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Prevalence of Intestinal Parasites in Vegetables Sold in Some Local Markets in Port-Harcourt, Rivers-State, Nigeria

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Abstract

A total of 492 vegetable leaves samples made up of cabbage (27), bitter leaves (50), garden egg leaves (44), green leaves (66), green onion (47), lettuce (51), pumpkin leaves (111), parsley (26) and water leaves (70), bought randomly from various local markets in Port-Harcourt was analyzed for the presence of some parasite stages. About 145(29.5%) out 492 samples examined were contaminated with various parasite stages. Green leaves had the highest level of contamination (40.9%), followed by bitter leaves (38.8%), while cabbage recorded the lowest (7.4%). Out of 202 parasite stages identified, the eggs of *Ascaris lumbricoides* were the most predominant 39 (19.3%), followed by the cysts of *Entarmoeba histolytica* 31 (15.3%), whereas the oocysts *Cryptosporidium parvum* and eggs of *Strongyloides stercolaris* had the least 4 (1.9%). Green leaves and pumpkin leaves harboured 8 (80.0%) and 7 (70%) respectively out of 10 different types of parasites obtained in this study; cabbage and parsley had only 3 (30.0%). Pumpkin leaves recorded the highest level eggs of *Ascaris lumbricoides* 18(30%), eggs of Fasciola species 10 (16.7%), cysts of *Entamaeba histolytica* 8 (50.0%), eggs of *Giardia lambia* 7 (11.7%), whereas cabbage overall had the lowest percentage of parasites with *Ancylostoma duodenale* 2 (50.0%); eggs of *Toxoplasma gondii* 1 (25.0%) and eggs of *Strongyloides stercolaris* 1 (25.0%). The present study revealed the potential hazard of vegetable leaves sold in some local markets in Port – Harcourt. Though the vegetables are properly de-contaminated after sales at the point of preparation/cooking, it is also very necessary for the de-contamination to be done before sales. There is

need for monitoring by educating both vendors and consumers on the good sanitary practices during processing displaying and sale of the vegetable products and possible danger of contaminated and spoiled vegetables.

Keywords: Prevalence; Parasites; Vegetables; Port – Harcourt

1. Introduction

Fresh vegetables are regarded as important part of a healthy diet. They are horticultural products, having tissues with continuing metabolism and subject to respiration, water loss and cell softening throughout the post – harvest period [1]. Vegetables are a good source of antioxidants and phytonutrients. They are low in calories and rich in complex carbohydrates, vitamins and minerals. In many countries, such leafty plants are eaten raw or lightly cooked to preserve taste and this practice may also favour the likelihood of food borne parasitic infections [2]. Pathogens on edible plants present a significant potential source of human illness. The pathogenic microorganisms which reside on the soil and in the intestinal tract of humans and animals are more likely to contaminate vegetables through faeces, sewages, untreated irrigation water or surface water [3]. Contamination can also take place during handling of the product, processing and transportation [4, 5]. Bacteria, viruses and parasites on vegetables have been linked with diseases [6, 7] and the most common intestinal parasites on raw vegetables are protozoans, nematodes, cestodes and trematodes [8, 9]. Intestinal parasitic infections are among the major public health and socio-economic concerns that affect well –being of the poor in developing countries. It has been estimated that *Ascaris lumbricoides*, hookworm and *Trichuris trichuria* infect1.050 million,1.300 million and 1.050 million people worldwide respectively ,while schistosomiasis affects over 200 million people [10]. *Entamoeba histolytica* and *Giardia lambia* are also estimated to infect about 60 million and 200 million people worldwide respectively [11].

2. Materials and Methods

A total of 492 vegetable leaves samples made up of cabbage leaves (27), bitter leaves (50), garden egg leaves (44), green leaves (66), green onion (47), lettuce (51), pumpkin leaves (111), parsley (26) and water leaves (70) were bought randomly from various local markets in Port-Harcourt Rivers-State from February –December 2015. About 250 g of each vegetable samples purchased was sliced into small pieces, packaged into a plastic bag and washed with 1000 ml of physiological saline solution (0.95% Nacl). The washing water/saline was left overnight. After the removal of leaves, about 400 ml of supernatant was transferred into 5ml test tubes and centrifuged at 2000 g for 20 minutes. After centrifugation, the supernatant was discarded and the sediment examined under light microscope, using x10 and x40 objectives for parasite stages (cysts, oocysts, eggs or larvae) after adding a drop of lugol iodine and the parasite stages identified. Positive samples were recorded and developmental stages recorded.

