

PREVALENCE OF *Schistosoma haematobium* AND ITS INTERMEDIATE HOSTS IN MAKURDI METROPOLIS

Abstract

Introduction: Urinary Schistosomiasis (US) is a chronic water-borne infection caused by digenetic trematode belonging to the genus *Schistosoma*, it is generally caused by *Schistosoma haematobium*. *Bulinus globosus* is a species of a tropical freshwater snail that act as an intermediate host of *Schistosoma haematobium*. Aim: The study was aimed at ascertaining the prevalence of *Schistosoma haematobium* infection and to describe its intermediate hosts among school children in Makurdi. Methodology :Snails were collected by hand picking and scooping net methods. Epidemiological survey research on urinary Schistosomiasis was undertaken from September to November 2017 among students that volunteered in the selected schools within Makurdi metropolis. A total of 97 fresh water snails were collected and 200 urine samples involving pupils aged between 5 to 18 years were collected and analyzed for the eggs of *Schistosoma haematobium* by microscopy using Urine Syringe Filtration Technique (USFT). Statistical analysis was performed using SPSS 20. Chi-square test was used to determine significant difference between variables. Results: Out of the 97 species of fresh water snails that were caught 41 (42.3%) were *Bulinus* spp. Of the 200 urine samples analyzed, 49 (24.5%) were found to be infected with ova of *S. haematobium*. The infection was higher among males 30 (25.6%) than females 19 (22.9%) although the difference was not statistically significant ($\chi^2_{CAL}=0.19$, $\chi^2_{TAB}=3.84$). The prevalence of *Schistosoma haematobium* infection among school children in relation to age showed that ages 15-19 years had the highest prevalence 13 (38.2%) and ages 5-9 had the lowest prevalence 3 (8.5%).The statistical analysis also revealed that there is no significant difference (8.302) in *Schistosoma haematobium* infection among the four schools in the study area. The presence of many snail species especially the *Bulinus* spp and increased contact time with the *Schistosoma haematobium* infested freshwater habitat were thought to be responsible for the prevalence of the disease in the area. Finding of this study shows that urinary Schistosomiasis was found to have a low prevalence in the area studied and there is need to intensified integrated control measures to reduce or completely eradicate the disease.

Key words. *Schistosoma haematobium*, Intermediate Hosts, Makurdi ,Metropolis

Introduction

Urinary Schistosomiasis also called Bilharzias is a parasitic disease caused by a digenetic blood fluke of the genus *Schistosoma* called *Schistosoma haematobium*. *Schistosoma haematobium* is the causative agent of urinary Schistosomiasis The disease is the second most prevalent neglected tropical diseases after hookworm and remains an important public health problem globally especially in the Sub-Saharan Africa [1]. School children of the age groups 5 to 15 have often swim and fish in some of the water bodies around their school during breaks and vacations. Some of the pupils engage in fishing during vacation as seen in the study area. There have been reports on high prevalence of urinary schistosomiasis in Makurdi and its environs, hence the need to study the prevalence of urinary schistosomiasis and its intermediate hosts in Makurdi. Previous studies had reported a high prevalence of urinary schistosomiasis amongst children in two local government areas in Benue state (Buruku and Katsina-Ala) [2]. Recording an overall prevalence of 41.5% among the 1,124 children examined. (%). Another study carried out in Gboko Benue State [3] reported 41% prevalence of *S. haematobium*. While a study in

Comment [WU1]: An epidemiological

Comment [WU2]: Remove the word

Comment [WU3]: References to buttress this should be cited.

Comment [WU4]: This should be the last sentence in the introduction.

Comment [WU5]: Please re-cast this statement

Comment [WU6]: What does this mean?

