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Infectivity with human ascariasis in Ibadan Oyo State, Nigeria

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Summary

Some of the common foodstuffs that assist in the transmission of ascariasis in Ibadan have been determined. The frequency of recovery of *Ascaris* ova in the different food samples examined varied from 9.6% in tomatoes to 25.6% in lettuce leaves. The indiscriminate pollution of Ibadan environment with human faeces enables the foodstuff consumed raw to serve as effective sources of heavy *Ascaris* infection which lead to other medical complications. The strategies for the control of *Ascaris* infection in Ibadan were discussed.

Résumé

Quelques produits alimentaires qui servent comme vecteur dans la transmission de l'*Ascaris* à Ibadan ont été déterminés. La fréquence de la recolte des oeufs d'*Ascaris* dans les différents aliments examinés varie de 9.6% dans les tomates à 25.6% dans la laitue. La population fécale non controllée des environs aide les aliments consumés crus de servir comme vecteurs effectifs dans la transmission de l'infection par l'*Ascaris* menant a d'autres complications médicales. Les stratèges du contrôle de l'infection ascaridienne à Ibadan ont été discutés.

Introduction

In areas where human faeces are used as manure and human faecal wastes are deposited indiscriminately in the environment, soil pollution is a big problem and helminth ova and larvae may be readily demonstrated on fresh vegetables and other food items consumed raw. Consequently, the faecal oral route of infection becomes very important and intestinal helminthiasis assume enormous proportions especially amongst indisciplined populations that are equally poor in their levels of personal and environmental sanitation. Efficient refrigeration and commercial canning have been very useful in combating this problem in the developed countries but these developments are still outside the reach of most areas in Nigeria. Fresh food items therefore come straight from the farms and gardens to table for consumption without pre-treatment to kill helminth ova and larvae in them.

As a result of the high level of faecal contamination of the Ibadan environment, and the climatic conditions which favour easy development of *Ascaris* ova to the infective stages, there are abundant opportunities for ascariasis to thrive in the human population. Consequently high infectivity rates with ascariasis have been recorded amongst the Ibadan populations (Cobban, 1959; Cowper & Woodward, 1961; Abioye & Ogunba, 1972; Ogunba, 1974; Adedeji, 1981), and it is sad that there are as yet no efforts to control this problem with an infectivity of up to 100% in some population groups.

Chang and Chin (1943) observed that none of the common preservatives such as salt, alcohol and vinegar in the usual concentration can be relied upon to kill the ova of *Ascaris lumbricoides* attached to the vegetables and food items consumed raw and the chances of heavy infections are high in heavily polluted environments. Since there have been no published records in Nigeria on the importance of root

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and leaf vegetables and other food items consumed raw in the transmission of ascariasis, this study was designed to find out their possible role in Ibadan.

Materials and methods

Different food items that are usually eaten raw or uncooked, such as gari, leaf vegetables, root vegetables and fruits were bought from different shops and open markets in Ibadan. The food items were examined for *Ascaris* ova. Each food item was washed in sterile distilled water several times. The distilled water was then centrifuged at 2500 rpm for 2 min using sterile universal containers with covers. The deposit was examined microscopically. The number of *Ascaris* ova present was counted and the number of embryonated ova noted.

The supernatant and the sediments of the washings from the food items were cultured on different types of culture media for bacterial growth. Palmwine purchased from local drinking bars was centrifuged at 2500 rpm for 2 min. Both the deposit and the supernatant were treated as above.

Gari was suspended in sterile distilled water, mixed very well and then allowed to sediment. The supernatant was collected. More water was added and most of the grains of gari were removed by straining through sterile four-ply gauze. The whole supernatant was then centrifuged as above and the deposit examined for *Ascaris* ova. Both the deposit and supernatant were cultured.

