Indexed, Abstracted and Cited: Index Copernicus International (Poland), ISRA Journal Impact Factor, International Impact Factor Services (IIFS), Directory of Research Journals Indexing (DRJI), International Institute of Organized Research and Scientific Indexing Services, Cosmos Science Foundation (South-East Asia), International Innovative Journal Impact Factor, Einstein Institute for Scientific Information {EISI}, Directory of Open Access Scholarly Resources, Science Indexing Library (UAE), Swedish Scientific Publication (Sweden), citefactor.org journals indexing, Directory Indexing of International

World Journal of Biology and Medical Sciences

Published by Society for Advancement of Science®

ISSN 2349-0063 (Online/Electronic)

Volume 6, Issue-2, 67-76, April - June, 2019

Journal Impact Factor: 4.197

WJBMS 06/02/20/2019

A Double Blind Peer Reviewed Journal / Refereed Journal

www.sasjournals.com

wjbmedsc@gmail.com/wjbms.lko@gmail.com

REVIEW ARTICLE

Received: 15/04/2019 Revised: 15/05/2019 Accepted: 16/05/2019

Prevalence, Intensity and Predictors of Urogenital Schistosomiasis among Pregnant Women in Ebonyi State, Nigeria

Imakwu, Cyril Ali Okeke, Obiageli Panth Ukwah, *Boniface Nwofoke and **Amana Gabriel Unekwu

Depatment of Zoology and Environmental Biology, University of Nigeria, Nsukka, Enugu State, Nigeria

***Department of Medical Laboratory Science, Ebonyi State University, Abakaliki, Nigeria**

****Department of Animal and Environmental Biology, Kogi State University, Anyigba Nigeria**

ABSTRACT

This study was conducted to determine Prevalence, intensity and preditors of urinogenital schistosomiasis among pregnant women in Ebonyi State. This Cross-sectional study on urinogenital schistosomiasis among pregnant women in Ebonyi State, Nigeria was carried out from April 2011 to March 2012 from two selected hospitals based on influx of antenatal visits. Urine specimens were collected from the women after brief exercise between 11am to 2 pm. The urine specimens were analysed within 2 hours of collection for Schistosoma haematobium infection. Intensity was graded into light, moderate and severe. Chi-square (χ2) was used to analyse the data generated. Statistical significance was set at P<0.05. Result showed that out of 360 pregnant women sampled, infection rate of 12.5% (45/360) was observed. Highest prevalence was observed among trimester, primigravidae and younger age group between 15-20 years. The study revealed that age is significantly associated with urogenital schistosomiasis. There was high positive significant correlation between prevalence of schistosome eggs in urine and micro- haematuria while on other hand proteinuria showed a negative not significant correlation with prevalence of S. haematobium among pregnant women in Ebonyi State. The findings from this study will be useful in developing specific programme for this special group of women in the society.

Keywords: Prevalence, Intensity, Urogenital Schistosomiasis, Pregnant Women, Ebonyi State and Nigeria.

INTRODUCTION

Human schistosomiasis, also known as bilharziasis due to *Schistosoma haematobium,* is widespread ranking second to malaria in terms of socio-economic and public health significance in the tropical and sub-tropical areas (Eyo *et al.* 2012). It is the most prevalent of the water-borne diseases, with a very great risk on the health of rural population (Hunter, 2005; Ekwunife *et al.* 2009; Eyo *et al.* 2012; Abiola et *al.* 2015). Over 20 million people residing in rural and agricultural area have schistosomiasis exhibiting severe morbidity (Ugbomoiko *et al.* 2010; Ayanda, 2010; Abiola *et al.* 2015). In addition, 500-600 million people are exposed to the infection amidst poverty, ignorance, poor housing, substandard hygienic practice and few if any sanitary facilities (Abiola *et al.* 2015). The annual economic loss from disability and lowered production due to schistosomiasis, according to Gryseels (2005), is about four hundred million pounds sterling globally. In Nigeria, schistosomiasis due to *S. haematobium* and *S. mansoni* are widespread, constituting a public health problem particularly in children (Chidozie and Daniyan, 2008; Uwazuoke *et al.* 2008; Ayanda, 2010; Sowole and Adegbite, 2012; Okwori *et al.* 2014; Abiola et *al.* 2015).

