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Prevalence of Parasitic Contamination of Salad Vegetables in Ilorin, North Central, Nigeria

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ABSTRACT

Fresh salad vegetables are essential for good health and they form a major component of human diet in every family in Nigeria. Raw vegetables can be agent of transmission of intestinal parasites. The aim of this study is to determine the parasitic contamination of salad vegetables sold at wholesale and retail markets around Ilorin metropolis. A total of 150 samples of salad vegetables obtained from five different markets were examined for both protozoa and helminth parasites using standard methods. About 25 samples each of lettuce, cabbage, carrot, cucumber, tomato and onion were examined. Eggs of *Ascaris lumbricoides, Entamoeba histolytica/dispar, Enterobius vermicularis,* cysts of *Giardia lamblia, Fasciola hepatica, Trichuris trichiura, Strongyloides stercoralis, Balantidium coli* and *Necator americanus* were detected in 28.0%, 23.3%, 11.7%, 5.0%, 6.7%, 3.3%, 10.0%, 3.3% and 8.3% respectively. Of the sampled areas, Ipata market recorded the highest parasite prevalence of 63.3% while G.R.A market recorded the lowest parasite prevalence of 13.3%. The most encountered parasite was *A.lumbricoides* (28.0%) while *N.americanus* was the least (3.3%) parasite found. The study revealed a high rate of protozoa and helminthes contamination of salad vegetables in the study areas. Parasitological contamination of raw salad vegetables sold in wholesale and retail markets in the study area may pose a health risk to consumers of such products.

Keywords: Parasitic, Salad vegetables, Contamination, Ilorin, Nigeria.

1. INTRODUCTION

Vegetable is that portion of a herbaceous plant's roots, stems, leaves or fruits that is fresh. Vegetables are either eaten fresh or prepared in a number of ways. Vegetables form an important ingredient of man's daily diet. It is a rich source of vitamins, proteins and mineral requirements for human health. They also contain chlorophyll, fibres, luthin, zeaxanthin, calcium, folate, vitamin C, and carotene. These nutrients reduce the risk of cancer, lower blood pressure and LDL cholesterol, normalize digestion time, support retina health and vision, fights harmful free radicals and boost immune system activity (Duckworth, 1996). They are relatively quite cheaper and affordable compared to the cost of meat which seems to have gone beyond the reach of an average Nigerian family.

Vegetables can become contaminated with enteric bacterial, viral and parasitic pathogens throughout the process of planting to consumption (Daryani et al., 2008). The extent of contamination depends on several factors that include among others, using contaminated water for irrigation, applying untreated or improperly composed manure as fertilizer, fecal contamination from domestic animals and human beings, post-harvest handling and hygienic conditions of preparation in food service or home settings (Gharavi et al., 2002; Damen et al., 2007). Fresh vegetables can be agents of transmission of protozoa cysts, helminth eggs and larvae (Abougrain et al., 2009; Uga et al., 2009; Ogunleye et al., 2010). This could occur as a result of occupational exposure or through consumption of vegetables that are contaminated with human or animal excreta without proper washing and disinfection (WHO, 2006; Netanya and Njom, 2003). Untreated waste water is being used for irrigation of vegetable crops in developing countries including Nigeria. Usage of untreated waste water for irrigation, application of raw manure of domestic animal origin as fertilizer, and the habit of eating vegetables raw or undercooked are reported to result in risk of infection with intestinal parasites. The prevalence and magnitude of parasitic contamination of food product varies from one area to another. Environmental sanitation and personal hygiene of the people are major contributory factors to the spread of food-borne illnesses, which is a major and serious problem in most developing countries. Most parasites rely on being swallowed in order to infect a human host (Opara and Udoidung, 2002; Dalomo, 2003; Ekwunife and Akolisa, 2009). There is sufficient epidemiological evidence of the increased risk of infection with intestinal parasitic diseases especially in populations where untreated waste water is being used for irrigating vegetable crops. These vegetables especially used as salads are potential sources for the spread of parasitic diseases due to the fact that they are consumed in their raw form. The high prevalence of vegetable-transmitted parasites especially in developing countries has been linked to the resistant nature of the infective stages of these parasites such as the eggs, cysts or oocysts to adverse temperatures, dessication, natural irradiation, chemicals and disinfectants (Beuchat, 1998; Zewdneh and Dawit, 2012). The consumption of such vegetables generally eaten unwashed, uncooked and unhygienically prepared, may lead to parasitic infestations (Ayer et al., 1992; Edungbola, 1999). In this context of vegetables and parasites, there is need for increase in awareness with the increasing population, poor socio-economic conditions, urbanization and poor sanitation. Presently, there are no available baseline data on the level of contamination of salad vegetables in Ilorin metropolis and so there is an urgent need for the study.

