GEOHELMINTHS EGGS CONTAMINATION OF VEGETABLES SOLD IN MAJOR MARKETS IN BENIN CITY, EDO STATE, NIGERIA

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ABSTRACT: The prevalence of helminth eggs on vegetables purchased at major markets in Benin City, Nigeria was examined using the test tube flotation method. Twelve types of vegetables were examined. Geohelminth eggs contamination on vegetables was highest in rainy season, 336 (61.5%) than in the dry season, 210 (38.5%) ($P<0.05$). Species of helminthes eggs detected during the survey were seven in number: *Ascaris lumbricoides* (33.5%); Hookworm, (26.0%) *Trichuris trichiura* (15.0%); *Toxocara canis* (14.1%); *Strongyloides stercoralis*, (7.3%); *Taenia* sp. (2.9%) and *Enterobius vermicularis* (1.28%). The result obtained shows that vegetables might act as a veritable source of transmission of helminthiasis, if not properly washed before consumption.

INTRODUCTION

Vegetables are important sources of nourishment and a major part of human food for good health. In many parts of the world vegetables have been reported to be contaminated by parasites (Uga *et al.,* 2009; Ogban, *et al*., 2010). These parasites infest vegetables while still on the field and are usually transmitted by contaminated water and spread by poor hygiene practices (Umoh *et al*., 2001). Control of protozoans and helminthes is a constant object of public health strategies, especially where reclaimed water is used. The resistant cysts or eggs of these organisms enhanced their survival in the natural environment (Erdogrul and Sener, 2005). In Nigeria and other developing countries of the world, intestinal parasites have been regarded as a major source of public health and socio-economic problems (Opara and Udoidung, 2003). Different species of soil transmitted helminthes are widely distributed in tropical and sub tropical parts of the developing world. Helminth like *Ascaris lumbricoides, Trichuris trichiura, Necator americanus and Ancylostoma duodenale* stand out.

This study is aimed at determining the prevalence of helminth parasite eggs contamination of vegetables available in markets in Benin City, Nigeria as this type of study has not been done in this city.

STUDY AREA

The study was conducted in Benin City, Nigeria. It lies within latitudes $6^0\ 17^1$ and $6^0\ 26^1$ N and longitudes 5°35′ and 5°41′ E. The climate is tropical and predominantly rainforest with an average annual rainfall between 1850mm and 2445mm and average atmospheric temperature between 30.0°C and 36.50°C. There are two distinct climatic seasons, the rainy (wet) and dry season. The rainy season spans from April to October, while the dry seasons span from November to March. The soil is compact laterite which becomes easily flooded after heavy rains.

MATERIAL AND METHOD

Sites of vegetable collection

Five markets (New Benin, Uselu, Uwa, Ikpoba-Hill and Upper forestry) within Benin City Metropolis were randomly selected for this survey. Nine types of leafy vegetables Pumpkin leaves (*Telfaria accidentalis*), Green leaves (*Amarantus hybridus*), Scent leaves (*Ocimium gratissimum*), Ebiewewea leaves (*Piper umbelutum*), Uziza leave (*Piper nigrum*), Water leaf (*Talinum triangulare*), Curry leaves (*Ocimum bassilicum*), Lettuce (*Lectuca sativa*), Cabbage (*Brassica oleracea*), two kinds of fruit vegetables, Tomatoes (*Lycomperiscum sativum*), Cucumber (*Cucumis sativa*) and one root vegetable, carrots (*Daucus carota*). All the vegetables were collected and examined in both the rainy and dry seasons (July 2009 – February 2010).

Recovery and observation of eggs

200g each of the various vegetables collected were examined by the test tube floatation method as described by (Eneanya and Njom, 2003) with saturated solution of sodium chloride (brine) as the floatation medium. Eggs of geohelminth observed were identified by the key of Thienpont *et al.* (1979) and Soulsby, (1982).

RESULTS

A total of three hundred and thirty vegetable samples were examined from the five markets (Uselu, New Benin, Ikpoba-Hill, Uwa, and Upper Forestry) in Benin City. Five hundred and forty-six helminth eggs were recovered. There was a significant difference ($P < 0.05$) between the parasites recovered from the various markets, Benin market had the highest 132 (24.18%) number of parasites recovered.

