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Prevalence of Parasites found on Vegetables, and Perception of Retailers and Consumers about Contamination in Abeokuta Area of Ogun State, Nigeria

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Abstract

This study investigated the prevalence of intestinal parasites associated with vegetables and the perception of consumers and retailers about contamination of vegetables in Abeokuta, Southwestern Nigeria. A total of 102(100%) vegetable samples were purchased from six randomly selected open markets in Abeokuta. Well structured questionnaires were also administered to retailers and consumers each in selected markets to investigate their perception on transmission of parasites associated with vegetables. 100 g of each collected vegetable were washed whole in 250 ml of 0.9% sodium chloride solution in the laboratory. Sedimentation and floatation technique were then employed in the preparation of the resulting wash water for microscopic examination under x40 objective lens. Data obtained were inputted using Microsoft excel 2007 and analyzed using SPSS 20.0 software. Of the 102 samples examined, 75(73.5%) were contaminated with parasite ova or larva. *Ascaris lumbricodies* was the most prevalent of the intestinal parasite with 70(68.6%), followed by *Fasciola spp* 19(18.6%), *Hookworm* 16(15.7%), *Entamoeba spp* 5(4.9%), *Strongyloides spp* 5(5.9%), *Trichostrogylus spp* 1(1.1%) and *Trichuris trichuria* 1(1.0%). The sampled retailers and consumers were ignorant of the possibility of contamination of vegetables with parasites, although majority of them parboil it before eating. There is therefore a need to enlighten vegetable marketers and eaters on the contamination of vegetables with parasites in order to prevent food borne infections.

Keywords: Vegetables, Parasites, Markets, Perceptions, Retailers, Consumers, Abeokuta

Introduction

Vegetables are palatable food source that improves appetite and supply consumers with fiber, protein, flavor, essential oils and flavonoid [1]. Many vegetables have been noted for their significant medical importance, those that are rich in potassium such as spinach may reduce the risk of developing kidney stones and also help to decrease bone loss [2]. Antioxidants in some vegetables also help to guard human body against oxidant stress, hence boosting immunity [3]. The foliage in vegetables improves the formation of red blood cells and reduces the risk of neural tube defects, spin bifida and anencephaly during fetal development in pregnant women, while the vitamins in vegetables keep eyes healthy, heals wounds, aid iron absorption, promote healthy teeth and gum. However the fiber present in vegetables helps in digestion and to prevent constipation of consumers [2]. As important and invaluable consumption of vegetables is to the health of humans, vegetables may act as passive vehicle for the transmission of parasites through the fecal-oral route [4]. Contamination of vegetables with parasites might take place before and/or after harvesting [5]. The use of fecal materials from infected human and animals (night soil) as manure on farm lands in rural areas of developing countries can contaminate the vegetables before harvest [6]. Vegetables can also be contaminated when water used during irrigation on farm land or for keeping the vegetables fresh contains infective stages of parasite [7,8]. Intestinal parasites such as *Ascaris lumbricoides, Trichuria trichiura*, *Strongyloides stecoralis,* Hookworm, *Giardia lambia*, *Entamoeba histolytica* and *Enterobius vermicularis* have been reported on vegetables in several parts of the Nigeria and outside [9-11]. These parasites are known to cause significant morbidity and mortality worldwide, particularly in developing countries [12]. In Nigeria, approximately 55 million people are infected with ascariasis, 38 million with hookworm infection and 34 million with trichuriasis

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[13]. The widespread habit of consuming contaminated raw or minimally cooked vegetables has increased the chance of hand-to-mouth transmission of these parasites [14]. Despite this known fact, majority of studies reporting vegetable contamination with parasites in Nigeria were from the northern part [10] and eastern part [11] of the country. There is little or no studies reporting the parasites contamination of vegetables sold at different markets in Abeokuta, Southwestern part of Nigeria. In addition, there is no published report on the hygienic practices of retailers and consumers of vegetables and their perception on transmission of parasite. This study presents the parasites associated with vegetables collected in the Abeokuta, southwestern part of Nigeria alongside the hygienic practices of retailers and consumers of vegetables and their perception on transmission of parasite.