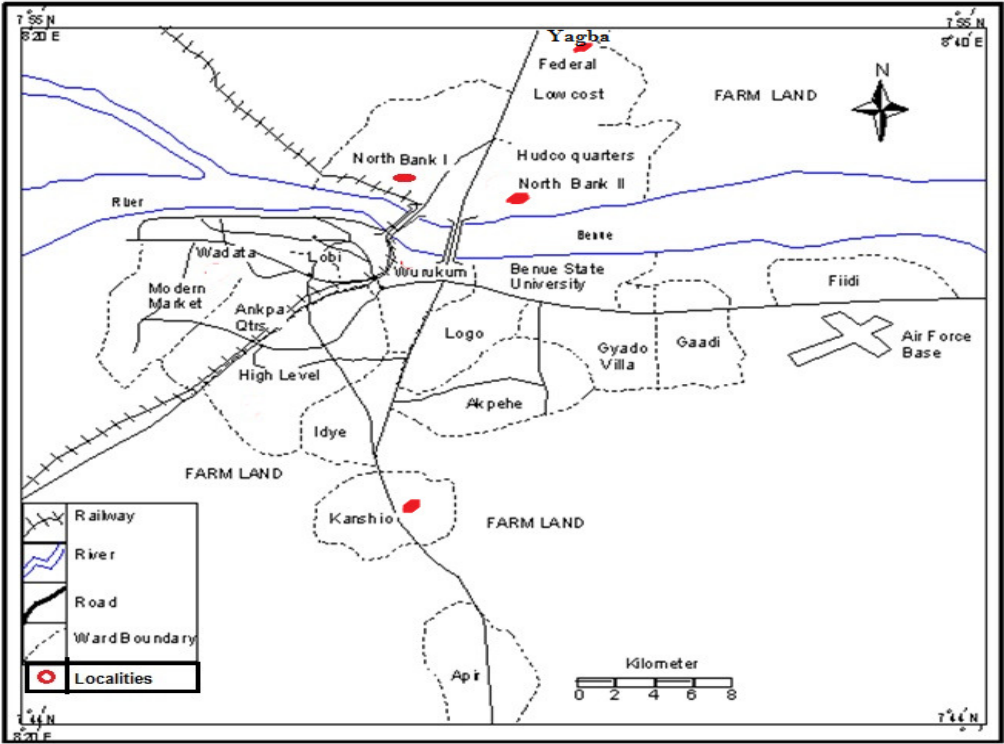
Comment [WU7]: Insert comma after Gboko

49 Keffi [3] reported 30.5% prevalence of *S.haematobium* among school children in Keffi town
50 Nassarawa state.

51 *Schistosoma haematobium* infection is endemic in over 50 countries in Africa, [4] It was
52 reported as the most devastating prevalent parasitic disease due to morbidity and mortality for
53 developing countries in Africa [5].

54 MATERIALS AND METHOD

Comment [WU8]: I sincerely feel this sentence should be moved to line 40.



56 Figure. 1: Makurdi Township showing Sampled Sites (source;google maps)

57 Makurdi is the capital of Benue State of Nigeria. The city is located in central Nigeria along
58 the Benue River and holds the base for the Nigerian Air force aircraft squadrons. Makurdi has
59 an estimated population of 500,797 persons. The major ethnic groups inhabiting the city are
60 the Tiv, Idoma, Igede and etulo. It holds the Benue State University and the Federal
61 University of Agriculture. It is located on latitude 7.7306°N and longitude 8.5561°E along the
62 banks of the Benue River which is a major tributary to the Niger River.

63 Sampling Site for urine collection

64 The management of four different schools within Makurdi LGA was consented to
65 allow urine samples to be collected from their students. Sampling within all four schools was
66 based on random selection. The five schools include; Daddy Memorial Nursery and Primary
67 School. Yagba, Josephine Nursery and Primary School, North Bank, Holy Family Nursery
68 and Primary School Karsio and L.G.E.A Nursery and Primary School North Bank.

Comment [WU9]: Are they primary schools only? Public or Private primary schools? Secondary schools?? Please clarify

Comment [WU10]: Write in full. This is the first time you using this LGA

Comment [WU11]: Re-cast this sentence. Consent (What kind of consent? Formal or informal??) was gotten from the Primary school authorities

69 The sampling sites were water bodies that are at proximity to the schools sampled. Snails'
70 samples were collected using the method of scooping net and hand picking as described in
71 Oguoma [6] *Bulinus spp* snail is the intermediate hosts of *S. haematobium* they were
72 collected from fresh water habitat found in Makurdi, Benue state.

