Studies on the infections of Malaria, Human Immunodeficiency Virus and Hepatitis B Virus among Secondary School Students in Enugu West

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***Abstract*- Background**: *Plasmodium falciparum*, the causative agent of the deadliest form of malaria, human immunodeficiency virus types-1&2 (HIV-1&2) are among the most important agents causing health problems worldwide while hepatitis B virus (HBV) is one of the most important infectious agents causing acute and chronic morbidity worldwide. **Objective**: Studies on the infections of malaria, human immunodeficiency virus and hepatitis B virus among Secondary School Students in Enugu West was investigated. **Materials and Methods:** A total of 1500 blood specimens were collected and assayed for Hepatitis B (HBsAg) by commercial enzyme-linked immunosorbent assay kits, the Nigerian National HIV testing algorithm recommended by WHO for resource – poor countries was used for HIV and malaria using CareStart malaria HRP2 and Giemsa staining of thick blood film. **Result:** Out of the 518 males screened, 22(4.3%) were positive to malaria parasite, 14(2.7%) to Hepatitis B Virus (HBV) and 0(0) to HIV. In females, 3(0.3%) were positive to HIV, 41(4.2%) to MP and 22(2.2%) to HBV out of the 982 females screened. The age group of 21-25 years was more prevalent to the infections of HIV+, MP+, and HBV+ than any other age group. In males, 4(12.1%) were positive to MP and 2(6.1%) to HBV, while in females, 3(9.1%) were positive to HIV, 2(6.1%) to MP and 1(3.0%) to HBV. Agwu LGA 3(1.0%) were positive to HIV and none 0(0.0) to Aninri, Ezeagu, Ojiriver and Udi. In Ezeagu and Ojiriver LGA 15(5.0%) subjects were positive to MP respectively, this was followed by Agwu and Udi LGA 12(4.0%) and the least was Aninri in which 9(3.0%) were positive to MP. HBV was more in Agwu, Ezeagu and Ojiriver, 9(3.0%) respectively. The values among the age group was significantly different at $p<0.05$. **Conclusion/Recommendation:** It is important to note that while these rates may be suggesting low endemicity, there is need to appreciate their public health implication considering the high rate of urbanization that the state is currently experiencing. This calls for public health alertness, proper sexual awareness and sex education among our Secondary Schools.

***Index Terms*-** Malaria**,** Human Immunodeficiency Virus, Hepatitis B Virus and Students

I. INTRODUCTION

Plasmodium falciparum, the causative agent of the deadliest form of malaria, and human immunodeficiency virus types-1&2 (HIV-1&2) are among the most important agents causing health problems worldwide while Hepatitis implies injury to the liver characterized by presence of inflammatory cell in the liver tissue. It can be both acute and chronic. Hepatitis B Virus (HBV) is one of the most important infectious agents causing acute and chronic morbidity worldwide (Ekeleme *et al*., 2014).

Malaria, HIV/AIDS and Hepatitis B Virus (HBV) are among the most devastating diseases in many low-income countries, particularly in sub-Saharan Africa (Lundqvist *et al*., 2010).

In Nigeria, malaria is one of the most health problems top ranking in the list of common infectious diseases and three quarter of the total land mass of the country is regarded as malarious and about 68% of the total population is at risk of malaria infection (Omalu *et al*., 2012). Nowadays, malaria, HIV and HBV are the three most important infectious diseases and have similar global distributions, with the majority of those infected individuals living in poor countries like sub-Saharan Africa, the Indian subcontinent, and Southeast Asia (Omalu *et al*., 2012).

Malaria infection is initiated by the transmission of 5-50 sporozoites to the host by the bite of an infected female Anopheles mosquitoes. Some sporozite will enter the blood stream, reaching the liver. They will invade and then multiply within hepatocytes. Upon maturity, merozites are released back into the bloodstream and invade red blood cell (RBC). After multiplication, new merozites will be formed and will reinvade red blood cell. During the cycle, sexual forms of the parasite are generated and consequently taken up by mosquitoes during feeding. This sexual form will mate and carry on further parasite development in the mosquito mid gut forming new sporozites. The pre-erythrocytic stage of infection which lasts between 5 and 14 days, depending on the human *Plasmodium* species is asymptomatic. The blood stages which are associated with clinical disease can last up to a year with *P. falciparum* infection and close 50 years with *P. malariae*, if not treated. A malarial attack is characterized by recurrent peak of fever during the acute

