



Research Article

Survey of Intestinal Parasites from Vegetables Sold in  
Maiduguri Metropolis, Borno State Nigeria

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ABSTRACT

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Food-borne diseases are becoming a global public health problem, and perceived as a major health concern in Maiduguri metropolis. These play a significant role in human morbidity and economic loss. Vegetables are considered as a high-risk food because they do not required any heating hence; washing or cleaning prior to consumption has always been the case. The aim of this study is to detect the presence of intestinal parasites in vegetables samples collected from various areas in Maiduguri metropolis. A total of 200 vegetable samples of Carrot, Tomatoes, Lettuce and Garden egg was collected from custom market, tashan bama market, Monday market, Abbaganaram market and Bolori market . Each sample was immersed in a sterile universal container with 10ml of 10% normal saline and the filtrate was process by sedimentation concentration method. The result shows that the overall prevalence of parasitic contamination was (7.5%). Filariform larva of hookworm (3.5%) was the most frequent parasitic contaminant followed by egg of ascaris lumbricoides (2.5%) and larvae of Strongyloides stercoralis (1.5%). This finding reported a high rates of intestinal parasites contaminated vegetables to represent as the potential source of spreading intestinal parasites to human. Therefore, it is necessary for health authorities to educate consumers on the standard washing methods of vegetables prior to Consumption.

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INTRODUCTION

Intestinal parasitic infections are widely distributed throughout the world causing substantial intimidation to the public health, economy, and physical and cognitive

development particularly among children in developing countries. The poor personal hygiene, poor environmental hygiene, and poor health system commonly observed in developing countries make the prevalence to be highest

among these populations (Okayay *et al.*, 2004; Wegayehu *et al.*, 2013). The consumption of fruits and vegetables helps in protecting human body from a number of diseases by providing nutrients, vitamins, minerals, protein, and fibers. It could also have a positive impact on body-weight regulation and related conditions, including diabetes and hypertension. However, fruits and vegetables, especially, those that are consumed raw and or not properly washed, have been the major way for the transmission of human pathogens (Abougrain *et al.*, 2010; Idahosa, 2011).

Intestinal parasitic infection may be acquired in different ways such as consumption of contaminated fruits, vegetables, other food stuff, and water (Al-Binali *et al.*, 2006). Eating unclean, raw, or undercooked fruits. Vegetables is one of the means by which the transmission of intestinal parasitic infections is propagated (Slifko *et al.*, 2000). Fruits and vegetables act as vehicles for the transmission of parasitic infections. These could be due some various associated factors like planting, harvesting, transportation, storage, market chain, and even at home (Idahosa, 2011; Omowaye and Audu, 2012). Despite the fact that intestinal parasitosis is common in Maiduguri Town (Haileamlak, 2005; Mariam *et al.*, 2008), there are no studies conducted to assess the level of contamination of fruits and vegetables with parasites of medical and zoonotic importance in the present study location. If our target is to control the intestinal parasitic diseases, it is not enough to depend merely on the chemotherapeutic intervention of identified cases, but need the concerted effort to reduce and eliminate the potential sources of infection. To our knowledge there is no published document to attest the level of parasitological contamination of fruits and vegetables in Maiduguri Town (remove). Therefore, this study was designed to determine the level of parasitic contamination of vegetables and associated factors in Maiduguri metropolis.

Outbreaks of human infections associated with consumption of raw fruits and vegetables have occurred with increased frequency during the past decade. Factors contributing to this increase may include changes in agronomic and processing practices, an increase in per capital consumption of raw or minimally processed fruits and vegetables, increased international trade and distribution, and an increase in the number of immune-compromised consumers (Beuchat, 2002). A general lack of efficacy of sanitizers in removing or killing pathogens on raw vegetables has been attributed, in part, to their inaccessibility to locations within structures and tissues that may harbor pathogens (Beuchat, 2002). (remove) It is against this background that the study was designed to evaluate the prevalence of intestinal parasites from vegetables in Maiduguri. Fresh vegetables play a major role in the nutritional livelihood of the population. The risk of food-borne parasitic infection increases when eating these vegetables without being properly washed. So there is need to undertaking such important research to increase hygienic awareness in the population and give sufficient information for the local health authorities to take right actions to improve the quality of such food.

Vegetables are good sources of vitamins, minerals which aid our bodies to function properly. Vegetables naturally low in fat, sodium, calories, rich in fiber which is very essential for the smooth movement of the digestive system, carbohydrates which are the main source of energy and it breaks down easily to make a quick source of energy, vitamin C which is a very necessary supplement to the body as it enhances the metabolic process. An important nutritional value of fruits is its antioxidant contents such as polyphenolic flavonoids, vitamin-C, and anthocyanins. These compounds protect human body from oxidant stress, diseases, and cancer. Vegetables and Fruits such as orange have the highest antioxidant value (Halvosen *et al.*, 2002). Eating vegetables and fruits daily is

recommended to reduce risks for diseases like cardiovascular disease and cancer (Heimendinger *et al.*, 1996 Krauss *et al.*, 2000). Many studies have evaluated fruits and vegetables consumption in relation to the risk of cardiovascular disease and specific cancers (Gaziano *et al.*, 1995).

