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Prevalence of Intestinal Parasites on Fruits and Vegetables Sold in Biu Local Government Area of Borno State, Nigeria

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Abstract

Prevalence of intestinal parasites on fruits and vegetables sold in Biu Local Government Area, Borno State, Nigeria, was studied from the month of September to November, 2022. The study was aimed to determine the prevalence, sample that harboured the parasite most and species of parasites on fruits and vegetables sold in the study area. Eight different fruits and five vegetables were purchased from the main markets of the three selected areas in the Local Governments (Biu, Buratai and Miringa) once in a week. A total of 384 samples, comprising of 280 fruits (Tomatoes, Guava, Watermelon, Orange, Bitter Garden Egg, Cucumber, Apple and Bananas) and 104 vegetables (Spanish, cabbages, lettuces, onions and Carrot) were purchased and examined for intestinal parasites using sedimentation method. An overall prevalence of 250 (65.1%) was observed and vegetables had the highest prevalence rate 82 (78.8%) while fruits had 168 (60%). The difference in prevalence rate in different locations within the study area on both fruits and vegetables were statistically not significant ($p<0.05$). Ascaris lumbricoide was the most prevalent specie 110 (44%) while hymenolopis nana was the lowest prevalence specie 7 (2.8%) on both fruits and vegetables. Others parasites encountered include Entamoeba histolytica 32 (12.8%), Trichuira trichuris 30 (12%), Ancylostoma spp 27 (10.8%), Taenia spp 16 (6.4%), Strongyloid stercoralis 16 (6.4%) and Giadia lamblia 12 (4.8%). From the results of this study fruits and vegetables sold in this study area were highly contaminated with intestinal parasites due to poor environmental sanitation, handling method and preservation techniques by vendors, farmers and consumers as well as use of wastewater and poor fertilizer during farming. This can be reduced or prevented through proper disposal of human and animal waste, proper handling and use of modern preservation techniques, use of clean or treated water and recommended fertilizer during farming as well as proper washing of fruits and vegetables before consumption.

Keywords: Prevalence, Fruits, Vegetables, Intestinal Parasites, Biu

INTRODUCTION

The consumption of fruits and vegetables is an important ingredient of a healthy life. A diet rich in fruits and vegetables can lower blood pressure, reduce the risk of heart disease and stroke, prevent some types of cancer, lower risk of eye and digestive problems and have a positive effect upon blood sugar, which can help keep appetite in check. Eating non-starchy vegetables and fruits like apples, pears, and green leafy vegetables may even promote weight loss (Bertoia *et al*., 2015). Vegetables also play a role in the provision of low amount of fat and carbohydrate as these are important components for healthy life (Jourdan *et al*., 2018;

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Mohamed *et al.,* 2016). Regular consumption of fruits and vegetables has been reported to reduce the risk of cardiovascular disease (especially coronary heart disease), cancer, stroke, cataracts and some of the functional declines associated with aging (Rui, 2003). Layade and Adeoye, (2014) reported that fruits and vegetables are the critical component of a healthy diet. Also, they serve as good sources of carbohydrates, proteins, protective micronutrients, dietary fibre, vitamins, and minerals. World health organization (WHO) recommends consumption of at least 400 g of vegetable or fruit per day to prevent some diseases (Punsawad *et al.,* 2019). The consumption of fruits and vegetables in Africa is lower than the recommended daily guidelines prescribed by the WHO (Hall *et al*., 2009). Steady rise in the burden of non-communicable diseases (NCDs) in Sub-Saharan Africa over the past 20 years, driven by an increase in risk factors such as unhealthy diets (Bigna and Noubiap, 2019). Based on this, medical practitioners and health educator regularly encouraged advised/encouraged people to use used fruits and vegetables on their daily nourishment. Raw of these fruits and vegetables are regularly consumed. The consumption of raw vegetables and fruits plays a major epidemiological role in the transmission of parasitic diseases (Abougrain *et al*., 2010).

Fruits and vegetables become contaminated in different ways some even when there are attached to the plant due to use of untreated manure and water. After harvest, it passes through many hands, increasing the contamination risk Asmita *et al*. (2016). Fruits and vegetables become contaminated during harvesting or processing, distribution and marketing or even at the consumption point (Usman *et al*., 2020). Several studies in different parts of the world reported the vegetables as the main transporter for protozoan cysts and oocysts, helminthic eggs and larvae as well as hookworms (Voung *et al*., 2007; Anwar and McKenry, 2012). In Nigeria many studies reported most of these parasites on both fruits and vegetables depending on the location and samples examined (Malann and Utitofon2016; Istifanus and Panda 2018; Usman *et al*., 2020).

