profile, including total cholesterol (Tchol), high density lipoprotein cholesterol (HDL-C) and triglycerides (TG) were determined using a Chemwell^(R) T-Automated Chemistry Analyzer, produced by Awareness Technology Inc., USA. The ChemWell[®]-T is a fully automated open system analyzer for biochemistry assays and is supplied with optimized programmed protocols ready for use with an extensive range of Megazyme test kits. All the reagents and serum samples were left out to adjust to room temperature prior to analyses Low density lipoprotein cholesterol (LDL-C) was calculated using the Friedewald *et al.* [11] equation.

2.8. Calculation of Atherogenic Indexes

The Atherogenic ratios were calculated as follows:

Atherogenic Index of Plasma (AIP) = $\log \text{ TG/HDL-C}$ [12];

Cardiac Risk Ratio-1 (CRR-I) = TC/HD-C [13] [14];

Cardiac Risk Ratio-11 (CRI-II) = LDL-C/HDL-C [13] [14];

Atherogenic Coefficient (AC) = $(\text{TC-HDL-C})/\text{HDL-C}$ [15].

2.9. Statistical Analysis

The results were analyzed using Statistical Analysis System (SAS). STAT 15.1 developed by SAS Institute, North Carolina State University, USA. Data were presented as mean \pm SEM, comparison of means of groups that were more than two was done using one-way analysis of variance (ANOVA) and the Tukey test

of multiple comparison was used to test for variance across groups. Variations in means of parameters were considered statistically significant at $p < 0.05$.

3. Results

3.1. The Demographics of the Study Population

A total of 532 voluntary unpaid blood donors participated in the study. The study population of voluntary blood donors in the North Central geo-political zone was 183 with a mean age of 34.89 ± 9.19 years out of which 154 (84.15%) were negative to hepatitis B (HBsAg) and 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. 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 (88.64%) made up of males 114 (64.77%) with mean age of 44.12 ± 7.35 years and females 42 (23.86%) with mean age of 28.05 ± 6.10 years while 20 (11.36%) participants comprising of 15 (8.52%) males with a mean age of 42.13 ± 4.07 years and 5 (2.84%) females with a mean age of 33.40 ± 2.61 years. 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 (88.44%) made up of males 109 (63.01%) with mean age of 43.41 ± 8.13 years and females 44 (25.43%) with mean age of 31.45 ± 7.55 years while 20 (11.56%) participants comprising of 14 (8.09%) males with a mean age of 42.00 ± 3.59 years and 6 (3.47%) females with a mean age of 33.67 ± 7.15 years were HBsAg positive. Combining the three zones, 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. However, 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% (Table 1).

Table 1. Sociodemographic characteristics 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	61.75	41	22.40	24	13.11	5	2.73
Age (Mean \pm 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	64.77	42	23.86	15	8.52	5	2.84
Age (Mean \pm 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	63.01	44	25.43	14	8.09	6	3.47
Age (Mean \pm SD)	39.92 ± 9.27	43.41 ± 8.13		31.45 ± 7.55		42.00 ± 3.59		33.67 ± 7.15	

The viral load (VL) of HBsAg positive subjects disaggregated by geopolitical zone is shown in **Table 2**. The distribution shows that North Central zone has the highest viral load mean of 31.8439 ± 12.784 IU/mol $\times 10^4$ for male subjects and 0.3378 ± 28.008 IU/mol $\times 10^4$ for females respectively. In the North East zone, mean viral load value for male subjects was 0.3454 ± 16.171 IU/mol $\times 10^4$, while the mean value for female subjects was 0.0561 ± 28.008 IU/mol $\times 10^4$. Similarly, in the South South zone, the mean viral load value for male subjects was 0.7583 ± 16.738 IU/mol $\times 10^4$ while the mean value for female subjects was 0.7976 ± 25.568 IU/mol $\times 10^4$. The F Ratio and P-value were inestimable due to large variability.

