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Full Length Research Article

DISTRIBUTION DYNAMICS OF INTESTINAL PARASITES ON VEGETABLES SOLD IN EGAH MARKET, KOGI STATE, NIGERIA

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ABSTRACT
For good human health, substantial amount of vegetables are required in diet. The vegetables must be of good quality, fresh and free from parasites and other pathogens. Consumption of contaminated vegetables can cause infections instead of promoting good health. It is essential that vegetable farmers, distributors, sellers at local markets and final consumers should ensure the safety of fresh vegetables. Aim: This study examined 105 vegetable samples by sedimentation method for intestinal parasites, which were sold in five selected locations within Egah Market, Kogi State, Nigeria. Methods: The samples comprised of cabbage (15), carrot (25), cucumber (25), pumpkin (20), and spinach (20). About 25g of each vegetable sample was weighed into 225mL of normal saline and washed gently using the hands with sterile gloves. The wash water was kept for 3-6 hr. to sediment, and the supernatant was discarded until about 15mL was left, which was transferred into a tube and centrifuged at 3000 rpm for 5 min. The final sediment was examined for parasite using the light compound microscope. Results: Seventy-nine (79) out of the 105 vegetable samples had parasites, giving an overall prevalence of 75.2%. Individual prevalence of different parasites identified were *Ascaris lumbricoides* 71(67.6%), hookworms 11(10.5%), *Trichuris trichiura* 10(9.5%), *Schistosoma mansoni* 5(4.8%), *Strongyloides stercoralis* 5(4.8%), and *Entamoeba histolytica* 4(3.8%). The order of parasitic contamination of the vegetable types was carrot 21(84.0%), cucumber 20(80.0%), spinach 15(75.0%), cabbage 11(73.3%) and pumpkin 12(60.0%). *Schistosoma mansoni* was significantly found in cabbage and pumpkin samples (P=0.015). There were highly significant occurrences of the parasites at wholesale points compared to retail points within Egah Market. Conclusion: The fresh vegetables sold within the market are unsafe if eaten raw, or in salad. Such vegetables will require proper washing with clean and germ-free water, peeling or cooking before consumption to avoid parasitic infections.

Keywords: Intestinal parasites, *Ascaris lumbricoides*, vegetables, contamination, infection, safety, Egah Market

INTRODUCTION

Vegetables are attractive when they are fresh. They can be cultivated in small gardens for family consumption or in bigger farms and sold in different markets. Most of the fresh vegetables in Nigeria are sold directly as harvested from the farms, without preliminary washing, cleaning or processing. Vegetables contain essential nutrients and mineral for good health (Bishop and Yohanna, 2018). However, when these vegetables are poorly processed, they can serve as vehicle for transmission of parasites among other pathogens (Beiromvard *et al.*, 2013; Eraky *et al.*, 2014; Nyirenda *et al.*, 2021), and pose a great deal of risks to human health (Bishop and Yahanna, 2018). Practices such as application of untreated human and animal wastes on vegetable farms, as well as the use of polluted water for irrigation contaminate vegetables and make them unsafe (Ofor *et al.*, 2009). It is very necessary that vegetables should be cultivated, stored and distributed under safe and hygienic methods. Irrigation farming system had become necessary due to high demands of vegetables all year round. Consequently, more attention had been given to constant supply of vegetables with little or no attention on their safety for human consumption. Whenever vegetables are bought, they must be properly washed with clean and germ-free water, and/or cooked before consumption (Yahaya and Bishop, 2022) to prevent infections. Hence, this study was focused on assessing the parasitic contamination of fresh vegetables and their safety for human consumption.

