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Transmission potential of Fasciola gigantica in irrigation water sources in Ebonyi State, Nigeria

C.A. Uhuo [1*], O.O. Odikamnoro [1], F.C. Okafor [3], I.M. Ikeh [1], G.A. Ibiam [2], N.F. Oko [3], A.C. Nwuzo [4]

[1] *Department of Applied Biology, Ebonyi State University, Abakaliki Ebonyi State. Nigeria*
[2] *Department of Medical Laboratory Sciences, Ebonyi State University Abakaliki, Ebonyi State*
[3] *Department of Zoology University of Nigeria Nsukka Enugu State. Nigeria*
[4] *Department of Applied Microbiology, Ebonyi State University, Abakaliki Ebonyi State. Nigeria*

Abstract

The study on the transmission potential of *Fasciola gigantica* in irrigation water was conducted by investigating the life cycle stages of the parasite in water sources using sedimentation, centrifugation methods and microscopic examination respectively. The study revealed that eggs, cercariae and metacercariae life cycle stages of *Fasciola gigantica* were recovered from the water sources assessed for irrigation in both wet and dry seasons between February,2012 to January,2013. The analysis of variance showed that there is a statistical significant difference between water sources in having life cycle stages of the parasite ($P<0.05$). Investigation of the parasite stages in vegetables ranked high in all sites and does not show any statistical significant difference. The life cycle stages (eggs, cercaria and metacercaria) in water at both seasons showed a perfect similarity coefficient (1.00). The use of sewage, domestic animal dungs as organic fertilizers for the cultivation of the vegetables and the use of contaminated water or wastewater for irrigation were found to be predisposing factors. Helminth parasite eggs in low quality water and unhygeinically processed edible vegetable show them as health risks when used for irrigation of crops and when the crops are consumed uncooked. This study suggests health education of rural farmers, improved agricultural practices and irrigation in the farms as ameliorating factors or risk reducing measures.

Keywords: Fasciola gigantica; Irrigation; Water sources; Nigeria

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* Corresponding author. *E-mail address:* coscusanas@gmail.com

1. Introduction

Fascioliasis is a major disease of public health importance caused by two digenetic trematodes, *Fasciola hepatica* and *Fasciola gigantica*. Both localised in the bile duct, liver or gall bladder of their host. *Fasciola gigantica* measures 2-3cm and reproduces both sexually and asexually while adults are haemophrodite (Schmidt and Robert, 2005). Although, fascioliasis occurs at all ages, most of the cases reported are adults, probably due to the increasing complications seen in this age group, such as acute cholangitis (Blumenthal et al., 2000) and high contact with their infective stages.

Human fascioliasis has been an important public health problem reported from countries in Europe, Asia, Africa, and Oceania (Mas-Coma et al*.,* 1999). This occurs where eating of watercress, aquatic vegetations, and drinking contaminated water containing infected metacercaria were the primary sources of infection (Yildirim, et al*.,* 2007).In addition with consumption of raw liver dishes from fresh liver infected. However, it has been estimated that 2.4 million people are infected with *Fasciola* and a further 180 million are at risk of infection (WHO, 2009). Metacercaria is the infective larval stage of *Fasciola gigantica* usually found in or on encysted resting or maturing stage of a trematode parasite in the tissue of a secondary intermediate host or on vegetation.

One miracidium hatching from a fluke egg can produce up to 4,000 infective cysts (metacercariae) due to the vegetative multiplication at the sporocyst and redia stages. The metacercarial stage of fasciola species does not withstand high atmospheric temperature but humid and cool temperature for its survival to maintain their life cycle (Andrews, 1999; Soulsby, 1982; Dunn, 1978).

Human fascioliasis occurs when one ingests or eats vegetable or drinks water encysted by metacercaria, they immediately penetrates the intestinal wall and creep over the visceral organ until contacting the capsule of the liver (Yildirim et al*.,* 2007). One of the problems associated with irrigation is its potential to facilitate transmission of waterborne human and animal diseases. The transfer from a rain-fed to an irrigation farms favours the development and propagation of water-borne infections to both humans and livestock.