Comment [WU12]: Scooping nets

Comment [WU13]: Insert full stop after the number 6

Comment [WU14]: Remove "is"

Comment [WU15]: Remove they

73 Sampling Materials

74 The following materials were used for the research: running water, a light microscope,
75 a centrifuge, universal specimen bottles, slides, gloves, Polycarbonate membrane filter,
76 detergent, 10ml syringe, laboratory coat, a record notebook, forceps, Questionnaires, scoop
77 net, rain boots and collection tray.

78 Ethical clearance

79 Before the commencement of the study, a letter of introduction was obtained from the
80 head of department, Biological science, Benue state university, an official ethical clearance
81 was obtained from the ministry of health, government of Benue state. The letter was followed
82 up by verbal persuasion and further verbal explanations to the principals and headmasters of
83 the above-mentioned schools where these samples were collected.

Comment [WU16]: Change to Head of Department, Biological Science, Benue State University

Comment [WU17]: This should be a letter??

Comment [WU18]: Is it the Federal Ministry of Health or State Ministry of Health in Benue State

Comment [WU19]: Remove

Comment [WU20]: Replace with the word enlightenment

Comment [WU21]: Do principals head primary schools?

Comment [WU22]: Replace with authorities

Comment [WU23]: was this closed ended or an open ended questionnaire?

84 Study Design

85 The study was conducted from September to November 2017. Sampling was
86 completely randomized, as there was no restriction whatsoever as to age, class, or sex. The
87 research was conducted on every student that volunteered. A total of 200 students of those
88 who volunteered were sampled at random from the four different schools.

89 A questionnaire was used in the primary school as the pupils were interviewed to
90 provide information such as age, sex, class, source of drinking water, bathing water and
91 parental occupation.

92 This involved noting the appearance of the urine sample. The color of the urine sample were
93 noted, some smoky brown, bloody, turbid and cloud appearance were noted.

Comment [WU24]: Where is the collection of the subjects urine into well-labelled urine specimen bottles? PLEASE re-visit this paragraph

94 Each urine sample were poured into clean 10ml test tube and properly labeled.

Comment [WU25]: Replace this word with observed.

95 Chemical Examination of the urine was carried out on sample using commercially prepared
96 test-strip (Combi 10 urine test-strip) noting the various parameter Glucose, Protein, Blood,
97 Urobilinogen, Nitrite, Bilirubin pH etc.

Comment [WU26]: Recast this

Comment [WU27]: Poured from where?

Comment [WU28]: What is etc?? Complete the other parameters.

98 Polycarbonate membrane filters (Millipore Comp.) of 13 mm diameter and 12-14 μ m
99 pore size were used for filtration of *Schistosoma haematobium* eggs from urine. Cheesbrough
100 M, (2009). The filters were removed at the laboratory from filter holders using a blunt-ended
101 forceps and transferred to a microscope slide, face upwards [7].

Comment [WU29]: Replace this with figure since it is a reference

102 The entire filter was systematically examined for eggs of *Schistosoma haematobium*. The
103 number of eggs in the preparation was counted and reported per 10ml 22 of urine.

Comment [WU30]: Please go through this procedure again. These Filters would have been dipped into a blue solution before being placed on a microscope slide to be viewed.

104 1-50 eggs per 10ml of urine were considered as light infection, 51-200 eggs per 10ml
105 of urine as moderate infection and above 200 eggs per 10ml of urine as heavy infection.[7;8].

Comment [WU31]: What does this mean?

106 On examination of the samples using the microscope, the parasite, *Schistosoma*
107 *haematobium*, was identified by the presence of its ova or egg. The eggs or ova of *S.*
108 *haematobium* have a characteristic terminal spine, are large, oval in shape and pale yellow-

109 brown in color. In most cases the presence of the ova in urine is associated with the presence
110 of pus cells and red blood cells (RBCs) [7].

111 The data were analyzed using the chi-square test with a P-value of 0.05. The chi-
112 square test was used to determine if the observed frequency of occurrence of any value
113 conformed to the expected frequency of that value. All data were entered into an Excel
114 spreadsheet, checked for errors and analyzed using SPSS for windows (version 15.0, SPSS
115 Inc, Chicago, USA). Pearson Chi-square was used to analyze prevalence of urinary
116 schistosomiasis and to assess the associations between the demographic characteristics of the
117 study subjects and the findings of the test samples.

