The Prevalence of Intestinal Parasitic Diseases in Human and Its Association with the Presence of Infection Stages in Vegetables, in El. Khorma Province, Saudi Arabia

Abdalla, M. A.[1], Salim, A. M.[2] and Hassanin, S. H.[1]

[1]Biotechnology Department, Faculty of Science and Education, Taif University (El.Khorma Branch), Kingdom of Saudi Arabia.
[2]Medical Microbiology Department, Faculty of Applied Medical Sciences, Taif University (Taraba Branch), Kingdom of Saudi Arabia.
drmuataz@yahoo.com

Abstract: We carried out a survey to investigate the prevalence of intestinal parasitic diseases in humans and the presence of parasite species in vegetables in El.Khorma Province of Saudi Arabia. A total of 193 stool specimens of patients attend to one private health unit were examined for the infection of intestinal parasitic diseases. The overall incidence rate was 12 %. *Entamoeba histolytica* was the high parasite prevalence (56%) followed by *Giardia lamblia* (13%). According to socio-demographic factors the incidence rate was 53.8, 69.2 and 76.9% in females, 20-39 age group and non-Saudis respectively. The high intensity of parasites was recorded in low standard being 76.9, 66.7 and 100% for *Entamoeba histolytica*, *Giardia lamblia* and *Entamoeba coli* respectively. On other hand of this study the overall of parasitic stages in vegetables was 13.8%. A high rate of parasitic contamination was found in watercress (28.1%) followed by green onion (15.6%). *Entamoeba coli* found in a high prevalence rate in vegetables in the study area being (27.3%).
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Key words: survey, intestinal parasites, El.Khorma, vegetables, parasitic stages.

1. Introduction

Intestinal protozoan and helminthes infection are endemic worldwide and have been described as constituting the greatest single worldwide cause of illness and disease (**Curtale *et al.*, 1998 and Stekettee 2003**). The most common intestinal helelminthes hook worms, *Ascaris lumbricoides* and *Trichuris trichiura* referred to as soil-transmition helminthes (**Saki *et al.*, 2012**). Of protozoan parasites, *Entamoeba histolytica* and *Giardia lamblia* are recognized as prevalent and widespread pathogens of human (**Bajer, 2008**). The intestinal protozoan *Entamoeba histolytica* is responsible for up to 100.000 deaths worldwide, especially in developing countries each year (**WHO, 2006**). The Kingdom of Saudi Arabia had improved standards of living in recent years that led to influx of expatriate workers from developing countries which they should expect parasitic infection among them (**Abuhassain, 2005**). Many studies were carried out in different regions of Saudi Arabia provided the high prevalence rate of intestinal parasite diseases (**Al.Shammari, 2001; Kalantan *et al.*, 2001; Al.Harathi, 2004; Abuhussain, 2005; Al.Khalife, 2006; Al.Harathi, 2007 and Zaglool *et al.*, 2010**).

Fresh vegetables are regarded as a potential source of intestinal parasite disease by contamination, during production, collection, transport and preparation of processing (**Ozlem and Senor, 2005**). The sources of zoonotic contamination are usually faeces, faecally contamined soil or water (**Slifko *et al.*, 2000; Damen *et al.*, 2007 and Daryani *et al.*, 2008**). The evaluation of the leafy vegetables plants for human consumption to check the harboring parasite stage was conducted in Saudi Arabia by many investigators (**Al.Binali 2006; Al.Magrin 2010 and Omar 2012**).

2. Material and methods

1- Human parasite infection detection

A laboratory survey analysis of stool specimens was carried out of intestinal parasite examination among the patients who attend to a private health unit in the study area complained with disease symptoms. A total of 193 stool specimens were examined from February to December 2013. The age, sex, nationality and other demographic information of the patients were recorded by doctors and technicians and thus these parameters were included in the data analysis. All patients were given a tight-lid plastic container to bring a stool specimen. They were also asked about other characteristics e.g. chronic diseases, water source, eating vegetables and past medical history. All specimens were examined grossly using macroscoping and microscopic analysis including sedimentation technique (**Suwansaksri *et al.*, 2002**). A portion of each stool specimens was fixed in 10% formal saline to be examined by concentration technique (**Khan *et al.*, 1987 and Suwansaksri *et al.*, 2002**). The parasite

species was identified based on microscopic characteristics (**Garcia and Bruchner, 1997**).