MATERIALS AND METHODS

Study area and item

This study was conducted in Egah Market, located in Idah Local Government Area (LGA) of Kogi State, Nigeria. Egah Market is a major market on the east bank of the lower Niger River. It is a five-day market, where rural farmers sell fresh vegetables and fruits brought directly from their farms. Some farmers have regular wholesalers and retailers they sell their farm produces to. People in Idah LGA are mainly engaged in farming and fishing occupations, given the nature of fertile soil and confluence of the Niger River and Benue River in Kogi State. A total of 105 vegetable samples were collected; which comprised of 15 cabbage, 25 each of carrot and cucumber, 20 each of pumpkin and spinach. Samples were bought at four different retail points and one wholesale point within the market. The samples were put in separate sterile low-density polythene bags and taken for parasitic examination at the Department of Science Laboratory Technology, Federal Polytechnic, Idah.

Parasitic examination

The procedure by Bishop and Yohanna (2018) was applied in processing the vegetable samples. Twenty-five (25g) of each fresh vegetable sample was weighed into 225mL of sterile normal saline and washed gently with hands (in sterile hand gloves). Then the mixture was gently shaken, before discarding the sample. The wash water was allowed to stay for 3-6 hr., after which the supernatant was discarded and the sediment was further concentrated by centrifugation at a speed of 3000 revolutions per minute (rpm) for 5 minutes. The final supernatant was then discarded, then the residue was transferred unto a clean, grease-free glass slide and a cover-slip was applied. The wet mount was

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examined under 10X and 40X objectives of light compound microscope for detection and identification of possible parasitic ova, cysts and larvae. Coloured parasitological atlas by Chiodini *et al.* (2001) was used as a guide during the identification.

Statistical analysis

Using the IBM SPSS version 23, data obtained (type of vegetables and sale points) were subjected to Chi Square analysis at 95% confidence interval. The results were simplified in a chart and tables.

RESULTS

The overall parasitic contamination of the fresh vegetables examined was 79(75.2%s), while 26(24.8%) of the samples had no parasites (Figure 1).

Ascaris lumbricoides ova were the most prevalent (67.6%), followed by ova of hookworms (10.5%) and ova of *Trichuris trichiura* (9.5%). There was 4.8% occurrence each of the ova of *Schistosoma mansoni* and larvae of *Strongyloides stercoralis* on the vegetables; while *Entamoeba histolytica* cyst (3.8%) was the least occurring parasite (Table 1).

Carrots had the highest parasitic contamination (84.0%), followed by cucumber (80.0%) and Spinach (75.0%), but pumpkin was the least contaminated vegetable (60.0%). Only the ova of *Schistosoma mansoni* were statistically associated with cabbage (P = 0.015) as shown in Table 2.

In Table 3, parasitic contamination of the vegetables were higher at wholesale point (100.0%) and retail point-1 (85.0%), with a statistical significant association (P = 0.004). Vegetables obtained from the wholesale point significantly associated with hookworms, *Strongyloides stercoralis, Entamoeba histolytica* and *Trichuris trichiura* (P ≤ 0.05).

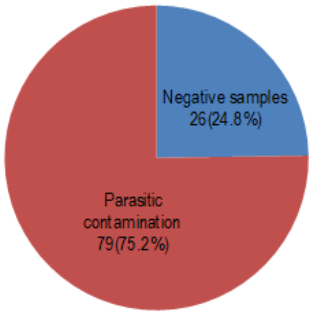

Figure1: Overall parasitic contamination of fresh vegetables sold in Egah Market, Kogi State, Nigeria.

Table1: Prevalence of Intestinal Parasites on Fresh Vegetables Sold in Egah Market, Kogi State, Nigeria

Intestinal Parasite n=105	Number positive (%)
Ascaris lumbricoides	71(67.6)
Hookworms	11(10.5)
Trichuris trichiura	10(9.5)
Schistosoma mansoni	5(4.8)
Strongyloides stercoralis	5(4.8)
Entamoeba histolytica	4(3.8)
Total	79(75.2)

Table 2: Distribution of Intestinal Parasites on Different Types of Vegetables Sold in Egah Market, Kogi State, Nigeria

