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Prevalence of *Schistosoma Haematobium* in Sudan Dry Land (A Case Study at Al-Rahad City, North Kordofan State)

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Abstract **– In Sudan dry land, the local communities depend on natural resources for alternative. They parctise subsistence agriculture and animal herding. Some of these activities may affect their life negatively by increasing the probability of getting infectious diseases such as Schistosomiasis. This disease is amongst the areas projecting tremendously higher prevalence and intensity especially during childhood. A cross sectional study was conducted to determine the prevalence and intensity of urogenital schistosomiasis among primary school children in Al - Rahad city in North Kordofan State, Sudan. A total of 114 students from 5 primary schools were chosen for sampling. They were classified into 3 age groups: 7-9, 10-12 and 13-15 years old. Their urine samples were examined using filtration laboratory technique for the infection with *S. haematobium* using the standard filtration technique. Data were analyzed statistically using SPSS, with respect to *S. haematobium* prevalence related to child sex and age group.**

The study has recorded an overall higher prevalence *S. haematobium* among male students, (54.4%), as compared to females, (45.6%). Results of the Student t-test insignificant difference of egg count between the two sexes, (p = 0.467). ANOVA results indicated significant difference of the egg count between and within the age groups, (p = P = 0.06). Results of Pearson Chi-square test revealed high correlation of *S. haematobium* infection to age group of infected children. These findings indicated that Al-Rahad city is endemic to urogenital schistosomiasis especially among males as compared to females and therefore, in order to mitigate the high intensity of infections, a control program is required.

The objectives of this study are to examine the prevalence Schistosomiasis in Sudan dry land especially in Kordofan State and to evaluate the infection rate among school children in Al-Rahd city. It also, meant to through some light on the endemic diseases in the area.

Keywords **– Sudan, Dryland *Schistosoma Haematobium*, Al-Rahad, Filtration Technique, Urogenital Schistosomiasis.**

I. INTRODUCTION

Dry land ecosystems are very fragile, and can rarely sustain the increased pressures that result from intense population growth. In Sudan, many of these areas are inappropriately opened to development Schistosomiasis (Bilharziasis or Bilharzia) is a chronic and acute parasitic disease caused by digenetic blood vessel-dwelling trematode of the genus Schistosoma. It occurs in the intestinal and urogenital forms. Urogenital schistosomiasis caused by Schistosoma haematobium (S. haematobium) and is characterized by progressive damage to the bladder, ureters and kidneys. In 2010 the disease has been enlisted as one of the Neglected Tropical Diseases (NTDs) that present some of the most universal health problems in the world. Around 119 million people worldwide while the regions surrounding Sub-Saharan Africa remains the area of prevalence with an overall mortality rate estimated to be at least 2 per 1,000 infected patients per year (23). This has led urinary schistosomiasis to be deadliest parasitic disease in the NTDs (38), Hotez et.al., 2006). In fact, only malaria accounts for more diseases 48 than schistosomiasis.

Infection occurs by contact with stagnant or slow-moving fresh water where infected Bulinus snails live. Preferably, lakes, natural streams, and ponds submerged with infected Bulinus snails forms the typical sources for infection. Irrigation systems, dams, and man-made water reservoirs are proven to significantly contribute in increasing the incidence of disease in the last few decades (McManus, & Loukas 2008). Thus, the main risk groups are children under 15 years of age, specific occupational groups (fresh water fishermen, irrigation workers, farmers), and women fetching water for home use and other groups using infested water for domestic uses (40). Patterns of sanitation, water supply, and human water use are crucial elements in making people vulnerable to infection. Moreover, Play habits of school-aged children such as swimming or fishing in infested water make them especially vulnerable to infection. According to Nokes et al (1999), schistosomiasis is considered a significant risk factor in children because it result in chronic anemia, malnutrition, growth stunting, protein calorie, cognitive disability, and poor school performance. Schistosomiasis decrease in sensitivity in adulthood and prevalence rises to a peak during the years 10–15, then declines through the 20s, 30s and 40s to well less than half of the childhood peak, due to behvioural activity shown in less contact with water and immunity to infection. Similar observations were reported by Nmorsi et al (2007).