3.2. Lipid Profile of the Voluntary Blood Donors by Geopolitical Zone, Hepatitis B Status and Sex

The lipid profile of the participants disaggregated by geopolitical zones, hepatitis B status and sex is shown in **Table 3**. The table shows that both HBsAg negative and HBsAg positive male and female participants in the three geopolitical zones had total cholesterol level within the normal reference range for the population. The pattern of plasma total cholesterol level across the geopolitical zones disaggregated by sex and HBsAg status is shown in **Figure 1**. The high density lipoprotein cholesterol level was reasonably normal for both HBsAg negative and HBsAg male and female participants in the three geopolitical zones. The pattern of distribution of high density lipoprotein cholesterol across the geopolitical zones disaggregated by sex and HBsAg status is shown in **Figure 2**. Also, the low density lipoprotein and triglycerides for both HBsAg negative and HBsAg positive male and female participants in the three geopolitical zones were also within normal reference limit [16]. The pattern of distribution of low density lipoprotein cholesterol and triglycerides concentrations across the geopolitical zones disaggregated by sex and HBsAg status are shown in **Figure 3** and **Figure 4** respectively. The pattern of distribution of the lipoproteins shows that total cholesterol and low density lipoprotein cholesterol were slightly higher in HBsAg positive male and female subjects in the North East while high density lipoprotein cholesterol concentrations were slightly higher in HBsAg positive male and female subjects in the South South and North East geopolitical zones. The pattern was normal in the North Central zone.

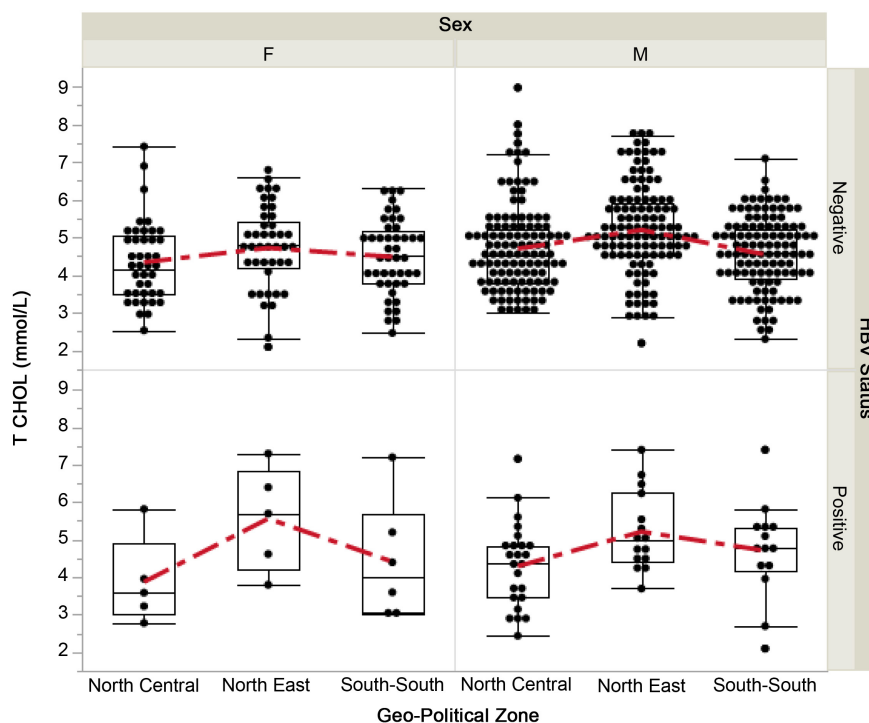
Table 2. Mean \pm SEM HBV viral load of volunteer donors by geopolitical zones.

Geopolitical zones	Gender	HBV viral load (IU/mol) $\times 10^4$
North Central	Female	0.3378 ± 28.008
	Male	31.844 ± 12.784
North East	Female	0.0561 ± 28.008
	Male	0.3454 ± 12.171
South South	Female	0.7976 ± 25.568
	Male	0.7583 ± 16.738

Table 3. Lipid profile parameters of volunteer blood donors by geo-political zone, hepatitis B status and sex (Mean \pm SEM).

