# PREVALENCE OF GEOHELMINTHS ON SELECTED FRUITS AND VEGETABLES SOLD IN CALABAR, CROSS RIVER STATE

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## ABSTRACT

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*Six different types of fruits and vegetables from five markets namely Watt market, Kim market, Edim Otop, Marian market, and Ikot Ishie marke in Calabar, Cross River State were screened for geohelminths. Three hundred (300) samples comprising 150 each for vegetables and fruits (Solanun lycopersicum, Musa sapientum, Ananas cosmosus, Talinum triangulare, Venonia amygdalina, Ocimum gratissimum) were bought from these markets and examined for presence of geohelminths using sedimentation procedures. Out of the 300 samples screened microscopically, 37 (12.3%) were positive for geohelminths and the parasites found included, Strongyloides stercoralis 22 (26.5%), Ascaris lumbricoides 41 (49.4%), Trichuris trichiura 14 (16.9%) and Ancyclostoma duodnale 6 (7.2%). Of the six different fruits and vegetables assayed, water leaf (Talinum triangulare) had the highest number of contaminated samples 15 (30%) while scent leaf called Ocimum gratissimum had least number of contaminated samples 1 (2.0%). However, the prevalence of geohelminths in relation to the markets showed that, Watt market had the highest number of contaminated samples of fruits and vegetables 11 (18.3%) while Akim market had the least number of fruits and vegetables 2 (3.3%). Geohelminth parasites can be acquired through the consumption of improper and unhygienic prepared fruits and vegetables. There is need for proper and hygienic preparation of vegetables and fruits before consumption.*

## INTRODUCTION

Fruits and vegetables are important components of a healthy diet, and often contain a number of essential vitamins and minerals, carbohydrate, dietary fiber and phytochemicals. Individually or in combination, they demonstrate considerable antioxidant activity of important health benefit (Liu, 2003; Zhang *et al*., 2009; Oranusi and Braide, 2012). They are essential for good health and form a major component of human diet (Abe *et al.*, 2016). Fruits and vegetables in the daily diet have been strongly associated with reduced risk for some forms of cancer, cardiovascular diseases (CVDs), stroke, and other chronic diseases (Liu, 2003; Hung *et al*., 2004). According to the WHO report (2002), low fruit and vegetable intake is estimated to cause about 31% of chiasmic heart disease and 11% of stroke worldwide. In botany, fruit is the seed-bearing structure in flowering plants formed from the ovary after flowering. In common language, fruit usually means the fleshy seed-associated structures of a plant that are sweet or sour and in either edible or raw form. Apples, oranges, grapes and bananas are example of fruits. Vegetables are different from fruits; they are parts of a plant consumed by humans as food or as part of a meal, these include cucumber, carrot, onion, water leaf etc. Common fruits in Calabar area include apples, oranges, guava, pineapple, tomatoes and watermelon. Vegetables commonly found in markets of Calabar include water leaf, scent leaf, bitter leaf, pumpkin leaf, cucumber, carrot, cabbage, etc. Most of the fruits are consumed raw while a few are blended to produce fruit juices. Vegetables are used in making delicious meals such as soups, salad, stew etc.

Various factors contribute to rapid spread in disease associated with uncooked fruits and vegetables. These include continuous use of untreated wastewater and manure as fertilizers for crop production of fruits and vegetables are a major contributing factor to contamination that causes numerous food-borne disease outbreaks. Soil transmitted helminths complete a part of their life cycle in the soil after being extruded along with faeces. The cultivation of vegetables for commercial and domestic purposes in Nigeria is mostly carried out by peasant farmers who depend on irrigation or natural rainfall. These vegetables though seasonal, are cultivated in the same piece of land every year. As a result of this continuous land usage there is a depletion of nutrient hence the need for fertilizer or manure. Most farmers use untreated animal waste and human faeces as manure, which are known to contain various species of parasites that are of medical and veterinary importance (Okoronkwo, 1998). Indiscriminate faecal deposition in bushes and farm lands with a belief of enriching the lands is also a common practice by farmers and unlearned citizens. Some of the water bodies used for irrigation are also polluted with parasites-infected excreta, that could lead to recycling of infection (Ayres *et al.*, 1992).