In Sudan, urogenital schistosomiasis is widespread and constitutes a critical public health problem mainly among children in their school going age as compared to other age groups (Ahmed, et al.,2012 and Seghor, et. al.,2014). A number of factors have been deemed responsible because of higher rates between the specified age groups. Thus, for instance, include the increased water activities such as fishing or swimming (Agrawal, and Rao, 2011). Besides, improper hygiene arrangements provide better opportunities for the spread of infection, (40). Some other factors include blood vessels supplying genitourinary system as well as immunological factors (Mutpi et.al.,2008, and Sam-Wobo, et. al., 2011). Furthermore, people in developing countries such as Sudan have poor living

standards and healthcare facilities which are needed for proper control of the disease (Monde, et.al., 2015). Southern Kordofan State lies on the border between Sudan and South Sudan. For more than 20 years, this state was the scene for war between Sudan and South Sudan that drastically affected the social and economic status of the 1.6 million people living in the State. People depend on subsistence agriculture and herding which may intensify infection since the disease associated with poverty and poor living conditions especially among risk group (37) and Elawad 2005). Water is provided mainly from dams, wells, superficial rainwater collections and water pumps. Many water ponds are present and stay wet year-round. The availability of latrines in SK State is very low (less than 20%), and the use of available latrines needs to be improved, (Federal Ministry of Health-Sudan, (2007).) There have been two major reasons for focusing the study in this area of Sudan. Firstly, it has been referred as the most vulnerable areas in the continent of Africa, where a profusion of schistosomiasis has been growing at unprecedented rates (Abou-Zeid, et.al., 2012, and Dahab, and El-Bingawi, 2012). The communities living there are found to be economically stressed and mostly dwell nearby rivers or water streams (Afifi, et.al., 2016). Secondly, there have been only a few studies reported regarding detection of schistosomiasis among the given population (Elfaki, et.al., 2016). Moreover the disease is responsible for extensive morbidity and mortality in up to 90% of severe infections detected in children of the state and thus recognized as one of 10 tropical diseases of most concern to the World Health Organization, (Amin, and Satti 1973, (39) and Amin et al. 2012 and)

The study, therefore aims to bridge the research gap and provides empirical evidences for formulating control programs for urinary schistosomiasis among the inhabitants of the city in accordance to the World Health Organization recommendations. (WHO).

II. Materials and Methods

Study Area

The study focused on the area of Al-Rahad city (12°43'0" N, 30°39'0" E, 85 1608 ft above the sea level), located in North Kordofan State, 545 km west of Khartoum, the capital of Sudan, North-East Africa, (Figure 1). It is a junction station on the western line of the national railway network in Sudan and its population amounts to 26,273 according to the last census 2009.

The climate is Semi-desert to subtropical savannah, with average annual rainfall of 400-600 mm. The rainy season lasts for about five months, usually begins in May and reaches its peak in August and continues up until September. One characteristic geographical feature of the area is the absence of rivers. Alternatively; at the west of the Al-Rahad city, there is a huge freshwater body (locally known as Al-Turda) that traverses the locality. Al-Turda is a permanent man-made lake used to store rainwater; its annual storage capacity is 52,000,000 Cubic Meters that are used to secure the City, the 98 villages, and the local farms in the surroundings against the annual 99 threatening of "Lack of Water" during the critical summer months. 100 Therefore, people in this part of Sudan depend mainly on Al-Turda for 101 drinking, domestic, fishing, animal and agricultural purposes and other water needs.

Throughout many visits to the study area, most of the children were observed to play and swim in Al-Turda after school and in their leisure time. As a result, contact with the water is an absolute necessity for the majority of them, besides that, their living conditions and individual hygienic practices were also poor. So, the populations of the selected schools were representative of the parasitological situation in this area.

Fig. 1. Location Map of Al -Rahd city.

