Differences in Schistosomiasis knowledge among irrigation rice farming communities in different irrigation schemes in Tanzania.

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ABSTRACT

Aims: To assess differences in schistosomiasis knowledge in farmers working in traditional, improved traditional and modern irrigation schemes in Tanzania.
Study design: A cross-sectional survey among farmers practicing irrigation rice farming, in 2 different regions and 6 different irrigation systems.
Place and Duration of Study: The study was carried out between November and December 2011 in the Morogoro and Kilimanjaro Regions, Tanzania.
Methodology: Random sampling with equal number of irrigators in each scheme was employed. Irrigators were chosen by the researcher from the list provided by the village government in the six schemes of all farmers practicing irrigation rice farming. 240 samples were used, 120 from each region, i.e. 40 farmers practicing irrigation rice farming in each scheme. Independent sample t-test was used for testing schistosomiasis knowledge differences among irrigators between schemes with the same design

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and construction of their infrastructures between the two regions.
Results: More than 88% of irrigators surveyed in Kilimanjaro schemes had better knowledge regarding to all schistosmiasis items asked compared to those in Morogoro. There were significant difference on irrigators knowledge on schistosomiasis symptoms (P<0.001), and predisposing factors (P<0.001) between Morogoro and Kilimanjaro Modern schemes. Knowledge on predisposing factors differed significantly (P<0.001) between irrigators in Morogoro and Kilimanjaro improved traditional schemes. Moreover significant difference were noted on irrigators knowledge on schistosomiasis symptoms (P<0.001), predisposing factors (P<0.004) and schistosomiasis control measures (P=0.003) between irrigators in Morogoro and Kilimanjaro traditional schemes.
Conclusion: Schistosomiasis knowledge was found to be lower in Morogoro schemes, and particularly in traditional scheme, indicating that water management education deliveries are needed for sustainable control of schistosomiasis in these schemes, which have found to be successful in other irrigation systems world-wide.

Keywords: schistosomiasis, knowledge, different irrigation schemes, Morogoro, Kilimanjaro, Tanzania.

1. INTRODUCTION

It is estimated that 207 million people world-wide suffer from schistosomiasis, and the majority of these live in sub-Saharan Africa (Steinmann et al., 2006). Moreover, some estimates indicate that as many as 400 million people are affected (King, 2010). Schistosomiasis is one of the major causes of morbidity in endemic areas of Asia, Africa and South America (WHO, 1995; Hotez et al., 2008). Professions with a high water contact pattern like: house wives in charge of collecting drinking water, fisher men and farmers are at a high risk of contracting the infection (Steinmann et al. 2006). In Tanzania the disease affects the irrigated rice growing communities in the Morogoro and Kilimanjaro regions and causes a high disease burden in both health of the irrigation farming communities and socio-economy of the country (URT, 2008).

Several factors influence schistosomiasis transmission levels in irrigation schemes, these include: the design of irrigation infrastructures farming practices, like poor drainage and vegetation cover in canals. Changes in the management of irrigation systems can help control the intermediate host. Increases in the flow velocity in irrigation canals, through the construction of irrigation canals with an elevated proper slope, is a potential way to disperse snails, though this should be balanced with possible increased erosion of irrigation canals (Oomen, de Wolf et al. 1990), and might not always be possible. The lining of irrigation canals, regular removal of weeds and improving drainage are however expensive.

Schistosomiasis is claimed to be primarily a disease that results from lack of education, public health facilities and poverty (Oniya, et al., 2007; King et al., 2010). Although chemotherapy can reduce morbidity caused by the infection, rapid re-infection usually occurs requiring repeated treatment (N'Goran et al.,

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2001). Therefore, improvements in hygiene, water supply and sanitation combined with health promotion and sustainable behavior change will need to be put on the agenda in case long term control of schistosomiasis can be achieved in Tanzania (Hamed, 2010; WHO, 2012). Understanding the levels of knowledge regarding schistosomiasis transmission will enable policy makers to help design control programmes. Integrating health education and medical intervention remain a high priority for the World Health Organization's (WHO) schistosomiasis control programs. However, in many endemic areas, control programs often do not incorporate public health promotion of the target groups.