Geo-Political Zone	Hepatitis B Status	Sex	T CHOL (mmol/L)	HDL-C (mmol/L)	LDL-C (mmol/L)	TRIG (mmol/L)
North Central	Negative	Female	4.35 \pm 0.17	1.17 \pm 0.08	2.45 \pm 0.14	0.99 \pm 0.09
	Negative	Male	4.71 \pm 0.10	1.26 \pm 0.05	2.76 \pm 0.08	0.99 \pm 0.06
	Positive	Female	3.88 \pm 0.50	1.18 \pm 0.22	2.57 \pm 0.40	0.96 \pm 0.26
	Positive	Male	4.29 \pm 0.23	1.02 \pm 0.10	2.68 \pm 0.18	0.96 \pm 0.12
North East	Negative	Female	4.73 \pm 0.17	1.42 \pm 0.08	2.60 \pm 0.14	1.47 \pm 0.09
	Negative	Male	5.20 \pm 0.10	1.42 \pm 0.05	3.14 \pm 0.08	1.40 \pm 0.06
	Positive	Female	5.56 \pm 0.50	1.54 \pm 0.22	3.74 \pm 0.40	1.78 \pm 0.26
	Positive	Male	5.22 \pm 0.29	1.57 \pm 0.13	3.03 \pm 0.23	1.55 \pm 0.15
South-South	Negative	Female	4.49 \pm 0.17	1.20 \pm 0.07	2.76 \pm 0.13	1.20 \pm 0.09
	Negative	Male	4.55 \pm 0.11	1.15 \pm 0.05	2.78 \pm 0.09	1.29 \pm 0.06
	Positive	Female	4.42 \pm 0.45	1.57 \pm 0.20	2.59 \pm 0.36	1.18 \pm 0.24
	Positive	Male	4.71 \pm 0.30	1.71 \pm 0.13	2.54 \pm 0.24	1.75 \pm 0.16
Test Statistic F-Ratio			0.9067	0.7651	1.8231	1.0926
P-value			0.4045 ^{ns}	0.4658 ^{ns}	0.1626 ^{ns}	0.3361 ^{ns}

Keys: TCHOL = total cholesterol, HDL-C = high density lipoprotein cholesterol, TRIG = triglycerides, LDL-C = low density lipoprotein cholesterol. Reference ranges: Tchol = up to 5.2 mmol/L, HDL-C; Male = 1.0 - 1.3 mmol/L, female = 1.30 - 1.50 mmol/L, LDL = 1.96 - 3.40 mmol/L, Trig. \leq 2.3 mmol/L [16].

**Figure 1.** Box plot of total cholesterol by HBV status and sex of volunteer blood donors within geo-political zones.

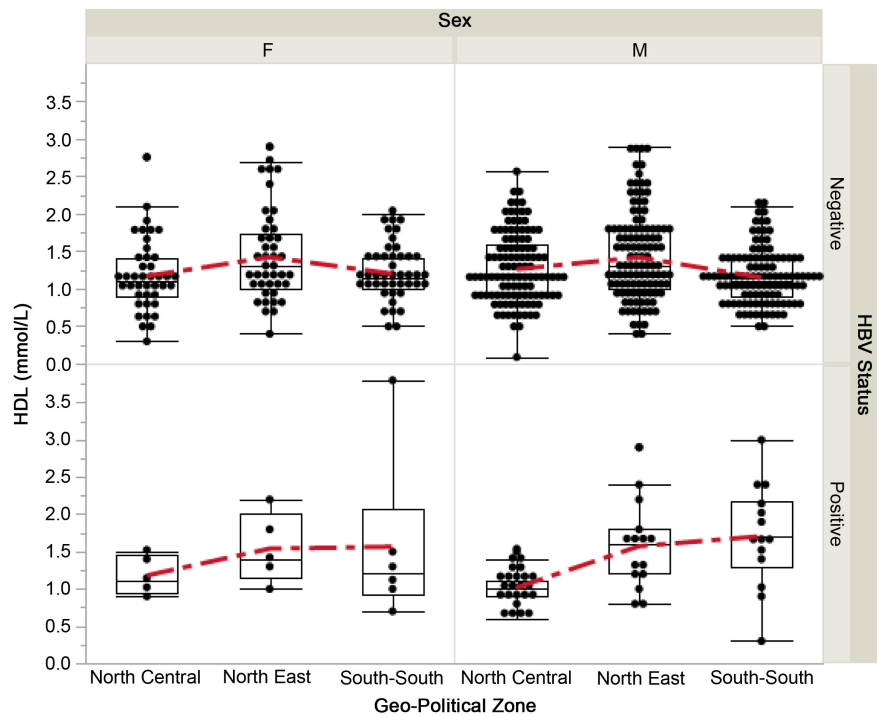


Figure 2. Box plot of high density lipoprotein by HBV status and sex of volunteer blood donors within geo-political zones.

