Parasitic contamination of some fruits and vegetables from major markets in Ede Town, Osun State, south-west Nigeria

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Abstract

This study determined the prevalence of parasites on some common fruits and vegetables from major markets in Ede Town, Osun State, Nigeria. A total of two hundred and forty six (246) samples of fruits and vegetables were examined by sedimentation technique after washing using normal saline. The overall parasite prevalence was 37.4%. The highest rate of parasitic contamination (46.7%) was recorded in pineapples (*Anana comosus*) while oranges (C*itrus sinensis*) were the least contaminated (16.7%). For vegetables, African spinach (*Spinacea oleracea)* was the most contaminated (77.8%) while the least contaminated (2.2%) was celosia leaf (C*elosia argentea*). *Ascaris lumbricoides* was the most (21.7%) frequent parasitic contaminants on fruits and vegetables followed by *Balantidium coli* (19.6%) and then Hookworm (13.0%). *Entamoeba histolytica* and *Strongyloides stercoralis* had the same percentage of occurrence (12.0%) while *Fasciolopsis buski* (2.2%) was the least parasite found. The highest number of parasites was found in Timi Market with 46.2% fruits and 66.7% vegetables contaminated. Since eating raw fruits and vegetables is a potential source of transmission of intestinal parasites in the study area, it is important that consumers are educated on the need to always ensure proper washing of their fruits and vegetables.

Keywords: Fruits; vegetables; parasitic contamination; *Ascaris lumbricoides;* Ede Markets.

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Introduction

Fruits and vegetables have historically held a place in dietary guidance because of their concentration of vitamins, especially Vitamins C and A; minerals especially electrolytes and more recently phytochemicals especially antioxidants (Joanne and Beate, 2012). Diets high in fruits and vegetables are widely recommended for their health promoting properties because they usually reduce the risk of stroke, cardiovascular disease and protect against a certain type of cancer (Alade *et al* 2013). However fruits and vegetables, especially those that are consumed raw and/or not properly washed, have been proved to be one of the major ways for the transmission of human pathogens (Bergal *et al* 2013).

Parasitic contamination of fruits and vegetables can be propagated during farming, harvesting, collection, preparation, transportation and even during processing (Simon-Oke *et al* 2014; UL-Haq *et al* 2014). Furthermore, the sources of the contamination more often are soil, faeces (of human and animal origin), water and irrigation and cleaning (Daryani *et al* 2008; Adejayan and Morenikeji, 2015). Handling by vendors, poverty and unhygienic conditions of preparation in food service or home settings are also implicated (Ogbolu *et al* 2009).

Fresh fruits and vegetables can be agents of transmission of protozoa cysts, helminth eggs and larvae (Daryani *et al* 2008). Recently, it has been reported that there is an increasing number of cases of food-borne illnesses mainly linked to eating fresh fruits and vegetables (Adeleke *et al* 2012; Emmanuel *et al* 2013). Tremendous outbreak of intestinal parasitic infection that was associated with fruits and vegetables has been reported from developed and developing countries (Duedu *et al* 2014; UI-Haq *et al* 2014). Parasitic infection leads to about 300 million severe illnesses with approximately 200,000 deaths occurring in developing countries (Duedu *et al* 2014).

Several surveys have been done in Nigeria (Shehu and Amina, 2001; Sam-Wobo *et al* 2004; Adeleke *et al* 2012; Adejayan and Morenikeji, 2015) indicating that fruits and vegetables can be a major source of transmitting protozoan parasite cysts, oocysts, helminth eggs and larvae in the country.

Despite the fact that intestinal parasitosis is common in Osun State (Adefioye *et al* 2011; Salawu and Ughele, 2014), no study has been carried out to assess the level of parasitic contamination of fruits and vegetables with parasites in Ede town. If the target to control intestinal parasites will succeed, it is not enough to depend merely on the chemotherapeutic intervention of identified cases, but there is a need for a concerted effort to reduce and eliminate the potential sources of infection. This study

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was designed to determine the parasitic contamination of selected fruits and vegetables in Ede Town, Osun State.

