Determination of Helminths in Wastewater and Vegetable Irrigated in Kawo Irrigation Farm of Kaduna State

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KEYWORDS

Abattoir, Helminths Irrigation, Kawo, Wastewater,

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ABSTRACT

The research is to investigate Helminths for the untreated municipal wastewater and vegetables produced in the Kawo abattoir irrigation farm. The location lies between latitude 100 34' 40.8'' E and longitude 070 26'39.1'' N of Kaduna North Local Government Area of Kaduna State. Abattoir and municipal wastewater confluence at a point where farmers get the wastewater for irrigation, not minding the health implication involve. The wastewater sample was collected from three different points designated as WW01, WW02, WW03, and WW04. The samples were analyzed for Helminths in the wastewater and fresh vegetable produce. The following Helminths were discovered, (i) Ova of Fasciolopsis buski, (ii) Segment of Tapeworm (Tania saginata), (iii) Cyst of Entamoeba histolytica (iv) Ova of Ascaris lumbricoid were found and above the recommended guidelines of which specify <1 nematode egg per liter of wastewater. This study observed that untreated wastewater used for irrigation at the study site contains hazardous Helminths. This practice can be dangerous to consumers and life-threatening to farm workers due to direct constant physical contact with the wastewater. It recommended that farmers should practice the use of stabilization ponds (aerobic, facultative, and maturation) before using the water for irrigation, adoption of safer irrigation methods such as drip or sub-surface irrigation to minimize contact of crops with contaminants present in irrigation water, and farmers around the study site should make use of personal protective equipment such as gloves, boots, trousers, and long sleeve shirts during farm work to reduce the level of exposure.

INTRODUCTION

Urban and peri-urban agriculture in some areas of many developing countries, at least to some extent depends on wastewater as a source of irrigation water (Khaled and Muhammad, 2016). In most parts of Nigeria, farmers prefer untreated wastewater even when freshwater is available because they earn higher profits. This shows that wastewater can be a more reliable source both in terms of availability and volume than rain or freshwater supply for irrigation systems. However, many households in poorer areas lack access to fertilizers and have a limited supply of fresh water; wastewater reuse at the individual level can provide a combined solution to these problems by supplying the water and nutrients needed for household food production, This practice is common amongst millions of farmers worldwide and it is estimated that 10% of the world's population consumes foods irrigated with Wastewater (WHO 2006).

The microbial population of untreated water is very diverse and dangerous microorganisms that can cause illness or disease are usually associated with human or animal faecal matter present in wastewater and surface water sources. Irrigation water contaminated with pathogens has often been blamed for foodborne illness outbreaks ((Blumenthal *et al*., 2000). It is important to carefully manage this risk when promoting the reuse of non-potable water sources to fulfil the water demand of agricultural irrigation activities. The pathogens are transmitted to the public through consumption of irrigated produce, especially crops eaten raw (Blumenthal *et al*., 2000). Several studies throughout the world have demonstrated a very close relationship between the consumption of fruits and vegetables irrigated with raw wastewater and many food-borne diseases like gastroenteritis, cholera, chemical toxicity etc (Sou *et al*., 2011).

Initial improvements in water quality can be achieved in many developing countries by at least the primary treatment of wastewater, particularly where wastewater is used for irrigation. Secondary treatment can be implemented at a reasonable cost in some areas, using methods such as waste-stabilization ponds, constructed wetlands, infiltration-percolation, and up-flow anaerobic sludge blanket reactors (Mara, 2003). Wastewater is increasingly being used in the agricultural sector to cope with the depletion of freshwater resources as well as water stress linked to changing climate conditions. As wastewater irrigation expands, research focusing on the human health risks is critical because exposure to a range of contaminants must be weighed with the benefits to food security, nutrition and livelihoods. (Dickin *et al*., 2016). (Abakpa *et al*., 2013) Conducted a study in Kano State Nigeria, which shows high-level contamination of irrigation water and irrigated vegetables as a result of point sources of effluents to the water bodies used for irrigation contributing significantly to the continuous influx of microorganisms throughout the year. The quality of the water and the irrigated vegetables exceeded standard microbiological limits. Helminthes and protozoan parasites enter the environment in feces from the intestinal tract of a wide range of domestic, wild, and companion animals used as manure for production. These pathogenic organisms can therefore pose a health threat to the farmers, of particular health importance is the transmission of intestinal helminths often referred to as Soil-transmitted Helminths (STHs). Soil-transmitted Helminthes infections are among the most common infections worldwide and affect the poorest and most deprived communities. They are caused by parasitic worms (Helminths) that are transmitted to people through contaminated soil. The main species of soil-transmitted Helminths that infect people are the roundworm (Ascaris lumbricoides), the whipworm (Trichuris trichiura), and the hookworms (Necator americanus and Ancylostoma duodenale) (Toze, 1997) . Soil-transmitted Helminths are transmitted by eggs that are passed in the feces of infected people. Adult worms live in the intestine where they produce thousands of eggs each day. In areas that lack adequate sanitation, these eggs contaminate the soil. People become infected with A. lumbricoides and T. trichiura by ingesting infective parasite eggs. This can happen in several ways.