3. Results

The frequency of distribution of different infected vegetable leaves consumed in Port-Harcourt is shown in Table 1. Out of 492 vegetables leaves examined, 45 (29.5%) harboured parasite stages. Green leaves (*Celosta argentea*) had the highest level of intestinal parasite contamination 27 (40.9%), followed by bitter leaves (*Vernomia amygdlima*) 19 (38.0%), while cabbage (*Brassica oleracae*) samples recorded the lowest level of contamination 2 (7.4%). The

eggs of *Ascaris lumbricoides* were the most predominant 39 (19.3%), followed by cysts of *Entamoeba histolytica* 31(15.3%), whereas the oocysts of *Cryptosporidium parvum* and eggs of *Strongyloides stercoralis* recorded the lowest percentage of occurrence of 4 (1.9%) as shown in Table 2. Table 3, shows a seasonal variation of the density of parasitic infections in the vegetables examined. The highest rate was recorded in the months of July 31 (15.3%), august 24(11.9%), followed by the month of June 20 (9.9%); while November got only 14 (6.9%). Table 4 shows the distribution of intestinal parasites in vegetable leaves consumed in Port-Harcourt. Out of 10 different parasites identified during this survey, green leaves harboured 8 (80%) different parasites, followed by bitter leaves and pumpkin leaves (*Telfairi occidentallis*) 7 (70%) each, where as cabbage and parsley (*Petroselium crispum*) recorded the least 3 (30%). The majority of parasites found in this study was identified from pumpkin leaves samples with *Ascaris lumbricoides* 18 (30% 0, eggs of Fasciola species 10 (16.7%), eggs of Taenia species, cysts of *Entamoeba histolytica* 8 (50.0%), eggs of *Giardia lambia* 7 (11.7) where as cabbage recorded the least number of parasites. Eggs of *Toxoplasma gondii* 1 (25%), eggs of *Strongyloides stercolaris* 1 (25.0%) and eggs of *Ancylostama duodonale* 2 (50%).

Vegetable	**Leaves**	**Number examined**	**Number positive (%)**
Cabbage	(*Brassica oleracae)*	27	2 (7.4)
Bitter leave	*(Vernonia amygdalina)*	50	19 (38.0)
Garden egg leaves	*(solanum manocarpum)*	44	15 (34.1)
Green leaves	*(Celosta argentea)*	66	27 (40.9)
Green onion	*(Allium wakegi)*	47	4 (8.5)
Lettuce	*(Letuca sativa)*	51	12 (23.5)
Pumpkin leaves	*Telfairi occidentallis)*	111	40 (36.0)
Parsley	*(Petroselium crispum)*	26	4 (15.4)
Water leaves	*(Talilum triangulare)*	70	22 (31.4)
Total		492	145 (29.5)

Table 1: Frequency of distribution of different infected vegetable leaves consumed in Port -Harcourt City, Rivers-State.

Parasites	**Number of parasites**	**Occurrence**
Ancyclostoma duodenale	25	12.3
Ascaris lumbricoides	39	19.3
Cryptosporidium parvum	4	1.9
Entamoeba coli	27	13.4
Entamoeba histolytica	31	15.3

Gardia lambia	24	11.9
Fasciola species	19	9.4
Taenia species	22	10.9
Toxoplasma gondii	7	3.5
Strongyloides stercolaris	4	1.9

Table 2: Percentage (%) of occurrence of Intestinal Parasites in Vegetable Leaves Consumed in Port-Harcourt, Rivers – State.

Examination Period	**Number of Parasites (%)**
February 2015	13 (6.4)
March 2015	15 (7.4)
April 2015	16 (7.9)
May 2015	18 (8.9)
June 2015	20 (9.9)
July 2015	31 (15.3)
August 2015	24 (11.9)
September 2015	15 (7.4)
October 2015	19 (9.4)
November 2015	14 (6.9)
December 2015	17 (8.4)
February 2015 – December 2015	202 (100)

Table 3: Seasonal Variation of Parasites Identified in the Vegetable Leaves Consumed in Port - Harcourt, Rivers - State; From February 2015 to December 2015.

