Knowledge, Attitude and Practices Associated with *S. Haematobium* Infections among Pregnant Mothers in Kwale County, Kenya

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Abstract

BACKGROUND

Schistosomiasis is a disease of global public health importance among populations residing in *Schistosoma*-infection endemic zones such as the Kenyan coast. Preventive measures and mass treatment of infected populations can reduce or possibly eliminate schistosomiasis. This study investigated the knowledge, attitude and practices associated with *S. haematobium* infection among pregnant mothers in Kwale County, Kenya.

METHODOLOGY

A mixed methods study with quantitative and qualitative methods was employed in Kwale County, from March through August 2016. Quantitative data was collected using structured questionnaires, in-depth interview guide was used for Key Informant interviews. Clinical investigations were done to detect *Schistosoma* infection as well and quantification of *Schistosoma* eggs using the Kato-Katz technique was done. Confirmatory pregnancy tests were carried and STATA version 12.0 was employed in logistic regression analysis. The qualitative data were analysed by NVIVO and presented in themes.

RESULTS

The overall prevalence of *S. haematobium* infection was 12.2%. Kinango Sub County had the highest prevalence of 14.1% and Mbuguni (site 1) in Matuga Sub County had the highest prevalence of 30% among the 18 sites. Rice farming significantly increased the infection risk. Among the participants, 36.7% utilized river water and 14% used water pans. Among the participants 29% did not use toilets instead went to the bush for open defecation. The participants were knowledgeable about bilharziasis; 96.7% knew what bilharzia was and 84.8% mistakenly identified the causal agent as an insect. Kitchen placement was significantly associated (P=0.024) with infection.

CONCLUSION

The prevalence of *S. haematobium* among pregnant mothers in Kwale County is 12.7% despite the low intensity. Low literacy levels may augment the risk of infection through practices such as bathing in rivers and the use of untreated water. The impact of rice farming on infection was inconclusive indicating other factors may be at play.

Keywords: *Schistosomiasis, S. haematobium infection, Pregnant mothers, Kwale County, Knowledge, Attitude, and Practices*

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Introduction

Schistosomiasis (Bilharziasis) is a parasitic disease caused by trematodes of the genus *Schistosoma* which include *Schistosoma haematobium, and S. mansoni* among others. *S. haematobium* is transmitted by direct body contact with trematodes-infested freshwater

bodies. Bilharzia affects the urinary system as blood flukes lay eggs inside the human bladder. The eggs penetrate through tissues and blood vessels into the surrounding organs like fallopian tubes, ovaries and vulva where they get trapped (1). Host Immune response against the *Schistosoma* eggs can cause server damage including, granulomas, sandy patches on the endometrium, and lesions on the vulva leading to pain, bleeding and discomfort (2). During pregnancy, Schistosomiasis disrupts foetal development leading to complications such as miscarriages, preterm births, anaemia in infancy and stillbirths. The disease worsens maternal anaemia and weakens the immune system, as the parasites deplete nutrients in the bloodstream. This can cause postnatal haemorrhage due to impaired blood components. Schistosomiasis can also exacerbate lethargy, fevers, poor appetite, headaches, weight loss and other complications such as hepatomegaly, lymphadenopathy and reduced eosinophil counts (3,6). These symptoms can complicate gestational processes and disable the daily activities of the pregnant woman. In chronic cases, those infected present with eosinophilia, low platelets, and constipation. Other complications include periportal liver fibrosis. *S. haematobium* leads to haematuria also calcification in long-term effects (6). In rare occurrences, Central nervous system schistosomiasis may occur causing granuloma and transverse myelitis (7).

In Africa and the Middle East, 53 Countries have been considered endemic to *S. haematobium*. People of all ages; both male and female are at risk once exposed to the parasite (4). School-age children, women, farmers in rice pads and fishermen are at higher risk (4, 5). The global prevalence is 207 million, 85% of which occur in Africa. According to WHO, 652 million people are at risk of getting infected worldwide as 200,000 related deaths occur annually. Schistosomiasis is the 3rd devastating tropical disease after malaria and intestinal worms.