In Africa, four major species of *Schistosoma* are known to cause disease in man, viz: *Schistosoma haematobium* associated with urinary schistosomiasis, *S. mansoni*, *S. japonicum* and *S. intercalatum* which cause intestinal schistosomiasis (Lia, 2009; Samie *et al.* 2010). These are a greater threat to public health because of high prevalence, wide distribution and pathogenicity (Abiola *et al.* 2015). Schistosome species are known to cause substantial clinical disease and can significantly contribute to the overall morbidity and mortality in endemic area. It is responsible for the death of about 200,000 people annually (Gazzineli *et al*. 2006). It has been shown by many authors that *S. haematobium* is responsible for several lesions (Engels and Savioli, 2006; Jourdan, 2013). Among these lesions are calcified bladders, deformity of the ureter and hydronephrotic lesions, which are common among adolescents and children as well as adults (Friedman *et al*. 2010; Aminu *et al*. 2014). The occurrence of significant degree of pathology is related to the intensity of infection and also to the intensity of host response. This is modified in the course of natural infection by other factors including malnutrition and alterations in the metabolic rate of the host. It is often difficult to determine the relative contributions of each of these parasites in lowering the health of an individual or a community. Schistosomiasis is an insidious disease, in as much as it exerts alarming clinical manifestations in exceptional cases; such cases are demonstrated only after heavy exposure of previously unexposed individual. It is known that the lesions caused by the disease build up slowly and the damaging effect on the host is compounded over several years. The immunity of the infected individual is lowered and consequently the victim becomes prone to other diseases (Aminu *et al*. 2014). Inspite of the fact that schistosomiasis is one of the major medical and health problems in many countries. Schistosomiasis is not a reportable disease. It would therefore be advantageous to include schistosomiasis in the list of reportable disease in endemic areas. The objective of study was to ascertain prevalence, intensity and predictors of urogenital schistosomiasis among pregnant women in Ebonyi State, Nigeria.

MATERIALS AND METHODS

Study Area

The study area, Ebonyi State is one of thirty-six states of Nigeria. It is in the South-Eastern part of the country. Ebonyi State is made up of thirteen Local Government Areas. Ebonyi State has a projected population of about 2.3 million and a total land area of about 5935km^2 (National Population Commission, 2007; National Bureau of Statistics, 2006). The State is located between latitudes 5^{0}30^1 North and 6^{0}46^1 North and longitudes 7^{0}30^1 East and 8^{0}30^1 East. Like most parts of Nigeria, it has two main seasons; rainy and dry seasons. The rainy season which is the main farming season commences around late April and could last up to October (Ministry of Environment, Abakaliki 2011). Ebonyi State is located within the rainforest and Guinea savannah zones of Nigeria characterized by high rainfall intensity with high run-off volumes and high relative humidity. The annual rainfall is over 1600 mm while the daily rainfall is over 150 mm. The daily maximum and

minimum temperatures are 32^0C and 25^0C respectively. The dry season commences around November and last up to early April. However, there could be occasional rains in January, February and March. The dry season is punctuated by a brief period of dry and chilly, wind and dust haze, known as the harmattan period. This usually occurs around late December through January although in recent times it seems to have extended up to February. The climate of Ebonyi State is temperate in nature.The temperature of Ebonyi ranges from 8 - 40^0 C. The humidity of Ebonyi State ranges from 22, 80% (Ministry of Environment, Abakaliki 2011).

Study Design and Population: The study was a cross-sectional, hospital-based study to investigate urinogenital schistosomiasis among pregnant woman attending antenatal clinic in Ebonyi State. The hospitals that were selected include Mile Four Hospital and Federal Medical Centre Abakaliki. These were located in Abakaliki and Ebonyi Local Government Area respectively. The study lasted for twelve months, from April 2011 to March 2012. The study employed such tools as informed conversation to raise awareness on the study, administration of questionnaire, parasitological examination of the parasite. Pregnant women attending antenatal clinics in their different trimesters were population selected for the research. Three hundred (360) pregnant women were selected from two hospitals.

