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Prevalence of Intestinal Parasites in Commonly Consumed Vegetables in ONELGA, Rivers State

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Abstract:
Leafy vegetables are important diet to the Niger Delta people. It is rich in dietary sources of various immune-boosting natural chemicals which protect human health against diseases. However, it could also be a medium through which humans can acquire infections with human intestinal helminths if taken without observing proper hygiene. This study aimed to ascertain the status of helminth parasites on leafy vegetables cultivated and sold in five (5) rural communities of Onelga. A total of 300 samples of leafy vegetables were purchased randomly across the markets, and parasitological analysis of the samples was done using sedimentation and centrifugal techniques. results of the study revealed a 40% prevalence of contamination of leafy vegetables with various parasite species. Parasites detected were Ascaris lumbricoides, Trichuris trichiura, Giardia lamblia, Entamoeba histolytica, and Hookworm species. Ascaris lumbricoides was the most frequently observed parasite species detected from the study. Higher intensity of contamination with 58.3% was observed in Obirikom community. The monthly distribution of parasite species observed showed that July had higher contamination of 28.6%. Results from seasons show wet season recorded a higher prevalence of 55.7%. Thus, this survey revealed that leafy vegetables cultivated and sold for human consumption could be a risk of intestinal helminth infections. Adequate sanitary measures of washing with water and common household salts should be employed to reduce the load of parasites before cooking and consumption.

Introduction:
In recent times, the populace amongst the Niger Delta Region discovered potent nature of leafy vegetables as one of the most important foods in the human diet, which is rich in phytonutrients, vitamins and proteins, minerals and fibre. These phytonutrients or phytochemicals from leafy vegetables protect human health from several diseases. It reduces the risks of stroke associated with cardiovascular diseases and depression associated with stress. It has also been proven that regular intake of leafy vegetables strengthens the human immune system by reducing inflammation, preventing DNA damage, slowing cancer cell growth and promoting healthy ageing (Vishvakarma et al., 2023). According to Bekele et al. (2017), Kadiene et al. (2023), it is recommended that an individual consume at least 400g of vegetables per day. Leafy vegetables have been a vibrant and diverse part of plants, and because of their culinary versatility and nutritional value, they create high demand amongst consumers, thus high cultivational interest amongst farmers has also continued to increase. There is a high rate of cultivation and consumption of leafy vegetables amongst the Niger Delta populace. And the presence of leafy vegetables in markets throughout the months of the year, from January to December, inclusive of dry and wet seasons, is available. Oladele (2011) opined that the successful cultivation of leafy vegetables even in the dry season is made possible with the use of untreated organic fertiliser and the use of irrigation water. Abe et al. (2016) also stated that in Nigeria use of sewage-contaminated water for irrigation is a common practice that has made the cultivation process possible.

However, due to an unhealthy environment for cultivation, leafy vegetables can be contaminated with human pathogenic organisms and could be a vehicle for the transmission of food-borne parasitic pathogens, especially the

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human gastrointestinal parasite infections which is a risk factor from cultivation practices with use of night soil and poor handling processes (Omowaye & Audu, 2012). Poor human behavioural disposition of indiscriminate defecation practices within the farm lands where leafy vegetables are cultivated could also prove risk factor for contamination. Several reports of defecation in open lands have proven to enhance the prevalence and survival of human health parasites (Klapec & Boreck, 2012; Odikamnoro et al., 2013). A report in 2021 by the United Nations Children's Fund (UNICEF) said open defecation systems still exist despite several interventions and efforts to curb the menace. And is a major contamination of our environment, impacting negatively on groundwater, polluting underground water sources-spreading into lakes, rivers and soil, thereby creating an environment totally unfit and unhealthy for the cultivation of leafy vegetables, which are an important source of healthy food for human health. According to Uneke and Udegbunam (2015) that contamination of leafy vegetables with gastrointestinal parasites arises from poor hygienic practices related to cultivation and harvesting. Consequently, according to Maikai et al (2019), soil is a major factor for leafy vegetable contamination, and indiscriminate disposal of human waste can negatively impact soil, creating an enabling/suitable environment for parasitic organisms to thrive. Human intestinal parasites are soil-related. Their development, survivability and transmission depend on the soil environment.

Intestinal parasites are parasites that live most preferably in the digestive tract of humans. They are medically important helminth and protozoan organisms. They cause inflammation of the small and large intestine, leading to pulmonary lesions, rectal bleeding, and obstruction of the respiratory and intestinal tract. Other pathogenicity includes epigastric pain, liver abscess, amoebic dysentery, diarrhoea, vomiting, abdominal pain, loss of appetite, and retard growth in children (Rostamin et al., 2016; Bartosova et al., 2021).

