A STUDY ON THE TRANSMISSION, PREVALENCE AND INTENSITY OF SCHISTOSOMA-HAEMATOBIUM INFECTION AMONG SCHOOL CHILDREN AT KIGOGO-KINONDONI DISTRICT-DAR-ES-SALAAM.

DR. RICHARD NDYOMUGYENYI, (MBCHB) (M.U.K)

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Abstract

A cross sectional survey for Schistosoma haematobium infection and some factors influencing its transmission were studied among school children from two schools at Kigogo-Kinondoni district of Dar-es-Salaam city. The overall prevalence rate was 230/483 47.6% based on microscopic examination of a single urine sample. The prevalence rates were 111/249 (44.6%) and 119/234 (50.9%) in Kigogo and Darajani Primary School respectively. Males (54.6%) were more infected than females (40.8%). The overall intensity of infection was (47 eggs/10ml urine). It was higher in males (54 eggs per 10ml urine) than in females (38 eggs/10ml urine). The 10-14 years age group had the highest prevalence rate and intensity of infection. The frequency of micro-haematuria among infected children was high (84.3%) reaching 92% from an egg output of 50 or more eggs/10ml urine; and the frequency of visible haematuria was 37.7%.

Human water contacts were mainly for recreational activities and domestic use. Males showed a higher frequency of water contact than females.

Malacological surveys recovered Bulinus (Ph.) globosus, B. (Ph.) nasutus and B. (Ph.) africanus from 8 out of 12 water contact sites searched.

Metrifonate in 3 doses at 2 weekly intervals had overall

cure rate of 88.7%.

Of the studied children, (47.5%) had never heard about the disease . However,knowledge about the disease among those children who had heard about the disease was high as assessed by the questionnaire survey.

It is concluded that the current prevalence rates and intensities of infection in the area are unacceptably high. Selective chemotherapy, health education and provision of alternative water sources for recreational activities are suggested as possible methods for the control of the disease in the area.

DECLARATION

I HEREBY DECLARE THAT THIS DISSERTATION IS MY ORIGINAL WORK AND HAS NEVER BEEN SUBMITTED IN ANY FORM, FOR A DIPLOMA OR DEGREE IN ANY OTHER UNIVERSITY

Candidate`s signature: Date: 24/8/92

DR. R. NDYOMUGYENYI

Supervisor`s signature: Date: 24/8/92

PROF. J.N. MINJAS

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TABLE OF CONTENTS

Contents		Page
Title		i
Abstract		ii
Declaration		iv
Copyright		v
Aknowledgement		vi
Table of contents		viii
Definition of terms		xi
List of tables		xii
List of figures		xviii
List of maps		xix
CHAPTER 1		
1.	Introduction and Review of Literature	1
1.1	Introduction	1
1.2	The life cycle of S. haematobium	3
1.3	Statement of the problem	7
1.4	Rationale and objectives	9
1.4.1	Rationale	9
1.4.2	Objectives	9
CHAPTER 2		
2.	Methodology	11
2.1	Description of the study area	11
2.2	Sample size estimation and selection of the study group	13
2.3	Water bodies and water contact site survey	13
2.4	Malacological survey	14
2.5	Parasitological survey	14

2.6	Questionnaire survey	16
2.7	Data analysis	16
CHAPTER 3		
3.1	Water bodies and contact sites	17
3.2	Malacological findings	18
3.3	Demographic characteristics	22
3.4	Parasitological survey results	22
3.5	The effect of metrifonate therapy	31
3.6	Water supplies	42
3.7	Human water contacts	42
3.8	Knowledge about S. haematobium infection	47
3.9	A correlation of Parasitological findings with water contact activities and history of past infection.	68
CHAPTER 4		
4.	Discussion	73
4.1	Prevalence rate and intensity of infection	73
4.2	Human water contacts	75
4.3	Haematuria and proteinuria	77
4.4	Water supplies	80
4.5	Knowledge about the disease	81
4.6	Chemotherapy	83
4.7	Malacology	83

CHAPTER 5

5. Conclusions and Recommendations 86

5.1 Conclusions 86

5.2 Recommendations 86

References 89

Appendices:

Appendix 1 English version of the questionnaire 99

Appendix 2 Swahili version of the questionnaire 105

Definition of terms

- Heavy infection is defined as an infection in which an individual is excreting 50 or more eggs of Schistosoma haematobium per 10ml urine sample.

- Potential transmission sites - Water contact sites frequented by the population where Bulinus snail intermediate hosts are found but snails are not shedding cercariae

- Human contact activities defined as activities which bring the human population into contact with water sources.

LIST OF TABLES

Tables

		Page
Table 1:	A summary table of contact sites, number of snails and the species recovered from each site.	
Table 2:	The distribution of the studied children by age and sex.	23
Table 3:	The prevalence rate and intensity of Schistosoma haematobium infection among school children.	24
Table 4:	Relationship between Schistosoma haematobium infection and place of residence.	26
Table 5:	Relationship between prevalence rate and intensity of S. haematobium infection and sex among school children.	27
Table 6:	The prevalence rate and intensity of S. haematobium by age and sex among school children.	32

Table 7: The prevalence rate of S. haematobium infection and frequency of excretion of 50 or more eggs/10ml urine samples by age and sex among school children. 33

Table 8: The distribution of Schistosoma haematobium eggs output among children who were infected in relation to haematuria. 34

Table 9: The relationship between the frequency of microhaematuria as detected by urinalysis reagent strips and Schistosoma haematobium infection among school children. 35

Table 10: The relationship between visible haematuria and S. haematobium infection. 36

Table 11: Semiquantitative determination of haematuria with urinalysis reagent strips among S. haematobium infected children between 5 years and 19 years in relation to intensity of infection. 37

Table 12: Semiquantitative determination of Proteinuria with urinalysis reagent strips among S. haematobium infected children between 5 years and 19 years in relation to the intensity of infection. 38

Table 13: Relationship between history of haematuria and S. haematobium infection among school children. 39

Table 14: The cure rate of S. haematobium infection among school children treated with 3 doses of Metrifonate (10mg/kg body weight) 8 weeks after therapy. 40

Table 15: The distribution of S. haematobium eggs output among children who were still excreting eggs in Urine 8 weeks after Metrifonate therapy in relation to microhaematuria. 41

Table 16: Frequency of swimming by time of the day 46

Table 17: Relationship between age and having heard about S. haematobium infection. 48

Table 18: The relationship between knowledge of dysuria as a symptom of S. haematobium infection and age. 49

Table 19: Relationship between knowledge of haematuria as a symptom of S. haematobium infection and age. 50

Table 20: Relationship between knowledge of frequency of micturition as a symptom of S. haematobium infection and age. 51

Table 21: Relationship between knowledge of lower abdominal pain as a symptom of Schistosoma haematobium infection and age. 52

Table 22: Relationship between age and knowledge of how pathogens get into man`s body. 53

Table 23: Relationship between age and knowledge of urinating in water as a mode of transmission of S. haematobium infection. 54

Table 24: Relationship between age and knowledge of aquatic snails involvement in the transmission of S. haematobium infection. 55

Table 25: Relationship between age and knowledge of fishing in contaminated water as a mode of acquisition of S. haematobium infection. 57

Table 26: Relationship between age and knowledge of bathing in contaminated water as a mode of acquisition of S. haematobium infection. 58

Table 27: Relationship between age and knowledge of swimming in contaminated water as a mode of acquisition of infection. 59

Table 28: Relationship between history of past S.haematobium infection and knowledge of dysuria as a symptom of the disease. 61

Table 29: Relationship between history of past infection and knowledge of haematuria as a symptom of the disease. 62

Table 30: Relationship between history of past S. haematobium infection and knowledge of frequency of micturition as a symptom of S.haematobium infection. 64

Table 31: Relationship between history of past S.haematobium infection and knowledge of lower abdominal pain as a symptom of the disease. 65

Table 32: Sources of information about S. haematobium infection. 66

Table 33: Perceived severity of S. haematobium infection by school children. 67

Table 34: Relationship between human water contact activities and the prevalence and intensity of S. haematobium infection among school children. 69

Table 35: Relationship between history of past Schistosoma haematobium infection and positivity for S. haematobium eggs in urine. 72

LIST OF FIGURES

		Page
Fig. 1:	Lifecycle of Schistosoma haematobium.	6
Fig. 2:	Man collecting water for watering from site 8 containing snail intermediate hosts of Schistosoma haematobium.	12
Fig. 3 & 4:	Children swimming, playing and women washing their feet.	20
Fig. 5:	The frequency of water contact activities by sex.	45
Fig. 6:	Frequency of water contact activities by age and sex.	46

LIST OF MAPS.

Page

Map 1: Map of Kigogo ward showing the major water bodies and water contact sites. 19

CHAPTER 1

1. INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

Urinary Schistosomiasis is caused by Schistosoma haematobium which is a trematode. Transmission of S. haematobium requires human water contact. Infection of human populations occurs where behavioural patterns results in exposure to cercarial infested water.

