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Seroprevalence of Hepatitis B and C infections among the University of Maiduguri Community in Nigeria

***Shakirat Iyabo Bello¹, Hadiza Yusuf², Babagana Mohammed Waziri³ and Aliyu AbdulKadir³**

¹Department of Clinical Pharmacy and Pharmacy Practice, Faculty of Pharmaceutical Sciences, University of Ilorin, Ilorin, Nigeria, ²Department of Clinical Pharmacy and Pharmacy Administration, Faculty of Pharmacy, University of Maiduguri, Maiduguri, Nigeria. ³University Medical Centre, University of Maiduguri, Maiduguri, Nigeria.

***Corresponding Author:** Dr. Shakirat Iyabo Bello, Department of Clinical Pharmacy and Pharmacy Practice, Faculty of Pharmaceutical Sciences, University of Ilorin, Ilorin, Nigeria; sibello10@yahoo.com; +2348035675609

Running Title: Hepatitis B and C among the University of Maiduguri Community

Abstract

Viral Hepatitis B and C antigens are asymptomatic infections causing death worldwide. The objective of this study was to assess the seroprevalence of Hepatitis B and C virus infections among students and staff attending the University of Maiduguri Medical Centre in North-Eastern Nigeria. A descriptive cross-sectional study was conducted among consented 464 students and staff who were tested for Hepatitis B and C viruses with the use of Wondfo Biotech Co. Ltd., Guangzhou, China. Structured pretested questionnaires were self-administered on social demographic and behavioral variables. Ninety-six (20.7%) respondents were reactive to Hepatitis B, eleven (2.4%) were reactive to Hepatitis C and one (0.2%) showed co-infection by both viruses. Predictors that were significantly associated with Hepatitis B infection included multiple sex partners and marital status. Smoking cigarettes and religion were potential significant predictors of having Hepatitis C infection. The significantly high seroprevalence rate of Hepatitis B surface antigen among the University students and staff underscores the need to intensify awareness and vaccination. Population screening-based guidelines are necessary to identify undiagnosed infected individuals and offer fundamental data for national prevention and control schemes.

Keywords: Hepatitis B surface antigen; Hepatitis C virus ; University students and staff; awareness; vaccination

Introduction

Viral Hepatitis B and C antigens are major liver diseases that resulted in death all over the world and of three folds over human immunodeficiency virus infection (Coppola *et al.*, 2016; Ringehan *et al.*, 2017). Based on the World Health Organization estimates around two billion individuals were infected by Hepatitis B surface antigens while 360 million people are chronic carriers causing over 780,000 deaths yearly. For Hepatitis C, about 200 million persons are with the disease burden while 3-4 million individuals are infected newly every year. Hence, viral Hepatitis B and C antigens accounted for 360 and 200 million chronic carriers, respectively. These carriers are prone to the threat of hepatocellular carcinoma, cirrhosis, liver failure, and chronic Hepatitis (WHO, 2016). Hepatocellular carcinoma has been ranked as 5th most

seroprevalence cancer and the 2nd major occurrence of deaths from cancer disease (Anaedobe *et al.*, 2015; Dusheiko, 2018). Hepatitis B and C infections exhibited common routes of transmission, so the need for their concurrent assessment (Olayinka *et al.*, 2016).

Many behavioral threat factors including pedicure, manicure, contact with blood specimens, unprotected intercourse, multiple sexual partners, body tattoos, beautification scarring, blood fights, body and ear piercing are subjected to both old and young ones causing co-morbidity of Hepatitis B and C viruses (Guéguen *et al.*, 2012; Olalekan, 2015). Statistics depict that Nigeria recorded the major Hepatitis infections in Africa with about 20 and 4 million infected by Hepatitis B and C, respectively (Olabowale and Adeyemi, 2018; Lesi *et al.*, 2019). Hepatitis seroprevalence in Nigeria calls for concerted efforts in screening and vaccination of the people to prevent new infections. This is because

several people are unaware of the disease being asymptomatic and deadly (Musa *et al.*, 2015; FMOH, 2017).

