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CO-INFECTION OF URINARY SCHISTOSOMIASIS AND MALARIA ASSOCIATED RISK FACTORS AND HAEMATOLOGICAL PARAMETERS AMONG RESIDENTS ALONG HADEJIA RIVER VALLEY, JIGAWA STATE, NIGERIA

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ABSTRACT

A study was conducted to determine the Co-infection of urinary schistosomiasi and, malaria among four communities residing along Hadejia river valley, Jigawa State, Nigeria. A total of 447 urine and blood samples were collected from people residing in four communities (Yamidi, Akubishin, Shawara and Dukkun villages) and screened for the presence or absence of urinary schistosomiasis eggs and malaria parasite using Concentration Sedimentation Technique for the detection of eggs of *Schistosoma haematobium*, while thick and thin blood smear was used for malaria parasite examination. Overall prevalence of urinary schistosomiasis co-infection with malaria parasite in study communities were 12.5%, 12.9%, 17.5% and 25.0% respectively. Prevalence of urinary schistosomiasis co-infection with malaria parasite was found to be higher in people with younger age group than people with older age group. There was statistical difference ($p<0.05$) in the prevalence of urinary schistosomiasis co-infection with malaria parasite based on age (p value = 0.5468). Prevalence of urinary schistosomiasis co-infection with malaria based on sex showed higher prevalence of the infections in males than females. There was statistical difference ($p<0.05$) in the prevalence of urinary schistosomiasis co-infection with malaria parasite based on sex (p value = 0.8346). Prevalence of urinary schistosomiasis co-infection with malaria parasites was found to be higher among farmers than fishermen and people with other occupation. There was statistical difference ($p<0.05$) in the prevalence of urinary schistosomiasis co-infection with malaria parasite based on occupation (p value = 0.8346). Haematological status variation with urinary schistosomiasis co-infection with malaria showed existence of mild anaemia with respect to age, sex and occupation.

Keywords: Co-infection, Malaria, Schistosomiasis, Urinary, Valley

INTRODUCTION

Schistosomiasis is a major parasitic disease caused by trematode of the genus *Schistosoma* and is a major health problem. Urinary schistosomiasis is a form of parasitic disease characterized by blood in the urine (Akinneye *et al*., 2018). Globally, schistosomiasis affects 78 countries, out of which 52 are at risk of the infection (WHO, 2013).

In Nigeria, schistosomiasis is due to *Schistosoma haematobium* which is wide spread constituting a public health problem particularly in children (Bala *et al*., 2012). schistosomiasis has been on the increase in Nigeria due to inadequate prevention, control and treatment (WHO, 2013). In most endemic areas the highest intensities of the infection are found in children between 5 and 15 years of age. In Sub Saharan Africa alone, it is estimated that 70 million individual experience haematuria, 32 million difficulty in urination (dysuria), 18 million bladder wall pathology and 10 million major hydronephrosis from infections caused by *S. haematobium* annually. The mortality rate caused due to non-functioning kidneys (from *S. haematobium*) and haematomesis has been estimated to be 150, 000 per year (Charles *et al*., 2019). School age children were thought to have frequent water contact that would make them more vulnerable to schistosomiasis and hence this age group would be more associated with schistosomiasis problems (Bala *et al*., 2012). High prevalence and high intensities are found in school aged children, adolescence and adults (Makaula *et al.*, 2014).

Malaria of the genus *Plasmodium*, is the most common protozoan parasitic disease in the tropical and sub-tropical regions of the world. Malaria is a mosquito transmitted parasitic disease, which still kills more than 400, 000 people and infects more 200, 000 million worldwide annually with 90% cases in tropical Africa (WHO, 2016). Malaria affected an estimated 219 million people causing 435, 000 deaths in 2017 globally. Malaria causes around 627, 000 deaths globally in 2013, mostly children less than 5 years living in Africa (WHO, 2013). Worldwide an estimated 212 million new cases of malaria and 249, 000 malaria deaths occurred in 2015 with 90 and 92%, respectively occurring in the Africa region. Children less than 5 years of age are particularly responsible to infection in areas with high malaria transmission. More than 70% of all malaria deaths occur in this age group (WHO, 2016). The clinical manifestation of malaria varies with geography, epidemiology, immunity and age. Understanding complex pathogenesis of malaria requires exploring mechanisms of parasite inversion and host immune response. Symptoms of malaria includes: severe headache, nausea, vomiting, chills and typical fever cycles. The severe manifestation often leads to clinically cerebral malaria, pulmonary oedema, acute kidney injury, hypoglycemia, lactic acidosis, anaemia and liver involvement (Tinashe *et al.*, 2018)).