2- Intestinal parasites detected in the vegetable samples

The vegetables were purchased from the market once weekly at the period of the study in El.Khorma Province. About 160 (32×5) vegetable samples were examined to investigate the presence of the intestinal parasite stages. Only five vegetable species: watercress, green onion, cabbage, lettuce and mint were chosen according to their availability almost the study period in the local market. A subset of each sample (250g) was chopped into small pieces and washed with physiological saline solution (0.95% NaCl). The washing water was left overnight. About 5 ml of supernatant was centrifuged at 1000 rpm for 15 minutes, then the supernatant was removed and the sediment was examined after adding a drop of lugol iodine for parasite presence (**Bailenger, 1962**). The parasite species were identified according to **Soulsby (1982)**.

3- Statistical analysis

Data analysis was carried out using a scientific calculator and statistical package. Data was fed into a Microsoft Excel table which was used to construct tables and figures. The Statistical Package for Social Sciences (SPSS) was then used to form all the statistical analysis. The main values for infection rates were compared using one away Anova and comparison of means further treated by Scheffe test to assess the heterogeneity or homogeneity levels.

3. Results

The infection rate for intestinal parasites in all samples was 12% (Table.1.), (Figure.1.). *Entamoeba histolytica* showed the highest infection rate (56%) followed by *Giardia lamblia* (13%) and *Taenia saginata* (8.7%), (Table.2.). The infection according to socio-demographic characteristics showed increasing in females, (20-39) age group and non-saudis are being 52.2, 69.6 and 73.9% respectively (Tables.4, 5 and 6.). The data analysis showed that there is no significant difference between these socio-demographic characteristics according to the incidence rate. Parasite infection intensity, which is measured by the number of eggs in examined samples was high prevalence in the low rate (1-3 ova) as represented by 56% (Table.7.). By the dietary habits the incidence rate was the highest in the sample of individuals who had used wells water being 69.5% (Table.8.), as well as, in individuals who had ate vegetables frequently being 69.9% (Table.9.).

On the other hand the results showed that 22 out of 166 sample of vegetables represent (13.8%) contains parasite stages. The prevalence of intestinal parasites in the plant species was found to be (28.1, 15.6, 9.4, 12.5 and 3.1%) in watercress, green onion, cabbage, lettuce and mint respectively (Table.10.). The high prevalence was recorded for *Entamoeba coli* which found to be 27.3% whereas there were no detection parasitic stages for *Taenia saginata* and *Schistosoma mansoni* (Table. 11.).

Table 1. Infection of intestinal parasite diseases in the study area (n=193)

Number examined	Number infected	Infection rate (%)
193	23	12

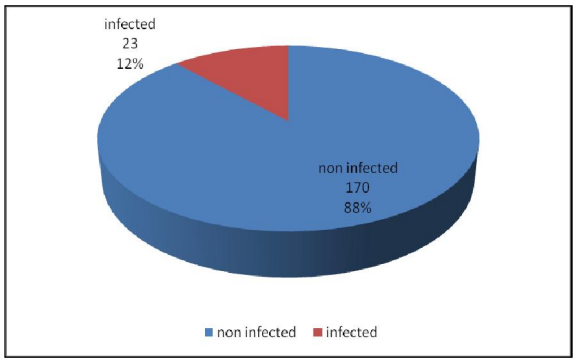

Figure 1. Infection of intestinal parasite diseases in the study area (n=193)

Table 2. Prevalence rate of intestinal diseases according to parasite species (n=23).

