

1 **Original Research Article**

2 **Detection of Intestinal Parasites in Food Handlers in Karari Locality, Sudan**

3 **Abstract:**

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

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

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

11 Methodology: A total of 1250 food handles were enrolled in this study. Stool sample was
12 collected from each food handler in clean universal screw cap bottle at morning. , the feces was
13 examined by the naked eye for its characteristics such as its consistency, color, texture and also
14 for the presence of larvae or adult of nematodes and/or segments of cestodes. Wet mount was
15 done to identify motile trophozoites, larvae, eggs and cysts. Modified Ziehl Neelsen staining
16 technique was used to identify Cryptosporidium oocysts.

17 Results: Our results demonstrate that males were 74.8% of total population, while female were
18 only 25.2%. The prevalence was found to be 6.1% among food handlers participated.
19 Predominated parasitic infestations were reported in; Giardia in 5%, *Entamoeba histolytica* 0.8%
20 and 0.3% cryptosporidium respectively. Among total identified parasites, Giardia was found the

21 **most dominated** parasite 81.6%, followed by *Entamoeba histolytica* 13.3% and Cryptosporidium
22 5.3% respectively.

23 Conclusion: There was low prevalence of intestinal parasitic infections in Karri locality food
24 handlers. The rate of infestations reported in male as approximately twice likely as females.
25 *Giardia lamblia* was the most common protozoa infection.

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27 **Key words:** Intestine, Parasites, Food Handlers.

28 **Introduction**

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

40 The distribution of intestinal parasitic infection of human may be related to several human
41 factors such as, age, gender, and infection by therapeutic measures, education in a personal

42 prophylaxis to prevent dissemination of infection and to reduce opportunities for exposure,
43 sanitary control of water, food living and working conditions, and waste disposal, destruction or
44 control of reservoir hosts and vectors, erection of biological barriers to the transitions of parasites
45 (3). Intestinal parasites infections are measured using the DALY (disability- adjusted life year)
46 and one DALY represents the loss of one year of equivalent full health (4). The resulting
47 diseases have socio-economic impact in terms of high treatment costs per DALY and
48 hospitalization costs (5). Globally, millions of people suffer from parasitic infections such as
49 *Ascaris lumbricoides* (1.2 billion), *Trichuris trichiura* (795 million), hookworms (*Ancylostoma*
50 *duodenale* and *Necator americanus*) (740 million) (6), *Entamoeba histolytica* (50 million) (7)
51 and *Giardia lamblia* (2.8 million) (8) . No available data concerning the prevalence of intestinal
52 parasites in Sudan, despite some studies have been obtained **dissimilar prevalence according to**
53 **the difference in climates, topography and others related factors**. Conversely, **many**
54 **gastrointestinal are** reported potentially harmful emerging as zoonoses, while others manifested
55 only human populations. However, **the most predominated** intestinal protozoa **are recorded**
56 ***Giardia lamblia*** and *Entamoeba histolytica*, whilst helminthes are prevailing nationwide;
57 *Schistosoma spp*, *Hymenolepis nana*, *Taenia spp* and *Strongyloides*.
58 **To best of knowledge** only few studies have been conducted about this subject in **sudan**.
59 Therefore, this study was aimed to determine the frequency of intestinal parasites among food
60 handler, **inaddition** to determine proportion of intestinal parasites among different nationalities
61 of food handlers and to identify distribution of intestinal parasites among different administrative
62 units in Karrai locality.

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64 **Material and methods**

65 **Study Design and setting**

66 This is a descriptive cross-sectional hospital-based study which conducted during the period
67 from January to July 2013. The study was carried out in Alnw Hospital which is situated at
68 Alhara - Althora of Karri- Omdurman. The hospital provides health services for Althora and
69 neighboring areas. This study was included food handlers who perform a routine medical
70 checkup at the laboratory of Alnw hospital during study duration, any food handlers who having
71 invalid medical certificates and providing informed consent for the study was included in this
72 study while those who didn't willing to participate in this study and/or having valid certificates
73 were excluded from this study. A total of 1250 food handles were enrolled in this study. Stool
74 sample was collected from each food handler in clean universal screw cap bottle at morning.

75 **Examination of Stool Samples**

76 **Macroscopic examination**

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

80 **Microscopic examination**

81 **Wet-mount Technique**

82 The stool samples were emulsified with 3-4 ml normal saline, then a drop of emulsified sample
83 was placed on a glass slide, a few drops of iodine were added, and all covered with a cover slip.
84 The preparation was first examined under a 10x objective lens, then 40x for detailed
85 identification of parasites under low light intensity. This process helped to identify motile
86 trophozoites, larvae, eggs and cysts.

