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Evaluation of the Parasitic Contamination of Vegetables from Farms and Markets in Owerri, Imo State

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ABSTRACT

This study was carried out to evaluate the parasitic contamination of vegetables from some selected farms and markets in Owerri, Imo State. A total of 100 samples of vegetables were evaluated. The types of vegetables include: tomato, okra, cucumber, garden egg, pepper, uziza, utazi, water leaf, ukazi and pumpkin leave. Fifty (50) samples of vegetables were collected randomly from farms and markets respectively within Owerri. Samples were washed in saline, and the resulting washing solution was filtered and centrifuged to concentrate the parasitic stages. Sediment were examined by wet preparation, sedimentation techniques and modifies ziehl Nelson stained smears. Intestinal parasites were detected in 50 samples. The total prevalence of intestinal parasites was 55%. The result from the farms has a total prevalence (62%) with a p. value 0.223. onyeanaekiri farm has the highest prevalence (41.9%), followed by Hope nana farm (32.3%) and 25.8% for Chibu farm. The result from the markets has a total prevalence of 48% with a p. value 0.199. Umuapu market has the highest prevalence of (37.5%) followed by Eke Umar (33.3%) while releave market (29.9%). The result from the different methods employed shows a total percentage of (55%) with a p.value of 0.157. The sedimentation technique has the highest percentage (58.2%) while wet preparation (41.8%). Hookworm were the most prevalent parasite (16%), followed by *Strongyloides stercoralis* (13%), *Acaris lumbricoides* (10%), *Trichuris trichura* (6%), *Enterobuis vermicularis* (3%), while *Fasciola hepatica, schistosoma haematobium* and *balatidium coli* have (2%) and *Taenia spp.* (1%). The highest contaminated vegetable was pumpkin leaves (26%), followed by water leaf (11%), and ukazi (5%), and uziza, tomato, utazi (3%) respectively, garden egg (2%) while 0kra and pepper (1%) respectively. This finding provides evidence for the high risk of acquiring parasitic infection from the consumption of raw vegetables in Owerri, Imo State. Effective measures are necessary to reduce parasitic contamination of vegetables.

Keywords*: Parasitic contamination, Vegetables, Prevalence, Intestinal parasites, Food safety*

INTRODUCTION

Intestinal parasitic infections are widespread globally, posing significant threats to public health [1]. These infections result in approximately 300 million severe cases and around 200,000 deaths, predominantly in developing countries [1]. Notably, numerous outbreaks of intestinal parasitic infections linked to raw vegetables have been documented in both developed and developing nations [2]. These outbreaks are largely attributed to poor sanitation and inadequate personal hygiene [3]. The key factors contributing to the spread of these infections include substandard personal and environmental hygiene as well as weak health systems. Such conditions facilitate the transmission of parasites from person to person and from soil to humans. Additionally, fecal-oral transmission through the consumption of contaminated food and water is a common route of infection [4].

Vegetables are an essential part of daily diets, providing vital vitamins, proteins, and minerals necessary for human health. They also play a role in neutralizing acidic substances produced during digestion. However, parasitic contamination of vegetables can occur both before and after harvest. Contamination can result from exposure to fecal matter (human and animal waste), polluted irrigation water, and animals such as insects and birds [2]. Furthermore, contamination may be introduced during the harvesting process, handling, transportation, or through contact with processing equipment [3].

In many developing countries, including Nigeria, there are no adequate systems for routine diagnosis, monitoring, or reporting of foodborne pathogens. As a result, outbreaks caused by contaminated vegetables often go undetected, and the true incidence of such infections is underestimated [3]. In Nigeria, the cultivation of vegetables for both commercial and domestic purposes is primarily carried out by peasant farmers who rely on either irrigation or natural rainfall . These farmers, however, tend to use the same land for cultivation year after year, which leads to soil nutrient depletion and necessitates the use of fertilizers or manure. Many farmers resort to using untreated animal and human feces as manure, which is known to harbor various species of medically and veterinarily important parasites [2]. Additionally, indiscriminate defecation in bushes and farmlands, a practice believed to enhance soil fertility, is widespread among local residents and farmers. The water sources used for irrigation are also often contaminated with parasite-infected feces, contributing to the cycle of infection [4].