In addition, the deposits and the supernatants of all washings from the food items were separately inoculated into nutrient both containing 5% and 10% acetic acid and into 70% ethyl alcohol. Both the acid and alcohol cultures were left for 15 min and 30 min before subculturing them onto nutrient media. The *Ascaris* ova present were cultured for larval development after washing off the acid and alcohol from the ova four times with sterile distilled water. The sediments and the supernatants were also boiled at 100°C for 5, 10 and 15 min. They were cooled down and then subcultured onto culture media. Similarly the ova present were cultured for larval development.

Identification of the isolated bacteria was based on the Gram's stain, motility and biochemical reactions.

Table 1 shows the recovery rate of *Ascaris* ova on the food items examined. The bacteriological examination of the food items yielded some bacterial species. The species recovered from the cultures of the water used to wash the food items were *Staphylococcus aureus, Staphylococcus albus, Escherichia coli, Proteus mirabilis, Proteus morgani and Proteus vulgaris*. No anaerobic organism was isolated.

Tables 2 and 3 show the effect of acetic acid and ethyl alcohol on bacteria and *Ascaris lumbricoides* ova. The 5% acetic acid killed all the bacteria isolated from the food items but had no effect on the ova of *Ascaris lumbricoides*. The acetic acid and ethyl alcohol appeared to be essentially without effect on either the embryonated (infective) or developmental stages (Table 3).

Boiling the ova and bacteria at 100°C is effective in killing them and this is confirmed by the failure of eggs to develop in culture.

Results and discussion

Intestinal nematodes abound both in the rural and urban environments of Nigeria because the tropical climate offers excellent opportunities for easy and rapid development of the different stages of these parasites which are rapidly disseminated in the soil through gross and indiscriminate defaecation habits. The prevalence of *Ascaris* infection among the people therefore varies from the lowest record of 5.81% in some parts in Northern Nigeria (Ramsay, 1934) to high records of over 80% in some parts of Southern Nigeria (Okpala, 1956; Ogunba, 1974).

Table 1 confirms that various food items that are eaten raw often get contaminated and are capable of serving as vehicles of *Ascaris* infection to man. The finding of *Ascaris* ova on edible fruits, therefore, emphasizes the need for strict observation of simple hygiene methods aimed at eliminating the *Ascaris* ova before consumption of the uncooked fruits and vegetables.

Table 1. Recovery of *Ascaris* ova on edible food items

Food items	No. examined	Positive specimen	% Positive	Average egg counts	
				Normal	Embryonated eggs
Lettuce leaves	43	11	25.6	27	10
Cucumber	55	9	16.4	21	6
Carrots (roots)	45	11	24.4	28	12
Mango	35	8	22.9	20	6
Tomato	52	5	9.6	13	8
Garden eggs	63	10	15.9	15	2
Sweet pepper	32	7	21.9	10	3
Onion (bulb)	29	4	13.8	7	1
Gari	36	7	19.4	10	7
Palmwine	29	5	17.2	11	5

Table 2. Effect of acetic acid and ethyl alcohol on bacteria

Type of organism	Time of exposure (min)	5% Acetic acid	10% Acetic acid	70% Ethyl alcohol
Staph. aureus	15	NG	NG	G
	30	NG	NG	NG
E. coli	15	NG	NG	G
	30	NG	NG	NG
Proteus spp.	15	NG	NG	G
	30	NG	NG	NG
Aerobic spore-bearers	15	G	G	G
	30	G	G	G

G = Growth on subculture, NG = no growth on subculture.

Table 3. Effect of acetic acid and alcohol of development of both embryonated and non-embryonated *Ascaris lumbricoides* ova

Type of specimen	5% Acetic acid	10% Acetic acid	70% Ethyl alcohol	Incubation period (days)
Ascaris lumbricoides ova plus bacteria	++	++	++	21
Ascaris lumbricoides ova only	++	++	++	21

++ = Development of ova to infective larval stage.

There are many ways by which these food items can be contaminated with *Ascaris lumbricoides* ova but the most important is through direct contact with polluted soil. The ova of *Ascaris* could, however, be transferred from objects to fingers and from fingers to the mouth or directly from the object to the mouth. In countries where ascariasis is highly prevalent, *Ascaris* ova have been recovered from varying objects including paper money (Dolt & Themme, 1949; Gonzalez-Castro, 1951).