Materials and Methods

Study area

This research was carried out in Abeokuta, Southwestern Nigeria. Abeokuta is located in Ogun state. Ogun state is one of the six South Western states in Nigeria, among others like Oyo, Osun, Ekiti, Lagos and Ondo state. The state is administratively divided into twenty (20) local government areas (LGA). The area has tropical climate and enjoy double maxima of rainfall from April –July and September - October with dry season from November to March. There are numerous markets within the study area having locally produced food stuff, drinks, vegetables and fruits for purchase. The vegetables are usually brought from the rural sector to the markets by farmers and are subsequently bought off by traders for retailers and/or consumers.

Selection of study markets

Six markets were randomly selected from three (3) different local government areas (LGAs) in Abeokuta. Two markets were selected each from the LGAs; Elega and Lafenwa market in Abeokuta North LGA; Osiele and Obantoko market in Odeda LGA; Kuto and Asero market in Abeokuta South LGA.

Questionnaire survey

Well structured questionnaire were used to investigate the perception of randomly selected retailers and consumers about transmission of intestinal parasites, personal and domestic hygiene before sale and consumption of vegetables.

Collection of vegetables

Three different vegetables; African spinach *(Amaranthus hybridus)*, Jute leaves *(Cochorus olitorus)* and Fluted Pumpkin *(Telfaira occidentalis)* were purchased from different retailers in the selected markets across the LGAs in the early hours of the morning between 7:00 am and 9:00 am. Areas where vegetables could not be assessed at point of visit where revisited. Collected samples were stored in sterile polythene bag and labeled accordingly before transportation for laboratory analysis.

Laboratory analysis

Collected vegetables were weighed using simple laboratory weighing balance and washed whole appropriately. 100 g of each vegetable was washed in 250ml of 0.9% sodium chloride solution. Sedimentation and floatation technique were further employed in the preparation of the resulting wash water [15].

Sedimentation technique

The wash water was filtered in a clean mesh cloth to remove debris and larger particles, the sieved solution were centrifuged at 2000rpm for 5 minute and leaving the sediment in the test tube.

Floatation technique

The wash water was filtered in a clean sieve to remove debris and large particles. It was centrifuged at 2000 replace rpm with "rotation per minutes (rpm) for 3 minutes and the supernatant was discarded. The sediment in each tube was filled to the brim with zinc sulphate as floatation media and left for 30minutes with a clean glass slide placed on the upper end of its meniscus.

Microscopic analysis

For sedimentation method, the sediment were later collected using a pasteur pipette and two drops of the sediment was placed on a clean grease free slide to make a smear which is covered with a cover slip. The smear was examined under a light microscope with a magnification of x40 objective lens. For floatation method, the inverted clean glass slide placed on top of the centrifuge tube was removed and examined under light microscope at x40 objective for parasite ova, larva and cyst.

Data analysis

Data obtained were inputted using Microsoft excel 2007 and analyzed using IBM SPSS 20.0 version, Armonk, NY: IBM Corp. Associations were ascertained using Pearson chi-square analysis and confidence interval was set at $P \leq 0.05$.

Result

General information on surveyed open markets in Abeokuta, Southwestern Nigeria

Table 1 shows the general information of the markets surveyed. Of the six markets, two each were situated close to farmers (Kuto and Osiele market), public road (Lafenwa and Elega market) and hygienic area (Obantoko and Asero market). A total

Table 1: General information on surveyed open markets in Abeokuta, Southwestern Nigeria

SN	Name of market	LGA	Comment on main market	Number of retailers sampled (%)	Number of retailers sampled (%)
1	Obantoko market	Odeda	Market situated in an hygienic area	3(16.7)	20(16.7)
2	Kuto ground market	Abeokuta south	Market situated close to farmers	3(16.7)	20(16.7)
3	Asero market	Abeokuta south	Market situated in an hygienic area	3(16.7)	20(16.7)
4	Elega market	Abeokuta north	Market situated close to road	3(16.7)	20(16.7)
5	Osiele main market	Odeda	Market situated close to farmers	3(16.7)	20(16.7)
6	Lafenwa main market	Abeokuta north	Market situated close to road	3(16.7)	20(16.7)
Total				18(100)	120(100)

of 18(100) retailers and 120(100) consumers were surveyed across the selected the markets.

