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Geohelminth Contamination of Fruits and Vegetables Sold in Selected Markets within Yenagoa Metropolis, Bayelsa State

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ABSTRACT

Vegetables and fruits form an essential part of the human diet as they provide vitamins, fibre and minerals. This study was conducted to determine the prevalence of geohelminths contamination in fruits and vegetables sold in selected markets within Yenagoa metropolis, Bayelsa state. Fifteen (15) samples each of five different fruits and vegetables which include; carrot (*Daucus carota*), cabbage (*Brassica oleracea*), Fluted pumpkins (*Telfairia occidentalis*), Waterleaf (*Talinum triangulare*), and Water Melon (*Citrullus lanatus*) were purchased from five local markets within Yenagoa Metropolis Bayelsa State, making a total of 375 samples. Sedimentation method and microscopy was used to determine the presence of geohelminth ova in the fruits and vegetables. Parasites observed were compared with the Atlas of Parasitology for proper identification. The results from the laboratory analysis revealed that geohelminths were more prevalent in Tombia market (18.7%), followed by Swali (13.3%), Opolo (9.3%), Kpansia (6.7%) and Akenfa (4%). Among the geohelminths identified, *Ascaris lumbricoides* had the highest prevalence (35.9%), followed by *Ancyclostoma duodenale* (33.3%), *Strongyloides stercoralis* (20.5%), while *Trichuris trichiura* recorded the lowest prevalence (10.3%). Carrot recorded the highest prevalence among the fruits and vegetables (17.3%), followed by pumpkin (13.3%), waterleaf and water melon recorded 9.3% prevalence each while cabbage recorded the least prevalence (2.7%). For a healthy society devoid of gastroenteritis, there is need for individuals, farmers, government, fruit and vegetable vendors to ensure fruit and vegetable hygiene.

KEYWORDS: Geohelminths, Gastroenteritis, Contamination, Fruits, Vegetables, Yenagoa, Bayelsa State

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INTRODUCTION

Geohelminth contamination of fruits and vegetables has become a major cause of gastroenteritis in virtually every part of the world. As a result, contamination of fruits, vegetables and seeds has thus become a subject of interest among researchers all over the world especially in the fields of public health and parasitology. It is true that there is an increase in reports on cases of food-borne ailments with origins drawn from the consumption of parasite-contaminated fresh fruits and vegetables (1,2,3,4,5). Today, several studies across the world have reported vegetables as the main route for protozoan cysts and oocysts, including Giardia, Entamoeba, Toxoplasma, helminths and nematodes (2,3,5). It is worthy of note that fruits, nuts and vegetables are a major source of minerals and vitamins that help humans live healthy. However, such fruits, vegetables and nuts could turn out to constitute a great risk when consumed unclean (contaminated).

A fruit could thus be defined as a mature ovary of a plant. This implies a tomato is botanically a fruit which is commonly considered a vegetable. Drawing from this definition, such as eggplants, pepper and squash to mention but a few are also fruits (4). Fruits form an important part of human diet. While they are commercially important, fruits are food commodities that are nutritionally indispensable (5,6).

To further understanding of the focus of this study, a brief of description of vegetables is unavoidable. A vegetable is usually made of raw fresh leaves which are commonly

consumed by animals and humans. As such, a vegetable could be defined as edible portions of a plant which could be from leaves, stem, root, tuber, bulb and even flowers. For instance, these edible parts dictate why a plant is grouped as a vegetable such as leaves (lettuce, turnips), tubers (potato), roots (turnips, carrot), stem (celery), bulbs (onion) and flowers (broccoli).

Vegetables form a requisite part of all major dietary composition or guidance systems. There are many chemical elements and compounds which are known to influence thousands of physiological functions also and promotes health in humans and other animals. Thus, man's dependence on vegetables is overwhelming and demands a careful hand lance before consumption to avoid health risks that me arise from intake of contaminated vegetables.

This study typical of safety awareness, is keen in unravelling the geohelminths contamination of fruits and raw vegetables, ascertain the most contaminated vegetables and fruits which are commonly sourced from public markets sold around the environs of the Bayelsa State capital and proffer professional counsel to ensure the safety of consumables such as fruits and vegetables in the Yenagoa metropolis.

MATERIALS AND METHODS

Study area

The study was conducted on selected markets in Yenagoa, Yenagoa Local Government Area of Bayelsa State. Yenagoa L.G.A is located by the Epie Creek which is an extract of the Nun River sharing boundaries with the Southern Ijaws Lacal Government Area on the South, Kolokuma L.G.A on the West and the Ahoada West LGA of Rivers State on the East. Yenagoa lies between latitude 4°55'29" N and longitude 6°5'51" N. It is the headquarters of Yenagoa Local Government Area of Bayelsa State in Nigeria, with a population of 352,285(N.P.C, 2006) and has an area of 1,698km^2 (656sqm). The city lies on a low and swampy area, hence most of the communities within the city are prone to perennial flooding. The Yenagoa metropolis in particular is predominantly composed of the indigenous Epie-Atisa People (flocked around by several visiting tribes being a State Capital) who are predominantly into farming and fishing, thus consumption of raw edible vegetables is a common practice.