Viral Hepatitis B and C viruses are silent killers and pandemic in Nigerians since many people are being infected daily based on ignorant. Therefore, there is an urgent requirement for continuous evaluation of the disease to mitigate the chronic burden and their resultant complications and deaths of both diseases. Based on the aforesaid, this study was conducted to determine the seroprevalence of Hepatitis B and C infections among staff and students of the University of Maiduguri in North-Eastern Nigeria

Materials and Methods

Study area

The research was performed in the Laboratory Unit of the University Medical Centre, University of Maiduguri, Maiduguri, Borno State, Nigeria. The University of Maiduguri is located in Maiduguri, the capital city of Borno State in North-Eastern Nigeria. The State share borders with the neighboring States of Adamawa to the South, Yobe to the West and Kano to the North-West and Gombe to the South-West. The Federal Government of Nigeria created the University in 1975. It enrolls about 25,000 students, 77 Academic Departments, one College of Medical Sciences, a School of Postgraduate Studies and 12 Faculties. The number of Academic staff ranges between 2,500 and 2,999 (UNIMAID, 2019).

Study design

This is a single-center, primary healthcare-based cross-sectional study. The study involved undergraduate students and staff who attended the Medical Centre of the University of Maiduguri.

Ethical Consideration

Approval to conduct the study was sought and obtained from the Ethical and Research Committee, College of Medical Sciences, University of Maiduguri. Before the collection of the sample, the consent of all participants was obtained.

Inclusion criteria

1. Male and female students and staff of the University of Maiduguri.
2. Those in the age range of 18 years and above.
3. Students and staff who consented to participate in the study.

Exclusion criteria

1. Non-students and staff of the University of Maiduguri.
2. Pregnant women.
3. Students and staff on hospital admission.

Sample Size Estimation and Sampling Technique

For populations that are greater than 10,000, equation 1 below was developed to generate a representative sample for the population studied (Araoye, 2004);

$$n = \frac{Z^2 pq}{d^2}$$

..... Equation 1

Where n is the sample size, Z is the abscissa of the normal curve that cuts off an area which equals the desired confidence level of 95%, d is the desired level of precision set at 0.05, p is the estimated proportion of an attribute that is present in the population, and q is $1 - p$.

Thus, $n=384$. Twenty-one percent was added to the calculated size to account for attrition and non-response. Therefore, the number of staff and students enrolled in the study was 464.

Simple randomization by using a sampling step of five was used to select participants from patients that visited the laboratory of the medical centre during the study periods. Every fifth participant presenting to the laboratory was requested to participate in the study.

Study questionnaire

All consenting students and staff that attended the Medical Centre on the survey days (Tuesdays, Wednesdays, and Thursdays of the week) were self-administered pre-tested structured questionnaires. The questionnaire comprised of 20 questions ranging from socio-demographic characteristics to behavioral risk factors for Hepatitis B and C viruses. The questionnaire was formed based on related questionnaires from previous similar studies. The questionnaire was used to capture information on potential behavioral risk variables; social histories such as smoking cigarettes, drinking of alcohol, body tattoo, ear or body piercing, illicit drug use, history of blood transfusion and multiple sexual partners. Other questions were sharing of toothbrushes, use of utensils, sharing of sharp objects, receipt of organ transplant, ever work in the medical field and have a blood exposure as well as socio-demographic factors (age, gender, religion, tribe, and marital status) linked with Hepatitis B and C viruses infections.

Hepatitis C virus Rapid Test

Principle of the Rapid Test

The Hepatitis C virus Rapid Test Strip (Wondfo Biotech Co. Ltd., Guangzhou, China) has been patterned to identify antibodies of Hepatitis C through the color that showed on the internal strip.