Materials and methods

Study area

Ede is one of the popular ancient towns in Yoruba land. It lies approximately on Latitude 07° 40′ north and Longitude 04°30′ east. It is in the guinea savannah zone. It has two Local Government Areas (LGA) namely Ede North and Ede South LGAs. The population is put at 159,866 according to the 2006 Population Census. The people engage in farming, trading and commercial activities on a large scale because of the central nature of the town and its closeness to major cities like Osogbo, Iwo, Ife and Ejigbo. Some are civil servants.

Ede is important in the history of Osun State due to the presence of the Federal Polytechnic, Redeemer's University, railway tracks connecting Lagos and northern Nigeria, River Osun which passes through the town and Ede Water Works that supplies water to about twenty LGAs in the State. There are very few social activities because most people in the area are religious. Electricity supply is good because of the closeness of the town to Osogbo which is the base of power distribution in the State. Majority of the houses in Ede town are old buildings. There are four major markets in Ede Town namely Timi, Atapara, Olobi and Oje markets.

Sample collections

Freshly harvested fruits and vegetables were obtained from the four major markets in Ede town. Six different types of fruits namely pineapple (*Anana comosus*), orange (*Citrus sinensis*), pawpaw (*Carica papaya*), banana (*Musa acuminata*), water melon (*Citrullus lanatus*) and tomato (*Solanum lycopersicum*) were obtained. Vegetables for the study included African spinach *(Spinacea oleracea),* pumpkin leaf *(Teilfaria occidentalis),* Celosia leaf *(Celosia argentea),* African egg plant (*Solanum aethiopicum)* and Cabbage *(Brassica oleracia).*

Parasitological analysis of the samples

The samples were transported to the Microbiology and Parasitology Laboratory of Ladoke Akintola University of Technology Teaching Hospital, Osogbo within one hour of collection in order to ensure proper identification of parasites (WHO, 2003). The parasites on the fruits and vegetables were checked using sedimentation method.

A portion (200 g) of each fruit and vegetable was washed separately in 500 mL of normal saline to detach the parasitic stages (ova, larvae, cysts, and oocysts) of helminths and protozoans. After overnight sedimentation of the washing solution, 15 mL of the sediment was sieved into a centrifuge tube, to remove undesirable matter. In order to concentrate the parasitic stages, the tube was centrifuged at 3,000 rpm for five minutes (Idahosa, 2011). After centrifugation, the supernatant was decanted carefully without shaking and the sediment was examined under a light microscope using x10 and x40 objectives.

Data analysis

The data generated from the study were analysed using SPSS version 21.0. The descriptive analysis of the data was done using frequencies and percentages. Chi-square was used to check the level of significance of contamination of fruits and vegetables at different markets. Statistical significance was set at $p<0.05$.

Results

A total of 246 samples comprising 156 fruits and 90 vegetables were examined in the study. Ninety-two (37.4%) samples of fruits and vegetables were positive for various parasites. Vegetables were more contaminated (46.7%) than fruits (32.1%).

Table 1 shows the parasitic contamination of fruits in Ede, Osun State. The highest contamination was in pineapples (*A. comosus*) (46.7%) while oranges (*C. sinensis)* had the lowest contamination (16.7%).

Table 2 summarises the parasitic contamination of vegetables from major markets in Ede Osun State. African spinach (*Spinacea oleracea*) was the most contaminated green vegetable in this study (77.8%) while the lowest parasite contamination was found in celosia (33.3%).

Table 1: Parasitic contamination of fruits from major markets in Ede, Osun State.