For the markets sampled, the various eggs recovered were *A. lumbricoides* (33.5%); *T. trichiura* (15.0%); Hookworm, (26.0%); *S. stercoralis* (7.30%); *Taenia species* (2.92%); *E. vermicularis* (1.28%) and *T. canis* (14.1%), Table 1.

In New Benin market, the total numbers of parasites recovered were 132 (24.17%). The most prevalent parasite egg was *Ascaris* and *Hookworm* (31.82%), followed by *T. canis* (12.88%); *T. trichiura* (12.12%); *S. stercoralis* (8.33%) and *E. vermicularis* (3.03%) was the least prevalent, Table 2.

In Uselu market, a total of 106 (19.23%) parasites were recovered. *A. lumbricoides* (37.14%) was also the most prevalent, *T. canis* (17.92%) was next in prevalence, followed by hookworm (17.92%), *T. trichiura* (16.98%) and *S. stercoralis* (10.37%) being the least, *E. vermicularis* was not recovered from this market, Table 3.

In Uwa market, 118 (21.61) parasites was seen. *Hookworm* was highest in prevalence (32.27%) followed by *A. lumbricoides* (28.81%), *T. canis* and *T. Trichuria* (16.10%) were of the same prevalence rate and *E. vermicularis* was not found, Table 4.

Table 1: Contamination of vegetables with geohelminth eggs in vegetables Examined

Vegetables	Total number of samples examined	Number of rainy/dry season sample	Total number (%) of positive samples		Rainy Season and Dry Season						
			Rainy Season	Dry Season	*Ascaris lumbriocoides eggs*	*Trichuris trichiura eggs*	*Hookworm eggs*	*Strongyloides stercoralis eggs*	*Enterobius vermicularis eggs*	*Taenia eggs*	*Toxocara canis eggs*
Pumpkin leaf	10	5/5	4(80.0%)	2(40.0%)	20/10	6/2	9/11	5/0	0/0	0	8/3
Green leaf	10	5/5	2(40.0%)	2(40.0%)	19/11	4/4	11/11	6/2	0/0	0	8/5
Scent leaf	10	5/5	2(40.0%)	1(20.0%)	14/10	2/5	10/6	5/2	2/1	0	3/3
Curry leaf	10	5/5	1(20.0%)	1(20.0%)	10/5	2/0	8/4	1/2	0/0	0	4/3
Ebiewewa leaf	10	5/5	3(60.0%)	1(20.0%)	13/5	7/10	10/9	6/1	0/1	0	4/8
Uziza leaf	10	5/5	3(60.0%)	1(20.0%)	15/10	9/6	10/8	6/1	0/2	0	6/8
Water leaf	10	5/5	3(60.0%)	2(40.0%)	12/2	8/3	12/4	2/1	1/0	0	4/2
Carrots	10	5/5	4(80.0%)	2(40.0%)	2/3	½	4/0	0/0	0	6/0	1/0
Tomatoes	10	5/5	2(40.0%)	2(40.0%)	4/0	2/1	2/0	0/0	0	5/0	0/2
Lettuce	10	5/5	1(20.0%)	2(40.0%)	5/5	3/2	2/1	0/0	0	1/0	½
Cucumber	10	5/5	1(20.0%)	1(20.0%)	2/1	0/1	3/2	0/0	0	1/0	0/2
Cabbage	10	5/5	2(40.0%)	1(20.0%)	2/3	0/2	4/0	0/0	0	3/0	0/0
Total	**120**	**60/60**	**28(46.6%)**	**18(30.0%)**	**118/65**	**44/38**	**85/56**	**31/9**	**3/4**	**16/0**	**39/38**

In Ikpoba-hill market, 112 (20.51%) parasites were recovered. *A. lumbricoides* was also highest in prevalence (33.03%) followed by hookworm (22.32%), *T. canis* (16.96%), T. *Trichuria* (15.17%), *S. stercoralis* (8.93%) and *E. vermicularis* (2.68%) being the least (Table 5).

