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Studies on Seasonal Variations in the Occurrences of Schistosoma haematobium and Bacterial Urinary Infections among School Age Children in Kano, Nigeria

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Abstract: *Urinary schistosomiasis in most cases is complicated with bacterial infections because the so called normal flora of the genito- urinary tract has a better chance of entering and invading the underlying internal tissues as a result of the constant tear and scar of the epithelium by the spiny schistosomal eggs. The study was carried ou ton seasonal variations in the occurrences of Schistosoma haematobium and bacterial urinary infections among school age children in 8 irrigation rural communities of four Local Government Areas of Kano State from March 2012 to February 2013, in order to determine the incidence of S. haematobium and its co-infection with bacterial pathogens among the pupils. Ethical clearance was sought from the State Universal Basic Education Board (SUBEB). Midstream urine samples were collected in sterile universal containers and transported to the laboratory in cold box for the laboratory procession. Urine sedimentation was carried out using centrifugation method, followed by microscopic examination the of S. haematobium. Urinalysis was carried out on each sample particularly to detect the presence of important makers of urinary schistosomiasis and urinary tract infections. Sample culture was carried out on Blood Agar and cystein lactose electrolyte deficiency (CLED) medium; Gram staining and biochemical analyses were carried out for characterization of the Bacterial pathogens. A total of 960 pupils were examined (480 in each of the dry and rainy seasons respectively), of which 306 (31.88%) were males and 112 (11.66%) were females; 165 (34.73%) male pupils and 57 (11.88%) females were found to be infected with S. haematobium during the dry season whereas 141 (14.69%) males and 55 (5.73%) females were found to be infected during the rainy season. The highest prevalence of 115 (23.96%) was found among the 11-13years age group in dry season while the lowest prevalence of 12 (2.50%) was found among the 14-16years age group the dry seasons. In rainy season, the 11-13 years age group had the highest prevalence (107) (22.29%) and 14-16years age group had the lowest prevalence (17) (3.54%).With regard to urinary tract pathogens, (8) (0.83%) female pupils and 4 (0.42%) male pupils were found to be infected during dry season while in rainy season, 70 (7.29%) females and 42 (4.38%) male pupils were infected. Considering co-infection, the rainy season had highest prevalence (4.38%) while dry season was found to have least prevalence (0.2%); the overall co-occurrence being 8.13%.The study shows no significant relationship between S. haematobium and urinary tract pathogens and seasonal variation has no profound effect on the occurrence of S. haematobium but plays an important role in urinary tract infections.*

Keywords: *Co-infection, Bacterial Pathogens, Schistosomiasis, Seasonal variation, Urinalysis.*

I. Introduction

Schistosomiasis is a chronic debilitating trematode (fluke) infection which reduces productivity and affects the development especially among children. Due to its insidious nature, it becomes apparently difficult to determine morbidity and mortality. Human infection is brought about by bathing or wading in infected water [1]. The disease is characterized with haematuria in 50% of cases, inflammation of the bladder, increased frequency of passing urine (micturation), reduce bladder capacity and complications of the lungs sometimes leading to death [2].The urethral lumen becomes greatly closed, penis or scrotum may develop obstruction and fistulas may tear through the skin [2].

Schistosoma haematobium is a parasite that pairs in the blood vessels of the liver before migrating to the veins surrounding the bladder (vesical plexus) [3]. It is the causative agent of urinary schistosomiasis (also known as bilharzia, bilharziasis or snail fever). The disease constitutes a major public health problem in the African continent [5] and in some tropical and sub – tropical regions of the world [6]. Although infection with schistosomes does not always results in clinical disease and many infections are asymptomatic, S. haematobium however could cause dysuria, nutritional deficiencies, lesion of the bladder, kidney failure and elevated risk of bladder cancer and growth retardation in children [7].