2. MATERIALS AND METHOD

2.1. Study Area

The study was conducted in five different locations within Ilorin east and west local government areas, Ilorin, Kwara State between the months of March and May 2013. Five different market areas were used for the study to ascertain the level of parasitic contamination of the salad vegetables. Ipata market is the biggest and one of the famous markets where most inhabitants of Ilorin buy their food products. It is surrounded by human settlement and drainages. Majority of the settlers are illiterate and engage themselves in activities such as trading, farming, etc. Oja-tuntun has a mini market from where inhabitants of this area and few from outside buy their food products. A large number of people in this area belong to the middle class.

GRA (Government Residence Area) is fast becoming a home of vegetables and fruits for consumers due to the availability of these food products in all corners of the street. Most of the residents in this area are literate, elite, and know much about sanitary habits. Hawkers come from different places to sell their products in this place.

Tipper garage is a densely populated area with most of its inhabitants being students and only few are not; hence most of the people that reside here are literate. Hawkers of vegetables and salad come from different locations. Oja-oba is one of the major markets in Ilorin. It is the second biggest market where food materials are sold .It is surrounded by settlement and refuse dumps are not far away from there.

2.2. Sampling

The salad vegetables were bought from the traders in these markets between 6.00 and 11.00 in the morning. Vegetables used as salads include- Cucumber (*Cucumis sativus),* Carrot (*Daucus carota),* Lettuce (*Lactuca sativa*), Onions (*Alium cepa*), Tomatoes (*Lycopersicum esculentum*) and Cabbage (*Brassica oleracea*). These vegetables were randomly collected in batches of five from each market. A total number of 150 salad vegetables of six different types were examined to obtain their qualitative estimation of parasitic contamination.

Each salad vegetable is stored in a separate polythene bag to prevent cross contamination and mix up of the samples. A questionnaire survey was also used to ascertain the source of the salad vegetables. This was administered to the market women before collecting the samples from there for analysis.

2.3. Sample Processing

Each of the samples was examined carefully macroscopically for the presence of segment of cestodes and adult nematode. The experimental procedure consisted of the removal of eggs from the vegetable substrate, concentration and viewing of prepared slide under microscope. The vegetables were soaked in normal saline solution for 30 minutes in different 20 ml beakers for the removal or elution of the parasite's ova, larva or cyst. The elute was filtered through wet gauze into a clean conical flask to remove debris. The filtrate was allowed to settle for 10 hrs and decanted to obtain the sediment.

Concentration of the eggs in the sediment was done by centrifugation. The sediment was dispensed equally into centrifuge tubes and centrifuged at 5000 rpm for 5 minutes. The supernatant was decanted and the sediment was mixed. A drop of each of the sediments was applied on the center of a clean grease free glass slide, stained with lugols' iodine, a clean cover slip was placed gently to avoid air bubbles and over flooding. The preparation was examined under the microscope for any parasite form using X10 and X40 objective lens.

2.4. Identification of Salad Vegetables and Parasites

All plant samples were identified in the herbarium, in the department of Plant Biology, University of Ilorin, while parasites were identified using a colored Atlas of Parasitology.

3. RESULTS

A total number of 150 samples of six different types of salad vegetables were examined for protozoa and geohelminth parasites of which 60 (40%) were found positive for different parasite forms. The parasites encountered include *Ascaris lumbricoides, Entamoeba histolytica, Enterobius vermicularis, Giardia lamblia, Fasciola hepatica, Necator americanus, Trichuris trichiura, Strongyloides stercoralis, and Balantidium coli.*

Table 1 shows the distribution of parasite forms in the vegetables by study areas. The data revealed that salad vegetables collected in Ipata had the highest parasite prevalence of 31.67% followed by Oja-oba (23.33%), Oja-tuntun (21.67%), Tipper garage (16.67%), and G.R.A had the least prevalence of 6.67%.