The procedure of the Rapid Test

This test was carried out with the use of blood by finger stick. Fifty microliters (2 drops) of a blood specimen was applied to the center region of the sample pad on the test strip. Thereafter, there was an addition of a drop of buffer solution and allowed for ten minutes before reading the result. During testing,

the blood sample was mixed with the colored Hepatitis C antigens colloidal gold conjugate that was pre-coated on the test sample pad. The mixture then moved on the membrane by capillary action to enable proper reaction with the reagents on the membrane. With the application of Hepatitis C antibodies on the blood sample at the membrane test region, a colored band appeared indicating Hepatitis C positivity. The nonappearance of colored band reveals Hepatitis C infection negativity. There is also the presence of a colored band in the procedural control region as illustrated by Villar *et al.* (2015).

Hepatitis B surface antigen Rapid Test

Principle of Hepatitis B Rapid Test

Like Hepatitis C virus Rapid Test Strip, the Hepatitis B surface antigen (HBsAg) Rapid Test Strip was modeled for the detection of HBsAg in the blood through a color that appeared on the strip. The membrane is reassembled with the anti-HBsAg-antibodies in the test region.

The procedure of Hepatitis B Surface Antigen Rapid Test

The HBsAg Rapid Test was conducted using blood by finger stick. Fifty microliters (2 drops) of a blood specimen was applied to the center region of the sample pad on the test strip. Thereafter, there was an addition of a drop of buffer solution and allowed for ten minutes before reading the result. Like that of the Hepatitis C virus Rapid Test Strip, the blood sample was mixed with the colored Hepatitis C antigens colloidal gold conjugate that was pre-coated on the test sample pad. The mixture then moved on the membrane by capillary action to enable proper reaction with the reagents on the membrane. With the application of Hepatitis C antibodies on the blood sample at the membrane test region, a colored band

appeared indicating Hepatitis C positivity. This also reveals that an effective reaction between the membrane and the blood with wicking occurring. However, the nonappearance of a colored band reveals Hepatitis C infection negativity. There is also the presence of a colored band in the procedural control region.

Statistical analysis

The data collected were subjected to statistical analysis with the level of significance set at $p < 0.05$ using Statistical Package for Social Science software, version 22. Logistic regression models were used to measure the correlation between variables and infection rates. Odds ratios and 95% confidence intervals were calculated. Simple frequencies and percentages were generated for categorical data.

Results

Out of 464 of the consented participants that attended the University Medical Centre within the period of this research, majority 362 (78 %) were students compared with only 102 (22 %) staff of the University (Table 1). Two hundred and four (44 %) participants were in the age range of 18 – 24 years, 180 (38.8%) were within 25 – 34 years, 47 (10.1%) 35 – 44 years, 20 (4.3 %) 45 – 54 years and 13 (2.8%) attendees were 55 years above. This implied that the majority were within 18 – 34 years old. Most of the participants 304 (65.5%) were singles, 147 (31.7%) were married and few were divorced 13 (2.8%). Also, 135 (29.1%) were Christians, 321 (69.2%) Muslims and 8 (1.7%) were Traditionalists. Among the participants, 158 (34.1%) were Hausa by tribe, 139 (30.0 %) Kanuri, 47 (10.1%) Marghi, 46 (9.9%) Yoruba, Fulfulde 19 (4.1%), Babur 14 (3.0 %) while other tribes not specified were 41 (8.8 %).

Table 1: Distribution of social-demographic variables of the participants

Variables	Category	Frequency (%)
		N = 464
Status	Staff	102 (22.0)
Gender	Student	362 (78.0)
	Female	227 (48.9)
Age	Male	237 (51.1)
	18 – 24	204 (44.0)
	25 – 34	180 (38.8)
	35 – 44	47 (10.1)
	45 – 54	20 (4.3)
	55 Above	13 (2.8)
Marital Status	Divorced	13 (2.8)
	Married	147 (31.7)
Religion	Single	304 (65.5)
	Christian	135 (29.1)
	Islam	321 (69.2)

Tribe	Others	8 (1.7)
	Hausa	158 (34.1)
	Kanuri	139 (30.0)
	Marghi	47 (10.1)
	Yoruba	46 (9.9)
	Fulfulde	19 (4.1)
	Babur	14 (3.0)
	Others	41 (8.8)

Out of 368 participants that had the negative status of Hepatitis B infection, 85 (23.1%) were staff while 283 (76.9%) were students (Table 2). Among the 96 (20.7%) participants who had the positive status of Hepatitis B virus, 17 (17.7%) were staff and 79 (82.3%) were students. Furthermore, 453 (97.6%) participants were found not having Hepatitis C, of which 100 (22.1%) were staff and 353 (77.9%) were students. Also, 11 (2.4%) participants that were positive with Hepatitis C, 2 (18.2%) were staff and 9 (81.8%) were students.