In Tanzania there have been several studies assessing community perceptions and knowledge about schistosomiasis, though most of these studies focused on school children (Mazigo *et al*., 2010; Clement et al., 2008; Freudenthal *et al*., 2006; Lansdown et al., 2001: Lwambo *et al.,* 1999; Guyatt *et al*., 1999), with the exception of one, which involved irrigated rice growers (Poggensee *et al*., 2000). The level of knowledge demonstrated by school children does not necessarily represent the level of knowledge of their parents, nor those of specific communities at risk like farmers and fishermen and neither is it necessarily comparable between traditional, improved traditional and modern irrigation schemes. In this case, there is no certainty on this subject matter. Therefore, this study sought to assess schistosomiasis knowledge differences among the farming communities in terms of the level of knowledge related to schistosomiasis cause, symptoms, transmission, control and health-effects that may occur due to schistosomiasis infection between schemes in Morogoro and Kilimanjaro regions. Results were envisioned to contribute to the identification of knowledge gaps on schistosomiasis among irrigation rice farming communities thus provide entry/departure points towards future schistosomiasis control efforts in Tanzania.

2. MATERIALS AND METHODS

2.1 Study Areas

Six irrigation schemes which differed in terms of design and construction of their irrigation infrastructures were purposively selected from two Regions, Morogoro and Kilimanjaro. Three irrigation schemes in each region were selected. Two irrigation systems: Lower Moshi and Mwega schemes were categorized as modern because their intakes, main canals, secondary and tertiary canals, division and drop structures are concrete lined. The schemes Kikafu Chini and Mkindo were categorised as improved traditional systems because only the intakes, and part of their main canals are concrete lined, while the rest of the

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infrastructure are earth lined. The final two: Njoro and Chabi were categorised as traditional schemes as from the intake, main, secondary canal and other infrastructures are earth lined and constructed using indigenous knowledge.

Njoro scheme is located in Kaloleni Ward, which is found in Moshi Municipal- Tanzania. It is the smallest ward in Moshi town. The major activity done in njoro is rice farming. There are about 232 rice farmers engaged in rice farming. Kaloleni ward has a population of about 6000 people with majority being poor farmers.

In 1999, Kikavu Chini had a population of nearly 3000, an average sized village in Tanzanian terms. The irrigation scheme is managed by about 760 farmers, including 430 land owners, 230 tenants, and 100 laborers. Kikavu is quite small, with 1600 acres. The irrigation scheme dominates the landscape taking up 1000 acres out of which only 300 acres are suitable for rice farming (Koopman et al. 2001).

Lower Moshi scheme is located 15 kilometers in the southern part of Moshi Town at the foot of the slopes of Mount Kilimanjaro (3º21'S, 37º21'E). The scheme lies at altitude ranging between 700 to 800 meters above sea level.

The detailed description of Chabi, Mkindo and Mwega schemes are given in Salehe and Hassan (2012).

The six schemes were selected due to the reason that they are among the main rice growing areas in Morogoro and Kilimanjaro. Additionally, nearly all the scheme inhabitants in the two regions use water from the canals for cooking, drinking, washing clothes and household utensils and for bathing.

2.2 Study design and sampling procedure

A cross sectional research design was used and data collection was carried out in six irrigation schemes between November and December, 2011. Data were collected at a single point in time. Random sampling with equal number of irrigators in each scheme was employed. Irrigators were chosen by the researcher from the list provided by the village government in the six schemes of all farmers practicing irrigation rice farming. The researcher chose a total of 240 irrigation rice farmers for the study, 120 from each Region and 40 from each irrigation scheme. A structured questionnaire with closed and open ended questions

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was used as a method of collecting data. Information on what causes schistosomiasis, how schistosomiasis can be transmitted, effects that can be caused by the disease, symptoms, schistosomiasis predisposing factors and schistosomiasis control measures was sought from each irrigator interviewed.

2.3 Determination of schistosomiasis knowledge index

For better assessment of schistosomiasis knowledge status, a nine item index was used (Table 1). However, the items were divided into 6 Schistosomiasis knowledge domains: (i) causes of schistosomiasis, (ii) effects of schistomiasis, (iii) symptoms of schistomiasis, (iv) schistomiasis predisposing factors, (v) transmission of schistosomiasis and (vi) schistomiasis control measures. Where a domain had more than one item, the items were combined into one index for the domain. Respondents were asked to respond to whether they understood each item concerning schistosomiasis or not. The respondents scored 1 for a correct answer and 0 for incorrect answer. Respondents' responses were added to form a schistosomiasis knowledge index which ranged from 0 to 6.

