PARASITIC CONTAMINATION OF VEGETABLES SOLD IN SOME MARKETS IN MUBI ADAMAWA STATE, NIGERIA

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ABSTRACT
Fresh vegetables are an important part of a healthy diet but if not adequate prepared, can be an agent of transmission of intestinal parasites. This study determines the parasitological contamination of some vegetables sold in markets in Mubi. Four hundred samples of vegetables analysed were for presence of intestinal parasite out of which 44.5% contamination rate was recorded. Parasitic contamination rate of *Sesamum indicum* was 62%, *Hibiscus subdariffa* 50%, *Abelmeschus esculentus* 48% and *Lactuca sativa* 44%. Parasitic prevalence rate of 28.8% were recorded for *Entamoeba histolytica*, 25% for *Fasciola spp*, *Ancylostoma spp* 22%, *Ascaris lymbricoides* 11.4%, while *B coli* had the lowest prevalence rate of 0.8%. The presence of parasite in vegetable underscore the fact that these vegetable could be potential source of infection, hence the need to educate consumers on the importance of good hygiene practice in handling and preparation of vegetable for consumption.
Key words: Vegetable, parasite, contamination, waste water, human intestinal parasite.

INTRODUCTION
Intestinal parasitic infection is a major health problem worldwide particularly in many developing countries and especially in persons with co morbidities (Nyarango *et al.,* 2008). Evidence over years show that man has continuously suffered from parasitic organism with debilitating and often fatal consequences. Even in these modern days, it has been estimated that a third of the world's population may harbour parasitic infection (Ezigbo, 1990). Most of the infection may be temporarily or permanently incapacitating, others may suffer from chronic, painful, debilitating or disfiguring disease. The same fate faces domestic animal and hence this can lead to grave economic looses (Ezigbo, 1990).

In man, intestinal parasites are significantly associated with diarrhea (Utzinger *et al.,* 1999). The fecal oral route is significantly involved in the transmission of parasitic infections to humans via personal hygiene, environmental conditions like contamination of soil and water sources with human feces, poor sewage disposal and use of night soil as fertilizers (Muttalib *et al.,* 1983, Mustafa *et al.,* 2001). The use of wastewater and human excreta (night soil) in agriculture is a traditional and wide spread practice (WHO 2006). Waste water use is also common in many developing countries especially in countries with problem of water scarcity for irrigation (VanderHoek *et al*., 2002, Amahmid and Bouhoum, 2005). Farmers in these countries, especially in peri urban areas often have to rely on waste water as the main source for irrigation. Waste water irrigated agriculture also provides job opportunities, increase crop yields, requires less or no use of inorganic fertilizers and improves incomes and livelihood of poor people (Ensink *et al.,* 2002, VanderHoek *et al.,* 2002, Leschen *et al.,* 2005). When the soil becomes contaminated, the egg in soil can be transferred on to vegetables then onto the hand and transferred directly into the mouth or ingested by eating raw or inadequately prepared vegetables (Mustafa *et al*., 2001). Vegetables are referred to as the fresh edible portion of herbaceous plant roots, stems, leaves or fruits. These plants are either eaten fresh or prepared in a number of ways.

Besides the undeniable benefits that waste water brings to its users, waste water irrigation in agriculture may have negative impacts on human health (WHO, 2006). Literatures have shown that the use of excreta polluted irrigation water is a health risk to the farmers and consumers of crops so produced. Raw waste water frequently contains high numbers of egg of human intestinal nematodes (Blumenthal *et al.,* 2001, Amahmid and Bouhoum, 2005, Ensink *et al.,* 2005). Therefore market vegetables are often contaminated by eggs of human intestinal nematodes where such polluted waters are used for irrigation purposes. The risk of intestinal parasites has been shown to be higher among the inhabitant of developing countries especially in the shanties and slums where there is poor disposal of garbage, poor health systems and overcrowding (Crompton *et al*., 1993). Intestinal parasites have been found to adhere to vegetables, fingers, utensils, door handle and money. Besides, they can be transmitted through flies and contaminated fingernails (Crompton *et al*., 1993, Ismid *et al*., 1998). Estimate of animal economic losses due to parasitic infections run into millions of dollars throughout Africa and considerable manpower and productivity is lost through ill health of parasitic diseases and there complications (Sofolowe and Bennett, 1985).