Collection of samples

Fifteen (15) samples each of five different fruits and vegetables which include; carrot (*Daucus carota*), cabbage (*Brassica oleracea*), Fluted pumpkins (*Telfairia occidentalis*), Waterleaf (*Talinum triangulare*), and Water Melon (*Citrullus lanatus*) were purchased from local markets in Yenagoa Metropolis, Yenagoa Local Government Area of Bayelsa State, namely; Swali market, Kpansia market, Tombia market, Opolo market and Akenfa market.

The samples were collected in the month of February, 2022. Collection of samples was carried out with slight modification of the method described by (6). The samples were taken into properly labelled sterile vessels (bags) and then transported to the laboratory for parasitological analysis within 20 to 40 minutes of sample collection.

A mixture of sedimentation method and microscopy was employed to identify the presence of parasitic ova (eggs), larvae and cysts of Soil Transmitted Helminths (STHs) as described by Amaechi et al. (6).

Laboratory analysis of samples

Sedimentation method reported by (23) was used. 50 grams of each fruit and vegetable samples were soaked in a litre of physiological saline, followed by a vigorous shaking with the aid of a mechanical shaker (Vortex Genie 2) for 15 minutes. It was allowed to sediment overnight in the washing solution. 15ml of the sediment was filtered through a sterile sieve to remove unwanted materials. In other to get the eggs concentration in the sediment, the filtrate from each vegetable and fruit was placed in different centrifuge tubes and spun at 3000 rpm for 5 minutes. The supernatant (upper fluid in the container) was decanted or disposed and the sediment (residue at the bottom) was then stirred. From the sediment of each tube, a drop was then placed on a clean grease-free glass slide and stained with Lugol's iodine and then a clean cover slip was placed carefully on the drop to avoid air bubbles.

The preparation (slide) was then examined under a light microscope using x10 and x40 objective lenses respectively. The observations made under the microscope was compared with the morphological features of STHs larvae, ova and cysts in the colored Atlas of Parasitology. The overall prevalence was determined using the formula below.

RESULTS

Prevalence of geohelminths in relation to location of markets

From a total of 375 sample units collected from five markets, samples from Tombia market had the highest occurrence of geohelminths with 18.7%. This was followed by samples from Swali market with 13.3%, Opolo market 9.3% and Kpansia 6.7% contamination rate of geohelminths respectively. Fruits and vegetables obtained from Akenfa market had the least contamination of geohelminths at 4% contamination rate.

From the 375 samples examined, 39 representing 10.4% on the overall across all markets were contaminated while 336 which represent 89.6% were free from any form of geohelminths contamination.(Table 1)

Table 1: Prevalence of soil transmitted helminths in relation to location of market.

Name of Market	No. Examined	No. Infected(%)	No. Not Infected(%)
Swali	75	10 (13,3)	65 (86.7)
Tombia	75	14 (18.7)	61 (81.3)
Opolo	75	7 (9.3)	68 (90.7)
Kpansia	75	5 (6.7)	70 (93.3)
Akenfa	75	3 (4)	72 (96)
TOTAL	**375**	**39 (10.4)**	**336 (89.6)**

Prevalence of geohelminths in relation to species

The results from the laboratory analysis further revealed that *Ascaris lumbricoides* had the highest prevalence (35.9%) followed by *Ancyclostoma duodenale* (33.3%), *Strongyloides starcoralis* (20.5%). *Trichuris trachiura* recorded the lowest prevalence with a percentage of 10.3.(Table 2)

Table 2: Prevalence of geohelminths in relation to species

Name of fruit/vegetable	*Ascaris lumbricoides(%)*	*Strongyloides stercoralis(%)*	*Ancyclostoma duodenale(%)*	*Trichuris trichiura(%)*	Total (%)
Pumpkin	3 (7.9)	4 (10.3)	3 (7.9)	0 (0)	10 (25.6)
Cabbage (leaf)	0 (0)	1 (2.6)	1 (2.6)	0 (0)	2 (5.1)
Waterleaf	3 (7.9)	0 (0)	4 (10.3)	0 (0)	7 (18)
Carrot	6 (15.4)	3 (7.9)	3 (7.9)	1 (2.6)	13 (33.3)
Water melon	2 (5.1)	0 (0)	2 (5.1)	3 (7.9)	7 (18)
Total	14 (35.9)	8 (20.5)	13 (33.3)	4 (10.3)	39 (100)

Prevalence of geohelminths in relation to the type of fruit/vegetable

For the fruits and vegetables, the result further indicated that carrot had the highest geohelminth contamination at 17.3% and was followed by pumpkin at 13.3%, waterleaf and water melon (9.3% each) Cabbage on the other hand had the least geohelminth contamination at 2.7% (Table 3)