Consumption of unwashed fruits and raw vegetables is one of the main ways soil transmitted helminthes spread, affecting more than a quarter of the world`s population (Mohammed *et al*., 2016; Jourdan *et al*., 2018). Because of the numerous health benefits of fruits and vegetables to humans, the World Health Organization recommends consumption of at least 400 g of vegetable or fruit per day to prevent some diseases (Punsawad *et al.,* 2019). Therefore, it is important to evaluate the conditions of fruits and vegetables in our environments. This will provide proper information for the consumers and guide the stakeholders in taking appropriate action. The present study aimed to determine the prevalence, samples that harboured the parasite most and species of intestinal parasites on fruits and vegetables sold in the study area.

MATERIAL AND METHODS

Study Area

Biu Local Government is one of the nine Local Governments Areas in Borno South senatorial zone, located between Latitude: 10° 36' 46.26" N and Longitude: 12° 11' 40.49" E, with an elevation of 762.32 meters (2501.05 feet) above sea level. According to the 2006 census, the area has a total human population of 176,072, with the predominant cultures being Babur and Bura, as well as others such as Margin, Tera, Mina, Fulani, and so on. Biu has a typical semi-arid climate with a yearly average temperature of 32.16ºC, 36.38 mm of precipitation, and 61.57 rainy days. Trading of goods and agriculture are the most important economic activities for

the people of Biu with crops such as maize, soya beans, beans sorghum, millet, cotton and groundnut grown in large quantities as well as some vegetables and fruits. Many fruits and vegetables are being brought from the neighboring areas for their daily need.

Sample Collection

Sample collection of fruits and vegetables from the selected markets (Biu, Buratai and Miringa main Markets) were done randomly; thirty two (32) samples of fruits (Tomatoes, Guava, Watermelon, Orange, Bitter Garden Egg, Cucumber, Apple and Bananas and vegetables (Spanish, cabbages, lettuces, onions and Carrot) were collected once in a week for a period of three months from September to November, 2022. A total of three hundred and eighty four samples (384) were collected which comprised of two hundred and eighty (280) fruits and one hundred and four vegetables (104). The samples were collected into a sterile polythene bags and transported immediately to the Biology laboratory, Faculty of Natural and Applied Sciences, Nigerian Army University Biu for parasitological analysis.

Laboratory Analysis

Each sample of fruits and vegetable was were washed in 450 ml of distilled water in a sterile beaker and each preparation (water) was left to settle for 30 minutes and then the settled water was decanted without disturbing the settled suspension and the decant water discarded. The suspension was strained through a sterile sieve to remove undesirable materials like sand. 15 ml of 10% formalin was added to the filtrate. The solution formed from the addition of 10% formalin to the filtrate was stirred fervently and put into the centrifuge tube. The tube was then placed in a centrifuge and spun at 3000 rpm for 5 minutes (Damen *et al.*, 2007). The sediments were tapped to mix and a drop was applied on the center of a clean glass slide and one drop of Lugol's iodine was added. The glass slide was covered gently with coverslip to avoid air bubbles and over-flooding. The slide was then placed on a microscope for viewing. X10 and X40 objectives were used for viewing and the number of ova, larvae and cysts of the parasites were isolated, counted and recorded. The identification of parasite was based on their morphological characteristics such as the shapes and sizes of the eggs using Arora and Arora (2008).

Data Analysis

The data was analyzed using Chi-square and simple percentage using Microsoft excel office version 2010 and $p>0.05$ was adopted to determine the level of significance

RESULTS

A total samples of 384 fruits and vegetables were examined during the study, with an overall prevalence of 250 (65.1%) and out of the three selected area, Biu town had the highest prevalence rate of 129 (51.6%) followed by Buratai 78 (31.2%) and Miringa had the least of 43 (17.2%). Biu had the highest prevalence rate on fruits 86 (71.1%) followed by Buratai 55 (57.3%) and then Miringa with 27 (42.2%) while on vegetables, Miringa had the highest prevalence rate 16 (84.2%) followed by Biu 43 (78.2%) and Buratai had the least of 23 (76.7%). The difference in prevalence rate in different location on both fruits and vegetables were statistically not significant ($p<0.05$) **(**Table 1**)**