It is estimated that at least 180 million persons are at risk of infection with Schistosoma haematobium and that about 90 million persons are infected globally with the majority in Africa (Cheesbrough, 1987). In United Republic of Tanzania, Iarotski and Davis (1981), estimated that 3 million (18.7%) persons were exposed to schistosomiasis with high endemicity of S. haematobium. Community based morbidity studies in Tanzania have shown radiographic abnormalities of the urinary tract in individuals infected with S. haematobium (Forsyth, 1969; Rugemalila, 1979). In endemic areas, several studies done about S. haematobium have shown that up to 80% of infected children have haematuria (Tanner et al., 1983; Rutasatira et al., 1984; Sarda, 1986). Haematuria and proteinuria are related to the intensity of infection (Wilkins et al., 1979; Mott et al.,1983; Sarda, 1986) and intensity is related to morbidity especially in children (Abdel-Salam and Ehsan,1978; Doehring et al., 1985).

poor or absent sanitation and water supply and the distribution of snail intermediate hosts have created conditions favouring the disease transmission to a greater extent than in the rural areas (Mott et al., 1990). Dar-es-Salaam city is well known for water-related diseases especially Urinary Schistosomiasis (Sarda et al., 1985a) which affects mainly children. However, only few detailed studies have been conducted to determine factors that influence the transmission of the disease in the city.

1.2 The Life cycle of Schistosoma haematobium

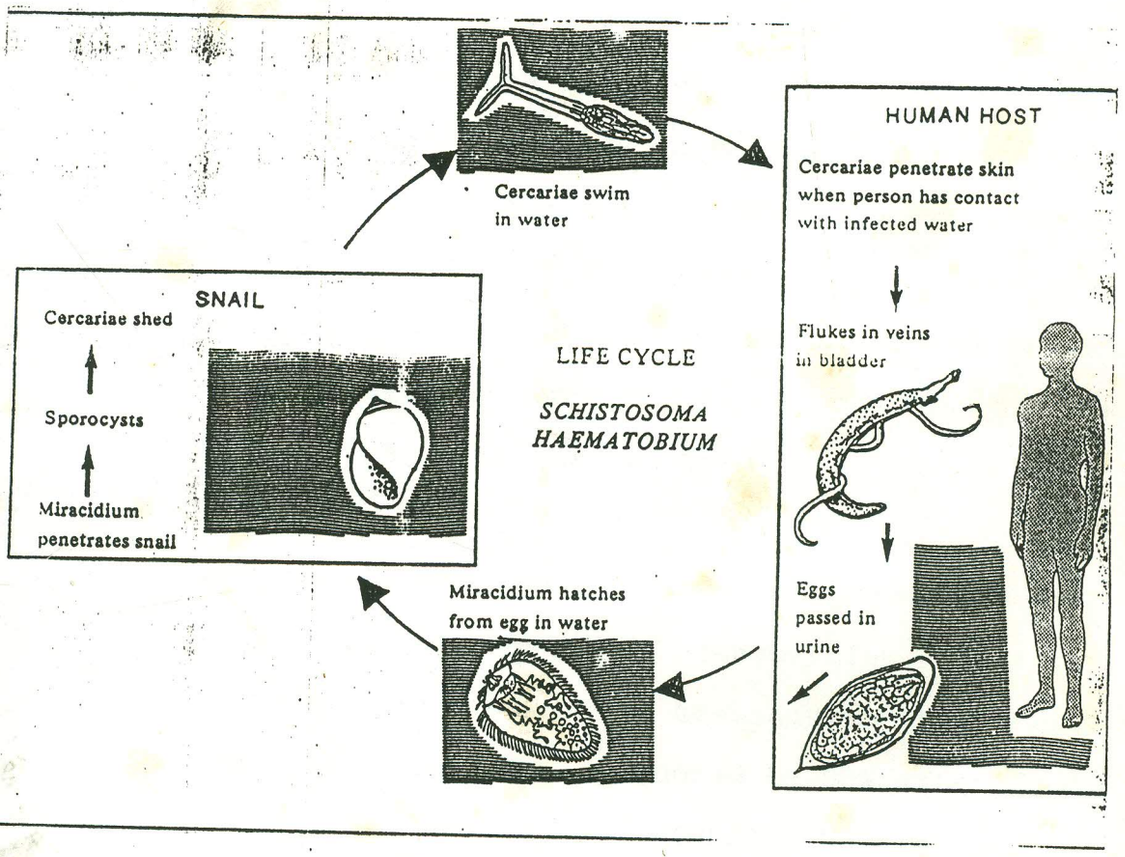
The life cycle is made up of a succession of stages (Fig. 1). Successful transmission and completion of the many - staged cycle of the parasite depends on the presence of fresh water bodies in which snail intermediate hosts can thrive and which man uses and contaminates. Eggs of the Schistosomes are passed along with human urine in water. When the water temperature ranges between 10-30°c (Webbe, 1982), the eggs hatch into the first larval stage miracidia. The free swimming miracidia remain infective to their snail intermediate hosts for 8-12 hours (Webbe, 1982). Shiff (1968) reported that with S. haematobium - Bulinus globosus combination, (60%) of miracidia do not penetrate the snail. After penetrating the soft tissue of the snail, miracidia by means of asexual reproduction, become mother and daughter sporocysts. The latter develop into cercariae, the second larval stage in the Schistosome cycle.

From one infestation in a snail, the output rarely exceeds 2000 motile sexually differentiated cercariae per day (Webbe, 1965). Light is the principal stimulus causing the release of cercariae usually at temperatures between 10°c and 30°c (Webbe, 1982). Most emerge between 10a.m and 2p.m. Fork-tailed cercariae are attracted to humans and can penetrate any part of the body-foot or fingers. During penetration, the cercariae shed their tails and develop into Schistosomules which migrate through subcutaneous tissue into blood vessels. In the blood, the young flukes are carried through the right side of the heart to the lungs. From the lungs most of the Schistosomules pass through the left side of the heart, enter the abdominal aorta, and from there reach the portal (liver) circulation. In the blood vessels of the liver, the young flukes reach maturity. Following mating, the paired flukes migrate to the veins surrounding the bladder (vesical plexus). Adult worms may live for 20-30 years, but the mean length of the life span is 3-8 years. Eggs excreted daily (evaluated as the number of eggs per worm pair) in Schistosoma haematobium infection is 22-203 (Loker, 1983). Many of the eggs penetrate through the bladder and are passed in urine. Eggs can be found in Urine from about 10-12 weeks after the initial infection (Jordan and Webbe, 1969).

Pathology in Schistosoma haematobium infection is due to eggs. Eggs which are not expelled from the bladder become calcified as they accumulate in the submucosa and lower ends of the ureters. Among the pathological manifestations of S. haematobium infection include haematuria (Wilkins et

al.,1979; Tanner et al., 1983; Mott et al.,1983; Rutasatira et al., 1984). Haematuria occurs as a result of eggs penetrating through the mucosa into the lumen of the bladder. Serious pathological conseguences of the infection like ureteric lesions, hydronephrosis or non-functioning kidneys have been reported (Forsyth and Bradley, 1966; Forsyth and Macdonald, 1966; Forsyth, 1969; Rugemalila, 1979). Studies done in East Africa (Bowry 1975 and Kitinya et al., 1986) in Egypt (Gilles, 1982) and Sudan (Malik et al., 1975) have shown a correlation between carcinoma of the bladder and Schistosoma haematobium infections. All these pathological manifestations and consequences show that Urinary Schistosomiasis is a disease of Public health importance needing intervention measures.

Fig. 1: The life cycle of Schistosoma haematobium



Adapted from Cheesbrough (1987).

1.3 Statement of the Problem

Control of Urinary Schistosomiasis comprises measures aimed at reducing the human contact with snail infested water and to reduce the contamination of such water bodies with Schistosoma eggs. It also involves the control of the snail intermediate hosts. Before these control activities can be done, data and information pertaining to the factors that predispose humans to the infested water bodies must be known. Furthermore, before embarking on self-help programmes, it is essential to have a clear indication of how Schistosomiasis is viewed as a problem by the community. This will help in assessing the nature of health education that is required in order to encourage the community to be actively involved in any programme that might be proposed.

Snail control has been long regarded as one of the most efficient methods of preventing transmission. In a pilot study in an endemic area for S. haematobium in Liberia, the Bulinus snail population was reduced by 99% after focal mollusciciding (Saladin et al., 1983). However, projects using a combination of chemotherapy and snail control achieve a rapid fall in incidence of the disease. A control project in North-West Tanzania showed a rapid fall in incidence of S. haematobium from an annual incidence of 30% to 14% in young children following combined chemotherapy and snail control. Similar results were obtained in a farming area in Southern Zimbabwe where S. mansoni and S. haematobium were present. The prevalence of both infections were reduced from 50% to 60% by a five year programme of chemotherapy combined with

snail control (WHO 1972). If localised snail control measures are to be applied, it is essential to know where transmission takes place. It is more cost effective to control snails on a routine basis in the transmission sites only.

The information about the prevalence and intensity of the disease is also important. The higher the prevalence, the higher is the proportion of the population harbouring heavy infections (Jordan and Webbe, 1982). The possibility for development of Urinary Schistosomal disease normally increases with increase in size of egg excretion (Abdel Salam et al.,1978; Doehring et al., 1985). Consequently the chances of Urinary Schistosomiasis as a general health problem may increase with increasing prevalence rate in the community.

