

RESEARCH PAPER

Effect of indiscriminate defaecation and disposal of faecal material on peri-urban cultivated crops potentials to expose parasites to community

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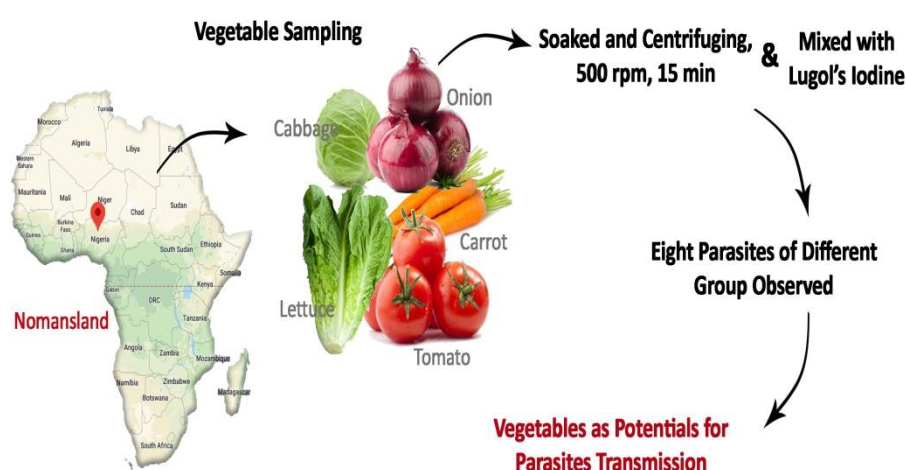
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Highlights

- Faecal contamination of food is a form of faecal - oral transmission.
- Waste water uses for agricultural activities have to be prohibited.
- This study would help policy makers to devise suitable means for food safety, policies and legislations.

Graphical Abstract



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Abstract

The risk factors of contracting Neglected Tropical Diseases are becoming increasingly high in both rural and urban settlements. Faecal contamination of food is another form of faecal – oral transmission. Opened space defecation is commonplace in rural settlement while indiscriminate disposal of faecal material is common in urban settlements. The business of faecal material disposal is flourishing in urban areas and the stake holders are not aware of risk factors and they lack proper site for the faecal waste disposal. As a result, parasites are exposed to community. For this reason, a study was conducted at Nomansland, a Peri-urban settlement in Kano metropolis, Nigeria. Over a period of four months, vegetables were examined for parasites and *Ancylostomaduodenale*, *Ascarislumbricoides*, *Entamoebahistolytica*, *Fasciolahepatica*, *Giardialamblia*, *Necatoramericanus*, *Schistosomahaematobium*, and *Strongyloidesstercoralis* were observed. Demonstration and implications of F-diagram (faeces, fingers, flies, fields, fluids, feed) should be addressed to members of the community. This study was restricted to parasitic examination. Bacterial, fungal and viral examinations are recommended to be further studied.

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1. Introduction

Peri-urban vegetable cultivation dates back some hundred years ago and has assisted by favorable environmental conditions, accessible markets, and suitable water supply. The practice had contributed immensely to the regular supply of vegetables mostly marketed and consumed within the city and its environs (Dinham, 2003). Most of the available lands beside urban streams use city dwellers to irrigate vegetables, fruits, and other high-value crops. Rivers and streams flow through the cities are mostly accounted for disposal sites of municipal wastes, indiscriminate defecation, and public sewage system draining (Amahmid and Bouhoum, 2005)

Therefore, the use of wastewater and night soil as manure for irrigation causes the irreversible risk to safe agricultural practices and disease potentials (Bichai et al., 2012). There is no barrier between the vegetables cultivated and wastewater, disposed of wastes, feces, etc. Therefore, the vegetables may be potentials for parasites and other disease transmissions. Parasites have associated with vegetables and fruit are borne outbreaks, particularly raw fruits, and vegetables demonstrated to be medium for the transmission of a range of parasites (Macpherson et al., 2000)

Vegetables are contaminated with microorganisms growing in the culture medium, harvesting, handling, processing, and distribution. On the other hand, the present research seeks to identify peri-urban cultivated vegetables as potentials for parasites transmission. Their consumption is becoming higher, so parasitic infestations would help policymakers devise suitable means for food safety, policies, and legislation (Binns et al., 2003).

2. Materials and Methods

2.1. Study area

The study was conducted at Nomansland, a densely populated settlement along the Jakara River that flows through Kano metropolis. The site is situated at 11° 59'N, 08° 28' E 840 Km far from the Sahara desert and mostly located in the Sudan savannah zone. The minimum and maximum temperatures range between 15 °C and 33 °C. Rainfall often took long from May to October. Precipitation was reported about 500 mm to 1200 mm, and also, the dry season is from November to April. The area is inhabited by Hausas, Igbos, Yorubas, Nupes, Igalas, Idomas, and other ethnic groups (Mcdonald et al., 2009; Baldantoni et al., 2014).