Prevalence of intestinal parasites on each fruit and vegetable shows that cabbage had the highest prevalence rate 19 (95%) followed by carrot and bitter garden egg with 17 (85%) and 29 (83%) respectively. Others include spinach 17 (75%), onion 15 (75%), watermelon 26

(74.3%), lettuce 14 (70%), tomatoes 22 (63%), cucumber 20 (57.1%), banana 19 (54.3%), orange 18 (51.4%), Guava 17 (49%) while apple had the lowest prevalence rate of 16 (46%) (Table 2). The species of intestinal parasites found in the study area are *Ascaris lumbricoides* 110(44.0%) which had the highest prevalence followed by *Entamoeba histolytica* 32 (12.8%), *Trichuira trichuris* 30 (12%), *Ancylostoma* spp. 27 (10.8%) *Taenia* spp. 16 (6.4%) *Strongyloid stercoralis* 16(6.4%), *Giadia lamblia* 12 (4.8%) and *Hymenolepsis nana* had the least 7 (2.8%) (Table 3).

Table 1: Prevalence of Intestinal Parasites on Fruits and Vegetables Based on Location

Location	No. examined	No. infected (%)	P Value	No. examined	No. Infected	P value	Total examined (%)	Overall total (%)	P value
	Fruits			**Vegetables**					
Biu	120	86 (71.7)		55	43 (78.2)		175	129 (51.6)	
Burutai	96	55 (57.3)	4.08	30	23 (76.7)	0.01	126	78 (31.2)	3.72
Miringa	64	27 (42.2)		19	16 (84.2)		83	43 (17.2)	
Total	**280**	**168 (60.0)**		**104**	**82 (78.8)**		**384**	**250 (65.1)**	

Table 2: Species of Parasites Encountered on Fruits and Vegetables in the Study Area

S/N	Samples	No. Examined	Parasites Encountered	No. of Each Specie Encountered	Prevalence on Each Sample (%)
1	Tomatoes	35	*Ascaris lumbricoides*	15	22 (63)
			Hymenolepsis nana	1	
			Trichuira trichuris	6	
2	Guava	35	*Ascaris lumbricoides*	13	17 (49)
			Strongyloid stercoralis	4	
3	Watermelon	35	*Ascaris lumbricoides*	14	26 (74.3)
			Hymenolepsis nana	6	
			Ancylostoma spp	6	
4	Orange	35	*Entamoeba histolytica*	9	18 (51.4)
			Ancylostoma spp	4	
			Trichuira trichuris	5	
5	Bitter garden egg	35	*Ascaris lumbricoides*	20	29 (83)
			Trichuira trichuris	9	
6	Cucumber	35	*Ascaris lumbricoides*	5	20 (57.1)
			Ancylostoma spp	12	
			Entamoeba histolytica	3	
7	Apple	35	*Entamoeba histolytica*	8	16 (46)
			Ascaris lumbricoides	8	
8	Banana	35	*Giadia lamblia*	9	19 (54.3)
			Ascaris lumbricoides	2	
			Entamoeba histolytica	8	
9	Spinach	24	*Ascaris lumbricoides*	9	18 (75)
			Giardia lamblia	3	
			Trichuris trichuira	5	

			Ancylostoma spp	1	
10	Cabbage	20	*Ascaris lumbricoides*	15	19 (95)
			Ancylostoma spp	4	
11	Lettuce	20	*Ascaris lumbricoides*	9	14 (70)
			Trichuris trichuira	5	
12	Onion	20	*Strongyloid stercoralis*	12	15 (75)
			Taenia spp	3	
13	Carrot	20	*Taenia* spp	13	17 (85)
			Entamoeba histolytica	4	
	Total	**384**			**250 (65.1)**

Table 3: Prevalence of Each Parasite Encountered During the Study

S/N	Species	Prevalence (%)
1	*Ascaris lumbricoides*	110 (44.0)
2	*Entamoeba histolytica*	32 (12.8)
3	*Trichuira trichuris*	30 (12)
4	*Ancylostoma* spp	27 (10.8)
5	*Taenia* spp	16 (6.4)
6	*Strongyloid stercoralis*	16 (6.4)
7	*Giadia lamblia*	12 (4.8)
8	*Hymenolepsis nana*	7 (2.8)
	Total	**250 (100)**

