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Prevalence of transfusion transmitted infection among blood donors in Jigawa state, Nigeria

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ABSTRACT

The study was designed to determine seroprevalence of transfusion transmissible diseases (TTD) among blood donors attending general hospitals in Jigawa Nigeria. **Methods:** Four undred blood donors were screened for malaria parasite, hepatitis B viral surface antigen (HBsAg) and hepatitis C virus (HCV). Screening for malaria parasites was done by Microscopic examination of the stained blood slides. HBsAg and HCV were screened using rapid diagnostic test kits. ABO blood group of each donor was determined using a standard haemaglutination test. Donor's information and status were obtained through questionnaire administration. **Results:** The overall prevalence of malaria, HBsAg and HCV among the donors were 16.3%, 11.5% and 3.0% respectively. Blood donors of age group 18-25 years showed the highest prevalence of Malaria Parasites infection. Businessmen and Civil Servants showed the highest prevalence for malaria, HBsAg and HCV. **Conclusion:** Transfusion transmissible infections were recorded in this study; hence advisably all blood donations should be screened for TTI before transfusion. Data used in this study were collected from the cross sectional study. It was analysed using Microsoft excel 2013 and R software.

Introduction

Blood transfusion service (BTS) is an important component of the health care delivery system of any country. An integrated strategy for blood safety is required for elimination of transfusion transmissible infections (TTIs) and for provision of safe and adequate BTSs to the people. Transfusion of blood and blood products is a life-saving method and help quite a number of people worldwide. However, it's also a route for transmitting infection to the recipients [1]. Screening test of blood donors for transfusion transmissible disease will enhance the safety of blood donation. World Health Organization (WHO) recommends that all blood donations should be screened for infections prior to use. Screening for HIV, hepatitis B, hepatitis C, and syphilis should be mandatory.

Every year more than 90 million units of blood are collected worldwide. Each transfusion is associated with risk of transmitting blood-borne pathogens, including mainly human immuno deficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HBV) and syphilis [2]. Africa do not only faces the highest transfusion needs in the world, but also has the highest prevalence of blood-borne pathogens and the weakest transfusion programs. Most blood banks in Africa are small, hospital-based and relying on an important proportion of replacement donors, in contrast with

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western transfusion units which is organized with large pools of voluntary donors [2].

Malaria is a devastating mosquito-borne febrile illness that is predominantly prevalent in the tropical and subtropical regions of the world. The incidence of transfusion-transmitted malaria among people residing in endemic areas is unknown. When malaria is transmitted through blood transfusion to a non-immune recipient, it can progress rapidly and may lead to significant morbidity and mortality, specifically when diagnosis is delayed [3,4]. According to 2020 world malaria report, Nigeria had the highest number of global malaria cases (27% of global malaria cases) in 2019 and accounted for the highest number of death (23% of global malaria deaths) [5].

Hepatitis B is a potentially life-threatening liver infection caused by the HBV [6]. It is a major global health problem and the most serious type of viral hepatitis [7]. In 2019, WHO estimates 296 million (228 - 423 million) people living with chronic hepatitis B virus infection with the prevalence of 3.8% (3.0 - 5.5%) in the general population globally. In African Region, prevalence of hepatitis B infection among the general population in 2019 was 7.5% [8]. In Nigeria, prevalence translates into 20.083 million people who had HBV [9]. The only feasible strategy for the control of the infection in the community is by keeping exposure to blood to a minimum level [10].

Hepatitis C is a global health problem. In 2019, WHO estimates 290,000 (230,000 - 580,000) people dying from hepatitis C-related with the prevalence of 0.8% (0.6 - 1.0%) in the general population. WHO hopes to eliminate hepatitis C by the year 2030. Prevalence of hepatitis C infection among the general population in African Region was 0.8% [8].

Hepatitis B virus and HCV are the two established causes of post transfusion hepatitis. Prevalence of transfusion-transmitted diseases is much lower in healthy voluntary blood donors as compared to professional blood donors [11]. Donors are generally selected according to the blood pressure, temperature, pulse, donation interval for the purpose of having good donors.