A parasite is an organism that lives on or in a host organism and gets its food from or at the expense of its host. Intestinal parasitic infections are widely distributed throughout the world causing substantial intimidation to the public health, economy, physical and cognitive development particularly among children in developing countries like Sudan. The poor personal hygiene, poor environmental hygiene, and poor health system commonly observed in developing countries make the prevalence to be highest among these populations (Okoye *et al.*, 2004, Wegayehu *et al.*, 2013).

There are three main classes of parasites that can cause disease in humans: protozoa, helminthes, and ectoparasites.

Protozoa are microscopic, one-celled organisms that can be free-living or parasitic in nature. They are able to multiply in humans, which contributes to their survival and also permits serious infections to develop from just a single organism. Transmission of protozoa that live in a human's intestine to another human typically occurs through a fecal-oral route (for example, contaminated food or water or person-to-person contact). Protozoa that live in the blood or tissue of humans are transmitted to other humans by an arthropod borne vectors (remove all in red)

## **MATERIALS AND METHODS**

### **Study design**

This is a cross sectional study that involve sample collection of vegetables from selected area in Maiduguri.

### **Study area**

The study was conducted in Maiduguri city located in the north eastern part of Nigeria, lies within latitude 11.15<sup>0</sup> and longitude 30.05<sup>0</sup> in the Sudan Sahel, on savannah zone with a dense

population that are mostly crop farmers fishermen, Hard men, and trader, it is a city with a rich cultural heritage and home to the Kanem Borno Empire. The capital city of Borno state which share international border with Niger, Chad and Cameroun republic. It also share border with neighbouring states such as Adamawa, Bauchi, Yobe and Gombe.

### **Study samples**

The vegetables used in this study were lettuce, carrots, tomatoes and garden eggs.

### **Areas of sampling**

These vegetables were obtained from five areas (Monday Market, Custom Market, abbaganaram Market, Bolori Market and tashan Bama Market) all in Maiduguri metropolis, Borno state. These markets were considered because majority of the farmers from different local government areas of Borno state convey their farm products, which include the above mention vegetables for sales in these markets.

### **Sample size**

A total of 200 samples were collected, vegetables were obtained randomly from five selected markets in Maiduguri to obtain qualitative estimation of parasitic contamination of these vegetables.

### **Sample processing**

#### **Sample collection**

Four types of vegetables were used in the study including: lettuce, carrots tomatoes and sprink onions. They were randomly collected from five different selected markets in Maiduguri. Each sample was placed in a labeled plastic bag.

#### **Parasitological examination**

The vegetables were washed separately in (0.85% normal saline) for detaching the parasitic stages (ova, larvae, cysts and oocytes) of helminthes and protozoa parasites (remove) commonly assumed to be associated with vegetables contamination. 15ml of 0.85% normal saline washing (remove) solutions was then transferred to a centrifuge tube using sieve, to remove undesirable matters. For concentrating the parasitic stages, the tube was

centrifuged at 3000 rpm for five minutes. After centrifugation, the supernatant was decanted carefully without shaking. Then the sediment was agitated gently by hand for redistributing the parasitic stages. Finally, the sediment was placed on a clean microscope glass slide and cover with a coverslip to stabilize the preparation and was examined under a light microscope using  $\times 10$  and  $\times 40$  objectives parasite morphology bench guide aid was use as the control.

#### Data analysis

Statistical analyses were carried out using chi-square tests of the SPSS software version 9.0 to compare the rate of parasitic contamination of vegetables among different market. The difference were considered significant at  $p < 0.05$

#### RESULTS

A total of 200 vegetables samples are collected from various major markets in Maiduguri. Among these samples, 50(25.0%) are tomatoes, 50(25.0%) carrots, 50(25.0%) lettuce and 50(25.0%) are garden eggs as shown in table 1.