Vegetables collected across the surveyed open markets Abeokuta, Southwestern Nigeria

For each market surveyed, a total of 18(100) vegetables were collected, 6(33.3) for Spinach, Jute and Fluted pumpkin each. However, only 12(100) vegetables were collected from Asero market with 6(50.0) each for Spinach and Jute (Table 2).

Prevalence of parasites associated with collected vegetables

Table 3 shows the prevalence of parasites on vegetables collected. Of the 102 samples, 75(73.5) were contaminated with at least one parasite egg or larva. Elega market had the highest prevalence 16(88.9%) of parasite contamination of vegetables followed by Asero 10(83.3%), Osiele 14(77.8%), Lafenwa 14(77.8%) and Kuto 13(72.2%) market, while the lowest prevalence was recorded in Obantoko market 8(44.4%). Of all the intestinal parasites observed, *Ascaris lumbricoides* was the most prevalent with 70(68.6), followed by *Fasciola spp* 19(18.6%) *Hookworm* 16(15.7), *Entamoeba spp* 5(4.9), *Strongyloides spp* 5(5.9), *Trichostrogylus spp* 1(1.1) and *Trichuris trichuria* 1(1.0).

Prevalence of parasite by method of laboratory examination

Figure 1 shows the prevalence of intestinal parasites by different laboratory technique employed. More parasites were recovered using sedimentation technique than floatation technique. Nematodes (*Ascaris lumbricoides, Hookworm*, *Strongyloides spp*, *Trichostrogylus spp* and *Trichuris trichuria*) were more prevalent using sedimentation technique compared to other parasites (*Entamoeba spp and Fasciola spp)* which were more prevalent using floatation technique.

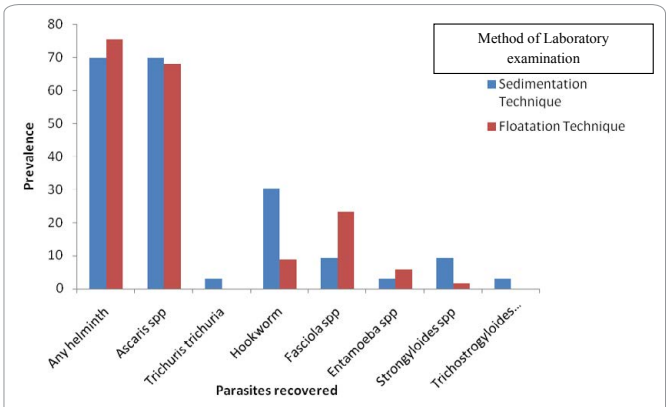

Figure 1: Prevalence of parasite by method of laboratory examination

Prevalence of parasites by type of vegetables

Table 4 shows the prevalence of intestinal helminthes by vegetable types. Majority of the parasites were recovered from Jute leaves 29(80.0%), followed by Fluted pumpkin 21(70.0) and Spinach 25(69.4%).

Demographic characteristics of retailers and consumers

A total of 18(100) female retailers were surveyed. However of the 120(100) consumers interviewed 116(96.7) and 4(3.3) were females and males respectively. Majority of the retailers and consumers both belonged to 35-54 years age group. Trading profession was the most common occupation among the surveyed retailers with 18(100) and consumers with 82(68.3) (Table 5).

