

Original Research Article

Parasite Contamination of Common Fruits and Vegetables from Selected Markets in Awka-North and Awka-South Local Government Area, Anambra State, Nigeria

ABSTRACT

Background: The practice of eating raw fruits and vegetables has led to infection with various parasitic diseases. Some flies species has been reported as mechanical transmitters of parasites and so contribute to the spread of the **disease causing** organisms on fruits and vegetables. Edible vegetables and fruits sold in selected markets in Awka-North and Awka-South LGA, Anambra State, Nigeria were examined for parasites between April and **August**, 2018.

Materials and Methods: Three different fruits (Garden egg: *Solanum macrocarpon*, Local Pear: *Dacryodes edulis* and Orange: *Citrus sinensis*) and four different vegetables (Spinach: *Amaranthus cruentus*, Fluted pumpkin: *Telfairia occidentalis*, Scent leaf: *Ocimum gratissimum*, Garden egg leaf: *Solanum macrocarpon*) were collected. One hundred grams (100g) of each sample was washed separately in beakers containing 100ml of normal saline. The resulting suspension was sieved to remove debris. Each filtrate was then transferred to a clean labelled specimen bottle and **were** examined for parasites using floatation and sedimentation techniques.

Results: Of 303 vegetables and fruits samples examined, 167(55.1%) were contaminated [Fruits: 58/135=41.4%; Vegetables: 109/168=64.9%]. Of 90 fruits and 108 vegetables examined in Awka-North markets, 41(45.6%) and 83(76.9%) were contaminated respectively. Of 45 fruits and 60 vegetables examined in Awka-South markets, 17(37.8%) and 26(43.3%) were contaminated respectively. There was **a higher** contamination of fruits and vegetables in Awka-North, 124(62.6%) than Awka-South, 43(41.0%). The overall prevalence was statistically significant ($P < 0.05$) using χ^2 . Orange 22(16.3%) was the highest contaminated fruit while Fluted pumpkin 29(17.2%) was the highest contaminated vegetable although not significant ($P > 0.05$). *Ascaris lumbricoides* was the most prevalent parasite recovered on Fruits, 22(16.3%) and vegetables, 41(24.4%).

Conclusion: This investigation has revealed that some fruits and vegetables in the study areas were contaminated with parasites. Therefore, fruits and vegetables should be properly washed and vegetables cooked before consumption to avoid parasite transmission.

Keywords: Parasite, Contamination, Fruits, Vegetables, *Ascaris lumbricoides*

1. INTRODUCTION

Vegetables are portions of roots, stems and leaves of some plants [1] while fruits are fleshy seeds of plants that are edible in the raw state [2]. Vegetables are **important** ingredient of a healthy diet [3, 4] which supply man with essential supplements, but could also become vehicles for **soil transmitted** helminth (STH) parasites [5]. **An observation** has revealed that vegetable consumption can also be a means of transmitting other parasitic diseases to man [6].

Some cyclorrhaphan flies has been reported as mechanical transmitters of parasites and so contribute to the spread of the disease causing organisms among fruits and vegetable sellers [7]. Hookworm ova, *A.*

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lumbricoides ova, *Trichuris trichiura* ova, *Strongyloides stercoralis* larvae and a protozoan parasite *Entamoeba histolytica* cyst, has all been isolated from the external body surfaces of flies, fruits and vegetables and *Musca domestica* was reported as the highest carrier of the helminthes and protozoan parasites [7, 8, 9, 10, 11, 12]. Therefore, consumption of these fruits and vegetables when inadequately washed or undercooked may lead to ingestion of eggs, cysts and larvae of these parasites [13, 14].

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Poor sanitation, lack of good water, inadequate facilities and poor hygienic cultures encourage the transmission of the parasites. Contamination of vegetables depends on some factors such as use of water supplies contaminated with sewage for irrigation, post-harvest handling, transportation and unhygienic practices in fruit and vegetable delivery [15]. The purpose of this study was to investigate the extent of parasite contamination of fruits and vegetables sold in selected markets in the study area.

