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Geo-helminths on leafy vegetables sold in Ogidi market, Idemili north local government area, Anambra state, Nigeria

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Abstract

Consumption of contaminated vegetables is a way through which people get infected with parasites. This study was carried out to determine the prevalence of Geo-helminth parasites that contaminate leafy vegetables sold in Ogidi market, Anambra state. The markets investigated were Oye Ogidi, Ekenweje and Nkwo Ogidi and vegetables were procured directly from the rural farmers who brought the vegetables to the markets which were examined in the laboratory for the presence of parasites using sedimentation method. Chi square was used to test for relationships at 95% confidence interval ($p<0.05$). Geo-helminth parasites observed were ova of *Ascaris lumbricoides, Trichuris trichuria*, Hookworm and larvae of *Strongyloides stercoralis* with an overall prevalence of 56%. There was statistical significance on the parasites and vegetables sold in the three markets ($X^2= 0.00$; $P<0.05$). *Ascaris lumbricoides* had the highest prevalence rate of 25.6%, while Hookworm had the least prevalence rate of 7.6%. The vegetable that had the highest contamination rate was Scent leaf (16.6%), while Uziza had the least contamination rate (5.3%) but there was no significance relationship in the prevalence of parasites and vegetables ($X^2=0.57$; $P>0.05$). Ekenweje market had the highest contamination rate (7.1%), while Oye Ogidi had the least contamination rate (4.9%) but there was no significant relationship between the parasites and the markets ($X^2=0.98$; $P>0.05$). These findings may have important implications for global food safety and emphasize the importance of leafy vegetables in public health through transmission of Geo-helminth parasites to humans in Nigeria. Individuals and local health authorities should improve the sanitary conditions in the areas where the vegetables are cultivated and consumed. Therefore, proper treatment of wastewater used in the irrigation of vegetables, and improvement of sanitary facilities in our markets and among vegetable vendors are recommended.

Keywords: Geo-helminths; Leafy Vegetables; Market; Ogidi

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1. Introduction

Vegetables are annual or perennial horticultural crops, with certain sections (roots, stalks, flowers, fruits, leaves etc.) that can be consumed wholly or partially, cooked or raw (Welbaum *et al*., 2015) and important ingredient of healthy life. This is due to the fact that vegetables help to protect human body against a number of diseases by providing the essential nutrient, vitamin, protein and fibres. They also play a role in the provision of low amount of fat and carbohydrate (Bashir *et al*., 2020) with positive impact on body weight regulation, hypertension and other related conditions such as diabetes, atherosclerosis and strokes. Due to the diverse health benefits of vegetables to humans, the WHO recommended the intake of a minimum of 400g of vegetables per day so as to curb the above mentioned diseases (Welbaum *et al*., 2015).

Geohelminth are among the most common infections worldwide and affect the poorest and most deprived communities which are transmitted by eggs present in human faeces which in turn contaminate the soil in areas where sanitation is poor (WHO, 2020). Vegetables are contaminated through treating soil with organic fertilizers such as manure, sewage sludge and from irrigation water which may lead to food borne diseases. Geohelminth infections are a major public health problem in tropical and developing countries in relation to poverty, inadequate hygiene, and sanitation (Addisu *et al*., 2020). They cause a lot of morbidity and socio-economic deprivations, high mortality in humans and domestic animals.

The main species that infect people are the roundworm (*Ascaris lumbricoides)*, the whipworm (*Trichuris trichura*), and hookworm (*Necator americanus and Ancylostoma duodenale*) (WHO, 2018). More than 1.5 billion people, or 24% of the world's population, are infected with soil transmitted helminth infection. Infections are widely distributed in tropical and subtropical areas, with the greatest numbers occurring in sub-Saharan Africa, the Americas, China and East Asia (WHO, 2018). Nigeria is not left out in the prevalence; a study by Umeaneto *et al*., (2016) recorded a prevalence rate of 57.1% for *Ascaris lumbricoides* and 7.1% for *Strongyloides stercoralis* in a study carried out on parasite contamination of edible vegetables sold in Onitsha markets, Anambra State.

In a study carried out by Elom *et al*., (2012) also recorded 54.5% for *Ascaris lumbricoides* in Ebonyi state. Edible raw vegetables and fruits sold at Nkwo-Edo market, Nnewi, Anambra state were also contaminated with *Ascaris lumbricoides* recording the highest (59.3%) while *Trichuris trichura* recorded the lowest (3.7%) prevalence (Ikpeze *et al*., 2017).