Eggs attached to vegetables are ingested when the vegetables are not carefully cooked, washed, or peeled.

Eggs are ingested from contaminated water sources.

Eggs are ingested by children who play in soil and then put their hands in their mouths without washing them. Helminthes eggs require moist shady soil for embryonation of the eggs over five to ten days before they can cause infection (Toze, 1997).

Farmers and their households (especially children) engaged in wastewater irrigation are at a higher risk of Helminthes infection due to the duration and intensity of their contact with the wastewater and contaminated soils (Strunz.,*et al*). Consumers of vegetables irrigated with wastewater, especially vegetables that are eaten without proper cooking or no cooking (spinach and lettuce) before consumption are also at risk of infection with pathogenic microorganisms found in the wastewater. Therefore there is the need to determine the risk of infection with those pathogenic microorganisms for the farmers and consumers. It has also been made abundantly clear that the approach of banning the largely informal practice will not work, therefore the main challenge is how to maximize the benefits of wastewater use while safeguarding public health and the environment as well. The research carried out in Kawo Abattoir irrigation farm aimed to assess the Helminths level in wastewater and vegetable produce in the research area which could cause serious health challenges to the consumers and farm workers.

MATERIALS AND METHOD

Study Area

The study site selected for this study is the Kawo Abattoir irrigation farm (Figure 3.2) which lies between latitude 100 34' 40.8'' E and longitude 070 26'39.1'' N of Kaduna North Local Government Area Kaduna State Nigeria. Kaduna North lies completely in the part of Western Africa, well within the northern limit of the movement of the Intertropical Convergence Zone (ITCZ). It is characterized by two distinct seasonal regimes, oscillating between cool to hot dry and humid to wet season. The climate is tropical in Kaduna. When compared with winter, the summers have much more rainfall. The climate here is classified as Aw by the Köppen-Geiger system (Aw = Tropical wet and dry or savanna climate; with the driest month having precipitation less than 60 mm (2.4 in) and less than 4% of the total annual precipitation). The average annual temperature in Kaduna is 25.2 °C, and about 1211 mm of precipitation falls annually. The driest month is January. There is 0 mm of precipitation in January. In August, the precipitation reaches its peak, with an average of 284mm**.**

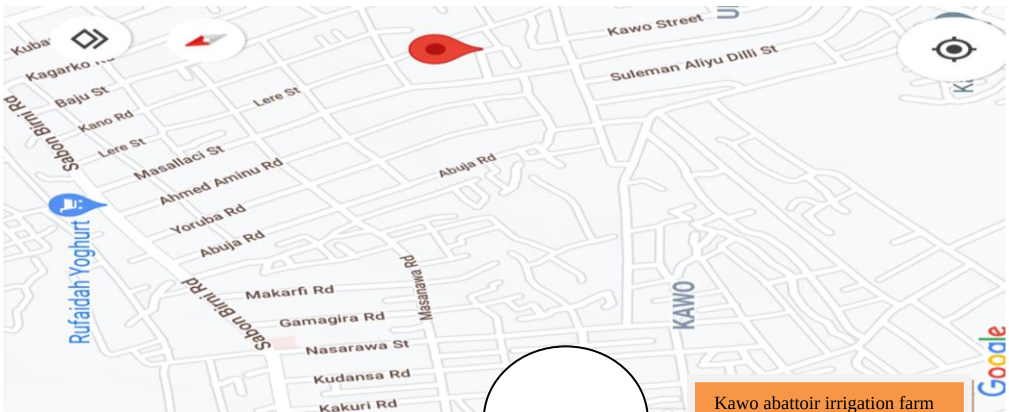


Figure 1: Map of kawo Kaduna showi... arm ... 24)