1.4. Rationale and Objectives

1.4.1 Rationale

A study carried out in Dar es Salaam City by Sarda et al., (1985a) to determine the prevalence of Schistosoma haematobium among school children found prevalence rates ranging from 5.3% to 55.1%. The majority of the Schools showed prevalence rates of around 16%. The highest prevalence (55.1%) and intensity (96 eggs/10ml urine) of infection were recorded from Kigogo Primary school at Kigogo ward. The overall objective of this study was to determine factors that influence the transmission of Schistosoma haematobium in the area which the previous authors did not investigate and the current prevalence rate and intensity of infection so as to assess the possible intervention measures that could be used to reduce the transmission of the disease and its morbidity among school children and the community at large at Kigogo-Kinondoni district of Dar-es-Salaam.

1.4.2 Objectives

Broad Objective

1. To determine factors related to the transmission of Schistosoma haematobium and its current prevalence and intensity among school children at Kigogo-Kinondoni district, Dar-es-Salaam.

Specific objectives

1. To determine the prevalence of S. haematobium among school children at Kigogo - Kinondoni district.

2. To determine the intensity of infection and how it relates to haematuria, Proteinuria, sex and age.

3. To determine the behavioural patterns and other factors like knowledge about the transmission of the disease

4. To map the water bodies and human water contact sites at Kigogo ward - Kinondoni District.

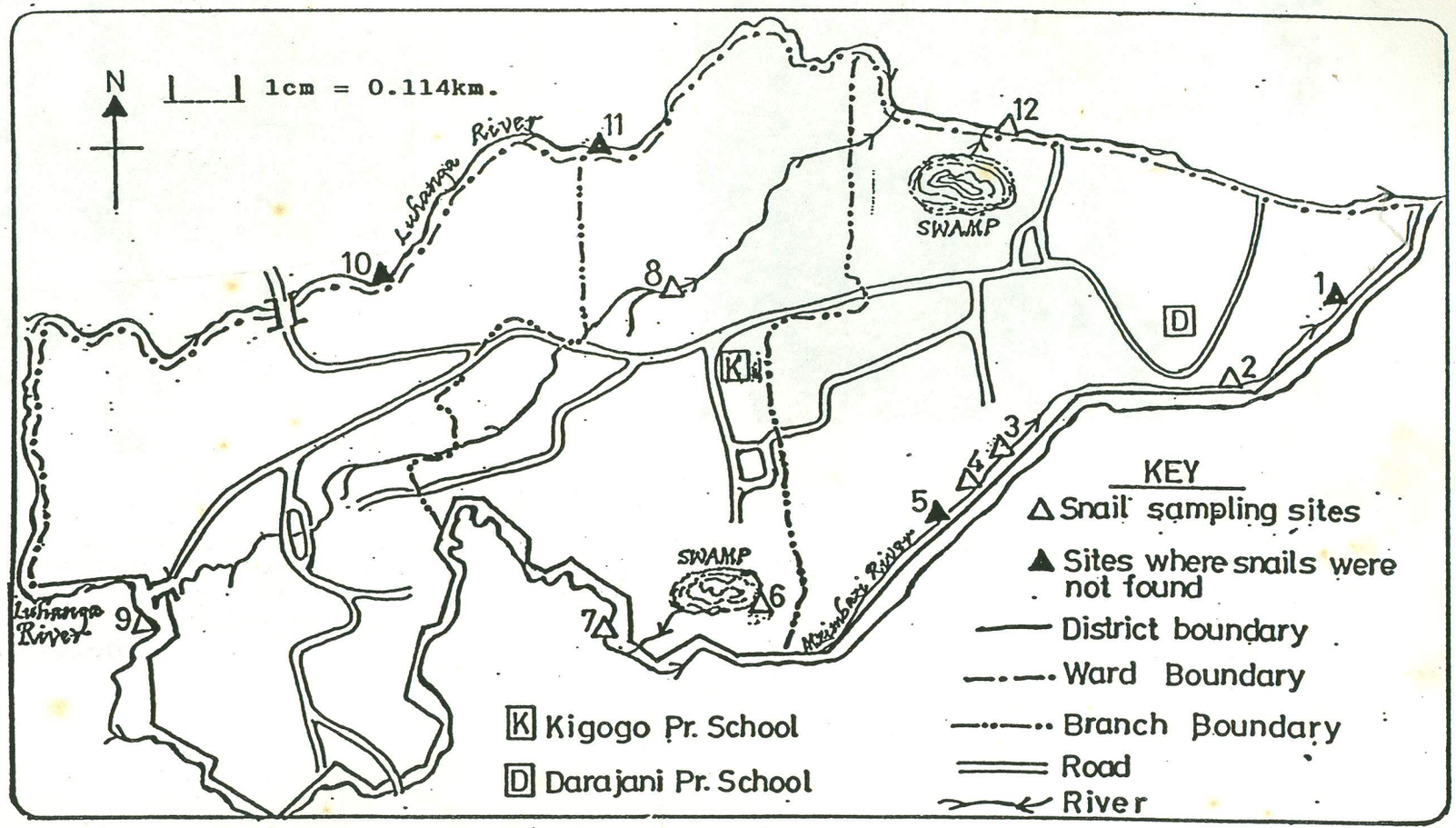
5. To look for the snail intermediate hosts of S. haematobium from the contact sites identified in objective number four and examining them for infection.

3.2 Malacological findings

Few snails were recovered during the period of the study. Bulinus (Physoposis) nasutus, Bulinus (Physoposis) globosus and Bulinus (Physoposis) africanus were the Bulinus snail species recovered from the sampled (water contact) sites. A total of 148 Bulinus snails were recovered. Bulinus (Ph.) nasutus was found more frequently 122/148 (82.4%) followed by Bulinus (Ph.) globosus 23/148 (15.6%) and Bulinus (Ph.) africanus 3/148 (2%). Table 1 summarises the contact sites, number of snails and the species recovered from each water contact site. None of these snail intermediate hosts of Schistosoma haematobium was shedding cercariae and none had detectable prepatent infection.

The sites which contained snails had a lot of emergent vegetation around them and the speed of the water was relatively slow or stagnant. Other snails like Melanoides, and Bulinus forskali were observed to be abundant in the sites sampled but they were not included in table 1 since they are known not to be intermediate hosts of S. haematobium in East Africa.

MAP 1 : A MAP OF KIGOGO WARD SHOWING MAJOR WATER BODIES AND SNAIL SAMPLING SITES



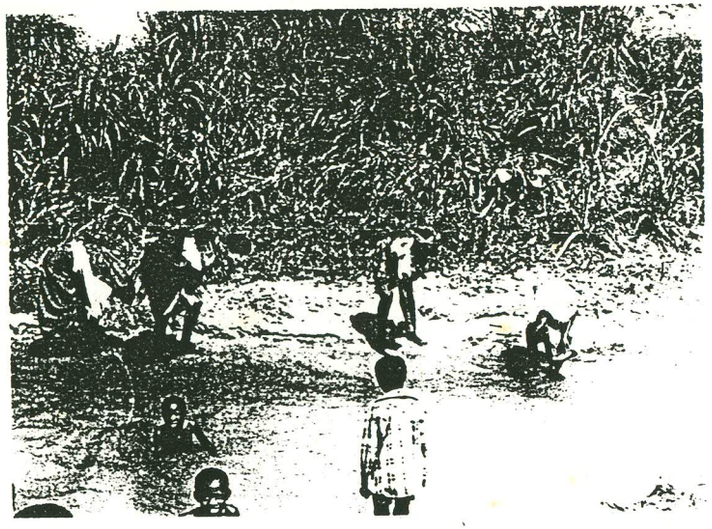


Fig. 3: Children playing, swimming and women washing feet in River Msimbazi at site 7 containg Bulinus intermediate hosts of S. haematobium.

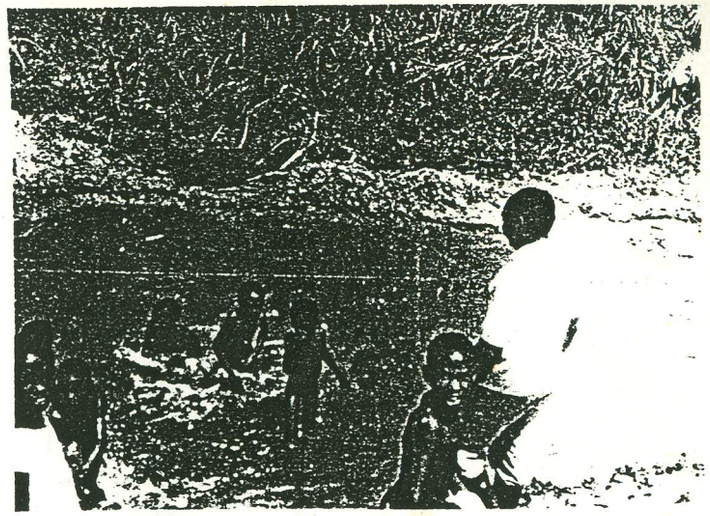


Fig. 4: Children playing and swimming in River Luhanga at site 11.

