The Bioscientist Vol. 4(1): 21-31, January 2016 Available online at
http://www.bioscientistjournal.com

Full Length Research Paper

PARASITE CONTAMINATION OF EDIBLE VEGETABLES SOLD IN ONITSHA MARKETS

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ABSTRACT

This study was carried out to determine the prevalence of parasites that contaminate edible vegetables sold in Nkpor Market, Ochanja Market and Ose Market all in Onitsha, Anambra State between July and August, 2014. These vegetables were procured directly from the rural farmers who brought the vegetables to the markets. They were examined in the laboratory for the presence of parasites using floatation and sedimentation techniques. Out of 480 vegetable specimens examined, 210 were contaminated thus giving a total prevalence of 43.8%. The parasites isolated were *Ascaris lumbricoides*120(57.1%), *Entamoeba histolytica* 30(14.3%), Hookworm 45(21.4%) and *Strongyloides stercoralis*15(7.1%). The highest parasite contamination was found in fluted pumpkin 43(20.5%) and the least on okro 11(5.2%) and carrot 11(5.2%). Ose market (53.1%) has the highest occurrence of parasite and Nkpor market (31.3%) had the least. These findings may have important implications for global food safety and emphasize the importance of raw vegetables in threatening public health by transmission of intestinal parasites to humans in Nigeria. Individuals and local health authorities should improve the sanitary conditions in the areas where the vegetables are cultivated and consumed. Therefore, proper treatment of wastewater used for irrigation of vegetables and improvement of sanitary facilities in our markets and among vegetable vendors are recommended.

Key words: prevalence, parasites, vegetables, markets, Onitsha

INTRODUCTION

Vegetables are edible plants of which the succulent leaves, roots, stems or fruits are consumed raw or partially cooked because of their palatability and nutritive contents (Doaa and Said, 2012). They are prepared in a number of ways either eaten as part of the main meal or used as desserts (Rajvanshi, 2010). Vegetables are very useful herbs and they are important ingredient of healthy diet

(Abougrain *et al*, 2010). They supply carbohydrate mainly in the form of simple sugars as well as essential vitamins like vitamin A and vitamin C, minerals and fibres which aid in the proper functioning of digestive system. Regular consumption of a diet rich in vegetables as part of an overall healthy diet may help reduce the risks of (or prevent) certain diseases like haemorrhoids, constipation, stroke and cardiovascular diseases, diabetes; protect against certain cancers as well as protect the human from oxidant stress (Alade *et al*, 2013) and helps in the formation of red blood cells (Alade *et al*, 2013). Vegetables are easy to grow and because they are relatively cheap, many families depend on them to complement their nutrition intake (Jon-Colby *et al*, 1986).

On the other hand, these vegetables can cause the spread of infectious and parasitic diseases (Izadi *et al*, 2006) and are the most important route through which human gets infected with parasites (Mehrabian *et al*, 2009), thereby undermining their nutritional and health benefits. The hygienic nature of these vegetables are questionable both from their source of growth to the point of consumption. On eating these vegetables raw or inadequately washed, one can ingest the eggs, cysts and encysted larvae of parasites (Eneanya and Njom, 2003). Intestinal parasites common to raw vegetables include protozoans, cestodes, nematodes and trematodes. Millions of people especially in the developing countries suffer from parasitic infections. About 3.5 billion people are infected with some kinds of intestinal parasites causing diseases like ascariasis, ancylostomiasis, trichuriasis, amoebiasis, giardiasis and so on (Uneke, 2004). These are responsible for about 2-3 million deaths annually worldwide. Most outbreaks caused by contaminated vegetables go undetected and the incidence of their occurrence in food is underestimated (Dorny *et al*, 2009). This has a lot of socioeconomic impact with respect to the cost of treatment and hospitalization (Nyarango *et al*, 2008)

Vegetables become contaminated while still on the plant in fields, orchards, during harvesting, transport, processing, distribution and marketing or even at home (Mahvi and Kia, 2006). Several factors may contribute to contamination of vegetables. Contamination can come from use of untreated or insufficiently treated wastewater and water supplies contaminated with sewage for irrigation, bad hygienic practices of food handlers both in food service centres and in the home, use of night soil as fertilizers (Simoes *et al*, 2001).