87 **Quality Control**

88 Prior microscopic examination, the microscope has been checked for calibration (9).

89 **Modified Ziehl Neelsen Staining Technique**

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

96 **Ethics considerations**

97 The study received approval from the ethics commission of GharbElneel College (Number
98 07/2013) and Alnw Hospital, and was conducted in accordance with the Declaration of Helsinki.
99 Informed consent was taken from each participant.

100 **Data Management and Analysis**

101 **Statistical Analysis**

102 The data were analyzed by Statistical Package for Social Science (SPSS) software, version 15
103 was used throughout. The chi-square (χ^2) test was used to compare data and to determine the
104 significance of differences between prevalence. Nationality and gender were used as
105 (independent) explanatory variables, while intestinal parasitic infestations were displayed as
106 dependent variables.

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110 Results

111 Our results showed that the ratio of male to female was found approximately to be in 3:1
112 respectively. Males were reported in 74.8% while female in 25.2% (Table 1). Among different
113 nationalities of food handlers whom involved in this study, Sudanese were 77.9%, followed by
114 Ethiopian 21.8% and Egyptian 0.2% respectively (Figure 2). Our results demonstrate that Karri
115 region was represented the peak of administrative units of food handlers 44.5%, followed by
116 Althora 25.8%. Sabreen administrative unit and Al-Senaat were recorded similar administrative
117 units (Figure 2) . Our result found that Giardia was found the most dominated parasite 81.6%,
118 followed by *Entamoeba histolytica* 13.3% and Cryptosporidium 5.3% respectively (Table 2).
119 The prevalence was found to be 6.1% among food handlers participated. Predominated parasitic
120 infestations were reported in; Giardia in 5%, *Entamoeba histolytica* 0.8% and 0.3%
121 cryptosporidium respectively (Table 3). Regarding the food handlers' occupations, 33.8%
122 worked in groceries, 17.4% tea sellers, 16.8% in cafeterias and restaurants, 15.5% were food
123 industry employers and 12.1% were bakery and 1.8% refresher sellers. Vegetable/ fruit-sellers
124 and where milk sellers were found likewise 0.6%. In addition, there was no statistical association
125 between intestinal parasites infestations and gender (p- value < 0.29). Males 50/76 were more
126 prone as more twice likely than females 26/76 for intestinal infestations (Table 5). Our results
127 illustrate the the was no significant association between different nationalities and intestinal
128 parasitic infestations (p <0.28). Sudanese food handlers seem to be infested by intestinal
129 parasites more than Ethiopian (Table 6). Our results showed that there was no statistical
130 association between administrative units' distribution and intestinal parasitic infestations
131 (p<0.53). Giardia cysts and Giardia trophozoites were found predominated in Karri

132 administrative unit, followed by Althora (Table 7). There was no a statistical difference noted
 133 between types of occupations and intestinal parasitic infestations (p value <0.06). Grocery sellers
 134 were recorded the highest occupation acquired intestinal parasitic infestations. Tea sellers were
 135 seen in 18/76 followed by cafeteria/restaurant employed 10/76, while bakery alike juice and
 136 labors at food preparation factories altogether (Table 8).

137 **Table 1: Gender distribution among Ffood handlers**

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

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140 **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

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

Intestinal parasitic infestations	Disease		Frequency	Percent
	Positive	Giardia	62	5
		<i>Entamoeba histolytica</i>	10	0.8
		<i>Cryptosporidium</i>	4	0.3
Total			76	6.1

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146 **Table 4: Different occupations among food handlers**

Occupation	Frequency	Percent
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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

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151 **Table 5: Cross tabulation between gender and intestinal parasitic infestations**

	Intestinal parasitic infestations	Total
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		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

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153 **Table 6: Relationship between nationalities and 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

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

		Intestinal parasitic infestations				Total
		G C	GT	E h	Crypto	
Administrative units	Karri	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

