

Title page

Title: Detection of Intestinal Parasites in Food Handlers in Karary Locality, Sudan

Abstract:

Aims: Food handlers play a major role in ensuring food safety. Mishandling and disregard for hygiene measures on their part may result in food contamination and its attendant consequences. This study was aimed to determine the frequency of intestinal parasites among food handlers in Karary locality.

Study design: This is a descriptive cross-sectional hospital-based study

Place and Duration of Study: This study was conducted in the department of Laboratory medicine during the period from January to July 2013.

Methodology: A total of 1250 food handlers were enrolled in this study. A stool sample was collected from each food handler in a clean universal screw cap bottle in the morning. The feces were examined by the naked eye for their characteristics such as their consistency, color, texture, and also for the presence of larvae or adults of nematodes and/or segments of cestodes. The wet mount was done to identify motile trophozoites, larvae, eggs, and cysts. Modified Ziehl Neelsen staining technique was used to identify Cryptosporidium oocysts.

Results: Our results demonstrate that males represented 74.8% of the total participants, while females were only representing 25.2%. The prevalence was found to be 6.1% among food handlers who participated. Predominated parasitic infestations were reported in; Giardia in 5%,

Entamoeba histolytica 0.8%, and 0.3% cryptosporidium respectively. Among total identified parasites, Giardia was found to be the most frequent parasite 81.6%, followed by *Entamoeba histolytica* 13.3% and Cryptosporidium 5.3% respectively.

Conclusion: There was a low prevalence of intestinal parasitic infections in Karary locality food handlers. The rate of infestations reported in males is approximately twice likely as in females. *Giardia lamblia* was the most common protozoa infection.

Keywords: Intestine, Parasites, Food Handlers.

Introduction

Health is an indispensable asset of every individual. In modern medical practice, health is regarded as a universal property of every human mankind, hence public health is the fundamental responsibility of every health professional. In this regard, the prevention and control of food born diseases which play an important role in public health and the responsibility of food handlers are of great concern. Food handlers play a major role in ensuring food safety. Mishandling and disregard for hygiene measures on their part may result in food contamination and its attendant consequences. However, food contamination may occur at any point during its journey through production, processing, distribution, and preparation (1). A major risk of food contamination lies with the food handlers' dangerous organisms present in or on, the food handler's body can multiply to an infective dose, given the right conditions, and come into contact with food, or surfaces used to prepare food (2).

The distribution of intestinal parasitic infection of humans may be related to several human factors such as age, gender, and infection by therapeutic measures, education in personal prophylaxis to prevent dissemination of infection and to reduce opportunities for exposure, sanitary control of water, food living and working conditions, and waste disposal, destruction or control of reservoir hosts and vectors, erection of biological barriers to the transitions of parasites (3). Intestinal parasites infections are measured using the DALY (disability-adjusted life year) and one DALY represents the loss of one year of equivalent full health (4). The resulting diseases have a socio-economic impact in terms of high treatment costs per DALY and hospitalization costs (5). Globally, millions of people suffer from parasitic infections such as *Ascaris lumbricoides* (1.2 billion), *Trichuris trichiura* (795 million), hookworms (*Ancylostoma duodenale* and *Necator americanus*) (740 million) (6), *Entamoeba histolytica* (50 million) (7) and *Giardia lamblia* (2.8 million) (8). Only a few data are available data concerning the prevalence of intestinal parasites in Sudan, despite some studies that have been obtained dissimilar prevalence according to the difference in climates, topography, and other related factors. Conversely, many gastrointestinal are reported potentially harmful emerging as zoonoses, while others manifested only human populations. However, the most predominated intestinal protozoa are recorded *Giardia lamblia* and *Entamoeba histolytica*, whilst helminths are prevailing nationwide; *Schistosoma spp*, *Hymenolepis nana*, *Taenia spp*, and *Strongyloides*. To best of knowledge only a few studies have been conducted about this subject in Sudan. Therefore, this study was aimed to determine the frequency of intestinal parasites among food handlers Indian addition diet determines the proportion of intestinal parasites among different nationalities of food handlers and to identify the distribution of intestinal parasites among different administrative units in the Karary locality.