Table 1: Schistosomiasis knowledge index

Knowledge Domains and Items
Domain 1: Causes of schistomiasis -Schistosomiasis is caused by snails
Domain 2: Effects of schistomiasis - Schistosomiasis deteriorate people's health - Schistosomiasis patient can die if not well treated
Domain 3: Symptoms of schistomiasis The following are not schistosomiasis symptoms; -Blood in urine, blood in stool, pains during urinating, pains during passing stool, pains below abdomen, abdominal pains
Domain 4: Schistomiasis predisposing factors - One can acquire schistosomiasis through washing limbs, bathing and washing farming tools in irrigation infrastructures.

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Domain 5: Schistosomiasis transmission - Urinating and defecating in the scheme areas transmits schistosomiasis
Domain 6: Schistosomiasis control measures - Construction of toilets in the scheme areas does not control schistosomiasis - Proper canal cleaning to remove vegetation growth does not control schistosomiasis - Draining excessive water in the plots and canals does not control schistosomiasis

2.4 Data analysis

The number of respondents who answered correctly to each knowledge item asked was expressed in percentage. Independent sample t-test was used for testing schistosomiasis knowledge differences among irrigators between schemes with the same design and construction of their irrigation infrastructure between the two egions.

3.0 RESULTS AND DISCUSSION

3.1 Results

3.1.1 Respondents' knowledge on Schistosomiasis among irrigation rice growers in Modern, Improved traditional and Traditional schemes in Morogoro Region

Table 2 presents responses related to schistosomiasis knowledge among irrigators interviewed in Modern (Mwega), Improved traditional (Mkindo) and Traditional (Chabi) schemes in Morogoro. 84% of irrigators in all three schemes had enough knowledge about schistosomiasis as a disease caused by snails. In addition, 93% of irrigators were knowledgeable on the effects that can be caused by schistosomiasis. Regarding irrigators' knowledge on schistosomiasis symptoms, only 58% in all three schemes had knowledge on that item. Moreover, less than half (44.2%) had knowledge on schistosomiasis predisposing factors. However, 81% of irrigators interviewed in the three schemes were aware of schistosomiasis control measures and 92% had knowledge on how schistosomiasis can be transmitted. Generally, irrigators in Morogoro traditional scheme (Chabi) had poor knowledge on schistosomiasis symptoms and schistosomiasis predisposing factors while those in Morogoro improved traditional Scheme (Mkindo) had also poor knowledge on schistosomiasis predisposing factors (Table 2).

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3.1.2 Respondents' knowledge on Schistosomiasis among irrigation rice growers in Modern, Improved traditional and Traditional schemes in Kilimanjaro Region

Table 2 results reveal that more than 88% of irrigators interviewed in modern, improved traditional and traditional schemes in Kilimanjaro had better knowledge on what causes schistosomiasis, effects that can be caused by schistosomiasis, schistosomiasis predisposing factors, schistosomiasis symptoms, how the disease can be transmitted and controlled. Generally irrigators in Kilimanjaro traditional scheme (Njoro) had better schistosomiasis knowledge compared to their counterparts in Improved traditional and Modern.

Table 2: Schistosomiasis Knowledge among surveyed irrigation rice growers in modern, improved traditional and traditional schemes in the two Regions.

Variables	Morogoro schemes			Kilimanjaro schemes		
	Traditional (Chabi)	**Improved tradition (Mkindo)**	**Modern (Mwega)**	**Traditional (Njoro)**	**Improved traditional (Kikavu chini)**	**Modern (Lower moshi)**
Causes of schistomiasis	38 (95)	28 (70)	35 (87.5)	37 (92.5)	33 (82.5)	37(92.5)
Effects of schistomiasis	38 (95)	37 (92.5)	37 (92.5)	39 (97.5)	38 (95)	38 (95)
Symptoms of schistomiasis	13 (32.5)	33 (82.5)	24 (60)	40 (100)	36 (90)	40 (100)
Schist. predisposing factors:	14 (35)	18 (45)	21 (52.5)	40 (100)	38(95)	39(97.5)
Schistosomiasis transmission	38 (95)	33 (82.5)	39 (97.5)	39 (97.5)	37 (92.5)	39(97.5)

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Schist. control measures	32 (80)	28 (70)	37 (92.5)	40 (100)	34 (85)	36 (90)

*Numbers in parenthesis refer to percentage of respondents that responded to schistosomiasis items.