Schistosomiasis is one of the most important diseases and is evident in about 75 tropical developing countries [8], schools and residents in rural and irrigated agricultural areas are estimated to be infected, while between 500-600 million people are at risk [9]. It affects 66 Million children throughout 76 countries and in some African villages over 90% of the children is infected by the disease [10].

Urinary tract infection (UTI) defines a condition in which the urinary tract is invaded by harmful pathogens, causing inflammation [11].Though the etiologic agents are similar in industrialized and developing countries, it is evident that a person with infection in resource constrained areas of the world including most African countries, often present for care with more severe illness and often only after complications have developed [12]

UTI is one of the most common entities encountered and accounts for approximately 25 – 30% of otherwise healthy women between 20 – 40 years of age at some point during their life time [13]. It is the second commonest site after the respiratory tract for bacterial infection, consequently urethritis, cystitis and phylonephritis are the infections of the urethral tract which can be caused by bacterial species such as *Staphylococcus saprophyticus*, *Escherichia coli*, Entercoccusspp, *Proteus* spp, *Pseudomonas* spp, *Klebsiella* spp and so on[4].

The disease is pandemic and is responsible for muchillnesses and constitutes significantly to the cost of providing health globally, leading to a number of deaths either from acute infection or from chronic renal failure [14].

Bacterial infections in most cases complicate the course of patients with urinary schistosomiasis because the otherwise so called normal flora of the genito- urinary tract have a better chance of entering and invading the underlying internal tissues as a result of the constant tear and scar of the epithelium by the spiny Schistosomal eggs.

Although, urinary schistosomiasis is endemic in Nigeria, it is usually a neglected common parasitic disease of childhood [15], [16]. Also only few attempts were made in the recent past to report the secondary urinary tract pathogen that could be associated with the disease among school age children in the country and no notable attempt particularly in the northern part of Nigeria. Studies on the relationship between *S. haematobium* and urinary tract pathogens from different regions are conflicting; hence there is a need to determine the situation in some endemic areas.

II. Materials And Methods

2.0.1 Study Area

This study was carried out in selected primary schools in eight different irrigation rural communities from four local government areas of Kano State viz; Kura, GarunMalam, Dambatta and Makoda.

2.0.2 Study Design

An experimental cross sectional survey was carried out among primary school children to determine and compare the prevalence rates of S. haematobium and urinary tract pathogens throughout the year. Biodata of the subjects were collected.

2.0.3 Study Population

The study was carried out among 960 pupils; 480 each for both dry and rainy seasons within the age range of 5 – 16 years irrespective of gender.

2.0.4 Ethical Consideration

Ethical clearance was sought from the State Universal Basic Education Board (SUBEB) Headquarters of each Local Government Area.

2.0.5 Samples Collection

About 20ml of clean catch, midstream urine samples were collected by subjects themselves in sterile universal containers. Samples were then immediately transported to the laboratory in a cold box for the laboratory investigations. They were then processed within 3 hours of collection as demonstrated by [17], [3]. About 10ml of each sample was used for parasitological and 10ml for bacteriological examination.

2.1 Parasitological Analyses

Urine sedimentation was carried out through centrifugation as described by [3] to detect the presence of *S. haematobium* in urine sample fraction and to determine the intensity of infection in each case. Intensity was

reported as the number of ova/10ml of urine and was categorized as light (<50 ova/10ml of urine), medium (50 ova/10ml of urine) and heavy (>50 ova/10ml of urine).
A few drops of saponin solution were added to each 10ml urine sample contained in a centrifuge tube to lyse the red blood cells and enhance clarity in microcopy as described by [3]. It was then centrifuged at 3000rpm for 5mins in order to sediment eggs of the schistosomes. The supernatant was discarded and all the sediment transferred onto a slide and covered with a cover glass and examined microscopically using the X10 objective. The number of eggs in each preparation was counted and reported as the number/10ml of urine.

