Prevalence of Hepatitis B Virus Infection Serologic Markers among Blood Donors at Federal Medical Center, Keffi, Nasarawa State, Nigeria

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Abstract:

Transfusion- associated HBV infection continues to be a major public health problem particularly in developing countries. This study was conducted to determine the prevalence of HBV infection serologic markers among blood donors at Federal Medical Center, Keffi, Nigeria. Blood samples were collected from 200 consenting donors from January to June, 2021. A well-structured questionnaire was used to obtain clinical and socio-demographic information of the patients. The resulting Sera were screened for HBV sero-markers (HBsAg, HBsAb, HBeAg, HBeAb and HBcAb), using the 5- panel HBV combo kit (colloidal gold). Data collected were analysed using statistical package for social science (SPSS), (version 12.0) and p-value of <0.05 was considered statistically significant. Of the 200 donors screened,16(8.0%) were positive for HBsAg, 16(8.0%) for HBsAb, 4(2.0%) for HBeAg, 2(1.0%) for HBeAb and 20(10.0%) for HBcAb.The patterns of these markers shows that 2(1.0%) had chronic infection with high viral replication, 4(2.0%) had acute infection with ongoing high viral replication, 4(2.0%) hepatitis B carrier with lower replication, 16(8.0%) immune due to vaccination, 6(3.0%) was recently vaccinated, 12(6.0%) had occult infection, while 156(78.0%) were non-exposed (susceptible) to the virus. Age, occupation, history of surgery and history of HBV in the family were significantly associated with HBV infection (p<0.05). However, gender, location, educational status, history of blood transfusion and exposure to human blood were not significantly associated with HBV infection (p>0.05). This study reported a high prevalence of HBV infection (8.0%) among prospective blood donors. Hence there is need for proper screening of HBV infection among blood donors to avoid transmission of HBV occult infection.

Introduction:

Background of the Study:

Hepatitis means liver inflammation, which can be caused by different type of viruses. Hepatitis A, B, C, D and E (Chisari *et al.*, 1997). Hepatitis B infection is one of the major and common liver infection disease worldwide (Alao *et al.*, 2009). Importantly, there are globally 2 billion carriers of hepatitis B virus (HBV), of these 350 million are chronically infected. With about 600,000 to 1.2 million deaths annually (WHO, 2004). Hepatitis B virus infection with its associated disease of major public health importance, being the 10th leading cause of death globally (Alao *et al.*, 2009). The possibility of hepatitis transmission through blood and blood product were first known since 1950 (Mahoney, 1999).

Research shows that the prevalence of hepatitis B virus infection varies widely with rate ranging from 0.1% to 20% through the world (Laranchy *et al.*, 2004). With high percentage in tropical countries, studies shows that hepatitis B surface antigen (HBSAg) prevalence of more than 8% in a community is considered high, 2-7% are intermediate and below 2% as low.

In 2001, WHO estimated that transfusion of unsafe blood alone accounted for 8-6million hepatitis B virus infection annually. Indeed, the presence of HBV DNA in blood is the first serological marker to dictate hepatitis B virus infection, followed by HBsAg DNA polymerase and HBeAg. Subsequently the antibodies to the hepatitis B antigens (HBcAb, HBeAb, HBsAb), can be detected. These markers can be used for diagnosing and determining the severity of the infection (Japhet *et al.,* 2011). The presence of hepatitis B virus surface antigen (HBsAg) is an important serological marker for diagnosing an ongoing hepatitis B virus infection. However, the presence of IgG ant ibodies against core antigen (anti-HBc) alone or in combination with antibodies against surface antigen (anti- HBs), indicates previous exposure to the virus (Laperche *et al.,* 2001). Absence of hepatitis B surface antigen can be interpreted in a number of ways: no current or past HBV infection if no other HBV markers are detected: recovered past infection with detectable anti- HBs and anti -HBc immunity due to vaccination with only detectable isolated anti- HBs. The route of infection of hepatitis B virus include vertical transmission (through childbirth), early life horizontal transmission (bites, lesions and sanitary habits) and adults' horizontal transmission (such as sexual contact and intravenous drug use (Cluster *et al.,* 2004). The persistent presence of anti-HBc is associated with chronic HBV infection and can be selective for HBV infected samples even in the absence of HBsAg (Elghannam *et al.,* 2009). The patients who remain HBsAg negative and anti- HBc positive are at risk of transmitting the disease on rare occasions, such as donation of solid organ tissue or reactivation of hepatitis B virus disease if they are immunosuppressed (El-khouri, 2004).

After the introduction of reliable serological screening by blood donations, post transfusion hepatitis has become rare. However, the identification of blood donors with occult HBV infection (donors who are negative for HBsAg but have detectable circulating HBV DNA) has created some concern with regards to safety of blood supply. It is generally accepted that the diagnosis of infection by HBV is based on the presence of HBsAg in the bloodstream. However, screening of blood bank donors does not totally eliminate the risk of HBV infection through blood transfusion since the absence of this marker in the serum does not exclude the presence of HBV DNA. It is possible that donors with occult HBV inflection, who lacked detectable HBsAg but whose exposure to HBV infection was indicated by a positive anti HBc and HBV DNA, are a potential source of HBV infection (Mohammed *et al,* 2010).

Mosley and his colleagues suggested that anti HBC screening of blood donations might prevent HBV transmission from HBsAg negative blood donor that are positive for anti- HBc (Mosley *et al,* 1995). The prevalence of occult hepatitis B varies significantly between geographical regions as well as among various patient populations tested. It also depends upon the assay employed in routine serological or nucleic acid test (NAT) screening. In Asia the prevalence of OHB ranges from 7.5%- 16% (Hollinger and Sold, 2010). The prevalence of anti HBc only in Europe and North America is overall quite low. Anti HBc positive prevalence rate among HBsAg negative blood donors that range from 0.56% in the United kingdom (Soldam *et al.,* 1999), 0.84% in United States (Klienmann and Busch, 2000), 1.4% in Germany (Henning *et al.,* 2002), 15.3% in Greese (Zervou *et al.,* 2001), 1.3% in Canada (Brien et al, 2007), less than 2% in Switzerland (Henning *et al.,* 2002). In Italian blood donor anti HBc positive was 1.8% (Paola, M *et al.*,2007). In area of high

HBV infection prevalence of about 20% - 70% of subject are positive for anti HBc antibody.