Vegetable type	Number examined	Parasitic contamination No. (%)	*Ascaris lumbricoides* No. (%)	Hookworm No. (%)	*Trichuris trichiura* No. (%)	*Schistosoma mansoni* No. (%)	*Strongyloides stercoralis* No. (%)	*Entamoeba histolytica* No. (%)
Cabbage	15	11(73.3)	11(73.3)	0(0.0)	2(13.3)	3(20.0)	2(13.3)	0(0.0)
Carrot	25	21(84.0)	19(76.0)	3(12.0)	4(16.0)	0(0.0)	0(0.0)	1(4.0)
Cucumber	25	20(80.0)	18(72.0)	4(16.0)	3(12.0)	0(0.0)	0(0.0)	3(12.0)
pumpkin	20	12(60.0)	11(55.0)	1(5.0)	0(0.0)	2(10.0)	1(5.0)	0(0.0)
Spinach	20	15(75.0)	12(60.0)	3(15.0)	1(5.0)	0(0.0)	2(10.0)	0(0.0)
Total	105	79(75.2)	71(67.6)	11(10.5)	10(9.5)	5(4.8)	5(4.8)	4(3.8)
		χ^2=3.857, df=4, P=0.426	χ^2=3.230, df=4, P=0.520	χ^2=3.706, df=4, P=0.447	χ^2=4.228, df=4, P=0.376	χ^2=12.390, df=4, P=0.015	χ^2=6.143, df=4, P=0.189	χ^2=6.757, df=4, P=0.149

No. = number

Table 3: Distribution of Intestinal Parasites from Different Sampling Locations within Egah Market, Kogi State, Nigeria

Sale point	Number examined	Parasitic contamination No. (%)	*Ascaris lumbricoides* No. (%)	Hookworms No. (%)	*Schistosoma mansoni* No. (%)	*Strongyloides stercoralis* No. (%)	*Entamoeba histolytica* No. (%)	*Trichuris trichiura* No. (%)
RP-1	20	17(85.0)	17(85.0)	0(0.0)	1(5.0)	0(0.0)	0(0.0)	1(5.0)
RP-2	23	17(73.9)	17(73.9)	0(0.0)	1(4.3)	0(0.0)	0(0.0)	1(4.3)
RP-3	21	14(66.7)	14(66.7)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
RP-4	20	10(50.0)	10(50.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(5.0)
WP	21	21(100.0)	13(61.9)	11(10.5)	3(14.3)	5(23.8)	0(19.0)	7(33.3)
		χ^2=15.622, df=4, P=0.004	χ^2=6.333, df=4, P=0.176	χ^2=49.149, df=4, P=0.000	χ^2=6.261, df=4, P=0.180	χ^2=21.000, df=4, P=0.000	χ^2=16.634, df=4, P=0.002	χ^2=17.691, df=4, P=0.001

No. = number; RP = Retail point; WP =Wholesale point

DISCUSSION

Human meal is incomplete without vegetables! Though vegetables are indispensable for healthy meal (containing minerals, vitamins and water), it is important that emphasis should not only be laid on how succulent and fresh they appear, but also on their microbial safety for human consumption. This study uncovered a very high parasitic contamination of 75.2% on vegetable samples obtained from Egah Market. The vegetables were fresh and attractive to buyers, but contained various pathogenic parasites. Both the farmers and sellers may not be aware of the potential risks associated with their contaminated produces. Hence, a major precaution should be taken by the final consumers who may either eat the vegetable raw (or in salad). This finding agreed with 75.0% parasitic contamination of vegetables earlier reported by Bishop and Yohanna (2018) in Zaria, Kaduna State, Nigeria. However, a much lower parasitic contamination of vegetables (of 26.0%) was recently reported in Zaria by Yahaya and Bishop (2022). The high level of parasitic contamination of vegetables sold in Egah Market indicates the possibilities of use of raw water from the east bank of the lower Niger River for irrigation or pre-washing of vegetables immediately after harvest, before taking them to the market. This river runs through many countries, carrying various degrees of human and animal wastes and has received excess water leading to severe flooding of river banks in recent time. Such raw water is a repository for pathogens!