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2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in selected markets in Awka-North and Awka-South LGAs. Awka-North and Awka-South has a population of 148,400 and 301,657 respectively [16]. The LGAs are located in the tropical rainforest zone of Nigeria. The study area lies between the coordinates of 6°10N 7°04E. The annual rainfall is about 200-280cm. Temperature ranges from 23.4°C to 29.9°C while relative humidity is between 60 to 80% [16]. Majority of the inhabitants of the area are farmers, others are traders dealing of vegetables, fruits and other farm produce. A few are civil servants and artisans, while others are blacksmiths producing farming equipments.

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2.2 Specimen Collection

The fruits and vegetables were randomly selected from different selling points in 3 markets (Orie Amansea, Orie Urum and Orie Achalla) in Awka-North and 3 markets (Eke Awka, Nkwo Amaenyi and Ifite) in Awka-South. A total of 303 specimens (135 fruits specimens and 168 vegetables) were sampled. The vegetables obtained were Fluted pumpkin (*T. occidentalis*), Spinach (*A. cruentus*), Scent leaf (*O. gratissimum*) and Garden egg leaves (*S. macrocarpon*) while the fruits include Garden egg fruit (*S. macrocarpon*), African pear (*D. edulis*) and Orange (*C. sinensis*). They were purchased in the morning between 8.00 and 10.00hrs to ensure their freshness. The fruits and vegetables were collected into properly labelled polythene bags and transported to the laboratory of the Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka, for examination.

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2.3 Examination of Specimens

One hundred grams (100g) of each sample was washed separately in 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. Floatation and sedimentation techniques were used for the examination [17].

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2.3.1 Floatation Techniques

Zinc sulphate solution (1.18-1.20 specific gravity) was used for the study. The specific gravity of the solutions was determined using the hydrometer. A test tube half-filled with the suspension resulting from the washing of the fruits and vegetable was then filled to the brim with 5ml of zinc sulphate solution. A clean, grease-free cover slip was placed on top of the tube with care to avoid trapping of air bubbles. The test tube was then allowed to stand for 20 minutes, then cover slip carefully removed and placed face-downwards on a slide and was examined microscopically using a 10X objective. After, a drop of Lugol's iodine was dropped through the edge of the coverslip, it was then examined with 40X objective to identify the eggs of helminths.

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2.3.2 Sedimentation Techniques

This method was employed for the detection of eggs of helminths and cysts of protozoa. A clean, sterile centrifuge tube half-filled with the suspension from washing of the fruits and vegetable was centrifuged at 1,006 xg for one minute. The supernatant was decanted and about 1gram of the sediments was placed

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on a clean glass slide, covered with a cover slip and examined under a 10X objective of the microscope. After, a drop of Lugol's iodine was dropped through the edge of the cover slip, then re-examined under 40X objective lens to identify the protozoa cysts and eggs of helminths.

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2.4 Data Analysis

The data were subjected to statistical analysis using SPSS version 16.0 computer package. T-test and Chi-square test were used to compare the significant differences.

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3. RESULTS

Of the 303 vegetables and fruits samples collected, 167(55.1%) were contaminated with parasites. In Awka-North, fruits 41(45.6%) and vegetables 83(76.9%) were contaminated, while in Awka-South, fruits 17(37.8%) and vegetables 26(43.3%) were also contaminated with parasites. Parasites contamination of fruits and vegetables was highest in Awka-North 124(62.6%) while the least 43(41.0%) was observed in Awka-South. There was a significant difference ($P < 0.05$) using χ^2 (Table 1).

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Table 1: Prevalence of parasites of edible fruits and vegetables in Awka-North and Awka-South LGA

Items	Awka-North		Awka-South	
	No. examined	No. positive (%)	No. examined	No. positive (%)
Fruits	90	41(45.6)	45	17(37.8)
Vegetables	108	83(76.9)	60	26(43.3)
Total	198	124(62.6)	105	43(41.0)

P value = .027639 ($P < 0.05$)

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Cumulatively, Orange 22(16.3%) was the highest parasite contaminated fruit in the entire study area while Garden egg fruit and Local pear were the least having equal numbers of 17(12.6%) each (Table 2). Fluted pumpkin and Scent leaf were the highest contaminated vegetables also in equal numbers of 29(17.2%) each, while Garden egg leaf 26(15.5%) was the least. Parasite contaminated Spinach was 27(16.1%). There was no significant difference in the level of contamination between the fruits and the vegetables ($P > 0.05$).