phase and can be associated with diverse range of syndrome, including severe malaria anemia, metabolic acidosis and shock syndrome (Hochman and Kami, 2009). It has been proposed that these syndrome result from differential parasite specificity (for example organ-specific sequestration) of parasite, Infected Red Blood Cell (iRBC), parasite toxins and the host immune response, (including cytokine and chemokine production and recruitment and sequestration of inflammatory cells to target organs) (Dondorp *et al*., 1999).

Pattern of malarial disease vary widely and partly depend on the endemicity of the parasite within the geographical setting. Where individuals have constant and repeated exposures to infection, natural immunity develops slowly. This immunity is first efficient only against clinical malaria but immunity strengthens progressively, leading to reduced blood stage parasite growth. However, even long term immunity can never completely counter either re-infection or low (subclinical) parasitaemia. This suggests that the pre-erythrocytic stage of the infection does not induce efficient natural immune responses (Hochman and Kami, 2009).

Although the mechanism of how natural immunity develops in malaria are not completely understood, recent studies suggest that the control and inhibition of the development of malaria parasite in the blood requires the activation of an innate pathway followed by adequate T and B cell responses. Innate mechanism of immunity involves dendritic and NK cell activation, pro-inflammatory cytokine release and the production of counter regulatory cytokine that can influence the first phase of blood development (Abebe *et al*., 2013).

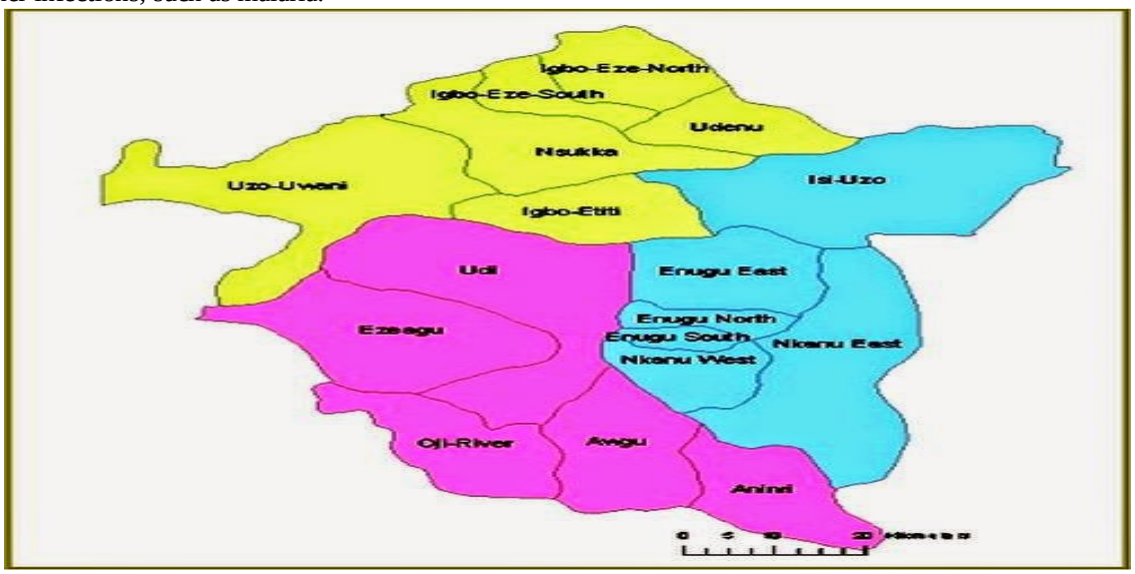
HIV infects and depletes CD4+ T lymphocytes, putting patients at risk of opportunistic infections and malignancy, the major causes of death due to HIV and AIDS. However, it also has effects on the systemic inflammatory response, causing activation and/or apoptosis in a variety of immune cells as well as elevated levels of proinflammatory cytokines and chemokines in plasma and lymph nodes. This immune activation, rather than being a reflection of antiviral immunity, is associated with HIV-1 disease progression (Hochman and Kami, 2009). It is also a potential means by which HIV affects disease course and outcome in other infections, such as malaria.