Table 4.2 shows the prevalence of intestinal parasites among the vegetable samples collected from Maiduguri major markets. It reveals that among the samples collected, Custom market, 10(5.0%) tomatoes were used where 1(0.5%) out of the 10 was positive for larva of *strongyloides stercolaris*. Out of the 10(5.0%) carrot samples collected, 1(0.5%) was positive filariform larva of hookworm. 10(5.0%) lettuce sample collected where 1(0.5%) is positive for larva of *strongyloides stercolaris*. And 10(5.0%) samples of garden egg were collected there was no parasite identified. At Tashan Bama market, 10(5.0%) tomatoes sample were collected out of which 1(0.5%) is positive for filariform larva of hookworm. 10(5.0%) carrots samples with 1(0.5%) positive out of the 10 for egg of *Ascaris lumbricoides*. 10(5.0%) lettuce samples are

collected out of which 1(0.5%) is also positive for egg of *Ascaris lumbricoides*, and 10(5.0%) garden egg were also collected and there was no parasite identified. Samples collected from Monday market include; 10(5.0%) tomatoes where 2(1.0%) was positive for filariform larva of hookworm and egg of *Ascaris lumbricoides*, 10(5.0%) carrots with 1(0.5%) out of the 10 being positive for egg of *Ascaris lumbricoides*, 10(5.0%) lettuce out of which 2(1.0%) are positive for filariform larva of hookworm, and 10(5.0%) garden egg with no parasite being identified among them. Samples also collected from Abbaganaram market are; 10(5.0%) tomatoes among which 2(1.0%) are positive for filariform larva of hookworm and egg of *Ascaris lumbricoides*, 10(5.0%) carrots with no parasite sample detected, 10(5.0%) lettuce of which 1(0.5%) was positive for larva of *strongyloides stercolaris*, and 10(5.0%) garden egg with also no parasite detected. And at Bolori market, only 1(0.5%) out of 10(5.0%) carrot sample was positive for filariform larva of hookworm, where there was no parasite detected from 10(5.0%) each of the tomatoes, lettuce and garden egg collected from the market. In this study, it reveals that the total prevalence of intestinal parasites present in various vegetables in Maiduguri majors markets is 7.5%.

Table 4.3 shows the distribution of the intestinal parasites detected in the vegetable samples, this include; larva of *strongyloides stercolaris* with 1 and 2 present in tomato and lettuce respectively, 3 each of tomatoes, carrot and lettuce are detected with filariform larva of hookworm, and 2 eggs of *Ascaris lumbricoides* each has been detected in tomatoes and carrots. The table also reveals that there was no significant difference ( $p < 0.05$ ) in the distribution of the intestinal parasites in various vegetable.

**Table 1:** Frequency Distribution of the Samples Collected from the Study Area

Sample	Frequency	Percent (%)
Tomato	50	25.0
Carrot	50	25.0
Lettuse	50	25.0
Garden Egg	50	25.0
<b>Total</b>	<b>200</b>	<b>100</b>

**Table 2:** Prevalence of Intestinal Parasites among Vegetable Samples from Maiduguri Metropolis

Location	Sample	No. of Tested (%)	No. of Positive (%)	No of Negative (%)
Costom Market	Tomatoes	10(5.0)	1(0.5)	9(4.5)
	Carrots	10(5.0)	1(0.5)	9(4.5)
	Lettuse	10(5.0)	1(0.5)	9(4.5)
	Garden Egg	10(5.0)	0(0.0)	10(5.0)
Tashan Bama Market	Tomatoes	10(5.0)	1(0.5)	9(4.5)
	Carrots	10(5.0)	1(0.5)	9(4.5)
	Lettuse	10(5.0)	1(0.5)	9(4.5)
	Garden Egg	10(5.0)	0(0.0)	10(5.0)
Monday Market	Tomatoes	10(5.0)	2(1.0)	8(4.0)
	Carrots	10(5.0)	1(0.5)	9(4.5)
	Lettuse	10(5.0)	2(1.0)	8(4.0)
	Garden Egg	10(5.0)	0(0.0)	10(5.0)
Abbaganaram Market	Tomatoes	10(5.0)	2(1.0)	8(4.0)
	Carrots	10(5.0)	0(0.0)	10(5.0)
	Lettuse	10(5.0)	1(0.5)	9(4.5)
	Garden Egg	10(5.0)	0(0.0)	10(5.0)
Bolori Market	Tomatoes	10(5.0)	0(0.0)	10(5.0)
	Carrotsl	10(5.0)	1(0.5)	9(4.5)
	Lettuse	10(5.0)	0(0.0)	10(5.0)
	Garden Egg	10(5.0)	0(0.0)	10(5.0)
<b>Total</b>		<b>200(100)</b>	<b>15(7.5)</b>	<b>185(92.5)</b>

**Table 3:** Distribution of the Intestinal Parasites Detected in the Vegetable Samples

Parasites	Samples				Total	p-value	X <sup>2</sup> -value
	Tomatoes	Carrots	Lettuse	Garden Egg			
Larva of <i>Strongyloides stercoralis</i>	1	0	2	0	3	0.502	11.315
Filariform Larva of hookworm	3	2	2	0	6		
Egg of <i>Ascaris Lumbricoides</i>	2	2	1	0	5		
<b>Total</b>	<b>6</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>15</b>		