Malaria and helminths infections are the most prevalent diseases in developing countries and their epidemiologic co-existence is frequently observed particularly in Africa

(Adegnik *et al*., 2012). Malaria and urinary schistosomiasis are parasitic infections with grave public health implications (Degarede *et al*., 2015). Co-infection with multiple parasites is common in malaria endemic area. Although much is known about the epidemiology and immunology of specific parasitic illnesses, little is known about the interaction of concurrent infections. Co-infection contributes to anaemia severity (Judith *et al*., 2017). Therefore, the scarcity of reports on the interaction of malaria and schistosomiasis infection in the risk of anaemia prompted investigation of the situation in *S. haematobium* and malaria endemic locality of Hadejia Valley. The main aim of the study is to assess urinary schistosomiasis malaria co-infection and to determine the possible association between the infections and haematological profile.

MATERIALS AND METHODS

Study Area

Hadejia Local Government is located in the north eastern part of Jigawa State. It lies between 9^0 37' E and 10^0 35' E Longitude and 13^0 02' N Latitude. The climate of the region is wet and dry type, rainfall spread between June and September with mean Annual rainfall of 315mm. The soil in the study area is sandy-loam. River Hadejia (Plate 1) provides water for irrigation and fish production (Abubakar *et al*., 2017). People in the area are farmers that grow both rain fed and irrigated crops, some are animal breeders and businessmen (Gambo *et al*., 2020).