2.2 Bacteriological Analysis

2.2.1 Urine Culture

Using a sterilized were loop each sample was inoculated on to the surfaces of blood agar (BA) medium and cystein lactose electrolyte deficiency (CLED) medium as was done by [4]. The pairs of cultured plates were then incubated aerobically at 37^0C for 24hours.Colonial characteristics including colony size, shape, haemolysis on BA medium, pigments production on CLED were noted.

2.2.2 Gram Staining

A smear of each bacterial isolate was made on a clean glass slide air dried and fixed by passing through flame. The slide was then placed on a staining rack, flooded with the crystal violet and allowed for 1 minute. The excess stain was then poured off and washed briefly with tap water. The smear was covered with lugols iodine for 1 minute and washed off with clean water. With the slide titled, 70% alcohol solution was dropped wisely until no visible colour comes off the slide. It was then flooded with safranin solution and allowed for 20 seconds and then washed immediately with clean water. The back of the slide was wiped off with cotton wool to remove any stain. The smear was then dried in a draining rack and the slide examined microscopically under oil immersion (X100) objectives [4].

2.3 Biochemical Reactions

2.3.1 Catalase Test

This was carried out as described by [4]. About 2mls of hydrogen peroxide solution was poured in a test tube. Some colonies of test organisms were immersed using a glass rod into the solution which was then examined immediately for building reaction [4].

2.3.2 Coagulase Test

A drop of distilled water or normal saline was placed on each end of a slide. The test organism was emulsified and mixed gently to make a thick suspension. This was followed by the addition of a loopful of plasma to one of the suspensions. After mixing it was observed for clumping while the other preparation served as a control. Clumping within 10 seconds indicate the presence of coagulase positive organisms [4].

2.3.3 Indole Test

This was also carried out according to [4].The test organisms was inoculated into bijou bottle containing 3ml of sterile peptone water and incubated at 35 – 37^0C for up to 48 hours. This was then followed by the addition of 0.5ml Kovac's reagent where pinkish colour on the surface layer indicated positive test for indole.

2.3.4 Citrate Test

This was done by inoculating the organisms into Simon's citrate agar slopes using of sterile straight wire. The slope was then streaked with a saline suspension of the test organism and the butt was stabbed and incubated overnight at 37^0C. A bright blue colour indicated positive results [4].

2.3.5 Urease Test

The test organisms was inoculated heavily into a bijou bottle containing 3ml of sterile Christensen's modified urea broth it was then incubated at 37^0C for 12hrs where the appearance of a pink colour indicates a positive test [4].

III. Results

From the total of 960 subjects examined, 306 (31.88%) were males while 112 (11.66%) were females. One hundred and sixty five (165) (34.73%) male pupils and 57 (11.88%) females were found to be infected with *S. haematobium* during the dry season (Table 3.1) whereas 141 (14.69%) males and 55 (5.73%) females were found to be infected during the rainy season.

Table 3.1: Gender related percentage prevalence of *S. haematobium* among schools children during dry and rainy seasons (n=960).

Gender	Dry season (%)	Rainy season (%)	Grand Total (%)
Male	165 (34.37)	141 (14.69)	306 (31.88)
Female	57 (11.88)	55 (5.73)	112 (11.66)
Total	**222 (46.25)**	**196 (20.42)**	**418 (43.54)**

Table 3.2 demonstrates age related percent prevalence of *S. haematobium* among school children during dry and rainy seasons. The highest prevalence of 115 (23.96%) was found among the 11-13yrs age group in dry season while the lowest prevalence of 12 (2.50%) was found among the 14-16 years age group the dry seasons. Also during the rainy season, the 11-13 years age group has the highest prevalence (107) (22.29%) and 14-16 years age group has the lowest prevalence (17) (3.54%).

Table 3.2: Age related percentage prevalence of *S. haematobium* among school children during dry and rainy seasons.