Recent studies have highlighted a rising number of foodborne illnesses, predominantly linked to the consumption of fresh vegetables [5]. Several studies conducted across the world have investigated parasitic contamination in vegetables, with findings reported from countries such as Syria, Ghana, India, Pakistan, Iran, Ethiopia, and Egypt. These studies reveal that vegetables can act as a significant vector for transmitting various parasites, including protozoa such as *Entamoeba histolytica* and *Balantidium coli*, oocysts like *Isospora belli* and *Cryptosporidium spp.*, and helminth eggs and larvae such as *Strongyloides stercoralis*, *Trichuris trichiura*, *Enterobius vermicularis*, *Fasciola hepatica*, *Ascaris lumbricoides*, *Toxocara spp.*, *Hymenolepis nana*, *Hymenolepis diminuta*, and *Taenia spp* [6].

Despite the risks, consuming raw vegetables and salads is common in Nigerian communities. This practice, coupled with insufficient washing of vegetables, heightens the risk of intestinal parasitic infections. Therefore, it is essential not to rely solely on chemotherapeutic interventions for identified cases but also to address and eliminate potential sources of contamination. Thus, the current study seeks to detect parasitic contamination in fresh vegetables. This approach aims to mitigate infection risks in Owerri metropolis, recognizing that proactive measures are required to reduce the transmission of intestinal parasites. Consequently, the study aims to assess the extent of parasitic contamination in vegetables harvested from selected farms and sold in local markets within Owerri Metropolis.

METHODOLOGY

Study Design

A descriptive observational study was conducted to assess the parasitic contamination of vegetables from selected farms and markets in Owerri, Imo State, Nigeria. A total of 100 vegetable samples were randomly collected, 50 from farms and 50 from markets. These samples were processed using saline washing, filtration, and centrifugation, and the sediment was examined for parasitic contamination. The prevalence of parasites was determined and analyzed to evaluate contamination levels across different locations.

Eligibility Criteria

Inclusion Criteria

Only common vegetables consumed in Owerri, Imo State were included in the study. These include tomatoes, okra, cucumber, garden egg, pepper, uziza, utazi, water leaf, ukazi, and pumpkin leaves. Vegetables collected from selected farms (Chibu farm, Onyeanachiri farm, Hopenana farm) and markets (Releave market, Eke Umar market, Umuoapu market) in Owerri. Only fresh, undamaged vegetables available for sale or harvested during the study period were included. Vegetables that were raw and had not been washed by the vendors or farmers before collection.

Exclusion Criteria

Vegetables that had been washed, processed, or cooked before sample collection were excluded. Vegetables that were visibly rotten or damaged were excluded to avoid contamination not related to parasitic infection. Samples from farms or markets not listed in the study's sampling sites were excluded. Any vegetable not among the targeted types (e.g., leafy greens not listed, fruits) was excluded.

Study Sample

The study sample for this research consisted of vegetable samples collected from three selected farms and three open-air markets within Owerri, Imo State, Nigeria. A total of 100 vegetable samples were collected, comprising 50 samples from the farms (Chibu farm, Onyeanachiri farm, and Hopenana farm) and 50 samples from the markets (Releave market, Eke Umar market, and Umuoapu market). The vegetables included tomatoes, okra, cucumber, garden egg, pepper, uziza, utazi, water leaf, ukazi, and pumpkin leaves.

Sample Collection

Ten types of vegetables including: Okro (*Abelmochus esculentus*), tomato *(Lycoperssicum sativus*) Pumpkin leave *(Telfaria occidentialis*) Cucumber (*Brassica Oleracea*), Garden egg (*Solanum melongena*), pepper (*Capsicum anneum*), Uziza (*Piper guineense*) Utazi (*Gongronema*

Latifolium), Okazi (*Gnetum, africanum*), and water leaf (*Talinum triangularis*) were purchased from three selected local market namely, releave market Eke Omar and Umuoapu market all in Owerri Metropolis. Total number of 100 samples were collected, 50 from farms and 50 from markets. The samples were collected and transported to the laboratory in sterile labeled populathene bags for examination of parasites.