3.1.3 Schistosomiasis knowledge differences among irrigators in Modern irrigation schemes between Morogoro and Kilimanjaro Regions.

An independent sample t-test indicates that there were significant differences on schistosomiasis symptoms and schistosomiasis predisposing factors among irrigator's between Morogoro modern scheme (Mwega) and Kilimanjaro modern scheme (Lowermoshi). Furthermore, results show that irrigators in Lower Moshi had more knowledge on schistosomiasis symptoms compared to those in Mwega (Table 3). Moreover irrigators in Lower Moshi had better understanding on schistosomiasis predisposing factors compared to their counterparts in Mwega.

3.1.4 Schistosomiasis knowledge differences among irrigators in Improved traditional irrigation schemes between Morogoro and Kilimanjaro Regions.

Table 3 revealed significant difference on schistosomiasis predisposing factors among irrigators between Morogoro Improved traditional scheme (Mkindo) and Kilimanjaro Improved traditional scheme (Kikafu Chini). Irrigators in Kikafu Chini scheme had more schistosomiasis knowledge on the above mentioned schistosomiasis item compared to those in Mkindo scheme.

3.1.5 Schistosomiasis knowledge differences among irrigators in Traditional irrigation schemes between Morogoro and Kilimanjaro Regions.

Table 3 results show significant differences on three schistosomiasis knowledge items between irrigators interviewed in Morogoro traditional scheme (Chabi) and those in the Kilimanjaro traditional scheme (Njoro). Irrigators' knowledge on schistosomiasis symptoms, schistosomiasis control measures and schistosomiasis predisposing factors differed significantly between the two schemes. Schistosomiasis knowledge on the mentioned items was widely understood by irrigators in Njoro than those in Chabi scheme (Table 5).

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Table 3: Schistosomiasis knowledge difference among irrigators in Modern, improved traditional and traditional irrigation schemes between Morogoro and Kilimanjaro regions

Variables	Modern Schemes			Improved Traditional Schemes			Traditional Schemes		
	Mwega	Lower Moshi	P-Value	Mkindo	Kikafu Chini	P-Value	Chabi	Njoro	P-Value
Causes of schistomiasis	0.88	0.92	0.46	0.70	0.82	0.19	0.95	0.92	0.65
Effects of schistomiasis	0.92	0.95	0.65	0.92	0.95	0.65	0.95	0.98	0.56
Symptoms of schistomiasis	0.60	1.00	<0.001**	0.82	0.90	0.34	0.32	1.00	<0.001**
Schistosomiasis transmission	0.98	0.98	1.00	0.82	0.92	0.18	0.95	0.98	0.56
Schistosomiasis predisposing factors	0.52	0.98	< 0.001**	0.45	0.95	<0.001**	0.35	1.00	0.004*
Schistosomiasis control	0.92	0.90	0.69	0.70	0.85	0.11	0.80	1.00	0.003*

*Mean difference statistically significant at P<0.05 level

** Mean difference statistically significant at <0.001 level

4. DISCUSSION

Schistosomiasis is one of the most widespread parasitic infections that affect humans in terms of socio-economic and public health importance in the developing world. Yet majority of the people in these countries are not aware of its symptoms and predisposing factors as highlighted in this study. Among irrigators interviewed in the three schemes in Morogoro, those in traditional scheme (Chabi) had poor knowledge on schistosomiasis symptoms and predisposing factors while those in Improved traditional (Mkindo) scheme had low knowledge on schistosomiasis predisposing factors only. This might be due to the reason that respondents in Chabi (Traditional) irrigation scheme had never received any training regarding schistosomiasis as a disease since the village does not even have health facilities such as dispensary. Therefore, our results tally with the study in Nigeria by Oniya (2007), that schistosomiasis results from lack of education and public health facilities. The findings are also in line with the results in

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Nigeria by Onyeneho *et al* (2010), that lack of knowledge is the main factor responsible for the high level of schistosomiasis.