Material and methods

Study Design and setting

This is a descriptive cross-sectional hospital-based study that was conducted during the period from January to July 2013. The study was carried out in Alnw Hospital which is situated at Alhara - Althora of Karary - Omdurman. The hospital provides health services for Althora and neighboring areas. This study involved food handlers performing a routine medical examination in the laboratory of Alnw hospital during study duration, any food handlers who had invalid medical certificates and provided informed consent for the study was included in this study while those who didn't willing to participate in this study and/or having valid certificates were excluded from this study. A total of 1250 food handles were enrolled in this study. A stool sample was collected from each food handler a in clean universal screw cap bottle in the morning.

Examination of Stool Samples

Macroscopic examination

Before the microscopic examination of stool samples, the feces were examined by the naked eye for its characteristics such as its consistency, color, texture, and also for the presence of larvae or adult of nematodes and/or segments of cestodes.

Microscopic examination

Wet-mount Technique

The stool samples were emulsified with 3-4 ml normal saline, then a drop of the emulsified sample was placed on a glass slide, a few drops of iodine were added, and all covered with a coverslip. The preparation was first examined under a 10x objective lens, then 40x for detailed

identification of parasites under low light intensity. This process helped to identify motile trophozoites, larvae, eggs, and cysts.

Quality Control

Prior to microscopic examination, the microscope has been checked for calibration (9). Also, stool samples with known parasites from the national reference lab were analyzed and we get the same results after the microscopical examination.

Modified Ziehl Neelsen Staining Technique

A fresh stool sample was mixed with normal saline, and then a smear from this emulsified stool was made. Afterward, each smear was air-dried and fixed in methanol for 2-3 minutes. The slides were then stained with cold carbolfuchsin for 5-10 minutes. The slides were then differentiated in 1% hydrochloric acid-ethanol solution and rinsed in distilled water. The slides were then counterstained with 0.3% methylene blue for 30 seconds and rinsed in tap water followed by air-dry and examined microscopically under a 100x objective oil-immersion lens.

Ethics considerations

The study received approval from the ethics committee of GharbElneel College (Number 07/2013) and Alnw Hospital and was conducted in accordance with the Declaration of Helsinki. Informed consent was taken from each participant.

Data Management and Analysis

Statistical Analysis

The data were analyzed by Statistical Package for Social Science (SPSS) software, version 15 was used throughout. The chi-square (χ^2), Independent T, and One Way Anova test was used to compare data and to determine the significance of differences between prevalence. The *P values*

were significant at the level of 0.05 and less. Nationality and gender were used as (independent) explanatory variables, while intestinal parasitic infestations were displayed as dependent variables.

Results

Our results showed that the ratio of male to female was found approximately to be in 3:1 respectively. Males were 74.8% while females were 25.2% (Table 1). Among the different nationalities of food handlers who participated in this study, Sudanese were 77.9%, followed by Ethiopians 21.8% and Egyptians 0.2% (Figure 1). Our results showed that Karary district represented the peak of administrative units for food handlers 44.5% followed by Al-Thora 25.8%. The Sabreen Administrative and Industries Unit registered similar administrative units (Figure 2). Our result found that Giardia was found the most frequent parasite 81.6%, followed by *Entamoeba histolytica* 13.3% and Cryptosporidium 5.3% respectively (Table 2). The prevalence was found to be 6.1% among food handlers who participated. Predominated parasitic infestations were reported in; Giardia in 5%, *Entamoeba histolytica* 0.8%, and 0.3% cryptosporidium respectively (Table 3). Regarding the food handlers' occupations, 33.8% worked in groceries, 17.4% tea sellers, 16.8% in cafeterias and restaurants, 15.5% were food industry employers and 12.1% were bakery and 1.8% refresher sellers, vegetable/ fruit-sellers and milk sellers were found likewise 0.6%. In addition, there was no statistical association between intestinal parasites infestations and gender (p -value < 0.29). Males 50/76 were more prone as more twice likely than females 26/76 for intestinal infestations (Table 5). Our results illustrate that there was no significant association between different

nationalities and intestinal parasitic infestations ($p < 0.28$). Sudanese food handlers seem to be infested by intestinal parasites more than Ethiopian (Table 6). Our results showed that there was no statistical association between administrative units' distribution and intestinal parasitic infestations ($p < 0.53$). Giardia cysts and Giardia trophozoites were found predominated in Karary administrative unit, followed by Althora (Table 7). There was no statistical difference noted between types of occupations and intestinal parasitic infestations (p -value < 0.06). Grocery sellers were recorded the highest occupation acquired intestinal parasitic infestations. Tea sellers were seen in 18/76 followed by cafeteria/restaurant employed 10/76, while bakery alike juice and labors at food preparation factories altogether (Table 8).