118 Simple percentages were used to calculate the prevalence of infection amongst the
119 students sampled.

Comment [WU32]: This should be moved to
Line 115 before Pearson Chi.....

120 Result

121 Two hundred (200) urine samples of pupils and students from across four different schools
122 within Makurdi LGA were collected and examined for ova of *S. haematobium*, 117 male and
123 83 female school children were involved. The prevalence of urinary schistosomiasis was
124 ascertained from their urine.

Comment [WU33]: Replace words with subjects

Comment [WU34]: As indicated in Table 1
below

Comment [WU35]: Delete

125 An overall prevalence of 49 (24.5%) school children tested positive to *S. haematobium*
126 infection. males recorded a higher prevalence of 30 (25.6%) than females 19 (22.9%).

Comment [WU36]: Table 3 below

127 Table 1 shows the different prevalence of the infection in different areas within Makurdi
128 LGA. Daddy Memorial Nursery and Primary School and Holy Family Nursery and Primary
129 School, Kanshio showed a prevalence of 15.1% and 20.5% to the infection respectively.
130 LGEA Nursery and Primary School show the highest prevalence of 37.9% and Josephine
131 international school north bank shows the lowest prevalence of 10.3%. Upon chi-square
132 analysis of the data in table 1, the results revealed there was a significant difference in the
133 prevalence recorded in the different schools ($\chi^2_{CAL}=13.77$, $\chi^2_{TAB}=7.81$ and $df = 3$). Table 2
134 shows the Abundance of fresh water snails in the different fresh water bodies areas located
135 close to the various schools that were samples for schistosoma infection within Makurdi
136 LGA. A total of 97 fresh water snails were sampled. The dam close to Daddy Memorial
137 Nursery And Primary School had a total of 22(22.6%) snails while that of Holy Family
138 Nusery And Primary School,Kanshio had a total of 21(21.6%). LGEA Nursery And Primary
139 School had the highest number of 36(37.1%) and Josephine International School North Bank
140 shows the lowest number of 18(18.5%). Table 3 shows the prevalence of *S. haematobium*
141 infection in relation to sex distribution. More males than females volunteered for the study;
142 males tested positive to the infection with a prevalence of 25.6% while females with a
143 prevalence of 22.9% Upon chi-square analysis of the data in Table the results revealed there
144 was no significant difference between the prevalence of both sexes ($\chi^2_{CAL}=0.19$, $\chi^2_{TAB}=3.84$
145 and $d.f = 1$).

146 Table 4 shows the age distribution of the prevalence of the infection. School children
147 between the ages 15-19 are most infected with a prevalence of 38.2%, with children between
148 the ages 5-9 recording the lowest prevalence of 8.5%. The study reveals that school children
149 within all ages are infected with the parasite. Upon chi-square analysis of the data in Table 4,
150 the results revealed there was no significant difference between the prevalence of the
151 different age groups amongst the school children ($\chi^2_{CAL}=8.302$, $\chi^2_{TAB}=5.99$ and $d.f = 2$).

152

153 **Table 1: Prevalence of *S. haematobium* Infection among School Children In Makurdi**
 154 **LGA.**

School	No. examined	No. infected (%)
Holy family Nursery & primary school	39	8(20.5)
Kanshio		
LGEA Primary school North Bank.	79	30(37.9)
Daddy Memorial Primary School North Bank.	53	8(15.1)
Josephine international school North Bank	29	3(10.3)
TOTAL	200	49(24.5)

155 ($\chi^2_{\text{CAL}}=13.77$, df = 3).

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171 **Table 2: Abundance of Freshwater Snails in the Different Water Bodies Areas**

172 **Located Close to the Various Schools**

173

School	Type of Fresh Water Snail				
	<i>Melanoides spp</i>	<i>Bulinus globolus</i>	<i>Bulinus forskali</i>	<i>Bulinus succiniodes</i>	other types
Holy family nursery & primary school. Kanshio.	3	4	3	2	9
LGEA primary school North Bank.	15	7	2	4	8
Daddy memorial primary School,North Bank.	5	11	2	0	4
Josephine Int'l School North Bank	4	3	3	0	8
TOTAL	27	25	10	6	29

