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Prevalence and Intensity of Schistosomiasis in Endemic Parts of Siaya County after Mass Deworming With Praziquantel; Understanding Community Perception on the Associated Factors

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ABSTRACT

Schistosomiasis is a disease caused by schistosomes or blood flukes of the genus schistosoma. According to World Health Organization (WHO). Also known as bilharzia or 'snail fever' the disease is one of the most prevalent parasitic diseases in the world. The highest intensity of the infection is usually observed in children but chronic consequences of infection may last into adulthood. The study was conducted in hot-spot and non-hot spot areas of Siaya County. A cross sectional study design adopting both quantitative and qualitative techniques was employed. The target population consisted of both Primary School-aged children and adults in ten (10) selected villages from hot spot areas of Bondo, Siaya County. Cluster sampling technique was used to select the ten (10) villages after which 200 participants were randomly selected from the clustered villages. Kato Katz technique was then used to obtain quantitative data microscopically and for further quantitative data, structured self-administered questionnaire was also used. Key Informant Interviews were conducted to obtain qualitative information from the selected parents and teachers as well as community health workers. Statistical tests were performed using R version 4.2.0 setting a 2-tailed α to reject the null hypothesis at 0.05. Data tables presenting categorical data as percentages with observed proportions was analyzed by prop test, while continuous data was presented using model means with 95% Confidence Intervals (95% CI). From the participants that consisted of 100 children aged between 9 to 17 years and 100 adults aged between 18 to 70 years, 81 of them (40.5%) tested positive for Schistosomiasis. Intensity levels were found to be higher in females compared to males 0.95 (95% CI = 0.48, 1.4, P = 0.03) and in adults compared to children 1.1 (95% CI = 0.64, 1.6, P <0.01).

Keywords

Schistosomiasis, Bilharzia, Prevalence, Intensity, Endemic, Hot spot, Non-hot spot, Community perception, Mass deworming, Praziquantel.

Introduction

Schistosomiasis is a disease caused by schistosomes or blood flukes of the genus Schistosoma. According to World Health Organization (WHO), the disease is known to be one of the most prevalent parasitic diseases in the world [1]. This disease is transmitted through contact with water containing the infective forms of the parasite called cercariae, which develop in the snail and penetrate the unbroken skin. Although it rarely causes mortality, the morbidity caused by this disease can inflict a heavy health burden on high-prevalence communities. The highest intensity of the infection is usually observed in children but chronic consequences of infection may last into adulthood [2]. At present, a cost-effective method of controlling the morbidity caused by the disease is chemotherapy on a community level since the development of the drug Praziquantel which can be used as a single oral dose against all the main species of schistosomes [3].

The older name for the disease that is still used in Africa is Bilhazia or snail fever. The disease affects rural communities as well as some communities in urban areas who depend on fresh water lakes and stagnated water sources such as pools, ponds, dams and streams for bathing and domestic purposes [8]. Activities such as irrigated agriculture, fishing and sand harvesting are major risk factors for infection by the parasite as they bring people into direct contact with the contaminated water. About 800 million people

are at risk of schistosomiasis of which 250 million are infected and 97% of these are in Africa [4]. In Africa, about 50 million pre-school children live with schistosomiasis.

In Kenya, schistosomiasis infection is estimated to affect over 6 million people and many more are at risk [5]. Both schistosoma haematobium (urinary type) and schistosoma mansoni (intestinal type) are the major cause of the disease in Kenya [8]. Among the most affected regions in Kenya includes the Coastal region, lower eastern region and Lake Victoria basin of Kenya (National multi-year Strategic plan of action for Control of neglected tropical Diseases, 2011-2015) [10]. Bond sub county is one of the sub counties in Siaya county with a population of 197, 883 according to the 2019 census. Bondo sub-county is along the Lake Victoria basin of Kenya whose population heavily relies on the lake, streams, rivers and other stagnant sources such as dams, ponds and pools as their major source of water for domestic use [9]. This population also engages in activities such as fishing, irrigated agriculture and sand harvesting for income generation, factors that pre dispose them to the infection by the parasite [6,7].