Hepatitis implies injury to the liver characterized by presence of inflammatory cell in the liver tissue. It can be both acute and chronic. It is acute if it lasts less than 6 months and chronic when it persists longer. It runs subclinical cases when the affected person may not feel ill. The patient becomes unwell and symptomatic when the disease impairs liver functions including secreting of harmful substances, regulation of blood composition and production of bile to help digestion (Riders and Beckingham, 2001). Currently, eleven virus are recognized as causing Hepatitis. Two are herpes viruses and nine are Hepato-tropic viruses that specifically target liver hepatocytes. Of the nine human hepato tropic viruses only five are well characterized. Hepatitis G and Transfusion Transmitted viruses (TTV) are more recently discovered viruses. Hepatitis A and E are transmitted by oral contamination. The other major types include hepatitis B. Hepatitis C and hepatitis D (Etusim *et al*., 2013). Hepatitis B virus infects the liver of hominoids including human and causes an inflammation called Hepatitis. It is a DNA virus and of many unrelated virus that cause viral Hepatitis (Etusim *et al*., 2013). This work is aimed at studying the infections of Malaria, Human Immunodeficiency Virus and Hepatitis B Virus among Secondary School Students in Enugu west.

II. MATERIALS AND METHODS

Study Area

This study was carried out at the General Hospitals in Enugu West. **Enugu West district**: The constituency is made up of five Local Government Areas namely, Aninri, Awgu, Ezeagu, Oji-River, and Udi Local Government Area. Aninri Local Government Area has an area of 364 km² and a population of 133,723. Awgu Local Government Area has a population of 390,68. Ezeagu Local Government Area has an area of 633 km² and a population of 169,718. Oji River Local Government Area has an area of 403 km² and a population of 126,587. Udi Local Government Area has an area of 897 km² and a population of 234,002.



Map of Enugu State showing the Local Government Areas

Ethical Clearance

Prior to the commencement of the study, ethical clearance was sought by writing from the Chief Medical Director (CMD) of General Hospitals in Enugu West. This was done in writing explaining the purpose of the study and seeking for permission to use the health facilities as well as the co-operation of their staff. On receiving approval, officers in charge of the Laboratory section were also consulted. The following General Hospitals was used (Aninri, Awgu, Ezeagu, Oji-River, and Udi).

Subjects

The population of Enugu West is predominantly traders while some are public servant, artisans, farmers, and students. Students between 11-15, 16-20 and 21-25 years of age were given special considerations.

Sample Size

An estimated 1500 subjects formed the population size in which 300 subjects were collected from each of the five Local Governments,100 subjects from each of the three Secondary Schools from each LGA. The following Schools were sampled: In Awgu LGA, Boys Secondary School, Mgbowo; Alpha Secondary School, Awgu; Girls Secondary School, Mmaku. Aninri LGA, Community Secondary School Oduma; Community Secondary School, Mpu; Comprehensive Secondary School. Ezeagu LGA, Community Secondary School Akama Oghe; Community Secondary School, Owa; Comprehensive Secondary School, Iwollo. Oji-River LGA, Model Secondary School Inyi; Urban Secondary School Oji river; Anglican Grammer School, Achi. Udi LGA, Paul Secondary School Eke; Community Secondary School Ngwo; Community Secondary School, Amaokwe, Udi.

Collection of Specimens

The method of specimen collection employed was venopuncture technique as described by Cheesbrough (2006). A tube tourniquet was used to tie the upper arm of the patient to enable the veins to be bulge. The skin was cleaned with ethanol and allowed to dry. New sterile syringe and needle was used to puncture the vein and the plunger was gently withdrawn. Ten milliliters of venous blood was collected. The blood specimens were used for

1. HIV screening based on Nigerian National HIV testing algorithm
2. Malaria screening using test kit and staining method
3. Hepatitis B virus screening using test kit

Experiment 1: **Prevalence of HIV among the subjects.**

Procedure: The Nigerian National HIV testing algorithm recommended by WHO for resource – poor countries was used. It is a serial testing using 3 rapid test kits (RTKs) namely Determine, (Inverness, Japan), UniGold (Trinity, Ireland) and StatPak (Chembo diagnostic system).