In Kwale County, pregnant women are excluded from Mass Drug Administration programs such as TUMIKIA. While malaria, STIs and anaemias are regularly screened, schistosomiasis is often overlooked, leaving infections undiagnosed. This study focused on diagnosing schistosomiasis in pregnant women and raising awareness among health workers about its impact during pregnancy.

According to Sacolo and colleagues (8), the occurrence of schistosomiasis in sub-Saharan Africa is mainly attributed to the limited level of knowledge on the factors that contribute to the spread of the disease. Attitudes and beliefs concerning the uptake of preventive services are also a major concern in the prevention of the disease. A study in Swaziland showed that despite the implementation of control programs, health education and deworming, very little attention is directed towards the evaluation of knowledge, attitudes and practices among the exposed population (9). A study done in the Niger Delta showed some of the myths on the understanding of *S. haematobium* infectivity by the community. The people believed that *S. haematobium* infection was due to witchcraft or sexually transmitted. Others believe that it is not a serious problem since it does not make them unable to feed. They also believed that *S. haematobium* infection did not have an effective cure (10). Another study conducted in Kenya in the Lake Victoria basin revealed that most of the respondents (68%) were unaware of how schistosomiasis was contracted, prevented and treated (11) (10).

Materials and Methods

Study site

The study was carried out in Kwale County in all Sub Counties; Matuga, Msambweni, Kinango and Lungalunga in the Coastal region of Kenya. Eighteen sites selected were, Bowa, Mbuguni, Boyani, Tiwi, Mkundi, Mbegani, Lukore, Burani and Tiribe in Matuga Sub-County, Mwachinga, Kinango and Gandini

in Kinango Sub-County, Diani, Msambweni and Bodo in Msawbweni Sub-County and Kikoneni, Bodo and shimoni in Lunga Lunga Sub-County were then selected. These areas cover the vast Kwale County endemic zones with *S. Haematobium*.

Study population

Participants were pregnant mothers 18 years and above selected within Kwale County and no specific gestation period was considered.

Study design

In this mixed methods study quantitative data was collected from pregnant mothers via a cross-sectional, and qualitative data was collected from key informants who were health workers within the community.

Sample size and sampling

The sample size was determined by the Single proportion formula (12). According to Umar (13), *S. haematobium* prevalence is 40% in the Msambweni area. Therefore, 40% was assumed as the prevalence within Kwale County.

$$n = \frac{z^2 pq}{e^2}$$

Where:

n= Minimum sample size;

Z = Standard normal deviate for α (1.96);

p = the prevalence of *S. haematobium* within the area of study;

q= 1-p

e= precision (0.05).

The minimum sample size attained for the study participants was 368. The study was conducted in the community using the chief's administrative meetings (*barazas)* for sensitization and recruitment. Clinics were set at marketplaces, schools and health facilities and participants recruited via snowball sampling, with information passed to family members and neighbours.

Clinic sites were conveniently sampled and 368 participants purposively selected on a first-come, first-served basis. For qualitative data, health workers were recruited randomly from the clinic, with 10 participating in the study.

Data collection

The study's 18 sites were visited twice: first for familiarization and training, and the second site visit for clinics which ran from March 17th to August 1st 2017 in Kwale Sub counties. Structured questionnaires were administered, collecting socio-demographics, and KAP data. Urine samples (20mL) were collected between 10 AM and 2 PM for *S. haematobium* egg analysis at KEMRI Laboratory using the filtration technique. The eggs were counted and the mean was expressed as the number of eggs per 10 ml of urine. Key informants, randomly selected health workers, responded to guided questionnaires and this data was analysed by N-Vivo 8 into themes.

Statistical analysis

Data was entered into Excel spreadsheets then statistical analysis was done using STATA version 12.0. Descriptive statistics were used to calculate the prevalence and socio-economic factors associated with *S,haematobium*. For knowledge, Attitude and practices associated with *S. haematobium* infection, frequencies and percentages were used. Bivariate logistic analysis was done for binary logistic regression analysis. Multivariate linear regression analysis was done for binary outcomes to test associations between the dependent and independent variables. This was to determine whether independent variables were predictors of dependent variables.

Thematic analysis

The data was coded and translated into themes entered into MS Word 2007 and then exported to N-VIVO version 8 for analysis. Qualitative analysis followed six steps: labelling content, grouping coded data, generating themes and defining the themes for clarity.