Methodology

A cross sectional study design adopting both quantitative and qualitative techniques were employed. The target population consisted of both Primary School-aged children and adults in ten (10) selected villages from hot spot areas of Bondo, Siaya County. Cluster sampling technique was used to select the ten (10) villages after which 200 participants were randomly selected from the clustered villages. Kato Katz technique was then used to obtain quantitative data microscopically while a Semi-structured self-administered questionnaire to elicit information from the respondents and Key Informant Interviews were conducted to obtain qualitative information from the selected community health workers and other local leaders.

Statistical Analysis

All statistical tests were performed using R version 4.2.0 setting a 2-tailed α to reject the null hypothesis at 0.05. Data tables presenting categorical data as percentages with observed proportions was analyzed by prop test, while continuous data was presented using model means with 95% Confidence Intervals (95% CI). Intensity levels of schistosomiasis were log transformed for statistical evaluation on the effects of predictors on the normally distributed continuously scaled outcome (Intensity) while the association between schistosomiasis and predictors was analyze by logistic regression at both the univariate and multivariate levels.

Results

Prevalence and Intensity of Schistosomiasis in Endemic Parts of Siaya County

To establish the prevalence and intensity of schistosomiasis in the endemic parts of Siaya County, samples were collected from the study participants using stool caps and transported in stool box packed with ice. Kato katz technique was used and microscopy to identify eggs in the slide containing stool. Intensity and prevalence rates in each village were first calculated using the formula in equation 1 and results reported in Figure 1. Proportion of infected participants were found to be significantly higher in males compared to females 48% vs 33% (*P = 0.04*) and in participants aged > 18 years compared to those aged < 18, 50 vs 31 (*P = 0.001)* Table 2. On the other hand, proportions of infected study participants in hotspots and non-hotspot villages were not statistically significant, Table 3. Further, intensity levels were found to be higher in females compared to males 0.95 (95% CI = 0.48, 1.4, P = 0.03) and in adults compared to children 1.1 (95% CI = 0.64, 1.6, P <0.01) Table 4.

Prevalence = (No. of individuals positive for bilharzia / No. of individuals sampled) * 100 (equation 1)

Community Perception and Level of Knowledge on Factors Associated with the Prevalence of Schistosomiasis in Endemic Parts of Siaya County

Knowledge level on prevalence, snails as vectors, causes and factors associated with schistosomiasis were used to determine the community's perception and level of knowledge on schistosomiasis in endemic parts of Siaya county. 143 participants had knowledge on schistosomiasis, 112 on factors associated with schistosomiasis, 87 on causes and 65 on snails as vectors of schistosomiasis Figures 2 and 3.

Factors Associated with Schistosomiasis in Endemic Parts of Siaya County

Children and adult data were first subsetted and analyzed separately at the univariate and multivariate levels to investigate factors associated with schistosomiasis in endemic parts of Siaya County. The odds of having schistosomiasis was lower among, children with knowledge on schistosomiasis compared to those without 0.34 (95% CI = 0.14, 0.83 P = 0.02), those with knowledge on the causes 0.32 (95% CI = 0.13, 0.76 P = 0.01) and among those with knowledge on factors associated with schistosomiasis 0.35 (95% CI = 0.15, 0.84 P = 0.02) Table 5. However, effects of predictors from the univariate analysis were not significant at the multivariate level Table 6. In adults, the odds of having schistosomiasis was lower among females compared to males 0.35 (95% CI = 0.15, 0.84 P = 0.02) and higher among those that used lake and water tanks as sources of drinking water compared to those that drank from the lake 2.42 (295% CI = 1.06, 5.55P = 0.04) Table 8.

Table 1: General characteristics of study population (N = 200).