Ascaris lumbricoides, hookworms *and Trichuris trichiura* were the first, second and third most prevalent intestinal parasites on vegetables sold at Egah Market. Their presence on fresh vegetables is a direct indication of faecal contamination in nearby farms, usage of raw sewage as manure or natural disasters like flooding over vegetable farms (especially those along the river banks). Annual flooding is common in Kogi State, which is a confluence point for the two largest rivers in Nigeria. It is well known that ova of these three parasites are capable of withstanding harsh environmental conditions, and are able to persist for long in the soil (Bishop and Yohanna, 2018). Most often, *Ascaris lumbricoides* is well reported as the most common intestinal parasites on fruits and vegetables from different parts of the world (Gupta *et al.*, 2009; Shafa-ul-Haq *et al.*, 2014; Bekele *et al.*, 2017; Yahaya and Bishop, 2022).

Ova of *Schistosoma mansoni* on the vegetables indicated that faeces from intestinal schistosomiasis cases had been discharged around the farms or carried in raw water used for irrigation. The presence of *Schistosoma mansoni* on vegetables poses no harm when consumed because human infection occurs only via skin penetration after emergence of infective cercariae from *Bulinus* snails (as intermediate hosts). Also, ova of *Strongyloides stercoralis* hatch in the soil to give rise to rhabditiform larvae. The presence of rhabditiform larvae of *Strongyloides stercoralis* on the vegetables pose no harm to man, as infection is only via penetration of intact skin by the filariform larval stage. However, *Entamoeba histolytica* cyst on the vegetable remains a threat for acute amoebiasis. The cyst is resistant and persists in the environment (Bishop and Inabo, 2015).

Carrots and cucumbers were the first and second most contaminated vegetables with parasites. Carrots are produced below the soil, to which untreated human wastes might have been used as manure. Cucumber plants in most of the farms are allowed to run on the ground and the resulting fruits pick up parasites from the soil. Spinach and cabbage have large surface areas, which allow parasitic ova, cysts and rhabditiform larvae to stick or attached to them. Yahaya and Bishop (2022) attributed significant occurrence of parasites on leafy vegetable like cabbage, lettuce and spinach to their large surface areas for attachment by parasites.

Samples obtained at wholesale point significantly had more parasites than those obtained from retail points ($P \leq 0.05$). After vegetables are harvested from major farms, they are bought by wholesalers, who in turn resell to the retailers; then the final consumers buy in smaller quantities from the retailers. At the whole sale point, vegetables from different farms are piled up together. Hence, contamination from one farm will spread. However, some retailers conduct preliminary washing of the vegetables before sale to make them more attractive. This practice helps to reduce the parasitic contamination, but does not make the vegetable safe for immediate raw consumption. However, it is not uncommon to find the same wash water used repeatedly for different vegetables, making it turbid with possible high microbial load. The same wash water is sometimes not discarded, but used to sprinkle on the vegetables, especially during a hot day to keep them fresh, hydrated and prevent flaccidity. Such a practice is unhygienic and makes the vegetables unsafe!

Since vegetables are prone to contamination from myriad of sources like, untreated sewage, dried faecal debris carried by wind, polluted washed water, infested irrigation water, during flooding, transportation, handling, and even during sale within the market (Tefera *et al.*, 2015; Simon-Oke *et al.*,2014; Bishop and Yohanna, 2018; Simon-Oke *et al.*, 2020; Yahaya and Bishop 2022), a major precaution lies on the final consumers to ensure that vegetables purchased are adequately washed, peeled or cooked before eating them.

Conclusion

The overall prevalence of intestinal parasites on vegetables sold in Egah Market was 75.2%. *Ascaris lumbricoides* 71(67.6%), hookworms 11(10.5%) and *Trichuris trichiura* 10(9.5%) were the most prevalent parasites on the vegetables, compared *Schistosoma mansoni* 5(4.8%), *Strongyloides stercoralis* 5(4.8%) and *Entamoeba histolytica* 4(3.8%), which occurred less. Carrots, cucumbers and spinach were the most contaminated vegetables (with different parasites). There was a statistically significant association between the parasites and wholesale point. No vegetable that is bought either from the farm or market should be considered safe for direct raw consumption. It is important that one takes caution by proper washing, peeling and/or cooking of the vegetables before consumption.