Hepatitis B virus is a DNA virus categorized in the virus family hepadnaviridae. The only known natural hosts are humans. Hepatitis B virus enters the liver through the bloodstream, and replication takes place only in liver tissue. The diameter of the whole infectious virus is 42-47nm and concentrations as high as 10^8 virions per ml circulate in the bloodstream. The hepatitis B core antigen (HBcAg), hepatitis B envelope antigen (HBeAg), partially double stranded 3200 nucleotide, DNA molecule and DNA polymerase with reverse transcriptase activity are found in the inner core of the virus. Hepatitis B surface antigen (HBsAg) is found both on the surface of the virus and as self-assembling, non-infectious spherical or tubular particles. (Shepard *et al,* 2006).

In order to replicate the Hepatitis B virus, first attach onto a cell which is capable of supporting its replication. Although hepatocyte is known to be the most effective cell type for replication of hepatitis B virus, other cell types in the human body are also found capable of supporting its replication but a lesser degree (Daniel *et al,* 2011).

The virion attached to the liver cell membrane by cell associated Leparin sulphate proteoglucan, the viral particle bind specifically to an unknown hepatocyte specific Presi-receptor. The DNA is then injected into the host cell by endocytosis and direct fusion of the viral envelop with the plasma membrane. To release/uncoat into the cytoplasm and transport of the nucleocapsid to the nucleus, the partially double stranded viral relaxed DNA (rcDNA) is repaired by the viral polymerase and in another step, the viral polymerase and RNA-Primer used for DNA plus-strand synthesis are removed by circular enzyme. Eventually, covalently used curricular DNA (cccDNA) is formed by covalent ligation of both DNA strands (Daniel *et al.,* 2011). The cccDNA is crucial in the persistence of hepatitis B virus infection. Viral cccDNA serve as template for RNA synthesis. All viral RNA are transcribed from the cccDNA using the cellular transcriptional mechanism (Funk *etal.,* 2002).

Statement of the Problem:

Before 1970, approximately 6% of multi transfused recipients acquired transfusion transmitted HBV (Niederhaneser, 2011). Over the last four decades, the risk of transfusion transmitted hepatitis B virus has been steadily reduced, yet HBV remains the most frequent transfusion transmitted viral infection. The residual risk of HBV transfusion transmission is mainly related to blood donations negative for HBsAg that have been collected during the pre-sero conversion window period. Factors such as blood donation during window period, emergence of newer transmissible pathogens and asymptomatic carrier pose a serious challenge to blood safety.

Justification of the Study:

There is a dearth of information and authoritative data regarding the prevalence of hepatitis B infection serological markers among blood donors as well as risk factor associated with this disease among blood donors attending Federal Medical Centre Keffi. This finding will further broaden the understanding of the donors on the risk factors associated with the virus with the implication of intervention initiative that will help design an effective control and prevention policies.

Materials and Methods:

Study Area

The study was conducted at Federal Medical Centre Keffi, Nasarawa State Nigeria. The Centre came into existence in July 2000 following the takeover of the former General

Hospital Keffi by the Federal Government. Keffi city is approximately 50km from Abuja, the capital of Nigeria and 128km from Lafia the Nasarawa State capital (Akwa *et al.*, 2007).

Study Population:
All consenting adults male and female blood donors donating blood in the blood bank were considered as the study population.

Ethical Clearance:
Ethical clearance with the Reference Number, FMC/KF/HREC/04/21, was obtained from the Health Research Ethics Committee of Federal Medical Centre, Keffi, Nasarawa State, Nigeria.

Sample Size Determination:
A representative sample size was determined using the formula propounded by Geohringer *et al.* (2017) for sample size calculation at 0.05 level of precision:
Where:
n = Desired minimum size of the target population >10,000
z = standard normal deviation at the required confidence interval (1.96) Which corresponds to 95% confidence interval.
P = prevalence rate (16.1%) = therefore,
P= 0.1.(Geiringer, 2017)
q = 1- p
d = Degree of accuracy/precision expected
= 0.05

$$n = \frac{1.96^2(0.1)(0.9)}{(0.05)^2}$$

$$n = \frac{3.8416 \times 0.09}{0.0025}$$

$$= \frac{0.3457}{0.0025}$$

$$= 138.29$$

n =138.

This was however rounded up to 200 samples to minimize error.

Inclusion and Exclusion Criteria
Inclusion Criteria:
All consenting apparently healthy blood donors without any medical or surgical history were recruited in the study.

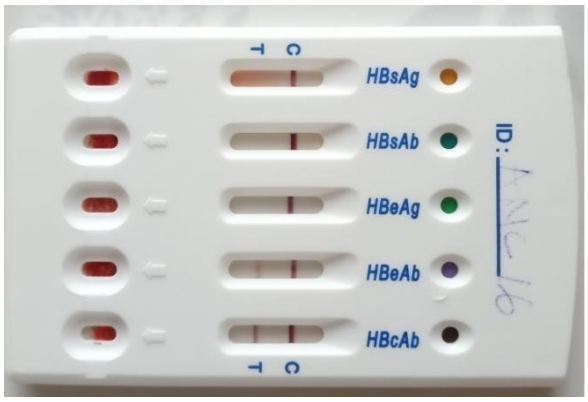
Exclusion Criteria:
Hepatitis B virus seropositive blood donors and those who did not agree to participate in the study were excluded.

Sample Collection and Processing:
Venous blood (3-5ml) was collected by standard aseptic technique with a 5ml disposable syringe and transferred into a sterile test tube from donors. The serum was separated by centrifugation at 3000rpm for 10 minutes. The sera were then preserved at the Medical Laboratory unit of Federal medical center, Keffi at -20^{0}C until ready for use.

Screening for HBV Infection Serological Markers:
HBV infection serologic markers (HBsAg, HBsAb, HBeAg, HBeAb and HBcAb) were screened using the 5-panel HBV combi kit (Colloidal gold) (Qingdad High Top Biotech Co. Ltd, Hangzhou, China) (Fig 3.1). It was carried out according to the manufacturer's instruction.

3.7.1 Principle of the test:
The HBV 5-panel Rapid test kit is a lateral flow chromatographic immunoassay consisting of 5 test panel strips assembled in one cassette. Each strip of the panel membrane is composed of a sample pad, colloidal gold, conjugate pad, nitrocellulose membrane (NC membrane), strip pre-coated with control band (C), test band (T) and absorbent pad.
The antigen (HBsAg and HBeAg) strips are anti-body-based sandwich immunoassays. The conjugate pad contains polyclonal anti-bodies (HBsAb and HBeAb) conjugated

with colloidal gold and the NC membrane is precoated with monoclonal antibodies (HBsAb and HBeAb). When an adequate volume of test specimen is applied into the sample well of the strips, the test specimen migrates by capillary action across the test strips.