Contamination of soil with animal wastes and increased application of improperly composted manures to soil in which vegetables are grown also play a role in parasite contamination to green vegetables (Beuchat, 2002). This research aimed at detecting the level of parasite contamination of edible vegetables sold in the markets. Such practical and reliable detection methods will help in monitoring foodstuffs as well as aid the prevention of parasitic disease outbreaks associated with contaminated food (Jaykus, 1997).

MATERIALS AND METHODS

Study area

The study was carried out in Onitsha, one of the major cities in Anambra State. Onitsha city is located within Latitude 6.15"N and Longitude 6.79"E with a population of 561,106 people (NPC/FRN, 2006). The city and its environs lies in the equatorial rainforest belt of West Africa with a high relative humidity of about 80% for the most period of the year. It experiences two distinct seasons in a year: the rainy season (March to October) and the dry season (November to February) with a short period

of harmattan (December and January). The mean annual rainfall varies from 200-280cm.

Majority of the people at Onitsha are traders and farmers. Farmers whose village are close to the market usually convey their vegetables using bicycles or they carry it in baskets on their heads to the market, while farmers coming from distant villages convey theirs with buses or canoe by tying them up in jute bags. These vegetables are picked fresh from the farms.

Sample collection

A total of eight vegetables were used for the study viz: Cabbage, *(Brassica oleracea),* Carrot (*Daucus carota),* Green peas (*Pisum sativum),* Okro (*Abelmoschus esculantus),* Fluted pumpkin (*Telfairia occidentalis),* Green (*Amarathus cruentus),* Scent leaf (*Ocimum grattissumum)* and *"*Utazi" (*Gongronema latifolium*). Of each vegetable, twenty specimens were collected from ten different sellers, two specimens from each seller making a total of 480 vegetable specimens, 160 from each of the markets.

The collection was done between 8.00 – 10.00 in the morning. The specimens were collected into sterile, labelled polythene bags and transported to the laboratory for examination for parasitic eggs, cysts and larvae.

Parasitological examination of vegetable specimens

***Microscopy*:** One hundred grams (100g) of each sample was washed separately in separate beakers containing 100ml of normal saline. The resulting suspension was sieved to remove debris. Each filtrate was then transferred to a clean specimen bottle and labelled. The concentration methods (floatation and sedimentation techniques) were done as described by Cheesbrough (2006).

Floatation Method: 11ml of the filtrate was collected from the specimen bottle and transferred into a clean test tube. Three milliliters (3ml) of zinc sulphate was added into the test tube and stirred using a glass rod. More zinc sulphate was added until the test tube was filled to the brim. The preparation was covered with a cover slip and allowed to stand for 30 minutes. The cover slip was lifted, placed on a clean slide and examined microscopically using X10 and X40 objective lens.

Sedimentation Method: 2ml of the filtrate was centrifuged at 2,000rpm for 2minutes and the supernatant decanted. Four milliliters (4ml) of 10% formalin was added to the sediment and allowed to stand for five minutes. Again, 4ml of ethyl acetate was added and thoroughly mixed. The contents were centrifuged at 1,000rpm for two minutes. The supernatant was decanted. A drop of sediment was mixed with a drop of iodine on a slide to allow visualization of protozoan cysts and the smear examined microscopically for cysts and eggs.

Data Analysis: ANOVA treatment and chi-square test were used to show the occurrence and distribution of the different parasites of the studied vegetables.

RESULTS

Of all the 480 specimens of vegetables examined, 210 had parasites, thus giving an overall prevalence of 43.8% (Table 1). The highest parasite contamination of vegetables was recorded in Ose market 85(53.1%), followed by Ochanja 75(46.9%) while the Nkpor market 50(31.3%) had the least contamination (Figure 1). *A. lumbricoides* (57.1%) was the highest parasite encountered on the vegetables while *S. stercoralis* (7.1%) was the least. The most contaminated vegetable was the fluted pumpkin 43(20.5%) while the least were okro and carrot 11(5.2%)

[Table 2]. The distribution of different species of parasites on different vegetables in the three different markets was significant (P<0.05).