Fruits	Scientific name	No. of samples examined	No. of samples infected (%)
Orange	*Citrus sinensis*	24	4(16.7)
Banana	*Musa acuminate*	24	7(29.2)
Tomato	*Solanum lycopersicum*	24	5(20.8)
Pawpaw	*Carica papaya*	24	10(41.7)
Pineapple	*Anana comosus*	30	14(46.7)
Water Melon	*Citrullus lanatus*	30	10(33.3)
Total		156	50(32.1)
x^2-value	3.055		
p-value	0.246		

Table 2: Parasitic contamination of Vegetables from major markets in Ede, Osun State.

Vegetables	Scientific name	No. of samples Examined	No. of samples infected (%)
African spinach	*Spinacea oleracea*	18	14(77.8)
Pumpkin leaf	*Teilfaria Occedentalis*	18	12(66.7)
Celosia leaf	*Celosia argentea*	18	4(22.2)
African Egg plant	*Solanum aethiopicum*	18	6(33.6)
Cabbage	*Brassica olaracea*	18	6(33.4)
Total		90	42(46.7)
x^2-value	9.488		
p-value	0 .002		

The most frequently encountered parasite on fruits and vegetables was *Ascaris lumbricoides* (21.7%), followed by *Balantidium coli* (19.6%), Hookworm (13.0%) and the least encountered parasite was *Fasciolopsis buski* (2.2%). (Table 3). Timi Market had the highest parasitic contamination of fruits (46.2%) and vegetables (66.7%) sampled, while the least contamination was observed in samples from Olobi Market (Table 4).

Table 3: Frequency of occurrence of parasites in fruits and vegetables from major markets in Ede, Osun State.

Food Type	Number Examined	Number Infected (%)	*A. Lumbricoides*	*B. coli*	*E. histolytica*	*G. lamblia*	Hookworm	*S. stercoralis*	*F. buski*	*S. species*	*T. trichiura*	*E. coli*
FRUITS												
Orange	24	4(16.7)	2(8.3)	0	0	0	1(4.17)	1(4.17)	0	0	0	0
Banana	24	7(29.2)	3(12.5)	2(8.33)	0	1(4.17)	0	1(4.17)	0	0	0	0
Tomato	24	5(20.8)	4(16.7)	0	0	1(4.17)	0	0	0	0	0	0
Pawpaw	24	10(41.7)	0	4(16.7)	3(12.5)	0	0	1(4.17)	0	1(4.17)	1(4.17)	0
Pine Apple	30	14(46.7)	1(3.3)	7(23.3)	1(3.3)	1(3.3)	2(6.7)	1(3.3)	1(3.3)	0	0	0
Water melon	30	10(33.3)	2(6.7)	0	1(3.3)	0	3(10)	2(6.7)	0	1(4.17)	1(3.3)	0
Total	156	50(32.1)	12	13	5	3	6	6	1	2	2	0
VEGE-TABLES												
African spinach	18	14(77.8)	3(16.7)	1(5.6)	2(11.1)	1(5.6)	2(11.1)	2(11.1)	1(5.6)	1(5.6)	1(5.6)	0
Pumpkin leaf	18	12(66.7)	3(16.7)	2(11.1)	2(11.1)	1(5.6)	1(5.6)	2(11.1)	0	1(11.1)	0	0
Celosia leaf	18	4(22.2)	0	0	0	0	2(11.1)	0	0	0	0	2(11.1)
African egg plant	18	6(33.3)	1(5.6)	1(5.6)	1(5.6)	0	1(5.6)	1(5.6)	0	0	0	1(5.6)
Cabbage	18	6(33.3)	1(5.6)	1(5.6)	1(5.6)	0	0	0	0	0	0	3(16.7)
Total	90	42(46.7)	8	5	6	2	6	5	1	2	1	6
Overall Total	246	92(37.4)	20(21.7%)	28(19.6%)	11(12.0%)	5(5.4%)	12(13.0%)	11(12%)	1(2.2%)	4(4.3%)	3(3.3%)	6(6.5%)

Table 4: Relationship between parasitic contamination in food samples and market source of food.