Sample Well

Figure 3.1: 5-Panel HBV Diagnostic Profile kit (Colloidal gold).

3.7.2 Test Procedure:

The test board and the testing sample were brought to room temperature (20-30°C), the right side of the test board was kept

horizontal from the original package, from left to right, respectively corresponding to HBsAg, HBsAb, HBeAg, HBeAb, HBcAb. Using a pipette to take sera, into 5 sample wells of the test board by drop (one drop). Experimental result was observed and recorded within 15 minutes.

3.7.3 Interpretation of Result

Positive: when pink colored bands are visible in both Control (C) and Test (T) regions for HBsAg, HBsAb and HBeAg or when the pink colored band is visible in only Control (C) regions for HBeAb and HBcAb tests.

Negative: when the pink colored bands is visible in only the Control (C) regions for HBsAg, HBsAb and HBeAg or when the pink colored bands are visible in both Control (C) and Test (T) regions for HBeAb and HBcAb tests.

3.8 Statistical Analysis:

The data obtained from the questionnaire and the results of the laboratory analysis was analyzed using the statistical package for social science (SPSS) statistical software. Descriptive statistics were presented in tables, figures and charts. The prevalence of hepatitis B virus infection was determined from the total population under consideration and expressed as percentage. Chi square test was used to determine the relationship between the socio-demographic data and hepatitis B virus p-value of ≤ 0.05 was considered statistically significant at 95% confidence interval.

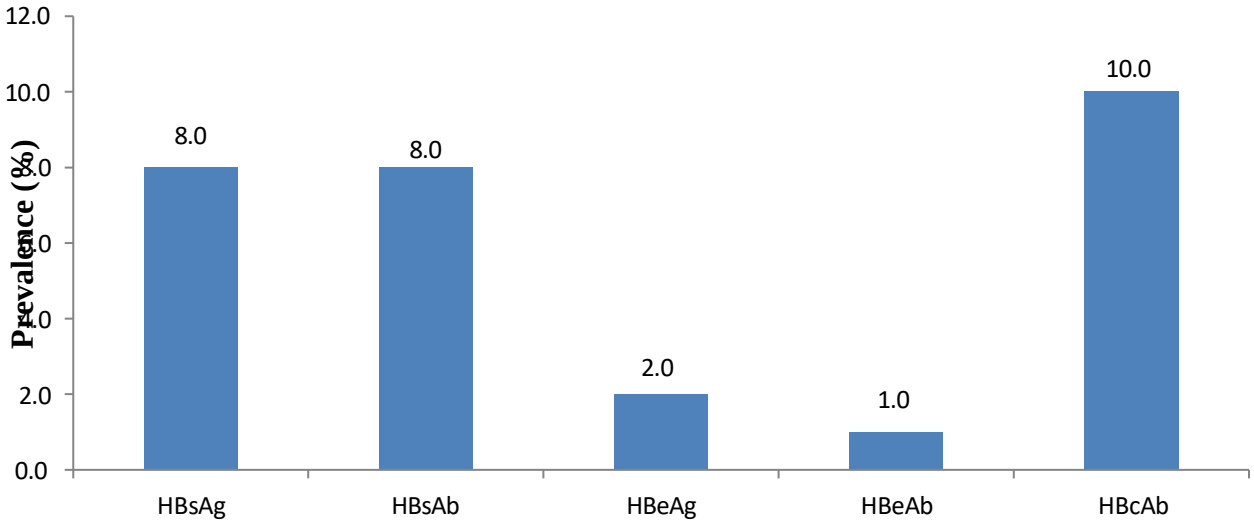
4.1 Results:

The results of the prevalence of hepatitis B virus infection serologic markers among blood donors at Federal Medical Center Keffi, Nasarawa showed that out the 200 participants screened, 16(8.0%) were positive for HBsAg, 16(8.0%) for HBsAb, 4(2.0%) for HBeAg, 2(1.0%) for HBeAb and 20 (10.0%) for HBcAb (Figure 4.1).

Table 4.1 shows the patterns of HBV infection serologic markers among the blood donors in which 1.0% had chronic infection with high viral replication, 2.0% had acute infection with high viral replication, 2.0% were carriers with low viral replication, 8.0% were immune due to successful vaccination, 3.0% were recently vaccinated, 6.0% had possible occult infection, while 78.0% had never come in contact with the virus (susceptible).

HBV infection serologic markers among blood donors was highest among those aged 18-27 years old for HBsAg and HBsAb 9.3%, followed by those aged 28-37 years for HBsAg 7.9%, and 38-47 years for HBsAg and HBsAb 7.1% and those aged ≥48 years 20.0%. However, the highest prevalence was reported among those aged

≥48 years for HBsAb (20.0%) and least for aged 28-37 years (5.3%) for the same marker (Table 4.1).



Pattern of HBV Serologic Markers					Interpretation	No. Of donors	Prevalence (%)
HBsAg+,	HBsAb-,	HBcAb^{+},	HBeAg^{+},	HBeAb^{-},	Chronic infection with high viral replication	2	1.0
HBsAg^{+},	HBsAb^{-},	HBcAb^{-},	HBeAg^{+},	HBeAb^{-},	Acute infection with ongoing high viral replication	4	2.0
HBsAg+,	HBsAb^{-},	HBcAb+,	HBeAg-,	HBeAb-,	Hepatitis B virus carrier with lower replication	4	2.0
HBsAg^{-},	HBsAb$^{+/-}$	HBcAb-,	HBeAg^{-},	HBeAb+,	Immune due to vaccination	16	8.0
HBsAg+,	HBsAb^{-},	HBcAb^{-},	HBeAg^{-},	HBeAb^{-},	Recently vaccinated	6	3.0
HBsAg-,	HBsAb-,	HBcAb+,	HBeAg-,	HBeAb-,	Occult Infection	12	6.0
HBsAg-,	HBsAb-,	HBcAb-	HBeAg-,	HBeAb-,	Non-exposed (Susceptible)	156	78.0
TOTAL						**200**	**100**

Figure 4.1: Prevalence of HBV Infection Serologic Markers among blood donors at Federal Medical Center Keffi, Nasarawa State, Nigeria.