DISCUSSION

An overall prevalence of 250 (65.1%) was observed and out of 280 fruits examined 168 (60.0%) were contaminated with one or two eggs of intestinal parasites and 82 (78.8%) out of 104 vegetables. Highest contamination was recorded on cabbage (95.0%) and the least on apple (65.0%). This result is higher compared with previous studies by Istifanus and Panda (2018) and Usman *et al.* (2020) on fruits and vegetables sold in Bauchi metropolis and Bauchi north senatorial zone. These authors Reported prevalence of (14.3%) on fruits and (13.8%) on vegetables and (20.1%) on fruits and (11.8%) on vegetables respectively. The difference might be due to the exposure of the fruits and vegetables to contaminated environments and contaminated irrigation water. In addition, this study area lacks good toilet facilities, a reasonable number of members of the community depend on open defecation or practiced open defecation and faecal matter contaminated with the egg of helminthes parasites may be washed off into water body that are used for irrigation. Contamination of fruits and vegetables may be caused by the use of untreated organic manure, wastewater for irrigation and contact with grazing animal's feaces. This might possibly be the reasons for high prevalence of intestinal parasites in this area. Shafa-ul-Haq *et al*. (2014) reported the use of untreated wastewater as the major causes of parasitic contamination of vegetables.

Bitter garden eggs (83%) and cabbage (95%) were found to harbor the highest intestinal parasite on fruits and vegetables respectively. Watermelon (74.3%), Tomatoes (63%), Cucumber (57.1%), Banana (54.3%), Orange (51.4%), Guava (49%) and Apple (46%) on fruits and Carrot (85%) Spinach (75%), Onion (75%) and Lettuce (70%) on vegetables. The cost of cabbage and bitter garden egg in the study area is less and there availability is high when compared with other fruits and vegetables. These might cause their poor handling by vendors, and consumers as they are always affordable and available in large quantity. This agrees with the finding of Bashir *et al*., (2020). *Ascaris lumbricoides* had the highest prevalent rate (44%) and

Hymenolopis nana had the lowest of (2.8%). Other parasites encountered include *Entamoeba histolytica* (12.8%), *Trichuira trichuris* (12%), *Ancylostoma spp* (10.8%), *Taenia* spp. (6.4%), *Strongyloid stercoralis* (6.4%) and *Giadia lamblia* (4.8%). *Ascaris lumbricoides* has been reported to be the highest or second to the highest in most of the previous studies conducted on fruits and vegetables in different parts of world such as Tefera *et al.* (2014) in Jimma Town, Ethiopia and Usman *et al.* (2020) in Bauchi North Senatorial Zone, Nigeria. All other species encountered were reported by various researchers in different parts of the country on fruits and vegetables such as Adamu *et al*. (2012) in Maiduguri and Oranusi *et al*. (2013) in Owerri with different prevalence rate. Many factors may be responsible for this variation include location, number and type of samples examined, laboratory technique, handling methods by vendors and consumers, preservation techniques, nature of water and type of fertilizer used during farming among others.

CONCLUSION

The results obtained in this study, fruits and vegetables sold in this study area were highly contaminated with intestinal parasites due to poor environmental sanitation, handling methods and preservation techniques by both vendors, farmers and consumers as well as use of waste water and poor fertilizer during farming. This can be reduced or prevented through proper disposal of human and animal waste, proper handling and use of modern preservation techniques, use of clean or treated water and recommended fertilizer during farming as well as proper washing of fruits and vegetables before consumption.

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REFERENCES

Abougrain, A., Nahaisi, M., Nuri, M., Mohamed, S. and Khaila, S. (2010). Prevalence of Intestinal Parasites in Fresh Salad Vegetables from Wholesale and Retail Markets in Tripoli, Libya. *J. Homepage Food Cont*., 11:5-14.

Adamu, N.B., Adamu, J.Y. and Mohammed, D. (2012). Prevalence of Helminth Parasites Found on Vegetables Sold in Maiduguri. *Food Control.,* 25: 23-26.

Anwar, S.A. and McKenry, M.V. (2012). Incidence and Population Density of Plant Parasitic Nematodes Infecting Vegetable Crops and Associated Yield Losses in Punjab, Pakistan. *Pakistan Journal of Zoology*., 44: 327-333.

Arora, D. R. and Arora, B. B. (2008). *Medical Parasitology*. 2nd edition, CBS Publishers and Distributors Pvt Ltd., New Delhi, India. 3(8): 168-180.