Table 2: Occurrence OF helminth eggs from New Benin market

Vegetables	***Ascaris lumbricoides***		***Trichuris trichuira***		***Necator americanus***		***Strongyloides sterocoralis***		***Enterobius vermicularis***		***Toxocara canis***		***Total***
	RS	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	
Green	5	3	1	1	2	4	3	0	0	0	1	1	21
Pumpkin	4	4	2	0	3	5	1	0	0	0	2	0	21
Scent leaf	6	0	0	2	4	2	0	0	0	1	0	3	18
Curry leaf	3	1	1	0	2	0	0	0	0	0	2	1	10
Water leaf	2	2	2	0	5	2	3	0	0	0	0	0	16
Uziza leaf	4	3	4	0	5	3	3	0	0	2	3	0	27
Ebiewewa	4	1	2	1	3	2	1	0	0	1	2	2	19
Total	**28**	**14**	**12**	**4**	**24**	**18**	**11**	**0**	**0**	**4**	**10**	**7**	
Grand total	**42**		**16**		**42**		**11**		**4**		**17**		**132**

Key: RS = Rainy season; DS = Dry season

Table 3: Occurrence of helminth eggs from Uselu market

Vegetables	***Ascaris lumbricoides***		***Trichuris trichiura***		***Necator americanus***		***Strongyloides stercoralis***		***Enterobius vermicularis***		***Toxocara canis***		**Total**
	RS	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	
Green	4	3	1	1	2	2	1	1	0	0	2	2	19
Pumpkin	6	2	2	0	0	3	1	0	0	0	1	1	16
Scent leaf	2	4	0	2	1	1	1	2	0	0	0	0	13
Curry leaf	2	2	0	2	1	2	0	1	0	0	0	2	12
Ebiewewa	4	1	3	3	1	2	1	0	0	0	2	3	20
Uziza leaf	3	3	0	2	1	1	2	0	0	0	3	2	17
Water leaf	3	0	2	0	2	0	1	0	0	0	0	1	9
Total	**24**	**15**	**8**	**10**	**8**	**11**	**7**	**4**	**0**	**0**	**8**	**11**	
Grand total	**39**		**18**		**19**		**11**		**0**		**19**		**106**

Key: **RS** = Rainy season **DS** = Dry season

Table 4: Occurrence of helminth eggs from Uwa market surveyed

Vegetables	***Ascaris lumbricoides***		***Trichuris trichiura***		***Necator americanus***		***Strongyloides sterocoralis***		***Enterobius vermicularis***		***Toxocara canis***		**Total**
	RS	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	
Green	6	1	0	2	4	4	0	1	0	0	3	1	22
Pumpkin	5	2	2	0	3	0	0	0	0	0	2	2	16
Scent leaf	4	3	1	0	1	3	2	0	0	0	1	2	17
Curry leaf	2	1	0	0	3	2	1	1	0	0	1	0	11
Ebiewewa	2	0	2	3	3	4	0	1	0	0	1	1	17
Water leaf	3	0	3	1	2	2	0	1	0	0	0	0	12
Uziza leaf	3	2	3	2	4	3	0	1	0	0	2	3	23
Total	**25**	**9**	**11**	**8**	**20**	**18**	**3**	**5**	**0**	**0**	**10**	**9**	
Grand total	**34**		**19**		**38**		**8**		**0**		**19**		**118**

Key: RS = Rainy season DS = Dry season

Table 5: Occurrence of helminth eggs from Ikpoba Hill market

Vegetables	***Ascaris lumbricoides***		***Trichuris trichuira***		***Necator americanus***		***Strongyloides sterocoralis***		***Enterobius vermicularis***		***Toxocara canis***		**Total**
	RS	DS	RS	DS	RS	DS	RS	DS	RS	DS	RS	DS	
Green	4	4	2	0	3	1	2	0	0	0	2	1	19
Pumpkin	5	2	0	2	3	3	3	0	0	0	0	2	20
Scent leaf	2	3	1	1	4	0	2	0	2	0	2	0	17
Curry leaf	3	1	1	0	2	0	0	0	0	0	1	0	8
Ebiewewa	3	3	0	3	1	1	2	0	0	0	1	2	16
Water leaf	4	0	1	2	4	0	0	0	0	0	0	2	13
Uziza leaf	4	2	2	2	2	1	1	0	1	0	0	3	18
Total	**22**	**15**	**7**	**10**	**19**	**6**	**10**	**0**	**3**	**0**	**9**	**10**	
Grand total	**37**		**17**		**25**		**10**		**3**		**19**		**112**

Key: RS = Rainy season DS = Dry season

At the vegetable market in Upper Forestry, 77 (14.10%) parasites were recovered. *S. stercoralis* and *E. vermicularis* eggs were not found while the prevalence for *A. lumbricoides* (35.07%), *Namericanus* (23.38%), *Taenia* (20.78%), T. *Trichiura* (18.18%), T. canis was (2.59%) (Table 6).