174 **Table 3: Sex Distribution of *S. haematobium* among School Children Examined**

Sex	No. examined	No. infected (%)
Male	117	30(25.6)
Female	83	19(22.9)
Total	200	49(24.5)

175 ($\chi^2_{\text{CAL}}=0.19$ and d.f = 1)

176 **Table 4: Age distribution of *S. haematobium* infection among school children in**

177 **Makurdi LGA.**

Age	No. examined	No. infected (%)
5-9	35	3(8.5)
10-14	131	33(25.2)
15-19	34	13(38.2)
Total	200	49(24.5)

178 ($\chi^2_{\text{CAL}}=8.302$, d.f = 2)

179 Some plants were found to be associated with some fresh water snails (intermediate host of
 180 *S. haematobium*) as they were attached to the roots and leaves of these plants. These plants
 181 include the following.

Comment [WU37]: included

- 182 1. Water lilly (*Nymphaea lotus*)
- 183 Scientific classification
- 184 Kingdom : Plantae
- 185 Clade: Angiosperms
- 186 Order : Nymphaeales
- 187 Family : Nymphaeaceae
- 188 Genus : Nymphaea
- 189 2. Bind weed (*Convolvulus arvensis*)
- 190 Other names include; field bindweed,european bindweed.
- 191 Scientific classification
- 192 Kingdom : Plantae
- 193 Clade: Angiosperms
- 194 Clade: Eudicots

195 Clade: Asterids
 196 Order : Solanales
 197 Family : Convolvulaceae
 198 Genus : Convolvulus
 199 Species: *C. arvensis*
 200
 201 3.Creeping Jenny (*Lysimachia nummularia*)
 202 Other names include;
 203 Money wort,herb two pence and two penny thot.
 204 Scientific classification
 205 Kingdom : Plantae
 206 (unranked): Angiosperms
 207 (unranked): Eudicots
 208 (unranked): Asterids
 209 Order : Ericales
 210 Family : Primulaceae
 211 Genus : *Lysimachia*
 212 Species: *L. nummularia*

213

214 **Table 5 : Plants found in fresh water bodies at the various locations**

Location	No. examined	No. of fresh water snails	Species of plant
Kanshio	39	21	Water lilly and Bind weed
North Bank.	108	54	Water lilly, Bind weed, Creeping Jenny
Yagba	53	22	Water lilly and Bind weed
TOTAL	200	97	

215

216 **Discussion.**

217 This work revealed a total prevalence of 49 (24.5%) for *S. haematobium* infection. This
 218 means only 49 school children out of the 200 respondents were infected by *S. haematobium*
 219 at Makurdi LGA. This is higher to reports with an overall prevalence rate of 17.8% [9], also
 220 earlier study recorded a prevalence rate of 15.7% [8] and a prevalence rate of 17% of the
 221 infection within Gboko town [3]. This can be attributed to contact with water contaminated
 222 with the cercariae of the parasite. The low prevalence observed in Josephine international

Comment [WU38]: could

223 school North Bank as compared to the three other schools. This could be due to the fact that
224 Josephine international school is a private school and is mostly attended by middle class
225 persons and a greater percentage of her students' source their bathing and drinking water
226 from boreholes which correlates with less contact with contaminated water. LGEA primary
227 school north Bank on the other hand has a greater number of her students depending on well
228 and stream water and is located in the rural region of Makurdi LGA. The school is a public
229 school and it's attended by pupils whose parents are low class.

230 The sex distribution of *S. haematobium* infection among school children in makurdi LGA
231 showed a higher prevalence rate in males 30(25.6%) than in females 19(22.9%), this is
232 similar to a previous [10] on the prevalence of the infection. Prevalence of urinary
233 schistosomiasis is known to be generally higher among males than females [2; 4; 9 and 11]
234 this difference in prevalence is however statistically not significant. The prevalence of *S.*
235 *haematobium* infection in relation to age indicates that the prevalence is highest in the age
236 group 15-19 and lowest in the age group 5-9. The difference in prevalence is however not
237 significant. This is similar to reports previous studies [3; 5; 12 and 13] on the prevalence of
238 the infection in different study areas in Nigeria. The low prevalence recorded within the 5-9
239 age groups may be due to less exposure to epidemiologic factors that predispose school
240 children to the infection.