Geohelminths (soil-transmitted helminths) are a group of trematode parasites with an essential phase of their asexual life cycle in the soil. Soil-transmitted helminths (STH) are responsible for some of the disease conditions that are predominant in the tropics and subtropics region of the world especially in areas with poor environmental sanitation, inadequate sanitary facilities, lack of safe potable water and poor hygiene culture (Akhlaghi *et al*., 2013). Estimates suggest that *Ascaris lumbricoides* infects over one billion people, *Trichuris trichiura* infects 79 million and hookworm *(Ancyclostoma duodenale*, and *Necator americanus)* infects 740 million people (WHO,

2008). Chronic and intense geohelminth infections can contribute to malnutrition, iron deficiency anaemia, and morbidity and sometimes, it can lead to cognitive process, which include tissue reaction such as granuloma and provoking intestinal obstruction or rectal prolapse (Ezeamama *et al*., 2005). The commonest are *Ascaris lumbricoides*, Hookworm (*Necator americanus* and *Ancylostoma duedenale*), *Trichuris trichiura* and *Strongyloides stercoralis* (Abe *et al*., 2016); however, Nigeria account for the highest population infected with STHs in sub-Saharan Africa (Federal Ministry of Health, 2013).

Few studies have actually examined geohelminths presence in fruits and vegetables in Nigeria. In a study to ascertain the geohelminths associated with date fruits *(Phoenix dactylifera)* sold in the Eastern (Anambra), Western (Lagos) and Northern (Bornu) regions of Nigeria conducted between February and July 2012 by Ekwunife *et al.* (2013), it was observed that 35.2% of the samples collected were contaminated with ova of parasites. Some common vegetables brought for sale in markets within Jos South Local Government Area of Plateau State were screened for human parasite by Idahosa (2011). He reported 56.3% prevalence of parasites for the samples. The present study was designed to determine the prevalence of geohelminths on some selected edible fruits and vegetables commonly consumed in Calabar with a view to proffering measures to curb or reduce contaminations and its attendant health implications on the populace.

## MATERIALS AND METHODS

### Study area

Calabar, the capital of Cross River State is one of the cities in Nigeria that attract investors and tourists. The study was conducted in Calabar Metropolis during the dry season between November 2016 and April 2017. Major markets in the Local Government Area where fruits and vegetable are sold were visited for sample collected. Calabar Metropolis lies between Latitude 04° 15' to 5° 15' N and Longitude 8° 15' E to 8° 25' E. In the north, the Municipal is bounded by Odukpani Local Government Area, in the north-east by the great Kwa River. Its southern shores are bounded by the Calabar River and Calabar south Local Government Area. It has an area of 331,551 square kilometers.

### Collection of fruits and vegetables used for the study

Ten (10) samples each of fruits such as Pineapple (*Ananas cosmosus* L.), Tomatoes (*Solanum lycopersicum* L) and Banana (*Musa sapientum* L) and vegetables such as water leaf (*Talinum triangulare* Jacq.), scent leaf (*Ocimun gratissimum* L), Bitter leaf (*Vernonia amygdalina* Delile) were randomly selected in the following markets: Akim market, Marian market, Ikot Ishie market, Edim Otop market and Watt market. The samples were randomly collected in batches of ten (10) per sample (fruit and vegetable) per selected market in the Calabar metropolis and wrapped in clean polythene bags and properly labeled. A total of 300 samples of vegetables and fruits of the six (6) different types were assayed for geohelminths. This implies for each market say Akim market, ten samples each of the three assayed fruits (pineapple, tomatoes and banana) and assayed vegetables (water leaf, scent leaf and bitter leaf) were collected, thus giving 60 samples and 300 in total for the five markets.

### Detection of geohelminths

The parasitological analysis of the selected fruits and vegetables was carried out in Good Deeds Medical Laboratory, Calabar, Nigeria using the Sedimentation techniques.