Table 1: A summary table of contact sites, number of snails and species recovered from each site.

BULINUS SPECIES	SITE NUMBER												
	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
B.(Ph) nasutus	0	2	12	2	0	53	12	32	3	0	0	6	122
B.(Ph). globosus	0	2	2	0	0	7	2	5	0	0	0	5	23
B.(Ph.) africanus	0	0	0	0	0	3	0	0	0	0	0	0	3
TOTAL	0	4	14	2	0	63	14	37	3	0	0	11	148
HABITAT DESCRI-PTION	RIVER	RIVER	RIVER	RIVER	RIVER	SWAMP RIVER		STREAM RIVER		RIVER	RIVER	RIVER	

Stream: small, shallow and the speed of water flow is less than that of a river.



3.3. Demographic characteristics

A total of 501 children were interviewed but only 483 were screened for **Schistosoma haematobium** infection. Eighteen children did not produce urine specimen samples and therefore were excluded from Parasitological data analysis. Females were 233/483 (48.2%) and males were 250/483 (51.8%) of the study population. The majority of children in the study were mainly in the age-group 10-14 years, who numbered 296/482 (61.4%) (table 2).

3.4 Parasitological survey results.

Of the 483 children screened, 249/483 (51.5%) were from Kigogo Primary School and 234/483 (48.4%) from Darajani Primary School. The overall prevalence of S. haematobium infection based on microscopic examination of one filtered urine specimen collected between 10 a.m - 3 p.m was 230/483 (47.6%). The prevalence rates in the respective schools were 111/249 (44.6%) and 119/234 (50.9%) in Kigogo and Darajani Primary School respectively. The overall geometric mean was 47 eggs/10ml urine among children who were infected. In the respective schools, the intensity of infection was 43 eggs/10ml urine and 50 eggs per 10ml urine in Kigogo and Darajani Primary School respectively. The difference in the intensity of infection among children studied from the two schools was not statistically significant (P>0.05): (table 3)

Table 2: The distribution of the studied children by age and sex

Age groups (Years)	Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent
5-9	36	14.6	42	18	78	16.2
10-14	143	57.4	153	65.7	296	61.4
15-19	70	28	38	16.3	108	22.4
TOTAL	249	100	233	100	482	100

Table 3. The prevalence rate and intensity of *Schistosoma haematobium* infection among school children

NAME OF THE SCHOOL	NUMBER EXAMINED	NUMBER INFECTED	% PREVALENCE	INTENSITY*
Kigogo	249	111	44.6	43
Darajani	234	119	50.9	50
TOTAL	483	230	47.6	47

* Geometric mean of eggs per 10ml urine of the infected children ($P > 0.05$).

A comparison was made between the prevalence and intensity of infection with places of residence (table 4)
The prevalence rates were 168/351 (47.9), 22/39 (56.4%) and 40/93 (43%) among children from Kigogo, Magomeni and "others" respectively. The difference in prevalence rates was not significant (x^2 test $P > 0.05$). The intensities were 43, 67 and 52 eggs/10ml among the infected children respectively. The difference in intensity was not statistically significant too ($P > 0.05$)

The results of this study show that males had a high prevalence and intensity of infection than females (table 5). The overall prevalence rate for males was 135/250 (54%) and for females 95/233 (40.8%). The difference in prevalence rates between the two sexes was statistically significant (x^2 test, ($P < 0.05$). The intensity of infection was recorded as 54 eggs/10ml urine and 38 eggs per 10ml urine among males and females respectively. The difference in intensity of infection between the two sexes was statistically significant too ($P < 0.05$).

Table 4: Relationship between Schistosoma haematobium infection and place of residence.

Place of Residence	Number Examined	Number Positive	% Prevalence	Intensity*
KIGOGO	351	168	47.9	43
MAGOMENI	39	22	56.4	67
OTHERS	93	40	43	52

Others: Included Ilala, Tabata and Mchikichini

* Geometric mean of eggs per 10ml urine of the infected children ($P > 0.05$)

Table 5: Relationship between prevalence and intensity of S. haematobium infection with sex among school children.

SEX	Number Examined	Number Infected	% Prevalence	Intensity*
MALES	250	135	54	54
FEMALES	233	95	40.8	38
TOTAL	483	230	47.6	47

$x^2 = 8.46$
degrees of freedom = 1
$P<0.05$
* Geometric mean of eggs per 10ml urine of the infected children ($P<0.05$).

The highest overall prevalence rate of S. haematobium infection was found in the age-group 10-14 years 147/296 (49.7%), table 6. The differences in prevalence rates between the three age-groups of the total number of children examined were not statistically significant ($P > 0.05$). For both sexes, the difference in prevalence rate among all the three groups was not significant too. The overall intensity of infection was also found highest in the age group 10-14 years. The differences in intensity between the three age-groups of the total number of children examined were statistically significant ($P < 0.05$). For males the difference in intensity among all three age groups was significant ($P < 0.05$). For females, the difference in intensity was not significant among all three age groups ($P > 0.05$) but it differed significantly between the age-group 5-9 vs 10-14 years and 15-19 years.

It was observed that a high proportion of the examined children had heavy infection (50 or more eggs/10ml urine). Of the 230 infected children seen, 114 (49.6%) were excreting 50 or more eggs/10ml urine samples. Seventy two males (53%) and forty two infected females (44.2%) had at least 50 eggs per 10ml urine. Of the 483 children screened 114 (23.6%) were excreting 50 or more eggs per 10ml urine. The highest overall percentage of children (male + female) with heavy infection was among children in the age group 10-14 years. For both sexes considered separately, the same age group showed the highest percentage of heavy infection (table 7).

The frequency of microhaematuria among children who were excreting 50 or more eggs per 10ml urine samples was high. One hundred and five (92%) of the children who were excreting 50 or more eggs/10ml urine had microhaematuria detected by urinalysis reagent strips. However, haematuria was also observed among children who were excreting less than 10 eggs/10ml urine samples.

Table 8: Illustrates the distribution of Schistosoma haematobium eggs output among infected children in relation to haematuria. Of the children who were excreting 50 or more eggs per 10ml urine samples, 58/114 (50.9%) had visible haematuria.

The overall prevalence of micro-haematuria among the examined children was 252/483 (52.2%). This occurred among infected and non-infected children. The prevalence of micro-haematuria among the infected children was 194 /230 (84.3%) and 58/253 (22.9%) among non-infected children (table 9). Of those who had haematuria without Schistosome eggs in urine, a repeat examination was done after 8 weeks and 15/58 (25.9%) were found excreting eggs. One of them had heavy infection. There was a strong association between microhaematuria and S. haematobium infection.

The sensitivity of micro-haematuria detected by urinalysis reagent strips as an indirect screening technique for the detection of Schistosoma haematobium infection was 194/230 (84.3%) and its specificity was 195/253 (77.1%).

Macrohaematura (visible haematuria) was observed in 98/448 (21.9%) of the studied children. Of those who were infected, 78/207 (37.7%) had visible haematuria. The association between visible haematuria and Schistosoma haematobium infection was statistically significant (x^2test $P < 0.05$). (table 10).

The sensitivity of visible haematuria as an indirect measure for detection of Schistosoma haematobium infection was 78/207 (37.7%) and its specificity was 221/241 (91.7%).

Haematuria and proteinuria were associated with S. haematobium infections and correlated with the intensity of infection as reflected in table 11 and 12 .

It was observed that a high proportion of the studied children had history of passing blood in their urine. Two hundred and eight (43.1%) of the examined children reported a history of haematuria. Of those who had, Schistosoma haematobium infection, 139(60.4%) had a history of haematuria. There was a strong association between history of haematuria and S. haematobium infection (x^2test, $P < 0.05$) (table 13).

The sensitivity of history of haematuria as an indirect screening technique for the detection of Schistosoma haematobium infection among the studied children was 139/230 (60.4%) and its specificity 184/253 (72.7%). Its sensitivity

by sex was 95/135 (70.4%) and 44/95 (46%) for male and female children respectively. The specificity values were 68/115 (59%) and 116/139 (84%) respectively.

3.5 The effect of Metrifonate therapy

Of the 230 school children who were found infected and treated, only 4 reported mild side effects such as abdominal pain and general weakness. Eight weeks after the 3rd dose of Metrifonate 10mg/kg body weight, 212/230 (92.2%) of the children who had received treatment were screened again for S. haematobium infection. Of those, 188/212 (88.7%) had ceased excreting eggs in urine. The cure rate,defined as the number of children with no eggs in their urine 8 weeks post-treatment examination was generally high in all categories of intensity of infection ranging from 60.7 to 100% (table 14). Of those children who were still excreting eggs, 12/24 (50%) were excreting 1-9 eggs per 10ml urine samples and only 2/24 (8.5%) were excreting 50 or more eggs per 10ml urine samples (Table 15).

The overall prevalence rate of micro-haematuria was reduced from 194/230 (84.3%) to 62/212 (29.2%) and that of visible haematuria was reduced from 78/207 (37.7%) to 8/212 (3.8%).