Study Population and Subject Selection

This is a cross-sectional study carried out among school children aged 7-13 years old in Al-Rahad city during three weeks in September 2014. School children were randomly selected from five primary schools in the city. Data were collected with exclusive reference codes given to each participant.. Each child was administered a simple health structured questionnaire to collect social and economic data of the pupils. Information on age, sex, educational background perception, knowledge of symptoms, sources of water supply / mode of transmission and health implications of schistosomiasis were obtained. The class teachers administered the questionnaire to the children in the language (Yoruba or English) he / she understand best.

Ethical Approval

The study received ethical clearance from the State government after it, a pre-survey visit to the study area was made during which consultations and discussions were held with local governors, the local community leaders and primary school teachers who were informed about the aims and methods of the study. Inormal seminars were conducted to raise public awareness before sampling commenced.

Informed Consent: verbal informed consent of the school children was obtained after the headmaster of the school had explained the project to the pupils. They were allowed a day to discuss and obtain permission of their parents. Children whose parents or legal guardians objected to their participation were excluded. On the sample collection day the class teacher helped to confirm the consent from the

pupils. Moreover, all those who participated in the study were informed that they could withdraw without any penalties, if they were not comfortable with participating. The children who took medication for schistosomiasis three weeks prior to and during the data collection and children who were seriously ill during data collection were also excluded.

Collection of Urine Samples:

Samples were collected in sterile plastic containers each assigned to an individual specific code for the sake of reference and record. The containers had a wide mouth and showed a capacity of 200 ml marked well with the identification numbers. Children were given the autonomy to self-collect their samples. However, they were given brief instructions for careful collection of the samples. They were instructed to collect urine by the mark of 10 ml and tightly cover bottles with the cap. Samples were collected in schools during the day timings precisely 10:00 am to 2:00 pm due to the circadian pattern of egg excretion, i.e. the excretion of eggs is at its peak and may bring expectedly accurate results (Senghor et.al., 2014). The appearance of urine was noted for each sample. Formal saline (3 drops) was added to preserve thesamples and avoid hatching of eggs (Agrawal,2012). The samples collected were 150 immediately stored in the black cellophane bags to avoid contact with the sunlight and were immediately moved to the field laboratory for examination could be performed then and there.

Parasitological Diagnosis

At the field laboratory, about 10 ml of an individual's urine were drawn into a plastic syringe and then discharged through polycarbonate (Nucleopore®) filter (25 mm diameter, 12.0 µm pores) according to the method described previously (Kean,et.al.,1978). The specimens (the filters) were microscopically examined for S. haematobium eggs using the 10 x and 40 x objectives. The examination and egg count was repeated on another portion of the sample. Results expressions were formed through presenting the mean number of eggs for every 10 ml of urine, if more than 50 eggs are present; there is no need to continue the counting. The cases of schistosomiasis were defined as children with at least one S. haematobium egg on microscopic examination of urine. Categorization of the intensity of infection was done according to instructions by (40), i.e. it is based on the egg count contained per 10 ml of urine. These include the non-infected samples (with no eggs), low intensity samples (containing 50 or less eggs per 10 ml), and highly infected samples (with 50 or more eggs per 10 ml). Individuals who tested positive for schistosomiasis infection were treated with praziquantel (Shin Poong, Seoul, South Korea) according to WHO guidelines.

Data Analysis

The Statistical Package for Social Science, (SPSS) was used to analyze the data. . The relationships between the characteristics of infection (prevalence and intensity). The chi-square test was used to test for the vaiance association. ANOVA and the Student test, were used to analyze prevelency and egg count between sex and ade group of infected children.

RESULTS

Sample Characteristics

Classification of sampled groups indicated that 45.6% are between 10-12 , 28.1% is between 13-15 years, and 26.3 % is between 7-9 (Figure 2).