Sample Analysis

The parasitic contamination of vegetables was analyzed using three key methods: normal saline wet preparation, the modified EPA method for the identification of helminth eggs, and the modified Ziehl-Neelsen staining technique. These methods enabled the identification of parasitic stages, including helminth ova, larvae, cysts, and oocysts, as well as protozoan parasites [7].

Statistical Analysis

Data were analyzed using Chi-square tests to compare prevalence across locations and methods, with a significance level set at $p < 0.05$.

RESULTS

Table 1: Prevalence of intestinal parasites in the selected farm in Owerri metropolis

Farms	Numb. of parasite seen (%)	Numb. of parasite not seen (%)	Prevalence	X^2	P-value
Chibu	8 (25.8)	7 (36.8)	53.3%		
Onyeanaekiri	13 (41.9)	7 (36.8)	65%	3000	0.23
Hope nana	10 (32.3)	5 (26.4)	66.6%		
Total	31	19	62%		

The result on table 1 shows that Onyeanaekiri has the highest prevalence of 41.9% which was followed by Hope nana (32.3%) and 25.8% for Chibu. P.value calculates 0.05. P> 0.05, therefore, is no significant relationship between parasitic infection of fresh vegetable and infection rate.

Table 2: Prevalence of intestinal parasites in the three selected markets in Owerri metropolis

Market	Numb. parasite seen (%)	Numb. of parasite not seen (%)	Prevalence	X^2	P-value
Eke Umar	8 (33.3)	7 (26.9)	53.3%		
Releave	7 (29.2)	8 (30.8)	46.6%	600	0.199
Umuapu	9 (37.5)	11 (42.3)	45%		
Total	24	26	48%		

Table 2 show the prevalence of intestinal parasites in the three selected markets in Owerri metropolis which shows that Umuapu has the highest number (37.5%) followed by Eke Umar (33.3) while releave (29.2-%). The p. value of X^2 calculated (6000) at df 4 = 0.199. This is greater than the X^2 value 0.05, therefore, there is no significant relationship between the intestinal parasites and the infection rate.

Table 3: Prevalence of intestinal parasites in the selected vegetable in Owerri metropolis

Detected parasites	Okro	Water leaf	Tomatoes	Cucumber	Uzazi	Utazi	Okra	Pumpkin leave	Pepper	Garden Egg	Total
Ascaris Lumbricoides	0	2	1	0	0	2	0	3	1	1	10
Enterobius vermicularis	-	-	-	-	1	1	-	1	-	-	3
Trichuris trichiura	1	2	0	0	0	0	0	2	0	1	6
Strongyloides Stercoralis	0	3	0	0	0	0	0	10	0	0	13
Hookworm	0	4	2	0	0	0	0	10	0	0	16
Schistosoma haematoboium	1	0	0	0	1	0	0	0	0	0	2
Fasciola Hepatica	0	0	0	0	2	0	0	0	0	0	2
Taenia species	0	0	0	0	0	0	1	0	0	0	1
Balartidium coli	1	0	0	0	1	0	0	0	0	0	2
Total	3	11	3	0	5	3	1	26	1	2	55

A total of 55 intestinal parasites were identified, with notable occurrences across different vegetable types. Hookworm was the most prevalent parasite, with 16 detections, followed by *Strongyloides stercoralis* (13 detections) and *Ascaris lumbricoides* (10 detections). Other parasites detected included *Trichuris trichiura, Enterobius vermicularis, Fasciola hepatica, Taenia species, and Balantidium coli*, each contributing to the overall parasite burden. The distribution of parasites varied among the vegetables tested, with pumpkin leaves showing the highest level of contamination at 26%, followed by water leaf (11%) and ukazi (5%).