Table 6: THE PREVALENCE RATE AND INTENSITY OF S. HAEMATOBIUM INFECTION BY AGE AND SEX AMONG SCHOOL CHILDREN

AGE GROUPS (YEARS)	MALES				FEMALES				TOTAL			
	No. Examined	No. Positive	% Prevalence	Intensity*1	No. Examined	No. Positive	% Prevalence	Intensity*2	No. Examined	No. Positive	No. Prevalence	Intensity*3
5-9	36	18	50	41	42	14	33.3	19	78	32	41	29
10-14	143	80	55.9	69	153	64	41.8	42	296	147	49.7	55
15-19	70	36	52.9	35	38	14	36.8	44	108	50	46.3	37
TOTAL	249	134	53.6	54	238	95	40.8	38	482	229	47.5	47

Overall prevalence rates among the 3 age groups: $x^2 = 3.315$
degrees of freedom = 2
$P > 0.05$

*1 and *2 Geometric means of eggs per 10ml urine of the infected male and female children (P. values 0.032 and 0.079) respectively.

*3 Geometric mean of eggs per 10ml urine of the infected children (P value 0.01).

Table 7: PREVALENCE RATE OF S HAEMATOBIUM AND FREQUENCY OF EXCRETION OF 50 OR MORE EGGS/10ML URINE SAMPLES BY AGE AND SEX AMONG SCHOOL CHILDREN

AGE GROUP YEARS	MALES			FEMALES			TOTAL		
	No. Examined	No. Positive Prevalence	No.and (%) with 50 or more eggs/10ml urine	No. Examined	Mo. Positive Prevalence	No. and (%) with 50 or more eggs/10ml urine	No. Examined	No. Positive Prevalence	No. and (%) with 50 or more eggs/10ml urine
5-9	36	18 50%	6 (33.3%)	42	14 (33.3%)	4 (28.6%)	78	32 (41%)	10 (31.3%)
10-14	143	80 (55.9%)	49 (61.3%)	153	64 (41.8%)	32 (50%)	296	147 (46.3%)	81 (55.1%)
15-19	70	36 (51.4%)	16 (44.4%)	38	14 (36.8%)	6 (42.9%)	108	50 (46.3%)	22 (44%)
TOTAL	249	134 (53.8%)	71 (53%)	233	95 (40.8%)	42 (44.2%)	482	229 (47.5%)	113 (49.3%)

Table 8: The distribution of Schistosoma haematobium eggs output among children who were infected in relation to haematuria.

Level of Micro-haematuria	Categories of intensity of infection (egg count/10ml urine)						
	1-9	10-19	20-29	30-39	40-49	50+	TOTAL
Negative	8	10	4	4	1	9	36
Trace	4	3	1	1	0	1	10
+	1	2	0	0	0	5	8
++	2	5	3	3	3	5	21
+++	13	15	13	7	13	94	155
Total	28	35	21	15	17	114	230
Visible Haematuria	3	8	5	2	2	58	78

Table 9: The relationship between the frequency of microhaematuria as detected by urinalysis reagent strips and Schistosoma haematobium infection among school children.

Micro-Haematuria	INFECTION		
	PRESENT	ABSENT	TOTAL
Yes	194 (84.3%)	58 (22.9%)	252 (52.2%)
No	36 (16.7%)	195 (77.1%)	231 (47.8%)
TOTAL	230 (100%)	253 (100%)	483 (100%)

$x^2 = 182.16$
degrees of freedom=1
$P<0.05$

Table 10: The relationship between visible haematuria and Schistosoma haematobium infection.

Visible Haematuria	INFECTION		
	PRESENT	ABSENT	TOTAL
Yes	78 (37.7%)	20 (8.3%)	98 (21.9%)
No	129 (62.3%)	221 (91.7%)	350 (78.1%)
TOTAL	207 (100%)	241 (100%)	448 (100%)

$x^2 = 56.257$
degrees of freedom=1
$P<0.05$

Table 11: Semiquantitative determination of haematuria with Urinalysis reagent strips among S. haematobium infected children between 5 years and 19 years in relation to intensity of infection.

	HAEMATURIA				
	Negative	Trace	+	++	+++
Number of infected children	36	10	8	21	155
Intensity*	25	15	59	29	61

*Geometric mean of eggs per 10ml urine of the infected children ($P < 0.05$).

Table 12: Semiquantitative determination of Proteinuria with Urinalysis reagent strips among S. haematobium infected children between 5 years and 19 years in relation to the intensity of infection.

	PROTEINURIA					
	Negative	Trace	+	++	+++	++++
Number of infected children	17	21	19	93	95	5
Intensity*	25	24	28	48	67	109

*Geometric mean of eggs per 10ml urine of the infected children ($P<0.05$)

Table 13: Relationship between history of haematuria and Schistosoma haematobium infection among school children.

HISTORY OF HAEMATURIA	INFECTION		
	PRESENT	ABSENT	TOTAL
Yes	139 (60.4%)	69 (27.3%)	208 (43.1%)
No	91 (39.6%)	184 (72.7%)	275 (56.9%)
TOTAL	230 (100%)	253 (100%)	483 (100%)

$x^2 = 54.03$
degrees of freedom=1
$P<0.05$

Table 14: The cure rate of S. haematobium infected school children treated with 3 doses of metrifonate (10mg/kg body weight) 8 weeks after therapy.

Time	Categories of intensity of infection (egg count/10ml urine)						
	1-9	10-19	20-29	30-39	40-49	50+	TOTAL
Number before Treatment (Zero weeks)	28	35	15	14	13	106	212
Number cured after 8 weeks	17	30	12	13	13	103	188
Cure rate	60.7%	85.7%	75%	92.9%	100%	97%	88.7%

Table 15: The distribution of S. haematobium eggs output among children who were still excreting eggs in urine 8 weeks after metrifonate therapy in relation to microhaematuria.

Level of Micro-haematuria	Categories of intensity of infection (egg count/10ml urine)						
	1-9	10-19	20-29	30-39	40-49	50+	Total
Negative	2	0	0	0	0	0	2
Trace	2	1	0	1	0	0	4
+	1	0	0	0	0	1	2
++	2	0	1	0	0	0	3
+++	5	5	2	0	0	1	13
Total	12	6	3	1	0	2	24

3.6 Water supplies

A total of 501 children were interviewed. Of the total interviewees 498/501 (99.4%) reported usage of piped water at their homes.

Other sources of water which were reported in case of piped water shortage were neighbours piped water supply 248/501 (49.5%), hand dug wells 120/501 (24%), spring water 32/501 (6.4%). Fifty eight (11.6%) reported ponds, streams and rivers as alternative sources of water. Only 43/501 (8.6%) reported no shortage of piped water supply at all.

3.7 Human water contacts

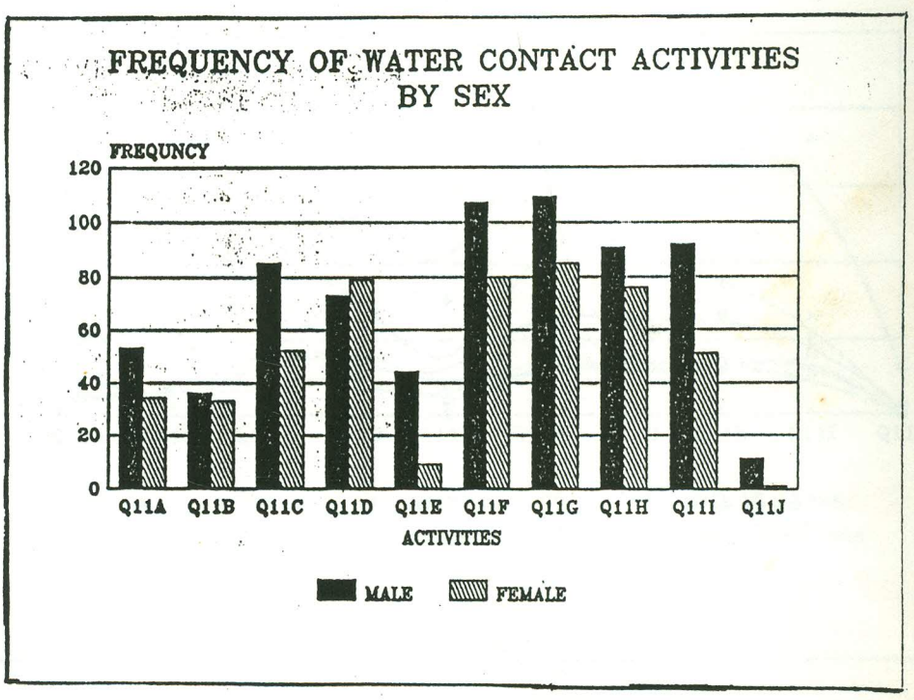
Fig. 5 illustrates the frequency of water contact activities by sex. It shows that males get in contact with water bodies such as ponds, rivers and streams for all activities more than females with exception of washing dishes where the frequency of water contact is higher among females. Other water contact activities which were mentioned included collecting sand for commercial purposes and building. The frequency of children who reported sand collection was very low and therefore was excluded from analysis. The frequency of water contact for all the activities was observed to be higher among male children aged between 10 years and 14 years followed by females of the same age group (Fig. 6) The water activities which were observed to attract children of this age group (male + female) to get in contact with water were mainly bathing, washing clothes, playing swimming and

collecting water for domestic use.