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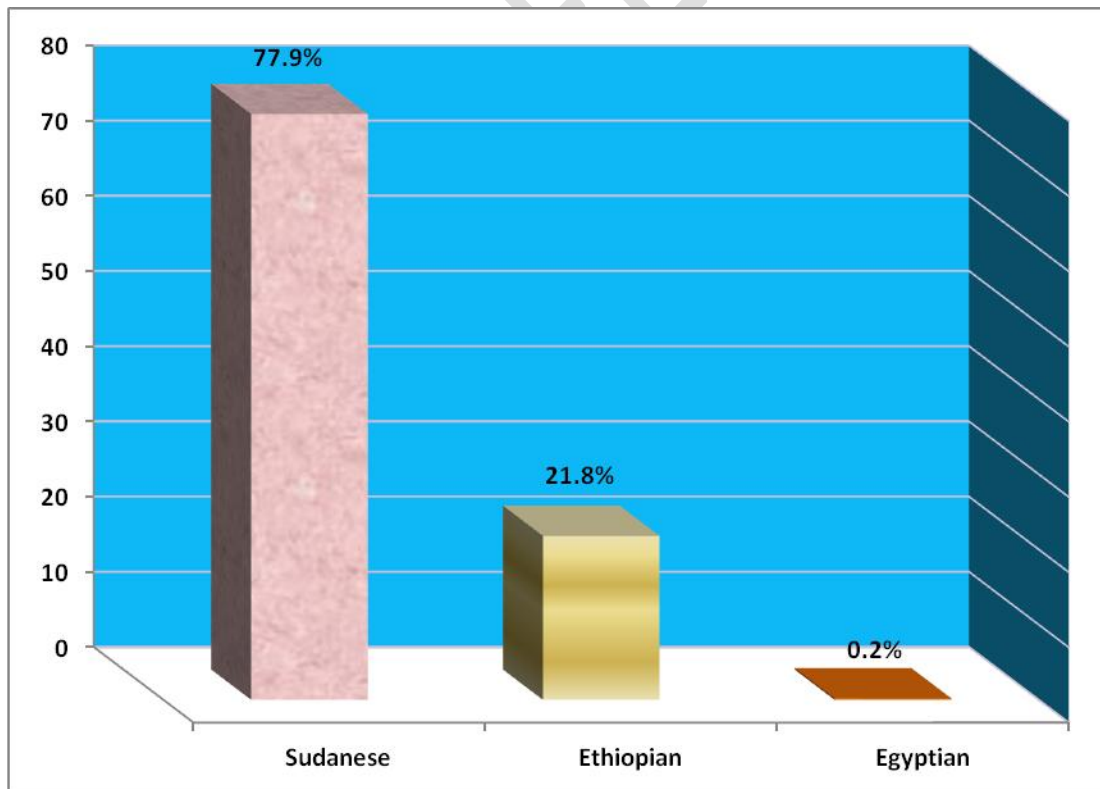
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166 **Table 8: Different occupation versus intestinal parasitic infestations**

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

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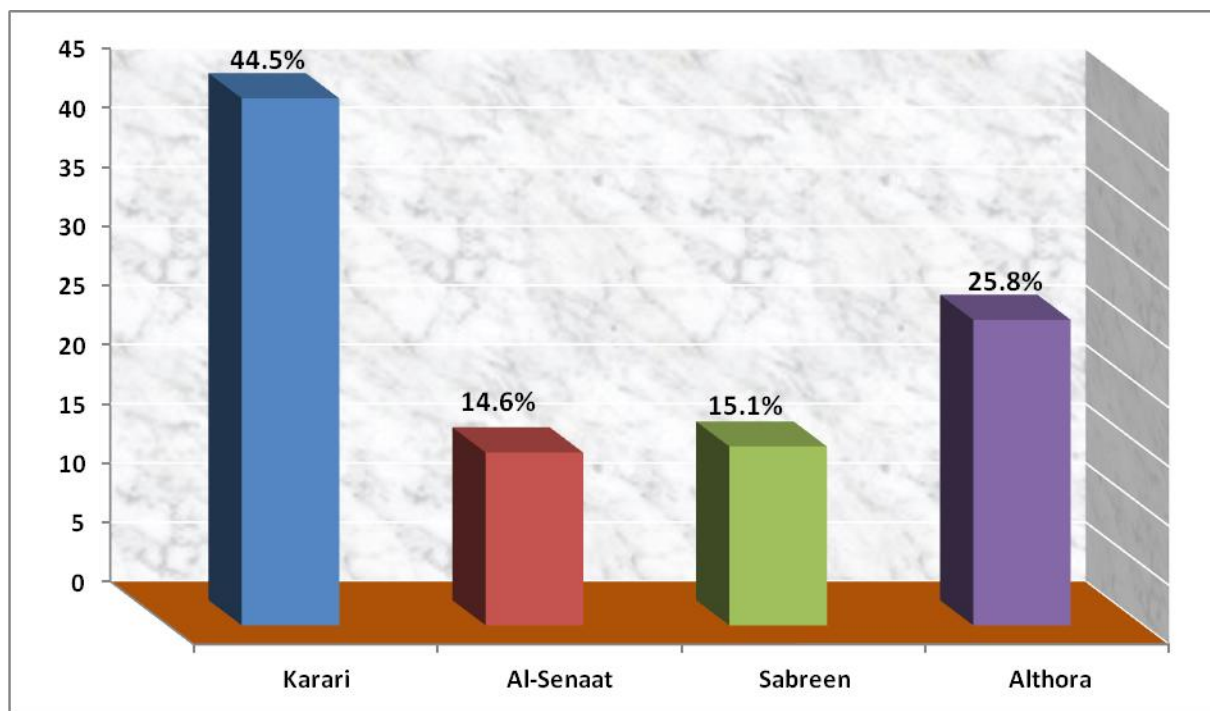
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170 **Figure 1 displayed different nationalities of food handlers**

