International Journal of Pathogen Research

9(3): 12-20, 2022; Article no.IJPR.85538
ISSN: 2582-3876

Sources of Transmission of Pathogenic Intestinal Parasites in Humans and Vegetables in Omdurman, Sudan – 2015

Mai Ahmed Elhag Mohamed [a*] and Muataz Mohamed Eldirdery [b]

[a] Department of Parasitology and Medical Entomology, Gharb Elneel College (Laboratory Medicine), Khartoum, Sudan.
[b] National Center for Research, Sudan.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPR/2022/v9i330226

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/85538

Original Research Article

Received 26 January 2022
Accepted 05 April 2022
Published 11 April 2022

ABSTRACT

This study was designed to investigate the possibility of infection via food with pathogenic organisms. It was carried out in the city Omdurman in Khartoum States during the period from December 2015 to November 2019. The objectives of the study were to identify the causative intestinal parasites in the examined individuals. A total of 600 stool specimens and 256 vegetables samples were examined. fecal samples were observed macroscopically for the consistency and presence of mucus, blood, worm larvae and cestodes segments. The samples were then examined by wet smear and formal - ether concentration technique. A bout 200 -300 grams of each vegetable and fruit were washed in 50 ml of sterile normal saline and filtrate was centrifuged then sediment was examined microscopically. Result showed that the overall prevalence of intestinal parasites microscopically was found to be 179/600(29.8%). *Entamoeba histolytica* cyst was reported in mothers 28 (62.2%) as twofold as in children 13 (28.9%), while in food handlers was recorded in 4(8.9%). *Gardia Lamblia* was more dominated in mothers 48(58.5%) as twice as seen in children 24 (29.3%), whereas in food a handler was noted in 10(12.2%). *Taenia spp* was found only in mothers 5 (71.4%) and children 2 (28.6%). Moreover, *Ascaris lumbricoides* was also seen in mothers 11(61.1%) and children 7 (38.9%). Among the examined vegetables and fruits samples, *G.lamblia* found to be the most dominated parasite 26 (66.7%), followed by *E. histolytica* 8 (20.5%) and

**Corresponding author: Email: mayahmed380@gmail.com;*

A.lumbrucoides 5 (12.8%) respectively. In conclusion, the overall of the prevalence intestinal parasites was more pronounced among mothers and their children's. *G. Lamblia* and *E. histolytica* were the most predominated parasites seen microscopically among participants. Mothers should be examined periodically for their health status regarding intestinal parasites to increase the awareness prompt detection.

Keywords: Intestinal parasites; food handlers; mothers; vegetables; fruits; stool examination.

1. INTRODUCTION

The chain that starts from harvesting crops, transportation, marketing to consumption by individuals is not without hazards, Food contamination due to in appropriate and inadequate sanitation that may occur in parts of such chain result in public health effects. Parasites are the major sources of contamination of food and consequently causative agents of diseases. Reports indicate that parasitic and bacterial infections are quite common in Sudan [1]. Intestinal parasites are among the main public health problems around the world especially in tropical and subtropical countries [2]. Of the nearly 1500 agents known to be infectious to humans, 66 are protozoa and 287 are helminths. Many vegetables are good sources of vitamin C, thiamine (Vitamin B1), Riboflavin and mineral elements [3]. The consumption of raw vegetables plays major sources of transmission of parasitic food borne diseases [2]. In recent years, there has been an increase in number of reported cases of food borne illness linked to consuming fresh vegetables. Several surveys in different parts of the world showed that the vegetables can be agents for transmissions of intestinal parasites such as *Cryptosporidium spp., Giardia lamblia, Entamoeba histolytica, Ascaris lumbricoides, hookworms, Enterobius vermicularis, Trichuris trichiura, Toxocara spp., Hymenolepis spp., Taeniaspp., Fasciola spp* [3]. Vegetables can become contaminated with enteric parasitic pathogens 2 throughout the process of planting to consumption. The extent of contamination depends on several factors that include use of untreated wastewater and water supplies contaminated with sewage for irrigation, post-harvest handling, and un hygienic conditions of preparation in food service or home settings It was found that fresh vegetable can be factors of transmission of protoaza cysts, Helminthes ova and larvae [4].