The frequency of water contact activities was generally low among children aged between 5 and 9 years and between 15 years and 19 years for both sexes.

As already noted, swimming was observed to be one of the activities which predisposed the study children to contaminated water and therefore infection. When asked about the time of swimming, the majority 71 (51.8%) of the children who reported that they swam, did so between 4 p.m and 6 p.m. (table 16).

Fig. 5



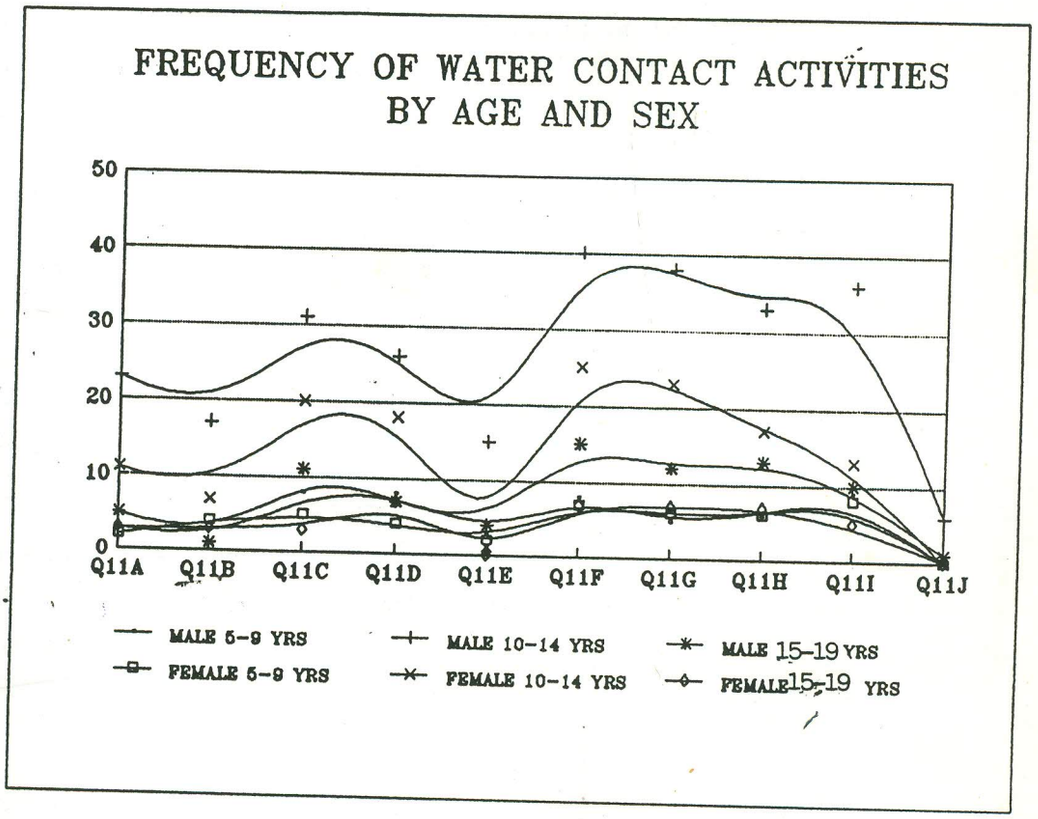
KEY:

Activities:

Q II

A CULTIVATION OF RICE
B COLLECTING WATER FOR WATERING
C SWIMMING
D WASHING DISHES
E FISHING
F BATHING
G WASHING CLOTHES
H COLLECTING WATER FOR DOMESTIC USE
I PLAYING
J WASHING CARS.

Fig. 6



KEY:

Q II Activities:

A CULTIVATION OF RICE
B COLLECTING WATER FOR WATERING.
C SWIMMING
D WASHING DISHES
E FISHING
F BATHING
G WASHING CLOTHES
H COLLECTING WATER FOR DOMESTIC USE
I PLAYING
J WASHING CARS.

Table 16: Frequency of swimming by time of the day

TIME	NUMBER	PERCENT
8 a.m - 9.59 a.m	8	5.8
10 a.m - 1.59 p.m	30	21.9
2 p.m. - 3.59 p.m.	28	20.5
4 p.m. - 6 p.m.	71	51.8
Total	137	100

3.8 Knowledge about Schistosoma haematobium infection

Of the total population (501) interviewed, 238/501 (47.5%) had never heard about S. haematobium infection. The proportions of children who had never heard about the disease by age were 76.8% ,49.2% and 21.1% for the age groups 5-9yrs,10-14yrs and15-19yrs respectively. Two hundred and sixty three (52.5%) had heard about the disease (table 17). One hundred and seventy (64.6%) of those children who had heard about the disease (male & female) knew that dysuria was a symptom of the disease. Two hundred and thirty nine (90.9%) knew haematuria as a symptom, 133 (50.6%) knew frequency of micturition as a symptom and only 97 (36.9%) knew that lower abdominal pain was a symptom of Schistosoma haematobium infection. Haematuria was known by the majority of the children as a symptom of the disease. The differences in knowledge about the symptoms of the disease between the three age groups were not significant (tables 18, 19, 20 and 21).

When asked about the mode of transmission (male + female) 112/263 (42.6%) knew that pathogens enter man`s body through skin penetration. 138/253 (54.5%) knew that urinating in water facilitates the transmission of the disease. One hundred and forty three (56.5%) knew that aquatic snails are involved in the transmission of Schistosoma haematobium infection. The differences in knowledge about the modes of transmission between the three age groups were statistically significant (tables 22, 23 and 24).

Table 17: Relationship between age and having heard about Schistosoma haematobium infection

Have you ever heard about S.haematobium infection?	AGE GROUPS (YEARS)			
	5-9	10-14	15-19	Total
Yes	19 (23.2%)	155 (50.8%)	90 (78.9%)	263 (52.5%)
No	63 (76.8%)	150 (49.2%)	24 (21.1%)	238 (47.5%)
Total	82 (100%)	305 (100%)	114 (100%)	501 (100%)

$x^2=56.243$
degrees of freedom=2
$p<0.05$

Table 18: The relationship between knowledge of dysuria as a symptom of Schistosoma haematobium infection and age.

Dysuria	AGE GROUPS (YEARS)			
	5 - 9	10 - 14	15 - 19	Total
Yes	16 (51.6%)	107 (62.9%)	47 (75.8%)	170 (64.6%)
No	15 (48.4%)	63 (37.1%)	15 (24.2%)	93 (35.4%)
TOTAL	31 (100%)	170 (100%)	62 (100%)	263 (100%)

$x^2 = 5.9$
degrees of freedom = 2
$P > 0.05$

Table 19: Relationship between knowledge of haematuria as a symptom of Schistosoma haematobium infection and age.

Haematuria	AGE GROUP (YEARS)			
	5 - 9	10 - 14	15 - 19	Total
Yes	26 (83.9%)	157 (92.4%)	56 (90.3%)	239 (90.9%)
No	5 (16.1%)	13 (7.6%)	6 (9.7%)	24 (9.1%)
Total	31 (100%)	170 (100%)	62 (100%)	263 (100%)

$x^2 = 2.30$
degrees of freedom = 2
$P>0.05$

Table 20: Relationship between knowledge of frequency of micturition as a symptom of Schistosoma haematobium infection and age.

Frequency of micturition	AGE GROUP (YEARS)			
	5 - 9	10 - 14	15 - 19	Total
Yes	14 (54.2%)	90 (52.9%)	29 (46.8%)	133 (50.6%)
No	17 (54.8%)	80 (47.1%)	33 (53.2%)	130 (49.4%)
Total	31 (100%)	170 (100%)	62 (100%)	263 (100%)

$x^2 = 1.1$
degrees of freedom = 2
$P > 0.05$

Table 21: Relationship between knowledge of lower abdominal pain as a symptom of Schistosoma haematobium infection and age.

Lower Abdominal pain	AGE GROUP (YEARS)			
	5 - 9	10 - 14	15 - 19	Total
Yes	13 (41.9%)	63 (37.1%)	21(33.9%)	97 (36.9%)
No	18 (58.1%)	107 (62.9%)	41 (66.1%)	166(63.1%)
Total	31 (100%)	170 (100%)	62 (100%)	263 (100%)

$x^2 = 0.58$
degrees of freedom = 2
$P>0.05$

Table 22: Relationship between age and knowledge of how pathogens get into man`s body

Pathogens enter man´s body through skin penetration	AGE GROUP (YEARS)			
	5 - 9	10 - 14	15 - 19	Total
Yes	12 (38.7%)	64 (37.6%)	36 (58.1%)	112 (42.6%)
No	19 (61.3%)	106 (62.4%)	26 (41.9%)	151 (57.4%)
TOTAL	31 (100%)	170 (100%)	62 (100%)	263 (100%)

$x^2 = 7.96$
degrees of freedom = 2
$P < 0.05$

Table 23: Relationship between age and knowledge of urinating in water as a mode of transmission of Schistosoma haematobium infection.