Table 4.2: Distribution and prevalence of HBV serologic markers in relation to socio demography among blood donors at Federal Medical Center, Keffi, Nasarawa.

		No. of Positive (%)				
Socio-Demography	**No. Scr N =**	**HBsAg**	**HBsAb**	**HBeAg**	**HBeAb**	**HBcAb**
Age (Years)						
18-27	86	8(9.3)	8(9.3)	4(8.3)	2(2.3)	6(6.9)
28-37	76	6(7.9)	4(5.3)	0(0.0)	0(0.0)	6(7.9)
38-47	28	2(7.1)	2(7.1)	0(0.0)	0(0.0).	6(21.4)
≥48	10	0(0.0)	2(20.0)	0(0.0)	0(0.0)	2(20.0)
		0.0216*	**0.6060**	**1.0000**	**1.0000**	**0.0020***
Gender						
Male	140	14(10.0)	12(8.6)	4(2.9)	2(1.4)	12(8.6)
Female	60	2(3.3)	4(6.7)	0(0.0)	0(0.0)	8(13.3)
P. Value		**0.1361**	**0.0661**	**1.0000**	**1.0000**	**0.0886**
Marital Status						
Married	64	2(3.1)	2(3.1)	2(3.1)	0(0.0)	2(3.1)
Unmarried	136	14(10.3)	14(10.3)	2(1.5)	2(1.5)	18(13.2)
P. Value		**0.0055***	**0.0055***	**0.7586**	**1.0000**	**0.8086**
Location						
Rural	40	0(0.00)	4(10.0)	0(0.0)	0(0.0)	2(5.0)
Urban	160	16(10.0)	12(7.5)	4(2.5)	2(1.3)	18(11.3)
P. Value		**1.0000**	**0.0661**	**1.0000**	**1.0000**	**0.8086**
Educational Status						
Not	28	0(0.0)	2(7.1)	0(0.0)	0(0.0)	10(35.7)

Educated						
Secondary/Tertiary	172	16(9.3)	14(8.1)	4(2.3)	2(1.2)	10(5.8)
P. Value		**1.0000**	**0.0766**	**1.0000**	**1.0000**	**0.7586**
Occupation						
Civil servant	5	6(12.2)	2(4.0)	4(8.0)	2(4.0)	2(4.0)
Student	82	6(7.3)	10(12.2)	0(0.0)	0(0.0)	10(12.2)
Business	68	4(5.9)	4(5.9)	0(0.0)	0(0.0)	8(11.8)
P. Value		**0.8662**	**0.0223***	**1.0000**	**1.0000**	**0.0110***

**** Statistically significant* (p<0.05)**

Table 4.2: Distribution and prevalence of HBV infection serologic markers in relation to risk factors among blood donors at Federal Medical Center Keffi, Nasarawa.

Risk Factors	**No. of Screened N = 200**	**No of Positive %**				
		HBsAg	**HBsAb**	**HBeAg**	**HBeAb**	**HBcAb**
History of surgery Yes	34	2(5.9)	0(0.0)	2(5.9)	0(0.0)	4(11.8)
No	166	14(8.4)	16(9.6)	2(1.2)	2(1.1)	16(9.6)
P. Value		**0.5011**	**1.0000**	**0.9586**	**1.0000**	**0.0020***
History of Blood Transfusion						
Yes	86	6(6.8)	8(9.3)	4(4.7)	0(0.0)	2(2.3)
No	114	10(8.8)	8(7.0)	0(0.0)	2(1.4)	18(15.8)
P. Value		**0.6611**	**0.9586**	**1.0000**	**1.0000**	**0.0886**
Multiple sexual Partner						
Yes	34	6(17.7)	2(5.9)	2(5.9)	0(0.0)	0(0.0)

No	166	10(6.0)	14(8.4)	2(1.20)	2(1.4)	20(17.2)
P. Value		**0.6611**	**0.0766**	**0.9586**	**1.0000**	**1.0000**
Exposure to human blood						
Yes	24	4(16.7)	2(8.3)	0(0.0)	0(0.0)	2(8.3)
No	176	12(6.8)	14(7.9)	4(2.2)	2(1.1)	18(10.2)
P. Value		**0.0661**	**0.0766**	**1.0000**	**1.0000**	**0.8066**
History of HBV in the Family						
Yes	10	2(20.0)	0(0.0)	2(20.0)	0(0.0)	0(0.0)
No	190	14(7.4)	16(8.4)	2(1.05)	2(1.05)	20(10.5)
P. Value		**0.0078***	**1.0000**	**0.9586**	**1.0000**	**1.0000**

**** Statistically significant* (p<0.05)**

HBeAg was higher among those aged 18-27 years and 8.3% non-reactive across other age group. Age group 18-27 years had the highest prevalence for HBeAb 2.3% and non-reactive across other age group. HBV infection serologic marker among blood donors was highest among those aged 38-47 years (21.4%) for HBcAb followed by age group ≥ 48 years for HBsAb and HBcAb (20.0%) and lowest prevalence was observed in age group 18-27 years (6.9%). However, there was statistically significant association between HBsAg and HBcAb with age ($p<0.05$), while there was no statistically significant association between other serologic marker and age of the participants ($p>0.05$). (Table 4.2). The distribution of HBV infection according to gender in all markers does not show any statistically significant association between prevalence of HBV infection and gender ($p>0.05$). Higher prevalence of HBV infection was reported among male than their female counterpart for all of the markers except for HBcAb where the prevalence was higher among female (13.3%) than male (8.6%).

The prevalence of HBV infection serologic marker with respect to marital status reported highest prevalence among single for HBsAg (10.2%). Similarly highest prevalence was reported among single for HBsAb (10.2%), for HBeAg and HBcAb. All markers have higher prevalence among unmarried except HBeAg (1.5%). However, there was no statistically significant association between HBeAg, HBeAb and HBcAb with respect to their marital status ($p>0.05$) (Table 4.2). The Prevalence of HBV infection serologic marker with respect to location reported higher prevalence among urban dwellers for HBsAg (10.0%), HBeAg (2.5%), HBeAb (1.3%) and HBcAb (11.3%). While highest prevalence was reported among rural dwellers for HBcAb (11.3%) and HBsAg (10.0%). However, there was no statistically significant association between HBV infection with

respect to location (p> 0.05) (Table 4.1). The prevalence of HBsAg was found to be higher among educated participant for (9.3%) while lowest or absent among the non-educated. There was no statistically significant association between the HBV infection serologic markers with respect to their educational status. (Table 4.1). On occupation, higher prevalence was recorded among civil servant for HBsAg (12.2%), followed by student (7.3%), and least among business people for (5.9%). Also for HBsAb, higher prevalence was observed among student (12.2%) and least among civil servant (4.0%). For HBeAg highest prevalence was observed among civil servant (8.0%) and non-reactive for student and business people. Similarly, for HBeAb higher prevalence was observed among civil servant (4.0%) and non-reactive for student and business people. And for HBcAb higher prevalence was observed among student (12.2%) followed by business people (11.8%) and least among civil servant (4.0%). However, there was a statistically significant association between HBsAb and HBcAb with respect to their occupation (p<0.05) while there was no statistically significant association between HBsAg, HBeAg and HBeAb with respect to their occupation (p>0.05). (Table 4.1).