Table 2: Distribution of viral Hepatitis B and C infections among students and staff

Variables	Responses	Respondents status		Total
		Staff	Student	
Hepatitis B virus	Negative	85 (83.3%)	283 (78.2%)	368 (79.3%)
	Positive	17 (16.7%)	79 (21.8%)	96 (20.7%)
Total		102 (100.0%)	362 (100.0%)	464 (100.0%)
Hepatitis C virus	Negative	100 (98.0%)	353 (97.5%)	453 (97.6%)
	Positive	2 (2.0%)	9 (2.5%)	11 (2.4%)
Total		102 (100.0%)	362 (100.0%)	464 (100.0%)

Table 3 shows that the seroprevalence rate of Hepatitis B infection among the subjects studied was 20.7%, as found in ninety-six infected participants, while 2.4% prevalence rate was obtained for eleven participants that contracted Hepatitis C infection. Only one (0.2%) of the participant had co-infection of viral Hepatitis B and C. This result revealed that the prevalence of Hepatitis B infection is higher among the staff and students than Hepatitis C virus infection.

Table 3: Prevalence of Hepatitis B and C virus infections among staff and students

Hepatitis B virus infection	No of staff and students	Percentage (%)
Non-infected subjects	356	76.7
Infected with Hepatitis B	96	20.7
Hepatitis C virus infection		
Infected with Hepatitis C	11	2.4
Co-infection with Hepatitis B and C	1	0.2

Table 4 shows a few participants 65 (14.0%) that smoke cigarette while 49 (10.6%) consumed alcohol. Sixty-two (13.4%) of the participants had a tattoo on their body and 102 (22.0%) have their ear or body pierced. One hundred and seventy-five (37.7%) students used injectable illicit drugs. About one-fifth of the participants 89 (19.2%) had undergone a blood transfusion. Fifty-six (12.1%) had multiple sexual partners while some shared toothbrushes 51 (11.0%) and utensils 124 (26.7%). Seventy-nine (17.0%), 32 (6.9%) and 106 (22.9%) of the participants had shared sharp objects, been operated on and had worked in the medical field with exposure to blood, respectively.

Table 4: Distribution of behavioral factors among the participants

Variables	Responses	N = 464 (%)
Ever work in the medical field	No	358 (77.1)
	Yes	106 (22.9)
Drinking alcohol	No	415 (89.4)
	Yes	49 (10.6)
Body tattoo	No	402 (86.6)
	Yes	62 (13.4)
Body/ ear piercing	No	362 (78.0)
	Yes	102 (22.0)
Illicit drug use	No	289 (62.3)
	Yes	175 (37.7)
History of blood transfusion	No	375 (80.8)
	Yes	89 (19.2)
Multiple sexual partners	No	408 (87.9)
	Yes	56 (12.1)
Receipt of organ transplant	No	432 (93.1)
	Yes	32 (6.9)
Sharing of sharp objects	No	385 (83.0)
	Yes	79 (17.0)
Sharing of utensils	No	340 (73.3)
	Yes	124 (26.7)
Sharing toothbrush	No	413 (89.0)
	Yes	51 (11.0)
Smoking cigarette	No	399 (86.0)
	Yes	65 (14.0)

Multivariate regression analysis of factors associated with Hepatitis B infection

Table 5 reveals that smoking cigarette, drinking alcohol, body tattoo, body/ear piercing, illicit drug use, history of blood transfusion, sharing of the toothbrush, sharing of utensils, sharing of sharp object, receipt of organ transplant and medical experience were found to have no significant contribution to the prevalence of Hepatitis B infection. These indicated that these independent variables were not important in predicting Hepatitis B infection among the University of Maiduguri community. However, the only strongest predictor that was significantly associated with Hepatitis B infection was multiple sex partners.