Asmita, R., Pragati, S. and Manvika,S.l (2016).Microbiology of Fresh Produce: Route of Contamination, Detection Methods, and Remedy**.** *Critical Reviews in Food Science and Nutrition* 56:14, Pages 2383-2390 https://doi.org/10.1080/10408398.2013.841119

Bashir, M. A., Amina, A.W., Haladu, A. G. and Umar, A. M. (2020). Prevalence of Helmenths Parasites in Vegetables Sold in Jama'are Metropolis, Bauchi State, Nigeria. *Bima Journal of Science and Technology.,* Vol. 3(2) Pp40-47

Bertoia, M.L., Mukamal, K.J., Cahill, L.E., Hou, T., Ludwig, D.S., Mozaffarian, D., Willett,

W.C., Hu, F.B. and Rimm, E.B. (2015). Changes in Intake of Fruits and Vegetables and Weight Change in United States Men and Women Followed for up to 24 years: Analysis from three Prospective Cohort Studies. *PLoS medicine.,* 22*; 12*(9):e*1001878*.

Bigna, J.J. and Noubiap, J.J. (2019). The Rising Burden of Noncommunicable Diseases in Sub-Saharan Africa. *Lancet Glob Health.*, **7**, 1295-6.

Damen, J. G., Banwat, E. B., Egah, D. Z. and Allanana, J. A. (2007*). Parasitic Contamination of Vegetables in Jos, Nigeria. Annals of African Medicine., 6(3), 115.*

Hall, J.N., Moore, S., Harper, S.B. and Lynch, J.W. (2009). Global Variability in Fruit and Vegetable Consumption. *Am J Prev Med.*, 36, 402-9.

Istifanus, W.A and Panda, S.M. (2018). Parasitic Agents in Fresh Fruits and Vegetables Sold in Open Markets in Bauchi, Nigeria. *Journal of Food Quality and Hazards Control*.,5:84- 88.

Jourdan, P. M., Lamberton, P. H., Fenwick, A., and Addiss, D. G. (2018). *Soil-transmitted Helminth Infections. The Lancet., 391(10117), 252-265.*

Layade, A.A. and Adeoye, I.B. (2014). Fruit and Vegetable Consumption among Students of Tertiary Institutions in Oyo State. *Russ J Agric Soc.*, 30.

Malann, Y.D. and Utitofon, I.T. (2016). The Prevalence of Intestinal Parasites on Fruits Sold in Markets Around Gwagwalada Area Council,F.C.T, Abuja. *AASCIT Communications*.,.3(2):107-111.

Mohamed, M. A., Siddig, E. E., Elaagip, A. H., Edris, A. M. M. and Nasr, A. A. (2016). Parasitic Contamination of Fresh Vegetables Sold at Central Markets in Khartoum state, Sudan. *Annals of clinical microbiology and antimicrobials,* 15**,** 17.

Oranusi, S., Braide, W. ad Etinosa-Okankan, O.J. (2013). Prevalence of Geohelminthes on Selected Fruits and Vegetables Sold in Owerri, Imo State, Nigeria. *African Journal of Food Science and Technology.,* Vol. 4(2) pp. 35-43

Available Online http://www.interesjournals.org/AJFST

Punsawad, C., Phasuk, N., Thongtup, K., Nagavirochana, S. and Viriyavejakul, P. (2019). *Prevalence of Parasitic Contamination of Raw Vegetables in Nakhon Si Thammarat Province, Southern Thailand. BMC Public Health., 19(1), 1-7.*

Rui, H. L. (2003). Health Benefits of Fruit and Vegetables are from Additive and Synergistic Combinations of Phytochemicals. *American J. Clin. Nutr.*,. 78: 517-519.

Shafa-ul-Haq, S., Maqbool, A., Javed, K.U., Yasmin, G. and Sultana, R. (2014). Parasitic Contamination of Vegetables Eaten Raw in Lahore, Pakistan. *Pakistan Journal of Zoology.,* 46: 130-135.

Tefera, T., Biruksew, A., Mekonnen, Z. and Eshetu, T. (2014). Parasitic Contamination of Fruits and Vegetables Collected from Selected Local Markets of Jimma Town, Southwest Ethiopia. *International scholarly research notices.,* 10.1155, 382715.

Usman, A.M, Babeker, E.A and Aliyu A.O. (2020). Prevalence of Intestinal Parasites on Market Sold Fruits and Vegetables. *Bima Journal of Science and Technology*., Vol. 4(1) Pp99- 106

Voung, T.A., Nguyen, T.T., Klank, L.T., Phung, D.C. and Dalsgaard, A. (2007). Faecal and Protozoan Parasite Contamination of Water Spinach (*Ipomea aquatic*) Cultivated in Urban Waste Water in Phnom Penh, Cambodia. *Tropical Medicine and International Health.* 12: 73-81.