General Principle of RTK: It is an immunochromatographic test for the qualitative detection of antibodies to HIV – 1 and HIV – 2. Specimen is added to the specimen pad. As the specimen migrates through the conjugate pad, it reconstitute and mixes with selenium colloid-antigen conjugate. This mixture continues to migrate through the solid phase to the immobilized recombinant antigens and synthetic peptides at the patient's window site. If antibodies to HIV – 1 and/or HIV – 2 are present in the specimen, the antibodies bind to the antigen – selenium colloid and to the antigen at the patient's window, forming a red line at the patient's window site. If antibodies to HIV – 1 and/or HIV – 2 are absent, the antigen – selenium colloid flows past the patient's window and no red line is formed at the patient's window site. To ensure validity, a procedural colour bar is incorporated in the assay device.

Expected Result: Two red bars in both the patient's window and control indicated a positive result. One red bar in the control window and no red bar in the patients represent a negative result. An invalid test occurs when a red bar develops at the patient window only and none at the control window.

Experiment 2: Prevalence of HBV among the subjects

Procedure: The blood that was collected was placed in a test tube and allowed to coagulate to obtain serum. The test card was placed on a smooth, horizontal clean surface with sticky parts removed to expose the sticky part. The test strip was dipped into the serum for 10 seconds without exceeding the maximum line on the test strip, then they were then read after 15minutes.

Expected Result: Two red bars in both the patient's region and control region indicate a positive result. One red bar in the control region and no red bar in the patient's region represent a negative result. When only one line appears on the control(c) region only, or one line appears on the test region and non on the control region(c) and also when no line appear on the test (T) and control(c), the result is said to be invalid.

Experiment 3: To study the distribution of malaria among the subjects using CareStart malaria HRP2

Whole blood was used for the diagnosis of malaria using parallel Malaria *Plasmodium falciparum* Rapid Test Device (manufactured by Global device, USA and INDR Diagnostica, USA). The malaria P.f. Rapid Test Device (Whole Blood) is a qualitative, membrane based immunoassay for the detection of P.f antigen in whole blood.

Principle: The principle is based on a rapid chromatographic immunoassay for the qualitative detection of circulating *P. falciparum* antigen in the whole blood. This method utilizes Gold conjugate to selectively detect *Plasmodium* antigen.

Procedure: The procedure was as described by the manufacturer. About 5µl of whole blood was added into sample well by using a pipette and 2 drops of assay buffer were added into assay buffer well. The result was read within 20 minutes.

Expected Result: The presence of two pink lines at the region of the control and test sample signified presence of *P. falciparum* malaria infection while the presence of only one pink line in the control region signified absence of *P. falciparum.* The test device has inherent quality control that validates the result.

Experiment 4: To study the distribution of malaria among the subjects using Giemsa staining of thick blood film

The method described by Etusim *et al*. (2013) and Onuigbo *et al.* (2015) were used. A thick blood film was made on a grease free slide. Giemsa stain was poured on the film and allowed to stay for 30 minutes on the staining rack; the stain was then washed off with running water. Finally, a drop of oil immersion was dropped on the stain and viewed through the objective lens (x100), when the slide had dried.

III. STATISTICAL ANALYSES

Data generated from this study was analyzed using IBM SPSS version 10.0 statistical software. The degree of correlation between variables was evaluated by using the Spearman correlation analysis method. For all the statistical tests, a two-tailed p-value < 0.05 was considered statistically significant.

IV. RESULTS

A total of 1500 blood specimens were collected from Secondary School Students in Enugu West and screened for Infections of Hepatitis B Virus (HBV), Malaria parasite (MP) and Human Immunodeficiency Virus (HIV). The result revealed that a total of 102 (6.8%) students were positive to all the infections, while malaria parasite was the most prevalent in the study population 63(4.2%), followed by hepatitis B virus 36(2.4%) and the least infection was HIV 3(0.2%), when compared, it was statistically significant at p>0.05 (Table 1).