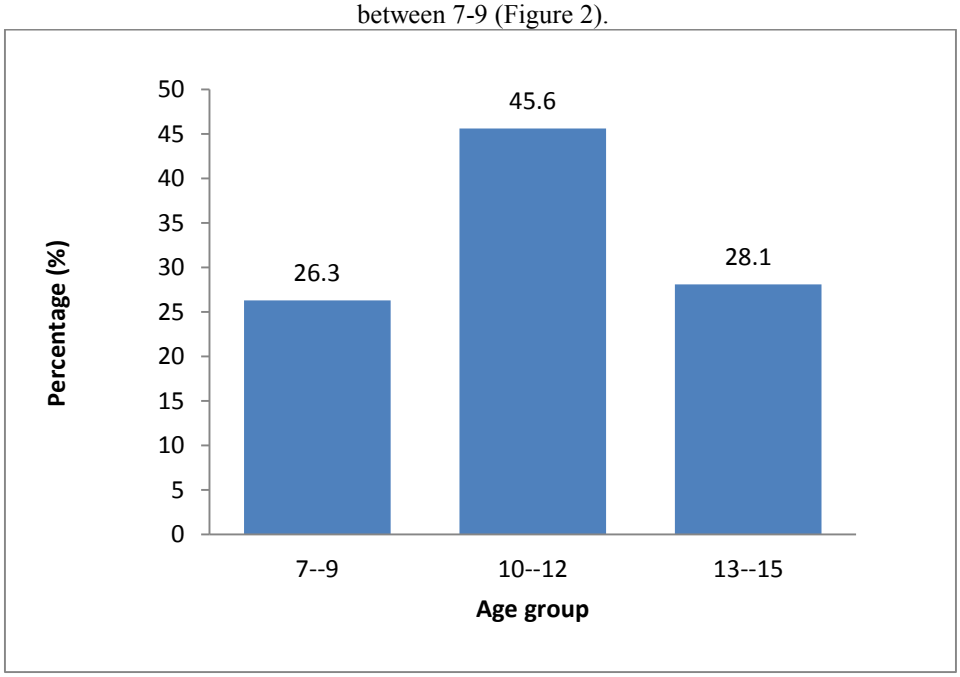

Fig. 2. Percentage of the different age group included in the study at Al-Rahad city during 2014.

Infection:

Incidence of S. haematobium infection in Al-Rahad city is evaluated in relation to age group of the sampled children. Results obtained illustrated that 45.6% of the encountered infected cases is reported age group 10-12 years. Whereas,28.1 and 26.3% of cases are recorded within the age range13-15 and 7-9 years, respectivly. Gender wise male are shown to get more infection of (54.4%) as compared to females (45.6%), (figure,3).

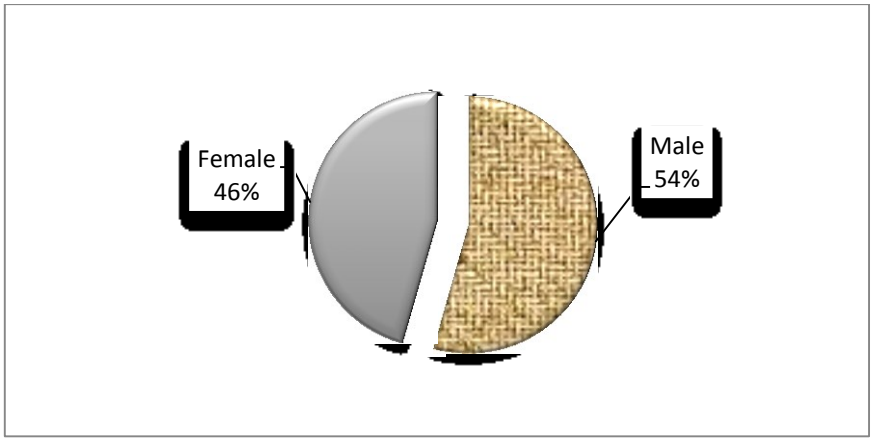

Fig. 3. Prevalence of S. haematobium according to the infected child sex at Al- Rahad city during 2014

S. haematobium's egg secretion

The count of the S. haematobium's eggs secreted in urine samples of the infected children shows significant variations in prevalence of relation to sex. Insignificant variation in intensity of egg secreted in male samples compared to females, (Table1).