Epidemiological survey done in Kenya's poor peri-urban and urban areas revealed a high prevalence of intestinal parasites with *Ascaris lumbricoides* (82%), *T. trichura* (60%), *E. histolytica* (41%), and *G.lamblia* (30%) (Akwale *et al.,* 2004). Nyarango *et al.* (2008) reported that 84 vegetables comprising of 11 kales, 12 cabbages, 17 spider flower and 15 black bight shade were examined out of which a total of 55 samples were infested with helminthes. Similarly, Vazquez *et al.* (1997) observed that soil contaminated with *Toxocara sp* eggs from parasitized dogs and cats or with either sewage or contaminated water where vegetable for human consumption are grown play a role as a transmission mechanism. Steele and Odumeru (2004) showed that the risk of disease transmission from pathogenic microorganism present in irrigation water is influenced by the level of contamination, the persistence of pathogens in water, soil and on crops, and the route of exposure as both ground, surface and human waste water are used for irrigation.

In Nigeria especially in the Northern part where amount of rainfall per annum is low, there is dependence on other sources of water for agricultural purposes and this gives rise to the use of waste water for irrigation in agriculture. This coupled with the indiscriminate disposal of faecal matter pose another problem as they are either used as manure or washed to nearby farm lands by erosion.

Although man has long consumed vegetables as source of vitamins, minerals, proteins and fibres, there have been reported cases of illness emanating from these food sources. Global sourcing of food coupled with changing consumer vogues including the consumption of raw vegetables and undercooking to retain the natural taste and preserve heat labile nutrient, increase the risk of food borne parasite transmission as the ingestion of such parasite and their form could pose a serious health hazard. In view of the foregoing fact, this study is designed to assess the extent of parasitic contamination of vegetables sold in Mubi markets and to discuss various ways in which vegetables should be processed in order to control the health risk associated with the consumption of contaminated vegetable.

MATERIALS AND METHODS

Study Area

The study was carried out between the months of February and May in Mubi metropolis which is located at northern senatorial district of Adamawa State, North East of Nigeria. The area has population of 300,000 people (Federal republic of Nigeria official gazette 2007), majority of which depend on open market for sources of meat, vegetables and other food-stuffs. Sanitary condition is generally poor around areas where vegetables are sold.

Sample Collection

Samples were purchase from four different markets where vegetables are sold. These include Mubi main market, Kaban, A market close to Mubi main motor park and Kasuwan kuturu. A total of four hundred samples (fifty samples for each) of the following vegetables; *Sesamum indicum* (sesame), *lactuca sativa* (Lettuce), *Cucurvita pepo* (Pumpkin), *Brassica oleracea* (Cabbage), *Abelmeschus esculentus* (Okra), *Talinum triangular* (Water leaf) *Amaranthus sp.* (Green leaf) and *Hibiscus subdariffa* (Yakuwa in hausa) were collected.

Processing of Samples

The vegetables were washed for removal of parasite ova, larva or cyst, using washing method described by Gaspard and Schwartzbrod (1991). The preparation was filtered through wet gauze into a clean universal bottle to remove debris. A portion of the solution was then dispensed into clean centrifuge tubes and spinned at 5000 rpm for five minutes, the supernatant was discarded and a drop of the sediment was placed on the center of a clean grease free slide and covered with a cover slip. The preparation was examined under the microscope for larva, ova and cyst using x10 and x40 objectives. Parasites were identified as described by Jeffery and Leach (1975).