The age and gender distribution of MP+, HIV+ and HBV+ among the study population revealed that the age group of 21-25 years was the most prevalent to the infections (In males, 4(12.1%) were positive to MP, 0(0.0%) to HIV and 2(6.1%) to HBV, while in females, 2(6.1%) to MP, 3(9.1%) were positive to HIV, and 1(3.0%) to HBV). The least was the age group of 11-15 years, In males, 3(1.2%) to MP, 0(0.0%) to HIV and 3(1.2%) to HBV, while in females, 6(2.4%) to MP, 0(0.0%) to HIV and HBV, respectively. p<0.05 differed significantly when compared among the age groups and other values are found in table 2.

Distribution of malaria, HIV and HBV according to Local Government Area (LGA) in Enugu West Senatorial Zone revealed that Ezeagu and Oji-river LGA were the most infected to malaria at a prevalent rate of 15(5.0%), respectively, this was followed by Agwu and Udi LGA, 12(4.0%) respectively and the least was Aninri LGA 9(3.0%), which differed significantly at P <0.05. In Agwu LGA, 3(1.0%) was positive to HIV and none 0(0.0%) to Aninri, Ezeagu, Ojiriver and Udi. In The distribution of HBV was most prevalent in Agwu, Ezeagu and Ojiriver, 9(3.0%) respectively, followed by Aninri 6(2.0%) and Udi 3(1.0%). The comparison between the LGA differed significantly at p<0.05 (Table 3).

The distribution of the infections according to Secondary Schools in Agwu LGA revealed that (B) Alpha Secondary School, Agwu was the most infected to malaria 5(5.0%), followed by (C) Girls Secondary School, Mmaku 3(3.0%), in females respectively, while the least infected to malaria 2(2.0%) was (A) Boys Secondary School, Mgbowo. HIV 2(2.0%), 1(1.0%) and HBV 4(4.0%), 2(2.0%) was most prevalent in B and C, respectively and it differed significantly at p <0.05 (Table 4).

The distribution of the infections according to Secondary Schools in Aninri LGA revealed that (D) Community Secondary School, Oduma was the most infected to malaria, 2(2.0%) in males and females, respectively, followed by (E) Community Secondary School, Mpu, 2(2.0%) to HBV in females while the least was (F) Comprehensive Secondary School, Ndeabor, 1(1.0%) to malaria. it differed significantly at p<0.05 (Table 5).

The distribution of the infections according to Secondary Schools in Ezeagu LGA revealed that (I) Comprehensive Secondary School, Iwollo, Oduma was the most infected to malaria 5(5.0%) in females and 3(3.0%) in males, followed by (G) Community Secondary School, Akama Oghe, 3(3.0%) to HBV in females, and 2(2%) to HBV in males while the least was (H) Community Secondary School, Owa, 1(1.0%) to malaria and 0(0.0%) to HBV. at p <0.05, was considered statistically significant (Table 6).

The distribution of the infections according to Secondary Schools in Oji-river LGA revealed that (J) Model Secondary School Inyi and (K) Urban Secondary School Oji river were the most infected to malaria 4(4.0%) and HBV 3(3.0%) in females, while the least was (L) Anglican Grammer School, Achi, 0(0.0%) to HBV in males and females and was considered statistically significant at p <0.05 (Table 7).

The distribution of the infections according to Secondary Schools in Udi LGA revealed that (O) Community Secondary School, Amaokwe, Udi was the most infected to malaria 5(5.0%) in females and 3(3.0%) in males, followed by (M) St. Paul Secondary School Eke and (N) Community Secondary School Ngwo 2(2.0%) to malaria, respectively. At p<0.05, was considered statistically significant (Table 8).

V. DISCUSSION AND CONCLUSION

Omalu *et al*. (2012) reported that malaria, HIV and HBV are the three most important infectious diseases and have similar global distributions, with the majority of those infected individuals lived in countries with constrained resources like sub-Saharan Africa, the Indian subcontinent, and Southeast Asia.