Vegetable leaves	***Ancylostoma duodenale***	***Ascaris lumbricoides***	***Cryptosporidium Parvum***	***Entamoeba coli***	***Entamoeba histolytica***	***Giardia lambia***	***Fasciola* species**	***Taenia* species**	***Toxoplasma gondii***	***Strongyloides stercolaris***
Cabbage (*B oleracae*)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (25.0)	1 (25.0)
Bitter leaves (*V amygdalina*)	2 (10.0)	3 (15.0)	2 (10.0)	4 (20.0)	6 (30.0)	0 (0.0)	1 (5.0)	2 (10.0)	0 (0.0)	0 (0.0)
Garden egg leaves (*S.monocarpum)*	0 (0.0)	5 (21.7)	2 (8.7)	9 (39.1)	2 (8.7)	3 (13.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (8.7)
Green leaves *(C. argentea*)	4 (12.1)	5 (15.1)	0 (0.0)	6 (18.1)	6 (18.1)	5 (15.1)	2 (6.1)	4 (12.1)	1 (3.0)	0 (0.0)

Green onion (*A. wakegi*)	1 (12.5)	2 (25.0)	0 (0.0)	4 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (12.5)
Lettuce (*L`.sativa*)	3 (18.8)	0 (0.0)	0 (0.0)	0 (0.0)	4 (25.0)	3 (18.8)	6 (37.5)	0 (0.0)	0 (0.0)	0 (0.0)
Pupkin leaves (*T. occidentallis)*	4 (6.7)	18 (30.0)	0 (0.0)	0 (0.0)	8 (50.0)	7 (11.7)	10 (16.7)	10 (16.7)	3 (5.0)	0 (0.0)
Parsley (*P. crispum*)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	3 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (33.3)	0 (0.0)
Water leaves *(T. triangulare)*	8 (25.0)	6 (18.8)	0 (0.0)	4 (12.5)	2 (6.3)	6 (18.8)	0 (0.0)	6 (18.8)	0 (0.0)	0 (0.0)

Table 4: Percentage distribution of intestinal parasites in vegetable leaves consumed in Port – Harcourt.

4. Discussion

The risk of infection with intestinal parasites to the population is increasing because the contaminated vegetables are sometimes eaten undercooked to retain the natural taste and preserve heat labile nutrient [12]. During this study, about 145 (29.5%) out of 492 Vegetable samples examined in Port-Harcourt city were contaminated with different parasite stages. The evidence of this moderate parasite score densities among vegetable samples examined indicates high transmission risk of such parasites to the inhabitants of the city. Analysis during this survey showed that all types of vegetables analyzed were contaminated with various infestation rates as: Green leaves recorded (40.0%), bitter leaves (38.0%), pumpkin leaves (36.0%), Garden egg leaves (34.0%), water leaves (31.4%), lettuce (23.5%), parsley (15.4%), green onion (8.5%) and cabbage (7.4%). This is in contrast to the reports of Wafa and Megrin et al. [13]. The contamination of all vegetables can be attributed to the handling technique [14], also to dirty and untrimmed nails and poor hand - washing habits [14]. Stages of parasites belonging to 10 genera known as: ova of *Ascaris lumbricoides*, cysts of *Entamoeba histolytica* and *Entamoeba coli*, trophozoides of *Giarda lambia*, eggs of Taenia species, eggs of Fasciola species, cysts of *Toxoplasma gondii* and eggs of *Strongyloides stercoralis* identified in this study had previously been recovered from leafy vegetables in Riyadh [13]. *Ascaris lumbricoides* (19.3%) was the most prevalent parasites; which is supported by the fact that *Ascaris lumbricoides* is more common in tropical regions [16], and also in accordance with the reports that found *Ascaris lumbricoides* being the most common parasites in vegetables [17]. These findings are in accordance with the reports of Uneke [9]; Damen et al. [18] and Alade et al. [19]. But in contrast to the reports that found *Entamoeba coli* and *Ancylostoma duodenale* as the most frequently encountered parasites on vegetables [20]; their presence may be due to the use of excreta as manure commonly practiced by vegetables farmers. Also Ascaris eggs are more resistant than other intestinal parasites to most types of inactivation processes. A temperature of 20-30°C, pH plays a significant role in the survival of Ascaris eggs; however above 50°C temperature becomes the most important factor for their survival [21]. *Entamoeba histolytica* (15.3%) and *Entamoeba coli* (13.4%) were second and third predominant parasites identified in this study, which is in accordance with reports of the study carried out by Al- Binali et al. but in contrast with the reports of Vuong et al. [23]; Darchenkova et al. [24]. Their noticeable presence could be attributed to the contamination of fresh vegetables during production, harvest, packing and distribution [25], contamination through soil, faeces (human and animal origin), water irrigation and application of manures or sewage [26, 27]. Besides, cysts of intestinal parasites have been found to adhere more easily to the surface of vegetables. *Entamoeba coli* is a non - pathogenic parasite (denotes a faecal contamination), but a recently recognized *Entamoeba coli* strain was reported to produce high toxins that cause kidney damage as septicaemia or blood poisoning. Symptoms can include diarrhea,