Khartoum, the capital of Sudan is inhibited by more than 7 million people. They rely on the rural areas on the outskirts of the city for securing, vegetables, meat and milk. Infective agent gain access via various routes, particular ingestion of contaminated food and water. In Sudan several reports on the prevalence of parasitic infections in humans but the various source and the modes of transmission of such agents are not fully explored the possibility of transmission of parasite to young children by infected mothers is an example, similarly, the role of food handlers in dissemination of agents is not fully investigated.

2. METHODS

2.1 Study Setting

This study was a descriptive community-based study. It was conducted in the city of Omdurman including Umbada, Karari, Sabreen and Althora. The study population was comprised of 200 mothers, 200 their children (5 years or less) and 200 food handlers distributed as follows 86 grocery workers 23 tea sellers, 15 cafeterias, Restaurant's workers,16 food industry workers 13 Bakers, 12 Refreshment sellers, 12 Butchers ,12 milkmen and11 Vegetables and Fruits sellers. Beside vegetables 32 samples for each kind from vegetables and fruits (Lettuce, Cabbage, Molokhia, Green onion, Tomatoes, and Cucumber) and (Mangoes and Oranges). Before collection of samples the purpose of study was explained to the participants to obtain their consent.

2.2 Fecal Specimens' Collection and Examination

Fecal samples were collected from mothers, children and food handlers in a clean plastic container. Before microscopic examination, faecal samples were observed for consistency, mucus, blood and also for the presence of worm larvae and cestodes segments.

2.3 Wet Mount Examination

Wet smear was made by putting a small amount of stool on clean glass slide, mixed with a drop of normal saline ,covered with cover slip and

examined microscopically using 10X and 40X objectives.

2.4 Formal Ether Concentration Technique

A small portion of about 2 grams was added to 9 ml of formalin and strained through save in a tube 3ml of diethyl-ether was then added and suspension was mixed and centrifuged at 2000 rpm for one minute. A drop of the sediment was transferred to a slide, covered with slip and examined at 10x and 40x lens.

2.5 Examination of Vegetables and Fruits

A bout 200 -300 grams of each vegetable and fruit were washed in50 ml of normal saline and strained through a sieve to remove un desirable materials . The filtrate was then centrifuged at 5000 rpm for 5 minutes. The supernatant was then decanted and a drop of the sediment was placed onto a slide, covered with a slip and examined microscopically at 10x and 40x objective lens.

2.6 Data Collection and Analysis

All the questionnaires and stool samples were labeled with the same number to ensure consistency and completeness. Data was entered and cleaned using Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics was done to assess the prevalence and distribution of intestinal parasites. Logistic regression analysis was performed to determine the independent effect of the independent variables with dependent variable by calculating the strength of the association between intestinal parasites infection and determinant factors using odds ratio (OR) and 95% confidence interval (CI). Crude OR and adjusted OR were estimated by bivariate and multivariate logistic regression analysis with respective 95% CIs respectively. P value less than 0.05 was considered as statistically significant.

3. RESULTS

3.1 The Rate of Infection Microscopically amongParticipants'

Fig. 1 showed the microscopic detection of stool parasite. The figure reveled that mother have the highest rate of infection among participants 92/600(15,3%), followed by their children 73/200 (12.2%) and food handlers 14/600 (2,3%) respectively.