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UNDER PEER REVIEW

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174 **Figure 2: Administrative units' distribution among participants**

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182 **Discussion**

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

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

198 Despite, observationally, participants who attended routine checkup at the hospital are
199 apparently **health** and maintaining a satisfactory personal hygiene. Thus, the findings highlight
200 the importance of regular and periodical examinations for food handlers. It has been confirmed
201 by many studies findings (11) which elucidated that food-borne disease outbreaks are due to
202 contamination by the food handlers.

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

208 Concerning the commonest type of parasites isolated in this study, our finding showed that 76
209 among the infected food handlers; *Giardia lamblia* was the most common protozoa infection
210 (5%), followed by *E. histolytica* (0.8). This result is consolidated by tremendous studies being
211 carried out had recorded that, *Giardia* was the most common parasite (10,16-18). On contrary to,
212 many authors' findings didn't in coherence with our study result (19-21). This inconsistency may
213 be attributed to geographical variations in distributing intestinal parasites.

214 *Cryptosporidium* was reported in our study in (0.3) which has been in line with global pattern
215 distribution (11).

216 According to the results of this study, there were no significant differences in the prevalence of
217 intestinal parasites among different occupations, gender and nationality, the ratio of infection
218 with parasites in males was found as twice likely as females. The high rate of infection in males
219 may be due to their activities and might be exposed to parasite, used to eat outsides and the
220 working pressure for almost the whole of day. Although there is a study in is not in agreement
221 with our study finding (22). This variance could be elucidated to the difference in culture,
222 activities and simultaneously with workplaces.

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

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

228 **Conclusion** the overall prevalence of intestinal parasitic infections among food handlers in Karri
229 locality- Omdurman is found in 6.1%. The rate of infestations reported in male as approximately
230 twice likely as females. There is an obvious variation within the selected locality concerning
231 prevalence of intestinal parasites. *Giardia lamblia* was the most common protozoa infection,
232 followed by *E. histolytica* and cryptosporidium. Sudanese food handlers recorded with a higher
233 prevalence compared to other nationalities. No statistical difference observed between parasitic
234 infestations; regarding gender, occupation and nationality.

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236 **Availability of data and materials**

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

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240 **References**

- 241 1- Green L, Selman C, Banerjee A, et al. Food service workers' self-reported food
242 preparation practices: an EHS-Net study. Int J Hyg Environ Health. 2005;208(1-2):27-35.
243 doi:10.1016/j.ijheh.2005.01.005.
- 244 2- Mohan U, Mohan V, Raj. A study of carrier state of typhi, intestinal parasites & personal
245 hygiene amongst food handlers in Amritsar city. Ind J Comm Med; 2006. 31(2): 2004-06.