Figure 4.1: Prevalence of HBV Infection Serologic Markers among blood donors at Federal Medical Center Keffi, Nasarawa State, Nigeria. There was statistically significant association between HBV infection serologic marker for HBcAb 10.0%, with respect to those that had history of surgery (p<0.05) but there was no statistically significant association between HBV infection serologic marker for HBsAg 8.0%, HBsAb 8.0%, HBeAg 2.0%, and HBeAb 1.0% with respect to those that had history of surgery (p> 0.05), highest prevalence was reported among those that had no history of surgery for HBsAg (8.4%), HBsAb (9.6%) HBeAb (1.1%), the prevalence of HBV infection in respect to those that had history of surgery reported highest while highest prevalence was reported among for HBeAg (5.9%) and HBcAb (11.8%) and non-reactive among those that had history of surgery for HBsAb and HBeAb. (Table 4.2).

The presentation of infection on the basis of those that had history of blood transfusion indicate highest prevalence reported for HBsAb (9.3%) and HBeAg (4.7%) while highest prevalence was reported among those without history of blood transfusion for HBsAg (8.8%), HBeAb (1.4%), and HBcAb (15.8%). However, there was no statistically significant association between prevalence of HBV infection with respect to those with history of blood transfusion (p>0.05). (Table 4.2). With respect to prevalence of infection with multiple sexual partners there was no statistically significant association between infection with HBV infection and history of multiple sexual partners (p>0.05), highest prevalence was recorded among participant that have multiple sexual partner for HBsAg (17.7%), (5.9%) for both HBsAb and HBeAg than those without multiple sexual partner HBcAb (17.2%), HBsAb (8.4%), HBsAg (6.0%), HBeAb (1.4%) and HBeAg (1.2%). (Table 4.2). For those that were exposed to human blood, there was no statistically significant association between prevalence of HBV infection and exposure to human blood, higher prevalence was reported among donors that had exposure to human blood for HBsAg (16.7%) and HBsAb (8.3%), while among those without exposure to human blood were HBsAb (7.9%) and HBsAg (6.8%), non-reactive for HBeAg and HBeAb among donors that were exposed to human blood. For other markers HBeAg (2.2%), HBeAb (1.1%), HBcAb (10.2%), (Table 4.2).

In relation to family history of HBV, higher prevalence of HBsAg was observed among participant who had family history (7.4) %, there was a statistically significant association between prevalence of HBV infection and history of HBV in the family ($p<0.05$). But no significant association between history of HBV and other serologic marker ($p>0.05$). Higher prevalence of HBV infection serologic marker was also reported among donors with history of HBV in the family for HBeAg (20.0%) while higher prevalence for HBsAb (8.4%), HBeAb (1.05%) and HBcAb (10.5%), was reported among donors without history of HBV in the family.(Table 4.2).

Discussion:

The discovery of the HBsAg was a major breakthrough in decreasing the incidence of post transfusion hepatitis. Screening of blood donors for HBsAg can reduce the risk of transfusion transmitted HBV infection (El Zayadi *et al.,* 2008). Therefore, providing safe blood devoid of transfusion transmissible agent is needed (CDC, 2020). This current study was conducted to determine the prevalence of HBV infection serologic markers among blood donors at Federal Medical Center Keffi, Nasarawa state Nigeria. HBV serologic markers can say alot about the state of HBV infection based on the patterns of positivity and Negativity of these markers (Lavanya *et al.*, 2012).

In this study, 200 eligible blood donors were screened for HBV infection serologic markers at Federal Medical Center Keffi, Nasarawa state. Majority of those screened were male (140) and female (60) between aged 18-27 Years. Of these 16(8.0%) were positive for HBsAg, 16(8.0%) for HBsAb, 4(2.0%) for HBeAg, 2(1.0%) for HBeAb and 20(10.0%) for HBcAb.

The recorded 8.0% rate of HBsAg in this study which is the most frequently used serologic marker for screening of HBV infection (Lok and McMahon, 2011) Is regarded as moderate according to World Health Organization classification which defines low prevalence as <2%, moderate as 2-8%, and high as 8% HBsAg positivity (WHO, 2010).

This rate (8.0%) of HBsAg recorded in this study was higher than the (4.7%) among student of the University of Utah (Mboto and Edet, 2012), (1.1%) among blood donors at University of Portharcout Teaching Hospital (Ejele *et al.,* 2015), (4.2%) among pregnant women in Zaria (Murkter *et al.*, 2005), (2.4%) among prospective blood donor in Yola (Olokoba *et al.,* 2008), (5.9%) among blood donors in Ibadan (Afolabi *et al.*, 2015) and (6.78%) among pregnant women in Ekiti (Esan *et al.,* 2014) and (4.8%) among prospective blood donors in Zambia (Kasolo *et al.,* 2013).

In contrast, higher prevalence rate has been reported in Nigeria and other part of the world such as (11.1%) among blood donors in Kano (Nwakwo *et al.,* 2012), (12.5%) amongst asymptomatic student in A.B.U Zaria (Aminu *et al.,* 2013), (9.2%) student in Nasarawa State University (Isa *et al.,* 2015), (17.5%) among blood donors in Asokoro general hospital, Abuja , (Agbesor *et al.,* 2015), (20.0%) amongst donors in Benue State (Paulyn *et al.,* 2011), (12.5%) among pregnant women in Nigeria (Ugbebor *et al.,* 2011), (11.5%) among student of Nasarawa state University Keffi (Pennap *et al.,* 2011), (17.3%) among pregnant women in Burkina Faso (Collen Berg *et al.,* 2006) and (11.2%) in Cameroon among blood donors (Ephraimental, 2015). The reason for these variations may be related to the fact that infections tend to vary from one locality to another and from one country to another depending on the level of associated risk factors. It could also be as a result of variation in the methodology adopted for viral detection in the different studies.