Though malaria and HIV are known to be the most severe of all infections in Nigeria (Omalu *et al*., 2012). However, this study was done to evaluate the concomitant infections of malaria, human immunodeficiency virus and hepatitis B virus among Secondary School Students particularly in the study area. In this study, the prevalence rate of single infection was found to be 4.2% for malaria, 0.2% for HIV and 2.4% for HBV. It is important to note that while these rates may be suggesting low endemicity, there is need to appreciate their public health implication considering the high rate of urbanization that the state is currently experiencing. This calls for public health alertness and proper screening of blood donations for medical emergency purposes including child-cum-parental closeness. The prevalence rate of hepatitis B infection 14(2.7%) for males and 22(2.2%) for females among the subjects observed in this work contrasts with the results of Ejele *et al*. (2004), who recorded 4.9% prevalent rate in Port Harcourt while Siriena *et al*. (2002) recorded 10.3% in Jos.

The age and gender distribution of malaria, HIV+ and HBV+ among the study population revealed that the age group of 21-25 years was the most prevalent to the infections (In males, 4(12.1%) were positive to MP, 0(0.0%) to HIV and 2(6.1%) to HBV, while in females, 2(6.1%) to MP, 3(9.1%) were positive to HIV, and 1(3.0%) to HBV). The least was the age group of 11-15 years, In males, 3(1.2%) to MP, 0(0.0%) to HIV and 3(1.2%) to HBV, while in females, 6(2.4%) to MP, 0(0.0%) to HIV and HBV, respectively. p<0.05 differed significantly when compared among the age groups, which is similar to the work Uko *et al*. (1998) in Calabar and Etusim *et al*. (2013). This study is also in accordance with Omalu *et al*. (2012), who studied the seroprevalence of malaria and hepatitis B (HBsAg) with

associated risk factors among pregnant women attending antenatal clinic in General Hospital Minna, North-Central Nigeria and obtained similar results.

There were variations in the rate of infection of subjects according to age group revealed that malaria was found to be higher among the age group of 21-25 years (12.1% for males and 6.1% for females), followed by 1.2%, 2.7% and 1.2%, 2.4% for age groups of 16-20yrs and 11-15yrs for males and females, respectively. The highest prevalence of malaria infection among the age group of 21-25yrs could be as a results of parental negligence to the children as they are now grown up or as reported by Omalu *et al*. (2012), who stated that in Nigeria, malaria is one of the most health problems top ranking in the list of common infectious. However, variations in the prevalent of HBV infection also existed among the males and females and various age group, 6.1% and 3.0%, 0.7% and 1.7% and 1.2% and 0.0% for 21-25yrs, 16-20yrs and 11-15yrs, respectively. Surprisely, the prevalence of 9.1% HIV infection among females in the age group of 21-25yrs could be as a result of illicit sexual interactions, lack of proper sexual awareness and lack of sex education among our Secondary Schools.

Distribution of malaria, HIV and HBV according to Local Government Area (LGA) in Enugu West Senatorial Zone revealed that Ezeagu and Oji-river LGA were the most infected to malaria at a prevalent rate of 15(5.0%), respectively, this was followed by Agwu and Udi LGA, 12(4.0%) respectively and the least was Aninri LGA 9(3.0%), which differed significantly at P <0.05. In Agwu LGA, 3(1.0%) was positive to HIV and none 0(0.0%) to Aninri, Ezeagu, Ojiriver and Udi. In The distribution of HBV was most prevalent in Agwu, Ezeagu and Ojiriver, 9(3.0%) respectively, followed by Aninri 6(2.0%) and Udi 3(1.0%). The comparison between the LGA differed significantly at P <0.05. Shankarkumar *et al*. (2011) stated, in areas of stable malaria, transmission is intense and continuous, although seasonal variations may occur. Immunity develops early in life, and young children and pregnant women are at greatest risk of morbidity and mortality from malaria. In these areas, HIV-related immunosuppression may increase rates of malaria infection and clinical malaria disease, but does not increase the rates of severe or complicated malaria as reported by Shankarkumar *et al*. (2011). Relative risk for parasitemia and malarial fever increase with decreasing CD4 count and increasing viral load. These findings suggest that HIV infection not only may interfere with parasite control, but also, perhaps more important, may cause the loss of antitoxic immunity, which protects persons with parasitemia from clinical disease. In regions of unstable malaria, transmission is intermittent and less predictable, and epidemics may occur (Shankarkumar *et al*., 2011).