One hundred (100 g) each from each sample of the fruits and vegetables were sliced and washed in 100 ml of distilled water in a clean round bottom plastic container. The suspension was strained through a sterile sieve to remove undesirable materials (Ngarango *et al*., 2008) and the supernatant was discarded into a disinfectant jar. The sediment from each tube was shaken gently to mix up and a drop was applied on the centre of a clean slide using a wire loop and a drop of normal saline (0.9%) was applied and the cover slip was placed gently to avoid air bubbles and over-flooding. The preparation was examined under a dissecting microscope for parasites at x10 and x40 magnifications.

### Identification of parasites

The parasites were identified based on the key and pictorial guide by Arora and Arora (2008) and Ash and Orihel (2007).

### Statistical analysis

Chi-square ($\chi^2$) analysis was utilized to investigate the significant prevalence of geohelminths on the selected fruits and vegetables.

## RESULTS

Of the 300 samples screened, 37 (12.3%) were positive for geohelminths. It also showed that of the six different fruits and vegetable assayed, water leaf (*Talinum triangulare*) had the highest number of contaminated samples 15 (30%) followed closely by *Solanum lycoperiscum* 10 (20%), then *Musa sapientum* 6 (12%). Scent leaf (*Ocimum gratissimum*) had the least number of contaminated samples 1 (2%). Geohelminths occurred in each of the six fruits and vegetables (Table 1). Table 2 shows that, of the five (5) selected markets, Watt market had the highest number of contaminated samples of fruits and vegetables 11 (18.3%) while Akim market had the least number of contaminated fruits and vegetables valued at 2 (3.3%). In all the markets sampled, geohelminths were present in

*Solanum lycopersicum* and *Talinum triangulare.* However, geohelminths were not found in *Musa sapientum, Ananas cosmosus, Vernonia amygdalina* and *Occimum gratissimum* for all the markets sampled. *Talinum triangulare* had the highest number of geohelminths prevalence (6) in all the sampled markets. The frequency of geohelminths isolated from selected fruits and vegetables revealed that *Ascaris lumbricoid* was most prevalent with a count of 41 (49.4%) while *Ancylostoma duodenale* was the least prevalent with a count of 6 (7.2%) (Table 3).

The percentage frequency of geohelminths isolated from the 37 (12.3%) contaminated samples of fruits and vegetables revealed that *Talinum triangulare* had the highest number of parasites 28 (33.7%) while *Ocimum gratissium* had the least number of parasites 1 (1.2%). *Strongyloides stercoralis* occurred mostly in *Talinum triangulare* (12) and least in *Musa sapientum* and *Ananas cosmosus* with one individual respectively. *Ascaris lumbricoides* was more prevalent in *Musa sapientum* (11) and least prevalent (1) in *Ocimum gratissimum. Trichurus trichiura* occurred most in *Musa sapientum* (6) and lowest in *Ananas cosmosus* and *Vernonia amygdalina* with an individual respectively. *Ancyclostoma duodenale* was highest in *Talinum triangulare* (3) and least in *Ananas cosmosus* (1).

Table 1: Percentage prevalence of contaminated fruits and vegetables

| Samples | Watt Market | Akim Market | Edim Otop Market | Marian Market | Ikot Ishie | Number Examined | Number (%) positive for geohelminths |
|---|---|---|---|---|---|---|---|
| Fruits | Samples collected from each market | | | | | | |
| *Solanum lycoperiscum* | 10 | 10 | 10 | 10 | 10 | 50 | 10 (20%) |
| *Musa Sepientum* | 10 | 10 | 10 | 10 | 10 | 50 | 6 (12%) |
| *Ananas cosmusus* | 10 | 10 | 10 | 10 | 10 | 50 | 3 (6%) |
| Vegetables | | | | | | | |
| *Talinum triangulare* | 10 | 10 | 10 | 10 | 10 | 50 | 15 (30%) |
| *Vernonia amygdalina* | 10 | 10 | 10 | 10 | 10 | 50 | 2 (4%) |
| *Ocimum gratissimum* | 10 | 10 | 10 | 10 | 10 | 50 | 1 (2%) |
| Total | 60 | 60 | 60 | 60 | 60 | 300 | 37 (12.3%) |