Out of the 200 blood donors tested for HBV serologic markers only 8.0% had HBsAb which is a neutralising antibody against HBsAg due to successful vaccination and immunity due to natural exposure against the virus (Odimayo, *et al.,* 2016). This result is higher than the 2.5% reported in the semi-arid region of Nigeria (Jeremiah *et al*., 2012). 4.9% in Ilorin, Nigeria (Ogunfemi *et al.,* 2017) but compares well with 8.6% at a tertiary centre in Nigeria (Akinbami *et al.*, 2012). While the rate is lower than the 22.5% prevalence of natural HBsAb among healthy individual in Benue (Mbaawuaga *et al.,* 2014), (22.2%) among Surgeon in Lagos (Bello AC, 2010) and (27.5%) among hospital personnel in Cairo, Egypt (Goldsmith *et al.,* 2013). The reason for the above can be as a result of the difference in methods used for the viral detection employed.

In this study, HBeAg which is the replicating phase of the virus was prevalent in 2.0% of the participants. This rate is lower than 4.7% reported among individuals with HBsAg seropositivity in Benue state (Odimayo *et al.,* 2016), 6.5% among pregnant Nigerian women (Abah and Aminu, 2016) and 2.7% in Benue state (Mbaawuaga *et al.,* 2014). The reason for this variation may be due to the fact that the studies was carried out in different populations with differences in inclusion and exclusion criteria.

The HBeAb is the antibody produced by the body against HBeAg and its presence indicates lowered infectivity and transmission of the virus (Chen *et al.,* 2012). Just like the HBsAb, it may serve as an indication of recovery from HBV infection (Jiang Hong, 2008). In this study there was a prevalence of 1.0% of this antibody (HBeAb) recorded. However, higher prevalence has been reported in other studies such as the 8.0% among HBsAg seropositive individuals in Markudi (Odimayo*et al.,* 2016), 51.6% among pregnant Nigerian women (Abah and Aminu, 2016), and 4.7% in a subset of young people in central Nigeria (Mohammed *et al.,* 2019). Differences in study population may account for the observed differences in findings.

HBcAb which is the first antibody to appear in HBV infection (Kao, 2007) recorded a prevalence of 10.0% among the participants. This implies that 10.0% of the participant have had contact with the virus at one time or the other in their lives. Other studies have reported higher rate of this antibody such as the 58.1% reported among pregnant Nigeria women (Abah and Aminu, 2016), 38.2% in Benue (Mbaawuaga *et al.,* 2014), 32.5% among blood donors in Ilorin (Ogunfemi *et al.,* 2017).

From this study, prevalence rate of HBsAg and HBcAb was statistically significant with the age of the participant ($p<0.05$). Meanwhile, prevalence rate of other serologic markers (HBsAb, HBeAg, HBeAb) were not significantly associated with age ($p>0.05$). However, donors of 18-27 years of age had the highest prevalence of HBsAg (9.3%), compared to other age groups. This outcome correlated with other reports. For instance, (Otori *et al.,* 2012) who reported higher rate of HBV infection serologic markers among younger age group 18-30 years. However, this observation contradicts the earlier report of higher HBV in older subject of 40 years and above (Lawal, 2009). The reason for this higher prevalence in younger age group may be as a result of high risk of predisposing activities such as body incision, tattooing, self-intravenous drug administration, exposure to sharp objects among individual in this age group.

Analysis of sex related prevalence rate of HBsAg showed that male (10.0%) were more infected than female (3.3%). Although gender was statistically insignificant with

the rate of the infection (p>0.05). These findings agree with that of Lawal *et al.*, *(*2009), at university college hospital Ibadan, Balogun, (2010), in Lagos Nigeria. Contrary to this outcome, other researchers Innocent *et al.*, (2015), reported higher prevalence of HBV infection in females than male among blood donors in Abuja, (Mustapha and Jibrin, 2004), and Gombe (Edia *et al.*, 2010), reported similar result among blood donors in Gombe state.

The prevalence of HBsAg among single is 10.2%, HBsAb 10.2%, HBeAg 1.47%, and HBcAb 13.2%, while amond married was 3.1% for HBsAg, HBsAb 3.1%, HBeAg 3.1%, HBeAb 0.0% and HBcAb 3.1%. This result corroborates with the work of (Ejele *et al.*, 2004). Who reported that single/unmarried patients constituted the highest proportion of those with HBV infection in Niger Delta.This study recorded significant association between marital status and prevalence of HBsAg and HBsAb among the blood donors (p<0.05). While, there was no statistical association between marital status and prevalence of HBeAg, HBeAb and HBcAb among blood donors (p>0.05). This may be explained by the fact that promiscuity and unprotected sexual behavior among single might be higher than among married, therefore increasing the risk of acquiring the virus due to their inability to stick to only one sexual partner. Additionally, the Prevalence of HBV was statistically insignificant between location and prevalence of HBsAg 8.0%, HBsAb 8.0%, HBeAg 2.0%, HBeAb 1.0%, and HBcAb 10.0%, among blood donors (p>0.05). However, prevalence of HBsAb 10.0%, was higher among rural dweller, other markers such as HBsAg 10.0%, HBsAb 7.5%, and HBcAb 11.3%, has higher prevalence among Urban dwellers. This outcome agrees with a similar study conducted in other countries (Nada and Atura, 2013, Okoroiwu *et al.*, 2018).

Rural donors can be the attributing factors for the prevalence of HBV due to poor awareness regarding the mode of transmission and prevention, low educational status and access to medical care that is more limited in rural communities compare to Urban. With respect to educational status, there was statistically insignificant association between prevalence of HBV and educational status (p>0.05). Result from this study showed a higher prevalence of HBV among educated participant across all the markers, this outcome agrees with (Pennap *et al.*, 2011). Who reported higher prevalence of HBV among student of Nigeria tertiary education. (Doa a *et al.*, 2010) also suggested that low level of maternal education is a risk factor for HBV infection. The reason for such an outcome in this research where educated participant recorded more prevalence could be because they constituted the larger population in this research work, there is a possibility that regard less of their educational background, they had multiple sexual partners with only few using protection (condom) during sexual intercourse. With respect to occupation, there was a significant association between HBsAb 8.0%, and HBcAb 10.0% for HBV (p>0.05), but no significant association between HBV infection among other markers with respect to occupation. This study recorded the highest prevalence of HBsAg (12.0%), HBeAg (8.0%), and (4.0%) for other markers among civil servant and least among business group for HBsAg and HBsAb was (5.9%), highest prevalence of HBsAb (12.2%) was observed among student and least among civil servant (4.0%) for HBsAb, HBeAb and HBcAb. This study contradicts what had been previously reported by (Augustine *et al.*, 2014). Which state that student have low prevalence of HBsAg. The reason for this outcome might be that there are other underlying factors that