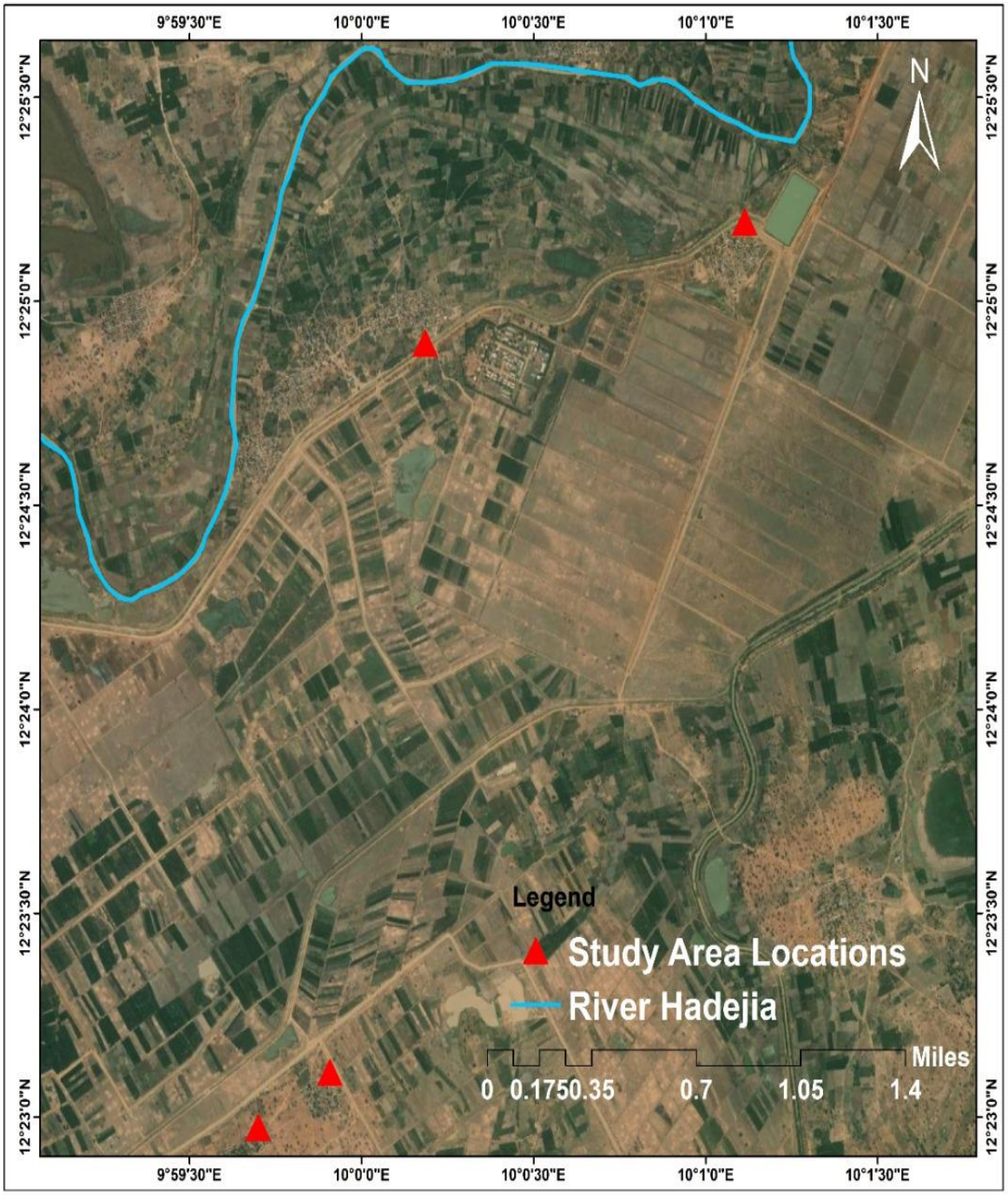

Figure 1: showing study area location (Source using GPRS)

Ethical Considerations

The study was conducted with strict compliance to ethical review committee of the Ministry of Health Jigawa State, Nigeria (MOH/PH/RAT/MN/23/001). Informed consent was sought from the study participants who were adequately informed of the nature and importance of the study prior to the specimen collection.

Study population

The required sample size was determined using single population proportion formula and assuming 76.8% proportion of urinary schistosomiasis from previous study by Abubakar *et al.,* 2017.

$$n = p(1-P)\left(\frac{Z}{E}\right)^2$$

$n = samplesize$

$Z = istheconfidencelevel\ (Z = 1.96\ for\ 95\%)$

$E = isthedesiredmarginoferror$

$p = istheproportionofschistosomiasisinthepopulationfrom\ Previousstudy$

$= 76.8\%$

$= 0.768$

$$n = 0.768(1-0.768)\left(\frac{1.96}{0.05}\right)^2$$

$n = 274$

Subjects who were both young and adult of both sexes were screened for the presence or absence of urinary schistosomiasis and malaria parasite in both the selected villages. The purpose of study was explained to the subjects in order to obtain their consent. The subjects were asked to provide urine samples between 10:00am and to 2:00pm for examination when excretion of eggs is greatest (Cheesbrough, 2014) a blood sample was collected to determine presence or absence of malaria parasite (Cheesbrough, 2014). Urine and blood samples were collected along with personal data that consist of name, age, sex, address, occupation and presence or absence of haematuria from each subject were obtained using oral interview.

Procedure for Urine Examination

Quantitative examination of single urine specimen was done using modified concentration sedimentation technique for the detection of eggs of *S. haematobium* (Cheesbrough, 2014). The subjects were given specimen bottles for sample collection. The urine samples were preserved with three drop of Hypochlorite to stop the eggs from hatching and later transported to Biology Laboratory in the Department of Science Laboratory Technology, Binyaminu Usman Polytechnic, Hadejia. Jigawa State, Nigeria for the detection of eggs. Ten (10mL) of the urine sample were collected in a clean dry container. It was then placed into a centrifuging machine for centrifugation; RCF = 44.72g. The supernatant was discarded and a drop of the sediment was placed on the glass slide and covered with cover slip. It was examined microscopically using low power time (×10) objective lens. The numbers of eggs in the preparation was recorded (Cheesbrough, 2014).

Blood Sample Collection

Blood samples were collected aseptically from the subjects until the required sample size was achieved. A total of 4mL venous blood sample was collected using sterilized vacutainer needle/holder dispensed into Ethylene Di-amine Tetra Acetic Acid (EDTA) bottle and mixed properly to avoid blood clot for malaria parasite diagnosis, packed cell volume and haemoglobin concentration (Salisu *et al.,* 2020).

