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By

Pam, D.D.
Pam, V.A.
Ogbru, K.I.
Bot, C.J.
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Pam, D.D.¹, Pam, V.A.², Bot, C.C.³, Abdullateef, M.H.³, Ogbu, K.I.⁴

¹University of Jos, Plateau State, Nigeria
²Department of Parasitology, FCAH&PT, National Veterinary Research Institute, Vom, Plateau State, Nigeria
³Department of Animal Health, FCAH&PT, National Veterinary Research Institute, Vom, Plateau State, Nigeria

Corresponding Author’s E-mail: vicpam2004@yahoo.com

ABSTRACT

A total of one hundred and sixty (160) vegetable samples where collected in Jos South Local Government, from two different markets (Building material and Vom market) between May to June 2013 for analysis. These vegetable samples include cabbage, carrot, garden egg, lettuce, and spinach. They were screened using normal saline sedimentation technique. Cysts, ova and larvae of intestinal protozoa, Cestodes and nematode were recovered. 88 (55.0%) of the sample were positive for different species of parasites. Strongyloides stercoralis 38.63% had the highest occurrence follow Entameoba coli, with 34 (38.63%), 29 (32.9%) were observed for Hookworm, Hymenolepis nana had the least with 5 (5.68%). Cabbage with 27.00% had the highest parasitic load, spinach was found to have the least multiple parasites contamination of sixteen (16%). The results from this work shows an indication that animal parasites can be acquired through the consumption of these vegetables, especially when not properly and hygienically prepared before taken to market.

Keywords: Contamination, Vegetables, Markets, Plateau State.

INTRODUCTION

Vegetables are essential for good health, and they form a major component of human and animal diet, they are vital energy contributors that are depended upon by all level of animals as food supplement or nutrient [Duckworth et al, 1996]

Vegetables are also sources of improving food quality and high water content as seen in lettuce and cabbage. Vegetables are food sources of vitamin C, carotene and mineral elements such as iron, and vitamins including thiamine (vitamin B120, Niacin and Riboflavin. [Frazier and West Hoff 1998, Adas, 1999, Erdogrul and Sener, 2005]

The cultivation of vegetables in many parts of the world has been amplified with the application of fertilizer or manure. In Africa, the transmission of intestinal Parasitic Infection has been considered to increase successfully due to the frequent use of untreated human or animal dungs as manure in cultivation by the local farmers, which can be a source of enhancement of zoonotic parasitic infection [Bean et al., 2000, Luka et al., 2000, Cheesbrough, 1991]. Consumption of raw prepared vegetables such as cabbage (Brassica oleracea) lettuce (Lactus sativa); garden egg (Sdanum macropium) cucumber (Cucumis sativa), carrot (Daurus caot), spinach (Amaranthus histilis), tomatoes (Lycopersicont psulentum) etc. are some of the risk factors for animal parasitic infection [Cheesbrough, 1991].

Vegetables for commercial and domestic purposes in Nigeria is mostly carried out by peasant farmers who depend on irrigation or natural rainfall [Luka, et al., 2000, Chiodini, 2001, Harold, 1979]. These vegetables though seasonal, are cultivated in the same pieces of land every year, as a result of this continuous land usage, there is depletion of nutrients, hence the need for fertilizer or manure. Most farmers use untreated animal and human faeces as manure, which are known to contain various species of parasites that are of medical and veterinary importance [Okoronkwo, 1998, Gibson and Brag, 1994, Gerald and Lary, 2000]. Indiscriminate faecal disposition in bushes, farm lands and even in present farms with a belief of enriching the land is also a common practice by farmers.

Some of the water bodies used for irrigation are polluted with parasites infected excreta which may lead to recycling of infection [Ayer, et al., 1992].
Alkekruse (1997) and Hedberg et al., 1994, Smith,(1999), reported that the potential risk factors for animal intestinal parasitic infection as Ascaris lumbricoides, Trichuris trichuria, Balantidium coli, Giadia intestinalis, Blastocystis hominis, involve unhygienic association with unhygienic environments and raw vegetables play a major epidemiologic role in the transmission of parasite food borne disease and intestinal parasites are widely prevalent in developed countries probably due to poor sanitation and inadequate personal hygiene [Kany et al., 1998, Socker, 1993, Wong and Bundy, 1990].

The presence of parasite eggs, larvae, cyst in food is of medical importance and the wide spread consumption of raw food (vegetable) allow for transmission of parasites which result from an infection due to invasion of animal body organism [Frazier and West Hoff, 1970]. It has been shown that the vegetable can be an agent of transmission of protozoan cyst. And helminthes egg, larvae of species like Taenia species, Fasciola species, Toxocara species, Ascaris and hook worm species. [Darehenkora et al., 2006, Okorokwo and Onwuliri, 1998].