N = 253
Missing cases = 10

Through urinating in water	AGE GROUPS (YEARS)			
	5 - 9	10 - 14	15 - 19	Total
Yes	11 (37.9%)	87 (53.4%)	40 (65.6%)	138 (54.5%)
No	18 (62.1%)	76 (46.6%)	21 (34.4%)	115 (45.5%)
TOTAL	29 (100%)	163 (100%)	61 (100%)	253 (100%)

$x^2 = 6.31$
degrees of freedom = 2
$P < 0.05$

Table 24: Relationship between age and knowledge of aquatic snails involvement in the transmission of Schistosoma haematobium infection.

N = 253
Missing cases = 10

Transmission through aquatic snails	AGE GROUP (YEARS)			
	5 - 9	10 - 14	15 - 19	Total
Yes	9 (31%)	88 (54%)	46 (75.4%)	143(56.5%)
No	20 (69%)	75 (46%)	15 (24.6%)	110(43.5%)
TOTAL	29 (100%)	163 (100%)	61 (100%)	253 (100%)

$x^2 = 13.79$
degrees of freedom = 2
$P < 0.05$

The majority of the studied children knew the modes of acquisition of the disease. One hundred and forty four (56.9%) knew that the disease could be acquired by fishing in contaminated water. High proportion 182 (71.9%) knew that it could be acquired by bathing in water contaminated with pathogens and 158 (62.5%) knew that it could be acquired through swimming in water contaminated with pathogens. There was no association between age and knowledge of fishing in contaminated water as a mode of acquisition of the disease. However, the differences in knowledge of bathing and swimming in contaminated water as modes of acquisition of the disease between the three age groups were significant (tables 25,26,27).

A high proportion of children did not know that the transmission of Schistosoma haematobium infection could be prevented. Only 101/253 (41.9%) knew that the disease could be prevented. When asked about how it could be prevented, 38/101 (37.6%) mentioned medication and 52/101 (51.5%) mentioned avoiding contact with water contaminated with the pathogens. Only 5/101 (5%) mentioned both medication and avoiding contact with contaminated water. Six (5.9%) did not know an method of preventing the transmission of the disease.

Table 25: Relationship between age and knowledge of fishing in contaminated water as a mode of acquisition of S. haematobium infection.

N= 253
Missing cases = 10

Fishing in water contaminated with pathogens	AGE GROUP (YEARS)			
	5 - 9	10 - 14	15 - 19	Total
Yes	16(55.2%)	93(57.1%)	35(57.4%)	144(56.9%)
No	13(44.8%)	70(42.9%)	26(42.6%)	109(43.1%)
Total	29(100%)	163(100%)	61(100%)	253(100%)

$X^2 = 0.04$
degrees of freedom = 2
$P>0.05$

Table 26: Relationship between age and knowledge of bathing in contaminated water as a mode of acquisition of Schistosoma haematobium infection

N =253
Missing cases = 10

Bathing in contaminated water	AGE GROUPS (YEARS)			
	5 - 9	10 - 14	15 - 19	Total
Yes	19(65.5%)	111(68.1%)	52(85.2%)	182(71.9%)
No	10(34.5%)	52(31.9%)	9(14.8%)	71(28.1%)
Total	29(100%)	163(100%)	61(100%)	253(100%)

$X^2 = 7.13$
degrees of freedom = 2
$P < 0.05$

Table 27: Relationship between age and knowledge of swimming in contaminated water as a mode of acquisition of infection.

N =253
Missing cases = 10

Swimming in contaminated water	AGE GROUPS (YEARS)			
	5 - 9	10 - 14	15 - 19	TOTAL
Yes	16(55.2%)	94(57.7%)	48(78.7%)	158(62.5%)
No	13(44.8%)	69(42.3%)	13(21.3%)	95(37.5%)
Total	29(100%)	163(100%)	61(100%)	253(100%)

$X^2 = 9.10$
degrees freedom = 2
$P<0.05$

Knowledge of symptoms of Schistosoma haematobium infection was generally good regardless of presence or absence of history of past infection. However, significant associations between history of past infection and knowledge of dysuria and haematuria as symptoms of the disease were observed. No associations were observed between history of past infection and knowledge of frequency of micturition and lower abdominal pain as symptoms of Schistosoma haematobium infection.

One hundred and nineteen (73%) of those children who knew dysuria as a symptom of the disease, had history of past infection compared to only 44 (27%) who had no history of past Schistosoma haematobium infection (table 28). The difference in knowledge of dysuria as a symptom of S. haematobium between children with history of past infection and those without history of past infection was significant (x^2 test, $P < 0.05$).

Haematuria as a symptom of Schistosoma haematobium infection was generally well known by the studied children regardless of presence or absence of past infection. However, 160 (69.6%) of those children who knew haematuria as a symptom of the disease had history of past infection compared to only 70 (30.4%) who had no history of past infection (table 29). The difference in knowledge of haematuria as a symptom of Schistosoma haematobium infection between the two groups was significant (x^2 test, $P < 0.05$).

Table 28: Relationship between history of past S. haematobium infection and knowledge of dysuria as a symptom of the disease.

N = 253
Missing cases = 10

HISTORY OF PAST INFECTION	DYSURIA		
	A symptom	Not a symptom	Total
Present	119 (73%)	47 (52.2%)	166 (65.6%)
Absent	44 (27%)	43 (47.8%)	87 (34.4%)
TOTAL	166 (100%)	90 (100%)	253 (100%)

$x^2 = 17.63842$
degrees of freedom = 1
$P < 0.05$

Table 29: Relationship between history of past *S. haematobium* infection and knowledge of haematuria as a symptom of the disease.

N = 253
Missing cases = 10

HISTORY OF PAST INFECTION	HAEMATURIA		
	A SYMPTOM	NOT A SYMPTOM	TOTAL
Present	160 (69.6%)	6 (26.1%)	166 (65.6%)
Absent	70 (30.4%)	17 (73.9%)	87 (34.4%)
TOTAL	230 (100%)	23 (100%)	253 (100%)

$x^2 = 18.419$
degrees of freedom=1
$P<0.05$

The differences in knowledge of frequency of micturition and lower abdominal pain as symptoms of Schistosoma haematobium infection between children who had history of past S. haematobium infection and those who had no history of past infection were not significant (table 30 and 31).

It was observed that those children who had some knowledge about symptoms, modes of acquisition and transmission of Schistosoma haematobium infection had obtained it from various sources. (table 32). One hundred and three (41.5%) had received the information from health personnel and 124/253 (49%) from school teachers. Only 100/253 (39.5%) had got the information from parents and 12/253 (4.7%) from the mass media. Twenty two (8.9%) had got the information from other sources which included friends.

A high proportion of children reported having suffered from Schistosoma haematobium infection previously. One hundred and sixty six (65.6%) had suffered from the disease. Of those 130/166 (78.3%) reported having received treatment for the infection and 36/166 (21.7%) never got treated. Schistosoma haematobium infection was perceived to be a dangerous disease by 223/253 (88.1%). Only 2/253 (0.8%) thought that the disease was not dangerous and 28/253 (11.1%) were not sure whether it was dangerous or not (table 33). The reasons why they considered Schistosoma haematobium infection to be dangerous were painful urination, blood in urine, loss of weight, infertility, bladder damage and death.

Table 30: Relationship between history of past S. haematobium infection and knowledge of frequency of micturition as a symptom of the disease.

N = 253
Missing cases = 10

HISTORY OF PAST INFECTION	Frequency of micturition as a symptom		
	A SYMPTOM	NOT A SYMPTOM	TOTAL
Present	88 (68.2%)	78 (62.9%)	166 (65.6%)
Absent	41 (31.8%)	46 (37.1%)	87 (34.4%)
TOTAL	129 (100%)	124 (100%)	253 (100%)

$x^2 = 0.79185$
degrees of freedom = 1
$P > 0.05$

Table 31: Relationship between history of past S. haematobium infection and knowledge of lower abdominal pain as a symptom of the disease

N = 253
Missing cases = 10

HISTORY OF PAST INFECTION	LOWER ABDOMINAL PAIN		
	A SYMPTOM	NOT A SYMPTOM	TOTAL
Present	57 (63.3%)	109 (66.9%)	166 (65.6%)
Absent	33 (36.7%)	54 (33.1%)	87 (34.4%)
Total	90 (100%)	163 (100%)	253 (100%)

$x^2 = 0.32122$
degrees of freedom = 1
$P > 0.05$

Table 32: Sources of information about Schistosoma haematobium infection

N = 253
Missing cases = 10

Source of information	Number	Percent
Health personnel	103	41.5
School teachers	124	49.0
Parents	100	39.5
Mass media	12	4.7
Others	22	8.9

Mass media: Radio and news papers
Others included: Friends, brothers and sisters.

Table 33: Perceived severity of Schistosoma haematobium infection by school children.