Examination of Blood for Malaria Parasite

Thick and thin blood smear was made on the different slide and were directly stain with Giemsa stain for 30 minutes and malaria parasite was observed under microscope. The blood film was then stained with Leishman stain for 30 minutes. Stained film was rinsed with running water from tap for 10 seconds and then allowed to dry. The slides were examined under light microscope (×100 oil immersion objective lens) (Cheesbrough, 2014).

Haemoglobin Estimation (Sahli Method)

Haemoglobin concentration was estimated using Sahli Method (Salisu *et al*., 2020).

Determination of Packed Cell Volume

Packed Cell Volume measures the percentage volume of blood that is occupied by the red cells. The value is called Packed Cell Volume (PCV) and blood from the EDTA container was allowed to enter heparinized capillary tube, until the tube was filled to about three quarter. The end of capillary tube that is free of blood was sealed with placticine. The sealed tube was centrifuged for 15 minutes at 300 rpm, after which the values were read directly using microhaematocrit reader (Cheesebrough, 2014; Salisu *et al*., 2020).

Red Blood Cells Count (RBC)

Red Blood Cell count was made using Neubauer's chamber (haematocytometer) (Cheesebrough, 2014; Salisu *et al*., 2020).

Data Analysis

Data was analyzed statistically using Statistical Package for Social Sciences (SPSS) software at 95% confidence level with significant p value ≤ 0.05. Chi-square(X^2) test was used to determine the degree of association between prevalence of the infection, age, sex and occupation.

RESULTS AND DISCUSSION

A total of 447 subjects were screened for the presence or absence of malaria parasite in both the selected villages. Out of this number 339 were males and 108 were females. The subjects are both young and adult.

Table 1 summarized prevalence of urinary schistosomiasis co-infection with malaria parasite based on age in the study area. Prevalence of urinary schistosomiasis co-infection with malaria parasite was found to be higher in people with younger age group than people with older age group in all the four villages of the study area. In Yamidi village people aged 05 – 15 years recorded higher prevalence of the infections 8.8%, while least prevalence among people aged 16 – 25 years was 1.2% prevalence. None was examined among people aged 36 years and above. In Akubishin village people aged 16 – 25 years recorded higher prevalence of 5.7% and least prevalence was in people aged 36 – 45 years with 1.4% prevalence. In Shawara village people aged 05 – 15 years recorded higher prevalence of 6.2% and least prevalence of 2.9% was recorded among people aged 56 years and above. In Dukkun village higher prevalence of 9.0% was recorded among people aged 05 – 15 years while least prevalence of 3.0% was reported among people aged 56 years and above. There was statistical difference ($p<0.05$) in the prevalence of urinary schistosomiasis co-infection with malaria parasite based on age.

Table 2 summarized prevalence of urinary schistosomiasis co-infection with malaria parasite base on sex in the study area. Prevalence of the infections was found to be higher

among males than females in all the four villages. In Yamidi village males' recorded high prevalence of 7.5% and their female counterpart recorded lower prevalence of 5.0%. In Akubishin village higher prevalence of the infection was 11.5% among males than females that recorded lower prevalence of 1.4%. In Shawara village higher prevalence of 15.0% was also recorded among males than females that obtained 2.5% prevalence. In Dukkun village similarly higher prevalence of 19.4% was recorded among males than females that recorded lower prevalence of 6.0%. There was statistical difference ($p<0.05$) in the prevalence of urinary schistosomiasis co-infection with malaria parasite based on sex

Prevalence of urinary schistosomiasis co-infection with malaria parasite based on occupation in the study area was found to be higher among farmers in all the four villages but least prevalence was sometime recorded among fishermen or people with other occupation. In Yamidi village higher prevalence was found among farmers with 10% prevalence and least prevalence was recorded among fishermen with 2.5% prevalence. None was examined among people with other occupation. In Akubishin village higher prevalence of 8.6% was found among farmers, followed with people with other occupation that recorded 2.9% prevalence and least prevalence of 1.4% was observed among fishermen. In Shawara village higher prevalence of 12.5% was recorded among farmers, followed by fishermen that recorded 3.7% Prevalence and least prevalence of 1.3% was observed among people with other occupation. In Dukkun village higher prevalence of 19.4% was observed among farmers, followed with people with other occupation that recorded 4.4% prevalence and least prevalence of 1.6% was obtained among fishermen. There was statistical difference ($p<0.05$) in the prevalence of urinary schistosomiasis co-infection with malaria parasite based on occupation.