RESULT

A total of 400 samples; 50 samples each of 8 different vegetable were examined for parasites contamination. Table 1 shows the distribution of parasite on the vegetable. Table 2 shows the rate of contamination of vegetable by parasites. Sasame had contamination rate of 31(62%), lettuce 22(44%), pumpkin 20(40%), Water leaf 18(36%), cabbage 17(34%), Green leaf 21(42%), okra fruit 24(48%) and yakuwa 25(50%). The prevalence rates of parasites in vegetable are shown on table 3. *Entamoeba histolytica* showed prevalence rate of (28.8%), *Fasciola spp* (25.0%), *Ancylostoma spp* (22.9%), *Schistosoma mansoni* (1%), *Ascaris lumbricoides* (11.4%), *Giardia lamblia* (2.8%), *Balantidium coli* (0.8%), *Trichuri trichiura* (1%), *hymenolopsis nana* (1.6%), and *strongyloide stecoralis* (4.7%).

Table 1 Distribution of Parasite on Vegetable

PARASITE	NO. OF VEGETABLE SAMPLES POSITIVE FOR PARASITE							
	A	B	C	D	E	F	G	H
E. histolytica	22	23	11	12	14	23	17	20
Fasciola spp.	9	15	13	16	23	19	10	18
Ancylostoma spp	18	5	14	7	11	20	19	19
S. mansoni	-	-	-	-	5	-	-	1
A. lumbricoides	22	13	8	3	-	3	7	-
G. lamblia	6	7	-	-	-	-	1	-
B. coli	-	-	-	-	-	-	4	-
T. trichiura	-	2	-	1	-	2	-	-
H. nana	-	-	-	5	-	-	-	3
S. stercoralis	7	4	-	-	-	-	3	9

Key: A= ***Sesamum indicum***, B= ***Lactuca sativa***, C= ***Cucurvita pepo***, D= ***Talinum triangular***, E= ***Brassica oleracea capitata***, F= ***Amaranthus spp.,*** G= ***Abelmeschus esculentus***, H= ***Hibiscus subdariffa***

Table 2: Rate of contamination of vegetable in %

Vegetable	No. vegetable sample positive for parasite	% of the samples positive for parasite
Sesamum indicum	31	62
Lactuca sativa	22	44
Cucurvita pepo	20	40
Talinum triangular	18	36
Brassica oleracea capitata	17	34
Amaranthus spp.	21	42
Abelmeschus esculentus	24	48
Hibiscus subdariffa	25	50

Table 3: Prevalence of parasite in vegetable in %

Parasite	Total no. of sample +ve	% prevalence
E. histolytica	142	28.8
Fasciola spp.	123	25.0
Ancylostoma spp	113	22.9
S. mansoni	5	1.0
A. lumbricoides	56	11.4
G. lamblia	14	2.8
B. coli	4	0.8
T. trichiura	5	1.0
H. nana	8	1.6
S. stercoralis	23	4.7

DISCUSSION

A study of the extent of contamination of vegetable by parasite in Mubi metropolis showed that 62% *Sesamun indicum*, 44% *Lactum sativa*, 40% *Cucurvita pepo*, 36% of *Talinum triangular*, 34% *Brassica oleracea capitata*, 42% *Amaranthus spp*, 48% *Abelmeschus esculentus* and 50% of *Hisbiscus subdariffa* were contaminated. Nyarango *et al*. (2008) showed that vegetables purchased at market have high rate of infection with parasite. In the same vane this studies showed that vegetables obtained from the markets are contaminated with parasites. This is not unconnected with the fact that waste water used for irrigation is the sources of these parasites pollution found on vegetable (Peterson *et al.*, 2001; Idrissa *et al.*, 2010).

One way analysis of variance showed that there was significant difference in the distribution of parasites on the vegetables. Results obtained showed high parasite contamination of *Sesamum indica*, followed by *Hibiscus subdariffa, Abelmeschus esculentus, Lactuca sativa and Amaranthus spp.* (Table 1). This implies that parasites are not evenly distributed on the vegetables. This uneven distribution could be attributed to differences in morphology of vegetable leaves which may be sticky as the case with *Sesamum indicum* or *Lactuca sativa* which may trap parasites in its leaves. Besides, process of handling during harvest and in market could be potential sources of contamination by parasites.

