

PREVALENCE OF HELMINTHS PARASITES IN VEGETABLES SOLD IN JAMA'ARE METROPOLIS, BAUCHI STATE, NIGERIA

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ABSTRACT

Consumption of raw vegetables provides essential nutrient to humans. However, eating these vegetables raw without proper washing serve as one of the major factors responsible for high morbidity and mortality globally. The present study aimed to evaluate the prevalence of soil-transmitted helminths (STH) parasites in commonly used vegetables in Jama'are Town, north east Nigeria. A total of 150 fresh raw vegetable samples were obtained from various markets within the study area. Each sample was divided into two groups; unwashed and washed with traditional method. The samples were examined using sedimentation concentration technique and data obtained were analyzed using Chi square in SPSS version 24. The overall prevalence of STH parasites was 22.6%. The unwashed vegetables (29.3%) had more STH contamination than the washed vegetables (16.0%). There was a significantly difference between the occurrence of STH parasites between unwashed and washed vegetables ($\chi^2=14.21$, $P=0.001$). Spinach (26.6%) had the highest prevalence, followed by cabbage, lettuce and carrot which all have 23.3% contamination while green pepper had the least contamination. For the unwashed, spinach (8%) had the highest prevalence while green paper (4.0%) has the least. There was no significant difference between the occurrence of STH parasite and the vegetable types ($\chi^2=4.200$, $P=0.380$). For the washed, cabbage and lettuce (4%) harboured more contamination while spinach, carrot and green paper (2.6%) have the least. Similarly, there was no significant difference between the occurrence of STH parasite and the vegetable types ($\chi^2=3.00$, $P=0.558$). The overall prevalence of STH infections in all the vegetables were as follows: hookworms (30.3%), *Ascaris lumbricoides* and *Strongyloides* (21.2%), *Taenia* sp. and *Trichuris trichiura* (15.2%). The results of the present study provide evidence that vegetables are potential risk factor for transmission of STH infection to human in Jama'are Metropolis, Bauchi State. Therefore, it is indispensable for retailers and consumers to proper wash their vegetables before consumption as this is necessary to reduce STH contamination.

Keywords: Vegetables, Contamination, Soil-transmitted helminths, North East Nigeria

INTRODUCTION

The consumption of vegetables is an important ingredient of healthy life. This is due to the fact that vegetables help to protect human body against a number of

diseases by providing the essential nutrient, vitamin, protein and fibres. Vegetables also play a role in the provision of low amount of fat and carbohydrate as these are important components for healthy life.

Apart from that, vegetables also have positive impact on body weight regulation, hypertension and other related conditions such as diabetic, atherosclerosis and strokes. Due to the diverse health benefits of vegetables to humans, the WHO recommended the intake of a minimum of 400g of vegetables and fruits per day so as to curb the aforementioned diseases (Punsawad et al., 2019). However, despite their nutritional benefits, vegetables especially those that are eaten raw can become contaminated more especially with soil-transmitted helminths (STH) parasites if not properly washed. Several studies have shown that consumption of raw vegetables is one of the major routes by which STH are propagated and this affects more than a quarter of the world population (Jourdan et al., 2018, Mohamed et al., 2016).

The extent of contamination of vegetables with STH depends on different unhygienic practices such as the use of untreated wastewater contaminated with sewage for irrigation (Tefera et al., 2014). This is because most cultivation of vegetables is carried out by peasant farmers which solely depend on irrigation and natural rainfall. Contamination of vegetables can also occur as a result of various associated factors related to planting, preparation or during processing, collection, post-harvest handling, and storage, transporting to market and other unhygienic condition at home (Luz et al., 2017).

Despite of several studies of STH in Nigeria, to the best of our knowledge, there has been no study on STH contamination in fresh vegetables in Jama'are Local Government Area of Bauchi State. Therefore, this study was designed to determine the level of STH contamination on washed and unwashed commonly

consumed vegetables in Jama'are Town, Northeast Nigeria.