Variable	Hotspots	Non-hotspots
Village	5 (100)	5 (100)
Gender		
Male	50 (50)	50 (50)
Female	50 (50)	50 (50)
Age mean ± SD	28.23 ± 15.4	28.7 ± 17.4
Bilharzia positive	59 (59)	22 (22)
Data presented as number (percent) unless otherwise stated.		

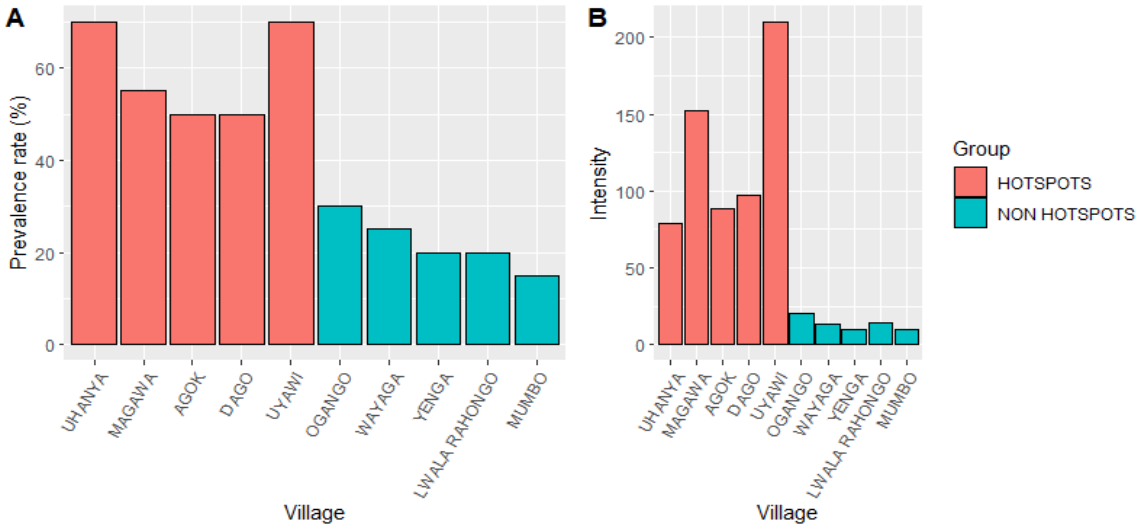

Figure 1: Prevalence and Intensity rates observed in each village.

Table 2: Socioeconomic determinants of Schistosoma (N = 200).

Variable		No. of individuals	Infected n (%)	P value
Gender	Male	100	48 (48)	
	Female	100	33 (33)	0.04
Age	Below 18 years	100	31 (31)	
	Above 18 years	100	50 (50)	0.01
Data presented as number (percent) unless otherwise stated.				

Table 3: Socioeconomic determinants of Schistosoma (N = 81).

Variable		Hotspots (n = 59)	Non-hotspots (n = 22)	P value
Gender	Male	35 (59)	13 (59)	1
	Female	24 (41)	9 (41)	1
Age	Below 18 years	26 (44)	5 (23)	0.13
	Above 18 years	33 (56)	17 (77)	0.13
Data presented as number (percent) unless otherwise stated.				

Table 4: Determinants of the intensity of Schistosoma (N = 200).

Variable		Intensity (95% CI)	P value
Gender	Male	0.63 (0.44, 0.83)	
	Female	0.95 (0.48, 1.4)	0.03
Age	Below 18 years	0.49 (0.3, 0.68)	
	Above 18 years	1.1 (0.64, 1.6)	<0.01

Figure 2: Community perception on factors associated with Schistosomiasis.

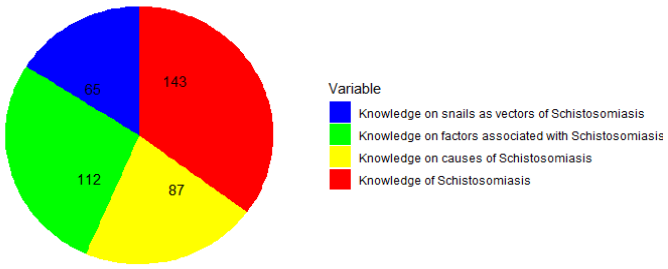

Figure 3: Community perception on prevalence of Schistosomiasis after treatment with praziquantel.