The social and environmental conditions in the unplanned slums of developing countries are ideal for the persistence of *Ascaris lumbricoides* and *Trichuris trichura* because the prevalences of *Ascaris lumbricoides* is greater in urban and rural areas, high rate of hookworm infection is restricted to areas where rural poverty predominates (Adamu et al., 2012).

2. Material and method

2.1. Study area

Ogidi, Idemili North Local Government Area, Anambra State is the headquarter of the Local Government with an estimated population of 70,000 (Mapcarta 2009). The town is situated between Umudioka and Nkpor and is made up of 9 villages; Ire, Abor, Ezi Ogidi, Umuru, Uru, Ogidi Ani, Nkwelle, Ikenga, Ezinkwo. The climate is tropical with an average rainfall of 1478mm, with a latitude of 6°9'7" North and longitude of 6°51'48" East (Mapcarta 2009). Their occupation is majorly farming, the town has three daily major markets that are distinguished from so many miniature and weekly markets, thus, Nkwo ogidi, Ekenweje and Orie Ogidi.

2.2. Sample collections

The vegetables were collected from the markets between 8:00am – 10:00am, at the time the traders arrived from the farms. A total of eight (8) different vegetables were collected for this study which are; Waterleaf (*Talenium triangulare*), Green vegetables (*Amaranthus cruentus*), Fluted pumpkin, (local name- "Ugu").(*Telfairia occidentalis*), Scent leaf, (local name "Nchuanwu"; *Ocimum gratissimum*), African eggplant/garden egg leaf, (local name "Akwukwo Anara"; *Solanium marcrocarpon*), Curry leaf (*Murraya* koenigii), False cubeb leaf, (local name "Uziza"; *Piper guineense*) and Bushbuck, (local name "Utazi"; *Gongronema latifolium*). Of each vegetable, twenty (20) specimens were collected from four (4) different sellers (five specimens from each seller) making a total of one hundred and sixty (160) from each market and a sum total of four hundred and eighty (480) vegetable specimens. They were transported in a well labeled clean transparent polythene bags to the Parasitology laboratory of Nnamdi Azikiwe University Awka, for examination.

2.3. Sample analysis and examination

A Hundred gram (100 g) samples of each vegetable were washed in 100mls of normal saline in a sterile beaker. The suspension was strained through a sterile sieve to remove undesirable materials (Nyarango *et al*., 2003). The filtrate was centrifuged at 1500rpm for 5 minutes (Damen *et al*., 2007) and the supernatant was decanted, the sediment was examined with x10 and x40 objective lens of a microscope for the presence of parasites.

2.4. Data analysis

The data was analyzed using chi square to test for relationships between prevalence and to check the significance between the contaminated parasites and type of vegetables at 95% confidence interval ($p<0.05$).

3. Results

Generally, four different parasites were identified; eggs of *Trichuris trichuria*, *Ascaris lumbricoides*, Hookworm, and larvae of *Strongyloides stercoralis* with an overall prevalence of *56%*.

Table 1 shows the Geohelminth parasites identified on the vegetables across the three markets. *Ascaris lumbricoides* had the highest prevalence of 25.6% with a statistical significance difference between parasites and the markets (X^2 - 0.00; $P<0.05$)

Table 2 shows the contamination rate of the vegetables across the three markets. The chi square result shows that the prevalence rate of Geohelminth infections varies across vegetables with Scent leaf having the highest prevalence of 16.6% but there was no significant difference between geohelminth infections and vegetables sold across the markets (X^2 -0.57; $P>0.05$).

Table 3 shows the contamination rate and overall prevalence of Geohelminths parasites across the three markets. The chi square result shows that the prevalence rate of geohelminths parasites varies across the markets but Ekenweje had the highest parasites prevalence (7.1%). There is no significant relationship between the geohelminth parasites and markets (X^2 -0.98; $P>0.05$)

Table 1 Geo-helminth parasites identified on vegetables across the three markets

Parasites	No identified	%
Ascaris lumbricoides	43	25.6%
Strongyloides stercoralis	20	11.2%
Trichuris trichuria	19	11.6%
Hookworm	13	7.6%
Total	95	56%

Chi square (X^2cal) = 22.01, Degree of freedom (D.f) = 3, prevalence (X^2tab) = 9.84; p value (probability value) =0.00, $p<0.05$.

Table 2 The prevalence of geo-helminth parasite on vegetables across the three markets

Vegetables	No. Recovered	%
Green	9	5.7%
Pumpkin	11	6.8%
Scent leaf	9	16.6%
Water leaf	17	10.5%
Uziza	9	5.3%
Curry	10	6%

Garden leaf	15	9.2%
Utazi	13	8.1%
Total	93	68.2%

Chi square (X^2cal) = 5.74, Degree of freedom (D.f) = 7, prevalence (X^2tab) = 14.07, p value=0.57, p>0.05.