Parasite species	No. infected	Prevalence (%)
Entamoeba histolytica	13	57
Entamoeba coli	1	4.3
Giardia lamblia	3	13
Enterobius vermicularis	1	4.3
Taenia saginata	2	8.7
Hook worm	1	4.3
Schistosoma mansoni	1	4.3
Ascaris lumbricoides	1	4.3
Total	23	100

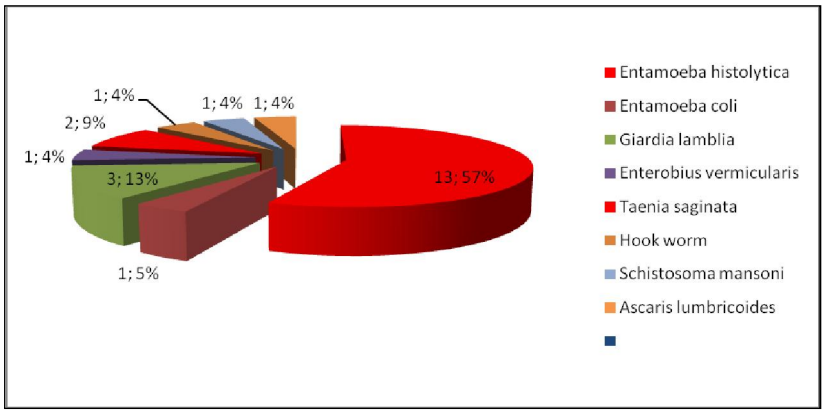

Figure.2. Prevalence rate of intestinal diseases according to parasite species (n=23)

Table.3. Socio-demographic characteristics related to incidences in the study area (n=193).

Characteristics	No. examined	No. infected(Rate %)
Sex		
Male	98	11(47.8)
Female	95	12(52.2)
Age groups		
>7	18	0(0)
7-19	20	0(0)
20-39	90	16(69.6)
40-60	48	6(26.1)
<60	17	1(4.3)
Nationality		
Saudi	83	6(26.1)
Non-Saudis	110	17(73.9)
Source of water		
Water wells	113	16(69.5)
Desalinated water	80	7(30.4)
Eating vegetables		
Infrequently	38	4(17.4)
To some extent	12	3(13)
Frequently	143	16(69.6)

Table.4. Sex-related incidence of intestinal parasite disease in the infected samples (n=23).

Parasite species	Males infected(Rate%)	Females infected(Rate%)
Entamoeba histolytica	6 (46.1)	7 (53.8)
Entamoeba coli	1 (100)	0(0)
Giardia lamblia	1 (33.3)	2 (66.7)
Enterobius vermicularis	1 (100)	0(0)
Taenia saginata	1 (50)	1 (50)
Hook worm	0(0)	1 (100)
Schistosoma mansoni	0(0)	1 (100)
Ascaris lumbricoides	1 (100)	0(0)
Total	11(47.8)	12(52.2)

*Statistical analysis $P = 0.707571357$ $P > 0.05$ no significant different

Table 5. Age-related incidence of intestinal parasite disease in the infected samples (n=23).

Parasite species	**>7 (Rate%)**	**7-19 (Rate%)**	**20-39 (Rate%)**	**40-60 (Rate%)**	**<60 (Rate%)**
Entamoeba histolytica	0(0)	0(0)	9(69.2)	4(30.8)	0(0)
Entamoeba coli	0(0)	0(0)	0(0)	1(100)	0(0)
Giardia lamblia	0(0)	0(0)	2(66.7)	0(0)	1(33.3)
Enterobius vermicularis	0(0)	0(0)	1(100)	0(0)	0(0)
Taenia saginata	0(0)	0(0)	1(50)	1(50)	0(0)
Hook worm	0(0)	0(0)	1(100)	0(0)	0(0)
Schistosoma mansoni	0(0)	0(0)	1(100)	0(0)	0(0)
Ascaris lumbricoides	0(0)	0(0)	1(100)	0(0)	0(0)
Total	0(0)	0(0)	16(69.6)	6(26.1)	1(4.3)

*Statistical analysis $P = 0.481157457$ $P > 0.05$ no significant different

Table 6. Nationality-related incidence of intestinal parasite disease in the infected samples (n=23).