Table 1: Overall prevalence of parasites of edible vegetables in the study locations

Markets	Total number (100g) of vegetables examined	Number of vegetables contaminated with parasite (%)
Nkpor	160	50(31.3)
Ochanja	160	75(46.9)
Ose	160	85(53.1)
	160	
Total	480	210(43.8)

Table 2: Different species of parasites recovered from different vegetables in the Markets

Vegetable/parasite	*A. lumbricoides* ova (%)	*E. histolytica* Cyst (%)	Hookworm Ova (%)	*S. stercoralis* Larva (%)	TOTAL (%)
Cabbage	16(13.3)	5(16.7)	3(6.7)	2(13.3)	26(12.3)
Carrot	8(6.7)	2(6.7)	1(2.2)	0(0.0)	11(5.2)
Green peas	11(9.2)	1(3.3)	4(8.9)	2(13.3)	18(8.6)
Okro	7(5.8)	4(13.3)	0(0.0)	0(0.0)	11(5.2)
Fluted pumpkin	25(20.8)	4(13.3)	10(22.2)	4(26.7)	43(20.5)
Green	16(13.3)	3(10.0)	10(22.2)	2(13.3)	31(14.8)
Scent leaf	24(2.0)	5(16.7)	10(22.2)	3(20.0)	42(20.0)
utazi	13(13.3)	6(20.0)	7(6.0)	2(13.3)	28(13.3)
TOTAL	120(57.1)	30(14.3)	45(21.4)	15(7.1).	210

F_{cal} = 6.0 >F_{tab}= 2.42; df = 0.05 (P<0.05)

Table 3: Species of parasites recovered from vegetables in different markets

Markets	*A. lumbricoides* Ova (%)	*E. histolytica* Cyst (%)	Hookworm Ova (%)	*S. stercoralis* Larva (%)	TOTAL (%)
Nkpor market	33(66.0)	7(14.0)	7(14.0)	3(6.0)	50(23.8)
Ochanja market	40(53.3)	12(16.0)	16(21.3)	7(9.3)	75(35.7)
Ose market	47(55.3)	11(12.9)	22(25.9)	5(5.9)	85(40.5)
TOTAL	120(57.1)	30(14.3)	45(21.4)	15(7.1)	210

F_{cal} = 6.4 >F_{tab}= 2.42, df = 0.05 (P<0.05)

Percentage parasite contamination in different markets was significant. In all the markets, *A. lumbricoides* 120(57.1%) was the highest parasite encountered while *S. stercoralis* 15(7.1%) was the least (Table 3).

The most contaminated vegetables were the fluted pumpkin (24.0%) and scent leaf (24.0%) while the least were carrot and okro (4.0%) (Figure 2).