Rice irrigators in Mkindo scheme had low knowledge on schistosomiasis predisposing factors despite existing evidence on provision of training on schistosomiasis from several institutions and the Mkindo Farmer's Centre. Such training programmes include those offered by the Japan International Cooperation Agency (JICA) whereby farmers in Morogoro schemes particularly Mwega and Mkindo schemes visited Lower Moshi scheme for training on rice production and water management practices**.** The findings correspond with the study done in Ghana by Wagatsuma *et al. (*2003), that children who had more awareness about urinary schistosomiasis raised the question why awareness did not result in low prevalence and avoidance of risk behaviour.

Irrigators interviewed in Modern, improved traditional and traditional schemes in Kilimanjaro had better schistosomiasis knowledge compared to their fellow irrigators in Morogoro schemes. This might be attributed to high literacy rate by Kilimanjaro farmers. This is supported by the URT (2005) report, that Moshi Urban and Moshi Rural are known to have higher percentage of adult literacy rate of 96% and 89% respectively compared to Morogoro Urban 85%. Njoro farmers' schistosomiasis knowledge was high may be because they cultivate rice twice a year and therefore due to frequent contact with water they have become more aware of the schistosomiasis symptoms. Moreover, multiple schistosomiasis infection by farmers in Kilimanjaro traditional scheme (Njoro) is probably another reason which might have made them understand better schistosomiasis symptoms compared to their counterparts in Morogoro traditional scheme (Chabi).

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5. CONCLUSION AND RECOMMENDATION

Generally schistosomiasis knowledge level was lower among irrigators interviewed in Morogoro schemes particularly in traditional scheme (Chabi) and higher among respondents in Kilimanjaro schemes.From the findings of this study it is concluded that schistosomiasis knowledge delivery is needed for sustainable control of schistosomiasis in Morogoro schemes as this strategy has been successful in Niger and Senegal.

Deliberate efforts are needed on the link between schistosomiasis and irrigation farming in modern, improved traditional and traditional schemes in Morogoro and Kilimanjaro. Farmers' awareness and provision of education on schistosomiasis, and how it relates with water need to be taken into serious consideration in designing future schistosomiasis mitigation/control measures in all old and new irrigation schemes.

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AUTHORS' CONTRIBUTIONS

Farida S. Salehe designed the study, collected data, performed the statistical analysis and wrote the first draft of the manuscript. Amon.Z. Mattee, Andrew K.P.R. Tarimo, Jeroen H.J. Ensink and Madundo M.A. Mtambo gave comments. All authors read and approved the final manuscript.

REFERENCES

Clements ACA, Brooker S, Nyandindi U, Fenwick A, Blair L. Bayesian spatial analysis of a national urinary schistosomiasis questionnaire to assist geographic targeting of schistosomiasis control in Tanzania, East Africa . International Journal of Parasitology. 2008;38:401-415.

Engel D, Chitsulo L, Montresor A, Savioli L. The global epidemiological situation of schistosomiasis and new approaches to control and research. Acta Tropica. 2002; 83:139-146.

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Freudenthal S, Ahlberg BM, Mtweve S, Nyindo P, Poggensee G, Krantz I. School-based prevention of schistosomiasis:Initiating a participatory action research project in northern Tanzania. Acta Tropica. 2006;100: 79-87.

Gallup JL, Sachs JD. The economic burden of malaria. The American Journal of Tropical Medicine and Hygiene. 2001; 64: 85-96.

Garba A, Aboubacar A, Barkire A, Vera C, Sellin B, Chippaux J. Impact of health education campaigns on the control of urinary bilharziasis in Niger. Cahiers Sante'. 2001;11: 35-42.

Guyatt H, Brooker S, Lwambo NJS, Siza JE, Bundy DAP. The performance of school-based questionnaires of reported blood in urine in diagnosing schistosoma haematobium infection;bpatterns by age and sex.Tropical medicine and International Health.1999; 4:751-757.

Gwatirisa PR, Ndamba J, Nyazema, NZ. The impact of health education on the knowledge, attitudes, practices of a rural community with regard to schistosomiasis control using plant *molluscicide phytolacca dodecandra.* Central African Journal of Medicine. 1999; 45: 94-97.