Report on assessment of 120 vegetables sold in major market in Nigeria found many of the vegetables to be heavily contaminated with worms of parasites such as hookworm and tapeworm, so making them potentially harmful to the body if not adequately washed. Interestingly, vegetables in some cities for instance Ibadan has contamination rate of 70%, Ilorin 70% and Lagos 65% (Olusoga *et al.*, 2009), while this study recorded parasitic contamination rate of 44.5%. Similarly, Damen *et al*. (2007) reported intestinal parasitic infestation of 36% in Jos, Nigeria, with cabbage having the heighest prevalence of 64% and tomato the least with 20%.

This study showed that *E. histolytica* is the most prevalent parasite with prevalence of 28.8% followed by *Fasciolla spp* 25%, *Ancylostoma spp* 22%, and *Ascaris lymbricoides* 11.4% (Table 3). This indicates a high rate of fecal contamination pointing to the fact that the use of raw waste water in agriculture process of vegetable production is a contributing factor. This agrees with the findings of Habbari *et al*. (1991) that waste water reuse may lead to public health risk of transmission of enteric disease following the consumption of raw vegetables. Since surface water are also contaminated due to human activities such as discharge of feces and urine, such water when used for crop production poses problem of contamination. Markets where these vegetables were sold as observed during the period of this study, is another source of contamination as flies that land on food, meat and decaying matter land on vegetables. In addition, litters of human feces were found on and around the farms where the vegetables are grown. Besides, constant flow of sewage and water transport parasites to vegetables. Nyarango *et al*. (2008) and Steel and Odumeru (2004) observed that ground water, surface water and waste water which are commonly used for crop production often contain high parasite load, though ground water is generally of good quality, but it's usually contaminated with surface run off.

Proper disposal of human and animal waste can prevent contamination of food and water, and can prevent parasitic infection through faeco-oral route. In addition, composting of these wastes before using as fertilizer for crops could kill parasite eggs (Doyle, 2003). A striking issue being considered by some parasitologist is the potential spread of parasitic diseases as global warming proceeds. Some diseases are presently confined to tropical and subtropical areas because cysts or intermediate hosts are not cold hardy. But if lake temperatures warm up and winter temperatures moderates, some disease may encroach on temperate areas (Andok, 1994).

In conclusion, contamination of fresh vegetable sold in markets with human intestinal parasite may pose a health risk to consumer of such products. Therefore, the need to institute control such as treatment of irrigated water, municipal waste water before use, treatment of infected persons and provision of good sanitary systems. The local health and environmental authorities should also educate the public on the health hazard of vegetable grown with sewage and faecal material from human and animal and the importance of washing and disinfecting them before consumption.

REFERENCE

Akwale S.W., Koji J. L., Kaneko A., Eto H., Obonyo C., Bjorkman A. and Kobayakawawa T. (2004), Anaemia and malaria at different altitude in the western highlands of Kenya,

Acta Tropica: 9: 167-175.

Ando K., (1994). The influence of global environmental changes on nematodes. *Japan Journal of Parasitology*; 43: 477-482.

Amahmid, O. and Bouuhounm K. (2005) Assessment of the health hazard associated with wastewater reuse: transmission of geohelminthic infections. *International Journal of Environmental Health Research* 15: 127-133.

Blumenthal U. J, Cifuentes E. Bennett, S., Quingley M. and Ruiz-PalaCios (2001) The risk of enteric infections associated with waste water reuse: the effect of season and degree of storage of wastewater. *Transctions of the Royal and Society of Tropical Medicine and Hygiene* 95; 131-137.

Crompton D. Saviola, L. (1993) Intestinal parasite infection and urbanization. *Bulleting of the world health organization*. 71: 1-7.

Damen J. G., Banwat, E. B., Egah D. Z. and Allanana J. A. (2007) Parasitic contamination of vegetable in Jos, Nigeria. *Annals of African Medicine*, **6**(2): 115-118.

Doyle, E. (2003) *Foodborne parasite*: A review of the scientific literature. Food research institute, University of Wisconsin, Madision.