MATERIALS AND METHODS

Study Area and Period

The study was conducted in Jama'are Town, Jama'are Local Government Area of Bauchi State, one of the States in North Eastern region of Nigeria. It is on a cross-section study was conducted between June 2019 and November 2019 to determine the level of STH contamination of vegetables sold at Jama'are Town.

Sample Collection:

Five types of vegetables including Spinach (*Spinacia oleracea*), Cabbage (*Brassica oleracea*), lettuce (*Lactuca sativa*), carrot (*Daucus carota*) and green pepper (*Capsicum* sp.). The choice of the vegetables used in the present studies was informed based on their availability, eaten raw and have high consumption by the local population. Equal numbers of samples (15 each for washed and 15 each for unwashed, totally 150 samples) were collected from the selected market. All samples were collected separately, put in plastic bags, properly labelled and brought to the Laboratory of Department of Biological Sciences, Bauchi State University Gadau, for parasitological analysis.

Sample Analysis

The sample preparation and examination were performed using sedimentation concentration method for STH eggs as described by Al-Megrem (2010) with some modifications. Briefly, 250g of each vegetable sample was placed separately in a plastic container and washed with 10ml

physiological saline solution (0.95% NaCl-w/v) for the removal STH egg or larval. The water used to wash the vegetables was left overnight for sedimentation to take place. After sedimentation, 5 mL of the sediment was transferred to a centrifuge tube and centrifuged at 2000 rpm for 20 minutes. After centrifugation, the supernatant was carefully discarded into the disinfectant jar and the sediment was re-suspended. A drop of the suspension was applied to the centre of a glass slide and drop of lugols iodine was applied. A clean cover slip was placed gently on slide to avoid air bubbles. The preparation was examined under the microscope using X10 and X40 objectives. The eggs of STH were identified based on morphological details as described by Chiodini et al. (2001).

Data Analysis

Data was analyzed using Chi Square in SPSS version 24 to establish significant difference in the prevalence of STH between washed and unwashed vegetables sold in Jama'are LGA of Bauchi State. A P value of <0.05 was used as a statistically significance difference.

RESULTS

The results showed that the unwashed vegetables 22 (29.3%) had more STH contamination when compared to washed vegetables 12 (16.0%) as shown in Table 1. Our finding revealed that 34 samples were identified to be contaminated with at least one STH parasite which gives the overall contamination rate of 22.6%. These include 26.6% of spinach which harboured most STH contamination, followed by 23.3% of

cabbage, lettuce and carrot, and 16.6% of green pepper which had the least.

Out of the 75 samples of washed vegetables analyzed, 12 (16.0%) were contaminated with STH parasites. Cabbage and lettuce harbored more STH contamination (4% each) then followed by spinach, green pepper and carrot that had 2.6% prevalence rate each (table 1). However, there was no significant difference between the occurrence of helminthes parasite and the vegetable types ($\chi^2=3.00$, $P=0.558$). In terms of the unwashed vegetables, out of the 75 samples analyzed, 22 (29.3%) were contaminated with STH parasite which is higher than that of the washed vegetables. The result of the unwashed vegetables shows that spinach (8%) had the highest prevalence of STH contamination, then followed by carrot (6.6%), cabbage and lettuce 4 (5.3%) and finally green pepper (4%). There was no significant difference between the occurrence of helminthes parasite and the vegetable types ($\chi^2=4.200$, $p=0.380$).

However, there was significant difference ($\chi^2=14.21$, $P=0.001$) between the occurrence of STH parasites on washed and unwashed vegetable types (Table 1). This finding agrees with that of Fallah *et al.*, (2016) which reported that traditional washing reduces the rate of contamination drastically but does not totally remove parasites from vegetables. Similarly, the finding is also in conformity to that of Patrobas *et al.*, (2018) which reported that there is a significant difference between washed and unwashed vegetables sold in Zaria market, Nigeria.