Table 2: Prevalence of Geohelminths on fruits and vegetables from the markets

| Markets | Watt | | Akim | | Edim Otop | | Marian | | Ikot Ishie | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NE | NP | NE | NP | NE | NP | NE | NP | NE | NP |
| Fruits | | | | | | | | | | |
| *Solanum lycopersicum* | 10 | 2 | 10 | 1 | 10 | 4 | 10 | 2 | 10 | 1 |
| *Musa sapientum* | 10 | 1 | 10 | 0 | 10 | 1 | 10 | 2 | 10 | 2 |
| *Ananas cosmosus* | 10 | 1 | 10 | 0 | 10 | 1 | 10 | 1 | 10 | 0 |
| Vegetables | | | | | | | | | | |
| *Talinum triangulare* | 10 | 6 | 10 | 1 | 10 | 3 | 10 | 3 | 10 | 2 |
| *Vernonia amygdalina* | 10 | 1 | 10 | 0 | 10 | 0 | 10 | 1 | 10 | 0 |
| *Occimum gratissimum* | 10 | 0 | 10 | 0 | 10 | 0 | 10 | 1 | 10 | 0 |
| Total | 60 | 11 | 60 | 2 | 60 | 9 | 60 | 10 | 60 | 5 |
| Percentage | 18.3 | | 3.3 | | 15 | | 16.7 | | 8.3 | |

*Note: NE: Number examined, NP: Number positive*

Table 3: Frequency of geohelminths isolated from selected fruits and vegetables in Akim, Marian, Ikot Ishie, Edim Otop and Watt markets

| Parasite Isolated | Frequency | Percentage (%) |
|---|---|---|
| *Strongyloides stercoralis* | 22 | 26.5 |
| *Ascaris lumbricoides* (ova) | 41 | 49.4 |
| *Trichuris trichiura* | 14 | 16.9 |
| *Anyclostoma duodenale* | 6 | 7.2 |
| Total | 83 | 100 |

## DISCUSSION

Food-borne parasitic infections have received little attention in developing countries. As a rule, these organisms contaminate fruits while still on the field and are usually transmitted by contaminated water and spread by ineffective hygienic practice (Silva *et al.*, 2007; Alli *et al.*, 2011). The contamination of fruits and vegetables by geohelminths in this study revealed that out of 300 samples of fruits and vegetables examined 37 (12.33%) were positive for geohelminths, which showed a low level of contamination when compared to the result from rural villages in Ebonyi State, south-east Nigeria which had 101 (40.4%) contained samples from 250 samples that

were screened (Elom *et al.,* 2012). The result also differs from reports of Damen *et al*. (2007) (36%), Alli *et al*. (2011) (35.4%). Idahosa (2011) (56.3%), Ekwunife *et al*. (2013) (32.5%), and Abe *et al.* (2016) (37.5%). Poor handling and poor personal hygiene by sellers also contaminate the fruits and vegetables which also get cross contaminated by the vessels used in the process of conveying them to the market (Oranusi and Braide, 2012). The relatively low level of contamination from the present study could be attributed to the level of civilization and sanitary practices by the vendors and peasant farmers in Calabar, competency of government tasks force on operation keep Calabar clean, and Cross River State environmental sanitation team.

Table 4: Prevalence of parasites in each fruits and vegetables in the markets studied

| Fruits and Vegetables | *Strongyloides stercoralis* | *Ascaris lumbricoides* | *Trichuris trichiura* | *Ancyclostoma duodenale* | Total (%) |
|---|---|---|---|---|---|
| *Solanum lycopersicum* | 8 | 10 | 3 | 2 | 23 (27.7%) |
| *Musa sapientum* | 1 | 11 | 6 | 0 | 18 (21.7%) |
| *Ananas cosmosus* | 1 | 6 | 1 | 1 | 9 (10.8%) |
| *Vernonia amygdalina* | 0 | 3 | 1 | 0 | 28 (33.7%) |
| *Ocimum gratissimum* | 0 | 1 | 0 | 0 | 4 (4.8%) |
| *Talinum triangulare* | 12 | 10 | 3 | 3 | 1 (1.2%) |
| Total | 22 | 41 | 14 | 6 | 83 (100%) |