Table 3: Prevalence of geohelminths in relation to the type of fruit/vegetable

Name of fruit/vegetable	No. Examined	No. Infected (%)	No. Not Infected(%)
Pumpkin	75	10 (13.3)	65 (86.7)
Cabbage (leaf)	75	2 (2.7)	73 (97.3)
Waterleaf	75	7 (9.3)	68 (90.7)
Carrot	75	13 (17.3)	62 (82.7)
Water melon	75	7 (9.3)	68 (90.7)
Total	**375**	**39 (10.4)**	**336 (89.6)**

DISCUSSION OF FINDINGS

The geohelminth contamination of fruits and vegetables plays an important role as it dictates the safety levels of fruits and vegetables which are naturally consumed either raw or mildly cooked. Thus, the findings of this study are reported to provide a standard for safe consumption of fruits and vegetables.

First, the study revealed that there was some level of contamination found among fruits and vegetables sold in various markets in Yenagoa metropolis, Bayelsa State. It was observed that Tombia market had the highest cases of fruits and vegetables contaminated by geohelminths(18.7%). The 18.7% reported in this study is slightly lower than the 28.0% recorded by (23) among fruits and vegetable sold in Bakin Ruwa in Kaduna State, Nigeria. The 18.7% recorded in this study may be due to open defecation on farm lands and poor hygiene on the part of fruit and vegetable vendors. It could also be due to poor washing/ undercooking of fruits and vegetables on the part of fruit and vegetable consumers. Swali market also had a high occurrence rate of geohelminths contamination of fruits and vegetables(13.3%). Although fruits and vegetables from Akenfa market recorded a very low geohelminth contamination rates(4%), samples from Opolo and Kpansia markets also had reportable cases of contamination (9.3% and 6.7% respectively). On the overall, over 10% of samples were contaminated with geohelminths while the rest were uninfected of uncontaminated. This finding aligns with the findings of (7,8,9,10)

Across the species of geohelminths, it was observed that the distribution of geohelminths were somewhat sample specific. For instance, the type of organisms found on carrot samples source from the various markets were, round worms (*Ascaris lumbricoides* and *Strongyloides stercoralis*), hook worm (*Ancyclostoma duodenale*) and whip worm (*Trichuris*

trichuria) as reported by Abe *et al*, (9,11,12,). Thus, majority of the helminths under this study were found on the carrot samples (33.3%) and this makes it the most contaminated fruit/vegetable under study. The following round worms (*Ascaris lumbricoides*), hook worm (*Ancyclostoma duodenale*) and whip worm (*Trichuris trichuria*) were also found on water melon samples.

Pumpkin samples were rather infested with round worms (*Ascaris lumbricoides* and *Strongyloides stercoralis*) and hook worm (*Ancyclostoma duodenale*) at 25.6%) while cabbage leaf samples had round worms (*Strongyloides stercoralis*) and hook worm (*Ancyclostoma duodenale*) at 5.1%, and water leaf also had round worms (*Ascaris lumbricoidesi)* and hook worm (*Ancyclostoma duodenale*) at 18%. This finding corroborates the positions of (7,13,14,15,16).

To underscore the occurrence rates of different helminths, the round worms *Ascaris lumbricoides* was the most reported helminth on fruits/vegetables sold in common markets in Yenagoa metropolis, Bayelsa State (35.9%). This was followed by the hook worm (*Ancyclostoma duodenale*) at 33.3%. Also, the round worm *Strongyloides strecoralis* reported in samples from waterleaf and water melon had 20.5%. It was further observed that the whip worm *Trichuris trichuria* was peculiar with the fruit samples such as water melon and carrot but only 10% was recorded in the vegetable samples in this study which on a wider note, aligns with the reports of (10,17,18,19,20,21,22).

Finally, it is worthy of note that of all fruit and vegetables samples under investigation, carrot samples were the most contaminated(17.3%) most probably due to the fact that the carrots are underground roots. This was followed by pumpkin (13.3) as this could as well be due to the fact that most pumpkins are runners on the forest floor and may have run through contaminated soils. Cabbage was the least contaminated among the fruits and vegetables examined in this study (2.7%). The 2.7% recorded in this study is lower than the 10.5 reported by (23). This could be due to low prevalence of geohelminths in the areas where the plant was cultivated coupled with good sanitary measures practiced by vendors. .

CONCLUSION

This study has revealed that a good number of fruits and vegetables obtained from the study areas were contaminated with one form of geohelminth or the order. Therefore, fruits and vegetables should be properly washed and vegetables should be cooked before consumption to evade parasitic infections. The infections caused by geohelminth parasites commonly referred to as “Geohelminthiasis” are among the world’s major health problems mostly in middle and low-income countries. Thus, vegetables consumed raw has been the principal source of transmission of geohelminth parasites. Hence, there is the need to ensure that fruits and vegetables sold in public markets meet public health safety standards. This perhaps does not propose that all fruits and vegetables sold in markets within the Yenagoa metropolis are all contaminated of geohelminths.

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