Table 1: Occurrence of helminths parasite on washed and unwashed vegetable types

Vegetables	Total washed vegetables	Washed vegetables positive	Total unwashed vegetables	Unwashed vegetables positive	Total positive parasite	Chi square (χ^2) and p-value
Spinach	15	2 (2.6)	15	6 (8)	8 (26.6)	* $\chi^2=14.21$
Cabbage	15	3 (4.0)	15	4 (5.3)	7 (23.3)	P=0.001
Lettuce	15	3 (4.0)	15	4 (5.3)	7 (23.3)	** $\chi^2=3.00$
Green pepper	15	2 (2.6)	15	3 (4.0)	5 (16.6)	P=0.558
Carrot	15	2 (2.6)	15	5 (6.6)	7 (23.3)	** * $\chi^2=4.20$
Total	75	12 (16.0%)	75	22 (29.3%)	34 (22.6%)	

NOTE: * Chi square for positive parasites on vegetables

** Chi square for positive parasites on washed vegetables

*** Chi square for positive parasites on unwashed vegetables

The species of STH parasites detected include *Strongyloids*, *Taenia* spp, *Trichuris trichiura*, Hook worm and *A. lumbricoides*. Table 2 show Hookworm 10 (30.3%) was the most frequently detected contaminant followed by *Strongyloids* and *A. lumbricoides* which have prevalence rate of 7 (21.2%) each. *Taenia* spp and *Trichuris trichiura* have the least prevalence rate of 5 (15.2%). The highest prevalence of

Hookworm was detected in spinach and least frequency from green pepper. *Strongyloides* was detected most frequent in spinach and carrot samples but less frequent in cabbage, lettuce and green pepper. Ova of *A. lumbricoides* was detected in lettuce and green pepper with the high frequency but not detected from the samples of carrot.

Table 2: Prevalence of STH parasites in vegetables sold at selected market in Jama'are Town of Jama'are Local Government of Bauchi State.

Detected parasites	Frequency in unwashed vegetables	Frequency in unwashed vegetables	Total Prevalence
<i>Strongyloides</i>	6	1	7 (21.2%)
<i>Taenia</i> spp	1	4	5 (15.2%)
<i>Trichuris trichiura</i>	2	3	5 (15.2%)
Hook worm	8	2	10 (30.3%)
<i>A. lumbricoides</i>	5	2	7 (21.2%)
Total Prevalence	22 (29.3%)	12 (16.0%)	34 (22.6%)

DISCUSSION

The result from the present study shows that, the prevalence of STH contamination in vegetables sold in Jama'are Local government area of Bauchi State is high. This finding is worrying as it may pose a public health problem to consumers. Our finding revealed that the overall STH contamination rate was 22.6% which is in line with findings from other part of Nigeria

(Luka *et al.*, 2016; Agbalaka *et al.*, 2019; Ani and Urom, 2015; Ikpeze and Chima, 2017 and Patrobas *et al.*, 2018). However, it is lower than what was reported in similar studies done in other part of Nigeria (Amaechi *et al.*, 2016). On the other hand, it is higher than that reported in similar studies done in other part of Nigeria (Agbalaka *et al.*, 2019; Luka *et al.*, 2016). Similar reports have also been made in some part of the world which include

Ghana (Dankwa *et al.*, 2018), Ethiopia (Tefera *et al.*, 2014), Sudan (Mohamed *et al.*, 2016), Iran (Rostami *et al.*, 2016), Thailand (Punsawad *et al.*, 2019), Brazil (Luz *et al.*, 2017) and Turkey (Adanir and Tasci, 2013). Several studies have shown that the use of untreated water to irrigate vegetables in Nigeria and other under developing countries is one of the major factors responsible for STH contamination (Alemu *et al.*, 2019). The differences in the prevalence rate may be attributed to the variation in the climatic condition, sample size and the technique used for the detection of the helminths parasites (Bekele *et al.*, 2017). The fact that these factors differ, there will also be different in the prevalence rate.

Spinach (26.6%) was found to harboured most of the STH contamination, followed by lettuce, cabbage and carrots which have a prevalence rate of 23.6% each. This agrees with finding of Patrobas *et al.*, (2018); Maikai *et al.*, (2012) and Uga *et al.*, (2009). The cost of spinach in the study area is less when compared with other vegetables and this might cause their poor handling by retail stores as they are always affordable and available in large quantity.