N = 253
Missing cases = 10

Severity category	Number	Percent
Not a dangerous disease	2	0.8
A dangerous disease	223	88.1
Don´t know	28	11.1

3.9 A correlation of Parasitological findings with water contact activities and history of past infection

The major human water contact activities which seemed to be important in the transmission of Schistosoma haematobium infection among the studied children were swimming, bathing and playing in water contaminated with pathogens. Table 34 shows the relationship between human water contact activities and the prevalence of infection. The prevalence was considerably higher among children who admitted getting in contact with water for the above three water contact activities (x^2 test, $P < 0.05$).

The intensity of infection among children who were infected and admitted contact with water for swimming, bathing and playing was higher than that of those who denied contact with water for the mentioned three activities. The same was true for other activities except washing cars. However, the differences in intensity were not significant ($P > 0.05$). All these water contact activities can be considered risky both in terms of acquiring the infection and transmitting it to other people since a high proportion of children 274/501 (56.7%) reported having urinated in water while swimming or during other water contact activities.

Table 34: The relationship between human water contact activities and the prevalence and intensity of Schistosoma haematobium infection among school children.

Water contact activities	No. Examined	No. Positive	% Prevalence	Intensity*
a. Rice Cultivation				
Yes	83	47	56.6	55
				P.value
No	400	183	45.8	45 0.329
	**x^2 = 2.83852, P value 0.020			
b. Collecting water for watering				
Yes	68	33	48.5	51
				P.value
No	415	197	47.5	46 0.629
	x^2 = 0.00097, P value 0.971			
c. Swimming				
Yes	134	79	59	51
				P.value
No	349	151	43.4	42 0.388
	**x^2 = 8.93582, P value 0.0028			
d. Washing dishes				
Yes	147	71	48.3	53
				P.value
No	336	159	47.3	44 0.377
	x^2 = 0.00980, P value 0.9211			
e. Fishing				
Yes	51	25	49	63
				P.value
No	432	205	47.5	45 0.215
	x^2= 0.00097, P value 0.971			

Table 34 continued

f. Collecting water for domestic use					
Yes	161	83	51.5	49	
					P.value
No	322	147	45.7	45	0.685
	x^2 = 1.271, P value 0.2596				
g. Playing					
Yes	140	82	58.6	50	
					P.value
No	343	148	43.1	44	0.490
	**x^2 = 8.87255, P value 0.0028				
h. Washing cars					
Yes	12	7	53.8	45	
					P.value
No	471	223	47.3	47	0.959
	x^2 = 0.2115, P value 0.6456				
i. Bathing					
Yes	134	79	59	50	
					P.value
No	349	151	43.3	44	0.420
	** x^2 = 8.93582, P value 0.0028				
j. Washing clothes					
Yes	147	71	48.3	52	
					P.value
No	336	159	47.3	43	0.294
	x^2 = 0.0098, P value 0.921				

* Geometric mean of eggs per 10ml urine of infected children.

** All x^2 values which are statistically significant (P values <0.05).

Three hundred and forty (70.4%) children reported that they often go out of Dar-es-Salaam city to rural areas and engage themselves in some water contact activities. One hundred and forty three (29.6%) reported that they had never gone to rural areas. There was no significant difference in prevalence rates among these two groups of children. Of those who reported that they often go to rural areas, 153 (45%) were infected and 77 (53.8%) of those who reported that they had never gone to rural areas were infected. This shows that at least 77/230 33.5%) of the infected children had acquired the infection from Dar-es-Salaam.

There was a significant association between history of past S. haematobium infection and positivity (excreting Schistosoma haematobium eggs in Urine) (table 35). Of those children who were excreting eggs in urine, 99/135 (73.3%) had history of past S. haematobium infection compared to 36/135 (26.7%) who had no history of past infection.

The sensitivity of history of past S. haematobium infection as an indirect measure for detection of S.haematobium infection was 73.3% and its specificity was 51/118 (43.2%).

Table 35: Relationship between history of past S. haematobium infection and positivity for Schistosoma haematobium eggs in urine.

N = 253
Missing cases = 10

HISTORY OF PAST INFECTION	Schistosoma haematobium eggs in urine		
	PRESENT	ABSENT	TOTAL
YES	99 (73.3%)	67 (56.8%)	166 (66.6%)
NO	36 (26.7%)	51 (43.2%)	87 (34.4%)
TOTAL	135 (100%)	118 (100%)	253 (100%)

$x^2 = 7.474$
degrees of freedom = 1
$P < 0.05$

CHAPTER 4

4. DISCUSSION

4.1 Prevalence rates and intensity of infection.

The previous studies done in Dar-es-Salaam (Sarda et al., 1985a; 1985b) and the results of this study confirm that Schistosoma haematobium infection is endemic and a disease of public health importance at Kigogo in Dar-es-Salaam city. The overall prevalence rate of S. haematobium infection based on microscopic examination of one filtered urine specimen was 47.6% and intensity of infection among the infected children was 47 eggs/10ml urine. In the respective schools, the prevalence rates were 44.6% and 50.9% at Kigogo and Darajani Primary School respectively. The intensities were 43 and 50 eggs/10ml urine samples in the two schools respectively. Prevalence rates and intensities have been recorded in Dar-es-Salaam before (Sarda et al., 1985a). Prevalence was 55.1% and intensity was 96 eggs/per 10ml urine at Kigogo primary school. In Mwanza the prevalence was 65% (Forsyth and Bradley, 1966) and in Tanga another coastal town in Tanzania it ranged from 38% to 57% (Bailey and Davis, 1970, Rugemalila, 1979). The variation in prevalence rates and intensity of infection depends partly on the different levels of endemicity, the season when the study is done, the methods used and on the time when urine specimens are collected for analysis. The prevalence rate and intensity found in this study is lower than what was recorded by Sarda et al.,(1985a) in the same area.

The difference could be attributed to different seasons when the two studies were carried out, since there is seasonal

variation in the transmission of Schistosoma haematobium infection (Webbe and Jordan, 1966).

The prevalence rate and intensity of infection was observed to be higher among children in the age-group 10-14 years. Similar observations have been made in the Gambia (Wilkins et al., 1979) and in Nigeria (Ejezie et al., 1981).

The high prevalence rate and intensity of infection observed in this age group has been attributed to more human water contact and exposure to infection (Dalton and Pole, 1978). In accordance with these authors, the frequency of water contact was higher among children in the age group 10-14 years (male + female) than in the age groups 5-9yrs and 15-19yrs and it was parallelled by higher prevalence rate and intensity of infection. Results of reinfection studies with Schistosoma haematobium offer strong support for the view that there is resistance to reinfection (Wilkins et al.,1987). Therefore,the decline in intensity and prevalence of infection in relation to age, may be partly attributable to the development of concomitant protective immunity as well as to changes in water contact.

Males had a significant higher prevalence rate and intensity of infection than females. Sexual differences in prevalence rates and intensity of infection have not been found to be significant in some previous studies (Forsyth and Bradley, 1966; Zumestin, 1983) but Edington et. al. (1970) found that

CHAPTER 5.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 **Conclusions.**

1. The prevalence and intensity of Schistosoma haematobium infection among school children at Kigogo branch/ward is still high.

2. Haematuria and proteinuria as detected by urinalysis reagent strips correlated positively with the intensity of Schistosoma haematobium infection in the area.

3. Some of the major factors contributing to the transmission of the disease in the area were:

The occurrence of permanent and semi-permanent surface waters, the presence of snail intermediate hosts of S. haematobium and human water contact patterns.

5.2 RECOMMENDATIONS

1. Treatment of infected school children on a regular basis with metrifonate is recommended for the control of S. haematobium infection in the area. The control should be undertaken through the existing primary health care structure by health personnel. The diagnosis of infected children should be made on the basis of the presence of blood in urine detected by urinalysis reagent strips and history of haematuria. The strips are rapid in making a diagnosis of heavily infected

children. With very little training, the primary health care workers and school teachers can detect heavily infected children needing treatment. The treatment of infected children will reduce morbidity and help infected children to recover from reversible lesions. It also reduces the output of eggs from infected subjects and thus reduce the chances of infecting the snails.

2. Health education should be part of the control strategies. Through parents, mass media and school teachers, the awareness of children about the cause, transmission and prevention should further be raised. Health education sessions about the disease in schools should begin from standard one rather than in standard five. Children should understand the nature of the disease and its implication for their health, consequently appreciate the need to seek medical care early, and co-operate with health workers in therapeutic issues. Children health education programmes on the radio should be intensified and among other health priorities in this country, Schistosomiasis should be included.

3. Provision of alternative water sources for recreational activities are suggested. Since the studied children reside in Dar-es-Salaam city which is near the Indian ocean, arrangements to transport children on a regular basis with guards especially on

weekends to this water body which is not infested with snail intermediate hosts is suggested as an alternative source of water for their recreational activities.

4. A longitudinal observational study on human water contact and on snail intermediate hosts is suggested. Such a study would be able to show seasonal variation in human water contact patterns and snail population densities which could not be observed in a cross-sectional study. Knowledge of focal and seasonal patterns of transmission could be utilized in focal and seasonal application of molluscicides to control the transmission of this disease in the area.

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