2. Study area

The study was carried out in Ishielu (Ezzagu), precisely Inyaba river between March 2012 to December 2012 in approximately 7”30N longitude 5”40SN and 6”45E. The climate is characterized with hot dry period, which stretches from November-April, while the rainy season is from May – October. Their major land mass is characterised with swamps and loamy.The Inyaba river starts from the Amodo lowlands of Enugu and flows from eastwards to south of the country covering a total length of 200km length and an area of 110km. The air shade temperature during the dry season of February to March is 38. 6^{o}C while the mean temperature between December to January is 23.3^{o}C. The period of rainy season has a maximum air shade temperature of 30.9^{o}C and a minimum temperature of 24.1^{o}C with an average rainfall of 150.6mm to 180.7mm. The temperature and rainfall information were taken from Akanu Ibiam International Airport Enugu radar since the area of the research lies on the same axis. Majority of homes in this area lack portable drinking water, no electricity and access road, where Inyaba River serves as the alternative drinking water source.

3. Collection of water sample

The waters which were the subject of the analysis was sampled for dry season. 1 litre of water samples was collected into sterile sample bottles and preserved by the addition of 10% formaline (2ml/liter) and transported in a cooler (at 4°C) to Applied Biology Laboratory complex.

3.1. Water samples

Samples of 1 litre of water from the river was collected from each 10 metres and preserved by the addition of 10% formaline in sterile bottles; the samples was allowed to settle for 8 hours as proper sedimentation may last longer period or throughout the overnight. The sediments was then transferred into a centrifuge tubes while the walls of the sedimentation tubes was screened well and washed thoroughly. The recovered materials were centrifuged at 1500 rpm for 15 minutes. The supernatant was removed and discarded and the sediments thus transferred into test tube. The mixture was re-centrifuged at 1500 rpm for 15 minutes and the pellets transferred into a microscope glass slide for final examination using objectives X10 and X40 magnification respectively.

4. Results

The prevalence of *F.gigantica* life cycle stages in irrigation water showed that Eguho (34.3) recorded the highest prevalence of eggs amongst the ten stations sampled in each location while Ugboenyim (9.3) recorded the least prevalence. There was no prevalence of cercaria and metacercaria life cycle stages of *F.gigantica* in all the water samples for these two stages. A total of 50 stations (ten each locations) were sampled and the total number of the parasite stages was added together per location to get the average life cycle stage of the parasite.

ANOVA result showed that variation in the prevalence rate of eggs in the samples from different locations was statistically significant ($P < 0.05$).

Table 1. Isolation of the *Fasciola gigantica* parasite life cycle stages in irrigation water.

S/N	Sample locations	Number of stations	Parasite life cycle stages		
			Eggs	*Cercaria*	*Metacercaria*
1	Azuinyaba	10	7(21.87%)	00	00
2	Ugboenyim	10	3(9.37%)	00	00
3	Onuinyaba	10	5(15.62%)	00	00
4	Onunweke	10	6(18.75%)	00	00
5	Eguho	10	11(34.37%)	00	00
	Total	50	32	00	00

The seasonal distribution of *F.gigantica* life cycle stages showed that wet season recorded the highest prevalence of the parasite life cycle stages in water (33.68). Cercaria and metacercaria were the least in the prevalence. While the prevalence of the parasite life cycle stages in dry season showed that egg recorded the highest prevalence. There was no ceracria and metacercaria life cycle stages present among samples of water analysed in this season.

ANOVA result showed that variation in the prevalence of the parasite life cycle stages in rainy and dry seasons was statistically significant(P<0.05).

Table 2. Prevalence of eggs, cercaria and metacercaria of *Fasciola gigantic*a in water and vegetables

S/N	Sample Location	No of stations	Parasite life cycle stages		
			Eggs	***Cercaria***	***Metacercaria***
1	Water	50	32(33.68)	0(0.00)	0(0.00)

The prevalence of the life cycle stages in water showed that water sample collected from fifty (50) different locations has the total number of 32 (33.68%) life cycle stages of eggs of *F.gigantica* , no cercaria and metacercaria was recorded from the analysis. While the highest life cycle stage of egg was found in leafy (66.31) analysed.