Among the salad vegetables examined in all the study areas, lettuce had the highest parasite prevalence of 25%, followed by cabbage (18.33%). Carrot and cucumber had the same prevalence of 16.67% each while tomato and onion had the lowest parasite prevalence of 11.67% (Table 2).

Table 1. Distribution of parasites by study area.

MARKET	***No. EXAMINED***	***No. POSITIVE***	***% POSITIVE***	***% DISTRIBUTION***
IPATA	30	19	63.0	31.67
OJA OBA	30	14	46.7	23.33
OJA TUNTUN	30	13	43.3	21.67
TIPPER GARAGE	30	10	33.3	16.67
G,R,A	30	4	13.3	6.67
TOTAL	150	60		100

Table 2. Distribution of parasites on each type of vegetable.

VEGETABLES	***No. EXAMINED***	***No. POSITIVE***	***%POSITIVE***	***% CONTAMINATION***
Lettuces	25	15	60	25.00
Cabbage	25	11	44	18.33
Carrot	25	10	40	16.67
Cucumber	25	10	40	16.67
Tomato	25	7	28	11.67
Onion	25	7	28	11.67
TOTAL	150	60		100

Table 3. Prevalence of each parasite on the salad vegetables.

PARASITE	***PREVALENCE***	***% PREVALENCE***
Ascaris lumbricoides	17	28.0
Entamoeba histolytica	14	23.3
Enterobius vermicularis	7	11.7
Giardia lamblia	3	5.0
Fasciola hepatica	4	6.7
Necator americanus	2	3.3
Trichuris trichiura	6	10.0
Strongyloides stercoralis	2	3.3
Balantidium coli	5	8.3
TOTAL	60	100

The prevalence of parasite species in the samples collected was shown in table 3. *Ascaris lumbricoides* was the most prevalent parasite with prevalence of 28%, followed by *Entamoeba histolytica* (23.3%), *Enterobius vermicularis (*11.67%*),* and *Trichuris trichiura* (10.0%). The percentage occurrence of *Giardia lamblia, Fasciola hepatica, Necator americanus, Strongyloides stercoralis and Balantidium coli* were generally low (< 10%).

The prevalence of each parasite on each salad vegetable showed that *A. lumbricoides* had the highest infection rate, with *N. americanus* and *B.coli* having the least (Table 4).

Prevalence of each parasite with respect to the study area showed that Ipata recorded the highest infection rate while the least infection rate was recorded in G.R.A (Table 5).

Table 4. Prevalence of each parasite on each salad vegetable.

Parasite	***Lettuces***	***Cabbage***	***Carrot***	***Cucumber***	***Tomato***	***Onion***	***Total***
A. lumbricoides	4	3	2	3	2	3	17
E. histolytica	3	2	3	2	2	2	14
E. vermicularis	2	1	1	2	1	-	7
G. lamblia	1	1	1	-	-	-	3
F. hepatica	1	1	-	1	1	-	4
N.americanus	1	-	1	-	-	-	2
T. trichiura	1	2	1	1	1	-	6
S. stercoralis	1	-	1	-	-	-	2
B. coli	1	1	-	1	-	2	5
Total	15	11	10	10	7	7	60

Table 5. Prevalence of each parasite in the study areas.