Fresh vegetables are regarded as an important part of a healthy diet and can be affected through soil-transmitted helminthes (STH) infection which is endemic in many areas of the world. Especially in countries with poor environmental sanitation and personal hygiene; the mode of infection is through oral means and the spread is high in people who live in areas contaminated with animal faeces, the infection can be by oral intake of infective stages of eggs, larvae and the Oocyst from contaminated environment. It has been revealed that many types of vegetables purchased at markets and farms in different regions were contaminated with Helminthes eggs, as well as protozoan Oocysts. Parasites can be Ecto (i.e they cannot complete their life cycle without spending at least a part of their life in a parasitic relationship) however they could have free living stage outside the host. Facultative parasites are not usually parasites, but can become parasites when they are accidentally eaten. [Garald and Larry, 2000] Examples of parasites include Entamoeba histolytical, Ascaris lumbricoides, enterobins vesmicularis, and Giardia lamblia.

Contamination of vegetation by parasite eggs, cysts and in some cases larvae may be from soil, irrigation water (i.e. water from ponds and rivers, waste water etc) manure which usually or mostly is organic either from human dung, animal dung, poultry droppings, etc are used in cultivating vegetables throughout the year. Plant roots are in constant contact with the soil often irrigated with polluted water. Studies have shown that pathogens presenting contaminated soil may remain viable or up to two (2) months or more especially in moist and shaded areas. Since vegetables require moist environments for their growth, these conditions favor the development of transmissible forms of ectoparasite such as protozoan’s cysts, helminthes egg, and viruses, water as a route of contaminant procedure either as a route of fertilizer application during handling.

Protozoa and helminthes are the parasites of primary public health concern for waste water re-use. Parasite eggs and cysts that is commonly associated with vegetable and some fruits that are of parasitological interest and eggs and cysts of soil nematodes, animal nematodes, cestodes and intestinal protozoa which include amoeba and flagellates. This is because the egg of cysts aid the survival of these parasites onto vegetables in other words, the cyst forms of intestinal parasites survives for long periods in water soil. The cyst therefore, is the only stage of infection of intestinal protozoa since without the cyst, these protozoa cannot establish an infection in the gastro intestinal tract. The protozoa (Giardia lamblia, Entamoeba histolytica and Entamoeba coli) are the most common protozoa to cause animal intestinal infection.

These parasitic eggs and cyst have been known to be transmitted to animals by the injection of food (either through vegetables or fruits). The infective form of the parasites [Cheesbough, 1987] can also get into the body by unwashed hands being put into the mouth after being in contact with things that have the infective form of the parasite in or on them, this means that the use of excreta polluted irrigation water is a health risk to farm workers and the consumption of crop produced. Raw waste water frequently contain high number of animal intestinal nematodes and workers as well as customers and easily infected through direct faecal contamination of the environment or skin penetration [Ayer et al., 1992, Jones, 1980, Lucas et al., 2000].

**MATERIAL AND METHODS**

**Study area**

The study was conducted in Jos-South Local Government Area of Plateau State during Raining Season, between May and June, vegetable samples were collected from both markets and farms in the Local Government area. Majority of the inhabitants of the area are peasant farmers and petty traders of low economic status. The watering of vegetable at this period is through rainfall, it is a common practice that majority of the farmers used animal manure to augment the commercially processed fertilizers to limit their cost of farming.
SAMPLE COLLECTION

Forage vegetable was collected randomly from two (2) different markets in the study area.

1. Building material market and
2. Vom market

Building material market is located along the express road to Jos, it is near the Air Force Girl’s Secondary school (vegetable and fruits are gotten from there). Vom market is located opposite Vom Christian Hospital in Jos South Local Government Area of Plateau State.

SAMPLES FOR THE SURVEY/STUDY

1. Cabbage (*Brassica oleracea*)
2. Spinach (*Amaranthus histilis*)
3. Garden egg (*Sdanum macropium*)
4. Lettuce (*Lactus sativa*)
5. Carrot (*Daucus carota*)

COLLECTION OF VEGETABLE

The vegetable sample for these survey were randomly collected from the two (2) different markets, sample were collected twice in a week for two months in the various areas of study. Vegetables were collected based on their duration in the market that is fresh sample recently brought into the market, and old (between five-one week old samples).

A total of one hundred and sixty (160) vegetable samples were collected from the two different markets that is: eighty from Building Material market and another eighty from Vom market. The vegetable sample were each collected in a different polythene bag from the market, sample were then taken to the parasitology laboratory of the National Veterinary Research Institute,(N.V.R.I), Vom for laboratory analysis.

RESULT AND ANALYSIS

A random sampling of one hundred and sixty (160) samples of vegetable obtained from building material, and Vom market yielded egg cysts and larvae of different parasites. They included cysts of *Entamoeba coli, Entamoeba histolytica, Strongyloides stercoralis, Ascaris lumbricoides, Hook worm* and *Hymenolepis nana*.

Of the one hundred and sixty (160) sample collected, eighty (80) from building material market and eight (80) from Vom market. A total of 87(98.50%) positive for intestinal parasites were observed. Building material had a highest prevalence of 45(51.70%) out of 80 (55.00%) followed by Vom with 42(52.5%) out of 80 samples screened. The samples from building material had the highest prevalence of parasites 45(55.00%), 42 (52.5%) was observed as prevalence for Vom market.