Table 4: The number and percentage of intestinal parasites detected in different methods employed

Farm/ Market	Numb. of parasite seen (%)	Numb. of parasite not seen (%)	Prevalence	X^2	P-value
Wet Preparation	23 (41.8)	27 (60.0)	46%		
Sedimentation	32 (58.2)	18 (40.0)	64%	2.000	0.157
Total	55	45	55%		

Table 4.4 shows the number and percentage of intestinal parasites detected in different methods employed, which shows a total percentage of 55%. Sedimentation technique has the highest percentage (58.2%) while wet preparation (41.8%). The p.value of x-calculated

(2.000) at df 1 = 0157. This is greater than, the X^2 value 0.05, (accepted level of significance). Therefore, there is no significant relationship between the intestinal parasites and infection rate.

DISCUSSION

The detection of intestinal parasites in vegetable are indicative of the fecal contamination from human and animal waste. As in many tropical countries, intestinal parasites are widely distributed in Nigeria not only due to the favourable climatic condition for the survival and dissemination of the parasites but also due to the unsanitary conditions that facilitate fecal pollution of water, food stuffs and soil [8].

Out of the 100 samples of vegetable examined 50 each was collected from the farms and markets respectively. Our findings revealed that vegetable sold in Umuapu has the highest number (37.5%) followed by Eke Umar (33.3%) and releave market (29.9%) although, this differs with that in Jos from four selected markets with contamination rate of 60% from Gada Biu Market, building material market 40%, Auguwman soya garden with 30.0% and Kwararafa market with 15.9%, this shows that one in every two samples vegetables was contaminated. It is however greater indication that much care should be taken in handling vegetable before consumption to prevent the deleterious harmful effect to human health [9].

Table 3 shows that ten (10) different types of intestinal parasites were isolated. The prevalence of the individual species of parasites are in the following order, Hookworm (16%), *Strongyloides Stercoralis* (13%), *Ascaris lumbricoides* (10%), *Trichuris trichura* (6%), *Enterobius vermicularis* (3%) while *Fasciola Hepatica*, *Schistosoma haematobium* and *Balantidium coli* have (2%) and *Taenia species* have (1%). Out of these only Hookworm are present in all the three markets. The highest contaminated vegetable was pumpkin leaves (27%), followed by water leaf (12%), utazi (6%), tomato (3%), while ukazi, garden egg and uziza(2%)respectively, okra and pepper (1%)respectively. This highlights the need for heighten sanitation measures. A recently recognized *Strongyloides Stercoralis* strain was report to produce high levels of toxins that can cause kidney damage as well as septicaemia or blood poisoning. The symptoms can include diahrrea, chills, headaches and high fever and in some cases the infection can lead to death even with medical intervention [10] [11] [12]. This is more reason why the vegetables, farms and market places should be keep clean for the good health of the general public which will inturn reduce the attendance to health facilities and reduce the burden on health service providers.

However, *Schistosoma haematoboium* being the most prevalent schistosomiasis. It is not only found in Africa and the Middle East but it is also one of the leading parasitic infection in humans [13] [14] [15]. Although it was not the most prevalent in this study, but presence of the parasite poses substantial risk in our environment.

Taenia species is prevalent in Africa, some parts of Eastern Europe, the Philippines, and Latin America. This parasite is found anywhere where beef is eaten, including countries such as the United States, with strict federal sanitation policies.

In the US, the incidence of *Taenia species* infection is low, but 25% of cattle sold are still infected. The total global infection is estimated to be between 40 and 60 million. It is most prevalent in Sub-Saharan Africa and the Middle East [16]. This finding from this study aligns with the US report of low incidence of *Taenia species.* This study only recorded one occurrence in the sample vegetables. The low prevalence may be due to the items used which were vegetables but according to the US report higher rate of 25% were found in cattle. So although there is a general report of high rate of the infection in Sub-Sahara Africa where Nigeria is domicile, we must consider the subject being investigated.

CONCLUSION

Freshly eaten vegetables should be considered a potentaial risk for contacting parasites, particularly protozoa in Owerri Imo State. Fifty five percent (55%) of the entire vegetable examine were contaminated with hookworm as the most prevalent of the ten parasites isolated. There is therefore a need for safety practice in planting, harvesting, storage and proper handling of vegetables.

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