ANOVA result showed that variation in the prevalence of the life cycle stages in water and vegetable in different locations was statistically significant (P<0.05). The similarity index for vegetable and water showed that there is a similarity coefficient (P<0.05) (1.00) in the different locations sampled.

5. Discussion

About 60% of the farmers in Inyaba villages practice farming majorly rice as a fulltime occupation; some engage in vegetable cultivation because of high demand of the products in the nearby markets. The water is flooded through channels to the vegetables probably causing potential risk of attachment of parasitic helminthes on upper as well as to lower surfaces of the vegetables. The artificial irrigation in the sample areas were practiced with animal dungs/ feaces and pellets from different plants and fruits and even with manures generated from the decay of grasses at various irrigation points. Irrigation of vegetables in developing countries including Nigeria is done using untreated wastewater and raw manure of domestic animal origins as fertilizers. However, table 1 showed the isolation of life cycle stages of *Fasciola gigantica* in water used for irrigation. The method of this investigation revealed that sample sources for infection of *Fasciola gigantica* were isolated using centrifugation and sedimentation methods of samples of water which include drinking contaminated water sources due to lack of portable water.

The result showed that sample from Eguho 11(34.3%) has the highest prevalence of eggs than samples from other areas as seen in the results. This could be that the eggs could arise from the domestic animal dung used as organic fertilizer (cow dungs, feacal matters of goats and sheep with pellets from other contaminated materials), which the animal hosts have ingested from *F.gigantica* infested pastures. This is in line with the work of Beutchat, (1998); Damen et al. (2007) which states that pre-harvest periodic vegetables are only exposed to the production related sources of parasitic contaminants associated with the practice of using untreated wastewater for irrigation and sewage or raw manure of domestic animal origin as fertilizer. Thus, I also suggest frequent flooding of the wastewater to the surface of the vegetables; thereby contaminating the vegetables. The water is flooded through channels to the vegetable probably causing potential risk of attachment of parasitic contaminant on upper as well as to lower surfaces of the vegetable, thus initiating a vehicle of transmission. The study revealed that eggs, cercaria and unsheathed metacercaria stages of *F.gigantica* parasites were also implicated in irrigation water. Therefore, the acquisition of fascioliasis in this area may be as a result of ingestion of infested water sources used for the cultivation of vegetable leaf and wastewater of domestic animal origin in their farms. The seasonal distribution of the parasites stages of *Fasciola giganti*a as recorded in the present study showed that rainy season favours the presence of the parasite infective stages. The highest prevalence in water (33.6) was recorded in rainy season (99.9). This is characterized with abundant rain, high moisture contents and low temperature suitable for the presence of the parasite life cycle stages and transmission of the pathogenic microorganism enroute feacal- oral contamination of leafy vegetables and water. It is also observed that the proximity between vegetable and domestic animal dungs which is a suspected carrier of the pathogens has a strong relationship that supports the parasite infectivity. Metacercaria of *Fasciola* species may survive for more than one year on pastures depending on moisture and temperature. This is supported by Weldesilassie (2010) on the examination of vegetable collected from commercial markets which showed that the vegetables were contaminated with many types of parasite eggs and cysts. His study revealed that the parasites were significantly more frequent in winter vegetables. Contrarily, he stated that *Fasciola* species were recovered in both winter and summer seasons with higher numbers in winter.

6. Conclusion and recommendation

The present study identified parasitic contaminants of irrigation water, organic manure or sewage for vegetable production; suggesting the fact that the parasites identified may pose occupational risk of infection to the farming communities and consumers.

the practice of using wastewater for irrigation offers many opportunities, but poses human health risks which is associated with consumption of contaminated vegetables irrigated with wastewater. To the studied areas, safe and clean drinking water should be provided in other to reduce the intake of Inyaba river which is highly incriminated with parasitic helminths. Health education should be given to users of Inyaba water on the health implications associated with using unhygeinically processed water. Also educate them on proper boiling of the water before use.

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