$\chi^2 = 18.84$, Df = 6, $p<0.05$

This study also revealed that there was no significant difference ($p<0.05$) in prevalence of geohelminths contamination of fruits and vegetables. This is not in consonance with report of Abe *et al.* (2016). This could be attributed equal to environmental conditions and sanitary practices in which both farmers and traders are exposed to in cultivation and handling fruits and vegetables in Calabar municipalities. The present study revealed *Ascaris Lumbricoides* (49.4%) and *Strongyloides stercoralis* (26.5%) as being the highest occurring parasites. Uneke (2004) isolated hookworm (36.4%), ova of *Ascaris lumbricoides* (54.2%), and *Trichuris trichiura* (9.3%) in Abakaliki, Ebonyi State as most occurring geohelminths. Alli *et al*. (2011) isolated ova of *Ascaris lumbricoides* (55.9%), ova of hookworm (32.3%) and *Strongyloides stercoralis* (11.8%) in Ibadan Markets, Oyo State as the predominant intestinal parasites. Also, Idahosa (2011) reported that *Strongyloides stercoralis* (60%) and hook worm (28.6%) were the most occurring parasites in Jos Markets. Elom et al. (2012) screened ova of *Ascaris lumbricoides* (54.5%) and kookwprm (23.8%) as most occurring geohelminths. Abe *et al*. (2016) isolated of *Ascaris lumbricoides* (89.3%) and hookworm (5.3%) as highest prevalent geohelminths. The disparity in these results is due to differences in abundance of the parasite in the area of study and the season of sampling and differences in the geographical location of the study. Despite variation in screened geohelminths, ova of *Ascaris lumbricoides* was common in all other studies, this could be due to the fact that that, this parasite had the tendency to withstand adverse environmental conditions (Alli *et al*., 2011)

## CONCLUSION

This study has shown the evidence of relatively low prevalence of geohelminths on edible fruits and vegetables from five different markets in Calabar, Cross River, Nigeria but there is still need to curb completely the infestation of this fruit and vegetables by these geohelminths because it arouses public health concern. There is need for proper preparation of fruits and vegetables before consumption. Humans cannot exclude fruits and vegetables from their daily diet but can curb and depress transmission of geohelminths through them. This can be achieved by appropriate personal and environmental hygiene by seller and consumers, avoidance of the use of human and animal waste as manure improperly in order to avoid faecal contamination, washing fruits and vegetables properly before cooking or eating and most importantly avoiding indiscriminate defecation within and outside areas where fruits and vegetables and planted. More enlightenment programmes for the public on necessity of food sanitation and personal hygiene should be intensified. Government should provide inorganic fertilizers at affordable rates to farmers in order to discourage the use of faeces or animal dungs as fertilizers and should provide good reliable source of water for the farmer and populace at large. Generally, results from the study shows a reasonable contamination level for geohelminths from five different market in Calabar, the population is still at risk of acquiring geohelminth infections by eating improperly and unhygienically prepared fruits and vegetables. Future studies should take into account, the effect of washing the samples 3 to 4 times as in domestic settings on geohelminth contamination and also heat effect (hot water) on geohelminth contamination after 3-4 times washing of the samples

## REFERENCES

Abe, E. M., Ajah, L. J., Ayuba, S. O., Mogaji, H. and Ekpo, U. F. 2016. Geohelminths contamination of fruits and vegetables sold in Lafia markets. *Annual Research & Review in Biology,* 11(2):1-8.

Akhlaghi, L., Mafi, M., Oormazdi, H., Reza, M. A., Shirbazou, S. and Tabatabaie, F. 2013. Survey of parasitic infections of consumed vegetables in Ahwaz city. *Annals of Biological Research,* 4(8):22-26.

Alli, J. A., Abolade, G. O., Kolade, A. F., Salako, A. O., Mgbakor, C. J., Ogundele, M. T., Oyewo, A. J. and Agboola, M. O. 2011. Prevalence of intestinal parasites on fruits available in Ibadan markets, Oyo State, Nigeria. *Acta Parasitologica Globalis*, 2(1):6-10.