Parasite species	**Saudi (Rate%)**	**Non-Saudi (Rate%)**
Entamoeba histolytica	3(23.1)	10(76.9)
Entamoeba coli	1(100)	0(0)
Giardia lamblia	2(61.5)	1(38.5)
Enterobius vermicularis	0(0)	1(100)
Taenia saginata	0(0)	2(100)
Hook worm	0(0)	1(100)
Schistosoma mansoni	0(0)	1(100)
Ascaris lumbricoides	0(0)	1(100)
Total	6(26.1)	17(73.9)

*Statistical analysis $P = 0.341661071$ $P > 0.05$ no significant different

Table 7. Intensity of the parasite related incidence of intestinal parasite disease in the infected samples (n=23).

Parasite species	High (≤7) **(Rate%)**	Medium **(4-6) (Rate%)**	Low **(1-3) (Rate%)**
Entamoeba histolytica	2(15.4)	1(7.7)	10(76.9)
Entamoeba coli	0(0)	0(0)	1(100)
Giardia lamblia	0(0)	1(33.3)	2(66.7)
Enterobius vermicularis	1(100)	0(0)	0(0)
Taenia saginata	0(0)	2(100)	0(0)
Hook worm	1(100)	0(0)	0(0)
Schistosoma mansoni	0(0)	1(100)	0(0)
Ascaris lumbricoides	1(0)	0(0)	0(100)
Total	5(22)	5(22)	13(56)

*Statistical analysis $P = 0.3504$ $P > 0.05$ no significant different

Table 8. Infection of intestinal parasite diseases related to water source

Parasite species	**Water wells (Rate%)**	**Desalinated water (Rate%)**
Entamoeba histolytica	8(61.5)	5(38.5)
Entamoeba coli	1(100)	0(0)
Giardia lamblia	2(66.7)	1(33.3)
Enterobius vermicularis	1(100)	0(0)
Taenia saginata	2(100)	0(0)
Hook worm	1(100)	0(0)
Schistosoma mansoni	0(0)	1(100)
Ascaris lumbricoides	1(100)	0(0)
Total	16(69.5)	7(30.4)

*Statistical analysis $P = 0.007660962$ $P < 0.05$ significant different between parasite species and water source

Table 9. Infection of intestinal parasite diseases related to the behavior of eating vegetables

Parasite species	Infrequently (Rate%)	To some extent (Rate%)	Frequently (Rate%)
Entamoeba histolytica	3(23.1)	0(0)	10(76.9)
Entamoeba coli	0(0)	0(0)	1(100)
Giardia lamblia	0(0)	1(33.3)	2(66.7)
Enterobius vermicularis	0(0)	1(100)	0(0)
Taenia saginata	1(50)	1(50)	0(0)
Hook worm	0(0)	0(0)	1(100)
Schistosoma mansoni	0(0)	0(0)	1(100)
Ascaris lumbricoides	0(0)	0(0)	1(100)
Total	4(17.4)	3(13)	16(69.6)

*Statistical analysis $P = 0.003096461$ $P < 0.05$ significant different between parasite species and the behavior of eating vegetables

Table 10. Prevalence of intestinal parasites in different vegetables (n=160).

Vegetable plant	No. examined	No. positive (Rate%)
Watercress (*Nasturtium officinale)*	32	9(28.1)
Green onion (*Allium makegi)*	32	5(15.6)
Cabbage (*Brassica oleracae)*	32	3(9.4)
Lettuce (*Letuca sativa)*	32	4(12.5)
Mint (*Mentha sp.)*	32	1(3.1)
Total	160	22(13.8)

Table.11. Distribution of intestinal parasites in different vegetable plants (n=160).