<table>
<thead>
<tr>
<th>Markets</th>
<th>Number screened</th>
<th>Number contaminated</th>
<th>Percentage contaminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vom</td>
<td>80</td>
<td>42</td>
<td>48.3%</td>
</tr>
<tr>
<td>Building material</td>
<td>80</td>
<td>45</td>
<td>51.7%</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>88</td>
<td>99.91%</td>
</tr>
</tbody>
</table>

No significant difference (X²= 0.101 df=1 P>0.05)
Table 2: Contamination of the different vegetables Sampled

<table>
<thead>
<tr>
<th>Parasite</th>
<th>C</th>
<th>L</th>
<th>C₂</th>
<th>S</th>
<th>G egg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongyloides stercoralis</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Entamoeba coli</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Entamoeba histolytica</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Ascaris lumbricoides</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Hook worm</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hymenolepis nana</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Key: C = Cabbage, L = Lettuce, C₂ = Carrot, S = Spinach, G = Garden egg
+ = positive, - = negative
Highly significant (X² cal=16.78 df=4 P<0.05)

Table 2 above shows the rate of contamination of the various vegetables sampled, the rate of infection was high with Lettuce, spinach and garden egg. They were contaminated with five different parasites higher than what was obtainable in the case of Cabbage and Carrot which were infected with four different parasites.

Table 3: Contamination Rate of the Different Vegetables Sampled

<table>
<thead>
<tr>
<th>Types of vegetables</th>
<th>Number examined</th>
<th>Number positive</th>
<th>Overall positive percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabbage</td>
<td>32</td>
<td>27 (30.6%)</td>
<td>84.3%</td>
</tr>
<tr>
<td>Carrot</td>
<td>32</td>
<td>13 (14.7%)</td>
<td>40.6%</td>
</tr>
<tr>
<td>Garden egg</td>
<td>32</td>
<td>13 (14.7%)</td>
<td>40.6%</td>
</tr>
<tr>
<td>Spinach</td>
<td>32</td>
<td>16 (18.4%)</td>
<td>50%</td>
</tr>
<tr>
<td>Lettuce</td>
<td>32</td>
<td>18 (20.4%)</td>
<td>56.2%</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>87 (98.5%)</td>
<td></td>
</tr>
</tbody>
</table>

Highly significant (X² cal=16.78 df=4 P<0.05)

Among the five (5) different vegetables, intestinal parasites were common in Cabbage 27(30.60%) followed by lettuce 18(20.40%) and Spinach 16(18.40%), the least was observed in the case of Carrot and garden egg having 13(14.70%) in each case.

DISCUSSION

The presence of intestinal parasite in vegetable samples is suggestive of faecal contamination. The trend of parasite infection in our society as reported through routine diagnosis is partly a factor of vegetables being a source of transmission. The following factors have contributed to the prevalence of parasite infection and have also confirmed the discovery of Donald,( 1995) and Roberson and Gjerde, (2001), the hygienic status of the consumers and producers of vegetables possibly harboring the infective forms of the parasites, the behavioral attitude of producers in the application of untreated human and animal dung as manure leading to the transmission of zoonotic infection, the use of irrigation sources which receive raw affluent from human and animal wastes. The consumption of vegetables raw or under-cooked is a way by which the transmission of these parasites is encouraged. The isolation of more than one parasite per sample in this work reflects the possibility of a poly faecal contamination of vegetables which most probably result to poly parasitic infections in both man and animals. High level of contamination and persistence of human and animal infection can be a source of contamination.

This is in agreement with the study of Gubson, [1994] and Mara Cairo,1989 reported that the prevalence of intestinal parasites among a particular animal is an attribute of environmental pollution by human and animal faeces, The life cycle of the parasite particularly the Strongyloides stercoralis which has both parasitic and free living state enhance the proliferation of larvae without the host [Feachem, et al, 1983, Roberson and Gjerde,2001], this study reveals Strongyloides stercoralis (62.96%) and Entamoeba coli (22.2%) as being the highest occurring parasite in this study area. However, the overall result is not an exact representation of the findings of previous researchers because the area of study differed both in geographical location, climatic condition, environmental condition and the general behavior of producers to hygiene which can possibly be what informed the prevalence observed in this research.
RECOMMENDATION

Vegetables cannot be removed from both animal and human diet, but can be excluded from the cycle of transmission and dispersion of parasites. This can be achieved by maintenance of sample personal and environmental hygiene by sellers and consumers.

CONCLUSION

Although the recovery efficiency of the method used in this study was not evaluated, actual contamination of vegetables by parasite eggs seem to be very high because, both methods are similar. Although many potential agents for the dissemination of parasites have been reported, infection through vegetables must be high. Considering the eating habits of the people plus the 17% embryonation rate of detected parasites; vegetables play an important role in infection. The result suggests the necessity for nationwide control measures against parasitic infection. In conclusion, contamination of fresh salad vegetables sold in wholesale and retail markets in Jos with pathogenic intestinal parasites may pose a health risk to consumers of such products. The local health and environmental authorities should educate the public on the health hazards of fresh salad vegetables and the importance of washing and disinfecting them before consumption. Furthermore, an adequate treatment of the sewage water and wastewater use for irrigation of plants intended for human consumption, among others, should be implemented.

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