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Table 2: Different fruits and vegetables contaminated with parasites in Awka-North and Awka-South LGA

Items	Number examined	Awka-North Number positive (%)	Awka-South Number positive (%)	Total
Fruits				
Garden egg fruit	45	15(33.3)	2(4.4)	17(12.6)
Local Pear	45	9(20.0)	8(17.8)	17(12.6)
Orange	45	15(33.3)	7(15.6)	22(16.3)
Subtotal	135	39(28.9)	17(12.6)	56(41.4)
Vegetables				
Spinach	42	21(50.0)	4(9.5)	27(16.1)
Fluted pumpkin	42	25(59.5)	4(9.5)	29(17.2)
Scent leaf	42	17(40.5)	12(28.6)	29(17.2)
Garden egg leaf	42	20(47.6)	6(14.2)	26(15.5)
Subtotal	168	83(49.4)	26(15.5)	109(64.9)
Grand total	303	124(40.9)	43(14.2)	167(55.1)

P value = .254358 ($P > 0.05$)

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In the markets in Awka-North, Orié Achalla had the highest contaminated fruits 24(26.7%) and vegetables 35(32.4%). Others were fruits 16(17.7%) and vegetables 24(22.2%) from Orié Amansea, and fruits 10(11.1%) and vegetables 15(13.9%) from Orié Urum (Table 3).

Table 3: Contaminated fruits and vegetables in selected markets of Awka-North LGA

Items	No. examined	Orié Amansea No. positive (%)	Orié Urum No. positive (%)	Orié Achalla No. positive (%)	Total
Fruits					
Garden egg fruit	30	7(23.3)	0	8(26.7)	15(16.7)
Local Pear	30	4(13.3)	5(16.7)	10(33.3)	19(21.1)
Orange	30	5(16.7)	5(16.7)	6(20.0)	16(17.7)
Subtotal	90	16(17.7)	10(11.1)	24(26.7)	50(55.6)
Vegetables					
Spinach	27	3(11.1)	4(14.8)	10(37.0)	17(15.7)
Fluted pumpkin	27	7(25.9)	0	11(40.7)	18(16.7)
Scent leaf	27	9(33.3)	4(14.8)	11(40.7)	24(22.2)
Garden egg leaf	27	5(18.5)	3(11.1)	3(11.1)	11(10.2)
Subtotal	108	24(22.2)	15(13.9)	35(32.4)	74(68.5)
Grand total	198	40(20.2)	25(12.6)	59(29.7)	124(62.6)

P value = .157879, P>0.05

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In the markets in Awka-South, Eke Awka had the highest contaminated fruits 7(15.6%) and vegetables 11(18.3%). Others were fruits 4(8.9%) and vegetables 6(10.0%) from Nkwo Amaenyi, and fruits 6(13.3%) and vegetables 9(15.0%) from Ifite market (Table 4). There was no significant difference in parasite contamination between the fruits and vegetable across the markets (P>0.05).

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Table 4: Contaminated fruits and vegetables in selected markets of Awka-South LGA

Items	No. examined	Eke Awka No. positive (%)	Nkwo Amaenyi No. positive (%)	Ifite Market No. positive (%)	Total
Fruits					
Garden egg fruit	15	1(6.7)	0	1(6.7)	2(4.4)
Local Pear	15	3(20.0)	2(13.3)	3(20.0)	8(17.8)
Orange	15	3(20.0)	2(13.3)	2(13.3)	7(15.6)
Subtotal	45	7(15.6)	4(8.9)	6(13.3)	17(37.8)
Vegetables					
Spinach	15	2(13.3)	1(6.7)	1(6.7)	4(6.7)
Fluted pumpkin	15	1(6.7)	1(6.7)	2(13.3)	4(6.7)
Scent leaf	15	6(40.0)	3(20.0)	3(20.0)	12(20.0)
Garden egg leaf	15	2(13.3)	1(6.7)	3(20.0)	6(10.0)
Subtotal	60	11(18.3)	6(10.0)	9(15.0)	26(43.3)
Grand total	105	18(17.1)	10(9.5)	15(14.3)	43(41.0)

P value = .20283, P>0.059

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Fruits 22(16.3%) and vegetables 41(24.4%) were contaminated more with *A. lumbricoides* than other parasites (Table 5). Other parasite contaminations were fruits 7(5.2%) and vegetables 10(6.0%) by *S. stercoralis*, fruits 9(6.7%) and vegetables 16(9.5%) by Hookworm, fruits 8(5.9%) and vegetables 21(12.5%) by *T. trichuira*, fruits 10(1.5%) and vegetables 23(5.4%) by cyst of *E. histolytica*. The distribution of parasites among fruits and vegetables was not significant (P>0.05).