Table 1: Gender distribution among food handlers

Gender	Frequency	Percent
Male	935	74.8
Female	315	25.2
Total	1250	100.0

Table 2: Frequency of intestinal parasites among food handlers

Disease	Frequency	Percent
Giardia cysts	50	65.8
Giardia trophozoites	12	15.8
<i>Entamoeba histolytica</i>	10	13.3
<i>Cryptosporidium spp</i>	4	5.3
Total	76	100

Table 3: The overall prevalence of intestinal parasitic infestations among food handlers

Intestinal parasitic infestations	Disease		Frequency	Percent
	Positive	Giardia		62
<i>Entamoeba histolytica</i>			10	0.8
<i>Cryptosporidium</i>			4	0.3
Total			76	6.1

Table 4: Different occupations among food handlers

Occupation	Frequency	Percent
Grocery seller	422	33.8
Tea seller	217	17.4
Cafeteria/ Restaurant workers	210	16.8
Food industry employers	194	15.5
Bakery	151	12.1
Refresher sellers	22	1.8
Butchers	20	1.6
Milk seller	7	0.6
Vegetable and fruits seller	7	0.6
Total	1250	100.0

Table 5: Cross tabulation between gender and intestinal parasitic infestations

		Intestinal parasitic infestations				Total
		G C	GT	E h	Crypto	
Gender	Male	33	8	8	1	50
	Female	17	4	2	3	26
Total		50	12	10	4	76

Table 6: Comparison between sudanese and Ethiopian in the prevalence of intestinal parasitic infestations

		Intestinal parasitic infestations				Total
		G C	GT	E h	Crypto	
Nationality	Sudanese	34	8	8	1	51
	Ethiopian	16	4	2	3	25
Total		50	12	10	4	76

Table 7: The relationship between administrative units and intestinal parasitic infestations

		Intestinal parasitic infestations				Total
		G C	GT	E h	Crypto	
Administrative units	Karary	32	10	6	2	50
	Al-Sanaat	1	0	0	0	1
	Sabreen	5	2	1	1	9
	Althora	12	0	3	1	16
Total		50	12	10	4	76

Table 8: Different occupation versus intestinal parasitic infestations

Occupations	Intestinal parasitic infestations				Total
	G S	GT	E h	Crypto	
Grocery seller	29	8	6	0	43
Tea seller	11	2	2	3	18
Cafeteria/restaurant employed	8	0	2	0	10
Bakery	0	2	0	0	2
laborers at food preparation factories	1	0	0	1	2
Juice seller	1	0	0	0	1
Total	50	12	10	4	76