Hygienic practices and perception of retailers and consumers on transmission of parasites

Table 6 shows the hygienic practices and perception of retailers and consumers on transmission of parasites. All the retailers surveyed do consume vegetables when they purchase from farmers. However, majority of the consumers interviewed

Table 2: Vegetables collected across the surveyed open markets Abeokuta, Southwestern Nigeria

SN	Market	Spinach	Jute	Fluted pumpkin	Total
1	Obantoko market	6 (33.3)	6 (33.3)	6 (33.3)	18 (100)
2	Kuto ground market	6 (33.3)	6 (33.3)	6 (33.3)	18 (100)
3	Asero market	6 (50.0)	6 (50.0)	-	12 (100)
4	Elega market	6 (33.3)	6 (33.3)	6 (33.3)	18 (100)
5	Osiele main market	6 (33.3)	6 (33.3)	6 (33.3)	18 (100)
6	Lafenwa main market	6 (33.3)	6 (33.3)	6 (33.3)	18 (100)

Table 3: Prevalence of parasites associated with collected vegetables

Market	NE	Any parasites	*Ascaris*	*Trichuris trichuria*	*Hookworm*	*Fasciola spp*	*Entamoeba spp*	*Strogyloides spp*	*Trichostrogylus spp*
Obantoko	18	8(44.4)	8(44.4)	1(5.6)	2(11.1)	0(0.00)	0(0.00)	1(5.6)	0(0.00)
Kuto	18	13(72.2)	12(66.7)	0(0.00)	4(22.2)	0(0.00)	0(0.00)	0(0.00)	1(5.6)
Asero	12	10(83.3)	10(83.3)	0(0.00)	2(16.7)	0(0.00)	1(8.3)	0(0.00)	0(0.00)
Elega	18	16(88.9)	13(72.2)	0(0.00)	6(33.3)	8(44.4)	0(0.00)	2(11.1)	0(0.00)
Osiele	18	14(77.8)	14(77.8)	0(0.00)	2(11.1)	6(33.3)	4(22.2)	0(0.00)	0(0.00)
Lafenwa	18	14(77.8)	13(72.2)	0(0.00)	0(0.00)	5(27.8)	0(0.00)	1(5.6)	0(0.00)
Total	102	75(73.5)	70(68.6)	1(1.0)	16(15.7)	19(18.6)	5(4.9)	5(3.9)	1(1.1)

NE: Number examined

Table 4: Prevalence of parasites by type of vegetables

Vegetable Type	NE	Any helminth	*Ascaris*	*Trichuris trichuria*	*Hookworm*	*Fasciola spp*	*Entamoeba spp*	*Strongyloides spp*	*Trichostrogylus spp*
Spinach	36	25(69.4)	23(63.9)	0(0.00)	4(11.1)	5(13.9)	1(2.8)	2(5.6)	0(0.00)
Jute	36	29(80.6)	28(77.8)	0(0.00)	8(22.2)	12(33.3)	3(8.3)	2(5.6)	0(0.00)
Fluted pumpkin	30	21(70.0)	19(63.3)	1(3.3)	4(13.3)	2(6.7)	1(3.3)	0(0.00)	1(3.3)
Total	102	75(73.5)	70(68.6)	1(1.0)	16(15.7)	19(18.6)	5(4.9)	4(3.9)	1(1.0)

Table 5: Demographic characteristics of retailers and consumers

Variable	Retailers Freq.(%)	Consumers Freq.(%)
SEX		
Male	-	4(3.3)
Female	18(100)	116(96.7)
Total	18(100)	120(100)
AGE RANGE		
15-24	-	30(25%)
25-34	3(16.7)	27(22.5%)
35-44	6(33.3)	39(32.5%)
45-54	6(33.3)	22(18.3%)
55-64	1(5.6)	1(0.8%)
65-75	2(11.1)	1(0.8%)
OCCUPATION		
Trader	18(100)	82(68.3%)
Student	-	23(19.2%)
Artisan	-	15(12.5%)

Table 6: Hygienic practices and perception of retailers and consumers on transmission of parasites