Table 5: Species of parasites recovered from contaminated fruits and vegetables in Awka-North and Awka-South LGA

Items	No. examined	<i>Ascaris lumbricoides</i> (%)	<i>Strongyloides stercoralis</i> (%)	Hookworm (%)	<i>Trichuris trichiura</i> (%)	Cyst of <i>Entamoeba histolytica</i> (%)	Total (%)
Fruits							
Garden egg fruit	45	7(15.6)	1(2.2)	0	0	3(6.7)	11(8.1)
Local Pear	45	9(20.0)	3(6.7)	4(8.9)	3(6.7)	7(15.6)	26(57.8)
Orange	45	6(13.3)	4(8.9)	4(8.9)	5(11.1)	0	19(42.2)
Subtotal	135	22(16.3)	7(5.2)	9(6.7)	8(5.9)	10(1.5)	56(41.5)
Vegetables							
Spinach	42	12(28.6)	1(2.4)	3(7.1)	4(9.5)	5(4.8)	25(14.8)
Fluted pumpkin	42	12(28.6)	2(4.8)	4(9.5)	13(31.0)	5(4.8)	36(21.4)
Scent leaf	42	10(23.8)	5(11.9)	6(14.3)	2(4.8)	6(7.1)	29(17.3)
Garden egg leaf	42	7(16.7)	2(4.8)	3(7.1)	2(4.8)	7(4.8)	12(12.5)
Subtotal	168	41(24.4)	10(6.0)	16(9.5)	21(12.5)	23(5.4)	111(66.1)
Grand total	303	63(20.8)	17(5.6)	25(8.3)	29(9.6)	33(3.6)	167(55.1)
P value=.278602 P>0.05							

4. DISCUSSION

The overall parasitic contamination of 55.1% recorded in this study was slightly lower than 57.8% reported in fruits and vegetables from selected local markets of Jimma Town, Southwest Ethiopia [18], but higher than 37.5% reported in Lafia markets, Nasarawa State [14], 11.87% in Kogi, Nigeria [19] and 16.33% in Akure metropolis, Ondo State, Nigeria [12]. The contamination could have resulted from lack of modern toilet facilities, inadequate public health enlightenment and ignorance that make people defaecate indiscriminately resulting in pollution of water and farmland. *Ascaris lumbricoides* was the most prevalent parasite, followed by hookworm and *T. trichiura*. This study observed that these parasites thrive on the fruits and vegetables because they are cultivated in the tropics and tropical climate which provides a conducive atmosphere for the development of helminth parasites. This observation is in line with previous reports [1, 2, 9, 20, 21].

Orange was the highest contaminated fruit while Fluted pumpkin was the highest contaminated vegetable. Low growth vegetables seem to be more exposed to contamination with parasite stages during high rainfall and floods unlike high growth vegetables. The tendency of fluted pumpkin growing near the soil and trailing on the soil predisposes them to contamination with various types of parasites which normally undergo part of their development in the soil. Soil contaminated as such may through rain splashing or flooding cause geohelminthes ova/larvae in faeces to be lifted above soil surface. Orange has infoldings which can retain parasites even after washing. This findings is also in agreement with previous observations in other studies [9, 20, 22]. There was higher contamination of fruits and vegetables in Awka-North than Awka-South. The level of sanitation of the market premises may play a role since Awka-North is more rural than Awka-South and environmental sanitation is more effective in the later.

5. CONCLUSION

The recovery of protozoan cysts, helminthes eggs and larvae from the local vegetables meant for consumption is of great public health significance. The potential risk of contracting intestinal parasite infections still remain the ingestion of locally grown unwashed fruits and vegetables. Proper washing of vegetables and fruits should always be performed to avoid transmission of intestinal parasites. An adequate treatment of water used for irrigation of plants should be implemented.

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