P&lt;0.05

## DISCUSSION

Different parasitic phases of development can contaminate several foodstuffs. If the food borne route is suspected in an outbreak, it is easy to identify how the food implicated became contaminated. However, it is often difficult to associate an outbreak with a particular food item (Slifko *et al.*, 2000). Vegetables, especially salads, are a significant route of transmission of intestinal parasites and have been shown to be an important source of food borne outbreaks in developing countries (Pires *et al.*, 2012). The most likely hypothesis of contamination is that it happened before harvest, either by contaminated manure, manure compost, sewage sludge, irrigation water, run off water from livestock operations or directly from wild and domestic animals. These potential contamination events are all believable and consistent with the assumption that the level of contamination must have been high (Mercanoglu & Halkman, 2011).

The findings from this study have shown that parasitic eggs and larvae can be found at harvest on vegetables these poses a high risk of contamination and infection by the parasites. Out of the 200 samples of vegetables processed, 15 (7.5%) of them were contaminated with parasites. This study is similar to the study carried out by (Adejumoke And Morenikeji, 2014) in Ibadan city Nigeria where 29 (11.6%) of the vegetables contaminated with parasites, (Yakhchali and Ahmadiashtiani, 2004) in Urmia, where 12.6% parasitic contamination was recorded and (Al-Megrin, 2010) in Riyadh, Saudi Arabia where 16.2% vegetables were positive for intestinal parasite stages. Results from this study which show that tomato has the highest parasitic contamination followed by lettuce and then carrot recorded the lowest while the 50 samples from garden egg has no parasite, could be due to the fact that the degree of contamination varies according to vegetables.

Lettuce have uneven surfaces which make parasitic eggs, larvae attach to it more easily, either in the farm or when washed with contaminated water while tomato, carrot and garden egg has the least prevalence presumably because of its smooth surface which reduces the rate of parasitic attachment.

Monday market (2.5%) recorded the highest prevalence of infected vegetable samples

followed by Abbaganaram market (1.5%), Custom market (1.5) and tashan bama (1.5%) then Bolori market (0.5%) with the least prevalence. The high prevalence of contamination with parasites on vegetables might be due to the fact that these open markets are characterized by the presence of refuse dump sites, poor drainage, improper disposal of faeces of traders and poor hygienic practices. This is in addition to preceding contamination of vegetables arriving from rural areas around and outside these markets.

Three different types of intestinal parasites (nematodes) were isolated. These parasites include; *Ascaris lumbricoides*, filariform larvae of Hookworm and larvae of *Strongyloides stercoralis*. Disparity in the parasites recorded may be due to differences in the location of the study. However, the intestinal parasites isolated from this study were not as many and differ from those isolated from other parts of Nigeria (Damen *et al.*, 2007; Ogunleye *et al.*, 2010, Idahosa 2011; Alade *et al.*, 2013) due to the fact that some of these vegetables like carrot, tomato and lettuce were transported from various part of the country into the state for consumption. During the process of harvesting and transportation, some of these parasites might have been destroyed. Despite variation in isolated parasites, *Ascaris lumbricoides* and Hookworm were common to all vegetables in all the studies. This could be due to the fact that these parasites can withstand a wide variety of adverse environmental conditions. Monthly prevalence of parasites recovered was highest in April and decreased in June. This is because rainfall is scanty in April when farmers use wastewater to improve crop growth but the rains usually become heavy as from May, thus reducing parasite rate with each downpour.

Faecal contamination of water sources used in crop irrigation is an important source of human infection and contamination of fresh vegetables are of greatest concern (Orlandi *et al.*, 2002). (Shuval *et al.*, 1986) observed that there is evidence that people consuming vegetables irrigated with raw waste water are exposed to the risk of infection with *Ascaris*, *Trichuris*, *Amoeba* and Tapeworm. The consumption of raw vegetable plays an important role in the transmission of parasitic infections (Anuar, 1977). Recovery of parasites from vegetables

may be helpful in indicating the incidence of intestinal parasites in a community.

### CONCLUSION

The level of parasitic contamination of vegetables in the study area is high. This calls for public health enlightenment on the rigor required to wash these vegetables before they are consumed. These findings may have important implications for the state food safety and emphasize the importance of raw vegetables in threatening public health by transmission of intestinal parasites to humans in Maiduguri metropolis. It is

recommended that local health and environmental authorities should improve the sanitary conditions in the areas where the vegetables are cultivated and consumed. Proper treatment of waste water used for irrigation of vegetables should be implemented and there is a need for improved surveillance systems on food-borne pathogens, on food products through adequate vegetable farming procedures which may improve transportation and storage facilities in the various market in the study area.

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