could necessitate the transmission of the infection. HBcAb indicates a previous or ongoing infection and this might be due to exposure, the kind of work people get involved into can lead to hepatitis B infection. From this study, prevalence of HBV serologic markers among those that had a history of blood transfusion is 6.8% for HBsAg, 9.3% HBsAb, 4.7% HBeAg, and 2.3% HBcAb, those without an history is 8.8% for HBsAg, 7.0% for HBsAb, 0.0% HBeAg, 1.4% HBeAb and 15.8% for HBcAb. However, previous history of blood transfusion did not have any significant association with HBV infection in this study which was in agreement with studies conducted in Ghana, Cameroon and Nigeria (Eke *et al.,* 2011, Formulu *et al.*,2015, Ephraim *et al.*, 2015). In other research carried out in Ethiopia, Nigeria and Egypt, history of previous blood transfusion was significantly associated with HBV infection (Kamal and Naseer, 2008, Olokoba *et al.*, 2011, Zenebe *et al.*, 2014).

Sexual transmission has been recognised as the major source of HBV transmission and from this study, having multiple sexual partners was statistically insignificant ($p>0.05$), predisposing factor for HBV infection across all the markers does not confirm a strong association between having multiple partners and the prevalence of HBV. Though higher prevalence was observed of HBsAg among those with multiple sexual partner (17.7%), this is in contrast with (Molla *et al.*, 2015). Who found a significant association between history of multiple sexual exposure and HBV infection. (Rabiu *et al.*, 2010, and Obi *et al.*,2006), also demonstrated that having a history of multiple sexual partners is a significant risk factors for HBV infection. The reason for the outcome in this present study is not clear.

Higher prevalence of HBsAg and HBeAg 20.0%, was observed among participant (donors) who had history of infection in their family compared to those who did not HBsAg 7.4%, HBsAb 8.4%, HBeAg1.05%, HBeAb 1.05%, and HBcAb 10.5%. In relation to history of HBV in the family for HBsAg, there was a significant association with the viral infection ($p<0.05$). But insignificant association for other markers HBsAb, HBeAg, HBeAb, HBcAb ($p>0.05$). This result agrees with the work of ElBeltagy *et al.*, (2008). Who reported that HBsAg positivity can occur in participant who had history of HBV in the family and those who have recently been vaccinated for HBV infection. The reason for this outcome could be due to close contact usually observed among family members especially in Nigeria where sharing is a common characteristic and any person that tend to isolate himself from sharing may be considered as a cultural disregard, social disregard, or showing indifference or disunity thereby increasing the chance of constructing the viral infections as a result of exposure to contaminated blood or body fluids.

Conclusion:

The outcome of this study has found the prevalence of HBV serologic markers to be (8.0%) for HBsAg, (8.0%) for HBeAb, (2.0%) for HBeAg, (1.0%) for HBeAb and (10.0%) for HBcAb among blood donors at Federal Medical Center Keffi, Nasarawa state. The report in this study are moderate according to WHO classification. it is important to give public education which is aimed at routine screening modification of risky social life style and vaccination of those who tested negative and are at risk. This is to reduce the potential risk of transmitting the infection. Most of the risk factors studied were not significantly associated with the viral infection. However, having history of HBV infection in the family is significantly associated with HBV infection and history of surgery was also

significantly associated with the acquisition of HBV infection for HBcAb marker. This indicates that close contact among family members and sharing of sharp and unsterilized object by some of the blood donors might be a predisposing factor. Furthermore, demographic factor studied revealed that HBsAg and HBcAb serologic markers in respect to age were significantly associated with HBV infection while there was no significant association between gender and HBV infection.

This work showed the role of unsterilized or sharp objects, sharing cloths, body scarification and history of HBV infection in the family in the transmission of the virus from person to person.

References:

1. Abah, H.O. and Aminu, M. (2016). Seroprevalence of hepatitis B Virus serological markers among pregnant Nigerian women. *Annals of African Medicine*;15(1):20-27.
2. Afolabi, A.Y., Oladipo, E K. and Fagbemi, A.H. (2015). Prevalence of hepatitis B Virus among potential blood donors in Ibadan, Nigeria. *International Research Journal Medical Sciences*, 3(2):40-45.
3. Agbede, O.O., Iseniyi, J.O., Kolewale, M.O. and Ojuawo, A. (2007). Risk factors and Seroprevalence of Hepatitis B antigenemia in mothers and their preschool children in Ilorin, Nigeria. *Therapy*; 4:67-72.
4. Agbesor, N.I., Amala, S.E. and Zaccheaus, A.J. (2016). Hepatitis B Virus profile among blood donors in the federal capital Territory Abuja, *Nigeria international journal of science and research*; 5(7):1668-1672.
5. Akinbami, A.A., Oshinaike, O.O., Dosunmu, O.A.,Adeyemo, T.A., Adediran, A., Akanmu, S., Wright, K.O., Ilori, S. and Aile, K. (2012). Seroprevalence of HBeAg and core antibioties (IgG anti-HBcore and IgM anti HBcore) among Hepatitis B surface antigen positive blood donors at a Tertiary center, *Nigeria. BMC Research*. Notes, 5:167.
6. Akwa V.L., N.L., Binbol, K.L., Samaila., K.L. and Marcus. (2007). Geographical perspective of Nasarawa state. Onaive printing and publishing company Ltd, keffi, p. 503. Akani, C.I., Ojule, A.C., Opurum, H.C. and Ejilemele, A.A. (2005). Seroprevalence of HBsAg in pregnant women in Portharcout. *Naija Postgraduate Medical Journal*, 12:226-270.
7. Alao, O. O., Akooru, O. O., Eguru, C. and Audi, F. (2009). Seroprevalence of hepatitis B surface antigen among prospective blood donors in an urban area of Benue state. *Internet J Hematol*, 5(2):12.
8. Allian, J.P., Candotli, D., Soldan, K., Sarkodie, F., Phelbs, B. and Giachetti, C. (2003). The risk of hepatitis B virus infection by transfusion in Kumasi, Ghana. *Blood*, 101:2419-25.
9. Arun, P., Sangwan, I. and Munjal, A. Prevalence of markers of hepatitis B in voluntary blood donors in fatehabad district of Haryana. International *Journal Basic Applied medical science*, 4:4107-4110.
10. Atul, J., Ruhi, M., Seema, C.T. and Ujawala, M. (2014). Prevalence of Hepatitis B among the voluntary blood donors of the department of immuno haematology & blood transfusion of MGM hospital, Kamothe, Navi *Mumbai. International Journal, Recent trends life science math* IJLSM, 1: 5 -8.
11. Balogun, T.M., Durijaiye, I.O., Sagoe, A. and Emmanuel, S. (2010). Seroprevalence epidemiology of hepatitis B surface Antigenemia in HIV patients.