Arora, D. R. and Arora, B. 2008. Textbook of microbiology, 3rd edn. CBS Publishers and Distributors, New Delhi, India. 771pp.

Ash, L. R. and Orihel, T. C. 2007. Atlas of human parasitology fifth edition. American Society of Clinical Pathologist, Chicago. 540pp

Ayres, R. M., Stott, R., Mara, D. D. and Lee, D. L. 1992. Wastewater reuse in agriculture and risk of nematode infection. *Parasitology Today*, 8(1):32-35.

Damen, J. G., Banwat, E. B., Egah, D. Z. and Allamana, J. A. 2007. Parasitic contamination of vegetables in Jos, Nigeria. *Annal of African Medicine*, 6(2):115-118.

De Silva, B. N. R., Hotez, S., Montressor, J., Engels, A. and Savioli, L. 2003. Soil transmitted helminth infections: Updating the global picture. *Trends in Parasitology*, 19:547-551.

Elom, M. O., Eze, U. A., Nworie, A. and Akpotomi, I. O. 2012. Prevalence of geohelminths on edible fruits and vegetables cultivated in rural villages of Ebonyi State, south east Nigeria. *American Journal of Food* and *Nutrition,* 2(3):58 - 64.

Ekwunife, C. A., Uzoma E. M., Nwaorgu, O. C., Ozumba, N. A., Aribodor, D. N. and Ezeunala, M. N. 2013. The role of date palm fruit (*Phoenix dactylifera*) in transmission of geohelminths in Nigeria. *The BioScientist*, 1(1):1-5.

Ezeamama, A. E., Friedman, J. F., Olved, R. M. A., Cost, L. P., Kurtis, J. D., Mor, V. and McGarvey, S. 2005. Functional significance of low-intensity-polyparasite helminth infections in anaemia. *Journal of Infectious Diseases*, 192(12):2160-2170.

Federal Ministry of Health 2013. Nigeria master plan for neglected tropical diseases (NTDs) 2013-2017, Abuja: Federal Ministry of Health. 142pp.

Hung, H. C., Joshipara, K. J. and Jiang, R. 2004. Fruit and vegetable intake and risk of major chronic disease. *Journal of National Cancer Institute*, 96:1577-1578.

Idahosa, O. T. 2011. Parasitic contamination of fresh vegetables sold in Jos market. *Global Journal of Medical Research*, 11(1):21-25

Liu, R. H. 2003. Health benefit of fruit and vegetable are from additive and synergistic combinations of phytochemicals. *American Journal of Clinical Nutrition*, 78:5175-5205.

Ngarango, R. M., Aloo, P. A, Kabiru, E. W. and Nyanchango, B. O. 2008. The risk of pathogenic parasitic infections in Kismi Municipality, Kenya. *BMS Public Health*, 8:237-242.

Okoronkwo, M. O. 1998. Intestinal parasites associated with human and animal waste stabilization in Jos and Barkin-Ladi Areas of Plateau State. Nigeria. Ph.D Thesis University of Jos, Nigeria. 169pp.

Oranusi, S. U. and Braide, W. 2012. Microbiology safety assessment of apple fruits (*Malus domestica* Borkh) sold in Owerri, Imo State Nigeria. *Advanced Journal of Food Science and Technology,* 4(2): 97-102.

Uneke, C. J. 2004. Potential for geohelminth parasite transmission by raw fruits and vegetables in Nigeria. Implication for a risk profile *Journal of Nutrition and Environmental Medicine*, 16(1): 59-68.

World Health Organization (WHO) (2002). Prevention and control of *schistosomiasis* and soil transmitted helminthiasis: Report of a WHO export committee. Geneva, *Technical Report Series;* 912: 1-57.

World Health Organization (WHO) (2008). Public health significance of intestinal parasitic infection. *Bulletin of World Health Organization*, 65(5):575-588.

Zhang, C. X., Ho S. C., Chen, Y. M., Fu J. H., Cheng, S. Z., Lin, F. Y. 2009. Greater vegetable and fruit intake is associated with a lower risk as breast cancer among Chinese women. *International Journal of Cancer*, 125(1):181-188.