Infection with *Ascaris* ova can be soil-borne through contamination of edible vegetables and roots, or water-borne in the case of palm-wine.

Ascaris ova have been known to withstand extremes of climatic conditions and still remain viable. Davaine (1863) found that the ova of *Ascaris lumbricoides* remained infective after storage for 5 years and Bailliet (1866) observed that the ova of *Ascaris* remained viable after 12 months' exposure to the heat of summer and to the cold of winter. Other studies (Brown, 1927; Cort, 1931; Cort & Otto, 1933; Otto & Cort, 1934; Headlee, 1936) have shown that ascariasis is essentially a household infection and the infectivity of the soil is maintained for the most part by promiscuous defaecation. For these reasons, all fruits getting in touch with contaminated soil or grown in contaminated environment would likely carry *Ascaris* ova on their surfaces either through direct contact with polluted soil or through the activity of insects like houseflies, bees, ants and cockroaches. Dust is also known to play an important part in the dispersal of *Ascaris* ova. Bogojawlenski and Demidowa (1928) and Nakayama (1956) have shown that *Ascaris* ova have physical characteristic of aerosols, and therefore can be airborne. They may be carried away by the wind from the surface of cultivated land (Kobayashi, 1955; Morishita, Nishimura & Imamura, 1959) and contaminate vegetables and exposed food items like gari in houses and market places. This observation is very significant and relevant to Nigeria where many food items are exposed for sale in open markets that are usually very dusty. The use of human faeces as fertilizer on agricultural farms and gardens offers excellent opportunities for *Ascaris* transmission if the human faecal manure is not well treated.

Ascaris ova also get flushed out of farmland during heavy rainfall and may be carried away to other places by the rain water and into streams, uncovered wells, rivers and ponds which are often used as sources of domestic and drinking water supplies.

The ovicidal action of acetic acid is well known and this is what qualifies it as the principal active constituent of natural vinegars, commonly used as food preservative (McCulloch, 1945). In this study, the use of 5% acetic acid failed to kill *Ascaris lumbricoides* ova. This finding agrees with the work of Soh (1960) and Faust, Russell and Jung (1970) who showed that chemical sterilization of *Ascaris lumbricoides* ova is impracticable, since the ova thrived and matured when immersed in strong chemical solutions. The use of 5% acetic acid was, however, capable of killing all the species of bacteria isolated from both the supernatant and the sediment of water used to wash the vegetables. These results confirm the work of Beaver and Deschaups (1949). This finding clearly shows that the use of acetic acid would not be effective as a prophylactic measure against *Ascaris* infection. The use of 70% ethyl alcohol cannot be relied upon as a prophylactic measure as it failed to kill the ova of *Ascaris*. Boiling treatment was however effective in destroying the ova in gari and would significantly reduce infectivity with ascariasis through gari consumption if it is widely adopted.

Of interest is the finding of *Ascaris* ova in palmwine which is one of the country's local wines that is normally consumed untreated or unfiltered. Since palmwine is tapped from palmtrees, it is expected to be free from contamination with helminth ova. Apart from contamination through dust and insects further contamination could be through the use of contaminated rain, pond or well water in diluting the wine and through the use of contaminated containers.

The principal epidemiological factors that are presently enhancing *Ascaris* transmission in Ibadan are the low levels of sanitation which results in the severe contamination of the Ibadan environment and the eating of contaminated raw foodstuffs. The contamination procedure is facilitated because most markets attract refuse dumps near them and these often serve as public toilets as well. It is not surprising therefore that ascariasis which is one of the easiest helminth infections to control and for which there are numerous effective chemotherapeutic drugs is still a problem in Ibadan

city, and continues to be responsible for many clinical complications that often require hospitalization and may, at times, prove fatal (Oluwasanmi, 1968; Lagundoye, 1972, Ajao & Solanke, 1977; Ajao & Ajao, 1979).

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