Humans acquire infections with intestinal parasites by ingesting the embryonated ova, cysts, or larvae attached to the leafy vegetables through eating undercooked or improperly washed contaminated leafy vegetables (Sahira & Al-Abboodi, 2023). Infection can also lead to a severe negative impact on human health. Global estimates of millions in tropical and sub-tropical areas account for the highest Disability Adjusted Life Years (DALYS), which are years of life lost due to mortality (YLLs) as a result of human intestinal parasite infections (HIPs), and years lived with morbidity (YLM) associated with HIPs (Richard & Ambareen, 2010). School-age children and farmers are mostly at risk of these infections, and it is considered the leading cause of sickness, school absenteeism, and healthy life years lost. Thus, this suggests the adverse effects of intestinal parasite infection on the economic productivity of individuals, family and the nation as a whole (Federal Ministry of Health, 2013).

This survey therefore seeks to investigate the prevalence of these parasites on leafy vegetables cultivated and consumed within our locality, and also to ascertain their intensity of occurrence compared with seasonal differences and also to proffer a solution on how best to use simple home practices of washing to reduce parasite load on the vegetables before consumption.

Methodology

Study area:

The research was conducted in Ogba/Egbema/Ndoni Local Government Area of Rivers State, Nigeria. Popularly known and called Orashi of the Niger Delta Region. Onelga is a host of the Nigeria Agip Oil Company (NAOC). The sampling for the research was done in five (5) rural markets where leafy vegetables are sold. Precisely, Oboh, Obie, Obirikom, Ebogoro and Okpurukpuala communities. The criteria for the selection of these markets are due to the fact that the majority of the people depend on these rural dwellers for the supply of fresh vegetables.

The people of the study area are agriculturists. Fishing and farming are their primary occupation. Their sanitary disposition is inadequate to the standard of the World Health Organisation. People still dump waste indiscriminately, with open defecation practices observed amongst the dwellers. There are little to no sanitary facilities situated within the markets, and an inadequate water supply is lacking.

Parasitological Analysis**:**

Sampling was carried out monthly in each of the study areas for 12 months, between May 2024 and April 2025. From the study markets, samples of vegetables were purchased randomly from five (5) different vendors. From each vendor, two (2) strands of the leafy vegetables were taken out of the bunch. This was done during the early hours of

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the day, between 7:30am-9:00am in the morning, when leafy vegetables are still moist. Each sample purchased are stored individually in a sterile white buckets, labelled appropriately and transported to the laboratory for analysis.

- Treatment: simple house-hold method of analysis to disengage parasitic stages from leafy vegetables commonly consumed was adopted. This method was adopted to check how contaminated vegetables can be treated in an individual home to reduce parasite loads for safe consumption. At the laboratory, the samples were treated with saline (250ml of 5% formol saline). Treatment entails soaking of the samples to disengage parasitic stages (ova, cysts, and larvae) from the vegetable samples. Soaked samples were allowed to stand for about 1hour, after that the vegetable samples were carefully removed with the aid of a forcept. Suspension was further allowed to stay for more 30minutes and then strained to remove debris.
- Centrifugation and sedimentation: after straining of the suspension, the solutions were centrifuged at 2,500 rpm (Revolutions Per Minute) for 10minutes. The supernatant was discarded, and sediments recovered from the centrifuged solution were checked for parasitic stages using X10 and X40 objectives. This was done using a pasteur pipette to drop the sediment on the microscopic slide with Lugol's Iodine added for a clear view of the parasites.
- Identification: identification was adopted by Cheesbrough (2009). It was based on the morphology of the parasites.

Data Analysis:
Data obtained from the research were analysed using a descriptive analysis.

Results
Results from this survey revealed the percentage intensity of contamination of leafy vegetables (*Telfaira occidentalis*) from different study areas, prevalence of various species of protozoa and helminths, frequency of parasite species distributed across the sampling months and frequency of parasite species occurrence observed in seasons across the sampling months.

Out of 300 strands of leafy vegetables sampled from the study areas, which are Obeh, Obie, Ebogoro, Obirikom and Okpurukpuala, 120 (40.0%) were contaminated with various species of parasites of human medical importance, with higher contamination of 58.3% observed from the Obirikom study area (Table 1).