VI. CONCLUSION

The higher prevalence of malaria infection among the age group of 21-25yrs (12.1% for males and 6.1% for females) and the prevalence of 9.1% HIV infection among females in the age group of 21-25yrs, could be as a results of parental negligence to the children as they are now grown up. The HIV infection could result from illicit sexual interactions, lack of proper sexual awareness and lack of sex education among our Secondary Schools. Therefore, an urgent need to institute public health measures that will reduce disease burdens and transmission among Secondary School students. This may include parental health talks, proper diagnosis, treatment and increased surveillance activities to protect the populations at risk.

Table 1: Gender distribution of the infections among the study population

Gender	Total No of subjects screened	MP+ (%)	HIV+ (%)	HBV+ (%)	Total no infected to all the infections (%)
Males	518	22(4.3)	0(0)	14(2.7)	36(7.0)
Females	982	41(4.2)	3(0.3)	22(2.2)	66(6.7)
Total	1500	63(4.2)	3(0.2)	36(2.4)	102(6.8)

P <0.05, was considered statistically significant.
Key: MP = Malaria Parasite, HIV = Human Immunodeficiency Virus,
HBV = Hepatitis B Virus, + = Positive, - = Negative.

Table 2: Age and Gender distribution of infections among the study population

		MALES			FEMALES		
Age group (Yr)	Total No of subjects screened	MP+ (%)	HIV+ (%)	HBV+ (%)	MP+ (%)	HIV+ (%)	HBV+ (%)
11-15	246	3(1.2)	0(0)	3(1.2)	6(2.4)	0(0)	0(0)

16-20	1221	15(1.2)	0(0)	9(0.7)	33(2.7)	0(0)	21(1.7)
21-25	33	4(12.1)	0(0)	2(6.1)	2(6.1)	3(9.1)	1(3.0)
Total	1500	22(1.5)	0(0)	14(0.9)	41(2.7)	3(0.2)	22(1.5)

P <0.05, was considered statistically significant Key: HBV = Hepatitis B Virus, HIV = Human Immunodeficiency Virus, MP = Malaria Parasite, + = Positive.

Table 3: Distribution of the infections according to LGA in Enugu West Senatorial Zone

LGA	Total no of subjects screened	MP+ (%)	HIV+ (%)	HBV+ (%)	Total no of subjects Positive
Agwu	300	12(4.0)	3(1.0)	9(3.0)	24(8.0)
Aninri	300	9(3.0)	0(0.0)	6(2.0)	15(5.0)
Ezeagu	300	15(5.0)	0(0.0)	9(3.0)	24(8.0)
Ojiriver	300	15(5.0)	0(0.0)	9(3.0)	24(8.0)
Udi	300	12(4.0)	0(0.0)	3(1.0)	15(5.0)
Total	1500	63(4.2)	3(0.2)	36(2.4)	102(6.8)

P <0.05, was considered statistically significant. Key: HBV = Hepatitis B Virus, HIV = Human Immunodeficiency Virus, MP = Malaria Parasite, + = Positive, - = Negative.

Table 4: Distribution of the infections according to Secondary Schools in Awgu LGA

		Males			Females			
Secondary Schools	Total no of subjects screened	MP+ (%)	HIV+ (%)	HBV+ (%)	MP+ (%)	HIV+ (%)	HBV+ (%)	Total no of subjects positive
A	100	2(2.0)	0(0.0)	1(1.0)	ND	ND	ND	3(3.0)
B	100	2(2.0)	0(0.0)	2(2.0)	5(5.0)	2(2.0)	4(4.0)	15(15.0)
C	100	ND	ND	ND	3(3.0)	1(1.0)	2(2.0)	6(6.0)
Total	300	4(1.3)	0(0.0)	3(1.0)	8(2.7)	3(1.0)	6(2.0)	24(8.0)

P <0.05, was considered statistically significant.
Key: A= Boys Secondary School, Mgbowo; B= Alpha Secondary School, Agwu; C= Girls Secondary School, Mmaku; HBV = Hepatitis B Virus, MP = Malaria Parasite, + = Positive ND= Not Determined.