241 The prevalence of *Schistosoma haematobium* to the parasite was compared with the
242 abundance of fresh water snails and the various plant species where they are attached to.
243 Most intermediate hosts of human *Schistosoma* parasites belong to *Bulinus*.

244 North bank location which had the highest number of snails (54) correlates with LGEA
245 nursery and primary school which the highest rate of infection. The high prevalence of *S.*
246 *haematobium* in Northbank location might be due to the abundance of surface water, which
247 enhances the development of high snail population, human water contact behavior and
248 environmental factors that affect snail population favourably [14]).

249 High number of fresh water snail signifies a high number of cercariae shed and this
250 invariably increases the incidence of infection [15].

251 Water Snail populations fluctuated strongly decreasing towards the end of rainy season. The
252 preference for different environmental conditions such as abundant microflora, oxygen
253 content and other physico-chemical factors could be one reason why the water snail
254 populations showed marked differences in each locality. Another factor could be the natural
255 behavioral mode of adaptation which is different for each species. *Melaniodes spp* is a quiet
256 water, surface feeding snail and could be washed down to the dam easily. It finds a resting
257 place when the speed of water current becomes greatly reduced whereas *B. globosus* can
258 cling to or settle to the bottom of the water and later come out to the surface. This would be
259 made easier by the rocky nature of the substratum or bed of the Ichwa dam along the road to
260 Federal University of Agriculture, Makurdi. Also [15] large numbers of *B. globosus* occurred
261 in habitats that were slightly polluted with faeces or decaying vegetation. Careless discharge
262 of effluent, piggery and domestic wastes may be another reason why more snails were
263 recorded at dams close to the LGEA nursery and primary school. Though there was no
264 particular trend in the variation of prevalence, it could be said from the result that increase in
265 snail populations may result in an increase in the infection of humans by schistosome
266 cercariae with increased human water contact activities.

267 The species involved can be identified by the shape of the outer shell. This was based on the
268 fact that the school children come in contact with open bodies of water.

269 School children that that were found close to the dam and streams located at north bank had
270 the highest prevalence of the infection compared with those who were usually in contact with
271 fresh water snail in the various dams. Notably those school children who frequented and had
272 prolonged contact with streams or rivers had the highest prevalence compared with those who
273 rarely frequented open bodies of water as they come in contact with the intermediate host
274 more often.

275 Species of Plants associated with the intermediate host were also found in these areas where
276 the snails were abundant, from table, most species of plants associated with the parasite were
277 located at north bank

278 5.2 Conclusion

279 The results from this study reveal that *S. haematobium* infection has a prevalence rate of
280 24.5% amongst school children within [makurdi] LGA, with the parasite was noted to affect
281 the rural population of school children more than those who lived within the township region
282 of the LGA. The study reveals Male school children are more infected than females although
283 this is insignificant. Also school children within the age group 15-19 years have been
284 revealed to be more infected by the parasite. The study reveals that school children who
285 expose themselves to water from wells and streams are more affected by the parasite than
286 those who do not. Also school children whose parents are farmers are more susceptible to
287 infection by the parasite than others. This points to the fact that epidemiologic factors that
288 enhance susceptibility to the infection are still very much existent within the study area.
289 These include ignorance, parental influence, poverty and poor personal hygiene.

Comment [WU39]: Markurdi

290 Lack of portable water, exposure to contaminated water, exposure to the intermediate host,
291 lack of health education and poor personal & public hygiene contribute to the spread of the
292 infection.

293 Symptoms in persons infected with *S. haematobium* vary dramatically, ranging from mild
294 symptoms to severe damage of the urinary tract including the kidney and bladder. It is in
295 view of the above that it is suggested that the prevention and control of the disease be a major
296 priority by both individuals and the Government.