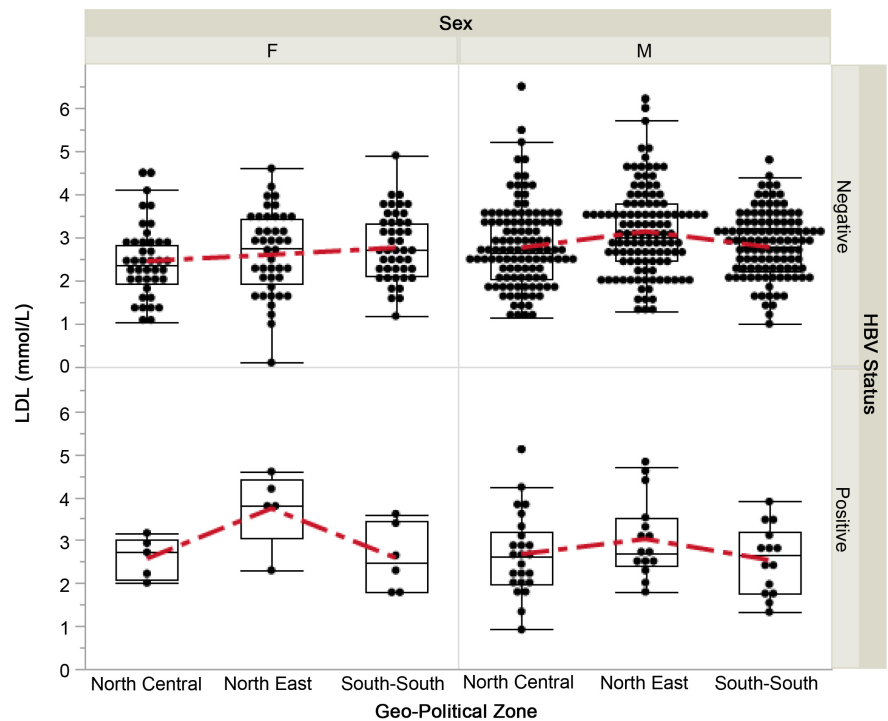


Figure 3. Box plot of low density lipoprotein by HBV status and sex of volunteer blood donors within geo-political zones.

3.3. Atherogenic Profiles of the Voluntary Blood Donors

The atherogenic profiles of the voluntary donors in the geopolitical zone was

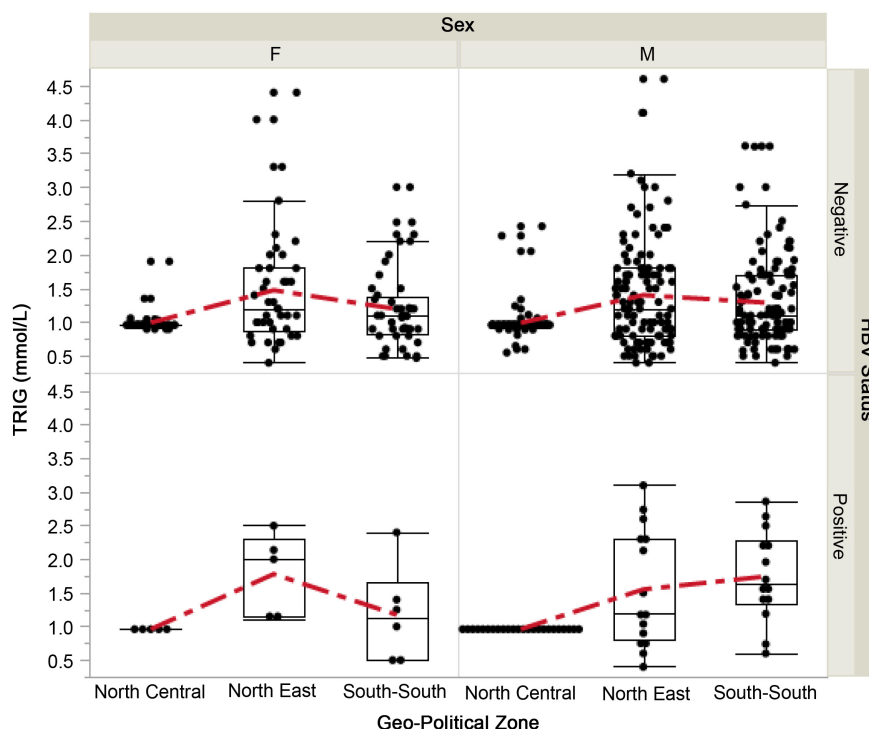


Figure 4. Box plot of triglycerides by HBV status and sex of volunteer blood donors within geo-political zones.