2.2. Choice of the study area

Peri-urban cultivation is done during the whole year when substantial vegetable production on both the Jakara River banks takes place. The Jakara River's water is substituted by domestic and industrial wastewater (Anglada et al., 2009). The soil is sandy, moist with decaying vegetation, and contaminated with indiscriminate human defecation and faecal disposal. Moreover, all these form the basis for parasitic cycles (Garcia and Shimizu, 1993).

2.3. Vegetable sampling

Five vegetables (cabbage, carrot, lettuce, onion, and tomatoes) were picked throughout the farmlands, and their choice was to the fact that they are mostly consumed fresh. The collection was at the maturity stage when the vegetables are ready for human consumption.

2.4. Sample analysis and identification of parasites

The samples were analyzed in two stages: (1) concentration stage and (2) the identification stage for parasites identification (Macpherson et al., 2000). Using the weighing machine, 25 g of vegetables were weighted and soaked into a beaker containing 250 ml of sterile distilled water. This was followed by centrifuging at 500 rpm for 15 minutes. The concentrated sediment at the bottom of the beaker was withdrawn using a rubber pipette

mixed with Lugol's iodine on a sterile microscope slide. The parasite or their cysts, ova or larva were identified microscopically (Maffei et al., 2013).

3. Results and Discussion

The study results on peri-urban cultivated vegetables as potentials for parasite transmission are presented in Table 1. Eight parasites were found associated with the five vegetables examined and namely, *Ascarislumbricoides*, *Ancylostomaduodenale*, *Necatoramericanus*, *Strongyloidesstercoralis*, *Schistosomahaematobium*, *Fasciolahepatica*, *Giardia lamblia*, and *Entamoebahistolytica*. Even though no adult parasite is found associating with the vegetable, their infective stage (eggs, larvae, cercaria and metacercaria) was observed. The parasites were collectively found to fall under three categories: nematodes, flukes, and protozoa. *Giardialambliia*, *E. histolytica* and *S. haematobium* were found common to all vegetables. *Fasciolahepaticawas* the least and were found associating with lettuce only. Carrot, lettuce, and onion were found to accommodate most parasites while cabbage and tomato accommodated the least (Macpherson et al., 2000).

Table 1. Peri-urban cultivated vegetables and associated parasites.

Parasites	Infective stage observed	Classification	Vegetables				
			Cabbage	Carrot	Lettuce	Onion	Tomato
<i>Ascarislumbricoides</i>	Eggs	Nematode	-	+	-	+	+
<i>Ancylostomaduodenale</i>	Larvae	Nematode	-	+	+	+	-
<i>Necatoramericanus</i>	Larvae	Nematode	+	-	-	+	-
<i>Strongyloidesstercoralis</i>	Larvae	Nematode	-	+	+	-	-
<i>Schistosomahaematobium</i>	Cercaria	Fluke	+	+	+	+	+
<i>Fasciolahepatica</i>	Metacercaria	Fluke	-	-	+	-	-
<i>Giardia lamblia</i>	Cyst	Protozoa	+	+	+	+	+
<i>Entamoebahistolytica</i>	Cyst	Protozoa	+	+	+	+	+

Legend: + = Associated with - = Not associated

The number of parasites contaminating vegetables is very high. Vegetables get contaminated with microorganisms while growing in the field. Therefore, the high incidence of helminths isolated has induced by soil contained parasites. The use of badly formed compost manure and water containing fecal materials leads to parasitic transmission (Amahmid and Bouhoum, 2005). The physical observation in the study area revealed the habit of the use of night soil as manure. These attitudes may be responsible for the abundance of the parasite observed (Garcia and Shimizu, 1993).

The six vegetables examined were found to be contaminated with some or almost all the parasites. For example, lettuce was found to be infected with all the parasites with the exception of *A. lumbricoides* and *N. americanus*, so also carrot has a similar level of contamination. The association between the vegetables and the parasites may be due to the soil and manure engaged in the practice and the water used. Approximately half of the world population is affected by water and food-related infections. Parasitic food-borne and water zoonosis contribute to the infection of a heavy toll on human health (Macpherson et al., 2000).

Results showed that organic and inorganic pollutants badly contaminated the river system. Besides, during the dry season, the Jakara-Getsi River flow is entirely made up of sewage and industrial wastewater entering the irrigation channel (Anglada and Urriaga, 2009; Bichai et al., 2012). Results showed that irrigation methods could influence the transmission of pathogens present in irrigation water.

Except in a few cases, all the vegetables examined in this study are consumed raw. Raw or uncooked vegetables facilitate the transmission of infection, especially helminths. Large amounts of helminths are the causes of humans' mortality.

4. Conclusions

This study had proved peri-urban cultivated vegetables as potentials for parasites transmission as it revealed eight parasites of different groups contaminating five vegetables examined. It was observed that the contamination was due to the method of cultivation employed, which involve the use of wastewater, use of human excreta as fertilizer (night soil) and indiscriminate defecation on the farmland.

Recommendations

The use of wastewater for agricultural exercises as well as the use of human excreta as fertilizer has to be prohibited. Indiscriminate defecation on the farmland should be avoided. There is also a need to avoid the consumption of raw vegetables until they are washed.

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