The discrepancy in the prevalence of STH contamination may be due to differences in the surface area and shape of the vegetables. The high prevalence rate observed in spinach, cabbage, carrot and lettuce may be attributed due to the fact that these vegetables have larger and uneven surface area which might probably increase the sticking of these STH eggs either in farm or when washed with contaminated water (Tefera *et al.*, 2014). So also, the high STH contamination of these vegetables in the present study may be as a result of how they grow on the surface of soil unprotected

due to the nature of their leaves. This finding is in accordance to that several reports which stated that vegetables which leave are exposed or unprotected from soil surface and also have uneven surface area have high prevalence rate (Agbalaka *et al.*, 2019; Tefera *et al.*, 2014).

On the other hand, the green pepper has the least prevalence of STH contamination and this can also be attributed as a result of the smooth surface area which might hinder or reduces the rate of the parasite attachment (Tefera *et al.*, 2014; Damen *et al.*, 2007). This is also in agreement to the finding of Agbalaka *et al.*, (2019). Out of the 575 total samples of vegetables and fruits they examined, they found that the green pepper is one of the vegetables with least of STH contamination

In terms of STH observed in the present study, hookworms have the highest prevalent rate of 30.3%. This finding is in agreement with other studies conducted in Thailand (Punsawad *et al.*, 2019), Iran (Rostami *et al.*, 2016), Sudan (Mohamed *et al.*, 2016) and Ghana (Duedu *et al.*, 2014) which have prevalence rate of 16.6%, 2.6%, 43.9% and 13% respectively. The high prevalence of hookworm in the present study could be as a result of use of human excreta as manure in the region. Lack of proper sanitation and use of human waste-contaminated water might also be responsible for hookworm infection in the study area. Additionally, the high prevalence of hookworm might be as a result of differences in geographical location, type of soil used and climatic condition (Silver *et al.*, 2018).

Strongyloides and *A. Lumbricoides* were the second most observed STH in the present study with the prevalence rate of 21.2% each. Our finding was consistent

with previous studies done by Tefera *et al.*, (2014) in Jimma Town, Ethiopia and Agbalaka *et al.*, (2019) in Jos, Nigeria which reported a 21.9% and 58.1% prevalence of *Strongyloides* contamination, respectively. This was higher than what was observed in the present studies. The high prevalence rate of *Strongyloides* observed in this study might be attributed due to the fact that they have a complex life cycle with a free-living stage in the environment that does not require a host for its proliferation (Jourdan *et al.*, 2018, Schär *et al.*, 2013).

In terms of *A. Lumbricoides* contamination, our finding was in agreement with the finding of Taherimoghaddam *et al.* (2018) that reported *A. lumbricoides* as the second most detected parasites in vegetables consumed in Hamadan, West Iran with the prevalence of 7.1%. The prevalence rate of *A. Lumbricoides* in the present study might be attributed because the parasites are ubiquitous in nature (Bekele *et al.*, 2017). In addition, the high numbers of eggs produced by the fecund female are strong and resistant in nature and these enable them to survive even on unfavourable. So also, the eggs produced by these parasites can also exist in the absence of oxygen, unaffected by desiccation for 2 to 3 weeks and can live for up to 2 years at temperature of 5-10°C (Bekele and Shumbej, 2019).

Most likely, the incongruity in the prevalence of STH contaminations between the present study and others might be attributed to the variation in geographical location, type and number of samples examined, methods used for detection, different laboratory techniques used, type of water used for irrigation, socio-economic activities such as post harvesting handling methods. Besides, the water used to wash vegetables can also play a vital role in the

epidemiology of transmission of parasitic diseases.

CONCLUSION

This study has shown that vegetables consumed in Jama'are Metropolis, Bauchi State, Northeast, Nigerian are contaminated with STH ova especially eggs of Hook worm which was more prevalent than other species. This is of public health significance as it indicates that humans can be at risk of infection, as vegetables are very important diet for humans. Therefore, advocacy about the importance of washing and disinfecting of vegetables before consumption will help to reduce their prevalence rate. In addition, proper treatment of urban or rural wastewater used for irrigation of vegetables should be implemented.

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