Ethical Approvals: Ethical review and clearance was obtained from the Ministry of Health, Ebonyi State and University of Nigeria Nsukka Ethical Research Committee. Ethical consideration was also obtained from the two hospitals selected for the study from antenatal division and research department. The permission to use hospital facilities was also obtained from management. Informed consent was also obtained from the pregnant women before collection of the sample. The approval was on the agreement that patient anonymity must be maintained, good laboratory practice and that findings would be treated with utmost confidentiality and for the purpose of this research only. All work was performed according to the international guideline for human experimentation clinical research (WMA, 2005).

Sampling Method: The hospitals used were purposively selected for the study based on the availability of active antenatal clinic. Random sampling through balloting was employed for the selection of pregnant women for the study. Pieces of papers written either yes or no were picked by the pregnant women attending antenatal clinics. Those that picked yes were chosen for the study. One hundred and eighty (180) pregnant women were numbers chosen for each hospital.

Administration of Questionnaire: A structured pretested questionnaire was administered to the randomly selected pregnant women through participatory approach. By this the researchers discussed each question and their options with the pregnant women in a manner that facilitates effective recall of experiences. The questionnaire sought information on age, gravidity, trimesters among others.

Collection of urine samples: About 20 ml of clean-catch terminal urine sample were collected in a 20 ml wide mouthed, leak-proof, universal containers. Samples were obtained between 10am and 2pm when excretion of *S. haematobium* egg is optimal (Eyo *et al*. 2012; Ivoke *et al*. 2014). The specimens were appropriately labelled with identification number and transported to the laboratory. Each urine sample was examined for microhaematuria and proteinuria using the reagent strip, medi-test combi 9 according to the manufacturers' instructions. Where delay in transportation of specimens to laboratory was inevitable, ordinary house hold bleach was added to the urine sample to preserve any Schistosoma ova present (Cheesbrough, 2009).

Microscopy and quantification of *S. haematobium* eggs: Laboratory examination of the urine samples collected was carried out by centrifugation techniques (Eyo *et al*. 2012). About 10 ml of well mixed urine was transferred to a labelled conical tube and centrifuged at 1000 rmp for 5 minutes. The supernatant was decanted and the sediment was remixed by tapping the bottom of the tube and one drop of the well-mixed sediment was transferred to a slide and covered with cover slip. This was examined with a microscope using the x10 objective lens for identification and counting of *S. haematobium* eggs. The intensity of infection was graded as light 1-29 eggs/10ml, moderate 30 - 49 eggs/10ml and severe ≥ 50 eggs/10ml.

Analysis: Results were analyzed using SPSS version 20.0. Preliminary information showing demographic profile of pregnant women was calculated as simple frequencies. Chi-square test was used to determine significant differences. Intensity of urinary schistosomiasis was categorized into light, moderate and severe. Significant difference in the prevalence of this categorized intensity in relation to the above stated variable was also checked using chi-square test. Statistical significance was set at $P<0.05$.

RESULTS

Characteristics of Studied Population: Three hundred and sixty pregnant women were sampled during the study with average age of 26.54 ± 4.61. Two hundred and four (204) pregnant women representing 56.7 %, 138 (38.9) and 18 (5.0%) were in their 3rd, 2nd, and 1st, trimesters, respectively. Primigravid, secundigravid and multigravid comprised 101 (28.1%), 85 (23.6%) and 174 (48.3%) respectively. Forty-one (41) pregnant women representing 11.4%, 125 (34.7%), 142 (39.4%), 38 (10.6%) and 14 (3.9%) were in their 15 - 20, 21-25, 26 -30, 31-35, and ≥ 36 age groups respectively.

Table 1. Demographic profiles of pregnant women attending antenatal clinics in Ebonyi State, Nigeria.

Variables	Frequency (360)	χ^2	P valve
Mean Age	26.54 ± 4.61		
Trimester – 1st trimester	18 (5.0)	7.25	0.03*
2nd trimester	138 (38.3)	8.45	0.22
Third trimester	204 (56.7)	8.56	0.36
Gravidity – primigravidae	101 (28.1)	6.89	0.03*
Secungravidae	85 (23.6)	7.05	0.03*
Multigravidae	174 (48.3)	3.87	0.05
Age groups yrs- 15-20	41 (11.4)	14.81	0.004*
21-25	125 (34.7)	15.49	0.07
26-30	142 (39.4)	10.48	0.09
31-35	38 (10.6)	11.36	0.03*
36 and above	14 (3.9)	12.59	0.07

Figures in parentheses = %.

