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Parasitic contamination of vegetables in some selected markets in Katsina Metropolis, North -Western Nigeria

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ABSTRACT

This study evaluated the prevalence of parasitic contamination of vegetables in Katsina Metropolis. Out of 180 vegetable examined 77 were found infected representing over roll prevalence of 42.7%. The highest prevalence was recorded in Ascaris lumbricoid nematode representing25% and 58% of total and infected samples respectively. The least prevalence rate was recorded in Ova of Hymenolepsis nana with 1.11% and 2.60% respectively. The Statistical significance difference was observed among the selected markets, with Kofarmarusa market having the highest contamination rate of 48.33% compared to others at p< 0.05. Lettuce had a high contamination ration rate of 60% as compared to spinach, cabbage and tomatoes. Our data demonstrated for the first time the importance of raw vegetables in a transmission of some intestinal parasites and highlight the role of raw vegetables in threatening public health in Katsina metropolis. Effective measures are necessary to reduce parasitic contamination of vegetables.

Keywords: Vegetable; Parasitic infection; Contamination, Market and Katsina metropolis

INTRODUCTION

Raw vegetables are an important constituent of a balance (healthy) diet. Vegetables can be contaminated with numerous pathogens such as bacteria, viruses and parasitic pathogens throughout the processes of planting to consumption [1-3].

Intestinal parasites serve as the one of the major public health problems especially in tropical and subtropical countries of the world [4]. Foodborne diseases associated with consumption of raw vegetables are on the increase in recent years. The consumption of raw vegetables is paramount important in the epidemiological role and transmission of parasitic foodborne diseases [5]. Various parasites that have been associated with vegetables includes species of protozoan and that of helminths, protozoan such as *Cryptosporidium sp, Giardia intestinalis, Cyclosopora cayetanensis* and *Toxoplasma gondii*, roundworms such as *Trichinella species* and *Anisakis species*, and Tapeworms such as *Diphyllobothrium species and Taenia species* [6]. These microscopic organisms can contaminate vegetable in a handful of ways, they might be present on the hands of field workers, marketers, buyers or people working in processing plants or in water used to pre–washed the product, during transport or packaging, they might also be present in the soil that the vegetables are grown, in animal manure used for fertilizer or in the water used as irrigate vegetables [6].

Epidemiological studies have also indicated that in areas of the world where parasitic diseases are endemic in the population are linked to areas where wastewater is highly utilized to irrigate vegetables and exhibited the habit of eaten raw vegetables; the consumption of wastewater irrigated vegetables without proper washing may lead to parasitic infection [7]. Many of the outbreaks due to parasitic contamination remain undetected or underestimated in developing countries which are associated to inadequate or even none existing systems for routine diagnosis and monitoring [8].

The most likely hypothesis of contamination is that it occurred before harvest while still on the plants in fields, either by contaminated manure, sewage irrigation water, and wastewater, but it has been noticed that vegetables can become contaminated by parasitic pathogens right from the process of planting to consumption, the extent of contamination depends on several factors that include, use of untreated wastewater and water supplies contaminated with sewage for irrigation, post-harvest handling and hygienic conditions of preparation in food services or home setting, the consumptions of such waste irrigated contaminated vegetables may also lead to parasitic infections[6].
Many studies have been done to evaluate the potential of raw vegetables in transmission of intestinal parasites in different parts of Nigeria and the world in general, such as in Jos, Nigeria [9], Alexandria, Egypt [10,11]; Tripoli, Libya[12], Riyadh, Saudi Arabia[5], Iraq [13], Tehran[14] and Philippines[15]. The results of these studies indicated different levels of parasitic contamination of raw vegetables. To our knowledge, there is no previously published data on the contamination of fresh leafy vegetables in Katsina. Therefore, this study provides important information to stakeholders on the potential contamination of vegetables in the area.

MATERIALS AND METHODS

Study Area

This study was carried out in Katsina metropolis which is located in Northern Nigeria and occupies 24, 192 squares kilometers. Katsina state lies between latitude (11^{0}00N and 13^{0} 30^{I} W) and longitude (60^{0} 30^{I} E). The people in the state are predominantly Hausa-Fulani; the great majority of them are settled cultivators and traders with a considerable number of nomadic cattle Fulanis, whose males' rear livestock while the females hawk locally prepared fermented milk in towns and villages.

