Prevalence of intestinal parasitic infections among food handlers in Khuzestan, Southwest of Iran: A 10-year retrospective study

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Intestinal parasitic infections (IPIs) are widely distributed throughout the world, especially in developing countries. Mortality and morbidity rates of these infections are significant. Infections are mainly transmitted via ingestion of water, soil or food contaminated by faeces containing the cysts and ova of protozoans and helminthes, respectively. In many cases, clinical features of the infections remain asymptomatic and consequently carriers act as on-going sources of infection within their community. In this regard, food handlers within a community may contribute disproportionately to the prevalence of infection. Therefore, studying the rate of intestinal parasitic contamination retrospectively among food handlers is important in order to design more effective systematic monitoring of infections in a region.

The recorded results of stool examination for 62,007 people during a recent 10-year period (2000 to 2009) in Khuzestan, Southwest Iran, were analyzed. In total, 4,830 (8.8%) and 15,750 (25.4%) were contaminated by pathogenic and non-pathogenic parasites, respectively, demonstrating continuous protozoan and helminthic contamination among food handlers. In conclusion, we suggest that the current system for monitoring of IPIs in food handlers is not sufficient and provide recommendations for changes, such as improving delivery of hygiene information to the target group and changing the periodicity of stool examination for food handlers from once to twice per year.

Key words: Intestinal parasites, food handlers, retrospective study, Iran.

INTRODUCTION

Intestinal protozoan and helminthic infections are endemic worldwide and have been described as constituting the greatest single worldwide cause of illness and disease (Steketee, 2003; Curtale et al., 1998). These infections have a worldwide distribution, especially in developing countries with low socio-economic status and poor living conditions (Adamu et al., 2006; Zuhaizam et al., 2007). More than 2 billion people are chronically infected with intestinal parasites (Alum et al., 2010). Helminthes and protozoa are the two groups of pathogens causing intestinal illness, with both direct and indirect methods of transmission among people (Cleaveland et al., 2001).

The most common intestinal helminthes are Ascaris lumbricoides, Trichuris trichiura and hookworms, referred
to as soil-transmitted helminths (STHs) (Bethony, 2006). Of protozoan parasites, Cryptosporidium and Giardia are recognized as prevalent and widespread pathogens of humans and many other species of mammals (Bajer, 2008). Another intestinal protozoan, Entamoeba histolytica, is responsible for up to 100,000 deaths worldwide, especially in developing countries, each year (WHO, 2006). All of the mentioned intestinal infections are mainly transmitted via ingestion of water, soil or food contaminated by faeces containing the cysts and ova of the protozoan and helminth species, respectively.

In most cases, clinical features of the intestinal parasitic infections (IPIs) are asymptomatic, leading to difficulties in the eradication and control of these parasites due to the number of potential carriers, such as food handlers (Ayeh-Kumi et al., 2009). Although IPIs cause generally low death rates but have a worldwide distribution, the global number of related deaths is significant (Tengku and Norhayati, 2011). A large body of research has indicated the importance of food handlers in the transmission of parasitic diseases (Wiwanitkit and Assawawitoontip, 2002; Hundy and Cameron, 2002; Feglo et al., 2004). Therefore, this study aimed to evaluate the prevalence and duration of IPIs in food handlers in Khuzestan, Southwest Iran, over a period of 10 years, in order to consider effective prevention strategies for substantially reducing the prevalence of faecal-oral transmissible parasites.

**MATERIALS AND METHODS**

A retrospective laboratory analysis of stool specimens was carried out for intestinal parasite examination in Khuzestan, Southwest Iran. The recorded results of different regions of the province were analyzed (Figure 1).

According to National Food Safety standards, all food handlers must receive a medical examination such as parasitologic stool examination prior to reception of their health certifications. Therefore, all food handlers were referred to medical diagnosis laboratories for checking of the IPIs. The individuals who have been away from their duties for any period of time as a result of illness must receive authorization from the medical department prior to resumption of duty.

The age, sex, economic and other demographic information of the food handlers were recorded inconsistently and thus, these parameters were not included in the data analysis. Food handlers include people who have contact with food from the time of preparation up to the time of serving of such food to the consumers. The data were collected from the health center laboratories of the Khuzestan Government, between January, 2000 and December, 2009. The stool specimens were examined using different microbiological analysis including formalin – ether acetate sedimentation technique (Suwansaksri et al., 2002), direct macroscopic and microscopic examinations and trichrome permanent staining (Ipek et al., 2007) in order to demonstrate the presence of worm eggs and larvae, Taenia proglottids and protozoan trophozoites and cysts. Parasite species were morphologically identified based on microscopic characteristics (Garcia and Bruckner, 1997).

**Statistical analysis**

In this study, SPSS version 16 software (Macintosh OS X) was used for data analysis and a student’s t-test (Zimmerman and Donald 1997) for significance differences between groups. Differences were considered as significant whenever the p value was less than 0.05.

**RESULTS**

The recorded results of parasitological laboratories for 62,007 food handlers during the 10-year period from 2000 to 2009 in Khuzestan, Southwest Iran, were analyzed. In total, 4830 (7.78%) and 15,750 (25.40%) were contaminated by pathogenic and non-pathogenic parasites, respectively. At least 12 different parasites were reported, and the most common pathogenic parasites identified were: G. lamblia (4.52%), Hymenolepis nana (1.29%), Entamoeba histolytica/dispar (1.39%) and A. lumbricoides (0.57%). These results are shown in Table 1. No infections with Taenia spp., Schistosoma spp. or hookworms were reported. The other parasites present were: Entamoeba coli 5643 (9.10%), Iodamoeba butschlii (5%) and Blastocystis hominis (11.32%), while infection with Enterobius vermicularis, T. trichiura, Strongyloides stercoralis, Chilomastix mesnili and Endolimax nana was each less than 0.5% (not showed in the Table 1).