Age Group	Number Examined (%)	Dry season (%)	Rainy season (%)
5-7	197 (20.52)	31 (6.46)	23 (4.79)
8-10	328 (34.17)	64 (13.33)	49 (10.21)
11-13	385 (40.1)	115 (23.96)	107 (22.29)
14-16	50 (5.20)	12 (2.50)	17 (3.54)
Total	**960 (100.00)**	**222 (46.25)**	**196 (40.83)**

The distribution of urinary tract pathogens among school children by gender during dry and rainy seasons is shown in table 3.3. Eight (8) (0.83%) female pupils and 4 (0.42%) male pupils were found to be infected with Urinary Tract pathogens during dry season and as much as 70 (7.29%) females and 42 (4.38%) male pupils were infected with Urinary Tract pathogens during the rainy season.

Table3. 3: Distribution of Urinary Tract Pathogens among School Children by Gender during Dry and Rainy Seasons.

Gender	No. Examined (%)	Dry season (%)	Rainy season (%)
Males	550 (57.29)	4 (0.42)	42 (4.38)
Females	410 (42.71)	8 (0.83)	70 (7.29)
Total	**960 (100)**	**12 (1.25)**	**112 (11.67)**

Table 3.4 shows age related distribution of urinary tract pathogens among school children in relation to seasonal variation. Age group 8-10 years were found to have the highest prevalence 6 (0.63%) and the lowest being 14-16 years (1) (0.42%) in dry season respectively. In the case of rainy season, 11-13 years age group had the highest prevalence 41(4.27) compared to 14-16 age group with 6 (0.63) being the lowest.

Table 3.4: Age Distribution of Urinary Tract Pathogens among School Children in Relation to Seasonal Variation.

Age Group	Number Examined (%)	Dry season (%)	Rainy season (%)
5-7	84 (8.75)	2 (0.21)	32 (3.33)
8-10	199 (20.73)	6 (0.63)	35 (3.65)
11-13	177 (18.44)	3 (0.31)	41 (4.27)
14-16	20 (2.08)	1 (0.42)	6 (0.63)
Total	**960 (100)**	**12 (1.25)**	**114 (11.88)**

Table 3.5 indicates the prevalence of *S. haematobium* coinfected with Urinary Tract pathogens in relation to seasonal variation. The dry season was found to have least prevalence (0.2%) of coinfection with Urinary Tract pathogens each in Kadawa Chiki and Kadawa Yantomo Primary Schools. while the highest prevalence (4.38%) was found at Kosawa Bigau with no occurrence at Shidar primary school during the rainy season.

Table 3.5: O**ccurrence of S. haematobium Coinfected with Urinary Tract Pathogens among School Children in Relation to Seasonal Variation.**

Primary Schools	**Dray season**			**Rainy season**		
	S. haematobium	***UTI***	***Coinfection***	***S. haematibium***	***UTI (%)***	***Coinfection***
Batta	6(1.25)	0(0.0)	0(0.00)	8(1.67)	9(1.88)	2(0.42)
Shidar	1(0.21)	4(0.83)	0(0.00)	0(0.00)	23(4.80)	0(0.00)
Kadawa Ciki	44(9.17)	1(0.21)	1(0.21)	42(8.87)	5(1.04)	4(0.84)
KadawaYantomo	37(7.71)	1(0.21)	1(0.21)	27(5.63)	6(1.25)	3(0.63)
Kura Special	36(7.50)	0(0.00)	0(0.00)	39(8.13)	4(0.8)	1(0.21)
KosawaBigau	53(11.04)	1(0.21)	0(0.0)	46(9.58)	26(5.42)	21(4.38)
Kantudu	32(6.67)	1(0.21)	0(0.00)	25(5.2)	20(4.20)	5(1.04)
Danmarke II	13(2.71)	4(0.83)	0(0.00)	11(2.30)	21(4.38)	1(0.21)
Total	**222(46.25)**	**12(2.50)**	**2(0.42)**	**198(41.25)**	**114 (23.75)**	**37(7.71)**

Key: Numbers in parentheses indicate percentages

IV. Discussions

Schistosomiasis is a chronic insidious and debilitating trematode infection which reduces productivity and affects the development of the young. Urinary tract infection defines a condition in which the urinary tract is invaded by pathogens, causing inflammation [11]; however, several studies have implicated bacteriuria co-infection with urinary schistosomiasis [19].