The aim of this study was to determine the seroprevalence of three TTIs namely HBV, HCV, and malaria, among blood donors in Jigawa state. This will permit an assessment of the occurrence of infections in the blood donors' population and consequently the safety of the collected donations. It will also give an idea of the prevalence of the TTIs among blood donors which allows for assessment of epidemiology of these infections in the community. All that will help the policy makers in public health to know which TTI has high prevalence for effective action.

Materials and Methods

Study area: The case study was carried out in three different general hospitals in Jigawa State of Nigeria namely; Hadejia general hospital, Gumel general hospital, and Dutse general hospital.

Sample size: Sample size was deduced from the relation: $n= \frac{(z^2)P(1-P)}{d^2}$

n= sample size

Z= standard distribution at 95% confidence interval= 1.96

P= study on past review 51.1%

d = allowable error taken as 0.05 [12]

$n =1.96^2$ x0.5 x(100-51.1)

n = 373

373 + 5% attrition= 373 x 5 = 392/100

The minimum sample sizes were 392 rounded up to 400

Donors' consent: Before sample collection, donors were briefed about the objective and significance of the study in order to obtain verbal consent and signed to avoid misunderstanding. All documents were kept confidential

Sampling techniques: Venous blood samples were collected from donors according to the standard procedures described by [12].

ABO blood grouping of donors

Haemagglutination procedure described by **Cheesbrough** [13] was employed to group the donors based on ABO blood group. A drop of three different antisera; A, B, and O was made on a clean tile, then a drop of the donor's blood were added to each antisera. The mixture were evenly mix with spreader then roaked to observe for agglutination

Detection of malaria parasite

Thick blood film procedure was employed to detect the presence of malaria parasite microscopically as described by **Cheesbrough** [13].

Detection of hepatitis B surface antigen (HBsAg)

A rapid test kit (LabACON) for the qualitative detection of HBsAg in plasma was used. The test was carried out by ensuring that specimen and test kits were brought to room temperature prior to testing. Foil wrapped pouch was opened and the

cassette was removed. The cassette was placed on a flat, clean surface. Using a dropper provided 3 drops of the plasma (approximately 75µl), was transferred to the sample well on the cassette. During testing the mixture migrates laterally on the membrane chromatographically by capillary action. The membrane is pre-coated with the HBsAg on the test line region of the strip. During testing if HBsAg is present in the specimen, it will compete with the particle coated HBsAg antibody for limited amount of HBsAg on the membrane. No line will form in the test region in absent of the antigen. And a visible coloured line will form in the test region if there is HBsAg in the specimen because all the antibody coated particles will be captured by the antigen coated in the test line region. To serve as a procedural control, a coloured line will always appear in the control line region indicating that proper volume of specimen has been added and membrane wicking has occurred. Result was read at 15 minutes.

Detection of hepatitis C virus

A rapid test kit (LabACON) for the qualitative detection of HCV antibody in plasma was used. The test was carried out by ensuring that specimen and test kits were brought to room temperature prior to testing. Foil wrapped pouch was opened and the cassette was removed. The cassette was placed on a flat, clean surface. Using a dropper provided 3 drops of the plasma (approximately 75µl), was transferred to the sample well on the cassette. During testing the mixture migrates laterally on the membrane chromatographically by capillary action. The membrane is pre-coated with the HCV on the test line region of the strip. During testing if HCV antibodies are present in the specimen, it will compete with the particle coated recombinant HCV antigen for limited amount of HCV on the membrane. No line will form in the test region in absent of the antibodies. And a visible coloured line will form in the test region if there is HCV in the specimen because all the antigen coated particles will be captured by the antibodies coated in the test line region. To serve as a procedural control, a coloured line will always appear in the control line region indicating that proper volume of specimen has been added and membrane wicking has occurred. Result was read at 15 minutes.