Variable	Retailers Freq.(%)	Consumers Freq.(%)
Do you take vegetables		
Yes	18(100%)	120(100%)
No	-	-
Where do you get it from		
Market	-	98(81.7%)
Farm	18(100%)	2(1.7%)
Street	-	20(16.7%)
How do you sanitize your vegetables		
Wash before purchase	1(5.6%)	-
Wash before selling	17(94.4%)	-
How do you cook your vegetable		
Wash with water	7(38.9%)	38(31.7%)
Wash with salt	-	2(1.7%)
Parboil it	11(61.1%)	80(66.6%)
Do you think parasites can be found on vegetables		
Yes	-	-
No	18	120(100%)
Do you think vegetables should be package in a sterile bag		
Yes	-	10(8.3%)
No	18	110(91.7%)

98(81.7) reported market as the source point for the vegetables they consume. Of the 18(100) retailers surveyed, 17(94.4) reported washing their vegetables before selling to consumers. None of the retailers and consumers knows that intestinal parasite can be on vegetables. In addition, majority of them think vegetables should not be packaged in sterile bag before selling.

Discussion

The occurrence of parasites on vegetables is a potential threat of public health significance, most especially to the numerous efforts and resources channeled towards combating food borne related infections. The overall prevalence of 73.5% reported in this study for intestinal parasites on vegetables calls for the need of stringent hygienic measures in markets, and for vegetable consumers living in rural areas such as that of our study. The overall prevalence reported in this study is considerably higher than those of [16-19] where 65%, 37.6%,16.2% and 36% were reported respectively. These inconsistencies in findings might be attributed to varying environmental conditions and hygiene practices of study area. Indiscriminate open defecation habits on farm soils by children and adults, use of organic manures (dung of animals or humans) during planting, and poor personal and domestic hygiene are probable factors aiding the development of parasites on soil and transmission to vegetables. Futhermore, preference for eating raw or slightly cooked vegetables to protect heat liable nutrients may increase the risk of infections. These factors should thus be considered for when hygiene focused campaigns are planned. The high occurrence of nematodes (*Ascaris lumbricoides, Trichuria trichiura*, *Strongyloides stecoralis* and Hookworm) reported in this study is in accordance with that of [20]. This study reports *Ascaris lumbricoides* as the most predominant nematode on vegetables examined. Findings of [21,22] in other parts of the country also reported a high prevalence of 76.4% and 55.9% for *Ascaris lumbricoides* infection compared to other observed nematodes. The preponderance of *Ascaris lumbricoides* infection could be attributed to its ability to withstand harsh and unfavourable environmental conditions. In addition, presence of suitable soil, poor feeding habit of consuming raw or minimally cooked vegetables and poor personal and domestic hygiene have contributed to this lasting prevalence. Comparing the two techniques used in isolation of parasites in this study, the sedimentation technique recovered more parasite compared to the floatation technique. This is in accordance with the findings of [19,22] where higher recovery rates were recorded for sedimentation technique compared to floatation technique. More parasites were also recovered from Jute compared to the two other vegetables examined. The texture of vegetables leaves and methods of harvesting cannot be ignored in the cause of heavy contamination. The sticky slimy secretion found on the surface of Jute leaves can facilitate adherence of parasite ova and larva more easily either on the farm during harvesting or when washed with contaminated water afterwards. To the best of our knowledge, this study is the first to report the perception of retailers and consumers of vegetables in the country. The poor knowledge of vegetable sellers and consumers about the possibility of transmission of parasites can be a setback in the control of food borne infections. Therefore, educating rural farmers and vegetable traders on the possibility of vegetables carrying these parasites and encouraging safe personal and domestic hygiene in markets and farmlands are important in preventing and controlling food borne infections.

Conclusions

Our study shows that vegetables consumed in Abeokuta, southwestern part of Nigeria are contaminated with parasites which have detrimental effects on human health. Moreover, vegetables retailers and consumers are totally ignorant of the possibility that vegetables can carry parasites. Therefore, vegetables consumers easily acquire parasitic infections when appropriate and safe hygienic measures are not put into consideration. We therefore recommend the development and delivery of programmes focusing on educating vegetable retailers and consumer on how best to maintain safe hygiene that would prevent the development of parasites on soil and their transmission to vegetables.

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