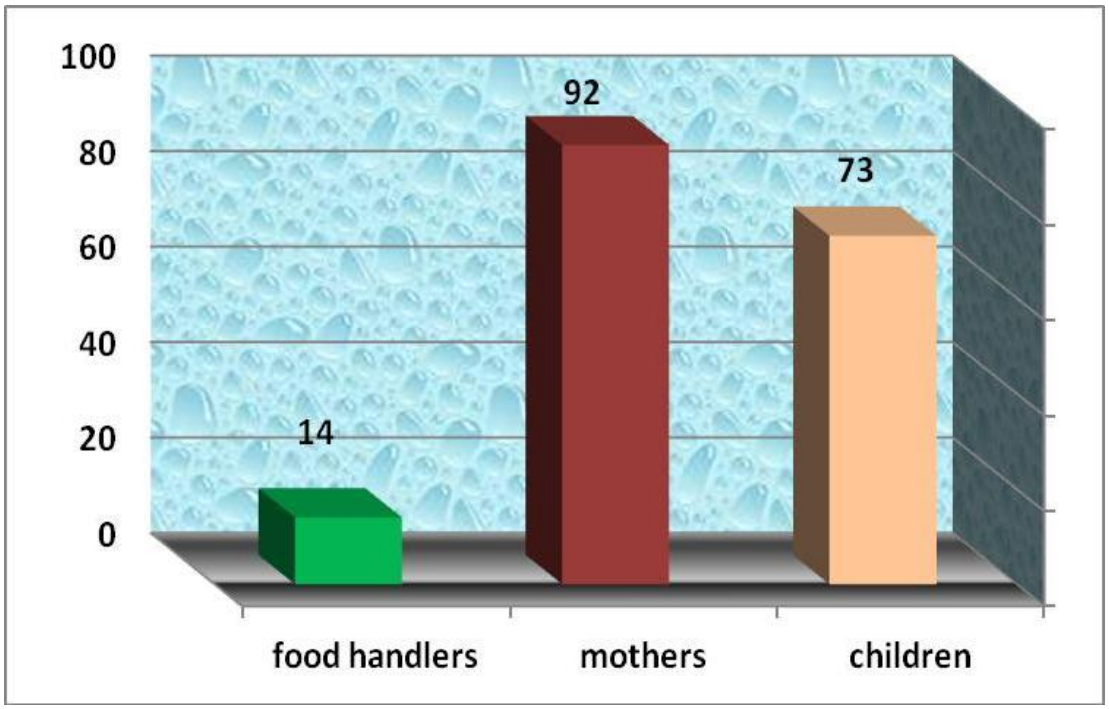

Fig. 1. The rate of infection microscopically among participants'

3.2 Macroscopic Examination of Stool Samples

Table 1. below showed that mucus was found similarly in children 27 (40.9%) compared to their mothers 26 (39.4), and constituted as twice likely as in food handlers 13 (19.7%). Blood was detected in mothers 14 (60.9%) as two folds compared to their children 7 (30.3%), while in food handlers was seen in 2 (8.7%) cases. Blood and mucus were most prevailed in children 10 (76.9%), while in mothers 2 (15.4%) as twice as food handlers 1 (7.7%). There was statistical association noted between macroscopic examination and different participants' p value (0.03).

3.3 Microscopic Examination for the Type of the Parasite in Stool Samples of Mothers, Children and Food Handlers

Table 2. showed that the relationship of the different parasites detected in participants' Entamoeba histolytica cyst was reported in mothers 28 (62.2%) as two folds as in children 13 (28.9%), while in food handlers was recorded in 4(8.9%). *Gardia Lamblia* was more dominated in mothers 48(58.5%) as twice as seen in children 24 (29.3%), whereas in food a handler was noted in 10(12.2%). *Taenia spp* was found only in mothers 5 (71.4%) and children 2 (28.6%). Moreover, *Ascaris lumbricoides* was also seen in mothers 11(61.1%) and children 7 (38.9%). However, *Hymenolepis nana* was only found in children 27(100%). Statistically association was reported between participants and types of parasites detected p value (0.00).

Table 3. showed that there was no association seen between macro and microscopic examinations for the stool sample p value 0.2. However, macro examination didn't indicate that the presence and/or the absence of organisms by detecting microscopically.

Table 4. showed that the rate of infection concerning age groups of children was increased gradually with augmenting of the age especially among those of more than 2 years 29 cases and between 1-2 years old 25 cases. However, the predominated parasites were found *Hymenolepis nana*, *Gardia Lamblia* and *Entamoeba histolytica* respectively. There was no significant association seen between increasing of child age and type of the parasite p value <0.83.