Seasonal and Monthly Prevalence of *Schistosoma haematobium* among Pregnant Women in Ebonyi State

Table 2 showed the seasonal and monthly prevalence of *S. haematobium* among pregnant women. Rainy season had the higher prevalence of 28 (15.6%) than dry season 17 (9.4%). There was no significant association ($P > 0.05$) in seasonal prevalence of *S. haematobium* infection in the study. In the monthly prevalence, infections occurred all through the study period with highest prevalence occurring in September 7 (23.3%). This was followed by July 5 (20.0%) and December 1 (3.3%). Only July and September had significant association ($P < 0.05$) in the prevalence of *S. haematobium* among pregnant women in relation to months of the year (Table 2).

Prevalence of *S. haematobium* in Relation to Trimester, Gravidity and Age among Pregnant Women in Ebonyi State

Table 3 showed the prevalence of *S. haematobium* in relation to trimester, gravidity and age among pregnant women in Ebonyi State, Nigeria. The 1st trimester had the highest prevalence of 4 (22.2%), followed by 2nd trimester 21 (15.2%) and 3rd trimester n = 20, (9.8%). No significant association ($P > 0.05$) was observed in the prevalence of *S. haematobium* among pregnant women by trimester. In gravidity, primigravidae had the highest prevalence 19 (18.8%). This was followed by multigavidae 19 (10.9%) while secundigravidae had the least prevalence rate of 7 (8.2%).

Table 2. Seasonal and monthly prevalence of *Schistosomiasis haematobium* among pregnant women in Ebonyi State, Nigeria

Variable	Number examined	Number infected	χ^2	P- value
Overall	360	45 (12.5)		
Season				
Rainy	180	28 (15.6)	3.07	0.08
Dry	180	17 (9.4)	5.20	0.53
Months				
April	30	4 (13.3)	6.39	0.34
May	30	4 (13.3)	6.39	0.34
June	30	5(16.7)	7.61	0.05
July	30	6 (20.0)	7.89	0.03*
August	30	3 (10.0)	4.55	0.27
September	30	7 (23.3)	9.21	0.04*
October	30	3 (10.0)	4.55	0.27
November	30	3(10.3)	3.54	0.32
December	30	1 (3.3)	1.57	0.09
January	30	4 (13.3)	6.39	0.34
February	30	3 (10.0)	4.55	0.27
March	30	2 (6.7)	5.52	0.60

Figures in parentheses = %

Table 3. Prevalence of *S. haematobium* in relation to trimester, gravidity and age group among pregnant women in Ebonyi State, Nigeria.

Variable	Number examined	Number infected (%)	χ^2	P value
Trimester				
1st trimester	18	4(22.2)	3.84	0.15
2nd trimester	138	21(15.2)	2.76	0.34
3rd trimester	204	20 (9.8)	2.01	0.27
Gravidity				
Primigravidae	101	19(18.8)	5.49	0.06
Secundigravidae	85	7(8.2)	3.76	0.08
Multigravidae	174	19(10.9)	4.19	0.09
Age group (yrs)				
25-20	41	9(22.0)	22.52	0.0001*
21-25	125	26 (20.8)	22.45	0.0003*
26-30	142	10(7.0)	12.60	0.001*
31-35	38	0 (0)	-	-
≥	14	0 (0)	-	-

Figures in parentheses = %.

There was no significant association (P > 0.05) observed in the prevalence of *S. haematobium* by gravidity in the study. The age prevalence followed a declined pattern, *S. haematobium* being more prevalent in the younger age groups. Prevalence decreased as the age increases. The highest prevalence 9 (22.0%) was observed in the 15 - 20 age groups, followed by 21 - 25 age groups 26 (20.8%), while the least prevalence was observed in the 26-30 age groups 10 (7.0%), 31 and above age group had zero prevalence 0 (0.0%). There was high significant association (P < 0.05) between

prevalence of *S. haematobium* and age groups of pregnant women sampled in Ebonyi State, Nigeria (Table 3).