determined using Atherogenic Index of Plasma (AIP), Cardiac Risk Ratio-1 (CRR-1), Cardiac Risk Ratio-11 (CRR-11) and Atherogenic Coefficient (AC), and their values were compared with reference ranges for normal populations. The atherogenic profiles are shown in **Table 4**. The atherogenic profile of the blood donors in the three geopolitical zones was within acceptable reference range using AIP as the scoring index. The values in both the HBsAg positive and negative subjects were below >0.1 . However, using CRR-1, most of the subjects from the three zones were at minimal risk of atherogenesis. CRR-2 did not indicate atherogenic risk for the subjects in the three zones but the computation of the AC shows that most of the HBsAg negative male and female subjects and HBsAg positive male in the North Central zone had AC value > 3.0 . Only some HBsAg negative males in the North East zone had AC value > 3.0 . In the South South zone, only the HBsAg negative male and female subjects had AC value > 3.0 .

4. 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 worldwide and is associated with life-threatening complications. As a result, it is recommended that each unit of blood has to be tested for hepatitis B infection [17].

Table 4. Atherogenic profiles of volunteer blood donors by geo-political zone, hepatitis B status and sex (Mean \pm SEM).

Geo-Political Zone	Hepatitis B Status	Sex	N	AIP	CRR-I	CRR-II	AC
North Central	Negative	Female	41	-0.040 ± 0.036	4.17 ± 0.36	2.37 ± 0.25	3.17 ± 0.36
	Negative	Male	113	-0.079 ± 0.022	4.45 ± 0.22	2.65 ± 0.15	3.45 ± 0.22
	Positive	Female	5	-0.081 ± 0.104	3.51 ± 1.04	2.30 ± 0.72	2.51 ± 1.04
	Positive	Male	24	-0.014 ± 0.047	4.38 ± 0.48	2.74 ± 0.33	3.38 ± 0.48
North East	Negative	Female	42	-0.007 ± 0.036	3.76 ± 0.36	2.20 ± 0.25	2.76 ± 0.36
	Negative	Male	114	-0.029 ± 0.022	4.15 ± 0.22	2.63 ± 0.15	3.15 ± 0.22
	Positive	Female	5	0.057 ± 0.104	3.70 ± 1.04	2.51 ± 0.72	2.70 ± 1.04
	Positive	Male	15	-0.052 ± 0.060	3.66 ± 0.60	2.23 ± 0.42	2.66 ± 0.60
South-South	Negative	Female	44	-0.026 ± 0.035	4.05 ± 0.35	2.54 ± 0.24	3.05 ± 0.35
	Negative	Male	109	0.027 ± 0.022	4.23 ± 0.22	2.61 ± 0.15	3.23 ± 0.22
	Positive	Female	6	-0.123 ± 0.095	3.24 ± 0.95	1.95 ± 0.66	2.24 ± 0.95
	Positive	Male	14	0.021 ± 0.062	3.15 ± 0.06	1.78 ± 0.43	2.15 ± 0.62
Test Statistic F-Ratio				0.7296	0.1982	0.2571	0.1982
P-value				0.4826 ^{ns}	0.8202 ^{ns}	0.7734 ^{ns}	0.8202 ^{ns}

Significance Level: ns = Not significant ($p > 0.05$). Abnormal values for cardiovascular risk AIP: > 0.1 , AC > 3.0 , CRR-I > 3.5 in males and > 3.0 in females, and CRR-II > 3.3 .

In our study among 532 blood donors screened, the overall seroprevalence of HBsAg positive from the three geopolitical zones was observed to be 12.92% (total 69 cases) which is quite high when compared with similar study conducted by Remya *et al.* [18] and Shah *et al.* [19] 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 [20]. Comparing these values to 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 [21], Tiruneh in 2008 [22], Quadri *et al.* in 2013, [23] and Remya *et al.* [18]. Our study also shows that the age range was lower in the female subjects when compared to the male counterparts.

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 [24]. 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 hepatocellular carcinoma (HCC) [25]. The DNA

levels obtained in this study for HBsAg positive volunteer blood donors in the three geopolitical zones ranged between 561 - 318,440 copies/mL. These DNA values in these asymptomatic carriers are high enough to trigger a progression in 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 [26]. 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 where it was found to be higher in the female HBsAg positive subjects. The highest HBV DNA value was recorded in the HBsAg positive males in the North Central zone.