Table 1. Value of the student t-test as calculated for egg secretion in relation to the sex of the infected child at Al-Rahad City during 2014

Sex	Means	P – value
Males	8.9469	0.206 ns
Females	9.4533	

*Significant at P=0.05

The impact of age group on *S. haematobium* egg count:

S. haematobium egg **count** in relation to the age group of infected children was studied. ANOVA results revealed considerable differences between and within groups. It indicated that the intensity of *S. haematobium* is influenced by both sex and age group. However, the impact of age groups on egg count is insignificant, (p= 0.467). A significant difference is found in prevalence between egg count within the age group, (P=0.06), (Table,2). Likewise, *S. haematobium* infection was correlated with age group of infected children. Results of Pearson Chi-square test revealed high correlation values as shown in table (3)

Table (2). ANOVA table for Impact infected children age group on S. haematobium egg count at Al-Rahad city during 2014

- Significant difference at p=0.05

Egg count	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.964	2	2.482	.766	.467ns 0.06 *
Within Groups Total	359.827 364.791	111 113	3.242		

Table 3: Pearson Chi-square test for *S. haematobium* infection and age group at Al-Rahad city during 2014

Chi-Square Tests	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square Likelihood Ratio	7.748 a	2 2 1	0.021
Linear-by-Linear Association N of	7.926		0.019
Valid Cases	7.678 114		0.006

DISCUSSION

The study recorded an overall prevalence of S. haematobium infection from selected age grouped children at Al-Rahad city during 2014. It was found that indicated that 45.6% of the sampled cases are from 7-9 years old. Also, infected males exceeded female ones. These results were in conformity of earlier studies conducted by (Senghor, et.al.,2014; Dahab,et.al.2012; Liao,et.al.2011; Abou-Zeid, et.al.,2013 and Deribe, et.al.,2011). These authors claimed that impacts of child age in relation to susceptibility of infection with S. haematobium. On the other hand, these findings disagreed with that of Ekpo,et.al.,(2010), who indicated insignificant differences in intensity of infection with the child age. This could be as ascribed to the impact of environmental hygiene condition that might exist among the study groups. Similar observations were made by Naphtali, et.al.,(2017),who correlated infection with S. haematobium to primary school children age group and parent education. Elias, et.al. (1994), formerly observed increased prevelance of S. haematobium within younger age group in a study in the Rahad irrigated scheme, Sudan.

This study also revealed that males had higher prevalence rates of infection than the females. This agreed with Shashie, et al. (2015), who indicated that males showed the highest infection intensity of infection than females. They attributed their findings to the fact that . male children have more affinity to be infected than females because they are engaged in water contact activities that necessitated them to be in direct contact with water bodies. These activities include farming ,fishing, bathing, and watering cattle. The results are in line with findings of (Risikat, and Ayoade,2012), but in contraction with those of Gyuse,et.al.,(2010). And Dabo, et.al.,(2010).

The count of the S. haematobium's eggs secreted in urine samples of the infected children shows significant variations in egg secretion of relation to sex. Insignificant variation in intensity of egg secreted in male samples compared to females. These results could be ascribed to the differences in the male and female intensities of infection, which may reflect the degree of sensitization and host response to the invading parasites as well as the extent of worm burden in the individual subject. This result is in accordance with

CONCLUSION

In Sudan the risk for *S. haematobium* is widespread in the different regions and school age children were at a higher risk of *S. haematobium* infection than the other age groups. Due to many factors such as higher rates of water activities, anatomical vasculature supplying genitourinary structures and immunological factors, school-aged children are the group at highest risk of contracting *S. haematobium* infection, Mohammed,(2006).

A field survey was carried out to study prevalence schistosomiasis in Sudan dry land with respect to the incidence among school children in Al-Rahd city. A higher prevalence of the infection was detected among male children than females. Also, higher prevalence was observed among children aged 10-12. A higher egg activity occurred among male children as compared to females. It is apparent that one way of reducing the disease prevalence is through minimizing the contact of the children with the infected water .sources. Also, treatment of children with higher intensity of schistosomiasis may be applied through large-scale chemotherapy. Provision of a piped water the residential area is a prerequisite to prevent childern from contracting the infection.

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