Intensity of *S. haematobium* among Pregnant Women Attending Antenatal Clinics in Ebonyi State

The intensity *S. haematobium* indicated that light intensity has the highest prevalence in rainy season 29 (90.6 %) while moderate and severe intensities had highest prevalence in dry season 2 (15.4 %) and 4 (30.4 %) respectively. There was significant association ($p < 0.05$) between season and intensities of *S. haematobium.* In relation to trimester, light intensity had highest prevalence of *S. haematobium* in first trimester 4 (100%), moderate intensity was highest in third trimester 3 (15.0 %) while in severe intensity highest prevalence was in second trimester 5 (23.8 %). There was no significant association between trimester and intensities of *S. haematobium.* In age group, there was no significant association between age group and intensities of *S. Haematobium* (Table 4).

Table 4. Intensity *S. haematobium* among pregnant women Ebonyi State, Nigeria.

Variable	Number examined	Light intensity	Moderate intensity	Severe intensity	χ^2	p value
Season						
Rainy	32	29(90.6)	1(3.1)	2(6.2)	7.82	0.020*
Dry	13	7(53.8)	2(15.4)	4(30.8)	7.12	0.028*
Trimesters						
1st trimester	4	4(100)	0(0.0)	0.(0.0)	7.30	0.12
2nd trimester	21	16(76.2)	0(0.0)	5(23.8)	8.93	0.06
3rd	20	16(80.o)	3(15.0)	1(5.0)	7.10	0.09
Gravidity						
Primigravidae	19	16(84.2)	1(5.3)	2(10.5)	1.0.3	0.91
Secunegravidae	7	5(71.9)	1(14.3)	1(14.3)	0.90	0.93
Multigravidae	19	15(78.9)	1(5.3)	3(15.8)	0.21	0.65
Age groups						
15-20	9	7(77.8)	1(11.1)	1(11.1)	0.950	0.91
21-25	26	21(80.8)	1(3.8)	4(15.4)	1.10	0.98
26-30	10	8(80.0)	1(10.0)	1(10.0)	0.89	0.81
31-35	0	0(0.0)	0(0.0)	0(0.0)	-	-
≥ 36	0	0(0.0)	0(0.0)	0(0.0)	-	-

Figures in parentheses = (%)

Correlations between Schistosome Infection, Haematuria and Proteinuria among Pregnant Women in Ebonyi State, Nigeria

Table 5 showed correlation between schistosome infection, haematuria and proteinuria among pregnant women in Ebonyi State. There was high positive significant correlation (r- 0.962, $P < 0.0001$) between prevalence of schistosome eggs in urine and micro- haematuria. On other hand proteinuria showed a negative not significant correlation ($r = 0.040$, $P = 0.447$) with prevalence of *S. haematobium* among pregnant women in Ebonyi State

Table 5. Correlations between schistosome infection haematuria and proteinuria among pregnant women in Ebonyi State, Nigeria .

Variable	Correlation coefficient (r)	P value	Remark
Micro-haematuria	0.962	< 0.0001	highly significant
Proteinuria	-0.040	0.447	not significant

DISCUSSION

The knowledge of the prevalence and intensity of schistosomiasis in any setting is crucial in planning of the disease intervention strategies. This is because like most parasitic diseases, a period of re-infection or relapse is imminent (Onyishi, 2010). A prevalence of 12.5% for urinary schistosomiasis was observed in this study. According to the classification of the WHO expert committee on the control of schistosomiasis (WHO 2005), prevalence greater than 25% are moderate, while those below are low. This finding was in keeping with Ofoezie (2002), Ibidapo *et al*. (2005) which had indicated low prevalence of 13% and 12.5% respectively. This finding was much lower than works done by Mafiana *et al.* (2003); Olufintoye and Odaibo (2006); Oladejo and Ofoezie (2006); Kabiru *et al.* (2013); Oyetunde *et al*. (2013); Okeke, (2014) and which had high prevalence of 24.3%, 29.1%, 47%, 38.3%, 20.8%, 26.6% respectively.