Table 5. showed that no statistically association noted between age of mothers and parasitic infections p value 0.31. The highest age group posed to infection was seen between 20-29 years, followed by 30-39 years.

Table 6. showed the presence of intestinal parasites in different fresh vegetables. Lecttuce 11 (4.3%), cabbage 10 (3.9%) followed by, molokhia 7 (2.7%), green onions 6 (2.3%), tomatoes 4 (1.6%), cucumber 1 (.4%) and mangoes 3 (1.2%) respectively.

Table 7. showed that different types of intestinal parasites in fresh vegetables and fruits. Intestinal parasites detected in vegetables and fruits were *G.lamblia* and found to be the most dominated parasite 26 (66.7%), followed by *E. histolytica* 8 (20.5%) and *A.lumbrucoides* 5 (12.8%) respectively.

Table 1. Macroscopic examination of stool samples

		Macroscopic examinations			Total	*P value*
		Mucus	**Blood**	**Mucus and blood**		
Type	Child	27	7	10	44	0.03
		40.9%	30.3%	76.9%	43.1%	
	Mother	26	14	2	42	
		39.4%	60.9%	15.4%	41.2%	
	Food handlers	13	2	1	16	
		19.7%	8.7%	7.7%	15.7%	
	Total	66	23	13	102	
		100.0	100.0	100.0	100.0	

Table 2. Microscopic examination for the type of the parasite instool samples of mothers, children and food handlers

		Type of the parasite					Total	*P value*
		E.histolytica	***G.lamblia***	***Taeniaspp***	***A.lumbricoides***	***H.nana***		
Type	**Child**	13	24	2	7	27	73	
		28.9%	29.3%	28.6%	38.9%	100.0%	40.8%	
	Mother	28	48	5	11	0	92	
		62.2%	58.5%	71.4%	61.1%	0.0%	51.4%	
	Food-	4	10	0	0	0	14	
	handlers	8.9%	12.2%	0.0%	0.0%	0.0%	7.8%	0.00
Total		45	82	7	18	27	179	
		100.0%	100.0%	100.0 %	100.0%	100.0%	100.0%	

Table 3. Cross tabulation between macroscopic and microscopicexaminations

		Microscopic examination					Total	P value
		E.histolytica cyst	***G.Lamblia***	***Taeniaspp***	***A.lumbricoides***	***H. nana***		
Macroscopic	Mucus	13	17	2	1	4	37	
examination	Blood	2	8	1	1	3	15	0.2
	Mucus andblood	2	0	0	1	2	5	
Total		17	25	3	3	9	57	

Table 4. Age groups of children in relation to parasitic infection

		Type of the parasite					Total	P value
		E.histolytica cyst	***G.Lamblia***	***Taeniaspp***	***A.lumbricoides***	***H. nana***		
Age group ofthe children	< 6 months	1	2	0	1	1	5	0.83
	6-12	4	4	1	1	4	14	
	13-24months	2	9	1	3	10	25	
	<24Months	6	9	0	2	12	29	
Total		13	24	2	7	27	73	

Table 5. Cross tabulation between parasites infection andmothers' age group

Age of mothers		Parasites				Total	P value
		Entamoebahistolytica cyst	***Gardia Lamblia***	***Taenia spp***	***Ascaris lumbricoides***		
	<20	3	5	0	0	8	
	20-29	14	26	3	2	45	0.31
Age group	30-39	10	12	1	7	30	
	40-49	4	5	1	0	9	
Total		31	48	5	11	92	

Table 6. Availability of intestinal parasites in fresh vegetables and fruits

Vegetable's type	No. of examined samples	
	Frequency	Percentage
Lettuce	32	11 (4.3%)
Cabbage	32	10 (3.9%)
Molokhia	32	7 (2.7%)
Green onion	32	6 (2.3%)
Tomatoes	32	4 (1.6%)
Cucumber	32	1 (.4%)
Mangoes	32	3 (1.2%)
Oranges	32	0 (0%)