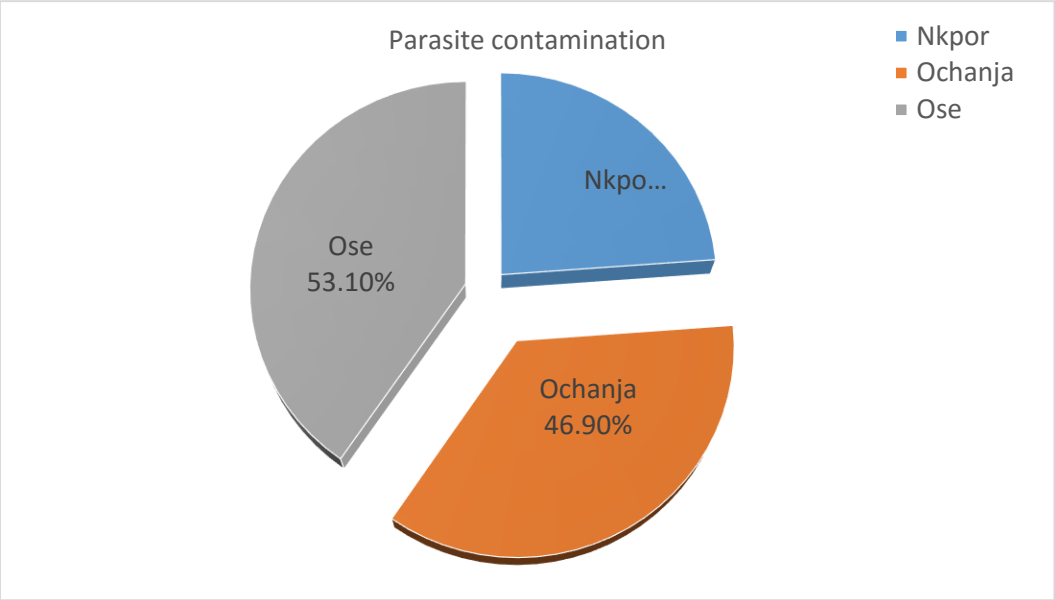

Figure 1: Overall edible vegetables contaminated in different markets studied

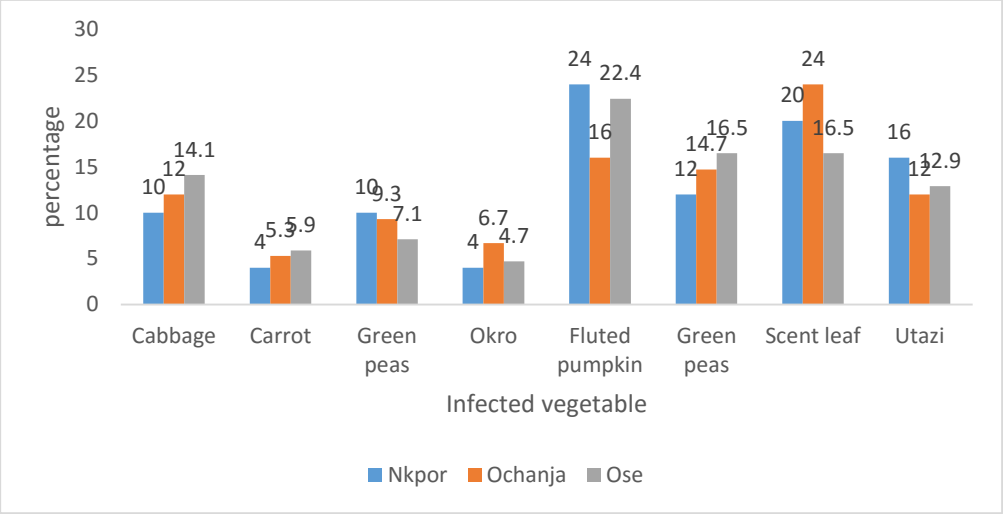

Figure 2: Percentage contamination of vegetables in the three markets

DISCUSSION

This study showed a considerably high level of intestinal parasites contamination of edible vegetables sold at Onitsha markets. Contamination may have resulted from either contaminated manure, manure compost, sewage sludge, irrigation water, runoff water from livestock operations or directly from wild and domestic animals. These potential contamination events are all plausible and consistent with the assumption that the level of contamination must have been high (Mercanoglu and Halkman, 2011).

The overall prevalence of 43.8% recorded in this study is higher than 36% recorded in Jos, Plateau state by Damen *et al*. (2007); 20% by Akyala *et al.* (2013) in Alhamis, Lafia, Nasarawa State; 14% by Umoh *et al*. (2001) in Kaduna and Zaria; 33% by Oranusi *et al.* (2012) in Owerri, Imo State and 11% in Zamfara by Shehu and Amina, (2014), all in Nigeria. The prevalence was also higher than 20.1% by Takayanagui *et al*. (2002) in Brazil; 29% by Uga *et al*. (2009) in Vietnam and 31.7% by Doaa and Said (2012) on green vegetables foodstuff in Alexandria, Egypt. However, prevalence of the present study was lower than 64% recorded by Kenneth and Nsima (2002), in Uyo, Akwa Ibom and 65.8% by Amaechi *et al.* (2011) in Owerri. However, the result was comparable to 41% recorded by Alade *et al*. (2013), in Ilorin Nigeria. Differences could have arisen from several factors which may include, geographical location, type and number of samples examined, methods used for detection of the intestinal parasites, type of water used for irrigation, and post-harvesting handling methods of such vegetables which are different from country to another.

Fluted pumpkin and scent leaf were more contaminated than carrot and okro. Low growth vegetables seem to be more exposed to contamination with parasite stages during high rainfall and flood unlike high growth vegetables. Scent leaf, Cabbage, Green peas, Utazi and fluted pumpkin are short growth plants. This tendency of growing near the soil and trailing on the soil predispose them to contamination with

various types of parasites which normally undergo part of their development in the soil. The contamination can also come from manure used for cultivation of these vegetables. These low growth vegetables tend to come in contact with applied manure in the soil since they are close to the ground and the manure can be compost or animal manure containing faecal material of animals like poultry, pig, cow and goat.

The higher contamination found in fluted pumpkin and scent leaf may also be attributed to the shape and surface of these vegetables. The leaf folds of green vegetables such as fluted pumpkin, scent leaf, "utazi" and green (*Amaranthus*) have uneven surfaces that make parasitic eggs and cysts attach to the surface more easily, either in the farm or when washed with contaminated water. They could also retain dirts which may not be easily removed by slight washing and these dirts most times harbour parasite eggs and cysts. This may be the reason why contamination was higher in leafy vegetables than root vegetables (Damen *et al.*,2007). This agrees with the findings of Damen *et al*. (2007) and Doaa and Said (2012), who recorded highest parasite contamination in leafy vegetables in Jos, Plataeu state, Nigeria and Alexandria, Egypt respectively.