Ethical considerations

Ethical clearance was received from Kenya Medical Research Institute, Scientific and Ethics Review Unit (SERU), protocol 3016. Additionally, permission was sought from the

relevant authorities in Kwale County and Sub-County hospitals, area Chiefs and all relevant authorities. Written informed consent was sought from participants and all data was de-identified.

Results

Socio-demographic and economic factors

Study participants were 18-43 years old with a mean age of 26 years (SD= 5.72 years) within Kwale County. Most of the women were aged 25 years and below (193,52.5%), and 22 (6.0%) were aged 36 years and above. The study comprised 139 (37.8%) women in Matuga Sub-County, 129 (35.1%) in Lungalunga, 64 (17.4%) in Kinango and 36 (9.8%) in Msambweni. 332 (90.4%) were married, 28 (7.7%) were single and the rest were either divorced or widowed. 257 (69.8%) were homemakers, 8 (2.2%) had informal jobs and 103(28.0%) worked in the formal sector. 221 (61.1%) of the women had achieved primary education and only 39 (10.8%) had been to Secondary school and above as shown in Table 1.

Socio-economic practices of pregnant mothers with *S. haematobium* in Kwale

135 (36.7%) used river water, 136 (37.2%) borehole water and 45 (12.2%) used tap water. 262 (71.8%) used open fire as a source of light and 322 (88.2%) firewood as their source of fuel. 310 (84.9%) were farmers. 102 (28.0%) took baths in rivers and 63 (17.5%) passed urine in the water. Only 256 (70.3%) had a toilet present in their homestead, as shown in Table 2

Qualitative results

Knowledge regarding schistosomiasis infection:

Theme 1: General knowledge of the disease and its transmission, treatment or prevention. Heath interventions by NGOs and the Ministry of Health, including deworming, health talks, household follow-ups CLTS activities and the TUMIKIA project, have improved community knowledge on helminths including *S. haematobium.*

Table 1:
Socio-Demographic Factors of Pregnant Women with S. Haematobium in Kwale County.

	Category	Frequency (%)
Sub-County	Matuga	139 (37.8)
	Kinango	64 (17.3)
	Msambweni	36 (9.8)
	Lunga Lunga	129 (35.1)
Age group	25 years and below	193 (52.5)
	26-35 years	153 (41.6)
	36 years and above	22 (6.0)
Religion	Muslims	252 (68.7)
	Christian	115 (31.3)
Occupation	Homemakers	257 (69.8)
	Informal jobs	8 (2.2)
	Formal jobs	103 (28.0)
Education	Never been to school	102 (28.2)
	Primary	221 (61.1)
	Secondary and above	39 (10.8)
Marital Status	Single	28 (7.6)
	Married	332 (90.5)
	Widowed/Divorced	7 (1.9)

These efforts also involve the distribution of water gourds and diagnosing as well as treating eligible populations with PQZ.

"Tumikia project used to support CHVs to give drugs in affected areas together with the public health officer." (Respondent one).

"Health talks by staff; PHOs, Nurses, Clinicians and Community Health Volunteers." (Respondent three)

"Yes, continuous follow-up of households on CLTS activities for the household to provide and use latrines, personal hygiene, public awareness on the disease and prevention measures." (Respondent Four)

Theme 2: Practices that affect Schistosomiasis prevalence in the community. *S. haematobium* prevalence was influenced by poor socioeconomic status leading to dependence on water from rivers, water pans and ponds, participants bathed in the rivers exposing themselves to infection and putting others at risk as some participants admitted to passing urine in the river.

Lessons had been offered on pit latrine construction but the actual practice was low because of affordability.

"Continuous health education and provision of advice on the construction of pit latrines both in schools and homes." (Respondent Four)

The percentage of those who practice this after the lessons is low due to poverty.