Table 1: Prevalence of Urinary Schistosomiasis Co-infection with Malaria Parasite Based on Age in the Study Area

	Urinary Schistosomiasis Co-infection with Malaria											
	Yam			Aku			Sha			Duk		
Age Range (Yrs)	**NE**	**NI**	**PR (%)**	**NE**	**NI**	**PR (%)**	**NE**	**NI**	**PR (%)**	**NE**	**NI**	**PR (%)**
05-15	26	14	8.8	14	4	2.9	13	5	6.2	8	6	9.0
16-25	32	2	1.2	30	8	5.7	16	4	5.0	14	5	7.4
26-35	22	4	2,5	28	Nil	Nil	9	2	2.5	12	2	3.0
36-45	34	Nil	Nil	24	2	1.4	18	2	2.5	15	2	3.0
46-55	24	Nil	Nil	24	Nil	Nil	12	Nil	Nil	9	Nil	Nil
56- Above	22	Nil	Nil	20	4	2.9	12	1	1.3	9	2	3.0
P value = 0.5468												
Total	**160**	**20**	**12.5**	**140**	**18**	**12.9**	**80**	**14**	**17.5**	**67**	**17**	**25.4**

Key: Yam = Yamidi Village, Aku. = Akubishin Village, Sha = Shawara Village, Duk = Dukkun Village, Yrs = Years, NE = Number Examined, NI = Number Infected, PR = Prevalence, (%) = Values in Parenthesis are Percentage; there was Statistical Difference ($p<0.05$) in the Prevalence of Urinary Schistosomiasis Co-infection with Malaria Parasite Based on Age.

Table 2: Prevalence of Urinary Schistosomiasis Co-infection with Malaria Parasite Based on Sex and Occupation in the Study Area

	Urinary Schistosomiasis Co-infection with Malaria											
	Yam			Aku			Sha			Duk		
Variable	**NE**	**NI**	**PR (%)**	**NE**	**NI**	**PR (%)**	**NE**	**NI**	**PR (%)**	**NE**	**NI**	**PR (%)**
Sex												
Male	110	12	7.5	120	16	11.5	56	12	15.0	53	13	19.4
Female	50	8	5.0	20	2	1.4	24	2	2.5	14	4	6.0
P value = 0.8093												
Total	**160**	**20**	**12.5**	**140**	**18**	**12.9**	**80**	**14**	**17.5**	**67**	**17**	**25.4**
Occupation												
Farming	96	16	10.0	108	12	8.6	50	10	12.5	52	13	19.4
Fishing	22	4	2.5	6	2	1.4	8	3	3.7	2	1	1.6
Others	42	Nil	Nil	26	4	2.9	22	1	1.3	13	3	4.4
P value = 0.8346												
Total	**160**	**28**	**12.5**	**140**	**18**	**12.9**	**80**	**14**	**17.5**	**67**	**17**	**25.4**

Key: Yam = Yamidi Village, Aku = Akubishin Village, Sha = Shawara Village, Duk =Dukkun Village, Yrs = Years, NE = Number Examined, NI = Number Infected, Values in Parenthesis are Percentage, Others = Other Occupation (Traders, Civil servants, Students, House wives); there was Statistical Difference ($p<0.05$) in the Prevalence of Urinary Schistosomiasis Co-infection with Malaria Parasite Based on Sex and Occupation.

Table 3 shows haematological status variation with urinary schistosomiasis co-infection with malaria parasite based on age in the study area. Haematological parameters obtained in the present finding shows mild anaemia exists among all the subjects in all the four villages of the study area. There was statistical difference ($p<0.05$) in the haematological parameters with urinary schistosomiasis co-infection with malaria based on age.

Table 4 shows haematological status variation with urinary schistospmiasis co-infection with malaria parasite based on sex and occupation in the study area. Haematological parameters observed were found to be higher in males than

females in all the four villages of the study area. There was statistical difference ($p<0.05$) in the haematological parameters with urinary schistosomiasis co-infection with malaria based on sex.