Data from the South Korean nationwide health and nutrition examination showed that HBV carriers have lower LDL cholesterol and triglyceride levels compared with control subjects. HBsAg carriers also showed a tendency for higher HDL cholesterol levels despite its relative lack of statistical significance [27]. In our present study, no significant variation was observed in the levels of LDL cholesterol, and triglycerides between the HBsAg negative and HBsAg positive carriers instead LDL cholesterol and triglycerides were found to be insignificantly increased in the North East HBsAg positive subjects. Owing to absence of hypertriglyceridaemia and low HDL-cholesterolaemia in these subjects, the prevalence of metabolic syndrome may be significantly lower in HBsAg carriers in these geopolitical zones. Our study also indicated that asymptomatic HBV infection may be associated with low risk of dyslipidaemia aside from low lipid levels, which are associated with decreased lipid metabolism in liver diseases. This finding corroborates with the report of Koo and Moon [28]. It has also been reported that in advanced disease, HDL cholesterol levels are also significantly decreased as disease severity increases [29].

Abnormal lipid profile has been recognized as one of the most influential risk factors for the development of coronary artery disease (CAD) by the INTER HEART study [30]. Low HDL-C concentrations, high triglycerides and increased levels of LDL-C are known to aggravate the incidence of coronary artery disease [31] [32]. It was observed in our study, that the levels of total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol and triglycerides were higher in both HBsAg negative and HBsAg positive carrier blood donors in the North East geopolitical zone than was seen in the North Central and South South geopolitical zones. However, high density lipoprotein cholesterol level was observed to be higher in HBsAg positive male and female subjects in the North East and South South geopolitical zones indicating that asymptomatic HBV infection may be associated with low risk of dyslipidaemia aside from low lipid levels.

Similarly, the different combinations of lipid profile parameters are considered to have optimal predictive capacity of the profile. Moreover, Atherogenic Index of Plasma (AIP), Cardiac Risk Ratio 1 and 2 (CRR-1 and CRR-2) and Atherogenic coefficient (AC) are the ratios shown to have high predictive values for cardiovascular risk assessment [33]. High density lipoprotein cholesterol has

been reported to have a protective effect against cardiovascular diseases [34]. The comparison of the atherogenic indexes across the three geopolitical zones shows that HBsAg negative male and female subjects in the North central and South South and only males in the North East zones have moderately increased atherogenic coefficient value above 3.0. The reason behind this contradictory observations in this study cannot be easily offered but it is, however, a pointer to the fact that subsequent studies to elucidate the mechanism of lipid metabolism in HBV infection in these populations in Nigeria are required although similar finding has been reported by Koo and Moon [28].

There are several limitations to this study. Firstly, since this is a cross-sectional study, a causal relationship could not be proven. We could not show the mechanism underlying not only the association between lipid profile and HBsAg status but also the discrepancy in the lipid levels obtained in this study. Secondly, the questionnaires were self-reported, and may have been subjected to recall bias. Our inability to identify the occupation of the participants and obtain data on certain risk factors for lipid profile related abnormality such as diet and physical inactivity from the subjects could have impacted on the results obtained in this study. Lastly, our findings may be limited to blood donor populations who may have chosen to live apparently low risk lifestyle.

5. Conclusion

Considering the sample size used in this study, it could be postulated that the seroprevalence rate of HBsAg in our study is moderately high. Therefore, a more stringent comprehensive screening of blood donors is highly recommended before blood transfusion service should be performed. With the advent of nucleic acid amplification and molecular assay designed for the quantification of HBV DNA, it may be possible to decrease the risk of HBV transmission to a major extent although it is not cost effective. Since our study revealed a high seroprevalence between the age group of 32 - 41, better education of donors and improved prophylactic measures at public levels should always be done to ensure safe blood donation. Proper predonation counseling and donor self-exclusion are also necessary. The study also revealed that the presence of HBsAg in the population could occultly complicate the cardiovascular profile of individuals in these zones, thus, strengthening the recommendation of elaborate HBV screening and elucidation of its impact on the cardiovascular profile of Nigerians across the six geopolitical zones of Nigeria.

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Conflicts of Interest

There is no conflict of interest.

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