"Some communities lack toilets as most community members defecate in open spaces which increased the occurrence of bilharzia." (Respondent Four)

Some of the common water sources in the area include boreholes, earth pans, wells, rivers, and dams:

"*Wells and springs*." (Respondent one)

Table 2:
Socio-Economic Factors and Practices among Pregnant Mothers with S. Haematobium in Kwale County

	Category	Frequency (%)
Source of water	Tapped Water	45 (12.2)
	River	135 (36.7)
	Borehole	136 (37.2)
	Water pan	52 (14.2)
Source of light	Electricity/Solar	91 (24.9)
	Open fire	262 (71.8)
	Others	12 (3.3)
Source of fuel	Firewood	322(88.2)
	Charcoal	35(9.6)
	Others	8(2.2)
Farming	Yes	310 (84.9)
	No	55 (15.1)
The roof of the housing	Thatched hut	214 (58.8)
	Iron roof	150 (41.2)
Kitchen Placement	The same house slept in	191 (52.3)
	Outside the house slept	172 (47.1)
Taking Bath in the River	Yes	102 (28.0)
	No	262 (72.0)
Passing Urine in the river	Yes	63 (17.5)
	No	298 (82.6)
The presence of a toilet in the homestead	Yes	256 (70.3)
	No	108 (29.7)

Theme 3: Attitude towards health-seeking behaviour. Most individuals in the community sought treatment after infection. However, some respondents believed that signs and symptoms of the disease were a curse and they thought urinating blood was normal. The supporting except:

"They feel urination of blood is normal and they have no contribution to the aspect of control." (Respondent three).

"*Seek treatment in health facilities after some time."* (Respondent one).

"When they are infected, they seek medical care." (Respondent two)

Table 3:
Knowledge and Attitude among Pregnant Mothers with S. haematobium Infection in Kwale County

	Category	Frequency (%)
Is Bilharzia a disease	Yes	350 (96.7)
	No	12 (3.3)
Knowledge of Bilharzia infection	Passing blood in Urine	291 (79.3)
	Pain in private parts	30 (8.2)
	Headache	11 (3.0)
	Not Known	34 (9.3)
What causes Bilharzia	Water	39 (11.7)
	Water Insects	283 (84.7)
	Witchcraft/Not Known	12 (2.5)
How does a person get Bilharzia	Contact with parasite-infested water	311 (84.7)
	Sexual contact with an infected person	18 (4.9)
	Bewitched/ Not known	38 (10.4)
Can Bilharzia be prevented	Yes	281 (79.8)
	No	71 (20.2)
Does Bilharzia Require treatment	Yes	363 (9.5)
	No	2 (0.6)

Table 4:
Prevalence of S. haematobium among Pregnant Mothers in Kwale County

Factors		Prevalence (95% CI)
Overall Prevalence		12.2% (9.30%- 16.07%)
Age group	25 years and below	10.9% (7.3%-16.3%)
	26-35 years old	13.1% (8.7%-19.7%)
	36 and above years old	18.18% (7.5%-44.1%)
Level of education	Never been to school	6.9% (3.4%-14.0%)
	Primary	14.0% (10.1%-19.4%)
	Secondary and above	12.8% (5.7%-29.1%)
Religion	Muslims	13.9% (10.0%-18.5%)
	Christians	8.69% (4.7%-15.5%)
Sub-County	Matuga	12.9% (8.4%-19.9%)
	Kinango	14.1% (7.7%-25.8%)
	Msambweni	2.8% (0.4%-19.2%)
	Lunga Lunga	13.2% (8.5%-20.5%)
Site (only the sites with the three highest prevalences reported)	Site 1	30.0% (11.6%-77.3%)
	Site 2	28.57% (12.5%-51.2%)
	Site 8	25.0% (7.5%-82.9%)
Occupation	Homemakers	12.1% (8.7%-16.5%)
	Formal sectors	0
	Informal sectors	13.6% (8.4%-22.1%)

The prevalence of *S. haematobium* was high at 12.7%. Most respondents consider it a major health concern, although it was not prioritized by local health systems.

Despite limited knowledge of the disease, quantitative data shows low literacy levels among the pregnant women in Kwale County, with many having little or no education. Key informants attribute the spread of *S. haematobium* to illiteracy, ignorance and knowledge gaps.

"*Illiteracy, ignorance and knowledge gap."*
(Respondent Two)

The qualitative results also showed practices such as open defecation, and bathing in rivers.