Results

A total of 400 donors were selected according to their blood pressure, temperature, Pulse, their blood samples were screened during the study. **Table 1** showed the socio-demographic status (obtained through questionnaire administered to the donors) of blood donors in Jigawa state. The highest attendance recorded were donors with blood group O^+ accounting up to 59.0% of total attendance, the least blood group recorded was blood group O^-. Blood group O^+ donors are more infected with HBsAg with prevalence of 12.7%, while HBsAg was not recorded among donors of blood group AB^+, A^+ and O^+. Donor with blood group O^- showed high prevalence to HCV with prevalent rate of 12.5%, whereas blood group AB^+ and A^- records no prevalence of HCV among the blood donors in this study. Blood group O^+ donor showed prevalence of 16.5% to malaria infection, whereas blood group O^- donors record no prevalent according to the this study, as shown in **table (2)**.

The socio-socio-demographic characteristic of the study subject show that the highest blood donation age category was between 26-33 years which account to 34.0% donors closely followed is age category 18-25 years with 32.8% of total donors.

Donors whose means of livelihood is business recorded the highest attendance of 33.7%. Farmers are the least blood donors with attendance rate of 18.5%. Civil servants are the most infected with HBsAg with prevalence rate of 23.4%, blood donors with farming as their means of livelihood (farmers) are found to be least affected with HBsAg with prevalence rate of 10.8% base on this study. Only 4.4% of the blood donors that are Businessmen are infected with HCV resulting in being the highest prevalence based on socio-demographic status. Students are the least infected with HCV based on this study as they account for only 1.1% prevalence rate. Civil servants showed high prevalence to malaria infection in this study with prevalence rate of 24.7% the least infected with malaria based on socio-demographic study are the businessmen with prevalence rate of 9.6% as shown in **table (3)**.

In relationship to age range of donors, age range 26-33 years recorded the highest attendance of 34%. The least in attendance are those donors of age range 50-57 years which account to 0.5%. Age group 18-25 years are most infected with HBsAg in this study, while age group 50-57 years are the least with no record of HBsAg infection. Hepatitis C virus infection is more prominent among age group 26-33 years. Age groups 42-49 years and 50-59 years have no record of HCV infection in this study. Malaria infection was found to be high among age

group 18-25 years in this study whereas age group 42-49 years and 50-59 years are the least infected with no record of malaria infection, as shown in **table (4)**.

Table 1. Shows the socio-demographic status of blood donors in Jigawa state.

Factor	**Number examined**	**Frequency (%)**
Male	400	
Female	0	
Age group		
18-25	128	32
26-33	136	34
34-41	115	28.8
42-49	19	4.8
50-57	2	0.5
Total	400	
Blood group		
A^+	80	(20.0)
B+	68	(17.0)
AB^+	6	(1.5)
O^+	236	(59.0)
A^-	2	(0.5)
O^-	8	(2.0)
Total	400	
Occupation		
Farmers	74	(18.5)
Students	94	(23.5)
Business	135	(33.7)
Civil servant	97	(24.3)

Table 2. Prevalence of HBsAg, HCV and malaria in relation to blood group among blood donors attended blood bank H.G.H, D.G.H and G.G.H in Jigawa state.

Blood group		**HBsAg**	**HCV**	**Malaria**
	No. Examined (%)	No. Infected (%)	No. Infected (%)	No. Infected (%)
A+	80(20.0)	10(12.5)	3(3.7)	13(16.2)
B+	68(17.0)	6(8.8)	1(1.5)	11(16.1)
AB+	6(1.5)	0(0.0)	0(0.0)	2(33.3)
O+	236(59.0)	30(12.7)	7(3.0)	39(16.5)
A-	2(0.5)	0(0.0)	0(0.0)	1(50.0)
O-	8(2.0)	0(0.0)	1(12.5)	0(0.0)
Total	400(100)	46(11.5)	12(3.0)	66(16.5)

KEYS: HCV= Hepatitis C virus, H.G.H= Hadejia general hospital, D.G.H= Dutse general hospital, G.G.H= Gumel general hospital

Table 3. Prevalence of HBsAg, HCV and malaria based on socio-socio-demographic data among blood donors attended blood bank H.G.H, D.G.H and G.G.H in Jigawa state.