Table 7. Different types of intestinal parasites in fresh vegetables and fruits

Vegetable type	*E.histolytica (cyst)*	*G.lamblia (cyst)*	*T.saginata (egg)*	*A.lumbricoides*	*H.nana (egg)*	Total
Lettuce	2	7	0	0	0	9
Cabbage	1	6	0	2	0	9
Molokhia	1	5	0	1		7
Green onion	1	3	0	02	0	6
Tomatoes	2	2	0	o	0	4
Cucumber	0	10	0	0	0	1
Fruits						
Mangoes	1	2	0	0	0	3
Oranges	0	0	0	0	0	0
Total	8 (20.5%)	26 (66.7%)	0	5 (12.8%)	0	39 (15.2%)

4. DISCUSSION

In this study it was found that the percentage of 15.3% women, and 12.2% children having intestinal parasites in their stool. It also showed 2.3% of Food handles and 15.2% of the vegetables were contaminated with intestinal parasites. This indicate that infect mothers can become a source of infection to their children. Similarly, contaminated vegetables and fruits constitute an important source of infection particularly fruits which are eaten fresh. Based on these findings, it seems reasonable to conclude that infected mothers are well as vegetables and fruits can convey internal parasites to their children. In a study conducted in Khartoum by Salim in 1999 showed that the rate of intestinal parasites In the school children in Khartoum was 37.5% such rate was higher that obtained in the present study [5]. As the author used same techniques then such differences may be attributed to the fact that Salim conducted his study among school children who are older and definitely more than 5 years. This can render them more resistant to infection. Similarly, the occurrence of parasites food handlers was found by Babiker etal., in 2009 to be such higher that the present result [6]. The only explanation for much differences is that the examined very many individuals (n = 1500) compared to those screened here. Elsewhere similar trials generated different results. For example, the rate in village people in Korea was 44% [7]. In preschool children in India was 64%, 20% in U.S.A and 9.3% in Saudi Arabia [8-10]. This differences in prevalence rates whether higher or lower than we obtained might be attributed to environmental factors. It is clear that mothers have a high prevalence of intestinal parasites compared to them under five children and food handlers [8]. This fact might be attributed to the negligence of mothers by their health status and/or the absence of regular checkup. Moreover, many mothers have behavior and tendency of treating themselves by using herbs rather to visit doctors. This behavior might be resulted in increasing the infection of intestinal parasites compared to food handlers, because of food handlers should be performed mandatory regular check up every six months to have their good health certificate for continuation their work.

This study found that there was no statistical association between macro and micro examinations. This result might be attributed to other confounder factors, where mucus could as result of cancer, whereas blood also might be attributed to cancer and ulcers. The results obtained showed that *G.lamblia* and *E.histolytica* were the predominant species in stood sampls of mother, children, and food remainder having scored the highest in the 3 categories. Other species such as *A. lumbricoide*s and *T. saginata* were detected in mothers, children and food handlers and *H .nana* in children only. In vegetables and fruits *E. histolytic*a and *G. lamblia* were also presented in almost all the varieties and *A.scaris* in 3 vegetables only. In our study there was significant association seen between the infection of mothers and their children regarding intestinal paraites. This fact might be suggested that the transmission of the parasites from mothers to their children occurred micanically. *G. lamblia* and *E. histolytica* were the prevailed species of intestinal parasites in this study in mothers, children, food handlers, vegetables and fruits. This results in compatible with other studies which found that *G.lamblia* and *E. histolytica* were highly frequent species parasites in his studied population [6], also compatible with study in Nigeria by Odongo in 1994 who found that *G.lamblia* was the most dominated parasite, followed by *E. histolytica* in fruits and vegetables samples [12]. When the results were compared with other studies found lower rates Kappus *et al* in 2003 and Auta *et al* in 2017 found that other types of intestinal parasites such as *A. lumbricoides* was the most common parasites found, whereas *G. lamblia* and *E. histoyica* were least [8,13]. This variation in ontaminations may be attributed to geographical location, type and number of samples examined, mothers used for detection, different laboratory techniques used, type of water used for irrigation, post harvesting handling methods of such vegetables and even the type of water used to wash vegetables can play an instrumental role in the epidemiology of transmission of parasitic disease Furthermore the highest prevalence found of *G. lamblia* may be as a result of the viability of their eggs in the soil for months and being the commonest parasites in the tropic. This may be due to the rough surface and leaf folds of this vegetable which may retain dirt that can be easily washed [14].