"Low latrine coverage." (Respondent one)

"Part of the community members do not have latrines hence they use open defecation and use accumulated water (ponds) for washing or bathing /farming activities." (Respondent Three**)**

Knowledge and attitude of participants on *S. haematobium*

Of the women surveyed, 96.7% knew Bilharzia is a disease, with 79.3% identifying blood in urine as a symptom and 8.2% associating it with pain in their private parts.

Table 5:
Logistic Regression for Risk Factors Associated with S. Haematobium Infection among Pregnant Mothers in Kwale County

	Factor	Odds Ratio (95% CI)	P-value
Source of water	River	0.5 (0.1-1.7)	0.245
	Borehole	0.6 (0.3-1.2)	0.157
	Water pan	0.5 (0.2-1.5)	0.210
	Tapped water	Reference	-
Toilet present in homestead	Yes	Reference	-
	No	1.0 (0.5-2.0)	0.923
Type of the housing roof	Thatched	0.6 (0.8-3.4)	0.221
	Iron	Reference	-
Kitchen placement	In the house slept	0.4 (0.2-0.9)	0.024*
	Outside	Reference	-
Source of Light	Open fire	1.1 (0.5-2.6)	0.797
	Electricity/Solar	Reference	-
	Others	3.1 (0.5-19.0)	0.231
Source of Fuel	Firewood	Reference	-
	Charcoal	0.4 (0.1-1.6)	0.206
	Others	0.5 (0.1-5.1)	0.584
Causes of Bilharzia	Water	1.5 (0.5-3.9)	0.454
	Not Known/Bewitched	0.0	-
	Water insects/parasites	Reference	-
Means of transmission	Sexual contact	0.4 (0.1-3.4)	0.417
	Not Known/Bewitched	0.9 (0.1-7.5)	0.897
	Drinking/washing with parasite-infested water	Reference	-
Is Bilharzia preventable	Yes	Reference	-
	No	1.3 (0.6-3.1)	0.499
Taking a bath in the river	Yes	Reference	-
	No	0.6 (0.1-2.2)	0.413
Passing Urine in the river	Yes	Reference	-
	No	1.2 (0.3-5.2)	0.832
Place of water use	Use in River	2.2 (0.6-7.9)	0.243
	No River	1.9 (0.7-5.4)	0.210
	Use away	Reference	-

While 84.7% believed it was caused by water insects, 11.7% thought it was due to water. Most women (84.7%) understood that infection occurred from contact with parasite-infested water, while 4.9% believed it was spread through contact with infected persons. Additionally, 79.8% knew the disease was preventable and almost all (99.5%) said medical care should be sought if infected as shown in Table 3.

Prevalence of *S. haematobium* among pregnant mothers in Kwale County

The prevalence of *Schistosoma haematobium* among pregnant women in Kwale County was 12.2%, with higher rates in the following strata; older women (36 years and above), women with primary education, and Muslim respondents.There were Geographic disparities, with Kinango and Lunga Lunga sub-counties, as well as specific sites, recording the highest prevalence. Women in informal occupations showed a slightly higher prevalence compared to homemakers, while no infections were reported among women in formal employment. See Table 4.

Risk factors associated with *S. haematobium* infection

Kitchen placement was the only factor significantly associated with *S. haematobium*, infection. OR=0.4 (95%CI: 0.2-0.9), p=0.024. Knowledge and practice factors while important, were not significantly linked to infection. Those who did not recognize Bilharzia as a disease had higher, tough non-significant risk OR= 1.91 (95%CI: 0.31-11.52), p=0.484. (Table 5)

Discussion

S. haematobium infection among pregnant women in Kwale County is 12.2% significantly lower than similar studies. In Zimbabwe (2020) prevalence was 26.8% (14), In Senegal (2024) 21.81 % *(15),* and in Madagascar (2024), a high of 55.8%. Despite the World Health Organisation (WHO) recommendations for treatment with praziquantel (PQZ), many women remain untreated. In Gabon (2019) 22.3% of women were infected. These figures highlight the significant public health concerns and neglect faced by women in endemic regions.

Unlike most studies, the highest prevalence of *S. haematobium* in Kwale County was observed in older women (36 + years) (7, 16) though not statistically significant. The age group at highest risk varies by region, for example, a study in Tanzania found higher infection rates among women 18 years and below. This variation may be due to differences in socio-economic activities and greater uptake of preventive measures by younger populations. Studies in sub-Saharan Africa also associate *S. haematobium* prevalence with socioeconomic factors like occupation and poverty, particularly in rural areas (5, 10, 17-19).