Sampling areas

The vegetables were collected from central market, Kofar Kaura Market and Kofar Marusa Market all in Katsina metropolis. These markets were considered because the majority of the farmers from different local government areas of Katsina state convey their farm products for sale in these markets.

Samples collection

A total of 180 samples, 45 each of tomato, cabbage, lettuce and spinach were selected randomly from the above markets. Each vegetable sampled were placed in a separate nylon bag and labeled with a unique number and date of collection and then taken to Biology Department Laboratory of Umar Musa Yar'adua University Katsina for examination of parasitic contamination

Sample washing procedure

Approximately 200g of each vegetable were soaked separately in a round bottom plastic container with one liter of physiological saline to take apart the parasitic stages (ova, larvae, cysts, and oocysts) of helminths and protozoan parasites commonly presumed to be associated with vegetable contamination followed by vigorous shaking for 15 minutes. Vegetable sample was allowed to stand overnight to enable proper sedimentation. The supernatant was discarded leaving about 15ml at the bottom. 10ml of the deposited mixture was then transferred to a centrifuge tube and centrifuged at 3000 rpm for five minutes. After centrifugation, the supernatant was decanted while the deposit was re-suspended with 10% physiological saline and re-centrifuged, the supernatant was decanted and sediment was examined under the light microscope under10x and 40x objectives [12]. A drop of iodine was added to stain the cysts.

Statistical Analysis

Simple percentages and chi-square tests were carried out using EXCEL 2007 to compare the rate of contamination of vegetables among different vegetables. The differences were considered significant at $p< 0.05$.

TABLE 1: Site prevalence of parasitic contamination

Observed values

MARKETS	NO. OF VEGETABLES EXAMINED	NO. CONTERMINATED	PREVALENCE(%)	TOTAL
KofarMarusa Market	60	29	48.33	89
Central Market	60	25	41.67	85
KofarKaura Market	60	23	38.33	83
Total	**180**	**77**	42.78	257

Expected values

MARKETS	NO. OF VEGETABLES EXAMINED	NO. CONTERMINATED	PREVALENCE (%)	TOTAL
KofarMarusa Market	62.33	26.70	48.33	89
Central Market	59.53	25.50	41.67	85
KofarKaura Market	58.13	24.90	38.33	83
Total	**180**	**77**	**42.78**	**257**
P value =	**0.777109624**			

TABLE 2: VEGETABLE SPECIFIC PREVALENCE OF PARASITIC CONTAMINATION

Observed values

TYPES OF VEGETABLES	NO. EXAMINED	NO. COTERMINATED	PREVALENCE	TOTAL
LETTUCE	45	27	60.00	72
SPINACH	45	22	48.89	67
CABBAGE	45	17	37.78	62
TOMATOES	45	11	24.44	56
TOTAL	**180**	**77**	**42.78**	**42.78**

Expected values

TYPES OF VEGETABLES	NO. EXAMINED	NO. COTERMINATED	PREVALENCE	TOTAL
LETTUCE	50.43	21.57	60.00	72
SPINACH	46.93	20.07	48.89	67
CABBAGE	43.42	18.58	37.78	62
TOMATOES	39.22	16.78	24.44	56
TOTAL	**180**	**77**	**42.78**	**257.00**
P value =	**0.492738364**			

Table 3:SPECIES SPECIFIC PREVALENCE OF PARASITIC CONTAMINATION

Parasite	No. Examined	%of totalexamined(180)	% of the total positive(77)
Ascarislumbricoides	45	25.00	58.44
Segment of Cestode	44	24.44	57.1
Ova of Enterobiusvermicularis	26	14.44	33.7
Cyst of Entamoeba coli	20	11.11	26.00
Ova of Hookworm	13	7.22	16.88
Trichuristrichiura larvae	08	4.44	10.40
Ova of Hymenolepis nana	02	1.11	2.60
Total	**77**	**42.77**	**100**

Plate 1*: A. lumbricoid*

Plate 2: eggs *E. vermicularis*

Plate 3: *E. vermicularis*

plate 4: Segment of cestode

RESULTS AND DISCUSSION

Distinct parasitic stages can contaminate various foodstuffs. It is always easier to find how the food connected to the outbreak if the mode of transmission is suspected to be of the food-borne route. However, it is usually difficult to link an outbreak with a specific food item. Three vegetables and especially salads are an important route of transmission of intestinal parasites and have been considered an important source of foodborne outbreaks in developing countries [16].