Ensink J. H. J., VanderHoek W., Matsuno Y. Munir S. and Aslam R. (2002) Use of untreated waste in peri urban agriculture in Pakistan: risk and opportunities. Research report 64, international waste water management institute. Colombo.

Ezigbo J. C. (1990) *Parasitology for Medical Students.* New frontier publishers, Lagos pp4-35

Federal republic of Nigeria official gazette. (2007). National population commission census figures. Published by Federal government printer, Lagos.

Gaspard P. Schwartzbrod J. (1991) Determination of the parasitic contamination of irrigated vegetables. *Environmental Quality and Ecosystem Stability,* 289-296.

Habbari K, Tifnouti A. Bitton G. and Mandil A. (1991) Geohelminthic infection associated with raw wastewater reuse for agricultural purpose in Beni Mellal, Morocco.*Parasitology International* 48: 249-254.

Idrissa, S. Belghyti, D., Elkarrim, K., and Yoro, Clement (2010) Parasitic contamination of the mint and irrigated by untreated wastewater in Sidi Yahia Gharb (Morocco). *BALWOIS*

Ismid, S. and Rukmono, B. (1983) Collected papers on the control of transmitted helminthiasis II vol. 5. Tokyo, Asian parasite control organization. Nail and dust examination for helminth eggs in orphanages. pp 1-53.

Jeffrey H. C. and Leach R. M. (1975) *Atlas of Medical Helminthology and Protozoology.* Churchil Livingstone, Edinburg, London. pp2-121.

Leschen, W. Little D. and Bunting S. (2005) Urban aquatic production. *Urban Agriculture Magazine* 14: 1-7.

Mustafa, U Adnan S. Gonul A. Hatice O. Suleyman A. (2001) Environmental pollution with soil transmitted helminthes in sanlurfa, Turkey. *Inst. Oswald Rio de Janeiro.* 96:903-90.

Muttalib, M. A., Huq, M. Huq, J. A., and Suzuki, N. (1983). Soil pollution with Ascaris ova in three villages of Bangladesh. Yokogowa collected papers on the control of soil transmitted helminthiasis. APCO, Tokyo 11: 66-71 .

Nyarango R. M, Aloo, P. A, Kabiru W. E. and Nyanchongi B. O (2008) The risk of pathogenic intestinal parasitic infection in Kisii munipality, Kenya. *BMC Public Health* 8: 237 – 245.

Olusoga O. Alli, O.A.T., Ogunleye, V. F., Olasun,I. I. and Ogbolu, F.F.O. (2009) The presence of intestinal parasite in slected vegetable from open market in South Western Nigeria. *Africa Journal of Medicine and Medicinal Science.*

Peterson S. R., Ashbolt N. J. Sharma A. (2001) Microbial risk from wastewater irrigation of salad crops: a screaming level risk assessment. *Water Environs Res*, 73(6): 667-672.

Sofoluwe G. O. and Bnnett F. J. (1985) *Principles and Practice of Community in Africa.* University Press Ltd, Ibadan.

Steele, M., and Odumeru, J. (2004) Irrigation water as a source of foodborne pathogens on fruits and vegetables. *Journal of Food Protection*, 67:2839-2849.

Utzinger, J. N'Goran, E. K. Marti, H. P, Tanner, M, Lengler, C, (1999) Intestinal amoebiasis, giardiasis and geohelminthiasis, their association with other intestinal parasites and reported symptoms. *Trans. R. Soc. Trop. Med Hyg.* 93: 137-141.

Van der Hoek W., Hassan M U, Ensink J. H. J, Mukhtar M., (2002) Urban waste water: A Valuable resource for agriculture-A case study from Haroonabad, Pakistan. Research Report 63. International water management Institute, Colombo.

WHO (2006a) Guidelines for the safe use of wastewater, excreta and greywater – volume 2: Waste water use in agriculture. WHO, Geneva.

WHO (2006a) Guidelines for the safe use of wastewater, excreta and greywater – volume 3: Waste water use in agriculture. WHO, Geneva.