Haematological status variation with urinary schistosomiasis co-infection with malaria parasite based on occupation in the study area shows higher haematological parameters among farmers and fishermen in most of the villages, while people with other occupation recording lower haematological values. There was statistical difference ($p<0.05$) in the haematological parameters with urinary schistosomiasis co-infection with malaria based on occupation.

Table 3: Haematological Parameters with Co-infection of Urinary Schistosomiasis and Malaria Parasite Based on Age in the Study Area

	Urinary Schistosomiasis Co-infection with Malaria											
	Yam			Aku			Sha			Duk		
Age range (Yrs)	**mHb (g/%)**	**m PCV (%)**	**mRBC (m/mm^3)**	**mHb (g/%)**	**mPCV (%)**	**mRBC (m/mm^3)**	**mHb (g/%)**	**mPCV (%)**	**mRBC (m/mm^3)**	**mHb (g/%)**	**mPCV (%)**	**mRBC (m/mm^3)**
05-15	12.1	36.3	3.5	13.7	41.0	3.4	12.3	31.8	3.7	13.0	39.0	3.8
16- 25	13.7	41.0	3.7	13.8	41.3	3.3	13.0	40.4	3.8	14.0	43.0	3.8
26-35	10.8	32.2	3.2	Nil	Nil	Nil	14.0	42.0	4.2	12.0	38.0	4.3
36-45	Nil	Nil	Nil	11.3	34.0	3.4	16.0	47.0	3.9	12.0	36.0	3.7
46-55	Nil	Nil	Nil	Nil	Nil	Nil	13.5	41.0	3.7	Nil	Nil	Nil
56-Above	Nil	Nil	Nil	13.6	40.0	3.2	11.5	41.0	3.7	13.0	40.0	3.0
P value = 0.1696												
Total	**12.2**	**36.5**	**3.5**	**13.1**	**39.1**	**3.3**	**13.3**	**40.5**	**3.8**	**12.8**	**39.2**	**3.7**

Key: Yam = Yamidi Village, Aku. = Akubishin Village, Sha = Shawara Village, Duk = Dukkun Village, Yrs = Years, NE = Number Examined, NI = Number Infected, mHb = Mean Haemoglobin Concentration, mPCV = Mean Packed Cell Volume, (%) = Values in Parenthesis are Percentage, mRBC = Mean Red Blood Cells, g/% = Gram Percent, (m/mm^3) = Million Cells per Cubic millimeter; there was Statistical Difference ($p<0.05$) in the Haematological Parameters with Urinary Schistosomiasis Co-infection with Malaria Parasite Based on Age.

Table 4: Haematological Parameters with Co-infection of Urinary Schistosomiasis and Malaria Parasite Based on Sex and Occupation in the Study Area

	Urinary Schistosomiasis Co-infection with Malaria											
	Yam			Aku			Sha			Duk		
Variable	**mHb (g/%)**	**mPCV (%)**	**mRBC (m/mm^3)**	**mHb (g/%)**	**mPCV (%)**	**mRBC (m/mm^3)**	**mHb (g/%)**	**mPCV (%)**	**mRBC (m/mm^3)**	**mHb (g/%)**	**mPCV (%)**	**mRBC (m/mm^3)**
Sex												
Male	15.0	5.0	3.5	13.8	41.3	3.3	13.4	43.5	4.1	13.4	40.8	3.7
Female	9.3	28.0	3.4	12.3	36.8	3.2	12.2	37.5	3.4	12.2	30.2	3.8
P value = 0.9766												
Total	**2.2**	**36.5**	**3.5**	**13.1**	**39.1**	**3.3**	**13.3**	**40.5**	**3.8**	**12.8**	**39.2**	**3.7**
Occupation												
Farming	11.7	35.5	3.4	14.0	42.2	3.5	14.6	43.4	3.1	13.4	41.2	4.1
Fishing	12.6	37.5	3.6	13.0	40.0	3.3	13.3	42.6	3.8	11.5	36.2	3.4
Others	Nil	Nil	Nil	12.4	35.0	3.2	12.0	35.5	4.5	13.4	40.2	3.5
P value = 0.3096												
Total	**2.2**	**36.5**	**3.5**	**13.1**	**39.1**	**3.3**	**13.3**	**40.5**	**3.8**	**12.8**	**39.2**	**3.7**