Prevalence in relation to season, rainy season had higher prevalence than dry season with prevalence of 15.6% and 9.4%, respectively. Studies by other researches in Kenya and Nigeria, have also reported on seasonality of schistosomiasis transmission (Sturrock *et al.* 2001; Anosike *et al.* 2006). Ugbomioko *et al*. (2010) observed that transmission of *S*. *haematobium* was generally more wide spread than *S. mansoni* and that it is more seasonal with highest transmission occurring during the rainy season. In this study there was no significant association between the diseases with seasons. The seasons in this study was in contrast with the work done by Mafiana *et al.* (2003) which reported higher prevalence during dry season than rainy season.

Monthly prevalence showed that infection occurred throughout the year. Prevalence of the infection peaked between rainy and late rainy months with prevalence of September 23.3% and July 20.0% having the highest rate. This study agreed with the findings by Biu *et al.* (2000). In the current study there was no significant association which showed that regardless of month persons have equal chances of being infected. In this study we reported the prevalence *S. haematobium* infection in pregnant woman by the varying stages of pregnant (trimester). Women in their early stages of pregnancy (1st trimester) had highest infection with *S. haematobium,* and then declined in those in their second trimester to third trimester. This agreed with Oyetunde *et al*. (2013).

The study showed no significant difference was observed between the infection and trimesters. This was in agreement with the work done by Oyetunde *et al*. (2013). In this study also gravidity was not associated with *S. haematobium*. This also agreed with the work done by Oyetunde *et al*. (2013). In this study primigravidae had the highest prevalence, and then declined in secundigravidea and increase slightly in multigravidae. The prevalence and intensity of infection in present study decreased with an increasing number of previous pregnancies. As a result, the morbidity associated with schistosomiasis might be more pronounced among primigravidae.

Age is generally recognized as one of the most important factors determining the severity of infection. Among the target group (pregnant woman) age related prevalence and intensity of infection was observed. The age related prevalence was highest among subjects between 15 - 20 years which was the youngest age group in the study and declined gradually in older age groups until zero infection status was observed between 31 and above in the study. Similar reports have been made by previous workers (Oyetunde *et al*. 2013). This observation also collaborated with the findings of Anosike *et al.* (2006) where both prevalence and intensity of *S. haematobium* infection increased with and declined in older age groups showing that prevalence was directly proportional to intensity. In this study there was strong significant difference between the age and *S*. *haematobium.* This agreed with the work done by Duhah and bristone (2000); Aminu *et al*. (2014). The intensity of infection in the present study decreased with increase in age groups. This could be attributed to concomitant immunity acquired over time due to continuous re-infection. Pregnant woman of younger age bracket probably are more energetic and young engage in domestic activities involving natural water bodies and are more exposed to infection sites than pregnant women in older age groups who may have adolescent children who help them out in such activities. Age dependent immunity to *S*. *haematobium* infection has been shown to affect egg excretion in urine of infected patients (Oyetunde *et al*. 2013; Aminu *et al*. 2014) the low intensity of *S*. *haematobium*

observed in this work in older age groups may therefore be attributed to acquired immunity, changes in water contact patterns and exposure indices.

Conclusion: Schistosomiasis is commonly regarded as a disease associated with the poor and for the past decades had a very low public rating in the health priorities in the sub-Saharan Africa countries where the disease is prevalent. The disease pathology is commonly observed in different organs of the body and the clinical manifestations ranged from acute to chronic form resulting in disease symptoms such as those associated with katayama fever like lethargy, wheezing, severe itching, muscle and joint pain, haematemesis, oesinophilia, spleen and liver enlargement, bronchiospersm and cardiovascular collapse among others. The chronic manifestations include haematuria, bladder carcinoma, ureteral obstruction etc. Hemiplegia and epilepsy occur when the central nervous system is affected. In the reproduction system, infection with schistosomiasis may result to infertility and in women, may cause abortion or still birth, damage to the vagina, uterus, ovary, vulva etc. These manifestations, in heavy infections could be fatal. The extent of suffering and stigma from infection particularly in females of reproduction and pregnant women especially when the genitals are involved are so enormous that the elimination of the disease is a good investment toward health maintenance in the affected persons and areas

REFERENCES

Abiola, F. A., Babatunji, E. O. and Abidemi, P. K. (2015). Impact of human schistosomiasis in Sub-Saharan Africa. *The Brazilian Journal of Infectious Diseases,* 19(2): 196-205.