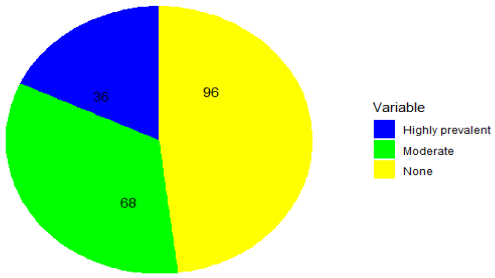

Table 5: Univariate logistic regression analysis of factors associated with schistosomiasis among children in endemic parts of Siaya County.

Variables	OR (95% CI)	P value
Age	0.9 (0.76, 1.06)	0.22
Sex		
Male	Ref.	
Female	2.06 (0.88, 4.8)	0.09
House hold size	0.98 (0.76, 1.27)	0.89
Knowledge on Schistosomiasis		
No	Ref.	
Yes	0.34 (0.14, 0.83)	0.02
Knowledge on Schistosomiasis prevalence		
None	Ref.	
Moderate	0.48 (0.19, 1.23)	0.12
Highly prevalent	0.42 (0.13, 1.3)	0.13
Knowledge on causes Schistosomiasis		
No	Ref.	
Yes	0.32 (0.13, 0.76)	0.01
Factors associated with Schistosomiasis		
No	Ref.	
Yes	0.35 (0.15, 0.84)	0.02
Awareness of snails as vectors		
No	Ref.	
Yes	0.85 (0.35, 2.07)	0.71

Frequency of water use		
Occasionally	Ref.	
Quite often	0.37 (0.11, 1.22)	0.1
Very often	0.32 (0.07, 1.36)	0.12
Water usage		
Domestic, bathing and swimming	Ref.	
Multipurpose	2.05 (0.83, 5.06)	0.11
Toilet present		
No	Ref.	
Yes	1.27 (0.55, 2.91)	0.58
Washing of hands after visiting the toilet		
No	Ref.	
Yes	0.65 (0.28, 1.54)	0.33
Source of drinking water		
Lake	Ref.	
Lake and water tank	1.37 (0.59, 3.15)	0.46
Drinking water treated		
No	Ref.	
Yes	1.05 (0.44, 2.49)	0.92
Washing of fruits before eating		
No	Ref.	
Yes	0.58 (0.24, 1.37)	0.22
Washing of hands before eating		
No	Ref.	
Yes	1.17 (0.49, 2.8)	0.73
Deworming		
No	Ref.	
Yes	0.64 (0.26, 1.56)	0.32
Abdominal pains		
No	Ref.	
Yes	1 (0.44, 2.32)	0.99

Table 6: Multivariate logistic regression analysis of factors associated with schistosomiasis among children in endemic parts of Siaya County.

Variables	Prevalence (95% CI)	p-value
Knowledge on Schistosomiasis		
No	Ref.	
Yes	0.59 (0.19, 1.85)	0.36
Factors associated with Schistosomiasis		
No	Ref.	
Yes	0.72 (0.21, 2.41)	0.59
Knowledge on causes Schistosomiasis		
No	Ref.	
Yes	0.53 (0.16, 1.68)	0.28

Table 7: Univariate logistic regression analysis of factors associated with schistosomiasis among adults in endemic parts of Siaya County.