Table 6: Occurrence of helminth eggs from Upper Forestry Market

Vegetables	***Ascaris lumbricoides***		***Trichuris trichuira***		***Necator americanus***		***Strongyloides sterocoralis***		***Enterobius vermicularis***		***Toxocara canis***		***Total***
	RS	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	**RS**	**DS**	
Carrots	2	3	1	2	4	0	0	0	6	0	1	0	19
Tomatoes	4	0	2	1	2	0	0	0	5	0	0	0	14
Lettuce	5	5	3	2	2	1	0	0	1	0	1	0	20
Cucumber	2	1	0	1	3	2	0	0	1	0	0		10
Cabbage	2	3	0	2	4	0	0	0	3	0	0	0	14
Total	**15**	**12**	**6**	**8**	**13**	**3**	**0**	**0**	**16**	**0**	**2**	**0**	
Grand total	**27**		**14**		**18**		**0**		**16**		**2**		**77**

Key: RS = Rainy season; DS = Dry season

DISCUSSION

The study revealed that vegetables purchased at the various markets in Benin City were highly contaminated with geohelminth eggs excreted by humans and animals. This could be attributed to the poor hygiene habits and use of night soil as fertilizer. *T. canis* eggs were found implicating contamination by animal faeces. The parasitic fauna in human faeces was reflected in the results of parasitic contamination of vegetables in markets in Nigeria, as shown in Table 1, and reported by Olaniyi *et al* (2007), and Eneanya and Njom (2003). The number of eggs recovered was significantly higher in rainy season than in dry season and it is assumed that eggs on the surfaces of the vegetables are not washed away by rain. Anaur and Ramachandran (1977) reported that the eggs of *A. lumbricoides* are difficult to wash off due to their adhesive nature. This observation contrast Uga *et al* (2009) who observed a higher prevalence of eggs in dry season than in rainy season. Rainfall could also be a major source of contamination as most of the vegetables are likely to be submerged under flood after heavy rainfall. There is the

tendency that the flood must have carried with it eggs and cyst of parasite from the surrounding environment since open air defecation is a common practice. The presence of eggs in the vegetables is of public health significance considering the fact that communities are at risk of infection. Consumers get infected through ingestion of parasitic eggs adhering to these leafy and fruity vegetables that may be eaten raw e.g. lettuce, carrots, cabbage, cucumber or made into raw salad dishes. The occurrence of geohelminths eggs in vegetables in the markets studied reflects the level of hygiene practices by vegetables farmers and marketers. Vegetables are heaped on the bare ground in wholesale markets which might have been contaminated with egg and cysts of parasites. The study of parasites on vegetables may be helpful in accessing the prevalence of helminth eggs in a population. Eneanya and Njom (2003) reported the degree of contamination by helminth of some common fruits and vegetables sold in markets in Enugu, Nigeria. The vegetables and fruits were brought directly from the rural farmers and checked for helminth eggs and larvae by the formalin ether concentration method. All the vegetables and fruits were found contaminated by helminth eggs, with the vegetables being more highly contaminated than the fruits. *Talinum triangulare* (water leaf) a low-growth vegetable frequently found growing wild around sewage system recorded the highest contamination (25.7%) while the fruit *Psidum guajava* (guava) was the least contaminated (1.4%). *A. lumbricoides* was the most frequently encountered, (76.4%) In this study, *A. lumbricoides* was also the most prevalent parasite *33.5%* followed by *Hook worm 26%, T. trichiura 15%, T. canis 14.1%, S. stercoralis 7.3%, Taenia 2.9%, E. vermicularis 1.3%*. When compared to this study the infection pattern is similar but the prevalence rates are lower for Benin City.

In this study, lettuce, water leaves and pumpkin leaves were found to be highly contaminated with *A. lumbricoides.* Some of these vegetables are creepers and become heavily infested as a result of flooding or run offs during the rainy season in the farms. This study supports reports by other researchers (Uga *et al*., 2009; Ogban, *et al*., 2010) that vegetables sold in markets are highly contaminated by geohelminths. Furthermore, there is need to educate farmers and marketers on hygienic handling of vegetables, the need for public enlightenment of consumers for the necessity to thoroughly wash leafy vegetables and disinfect salad vegetables before use. In addition, the use of human and animal wastes as manure should be discouraged.

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