West Africa *Journal of Medicine*; 29(3):167-173.
12. Brien, S.F., Fearon, M.A., Y Q.L, Fan, W., Scalia, V. and Muntz, I.R. (2007). Hepatitis B virus DNA - positive, Hepatitis B surface antigen - negative blood donations intercepted by anti-Hepatitis B core antigen testing: The Canadian blood services experience. *Transfusion,* 47:1809-15.
13. Bello, A.C. (2000). Prevalence of Hepatitis B Virus markers in Surgeons in Lagos, Nigeria. *East African Medicine Journal,* 77:283-285.
14. Bello, A.C. (2010). Prevalence of hepatitis B Virus markers in Surgeons in lagos, Nigeria. *East African Medical journal*; 77:283-285.
15. Bortolotti, F., Jara, P., Crivellaro, C., Hierro, L., Cadrobbi. and Frauca, E. (2010). Outcome of chronic hepatitis B in Caucasian children during a 20- year observation period. *Journal Hepatology*; 20:184-90.
16. Centers for Disease Control and Prevention. (2002). Prevention of hepatitis B infection and other vaccine-Preventable Diseases Atkinson W, Wolfe S, Hamborsky J, 10th edition Washington DC: Public Health Foundation.
17. Centers for Disease Control and prevention. (2016). Hepatitis B frequently asked questions for health professionals; 2017. Accessed on 3 October, 2020.
18. Chang, M.H. (2000). Natural history of hepatitis B infection in Children. *Journal Gastroenterol Hepatology,* 15: E11-E19.
19. Chang, M.H., Hsu, H.C. and Lai, M.Y. (2003). Hepatitis B Virus Infection. *Semin Fetal Neonatal Medicine,* 12:160-167.
20. Chen, Y.S., Liang, X. and HU J.F. (2012). The serum markers of Hepatitis B Virus (HBV) infection and the natural history of chronic HBV infection. Zhonghua Yi miso He Mian Yi, 15(3)279-283.
21. Chisari, F.V. and Ferrari, C. (1997). Viral hepatitis. In Notanso, N., Ed's viral Pathogenesis. *Philadelphia. Lippincott-Raven,* 745-748.
22. Collen Berg, E., Ouedraogo, T., Game, J., Fickenster, H., Kynast- Wolf, G. and Becher, H. (2006). Seroprevalence of six different viruses among pregnant women and blood donors in rural and Urban Burkina Faso: A comparative analysis. *Journal of Medical virology*; 78:683-692.
23. Custer, B., Sullivan, S.D. and Hazlett,T.k. (2004). Global Epidemiology of Hepatitis B Virus. *Journal Chlin gastroenterol*, 38: SUPPL35158-68.
24. Daniel, G, Robert, T. and Hebert, E.B. (2011). HBV life circle and Novel drug target: *International Journal S.F hepatology*, 5 (2):644-653.
25. Dienstag, J.L. (2010). non-B A, non-B hepatitis. I. Recognition, epidemiology, and clinical features. *Gastroenterology* ,85(2), 439-462.
26. Di Marco, V., Lo Lacono, O., Camma, C., Veccaro, A., Giunta, M. and Martorana, G. (2014). The long-term courses chronic hepatitis B. *Hepatology*, 30:257-64.
27. Doa, a, A.S., Shebi, F.M., El-Kamary, S.S., Magder, L.S., Abdel-Hamid, M. and Mikail, N. (2010). Incidence and risk factors for community acquired hepatitis C infection from birth to 5 Years of Age in rural Egyptian children. *Transactions of the Royal Society of Tropical Medicine and Hygiene* ,104(5):357-363.
28. Edia-Asuke, U.A., Abubakar, Z. and Asuke, S. (2016). Seroprevalence of Hepatitis B surface antigen among out patients attending a Tertiary hospital in Kaduna state, Nigeria. *Journal of Microbiology*; 1:38-44.
29. Ejele, O.A., Nwauche, C.A. and Erhabor, O. (2004). The prevalence of hepatitis B

surface Antigenemia in HIV positive patients in the Niger Delta, *Nigeria Journal of Medicine*, 13(2):175-179.

30. Eke, A.C., Eke, U.A., Okafor, C.I., Ezebialu, I.U. and Ogbuagu. (2011). Prevalence, Correlates and patterns of Hepatitis B surface antigen in a low resource setting. *Virology Journal*, 8(1),1.
31. El Beltagy, K.E., Al Balawi, I.A., Maha, A. and Ziad, A.M. (2008). Prevalence of hepatitis B Virus markers among blood donors in a tertiary hospital in Tabuk, North Western Saudi Arabia. *International journal infectious Disease*, 12:495-499. Katandeep Singh, Sudha Bhat, Shamed Shastry, (2009). Trend in Seroprevalence of hepatitis B Virus infection among blood donors of Coastal Kamataka, *India Journal infection in developed Countries*, 3(5):376-379.
32. Elghannam, D.M. (2009). Clinical significance of antibody to hepatitis B core antigen in multitransfused hemodialysis patients. *Asian journal of transfusion science, 3: 14-17.*
33. El Khour, M. and dos Santos, V.A. (2004). Hepatitis B. Epidemiological immunological and serological consideration emphasizing mutation. Ravista do hospital das clinicas, 59: 216-224.
34. El- Zayadi, R., Ibrahim, I.H., Badran, H.M., Said, A., Moneib, N. A., Shemis, M.A., R.Ni, Abdel- Sattar, R.M., Ahmady, A.M. and El-Nakeeb, A. (2008). Anti-HBC screening in Egyptian blood donors reduce the risk of hepatitis B Virus transmission. *Transfusion Medicine*, 18(1):55-61.