Sampling

Sample collection for waste water

Wastewater samples were collected from four different points designated as WW01, WW02, WW03, and WW04. Wastewater from municipal, (which is the wastewater coming directly from municipal), Wastewater from Abattoir, (wastewater flowing from the abattoir), Wastewater from Irrigation (the point of confluence of the two wastewater above is now pumped and used for irrigation), and open well water (control) respectively. Wastewater samples were collected in 50ml clean sterile containers as shown (plate 1). The samples were collected and transported in a cooler box to the laboratory for analysis within twenty-four hours of collection.

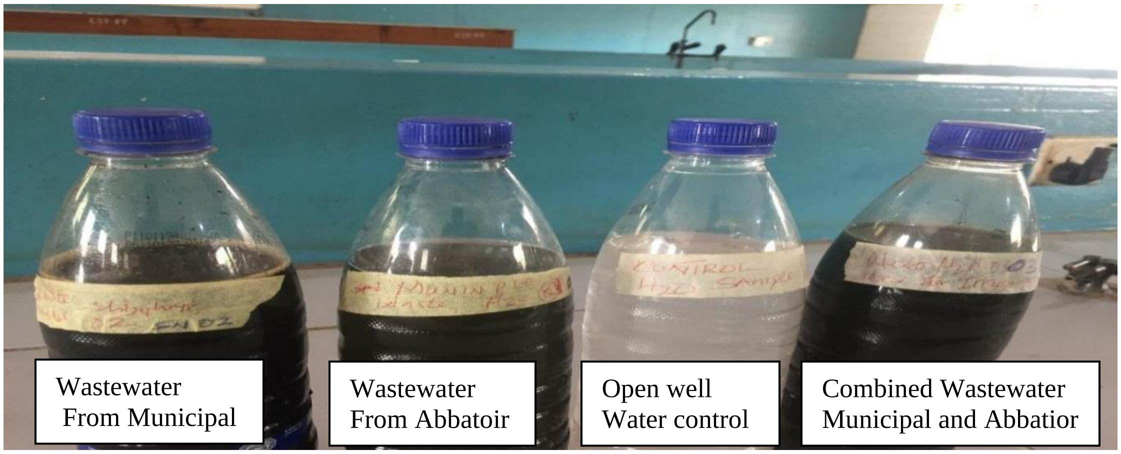


Plate 1: Wastewater sample

Sample collection for vegetables

Vegetable (spinach and lettuce) samples were collected under normal conditions, from three sampling points of the irrigation farm, put in paper bags, and then transported immediately to the laboratory where they were analysed within 24hrs. The same method was also applied to a control group of vegetables (spinach and lettuce) grown using open well water under identical conditions

Determination of Helminthes using Parasite direct microscope iodine method

Procedure for determination of Helminthes Parasite in wastewater

Two loops full of the sample were placed at the center of the clean dried sterilized microscope slide as shown in Plate 2 below. Two drops of 1% solution of grams iodine were mixed with the content and covered with the cover slip. The content was observed with low and high power objectives of the microscope as shown in plate 3 below for the cysts ova or larva of parasites, where the observation was recorded with the aid of a diagram. The experiment was conducted in the laboratory of the department of food and nutrition Kaduna polytechnic Kaduna State.

Procedure for determination of Helminthes Parasite in Vegetable

Ten grams of each vegetable sample was weighed and blended using an RM 206 model blender containing 100 ml of sterile saline solution for 2 min under sterile conditions. The blender was carefully disinfected to prevent any cross-contamination. Then the same method was employed as in this Section.