- 246 3- Neva F A and Brown H. W. *Basic clinical parasitology* Appleton and lange, press. U. S.
247 A. 1994.
- 248 4- Murray CJL and Lopenz AD. The global burden of disease: a comprehensive assessment
249 of mortality and disability from diseases, injuries, and risk factors in 1990 and projected
250 to 2020. Cambridge (MA): Havard University Press; 1996.
- 251 5- De Silva NR, Brooker S, Hotez PJ, Montresor A, Engels D, Savioli L. Soil-transmitted
252 helminth infections: updating the global picture. *Trends Parasitol.* 2003;19(12):547-551.
253 doi:10.1016/j.pt.2003.10.002
- 254 6- Pozio E. Foodborne and waterborne parasites. *Acta Microbiol Pol.* 2003;52 Suppl:83-96.
- 255 7- Stanley SL Jr, Reed SL. Microbes and microbial toxins: paradigms for microbial-mucosal
256 interactions. VI. *Entamoeba histolytica*: parasite-host interactions. *Am J Physiol*
257 *Gastrointest Liver Physiol.* 2001;280(6):G1049-G1054.
258 doi:10.1152/ajpgi.2001.280.6.G1049
- 259 8- Ali SA, Hill DR. *Giardia intestinalis*. *Curr Opin Infect Dis.* 2003;16(5):453-460.
260 doi:10.1097/00001432-200310000-00012.
- 261 9- Bdir S and Adwan G: Prevalence of intestinal parasitic infections in Jenin Governorate.
262 *Asian Pac J Trop Med*, 2010; 745–747.
- 263 10- Colli CM, Mizutani AS, Martins VA, Ferreira EC, Gomes ML. Prevalence and risk
264 factors for intestinal parasites in food handlers, southern Brazil. *Int J Environ Health Res.*
265 2014;24(5):450-458. doi:10.1080/09603123.2013.857392.
- 266 11- Van Asperen IA, Mank T, Medema GJ, et al. An outbreak of cryptosporidiosis in the
267 Netherlands. *Euro Surveill.* 1996;1(2):11-12. doi:10.2807/esm.01.02.00126-en.

- 268 12- Nolla AC, Cantos GA. Relação entre a ocorrência de enteroparasitoses em manipuladores
269 de alimentos e aspectos epidemiológicos em Florianópolis, Santa Catarina, Brasil
270 [Relationship between intestinal parasites in food handlers and epidemiological factors in
271 the city of Florianópolis, Santa Catarina, Brazil]. *Cad Saude Publica*. 2005;21(2):641-
272 645. doi:10.1590/s0102-311x2005000200033
- 273 13- Nyarango RM, Aloo PA, Kabiru EW, Nyanchongi BO. The risk of pathogenic intestinal
274 parasite infections in Kisii Municipality, Kenya. *BMC Public Health*. 2008;8:237.
- 275 14- Ibrahim OM, Bener A, Shalabi A. Prevalence of intestinal parasites among expatriated
276 workers in Al-Ain, United Arab Emirates. *Ann Saudi Med*. 1993;13(2):126-129.
277 doi:10.5144/0256-4947.1993.126.
- 278 15- Taha HA, Soliman MI, Banjar SA. Intestinal parasitic infections among expatriate
279 workers in Al-Madina Al-Munawarah, Kingdom of Saudi Arabia. *Trop Biomed*.
280 2013;30(1):78-88.
- 281 16- Khurana S, Taneja N, Thapar R, Sharma M, Malla N. Intestinal bacterial and parasitic
282 infections among food handlers in a tertiary care hospital of North India. *Trop*
283 *Gastroenterol*. 2008;29(4):207-209.
- 284 17- Zagloul DA, Khodari YA, Othman RA, Farooq MU. Prevalence of intestinal parasites
285 and bacteria among food handlers in a tertiary care hospital. *Niger Med J*.
286 2011;52(4):266-270. doi:10.4103/0300-1652.93802.
- 287 18- Ayeh-Kumi , Quarcoo S, Kwakye-Nuako G, Kretchy JP, Osafo-Kantanka A1, Mortu S.
288 Prevalence of Intestinal Parasitic Infections among Food Vendors in Accra, Ghana. *J*
289 *Trop Med Parasitol*. 2009;32:1-8.

- 290 19-Donato G. Esparar, Vicente Y. Belizario, et al., Prevalence of Intestinal Parasitic
291 Infections among Food Handlers of a Tertiary Hospital in Manila using Direct Fecal
292 Smear and Formalin Ether Concentration Technique. *Phil J Microbiol Infect Dis* 2004;
293 33(3):99-103.
- 294 20-Kamau P, Aloo-Obudho P, Kabiru E, Ombacho K, Langat B, Mucheru O, Ileri L.
295 Prevalence of intestinal parasitic infections in certified food-handlers working in food
296 establishments in the City of Nairobi, Kenya. *J Biomed Res.* 2012; 26(2):84-9.
- 297 21-Babiker MA, Ali MS, Ahmed ES. Frequency of intestinal parasites among food-handlers
298 in Khartoum, Sudan. *East Mediterr Health J.* 2009;15(5):1098-1104.
- 299 22-Sitotaw B, Mekuriaw H, Damtie D. Prevalence of intestinal parasitic infections and
300 associated risk factors among Jawi primary school children, Jawi town, north-west
301 Ethiopia. *BMC Infect Dis.* 2019;19(1):341. Published 2019 Apr 25. doi:10.1186/s12879-
302 019-3971-x