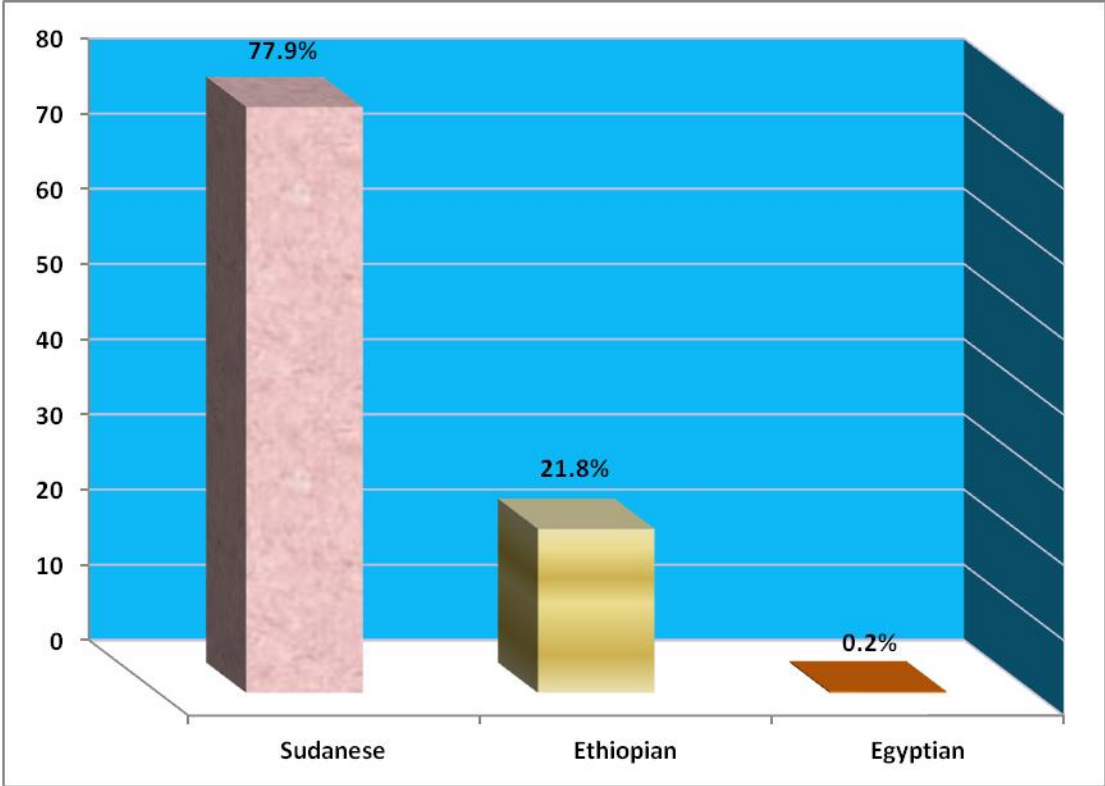


Figure 1. Describe the distribution of participants according to their nationalities