Table 3 The prevalence of geohelminth parasite across the three markets

Parasites	**No. Recovered**	**%**
Nkwo-Ogidi	32	6.8%
Oye-Ogidi	24	4.9%
Ekenweje	34	7.1%
Total	37	18.8%

Chi square (X^2cal) = 3.441, Degree of freedom (D.f) = 11, prevalence (P or X^2tab) = 19.68, p value =0.98, p > 0.05.

4. Discussion

Consumption of contaminated or poorly washed raw vegetables plays a big role in the transmission of human parasitic infections. The result of this study showed evidence of parasitic contamination of fresh leafy vegetables sold in Ogidi markets.

The overall prevalence of 56% recorded in this study is higher than the prevalence (11%) recorded in Zamfara state by Shehu and Amina, (2014) and Kogi, (Omowaye & Audu 2012) but in agreement with studies performed in Jos markets, (Idahosa,2011), all in Nigeria and Kota Bharu, Kelantan, Malaysia (Zeehaida *et al*., 2011), However differences could have been as a result of several factors which may include, climatic conditions, Geograhical locations, type of soil, type of water and organic manure used for Agriculture, and hygienic practices during the transportation and marketing of the vegetables.

The parasitic contamination rates were not significantly different for samples collected from the three markets, Ekenweje had the highest prevalence of parasite (7.1%) but the difference in contamination rate in the three markets might be due to different sources of vegetables as well as the hygienic practices in handling by different sellers. The level of sanitation of the market premises may also play a role; vendors serve as intermediary between the farmers and the final consumers, in the distribution chain of vegetable produces and also on the contamination and distribution of the contaminants (Oranusi *et al*., 2012). Flies can easily carry parasite eggs and cysts from the refuse dump in the filthy market premises and surroundings and transfer them mechanically to already displayed vegetables since there were refuse dumps in and around the market premises.

From this study, *Ascaris lumbricoides* had the highest occurence in the area (25.6%); and scent leaf had the highest parasitic contamination rate of 16.6% with chi square ($p<0.05$), showing that there is significant association between the geohelminth parasites and vegetables sold across the markets. Behaviors also influence the prevalence and intensity of soil transmitted helminthes infections as Eneanya *et al*., (2003) reported that it is a common practice in villages around Enugu state to make shallow pit latrines for young children to defaecate thereby infecting farms during the rainy season.

The contamination rate of geohelminth parasites on vegetables examined showed that the contamination rate varies across vegetables with no significant association between geohelminth parasites and vegetables sold across the markets ($p>0.05$).

The contamination rate of geohelminth parasites across the markets showed that geohelminth parasites contamination rate varies across markets, and no significant relationship between the geohelminth parasites and the markets ($p>0.05$).

The results of this study emphasized that raw vegetables from markets in the study area could be possible vehicles of parasitic transmission to humans. Helminthes are associated with poverty, poor sanitation and lack of clean water. Hence the health authority should provide the education on the proper washing methods of vegetables in other to

prevent parasite transmission. Provision of clean water and improved sanitation are essential for the prevention and control of helminthes. However, it is important to note that this study has limitations and does not demonstrate the effects of seasonal variation on parasitic contamination. We did not address the intensity of vegetable washing before display for sale or the source of water used by each seller.

5. Conclusion

In conclusion, this study highlighted the importance of raw vegetables as the potential source of transmission for Geo-helminth parasites to humans. Vegetables contamination with the pathogenic parasites poses health risk to the consumers, if consumed without proper handling, washing and cooking.

The most effective way of reducing food borne parasitic infections is through prevention of contamination. Vendors and farmers of vegetables, and the general public should be given a comprehensive health education on the health risks associated with consumption of contaminated vegetables. Consumers should always observe the basic principle of food, handling and personal hygiene before consumption.

Recommendations

Vegetable vendors should avoid the contact of the produces with soil while displaying for selling. Further studies should be conducted on the viability of parasitic contaminants of vegetables, and also evaluate the level of parasitic contamination of farm produces, water and soil in which vegetables are cultivated. There should be improvement in areas where vegetables are grown and processed, implementation of proper treatment of wastewater used for irrigation. Generally, policy makers and vegetable vendors should improve in hygiene and cleanliness of the markets. Improved surveillance system is needed on food borne pathogens, food products, through adequate vegetable farming procedures, improved transportation and storage facilities in the various markets.

Compliance with ethical standards

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Disclosure of conflict of interest

I hereby state that there is no conflict of interest in this work.

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