Market	Fruits		Vegetables	
	No. examined	Positive %	No. examined	Positive %
Olobi	52	13 (25.0)	30	10 (33.3)
Timi	52	24 (46.2)	30	20 (66.7)
Atapara	52	13 (25.0)	30	12 (40.0)
Total	**156**	**50 (32.1)**	**90**	**42 (46.7)**

x^2 -value – 9.00
p-value – 0.342

Discussion

Infestation of fruits and vegetables with intestinal parasitic stages has become a very important global research discourse together with that of contamination of soils with eggs of these geo-helminths (Joanne and Beate, 2012). The study of parasites on fruits and vegetables is helpful in assessing the prevalence of some intestinal parasites in a population. The prevalence of these food-borne parasites poses a public health risk to susceptible individuals who buy and consume them.

The present study has attempted to assess the level of contamination and prevalence of different intestinal parasites in some fruits and vegetables sold in selected markets in Ede Town. The overall parasitic contamination rate was found to be 37.4%. Pineapples were the most contaminated fruits (46.7%). This result is similar to the work carried out by Ali *et al*. (2011) on the prevalence of intestinal parasites on fruits available in Ibadan markets, where 35.4% of fruits were positive for the parasites and pineapple had the highest parasitic contamination of 62.5%. In another similar study, by Uneke (2004) in Abakaliki, there was a relatively higher parasitic contamination of pineapples compared to the other sampled fruits. The relatively higher level of contamination of pineapples observed in this study might be due to the closeness of the fruit to the ground level, making it prone to contamination. Moreover, the fruit has an uneven surface which makes the parasitic eggs, larvae or cysts attach to its surface more easily, either on the farm or when it is been washed with contaminated water.

For vegetables, African spinach was found to be the most frequently contaminated (77.8%) followed by pumpkin leaf (66.7%). This result is similar to the findings of Simon-Oke *et al* (2010) who screened fruits and vegetables sold in Akure and recorded pumpkin as the vegetable that harbored the highest number of parasites. The relatively higher degree of parasitic contamination of the *A. spinach* samples observed in this study might be due to the rough surface and leaf folds of the vegetable may retain dirt that cannot be easily washed off at the point of harvesting. Similarly, most vendors ignore washing it rigorously in order to maintain the freshness; this makes them a potential source of infection. Contamination can also arise as a consequence of treating soil with fertilizer such as manure, sewage sludge and from irrigation water.

The results from this study show that samples collected from Timi Market recorded highest contamination rate of

46.2% and 66.7% for fruits and vegetables respectively. This may be due to the fact that Timi Market is a night market and most of the vendors there are aged people who may not have the strength to wash the fruits and vegetables thoroughly before taking them to the market for sale.

A. lumbricoides was the most frequently detected parasite on fruits and vegetables with a prevalence of 21.7%. This is in line with the works of Sheu and Amina (2001), Sam-Wobo *et al* (2004), Dauda *et al*. (2011), Duede *et al* (2014). The relatively higher frequency of detection of *A. lumbricoides* may be as a result of the viability of the eggs in the soil for months (Stephenson, 1987). Moreover, *A. lumbricoides* is widely reported to be the most prevalent helminth in the tropics (Auta *et al* 2013; Auta *et al* 2014). The presence of *Ascaris* eggs in vegetables can be due to the quality of water used for irrigation and the probable use of untreated night soil (Doaa, 2012).

It is important to note that *A. lumbricoides* and other geohelminth parasites recorded in this study are carried easily by runoff water or flood are thus able to contaminate many fruits and vegetables, thereby creating public health risks (Stephenson, 1987).

Conclusion

The study has shown that there is a high infestation of commonly eaten fruits and vegetables in Ede Town and this could be a significant mode of transmission and sustenance of some parasitic infections in the area. Standardization and monitoring of the quality and safety of fruits and vegetables sold in the markets should be pursued and strictly enforced. There is a need to take urgent steps to address the rampant attitude of eating fruits and vegetables sold without washing them. Adopting control measures that cover guideline for irrigation, water quality, usage of untreated night soil as fertilizer are highly recommended.

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