Aminu, B., Abdulgafar, O. J., Sirajo, B. S. and Shuaibu, A. H. (2014). Prevalence of urinary schistosomiasis and associated haemato-proteinuria in Wurno Rural Area of Sokoto State, Nigeria. *Orient Journal of medicine,* 26(3-4): 113-120.

Anosike, J. C., Ogwuike, U. T., Nwoke, B. E. B., Asor, J. E., Ikpeama, C., Nwosu, D. C. and Ogbusu, I. I. (2006). Studies of the vesical schistosomiasis among rural Ezza farmers in the south western border of Ebonyi State, Nigeria.*Annals of Agricultural and Environmental Medicine,* 13: 13 - 19.

Ayanda, O. I. (2010). Prevalence of snail vectors of schistosomiasis and their infection rates in two localities within Ahmadu Bello University (A.B.U.) Campus, Zaria, Kaduna State, Nigeria. *Journal of Cell and Animal Biology,* 3 (4): 058-061.

Biu, A. A., Nwosu, C. O. and Akuta, A. (2000). The incidence of human schistosomiasis in Maiduguri, Northern Nigeria. *Bioscience Resources*, 12(1): 9-11.

Cheesbrough, M. (2009). *District laboratory practise in tropical countries (part 2).* Cambridge University Press, UK.

Chidozie, E. U. and Daniyan, S. Y. (2008). Epidemiological survey of urinary schistosomiasis among school children in selected schools: A preliminary study in Minna, Nigeria. *African Journal of Biotechnology.* 7(1): 2773 - 2776.

Duhah, C. S. and Brimstone, B. (2000). Prevalence of urinary schistosomiasis amongst, primary school pupils in Mayo-Belwa Local Government Area of Adamawa State *Nigeria. Journal of Parasitology,* 21:15 - 20.

Ekwunife, C. A. Agbor V. O., Ozumba A. N., Eneanya, C. I. and Ukaga, C. A. (2009). Prevalence of urinary schistosomiasis in the lyede-Ame Community and Environ in Ndukwa East Local Government Area, Delta State, Nigeria. *Nigeria Journal of Parasitology,* 30(1): 27- 31.

Engels. D. and Savioli, L. (2006). Reconsidering the underestimated burden caused by neglected tropical diseases. *Trends in Parasitology,* 22: 363-366.

Eyo, J. E., Onyishi, G. C. and Okafor, F. C. (2012). Urinary Schistosomasis among pregnant moment in some endemic tropical semi-urban communities of Anambra State, *Nigeria Tropical Biomedian*, 29(4): 575-579.

Friedman, J. F., Kanzaria, H. K. and McGarvey, S. T. (2010). Human schistosomiasis and anaemia: the relationship and potential mechanisms. *Trends in Parasitology,* 21(8): 386 - 392.

Grazzinelli, A., Velasquez-Melendez, G., Crawford, S. B., LoVerde, P. T., Correa-Oliveira, R. And Kloos, H. (2006). Socioeconomic determination of schistosomasis in a poor rural area in Brazil. *Acta Tropical*, 99: 260 - 271.

Gryseels, B. (2005). Schistosomiasis vaccines: A devils‟ advocate view. *Parasitology Today,* 16 (2): 46 – 48.

Hunter, J. M. (2005). Inherited burden of disease: agricultural dams and the persistence of bloody urine (Schistosomiasis hematobium) in the Upper East Region of Ghana, 1959-1997. *Social Science and Medicine,* 56(2): 219 - 234.

Ivoke, N., Ivoke, O. N., Nwali, C. D., Ekeh, F. N., Asogwa, C .A., Attama, C. I. And Eyo J. E. (2014). Prevalance and transmition dynamics of schistosoma haematobium infection in a rural community of South-Western Ebonyi State, Nigeria. *Tropical Biomedicine*, 3(1): 77-88.

Jourdan, P.M. (2013). *Schistosomasis Haematobium* infection in the female genital mucosain malaria and Madagascar. Ph.D Thesis, University of Oslo, Norway.

Kabiru, M., Mohammed, R. A., Ikeh, E. I., Aziah, I. and Omar, J. (2013). Prevalence and intensity of *Schistosoma haematobium* infection: A community based survey among school children and adults in Wammako town, Sokoto State, Nigeria. *International Journal of Tropical Medicine and Public Health,* 2(1): 12 - 21.