Katsina is the capital city of katsina state; it has some agriculture fields. Therefore, the present study aimed at investigating some green vegetables that are frequently eaten raw for their possible contamination with parasites in Katsina metropolis. The result of parasitic distribution in some selected market revealed that out of the 180 vegetables examined 77 were found contaminated representing 42.70%. The highest prevalence was recorded in Kofarmarusa market representing 48.33% followed by the Central market with a prevalence rate of 41.70%. The least prevalence was recorded at Kofarkaura market representing 38.33% (Table 1).These high contaminations may be attributed to the fact that many farmers used manure as fertilizer. This finding was consistent with previous reports such as Saidin Egypt [10] and Daryaniin Iran [17] where the contamination rates were 31.70% and 29.00% respectively. It also tallies with several other findings in a different part of the world as documented such as [14,1,712,18]. Moreover, the previous study revealed that several factors may account for the high contamination [19]. Many types of vegetables purchase at market with high rate of parasitic contamination lead to various type diseases when consumed and are associated with inadequate sanitation, lack of access to clean potable water, poor domestic hygiene and market-related handling; are the cause of 80% of all infectious diseases such as Typhoid, Cholera, Hepatitis and Polio in the world. Moreover, they are responsible for 10-25 million of death each year among children under 5years age and the diseases are mostly transmitted via fecal-oral route, faecally contaminated water, food or soil [19]. In most cases, contamination is associated with water used for irrigation [20, 3].

Our finding disagrees with the low rate of contamination found in the Middle East (Riyadh, Saudi Arabia) with 16.20% [5] and Turkey with 6.30% [21] might be attributed to good environmental hygiene and proper disposal of waste.

Lettuce was found to have the highest prevalence rate of 60.00% followed by Spinach with a prevalence rate of 48.90% and 37.80% in Cabbage were as Tomatoes showed the least prevalence rate of 24.44% (Table 2). The high contaminations in lettuce and spinach compared to other vegetables may be attributed to their leafy nature which provides surface area for the parasitic eggs, cyst and oocyst to sticks. These results were in agreement with several other findings such as Abougrain inTripoli, Libya [5] who reported 96% of lettuce, Damen detected contamination of 40% in lettuce samples in Nigeria [7] and Said, reported the prevalence of 45% in Alexandria [10]. It is also in contrast with another study in Saudi Arabia which revealed lower contamination of 17% in lettuce [22]. The least prevalence in Tomato as revealed in this study may be attributed to the smooth nature of its surface. This agrees with the findings of Damen, which detected contamination of 20.00% of tomato in Jos, Nigeria [7] and another study in Accra, Ghana that detected contamination rate of 18.00% in tomato [23]. This variation in contamination rates may be due to the differences in shapes and surface of vegetables. Green leafy vegetable such as lettuce, cabbage and spinach have uneven surfaces that probably facilitate sticking of parasitic eggs, cysts and oocysts more readily either at the farm or when washed with contaminated water, and also vegetables with a smooth surface such as tomato had the lowest prevalence [7,10].

The high prevalence of *Ascaris lumbricoid* compared to other parasites as showed in this study (Table 3, Plate 1, 2, 3 and 4), agreed with several other findings such as[24,17,25]. The least prevalence recorded in Ova of *Hymenolepis*

nana also agreed with study in Gaza, Palestine which reported 2.5%*Enterobiusvermicularis*, 1.3% of *Trichuristrichura*and 2.5% of *Hymenolepis nana* [17].

The high prevalence is attributed to the fact that, One sixth of the human population is estimated to be infected by *Ascaris lumbricoides* or another round worm [26].

CONCLUSION

In conclusion, this study clearly showed high contamination in vegetables with parasites capable of causing diseases to human. There is, therefore, the need to plan effective control measure so as to prevent or minimize the public health problem of vegetables.

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