Variables	OR (95% CI)	P value
Age	1.03 (0.99, 1.07)	0.22
Sex		
Male	Ref.	
Female	0.43 (0.19, 0.97)	0.04
House hold size	1.04 (0.81, 1.35)	0.74
Knowledge on Schistosomiasis		
No	Ref.	
Yes	1.21 (0.39, 3.73)	0.75
Knowledge on Schistosomiasis prevalence		
None	Ref.	
Moderate	1.73 (0.69, 4.36)	0.25
Highly prevalent	2.77 (0.91, 8.39)	0.07
Knowledge on causes Schistosomiasis		
No	Ref.	
Yes	1.51 (0.68, 3.33)	0.31
Factors associated with Schistosomiasis		
No	Ref.	
Yes	2.18 (0.95, 5.02)	0.07
Awareness of snails as vectors		
No	Ref.	
Yes	1.45 (0.63, 3.35)	0.38
Frequency of water use		
Occasionally	Ref.	
Quite often	0.64 (0.17, 2.4)	0.51
Very often	0.63 (0.14, 2.81)	0.54
Water usage		
Domestic, bathing and swimming	Ref.	
Multipurpose	1.38 (0.63, 3.04)	0.42
Toilet present		
No	Ref.	
Yes	0.57 (0.26, 1.29)	0.18
Washing of hands after visiting the toilet		
No	Ref.	
Yes	1.32 (0.59, 2.93)	0.5
Source of drinking water		
Lake	Ref.	
Lake and water tank	2.38(1.06, 5.35)	0.03
Drinking water treated		
No	Ref.	
Yes	1.46 (0.6, 3.6)	0.4
Washing of fruits before eating		
No	Ref.	
Yes	1.62 (0.7, 3.8)	0.27
Washing of hands before eating		
No	Ref.	
Yes	1.26 (0.53, 3.0)	0.6

Table 8: Multivariate logistic regression analysis of factors associated with schistosomiasis among adults in endemic parts of Siaya County.

Variables	Prevalence (95% CI)	p-value
Sex		
Male	Ref.	
Female	0.43 (0.19, 0.98)	0.04
Source of drinking water		
Lake	Ref.	
Lake and water tank	2.42 (1.06, 5.55)	0.04

Discussion

The Proportion of infected participants was found to be significantly higher in males compared to females 48% vs 33% (P = 0.04) and in participants aged > 18 years compared to those aged < 18, 50 vs 31 (P = 0.001). Further, intensity levels were found to be higher in females compared to males 0.95 (95% CI = 0.48, 1.4, P = 0.03) and in adults compared to children.

Knowledge level on prevalence, on snails as vectors and on causes as well as on factors associated with schistosomiasis were used to determine the community's perception and level of knowledge on schistosomiasis in endemic parts of Siaya county. 143 participants had knowledge on schistosomiasis while 112 on factors associated with schistosomiasis, 87 on causes and 65 on snails as vectors of schistosomiasis. The odds of having schistosomiasis was lower among children with knowledge on schistosomiasis compared to those without 0.34 (95% CI = 0.14, 0.83 P = 0.02), those with knowledge on the causes 0.32 (95% CI = 0.13, 0.76 P = 0.01) and among those with knowledge on factors associated with schistosomiasis 0.35 (95% CI = 0.15, 0.84 P = 0.02) However, effects of predictors from the univariate analysis were not significant at the multivariate level.

In adults, the odds of having schistosomiasis was lower among females compared to males 0.35 (95% CI = 0.15, 0.84 P = 0.02) and higher among those that used lake and dam as sources of water for domestic use compared to those that depended on tanks and other sources 2.42 (295% CI = 1.06, 5.55P = 0.04).

Conclusions

Prevalence of schistosomiasis was found to be significantly higher among male adults even after deworming with praziquantel. This could be attributed to reinfections due to frequent exposures of the men to the infested waters especially those involved in fishing and sand harvesting as an economic occupation in the area. The men in this area were also found to be fond of bathing and swimming in the lake after their day's engagement unlike most women and children. Prevalence was also found to be lower among school-aged children with knowledge of schistosoma disease, among those who had knowledge on factors associated with the disease and had been dewormed during the mass drug administration in school.

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