PARASITE	***IPATA***	***OJA OBA***	***OJA TUNTUN***	***TIPPER GARAGE***	***G.R.A***
A.lumbricoides	5	4	3	4	1
E.histolytica	4	2	3	3	2
E.vermicularis	2	1	2	1	-
G.lamblia	1	1	1	1	-
F. hepatica	2	1	1	-	-
N. americanus	-	2	-	-	-
T.trichiura	2	-	-	-	-
S.stercoralis	1	2	1	-	1
B. coli	2	1	2	1	-
Total	19	14	13	10	4

4. DISCUSSION

In developing countries like Nigeria, intestinal parasites are very common in the environment. Our results showed that locally consumed vegetables are often contaminated with human intestinal parasites especially in areas where night soil or waste water reuse is practiced. Fresh salad vegetables have been found to be a salient mode for the transmission of parasitic infections (Damen et al., 2007; Adamu et al., 2012). Vegetable consumers and agricultural workers are a major target of these infections. Nine species of parasites recorded in this study have been reported as frequent gastro-intestinal parasites in many parts of Nigeria (Umoh et al., 2001; Opara and Udoidung, 2002; Netanya and Njom, 2003; Uga et al., 2009; Ogunleye et al., 2010).

The persistent occurrence of these parasites suggests a high level of contamination and long-time transmission; however the occurrence of these parasitic species in various salad vegetables varied. The variation of contamination among the salad vegetables might be due to uneven surfaces which make the parasitic stages attach more easily to the surface of these vegetables.

According to Umoh et al. (2001) the rate of contamination of food is dependent on the sanitation in a particular environment and sanitary habits of people living in such environment. This is also in line with the result of this study which also showed that the parasite occurrence varied with market location. In this study salad materials examined in Ipata area recorded higher number of parasite species than all other areas. Dalomo (2003) reported that the degree of pollution is attributed to poor sanitary habits of the people where human wastes are indiscriminately disposed around houses and vegetable gardens. The presence of Aluko river which is close to Ipata usually serves as a source of water for the washing of the salad vegetables. Unfortunately, a lot of human activities including dumping of human wastes into the water body led to its contamination. In comparison, the salad vegetable samples collected from G.R.A where the residents are more literate, less number of parasites were recorded because wastes are properly disposed through efficient sewage system. Also, the water used for washing the vegetables in this market is mainly pipe borne which has minimal parasitic contamination.

This study also showed that *Entamoeba histolytica* and *Ascaris lumbricoides* were the commonest parasite species found in the food products. This confirmed the findings of Leon et al. (1992); and Ogunleye et al. (2010). The water used for washing the vegetables might have introduced these parasites. The presence of soil transmissible helminthes is an indication of poor socio-economic condition, as well as poor environmental and sanitation practices. The presence of protozoa and cestodes is due to the inadequate provision of toilet facilities in Ipata area, inadequate public health awareness and illiteracy that makes people in the area defecate indiscriminately resulting in pollution of farmlands and water bodies. The high level of these parasites can also be attributed to favorable weather and climatic condition, such as high temperature, high humidity and rainy season. Atay et al. (2001), in Sanliurfa, Turkey, detected soil transmitted helminthes (mainly *A. lumbricoides*) in 14% of fresh vegetables, in 84% of soil samples where the vegetables were cultivated, and in 61% of irrigation water. The findings strongly indicate that the vegetables were irrigated with sewage water.

Leafy salad vegetables exhibited high prevalence of parasites with lettuces showing the highest prevalence (60%). This may be due to the fact that they being shrub plants are close to the ground which predisposes them to contamination with geohelminth parasites during flooding and heavy rain. The observations of Damen et al. (2007) revealed that farms were flooded and plants were submerged in water which may contain cysts or ova. Beside, the presence of parasites on the salad vegetables suggests that the method of harvest is unhygienic particularly where fruits were mostly allowed to ripe on their own and drop on contaminated soil. This is often the case with *Lycopersicum esculentum*.

Lettuces and carrot are produced and transported from the Northern parts of Nigeria where human and animal wastes are used as manure to supplement fertilizers and contaminated waters are used for cleaning the farm products before they are offered for sale. The use of feacal contaminated water and hands to wet the vegetable in the bid to make it fresh and attractive are also important contaminating agents.

The presence of *Strongyloides stercoralis*is is of serious concern due to its ability to exist in a free living state and it usually does not require a host for its proliferation. The detection however is an indication that fecal contamination of salad with the parasite and other extrinsic bacterial and viral agents that can cause serious infection is present. Farmers need to be sensitized on the potential health risk associated with the use of sewage contaminated water for irrigation. Food vendors in particular and the general public must be informed on the need to properly wash raw vegetables with salts before consumption.

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