REFERENCES

Beiromvard, M., Akhaghi, L., Fattahi Massom, S.H., Meamar, A.R., Motevalian, A., Oomazdi, H., Razmjou, E. (2013). Prevalence of zoonotic intestinal parasites in domestic and stray dogs in a rural area of Iran. *Preventive and Veterinary Medicine*, 109(1-2):162-167.

Bekele, F., Tefera, T., Biresaw, G., Yohannes, T. (2017). Parasitic contamination of raw vegetables and fruits collected from selected local markets in Arba Minch Town, Southern Ethiopia. *Infectious Diseases of Poverty*, 6(19):1-17.

Bishop, H.G. and Yohanna, A.Z. (2018). Contamination ofvegetables with geohelminths: prevalence, intensity and roles of hygiene practices in Samaru-Zaria, Nigeria. *International Journal of Academic and Applied Research*, 2(7):8-13.

Bishop, H.G. and Inabo, H. I. (2015). Incidence of *Entamoeba histolytica* in well water in Samaru-Zaria, Nigeria. *International Journal of Scientific Research in Environmental Sciences*, 3(1): 0016-0022.

Chiodini, P.L., Moody, A.H. and Manser, D.W. (2001). *Atlas of Medical Helminthology and Protozoology*, 4th ed. Churchill Livingstone, London, UK.

Eraky, M.A., Rashed, S.M., Nasr, M.E., El-Hamshary, A.N.S. and El-Ghannam, A. S. (2014). Parasitic contamination of commonly consumed fresh leafy vegetables in Benha, Egypt, *Journal of Parasitology Research*, 2014(Article ID 613960).

Gupta, N., Kahn, D.K., Santra, S.C. (2009). Prevalence of intestinal helminth eggs on vegetables grown in waste water-irrigated areas of Titagarh, Benghad, India. *Food Control*, 20: 942-945.

Nyirenda, S.S., Bukowa, K.M., Banda, W.R., Mbewe, J., Hamankolom, F., Banda, F., Kwenda, G., Munba, M. and Zulu, E. (2021).

Parasitic contamination of common vegetables sold in Lusaka, Zambia. *Journal of Food Quality and Hazards Control,* 8(2021):112-118.

Ofor, M.O., Okorie, V.C., Ibeawuchi, I.I., Ihejirika, G.O., Obilo, O.P., Dialoke, S.A. (2009). Microbial contamination in fresh tomato wash water and food safety consideration in South-eastern Nigeria. *Life Science Journal*, 6(3):80-82.

Shafa-ul-Haq, S., Maqbool, A., Javed, K.U., Yasmin, G., Sultana, R. (2014). Parasitic contamination of vegetables eaten raw in Lahore, Pakistan. *Pakistan Journal of Zoology*, 46: 130-135.

Simon-Oke, I.A., Afolabi, O.J. and Obimakinde, E.T. (2020). Parasitic contamination of water sources in Akure, Ondo State, Nigeria. *The Journal of Basic and Applied Zoology*, 81:50.

Simon-Oke, I.A., Afolabi, O.J., and Obasola O.P. (2014). Parasitic contamination of fruits and vegetables sold in Akure metropolis, Ondo State, Nigeria. *Researcher*, 6: 30-35.

Tefera, T., Biruksew, A., Mekonnen, Z., Eshetu, T. (2014). Parasitic contamination of fruits and vegetables collected from selected local markets of Jimma Town, Southwest Ethiopia. *International Scholarly Research Notices*, ID 382715.

Yahaya, O. and Bishop, H.G. (2022). Parasitic contamination of fresh vegetables sold in some major markets and farms in Zaria. *Science World Journal*, 17(1):130-133.