The overall finding of this study shows that more males (306) (31.88%) were infected with *S. haematobium* than female pupils (112) (11.66%). This may be due to the fact that although girls are also involved in the agricultural activities, boys were more involved in agricultural activities. Also boys usually engage themselves in fishing and swimming activities and are thus more exposed to the hazards than females. This result quite contradicted that obtained by[19] who recorded no significant difference by sex, but agrees with that of [20] ($P<0.05$). The overall prevalence of schistosomiasis was found to be 43.54%, which is higher than the finding of [21] (35.50%). It is also higher than the result obtained by [22] (10.70%). This may be due to higher agricultural activities of the study area compared to other areas where previous studies were carried out. It may also be due to differences in geographical location and socioeconomic status of the study population.

With regards to age distribution and seasonal variation, pupils of age groups 11-13 years were found to be more infected during both dry and rainy season with *S. haematobium* than those of 14-16years ($P<0.05$), which agrees with that of [21] who recorded no linear relationship between age progression and infection rate and even reported pupils 16 years and above to have the least infection rate and 10-12 years age bracket, the highest rate of infection, however, no significant difference was recorded between dry (46.00%) and rainy (41.00%) seasons. Statistical analysis by chi-squared test revealed that there is no significant difference between the seasons, ($P>0.05$), thus any perceived differences is due to mere chance. Also, no significant difference was observed in the rate of intensity of schistosomiasis with season ($P>0.05$). This may be attributed to the snail vector availability all the year round due to intense irrigational activities.

With respect to urinary tract infections, the overall prevalence was found to be 11.67% which is higher than the finding of [23] (7.00%) and lower than the results of [24] (60.00%) and also lower than that of [25] (48.00%). However, more females were found to be infected (0.83% and 7.29%) than the males (0.42% and 4.38%) during both dry and rainy seasons respectively. Significant relationship was found between males and females; this contradicted the finding of [20] that there is no significant difference between sexes but agrees with the general knowledge that females are more likely to acquire UTI than males because they are more exposed to the risk factors. It also agrees with the result of [26] who recorded more UTI in females than in males. Age wise, linear relationship between age progression was observed during the rainy season but not during the dry, however there is no significant differences between age groups, ($P>0.05$). This result contradicted that of [26] who recorded more UTI in younger children and attributed their susceptibility to their toilet accessibility and orientation problems. More urinary tract pathogens were isolated during the rainy season than dry season which may be attributed to the fact that the rainy season in this part of the country is accompanied with hot and humid weather conditions which favours bacterial growth and proliferation [27].

Also concomitant occurrences between urinary tract pathogens and schstosomiasis was found to be higher during the rainy season 37(7.712%) than dry season 2(0.42%) which can be compared with the result of [28] who recorded a higher prevalence of UTI (98.3%) in locality were S. haematobium infection was also considerably higher (79.4%). Furthermore, S. haematobium was found to beco-infected with urinary tract pathogens in relation to seasonal variation. The overall prevalence with regard to co-occurrence in this study was 8.13% which is lower than the findings of [20] (8.20%) and that of [29] (53.70%). Moreover, several studies have implicated bacteriurial co-infection with urinary schistosomiasis as affirmed by [18], however the study shows no significant relationship between *S. haematobium* and urinary tract pathogens occurrence ($P \geq 0.05$).

V. Conclusion

The findings of this study revealed that the study area was endemic with respect to schistosomiasis. Moreover, the study shows no significant relationship between S. haematobium and urinary tract pathogens occurrence. Hence, seasonal variation has no profound effect on the occurrence of *S. haematobium* but plays an important role in urinary tract infections.

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