Species of parasites detected from the study were *Ascaris lumbricoides, Hookworm species, Trichuris trichiura, Entamoeba histolytica and Giardia lamblia* (Table 2). From the detected species, the result revealed that *Ascaris lumbriciodes* was most frequently observed with 40.0% prevalence, followed by *Entamoeba histolytica* with 27.2% prevalence, while 12.9%, 11.4% and 8.6% prevalence were observed from *Giardia lamblia, Trichuris trichiura* and *Hookworm species* respectively. Monthly distribution of parasite species observed during the study in (Table 3) showed month of July had higher parasite occurrence of 28.6%, followed month of April with 17.2%, 14.2% from month of May, November with11.4%, June 10.0%, October with 8.6% while 2.9% were recorded from the month of August, September, and March. Least occurrence of 1.4% were observed in Februrary while December and January recorded zero occurrence.

Frequency of parasite species distribution from dry and wet season across the sampling months (Table 4), revealed that wet season recorded higher prevalence of 55.7%, while 44.3% prevalence were recorded in dry season. Result further revealed that *Ascaris lumbricoides* and *Entamoeba histolytica* were most frequently observed amongst other species, both in the dry and wet season. However, there were no significant differences in the occurrence of parasites across seasons at $P < 0.05$

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Table 1: Overall Intensity of Contamination of samples across the Study Areas

Study Areas	No. of sample Examined (N=5g)	No. of Samples Infected	(%) Intensity of Contamination
Oboh	60	21	35.0%
Obie	60	18	30.0%
Ebogoro	60	20	33.3%
Obirikom	60	35	58.3%
Okpurukpuala	60	26	43.3%
Total =	**300**	**120**	**40.0%**

Table 2: Distribution of Parasite Species Observed Across the Study Areas

Study Areas	*Ascaris lumbricoides*	*Trichuris trichiura*	*Hookworm species*	*Giardia lamblia*	*Entamoeba histolytica*
Oboh	5	1	1	1	2
Obie	4	2	0	0	2
Ebogoro	4	0	2	2	6
Obirikom	7	3	2	4	4
Okpurukpuala	8	2	1	2	5
Total=	**28(40.0%)**	**8(11.4%)**	**6 (8.6%)**	**9(12.9%)**	**19(27.2%)**

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Table 3: Monthly Distribution of Parasite Species Observed During Sampling

Study Areas	Isolated Parasites	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan.	Feb	Mar.	Apr.
Oboh	*AS*	0	1	2	0	0	0	1	0	0	0	0	1
	T.T	0	0	1	0	0	0	0	0	0	0	0	0
	HK	0	0	0	0	0	0	1	0	0	0	0	0
	EN	1	0	1	0	0	0	0	0	0	0	0	0
	GL	0	0	1	0	0	0	0	0	0	0	0	0
Obie	*AS*	1	0	2	0	0	0	0	0	0	0	0	1
	T.T	1	0	0	0	0	0	0	0	0	0	0	1
	HK	0	0	0	0	0	0	0	0	0	0	0	0
	EN	0	1	1	0	0	0	0	0	0	0	0	0
	GL	0	0	0	0	0	0	0	0	0	0	0	0
Ebogoro	*AS*	0	1	0	0	0	1	1	0	0	0	0	1
	T.T	0	0	0	0	0	0	0	0	0	0	0	0
	HK	0	0	0	0	0	0	1	0	0	0	0	1
	EN	1	0	1	0	0	0	2	0	0	0	0	2
	GL	0	0	0	0	0	1	1	0	0	0	0	0
Obirikom	*AS*	2	0	1	1	0	2	0	0	0	0	0	1
	T.T	0	0	2	0	0	1	0	0	0	0	0	0
	HK	0	0	0	0	0	0	1	0	0	0	0	1
	EN	1	0	1	1	0	0	0	0	0	0	1	0
	GL	0	0	2	0	0	0	0	0	0	0	1	1
Okpurukpuala	*AS*	1	2	2	0	1	1	0	0	0	0	0	1
	T.T	0	0	1	0	1	0	0	0	0	0	0	0
	HK	1	0	0	0	0	0	0	0	0	0	0	0
	EN	1	2	1	0	0	0	0	0	0	1	0	0
	GL	0	0	1	0	0	0	0	0	0	0	0	1
Total	=	**14.2 %**	**10.0 %**	**28.6 %**	**2.9 %**	**2.9%**	**8.6 %**	**11.4 %**	**0.0 %**	**0.0 %**	**1.4 %**	**2.9 %**	**17.2 %**

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Keys*: AS=Ascaris lumbricoides*
T.T=Trichuris trichiura
HK=Hookworm species
EN= Entamoeba histolytica
GL=Giardia lamblia