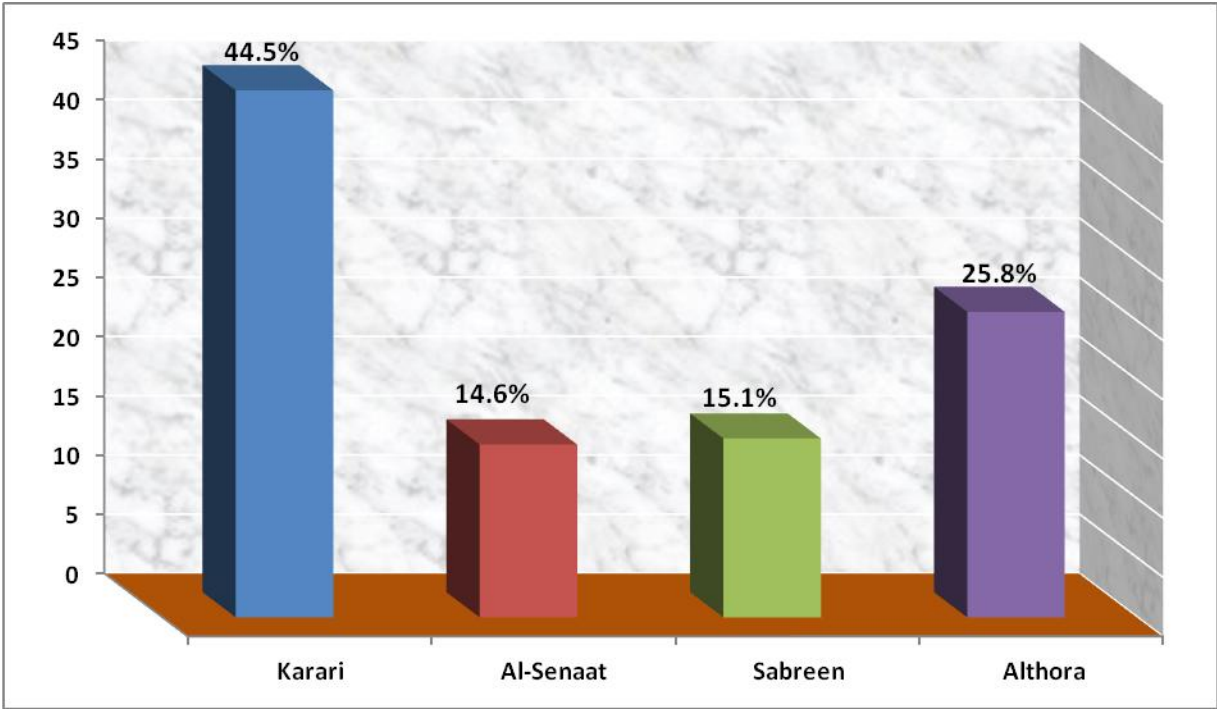


Figure 2: Administrative units' distribution among participants

Discussion

This study has shown that the prevalence of intestinal parasitic infestation among food handlers is found relatively quite low at 6.1%. This finding is of particular significance since infected food handlers may be at risk of developing illness themselves, and may pose a threat to the health of consumers. All intestinal parasitic infestations reported in this study are transmitted via the fecal-oral route. The predominance parasitic intestinal seen were *Giardia lamblia* (5%), *Entamoeba histolytica* (0.8%), and *Cryptosporidium* (0.3%) correspondingly. This result is found similar to previous studies (10). The overall, prevalence obtained in the current study is found to be (6.1%). This finding is in accordance with other authors' results elsewhere which had obtained alike results (11). Nevertheless, other studies have been conducted elsewhere found the prevalence of intestinal parasites is remarkably higher than the current study finding (12). This discrepancy might be probably attributed to the difference in environmental sanitation and hygiene of food handlers regarding intestinal parasitic infestations.

In the present study, most of the infested food handlers were food workers in grocery, tea sellers' cafeterias/restaurants, and food industry employed; a similar finding has been observed in another study (13).

Despite this, observationally, participants who attended routine checkups at the hospital are apparently healthy and maintain satisfactory personal hygiene. Thus, the findings highlight the importance of regular and periodical examinations for food handlers. It has been confirmed by many studies findings (11) which elucidated that food-borne disease outbreaks are due to contamination by the food handlers.

In our study, parasitic infestations are more prevailed among Sudanese rather than their counterparts from other nationalities. This finding may be explained by involving a high number of Sudanese food handlers. In contrast, other studies have been conducted in United Arab Emirates (14) and Saudi Arabia (15). This variation could be verified by examining only expatriates rather than their own nationalities.

Concerning the commonest type of parasites isolated in this study, *Giardia lamblia* was the most common protozoa infection (5%), followed by *E. histolytica* (0.8). This result is consolidated by tremendous studies being carried out had recorded that, *Giardia* was the most common parasite (10,16-18). In comparison to many other authors' findings, they didn't in coherence with our study result (19-21). This inconsistency may be attributed to geographical variations in distributing intestinal parasites. *Cryptosporidium* was reported in our study in (0.3) which has been in line with global pattern distribution (11).

According to the results of this study, there were no significant differences in the prevalence of intestinal parasites among different occupations, gender, and nationality, The incidence of parasites in males is twice that of females. The high rate of infection in males may be due to their activities and might be exposed to the parasite, used to eat outdoors and the working pressure for almost the whole of a day. However, another study is in disagreement with our study finding (22). This variance could be elucidated to the difference in culture, activities, and simultaneously with workplaces.

Variations in these factors from different administrative units to another within the study setting may be explained by differing socioeconomic factors, poverty, and malnutrition. However, two different studies have been conducted in Saudi Arabia (17,15), which concurs with our study

results, showed differences in the prevalence and types of parasites among infected food handlers in various areas within the same country.

Conclusion:

The overall prevalence of intestinal parasitic infections among food handlers in Karri locality-Omdurman is found in 6.1%. The rate of infestations reported in males is approximately twice likely as in females. There is an obvious variation within the selected locality concerning the prevalence of intestinal parasites. *Giardia lamblia* was the most common protozoa infection, followed by *E. histolytica* and cryptosporidium. Sudanese food handlers recorded a higher prevalence compared to other nationalities. No statistical difference was observed between parasitic infestations; regarding gender, occupation, and nationality. Further studies should be done with the inclusion of more sample size and using concentration techniques is recommended to help in the reduction of infection spreading.

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Competing Interests

Authors have declared that no competing interests exist

Authors contribution

M.A. was responsible for the statistical analysis, interpretation of the data, and the drafting of the manuscript. M.A. was responsible for the conception and design of the study, analysis, and interpretation. M.A. revise the final draft of the manuscript.

Ethics considerations

The study received approval from the ethics committee of GharbElneel College (Number 07/2013) and Alnw Hospital and was conducted in accordance with the Declaration of Helsinki. Informed consent was taken from each participant.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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