Parasite species	Watercress	Green onion	cabbage	Lettuce	Mint	Total (Rate%)
Entamoeba histolytica	3	0	0	1	0	4(18.2)
Entamoeba coli	4	2	0	0	0	6(27.3)
Giardia lamblia	0	0	1	0	0	1(4.5)
Enterobius vermicularis	1	1	0	1	0	3(13.6)
Taenia saginata	0	0	0	0	0	0(0)
Hook worm	0	2	1	0	1	4(18.2)
Schistosoma mansoni	0	0	0	0	0	0(0)
Ascaris lumbricoides	1	0	1	2	0	4(18.2)
Total	9	5	3	4	1	22(13.8)

4.Discussion

The cumulative incidence of intestinal parasitic diseases infection was found to be 12 % in the study area. These findings agree with other studies in Kingdom of Saudi Arabia which had reported prevalence ranging from (13.2%) in Abha Province (**Ali *et al.*, 1992**), to (14.2%) in Riyadh school children (**Ahmed and Bolbol, 1989**) and (13.2%) in Makka (**Al.Harathi, 2004**). But **Al.Shammari *et al*. (2001)** had reported prevalence rate of (32.2%) in Riyadh town due to the fact that they did a study in a wide community that coincided with the high incidence rate. The common parasites observed in the study were *Entamoeba histolytica* (56%), *Giardia lamblia* (13%) and *Taenia saginata* (8.7%). These results similar to the findings obtained by **Al.Harathi *et al*., 2004 and Zaglool *et al*., 2010** who found (4.7-1.3%) and (65-6%) prevalence rate for *Entamoeba histolytica* and *Giardia lamblia* respectively in Makka Province. *Entamoeba histolytica* parasite also had represented the highest incidence rate according to socio-demographic factors as sex, age and nationality being 53.8, 69.2 and 76.9% in females, 20-39 age group and non-Saudis respectively. The high prevalence of *Entamoeba histolytica* according to other factors agree with what had been found by **Al.Faleh 1982; Omar *et al.* 1991; Al. Braiken *et al.* 2003; Al. Harathi 2004 and Majed 2009** who found infection rate of 37.7% in Riyadh; 5.2% in Al.Qasim; 4.1% in Asir; 2.2% in Jeddah and 2.7% in Makka respectively. The present study suggests that the increasing of incidence in 20-39 age group as well as in non-Saudis probably explained by the selecting of one of the health centers which contains expatriates inspection that might be carriers of diseases. According to the dietary habits in analysis of data we can see source of water ($p = 0.0001$), eating vegetable ($p = 0.006$), has stronger association as their p value as < 0.05 and statistically significant confidence interval and t value. The other variables have a non-significant t value.

The overall prevalence of parasitic stages in vegetables in the present study was 13.8%. There is a marked difference in this results to **Al.Binali (2006) and Al. Megrin (2010)** who had been recorded an overall prevalence of 63% and 76% in South west of Saudi Arabia and Riyadh town respectively. This may explain by their coverage a long period in their studies that resulted in the high prevalence rate. A high rate of parasitic contamination in the watercress (28.1%) similar to **Al. Megrin (2010)** who found prevalence of 22.8% in the watercress. *Entamoeba coli* had a prevalence rate of 15.6% confirmed with **Al.Binali (2006)** findings who had recorded a prevalence rate of 19% in vegetable for *Entamoeba coli*. The study suggests that the prevalence of vegetable contamination with parasitic stages (13.8%) may be reflected in the high proportion (69.6%) of infected individuals who eat vegetables frequently.

In conclusion, we can say there is a high risk of infection with intestinal parasites in the study area. The high incidence of intestinal parasite diseases has been found in communities that eat raw vegetables which constitutes an important route of intestinal parasites transmission.

Corresponding author:
Dr. Muataz Ahmed Abdalla,
Biotechnology Department, Faculty of Science and Education, Taif University (El.Khorma Branch), Email: drmuataz@yahoo.com.

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