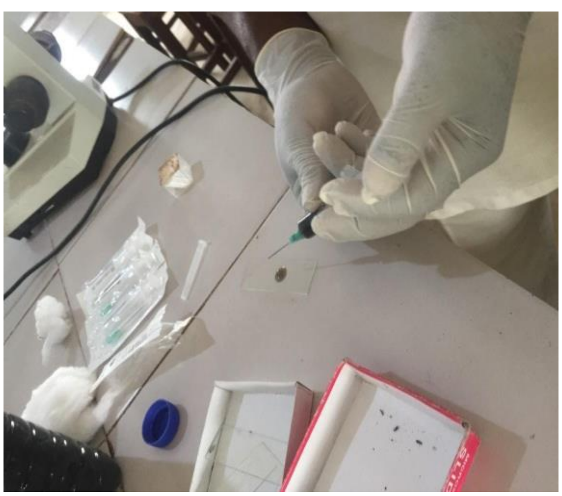


Plate 2: Loops full of the sample preparation

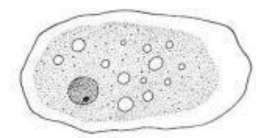
Plate 3: Observation of sample with microscope

RESULTS AND DISCUSSION

Results

A total of 4 samples for wastewater and 4 samples each of vegetable (spinach and lettuce) were collected and analyzed for Helminthes, Table 1 shows the result for Helminthes found in the Wastewater sample which was counted and observed to be above <1 nematode egg per liter of wastewater by (WHO 1989).

Table 1: Results of Parasite/Helminthes determination

S/N	CODE	SAMPLE NAME	IDENTIFIED PARASITE (seen)	PARASITE DIAGRAM
1	WW01	Wastewater from Municipal	i. No ova or cyst of parasites seen	 *Fasciolopsis (Wikipedia.org DPDx.JPG)*
2.	WW02	Wastewater from Abattoir	i. Ova of *fasciolopsis buski* ii. Segment of Tapeworm (*Tania saginata)*	
3.	WW03	Wastewater from Irrigation	i. Ova of fasciolopsis buski ii. Segment of Tapeworm *(Tania saginata)* iii. Cyst of *Entameoba histolytica* iv. Ova of *Ascaris lumbricoids*	 *Tania sagina (Wikipedia.org DPDx.JPG)*
4.	WW04	Open wellwater (Control)	i. No ova or cysts of parasites	
5.	SP01	Spinach Farm A	i. No ova or cysts of parasites	 *Entameoba histolytica (Wikipedia.org DPDx.JPG)*
6.	SP02	Spinach Farm B	i. Ova of *faciolopsis buski*	
7.	SP03	Spinach Farm C	i. Ova of *faciolopsis buski* ii. Cyst of *Entamoeba histolytica*	
8.	SP04	Spinach Control	i. No ova or cysts of parasites	
9.	LT01	Lettuce Farm A	i. Cyst of *Entamoeba histolytica*	
10.	LT 02	Lettuce Farm B	i. Ova of *faciolopsis buski*	
11.	LT 03	Lettuce Farm C	i. Ova of *faciolopsis buski*	 *Ascaris lumbricoids Wikipedia.org DPDx.JPG)*
12.	LT 04	Lettuce Control	i. No ova or cysts of parasites	

CONCLUSION

This study observed that untreated municipal wastewater and vegetable produce at the study site contains Helminthes above the recommended guideline value of <1 ova of Helminths/l (WHO 2006). The study aimed at reducing the risk of infection, which indicates that the water is unfit for irrigation purposes and the vegetables are highly contaminated. From the findings of the research it is recommended that farmers should practice the use of a stabilization pond (aerobic, facultative, and maturation) before using the water for irrigation, Consumers of vegetables should wash them properly using vinegar, and adoption of safer irrigation methods such as drip or surface irrigation to minimize contact of crops with contaminants present in irrigation water especially crops that are eaten raw, and also farmers should be encouraged to use Personal Protective Equipment such as gloves, boots, trousers, and long sleeve shirts during farm work to reduce the level of exposure. Most times major sources of these parasites might be as a result of inadequate modern toilet facilities and, a lack of public health enlightenment where people practice open defecation resulting in pollution of water sources and farmlands.

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