The women with limited knowledge about bilharzia although not statistically significant, had a higher likelihood of infection. This included individuals unaware of Bilharzia as a disease, its cause or that it is preventable. Studies confirm that knowledge, attitudes and practices are crucial in determining *S. haematobium* prevalence (7, 16). In Cameroon, for example, 95% of infected mothers had only primary education. In Kwale County 20.9% of infected women had no formal education or they had only primary-level education, but general awareness of the disease was adequate, despite the lack of significant association with prevalence. Notably, 12.8% of the infected women had secondary education or higher, suggesting that environmental factors rather than educational background, could play a larger role in exposure in Kwale County. A study in Yemen revealed that the majority of the households had a fair knowledge of the transmission, signs and symptoms of the disease but they did not consider the disease harmful (15). A study done in the Niger Delta showed some of the myths on the understanding of *S. haematobium* infectivity by the community. The general population believed

that *S. haematobium* infection was due to witchcraft and that it was sexually transmitted with no effective cure (4).

Kinango and Lunga Lunga had the highest prevalence of *S. haematobium* in Kwale County (14.1 and 13.2 respectively), likely due to poor water access, where people rely on dirty ponds for washing and bathing, increasing transmission risk. Notably, in Msambuaeni, where rice farming exposes women to cercaria worms, the infection rates were lower albeit, high intensity. Generally, drier areas had a higher prevalence due to less effective preventive measures. Areas like Mbuguni with poor water sources also had a high prevalence. Most of the study participants were from lower socio-economical cadres, with homemakers and informal workers at greater risk of infection, while no infections were reported in formally employed individuals highlighting poverty as a key risk factor.

In Kenya, more than 5 million people are infected, with a prevalence of 40% in the South Coast. However, few studies have addressed the impact of *S. haematobium on* pregnant women. A study found a rise in subfertility linked to schistosomiasis prevalence in the coastal region (20). Additionally, another study indicated that children born to mothers with schistosomiasis had significant levels of N-antibodies for anti-measles making the children more susceptible to measles (21).

Globally, an estimated 40 million women of childbearing age are infected with Schistosomiasis, and about 10 million are estimated to have Schistosomiasis in pregnancy while their knowledge *of S. haematobium* infectivity remains unknown (2). The magnitude of *S. haematobium* among pregnant women in Kenya is unknown as the majority of the studies focus on the prevalence of the disease in the general population and this study aimed at bridging this gap.

Limitations of the study

The selection criteria excluded those under 18 years of age, who could have given us a scope of information regarding early pregnancies and Schistosoma morbidities. The snowball method of sampling used reduces the strength of generalisability since participants tend to engage with the people already known to them; relatives, close friends and immediate neighbours thus those out of this bracket will miss information even if they are legible and the epidemiology of the disease in one family or surrounding will be restrictive even if the sample size is reached. It narrows the distribution of information. For example, they may all be using the same safe source of water for home use like taps, while those left out could be using a riskier pond as a source of water.

Conclusion

In Kwale County, there is a high prevalence (12.7%) of *S. haematobium* infection among pregnant women, posing significant public health concerns as no praziquantel (PZQ) treatment is provided during antenatal care. While the general knowledge about Schistosomiasis was adequate, low literacy levels and socioeconomic challenges hinder the effective uptake of preventive measures. Although the intensity of infection was low, allowing for potential successful prevention efforts, common practices such as bathing in the rivers and the use of untreated water contribute to the ongoing transmission. Additionally, the impact of rice farming was inconclusive, suggesting that other risk factors should be investigated.

Recommendations

1 The Ministry of Health should establish guidelines for treatment with Praziquantel for pregnant women and include pregnant mothers in sensitization campaigns to educate them adequately on prevention and control measures. Moreover, Community Health workers should

sensitize the population on safe farming practices; with emphasis on proper utilization of protective personal equipment to limit exposure to *S. haematobium* infection.

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Conflict of interest. There was no conflict of interest in this project.

Availability of data. This information is available upon reasonable request.

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