5. CONCLUSIONS

The overall prevalence of intestinal parasites and bacteria was more pronounced among mothers and their children's. Food handlers, vegetables and fruits showed lower prevalence of infections. *Gardia Lamblia* and *E.histolytica* were the most predominated parasites seen microscopically among participants**.** There was significant association between mothers and their children concerning intestinal parasites.

CONSENT AND ETHICAL CONSIDERATIONS

Prior to the commencement of the study approval was obtained from Sudan Academy of Sciences. Permission was also obtained from administrative units of the selected settings. Moreover, mothers or/and the head of the household was informed by the study objectives. Then, a written consent was obtained from participants. Confidentiality during the interview and stool collection was maintained.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Goja AM, Mahmoud MS. Microbial quality of some vegetables sold in ED DueimTwon, Sudan. Pak J Biol Sci. 2013;16(12):585-588.
2. Wakid MH .Improvement of Ritchie technique by identifying the food that can be consumed pre-analysis," Journal of Applied Sciences Research. 2009; 5 (3):293–296.
3. Frazier WC, and Westhoff DC. "Food Microbiology", T. M. H. Edition. Chapman & Hall, New York. 1998:198 – 209.
4. Amoah P, Drechsel P, Abaidoo RC, Klutse A. Effectiveness of common and improved sanitary washing methods in selected cities of West Africa for the reduction of coliform bacteria and helminth eggs on vegetables. Trop Med Int Health. 2007;12 Suppl 2:40-50. DOI:10.1111/j.1365-3156.2007.01940.x
5. Salim MI. Prevalence of intestinal parasitic infection in school children in Khartoum State. MD Thesis. University of Khartoum; Sudan. Saudi Med J. 1999;22(10): 857-59.
6. Babiker MA, Ali MS, Ahmed ES. Frequency of intestinal parasites among food-handlers in Khartoum, Sudan. East Mediterr Health J. 2009;15(5):1098-1104.

7. Lee KJ, Bae YT, Kim DH, et al. Status of intestinal parasites infection among primary school children in Kampongcham, Cambodia. *Korean* J Parasitol. 2002;40(3): 153-155.
8. Kappus KD, Lundgren RG Jr, Juranek DD, Roberts JM, Spencer HC. Intestinal parasitism in the United States: update on a continuing problem. Am J Trop Med Hyg. 1994;50(6):705-713. DOI:10.4269/ajtmh.1994.50.705
9. Khurana S, Taneja N, Thapar R, Sharma M, Malla N. Intestinal bacterial and parasitic infections among food handlers in a tertiary care hospital of North India. *Trop Gastroenterol*. 2008;29(4):207-209.
10. Megrm W. Prevalence intestinal parasites in leafy vegetables in Riyadh, Saudi Arabia," International Journal of Tropical Medicine. 2010; (5) 2:20–23.
11. Odongo-Aginya EI, Lakwo TL, Schweigmann U, et al. Urban Schistosoma mansoni near Enyau river in Arua town, Uganda. East Afr Med J. 1994;71(9): 604-606.
12. Abua Al-Sad, AS. A Survey of the pattern of parasitic infestation in Saudi Arabia", Saudi Medical Journal. 1983;4 (2):117-122.
13. Auta T, Kogi EO, KA. Studies on the intestinal helminthes infestation among primary school children in Gwagwada, Kaduna, North Western Nigeria", Jurnal of Biology, Agriculture &Healthcare. 2017; (3)7:48-53.
14. De Silva NR, Brooker S, Hotez PJ, Montresor A, Engels D, Savioli L. Soil-transmitted helminth infections: updating the global picture. Trends Parasitol. 2003;19(12):547-551.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/85538