297 REFERENCE

- 298 1. Ishaleku, D., Yako, A., Usman, D. and Azamu, S. (2012). *Schistosoma haematobium*
299 Infections among school children in Keffi Town, Nasarawa State, Nigeria . *Scholarly*
300 *Journal of Medicine*, 2: 104-107.
- 301 2. Houmsou, R., Amuta, E. and Sar, T. (2012). Profile of an epidemiological study of
302 urinary schistosomiasis in two LGAs of Benue state, Nigeria. *International Journal of*
303 *Medicine and Biomedical Research*, 12: 39-48
- 304 3. Gberikon, G., Aguoru, C. and Yandev, D. (2015). Incidence of *Schistosoma*
305 *haematobium* and *Trichomonas vaginalis* among Occupational status of patients
306 attending some selected hospitals in Gboko, Benue state of nigeria. *International*
307 *Journal of sciences*. 3:45-49.

308

- 309 4. Bolaji, O., Elkanah, F., Ojo, J., Ojurongbe, O. and Adeyeba, O. (2015). Prevalence
310 and intensity of *Schistosoma haematobium* among school children in Ajase-Ipo,
311 Kwara state, Nigeria. *Asian journal of biomedical and pharmaceutical sciences*, 5: 6-
312 11.
- 313 5. Okwori, A., Sidi, M., Ngwai, Y., Obiekezie, S., Makut, M., Chollom, S., Okeke, I.
314 and Adikwu, T. (2013). Prevalence of schistosomiasis among primary school children
315 in Gadabuke District, Toto LGA, North central Nigeria. *British microbiology*
316 *research journal*, 4: 255-261.
- 317 6. Oguoma, V., Ugorji, D., Okolo, K., Mbanefo, E. and Umeh, J. (2010). Aquatic snail
318 species of two adjoining rivers in Owerri, Imo state, Southeastern Nigeria. *Animal*
319 *Research International*, 7(1): 1125-1128
- 320 7. Cheesbrough, M. (2009). District Laboratory Practice in Tropical Countries. New
321 York: Cambridge University Press 5: 236-240.
- 322 8. Ugochukwu, O., Onwuliri, C., Osuala, F., Dozie I., Opara F. and Nwenyi, U. (2013).
323 Endemicity of schistosomiasis in some parts of Anambra State, Nigeria. *Journal of*
324 *Medical Laboratory and Diagnosis*, 4: 54-61.
- 325 9. Dawaki, S., Al-Mekhlafi, H., Ithoi, I., Ibrahim, J., Abdulsalam, A., Ahmed, A., Sady,
326 H., Atroosh, W., Al-Areeqi, M., Elyana, F., Nasr, N. and Surin, J. (2016). Prevalence
327 and risk factors of schistosomiasis among hausa communities in Kano state, Nigeria.
328 *Journal Of The Institute Of Tropical Medicine Sao Paulo*, 7:45-76.
- 329 10. Umar, A., Oche, M., Arkilla, M. and Zailani, S. (2008). Prevalence and intensity of
330 urinary schistosomiasis in settlements around the Goronyo dam, Nigeria. *Borno*
331 *Medical Journal*, 5:4-10.
332
- 333 11. Ojurongbe, O., Sina-Agbaje, O., Busari, A., Okorie, P., Ojurongbe, T. and Akindele,
334 A. (2014). Efficacy of praziquantel in the treatment of *Schistosoma haematobium*
335 infection among school-age children in rural communities of Abeokuta, Nigeria.
336 *Infectious Disease of Poverty Journal*. 3:34-37.
337
- 338 12. Balla, H., Babagana, I., Baba, S. and Ibrahim, H. (2015). Incidence of Urinary
339 Schistosomiasis Amongst Out-of-School Pupils and “Almajiris” in Dikwa, North
340 Eastern Nigeria. *Global Journal of Medical Research: C Microbiology and*
341 *Pathology*, 15(2): 9-14.
- 342 13. Ivoke, N., Ivoke, N., Nwani, C., Ekeh, F., Asogwa, C., Atama, C. and Eyo J. (2014).
343 Prevalence and transmission dynamics of *Schistosoma haematobium* infection in a
344 rural community of south-western Ebonyi State, Nigeria. *Tropical Biomedicine*, 31: 1-
345 12.
- 346 14. Jordan, P. (2014). The beginning of epidemiology and control of bilharzia. *Acta Trop.*
347 77:9–40
- 348 15. Brown, D.S. (2016) Freshwater snails of Africa and their medical importance. 2nd

349 edition. Taylor and Francis, London. Pp 56.