Table 5: Logistic regression analysis for predictors of behavioral factors for Hepatitis B virus infection

Variable	B	p-value	Odds ratio	95.0% C. I.	
				Lower	Upper
Smoking cigarettes	-0.241	0.611	0.786	0.311	1.987
Drinking alcohol	-0.123	0.843	0.884	0.261	2.997
Body tattoo	0.181	0.694	1.198	0.488	2.943
Body/Ear piercing	-0.437	0.145	0.646	0.359	1.163
Illicit drug use	0.322	0.248	1.379	0.799	2.381
History blood transfusion	0.276	0.437	1.317	0.657	2.641
Multiple sex partners	0.350	0.037*	1.419	0.530	3.802
Sharing of toothbrush	-0.306	0.506	0.737	0.299	1.814
Sharing of utensils	0.184	0.523	1.202	0.683	2.116
Sharing of sharp object	0.146	0.708	1.157	0.540	2.478
Receipt of organ transplant	0.071	0.905	1.073	0.336	3.424
Medical experience	-0.062	0.842	0.940	0.511	1.728

*Statistically Significant at $p < 0.05$; C. I. = Confidence Interval

The Logistic regression analysis of the dependent variable (Hepatitis B virus infection) and the independent variables (socio-demographic variables) revealed that the marital status of the participants was only associated with Hepatitis B virus positivity at $P < 0.05$ (Table 6).

Table 6: Logistic regression model of social-demographic factors associated with Hepatitis B virus infection

Variables	B	p-value	Odds ratio	95% C. I	
				Lower	Upper
Participants 'Status	-0.640	0.090	1.061	0.903	3.446
Marital Status	0.458	0.042*	1.211	0.561	2.486
Religion	-0.406	0.715	1.559	0.419	4.964

*Statistically Significant at $p < 0.05$; C. I. = Confidence Interval

Table 7 indicates that multiple sex partners, drinking of alcohol, body tattoo, body/ear piercing, illicit drug use, history of blood transfusion, sharing of the toothbrush, sharing of utensils, sharing of sharp object, receipt of organ transplant and medical experience have no significant contribution to the prevalence of Hepatitis C virus infection. These independent variables were not important in predicting Hepatitis virus C infection among staff and students of the University of Maiduguri. However, the strongest predictor of having Hepatitis virus C was the smoking of cigarettes ($p < 0.003$).

Table 7: Logistic regression analysis for predictors of behavioral factors for Hepatitis C virus Infection

Variable	B	p-value	Odds Ratio	95.0% C.I.	
				Lower	Upper
Smoking cigarettes	0.727	0.003*	2.070	0.067	63.715
Drinking alcohol	-2.389	0.196	0.092	0.002	3.428
Body tattoo	0.058	0.971	1.060	.046	24.207
Body/Ear piercing	0.631	0.576	1.879	0.206	17.159
Illicit drug use	-0.207	0.785	.813	0.184	3.595
History blood transfusion	0.422	0.709	1.525	0.166	14.012
Multiple sex partners	17.869	0.997	5.7587	0.620	4.283
Sharing of toothbrush	17.361	0.997	3.4677	0.381	5.339
Sharing of utensils	0.085	0.923	1.089	0.194	6.114
Sharing of sharp object	-0.314	0.786	0.731	0.076	7.063
Receipt of organ transplant	16.473	0.998	1.4257	0.392	2.333
Medical experience	0.705	0.531	2.024	.223	18.386
Constant	-54.90	0.995	0.000		

*Statistically Significant at $P < 0.05$; C. I. = Confidence Interval

The Logistic regression analysis of the dependent variable (Hepatitis C virus infection) and the independent variables (socio-demographic variables) revealed that religion of the participants was only associated with Hepatitis C virus positivity (Table 8).