Occupation		HBsAg	HCV	Malaria
	No. Examined (%)	No. Infected (%)	No. Infected (%)	No. Infected (%)
Student	94(23.5)	10(10.6)	1(1.1)	18(19.1)
Civil servant	97(24.3)	11(23.4)	3(3.0)	24(24.7)
Business	135(33.7)	17(12.5)	6(4.4)	13(9.6)
Farmer	74(18.5)	8(10.8)	2(2.8)	11(14.8)
Total	**400(100)**	**46(11.5)**	**12(3.0)**	**66(16.5)**

KEYS: HCV= Hepatitis C virus, H.G.H= Hadejia general hospital, D.G.H= Dutse general hospital, G.G.H= Gumel general hospital

Table 4. Prevalence of HBsAg, HCV and malaria in relation to age group among blood donors attended blood bank H.G.H, D.G.H and G.G.H in Jigawa state.

Age group		HBsAg	HCV	Malaria
	No. Examined (%)	No. Infected (%)	No. Infected (%)	No. Infected (%)
18-25	128 (32.0)	19 (14.8)	4 (3.1)	29(22.6)
26-33	136 (34.0)	12 (8.8)	6 (4.4)	19(14.0)
34-41	115 (28.7)	13 (11.3)	2 (1.7)	18(15.6)
42-49	19 (4.7)	2 (10.5)	0 (0.0)	0(0.0)
50-59	2 (0.5)	0 (0.0)	0 (0.0)	0(0.0)
Total	400 (100)	46 (11.5)	12 (3.0)	66(51.9)

KEYS: HCV= Hepatitis C virus, H.G.H= Hadejia general hospital, D.G.H= Dutse general hospital, G.G.H= Gumel general hospital

Discussion

The seroprevalence rate of malaria 47.5% recorded in the study showed that it is still a major health challenge in Nigeria. This prevalence rate is similar to that observed in other parts of Nigeria with prevalence rate ranging from 51.5% to 77.4% prevalence of malaria parasite among blood donors [12, 14]. The high prevalence rate is probably due to the fact that malaria being endemic in Nigeria has a stable and intensive transmission in the country. The high infection occurred among age group 18-25 years. High socio-activities among this age group could be the reason for the high infection among the age group. The result is similar to that recorded by [15]. Majority of infected donors are less than 30 years of age, a similar observation was recorded by [16].

Blood group O^+ donors were found to be more infected with malaria. [17] suggested that people with blood group O^+ have higher burden of malaria parasites and engage much more frequently in repeated blood donation than donors of other blood group. Blood group O^+ was dominant blood group in the study which is similar with studied reported by [18]. In this study the prevalence of HBsAg infection among blood donors was 11.5% which concur with the findings of [19]. Prevalence of 10.3% was recorded by [20] which is less than the findings of this study. Similar studies conducted by [21,22] recorded higher prevalence which contradicts the findings of this study.

The 3.0% prevalence of HCV recorded in this study tally with result obtained by [23] which reported prevalence of 4.3%. In contrast the result

obtained is lower than the report by [24] which reported a prevalence of 14.9% in Enugu, Nigeria. The result is also lower than the result obtained by [15] who recorded a prevalence of 5.2%.

Business and civil servant based on socio-socio-demographic character have the highest prevalence of TTIs. Moreover, the incidence of malaria parasites in blood donors requires greater concern particularly in Jigawa state blood transfusion services.

Conclusion

Transfusion transmissible infections were recorded in this study; hence all blood donations should be screened for TTI before transfusion to recipients. This is to ensure the safety of blood donated transfused. Donor's selection criteria should be enforced and the use of sensitive/selective testing kits and procedures by qualified practitioners should be enforced to minimized TTI.

Ethical Approval: Ethical clearance with number; DGH/SUB/GEN/25/SMT/VOLII,HGH/GEN/626/11/23, GHG/GEN/240/1/100 were obtained from ethical committee of the three hospitals.

Conflict of interest: None.

Financial disclosure: None.

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