On the other hand, okro vegetable had its growth little higher above the soil. Okro is spiky and pubescent (hairy) so it is most likely not to harbour much parasite eggs and cysts because of the spiky nature. Carrot is a root crop that grows inside the soil so most parasites may not be able to reach it. It is also worthy to note that most of the parasite eggs and cysts are highly resistant in nature resulting to varying contamination rates. These may be part of the reasons why okro and carrot were the least contaminated vegetables.

The use of sewage contaminated water for irrigation of vegetables is a common practice in developing countries including Nigeria where Onitsha is located. The main water source used for irrigation of fields in and around Onitsha city is the water from the famous River Niger and its tributaries where so many waste waters, sewages and wastes from households, industries and market places are channeled into. The water contaminated with these wastes is not treated before being used for irrigation. Vegetables may not only contaminate in the farm, but also from unclean environment in the markets as well as from vegetable vendors due to their poor sanitary status.

Vendors serve as intermediary between the producer farmers and the final consumers; they play an important role in the distribution chain of fruits and vegetable produces and also on the contamination and distribution of the contaminants (Erdogrul and Sener, 2005; Oranusi and Braid, 2012). Some vendors display their goods on the road side exposed to dust, flies and other insects. This practice coupled with the handling of the vegetables by different customers during bargain can contribute to contamination of vegetables (Wafa, 2010; Oranusi and Braid 2012). Flies like housefly can easily carry parasite eggs and cysts from the dumped refuse in the filthy market premises and surroundings and transfer them mechanically to already displayed vegetables.

From the study, *Ascaris lumbricoides* had the highest occurrence followed by hookworm, *E. histolytica* while *S. stercoralis* had the least. The finding was comparable to various similar studies carried out in some markets in other parts of Nigeria. Uneke, 2004, Oranusi *et al*., 2012, Alli *et al*., 2011 and Uga *et al*, (2009) recorded highest prevalence of *A. lumbricoides* in Ebonyi, Imo and Oyo states Nigeria and Vietnam respectively. The

highest *Ascaris* contamination was found in the leafy vegetables (fluted pumpkin and scent leaf) and least in carrot and okro. The presence of helminth eggs in different vegetables is mainly related to contamination of soil rather than contamination of irrigating water (Ulukanligil *et al*., 2001).

It must be noted that these vegetables are cultivated in the tropics and tropical climate provides a conducive atmosphere for the development of these parasites. Biologically, the highest health risk is found in helminth infections compared with other pathogens because helminthes persist for longer periods in the environment and the infective dose is small (Gaspard *et al*., 1997).

Ose market had the highest occurrence of parasite followed by Ochanja market then Nkpor had the least. Ose market has close proximity to the river Niger through which rural farmers transport their vegetables using canoe. There is every possibility that these sellers may be washing their vegetables with the contaminated water collected from the river. Also the level of sanitation of the market premises may play a role. The vessels used by the farmers to convey these vegetables from the farm to the markets may contribute to the contamination. They may use containers used for other things in carrying these vegetables and this may encourage cross contamination.

CONCLUSION

The findings of the present study revealed the poor socio-economic condition, as well as poor sanitation practices in our environment. The presence of these parasites in the local vegetables meant for consumption might be due to lack of modern toilet facilities, inadequate public health enlightenment and ignorance that make people defecate indiscriminately resulting in pollution of water and farmland. There is dire need for the improvement of sanitary facilities in our markets and among vegetable vendors. There should be proper treatment of wastewater used for irrigation of vegetables, enlightenment campaign, environmental and friendly policies by government, sanitation laws; therefore, local market water and environment authorities have major roles to play. Researches should be done on edible vegetables sold in other markets of Nigeria to ascertain the hygienic status of the vegetables the citizens consume on daily basis. Combination of these results will help in policy making on good sanitary system that will govern the environment.

ACKNOWLEDGEMENT

The authors acknowledge the technical staff of Parasitology and Entomology laboratory of Nnamdi Azikiwe University, Awka, Anambra State as well as the market women in these three markets used for the study for their co-operation during this study.

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