Table 8: Logistic regression analysis for predictors of demographic factors for Hepatitis C Virus Infection

Variable	B	p-value	Odds Ratio	95.0% C. I.	
				Lower	Upper
Student	-0.834	0.459	1.114	0.048	3.944
Gender	0.240	0.716	2.321	0.349	4.630
Marital Status	0.167	0.868	4.614	0.268	5.658
Religion	17.041	0.032*	1.711	0.459	2.722

*Statistically Significant at $p < 0.05$; C. I. = Confidence Interval

Discussion

Viral Hepatitis B and C viruses are deadly asymptomatic infection causing chronic Hepatitis and acute liver diseases (Esan *et al.*, 2014). In this research, most of the community people attending the University of Maiduguri Medical Centre were students. Also, the majority of consented participants were 18 – 24 years old. This result is similar to the study of Olalekan (2015) who reported that most (81.7%) of the clients were in the age group of 20 – 24 years. Furthermore, this study revealed that about one-third of the participants were married and practicing Christianity religion.

In this study, a viral Hepatitis B seroprevalence of 20.7% was observed. This supports the studies of Alo *et al.* (2013) with the Hepatitis B virus rate of 15.5% and the national average prevalence of 20.0% in Nigeria (Adoga *et al.*, 2010). This result was higher when compared to previous studies conducted in Nigeria University communities with Hepatitis B virus seroprevalence of 3.2% (Odusanya *et al.*, 2007), 4.5% (Dawurung *et al.*, 2012), 6.1% (Mboto and Edet, 2012), 6.2% (Udeze *et al.*, 2012), 6.2% (Olalekan, 2015) and 12.5% (Aminu *et al.*, 2013). The higher figure observed in this study could be attributed to the University members of staff included which were not in the earlier studies and unawareness of the free Hepatitis B virus vaccine available in the University centre.

The result of Hepatitis C virus seroprevalence in our study (2.2%) was consistent with the findings of Olalekan (2015) with (2.3%) and global prevalence rate of 2-10% in Nigeria (Oshun and Odeghe, 2019). Higher prevalence figures had been reported by Ogunro *et al.* (2007) with 9.2% and Udeze *et al.* (2012) (8.0%). The decline in the trend of Hepatitis C virus infection in the current study population could be the increase in awareness rate and positive attitude of the students and staff in the University community to prevent contracting the infection with the numerous complications associated with the virus. Furthermore, the prevalence rate of 0.2% was found among the studied participants with Hepatitis B and C co-infection. This result is lower

compared with figures reported in the previous studies; 0.7% (Behzadi *et al.*, 2019), 1.6% (Olalekan, 2015), 7.3% (Supram *et al.*, 2015) and the worldwide prevalence of 1–15% (Pol *et al.*, 2017).

Most of the socio-demographic and behavioral independent variables were not significant in predicting Hepatitis C virus infection among the participants. However, the strongest predictors of having Hepatitis C infection were smoking of cigarettes and religion. Nonetheless, the non-significant association of the prevalence of Hepatitis C with some socio-demographic and knowledge factors was observed by Komas *et al.* (2010) and Aminu *et al.* (2013). Although, the results of Olalekan (2015) that, a statistically significant association exists between Hepatitis C and sex and the occurrence of risk factors supported this study. The only strongest predictor that was significantly associated with Hepatitis B was multiple sex partners and marital status. These findings were consistent with that of Olalekan, (2015) who showed a statistically significant association between Hepatitis B and the occurrence of risk factors at $p < 0.05$ and there is no such association with age and sex.

In the current study, the seroprevalence of Hepatitis B was high and multiple sex partners and marital status were the risks associated with the infection. The significantly high seroprevalence of Hepatitis B surface antigen underscores the need to intensify awareness and efforts on the part of the University of Maiduguri Medical Centre on vaccination of the virus among students and staff. Although, Hepatitis C seroprevalence in this studied population was lower than the world's average prevalence rate. This problem can be further reduced with the use of novel direct-acting antiviral drugs.

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Conflict of interest

There are no conflicts of interest.

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