Lia, S. F. (2009). *Epidemiology of polyparasitism in coastal Kenya: determinants, interactions and health effects of Plasmodium Species and Schistosoma haematobium infections*. Ph.D Thesis, University of Michiagan.

Mafiana, C .F., Ekpo, U. F. and Ojo, D. A. (2003). Urinary schistosomiasis in preschool children in settlements around Oyan reservoir in Ogun State, Nigeria. Implication for Control. *Tropical Medicine and International Health*, 8(1): 111 - 118.

Ministry of Environment, Abakaliki (2011). Ebonyi and its environmental conditions.

National Bureau of Statistics, (2006). National census. http//www.nigerianstat.gv.ng /connections/pop2006.pdf.

National Population Commission (2007). Federal Republic Nigeria. Official Gazette. 4: 1-4.

Okwori, A. E. J., Sidi, M., Ngwali, Y. B., Obiekezie, S. O., Makut, M. D., Chillom, S. C., Okeke, I. O. and Adikwu, T. I. (2014). Prevalence of schistosomiasis among primary school children in Gadabuke district of Toto LGA, North Central Nigeria. *British Microbiology Journal of Research,* 4(3): 255 - 261.

Oladejo, S. O. and Ofoezie, I. E. (2006). Unabated schistodomiasis transmission in Erince River Dam, Osun State, Nigeria: evidence of neglect of environmental effects of development projects. *Tropical Medicine and International Health*. 11:843 - 850.

Olofintoye, L. K. and Oduibo, A. B. O. (2006). Urinary schistosomiasis among school pupils in Ondo and Ekiti, State Nigeria, *The Zoologist,* 1(14): 92-99.

Onyishi, G. C. (2010). *Urinary schistosomiasis and associated Biochemical Variables in pregnant women in Anambra and Enugu State, Nigeria.* Ph.D thesis, University of Nigeria Nsukka Enugu State, Nigeria.

Oyetunde, T., Salawu, A. B., Alexander B. and Odaibo, A. (2013). Schistosomiasis among pregnant women in rural communities, Nigeria. *Journal of Gynecology and Obstetrics*, 122: 1 - 4.

Samie, A., Nchachi, D. J., Ob, C. V., and Igumbor, E. O. (2010). Prevalence and temporal distribution of *Schistosoma haematobium* infections in the Vhembe district, Limpopo Province, South Africa. *African Journal of Biotechnology,* 9(42): 7157 - 7164.

Sowole, A.R. and Adegbite, A.A. (2012). Correlation analysis between the prevalence of *Schistosoma haematobium* infection and water conditions: a case study among school pupils in south-western Nigeria. *International Journal of Research and Reviews in Applied Science,* 13 (1): 160 - 165.

Sturrock, R. F. (2001). Schistosomasis Epidemilogy and control: how did we go there and where should we go? *Memories Do* Institute *Oswaldo Cruz*., 96: 17-27.

Ugbomiko, U. S., Ofoezie, I. E., Okoye, I. C. and Heukelbach, J. (2010). Factors associated with urinary schistosomiasis in two peri-urban communities in South-western Nigeria. *Annuals of Tropical Medicine and Parasitology*, 104(5): 409 - 419.

Uwazuoke, J. C., Anosike, J. C., Udujih, O. S., Onyeka, P.I.K. (2008). Epidemiology of Bacteriological studies on vesical schistosomiasis in Ikwo Area, Ebonyi State, Nigeria. *Journal of Applied Science and Environmental Management,* 12(2): 75 - 80.

World Health Organisation (2005). Update on schistosomiasis. WHO division of control of Tropical diseases. *World Health Organization* Genva.

World Medical Assocaition (2005). Ethical principles for medical research involving human subjects. Edinburgh: World Medical Association. (http://www.wma.net/ epolicy/ b3.htm, accessed on 15 June 2005).

Corresponding authors: Imakwu, Cyril Ali, Department of Zoology and Environmental Biology, University of Nigeria, Nsukka, Enugu State, Nigeria
Email: cyimakwu@gmail.com gabrielunekwuamana@gmail.com
Phone: +2347062756660 ; +2347066024115