Key: Yam = Yamidi Village, Aku. = Akubishin Village, Sha = Shawara Village, Duk = Dukkun Village, Yrs = Years, NE = Number Examined, NI = Number Infected, mHb = Mean Haemoglobin Concentration, mPCV = Mean Packed Cell Volume, (%) = Values in Parenthesis are Percentage, mRBC = Mean Red Blood Cells, g/% = Gram Percent, (m/mm^3) = Million Cells per Cubic millimeter, Others = Other Occupation (Traders, Civil servants, Students, House wives); there was Statistical Difference ($p<0.05$) in the Haematological Parameters with Malaria Parasite Based on Sex and Occupation.

Discussion

Prevalence of urinary schistosomiasis co-infection with malaria parasite based on age was found to be higher in people with younger age group than people with older age group in the study area. The overall prevalence of urinary schistosomiasis and malaria co-infection in Yamidi, Akubishin, Shawara and Dukkun villages was 12.5%, 12.9%, 17.5%, and 25.4%. Schistosomiasis and malaria co-infections were prevalent in all the study villages and substantial level of co-infections existed. All the villages surveyed have the overall prevalence of the infection below World Health Organization threshold of 50% for high transmission (WHO, 2017). The low prevalence was attributed to reduced water contact activities as a result of renovation of main distribution canal for the whole year, that lead to stoppage of irrigation activities, supply of safe drinking water through constructing many hand pump and solar water supply and increased distribution of insecticide treated bed nets. Thus these decreases breeding sites for both snails and mosquitoes, it also decreases water contact activities and thus decreases the

infection rate. This finding is similar to the finding of Judith *et al.* (2017) that reported the overall prevalence of 15.2% co-endemicity of both the infections in Munyenge, mount Cameroon. The work in the present study was found to be higher than the work of Olayinka *et al.* (2020) that reported 2.6% among the participants that had concurrent infections with schistosomiasis and malaria. Similarly the work in the present study was higher than the work of by Deribew *et al*. (2013) that work in schistosomiasis and malaria associated anaemia in Ethiopia recorded 2.84% prevalence. The present finding was lower than the work of Okafor-elenwo and Elenwo (2014) that access malaria and urinary schistosomiasis reporting 55.1% prevalence.

Prevalence of urinary schistosomiasis co-infection with malaria parasite based on age was found to be higher among people with younger age group than people with older age group. The work in the present study was in agreement with the work of Ruth *et al.* (2018) that reported 1.6% *S. haematobium* and *P. falciparum* co-infection among children 12 -14 years of age, while children 9 – 11 years reported 0% prevalence. Similarly the current study coincide with the work of Judith *et al*. (2017) that report *S. haematobium* and *P. falciparum* co-infection among children ≤ 20 years that recorded 25% prevalence, Children 21 – 25 years recorded 17.7% prevalence, children 26 -30 years recorded 9.9% prevalence and children > 30 years recorded 6.8% prevalence. The work in this finding disagree with the work of Nmorsi *et al*. (2009) that work on *S. haematobium* and *P. falciparum* co-infection in Nigerian children, who reported higher prevalence of co-infection among people with older age group than young 1 – 5 years recording 20.5% prevalence, 6 – 10 years recording 42.5% prevalence and 11- 15 years recording 32.5% prevalence.

Prevalence of urinary schistosomiasis co-infection with malaria parasite based on sex shows the prevalence was higher in males that females in the study area. This assertion was in concordance with the report of Safari *et al.* (2017) that reported prevalence of co-infection more frequently in boys than girls. This may be because males are more exposed to predisposing factors for schistosomiasis and malaria infections. More so, the present report is in disagreement with the work of Ruth *et al.* (2018) that reported higher prevalence of co-infection among females (1.2%) than males (0.9%).