chills, headaches and high fever and in some infections can lead to death even with medical intervention [28]. The increased demand, global sourcing and rapid transport of food, especially soft fruits and vegetables enhance both likelihood of surface contamination and survival of transmissive stages of parasites pathogenic to man. *Cryptosporidium parvum* is well known to be a causative agent of prolonged diarrhea among HIV/AIDS patients, but its identification could be attributed to the fact that as a zoonotic parasite can be transmitted by water borne and food borne routes. That means contact between fresh vegetables and some infected animals (public, pet or wild) could had been another source of these intestinal parasites [29].

Moderate presence of *Giardia lambia* and *Strongyloides stercoralis* is similar to the reports of Ali et al. [20]. Evidence has also indicated that infection with *Giardia lambia* could cause malabsoption, chronic diarrhea and long term growth retardation in children [30]; While *Strongyloides stercolaris* causes Strongyloidiasis which presents no destructive picture and contamination of vegetables becomes obvious when the eggs of Strongyloides stercoralis remain quiescent in the film of contaminated soil and there is contact with the vegetation (vegetables). The presence of *Toxoplasma gondii*, Teania species and Fasciola species in this study was not in agreement with the reports of Nyarango et al. [31]. The water-food connection for parasites zoonoses is complex, with faeces as a major vehicle for many environmental transmission stages. The transmissive stages can contaminate food or vegetables directly voided in faeces, or indirectly water is a major conduct for these parasites by the use of contaminated water which in turn can contaminate vegetable. Contamination can also occur when vegetables are rinsed in parasites contaminated water. *Toxoplasma gondii* has been associated with waterborne diseases. Taenia and Fasciola species idendification is a possible justification of the use of animal manure as fertilizers and waste water effluent for irrigating acquatic and semi-acquatic vegetable crops [32].

This study was conducted during a period of 10 months (February 2015-December 2015). It was observed that parasite density rates were higher in the month of July, August, June and October being the rainy season in Port - Harcourt Rivers-State. The reason of this finding is characterized by the fact that rain splashes, irrigation or river flush of contaminated soil or poor sewage disposal during heavy rainfall will deposit contaminated soil on the surface of leaves of vegetables. These findings are in contrast to the reports by Ali et al and Monger et al. [20], but similar to the reports that recorded higher parasite rates in rainy season [33]. February recorded only 6.4% parasite rate and the reason was not well known.

Despite the widespread incidence of these parasites, the non-acute nature of these infections has contributed to the perception of intestinal parasites being common, but usually unimportant to the public health community. Over the years, several estimates of global and regional prevalence and number of infections by intestinal parasites have been made, and these estimates project similar pictures [34, 35]. Ascaris still remain the most common intestinal parasite and the most prevalent in Sub-Saharan Africa and India [36]. Results of this present study showed significant rate of parasite in vegetables in Port-Harcourt which is of serious public health concern. Results of this work indicate poor hygienic conditions of the vegetables and the consumers are at risk of contracting food borne diseases. Though the vegetables are properly de-contaminated after sales at the point of preparation/cooking, it is also very necessary for

the de-contamination to be done before sales. Therefore measures should be taken to spread awareness among vendors about the safe and hygienic practices and government agencies should take initiative to lay out guidelines for selling of fresh fruits and vegetables.

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