Table 5: Distribution of the infections according to Secondary Schools in Aninri LGA

Secondary Schools	Total no of subjects screened	Males MP+ (%)	HIV+ (%)	HBV+ (%)	Females MP+ (%)	HIV+ (%)	HBV+ (%)	Total no of subjects positive
D	100	2(2.0)	0(0.0)	1(1.0)	2(2.0)	0(0.0)	1(1.0)	6(6.0)
E	100	1(1.0)	0(0.0)	2(2.0)	2(2.0)	0(0.0)	2(2.0)	7(7.0)
F	100	1(1.0)	0(0.0)	0(0.0)	1(1.0)	0(0.0)	0(0.0)	2(2.0)
Total	300	4(1.3)	0(0.0)	3(1.0)	5(1.7)	0(0.0)	3(1.0)	15(5.0)

P <0.05, was considered statistically significant. Key: D = Community Secondary School Oduma; E = Community Secondary School, Mpu; F = Comprehensive Secondary School, Ndeabor; HBV = Hepatitis B Virus, MP = Malaria Parasite, + = Positive.

Table 6: Distribution of the infections according to Secondary Schools in Ezeagu LGA

Secondary Schools	Total no of subjects screened	Males MP+ (%)	HIV+ (%)	HBV+ (%)	Females MP+ (%)	HIV+ (%)	HBV+ (%)	Total no of subjects positive
G	100	1(1.0)	0(0.0)	2(2.0)	3(3.0)	0(0.0)	3(3.0)	9(9.0)
H	100	1(1.0)	0(0.0)	0(0.0)	2(2.0)	0(0.0)	0(0.0)	3(3.0)
I	100	3(3.0)	0(0.0)	1(1.0)	5(5.0)	0(0.0)	3(3.0)	12(12.0)
Total	300	5(1.7)	0(0.0)	3(1.0)	10(3.3)	0(0.0)	6(2.0)	24(8.0)

P <0.05, was considered statistically significant. Key: G= Community Secondary School Akama Oghe; H= Community Secondary School, Owa; I= Comprehensive Secondary School, Iwollo; HBV = Hepatitis B Virus, MP = Malaria Parasite, + = Positive.

Table 7: Distribution of the infections according to Secondary Schools in Oji-river LGA

Secondary Schools	Total no of subjects screened	Males MP+ (%)	HIV+ (%)	HBV+ (%)	Females MP+ (%)	HIV+ (%)	HBV+ (%)	Total no of subjects positive
J	100	2(2.0)	0(0.0)	1(1.0)	4(4.0)	0(0.0)	3(3.0)	10(10.0)
K	100	2(2.0)	0(0.0)	2(2.0)	4(4.0)	0(0.0)	3(3.0)	11(11.0)
L	100	2(2.0)	0(0.0)	0(0.0)	1(1.0)	0(0.0)	0(0.0)	3(3.0)
Total	300	6(2.0)	0(0.0)	3(1.0)	9(3.0)	0(0.0)	6(2.0)	24(8.0)

P <0.05, was considered statistically significant. Key: J= Model Secondary School Inyi; K= Urban Secondary School Oji river; L= Anglican Grammer School, Achi; HBV = Hepatitis B Virus, MP = Malaria Parasite, + = Positive.

Table 8: Distribution of the infections according to Secondary Schools in Udi LGA

Secondary Schools	Total no of subjects screened	Males MP+ (%)	HIV+ (%)	HBV+ (%)	Females MP+ (%)	HIV+ (%)	HBV+ (%)	Total no of subjects positive
M	100	0(0.0)	0(0.0)	0(0.0)	2(2.0)	0(0.0)	0(0.0)	2(2.0)
N	100	0(0.0)	0(0.0)	0(0.0)	2(2.0)	0(0.0)	0(0.0)	2(2.0)
O	100	3(3.0)	0(0.0)	2(2.0)	5(5.0)	0(0.0)	1(1.0)	11(11.0)
Total	300	3(1.0)	0(0.0)	2(0.7)	9(3.0)	0(0.0)	1(0.3)	15(5.0)

P <0.05, was considered statistically significant. Key: M= St. Paul Secondary School Eke; N= Community Secondary School Ngwo; O= Community Secondary School, Amaokwe, Udi; HBV = Hepatitis B Virus, MP = Malaria Parasite, + = Positive.

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