Hamed MA. Strategic Control of Schistosome Intermediate Host. Asian Journal of Epidemiology. 2010; 3: 123-140.

Hotez PJ, Bethony JM. Oliveira,SC, Brindley PJ, Loukas A. Multivalent anthelminthic vaccine to prevent kworm and schistosomiasis. Expert Review of Vaccines. 2008; 7:745-752.

King CH. Parasites and poverty: the case of schistosomiasis. Acta Trop. 2010; 113: 95–104.

Kloos H, Ouma JH, Kariuki HC, Butterworth AE. Knowledge, perceptions and health behavior pertaining to schistosomiasi mansoni related illness in Machakos district, Kenya. Tropical Medicine and Parasitology. 1986; 37:171-175.

Koopman J, Kweka R, Mboya M, Wangwe S. Community Participation in Traditional Irrigation Scheme Rehabilitation Projects in Tanzania: Report of a Collaborative Research Project; 2001.

Lansdown R, Ledward A, Hall A, Issae W, Yona E, Matulu J, Mweta M, Kihamia C, Nyandindi U, Bundy D.Schistosomiasis, helminth infection and health education in Tanzania:achieving behavior change in primary schools. Health Education Research. 2001;17:425-433.

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Lwambo NJS, Siza JE, Brooker S, Bundy DAP, Guyatt H. Patterns of concurrent infection with hookworm and schistosomiasis in school children in Tanzania. Transactions of the Royal Society of Tropical Medicine and Hygiene. 1999; 93:497–502.

Mazigo H, Waihenya R, Mkoji GM, Zinga M, Ambrose EE, Jahanpour OF, Bahemana E, Mnyone LL, Kweka EJ, Lwambo NJS. Intestinal Schistosomiasis: Prevalence, Knowledge, Attitude and Practices among School Children in an Endemic Area Of Norther Western Tanzania. Journal of Rural and Tropical Public Health. 2010; 9: 53 – 60.

Oniya MO. Socio-Cultural Practices Promoting the Transmission of Urinary Schistosomiasis among School Aged Pupils in a South Western Village in Nigeria. Research Journal of Biological Sciences. 2007; 2: 1- 4

Onyeneho NG, Yinkore P, Egwuage J, Emukah E. Perceptions, attitudes and practices on schistosomiasis in Delta State, Nigeria.Tanzania Journal of Health Research. 2010;*12.*

Poggensee G, Krantz I, Kiwelu I, Feldmeier H. Screening of Tanzanian women of childbearing age for urinary schistosomiasis: validity of urine reagent strip readings and self- reported symptoms. Bulletin of the World Health Organisation. 2000;78(4).

Salehe FS, Hassan SN. Socio-economic Effects of Schistosomiasis on Irrigation Rice Growers in Morogoro, Tanzania. American Journal of Experimental Agriculture. 2012; 2(3): 395-406.

Steinmann P, Keiser J, Bos R, Tanner M, Utzinger J. Schistosomiasis and water resources development: systematic review, meta-analysis, and estimates of people at risk. Lancet Infect Dis. 2006; 6: 411–25.

Tesfa-Michael T, Ayele T, Birrie H, Lo CT. Evaluation of Multidisciplinary control of schistosomiasis mansoni in a northern Ethiopian community.Institute of Pathobiology Research Report.1987; 3: 17-29.

United Republic of Tanzania. The National Schistosomiasis and Soil-transmitted helminth Control Programme (NSSCP). 2008. Dar es Salaam, Tanzania.

United Republic of Tanzania. Poverty at the Disrict Level in mainland Tanzania, Poverty and Human Development Report. 2005.

Wagatsuma Y, Aryeetey MF, Nkrumah FK, Sack DA, Kojima S. Highly symptom-aware children were heavily infected with urinary schistosomiasis in southern Ghana. Central African Journal of Medicine. 2003; 49:16-19.

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World Health Organisation. Schistosomiasis Fact Sheet N°115. 2012. Available online http://www.who.int/mediacentre/factsheets/fs115/en/index.html

World Health Organisation. A picture of health? 1995. WHO, Geneva/UNICEF, New York

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