Table 4: Frequency of Parasites Observed from the two Seasons

Observed parasites	Wet season (% Frequency)	Dry season (% frequency)
Ascaris lumbricoides	18	10
Trichuris trichiura	5	3
Hookworm species	2	4
Giardia lamblia	3	6
Entamoeba histolytica	11	8
Total =	**39(55.7%)**	**31(44.3%)**

Discussion:
Intestinal parasites of protozoa and helminths in recent times have been observed in many studies to be most commonly associated with food-borne infections (Eze et al., 2024). Their prevalence in an area indicates a significantly high public health hazard (Christiana et al., 2022). Across Nigeria, several studies have reported on the prevalence of parasites on edibles, where very high contamination rates are related to lack of infection awareness, poor behavioural habits towards sanitary processes and lack of adequate water and sanitary facilities within the foci (Hassan et al., 2017).

This study aimed to ascertain the prevalence of Intestinal parasites on leafy vegetables cultivated and consumed within our locality, and also to ascertain the intensity of contamination compared with seasons.

In this study, leafy vegetables (*Telfaire occidentalis*) were sampled from different locations where they are cultivated and sold in larger quantities. Findings revealed, 40.0% of the leafy vegetable samples screened were contaminated with various species of protozoa and helminth parasites. This higher contamination rate corroborates with similar reports within Nigeria and other parts of the world, where leafy vegetable samples screened were found to be contaminated with parasites (Simeon-Oke et al., 2014; Kadiene et al., 2023). Leafy vegetable contamination can likely arise from farm practices. Practices that could significantly pose a risk factor for contamination. Farm practices that involve the use of irrigation water, contaminated night soil and contaminated animal dungs as fertilizer, and poor handling practices amongst farmers (Su et al., 2012). According to Paller et al (2022) that poor hygienic practices amongst farmers, inadequate/lack of access to quality water supply, relating to processes of handling and contaminated environment where leafy vegetables are cultivated, could be a contributing factor to contamination. Olyaeri and Hajivandi (2013) stated that proper washing with sufficient clean water from the place of harvesting to the markets can efficiently reduce the contamination load of the leafy vegetables.

From the study, it is evident that human intestinal parasites of medical importance, like *Ascaris lumbricoides* and *Entamoeba* histolytica, were the most frequently observed parasites. It was observed that they were recovered in each of the five (5) study areas. This agrees with earlier reports of Idahosa (2011) and Abe et al (2016), who reported *Ascaris lumbricoides* as most prevalent, while Sahira & Al-Abboodi (2023) reported *Entamoeba histolytica* as the most prevalent parasite observed during examination. Over the years, there have been reports of contamination of Ascaris lumbricoides on farmlands and dumped sites. It is known to be the principal geohelminth that contaminates edible vegetables (Odikamnoro et al., 2013). This is because the soil ecology provides a suitable environment at all times for their development, survival and transmission processes. Their prevalence also shows they are cosmopolitan in distribution, and their robust and resilient eggs have the tendency to survive long-term environmental challenges right in the soil for a very long period of time, as long as the ecological conditions are favourable within the foci.

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The monthly distribution of parasites from May 2014 through April 2025 shows that higher contamination occurs in months of rain than in months of dry. Revealing that the wet season had a higher prevalence of parasites than the dry season. Thus, this reports corrobarates with (Hassan et al., 2017) who observed and reported high level of intestinal parasites contamination on wet season. In Nigeria, several reports show climatic factors contribute greatly to the higher prevalence of geohelminths. This revealed that soil moisture sustains parasites from dessication, particularly larva. Moisture content of soil provides a conducive environmnent for the survival, and development of parasites for a long period of time, and also enables the transmission process of these parasites. According to Nwoke et al (2013) that this soil moisture is a result of rainfall.

Conclusion

In the Niger Delta region, consumption of leafy vegetables is crucial for human health. Daily recommendation intake is because they contain anti-inflammatory, anti-oxidative and anti-hypertensive properties and have the tendency to fight off diseases by strengthening the immune system. This study thus has revealed that these important edibles can also be a vehicle for the transmission of human pathogenic organisms such as *Ascariasis, Trichuriasis, Hookworm infection, Giardiasis, and Entamoebiasis.* There is therefore a need for adequate washing and cooking of the leafy vegetables before consumption. Based on the study, Sodium Chloride (a common household salt) must be applied together with adequate water during washing to reduce parasite load.

There is also need for community sensitization programme, which should incorporate the populace with adequate education to maintain good hygiene practices. The health implications of the prevalence of these parasites should also be made known to them. Government, private and well-meaning citizens should assist to provide improved sanitary facilities, inclusive of potable water supply, and that should be made accessible to farmers and leafy vegetable vendors.

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