Prevalence of urinary schistosomiasis co-infection with malaria parasite based on occupation in the study area shows the prevalence was higher among farmers than fishermen and people with other occupation. This work was supported by the work of Ganau *et al.*(2016) that worked on urinary schistosomiasis infected children of Wamako, Sokoto , State, Nigeria, reported pupils whose parent were irrigated farmers recording 55.8% prevalence, followed by those whose parent were fishermen that recorded 53.6%. The lowest prevalence rate recorded among pupils whose parents were in other occupation (traders, blacksmiths, taxi drivers etc) with prevalence of 29.1%. The work in the present study disagrees with the work of Ruth *et al.* (2018) that reported low prevalence among fishermen 11.2%. The occupational practices of those living in these communities such as fishing and farming and lack of hygiene and indiscriminate littering of human waste around residential areas and water bodies create a powerful enabling environment for the transmission of those infections (Olayinka *et al*., 2020). Individual that engaged in certain activities and occupations are at increased risk due to increase of environmental exposure (WHO, 2019).

Anaemia was categorized for both males and females as Hb value < 11.0 g/% (WHO, 2011). Anaemia classification was further categorized as follows (Hb – 10.9 g/%) was mild, (Hb 7 – 9.9 g/ %) was moderate and severe anaemia was (Hb < 7.0 g/%) (WHO, 2011). Anaemia in males was also defined as follows Hb value < 13 g/% or PCV value < 39 % or RBC value < 5.0 m/mm^3. But in females anaemia was defined as Hb value < 12g/% or PCV value < 36% or RBC value < 4.5m//mm^3 (WHO, 2011; Sembulingam and Sembulingam, 2012; Jonathan *et al*., 2016). The haematological values reported in the present study according to age, sex and occupation in relation to urinary schistosomiasis shows mild anaemia, which is in line with values reported by (WHO, 2011; Sembulingam and Sembulingam, 2012; Jonathan *et al*., 2016) as shown in the result.

Haematological status variation with urinary schistosomiasis co-infection with malaria parasite based on age during dry season shows mild anaemia in all the study area across all ages. The report observed in the present study was in concordance with the work of Ruth *et al.* (2018) that reported all respondents with co-infections had anaemia. The concurrent infections with both parasites may have enhanced risk of anaemia in children who were co-infected. Children with light co-infection had higher haemoglobin concentration compared with respondents with heavy infections (Ruth *et al*., 2018). The work in the present study was also similar to the work of Judith *et al.* (2017) that reported co-infection among pregnant women to have lower haemoglobin concentration when compared to single infection. The risk of co-infections was associated with stream usage (bathing and domestic contact with stream) while less water contact usage decrease risk of infections (Judith *et al*., 2021).

Haematological status variation with urinary schistosomiasis co-infection with malaria parasite based on sex during dry season shows the haematological parameters to be higher in males than females in the study area. This implies that females are more anaemic than males showing mild anaemia. The finding in the present research agrees with the work of Ruth *et al*. (2018) that reported higher prevalence of anaemia in females 1.2% than males 0.9%. Similarly the report of Judith *et al*. (2021) revealed haemoglobin level were significantly lower among women co-infected with *P. falciparum* and *S. haematobium* infections than those with no infections. The work in the present study was found to contradict the work of Tjalling *et al.* (2006) that reported higher anaemia in males (35.6%) than females (25.3%) respectively.

Haematological status variation with urinary schistosomiasis co-infection with malaria parasite based on occupation during dry season reported haematological parameters to be similar among people in the entire occupational group in the study area that shows existence of mild anaemia. The work in the present study was found to be in conformity with the work of Judith *et al.* (2017) that reported 9.6 g/dl among house wife, followed by farmers that recorded 9.4 g/d followed by Businessmen recording 8.7 g/dl and students recording 8.0 g/dl, which shows mild level of anaemia.

CONCLUSION

Urinary schistosomiasis co-infection with malaria parasite was moderately prevalent in all the study area. Prevalence of the infections was higher in young than older people. Prevalence was higher in males than females, prevalence of the infections was higher in farmers and least was in fishermen. Haematological parameters with urinary schistosomiasis co-infection with malaria show mild anaemia among the subjects.

RECOMMENDATION

There is a need to enhance health education programmes by environmental health workers and civic societies among local

inhabitants about the potential risk with contact with water body, There is a need to carryout nationwide survey to help in planning and evaluating schistosomiasis control measures. Public health intervention to reduce the prevalence of malaria and schistosomiasis particularly among school children

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