The finding of this study indicates reduction in the prevalence of IPIs among food handlers in Khuzestan Province, Southwest of Iran over a period of 10 years (Table 1). The prevalence of the infections was including 10.64% in year 2000 but gradually decreased in following years, finally reached to 3.49% in year 2009. The
Differences between these values were statistically significant (p<0.05).

**DISCUSSION**

Despite efforts to improve sanitation and reduce transmission, IPIs are still prevalent throughout the world. In Iran, particularly in rural regions, the prevalence has been reported as between 19.3 to 27.3% (Sayyari et al., 2005; Nematian et al., 2004; Haghighi et al., 2009). Other studies in countries neighboring Iran such as Turkey, Saudi Arabia and Qatar revealed prevalence rates of 31.8 to 37.2% (Okyay et al., 2004; Çeliksöz et al., 2005), 31.4 to 32.2% (Al-Shammari et al., 2001; Abahussain, 2005) and 33.9% (Abu-Madi et al., 2008), respectively. The infection rate is affected by many factors such as socioeconomic status, climate, poverty, malnutrition, personal and community hygiene and population density (Marothi and Singh, 2011). One of several important factors influencing the prevalence of IPIs is the presence of carrier people that transmit parasitic infections directly or indirectly through contamination of food and water. Food handlers, who come into contact with food and water consumed by a large number of people, are therefore ideally placed to transmit parasites if they fail to have sufficiently rigorous personal hygiene. For example, a cross-sectional study of sidewalk food vendors in Jakarta, the capital and largest city of Indonesia, showed that 83.9% of fingernail specimens were positive for intestinal parasites (Suriptustuti and Widiaustuti, 2011). Another study, in Nigeria, on street food vendors revealed a 98.7% rate of IPIs (Idowu and Rowland, 2006), indicating the important role of these groups in infection dissemination.

Data analysis of the present study indicates reduction in the prevalence of IPIs among food handlers in Khuzestan, Southwest of Iran over a period of 10 years. In total, 12 pathogenic and non-pathogenic species of intestinal parasites were observed in this retrospective study. With regards to the pathogenic infections, *E. histolytica/dispar* (1.39%) and *Giardia* (4.52%) were the most common intestinal protozoa, while *H. nana* (1.29%) was the most common helminth. The prevalence of intestinal helminthic infections in general population varies between 0 to 3.6% in different parts of Iran and the decrease in prevalence of IPIs infections is determined by epidemiological researches (Sharif et al., 2010; Nasiri et al., 2009).

Several researchers around the world studied the prevalence of intestinal parasites among food handlers during the recent years (Table 2).

In a study in Hamadan, Western Iran (Fallah et al., 2004), analysis conducted on 938 stool samples of food handlers indicated over 74% of stool samples contained at least one species of parasite. *E. coli* (45%) was the most common parasite followed by *A. lumbricoides* (39%), *E. histolytica* (14.5%) and *G. lamblia* (9%). This difference may due to emphasis placed on mainly pathogenic parasites in current study mentioned in the Table 1. However, raising of IPIs rates in Hamadan region is unknown and need more studies (Fallah et al., 2004).

Majed et al. (2009) from Saudi Arabia detected intestinal parasites in 31.94% of food handlers. The most common pathogenic parasites observed in this study were *T. trichiura* (10.70%), hookworms (7.54%), *E. histolytica* (2.78%), *G. lamblia* (1.98%), *Schistosoma mansoni* (1.59%), *S. stercoralis* (1.00%), *A. lumbricoides* (0.8%), *H. nana* (0.6%) and *E. vermicularis* (0.2%). The possible explanation for these diversity rates of infections is the epidemiological-related conditions of the collected samples, belonging to different countries with special epidemiological situation affecting the infection rates (Marothi and Singh, 2011).

This results indicated statistically lower infection rates for *G. lamblia* and *H. nana* than similar amounts of present study but significantly higher for others (p<0.05).

### Table 1. Prevalence of IPIs among food handlers for the period of 10 years (2000 to 2009) in Khuzestan, Southwest Iran.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of samples</th>
<th><em>Giardia</em> No (%)</th>
<th><em>H. nana</em> No (%)</th>
<th><em>E. his/dis</em> No (%)</th>
<th><em>A. lumbricoides</em> No (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4811</td>
<td>269(5.59)</td>
<td>101(2.09)</td>
<td>67(1.39)</td>
<td>75(1.55)</td>
<td>512(10.64)</td>
</tr>
<tr>
<td>2001</td>
<td>5862</td>
<td>381(6.49)</td>
<td>70(1.19)</td>
<td>105(1.79)</td>
<td>70(1.19)</td>
<td>626(10.67)</td>
</tr>
<tr>
<td>2002</td>
<td>6730</td>
<td>397(5.89)</td>
<td>127(1.88)</td>
<td>100(1.48)</td>
<td>60(0.89)</td>
<td>684(10.16)</td>
</tr>
<tr>
<td>2003</td>
<td>5670</td>
<td>357(6.29)</td>
<td>34(0.60)</td>
<td>130(2.29)</td>
<td>40(0.70)</td>
<td>561(9.89)</td>
</tr>
<tr>
<td>2004</td>
<td>6029</td>
<td>313(5.19)</td>
<td>108(1.79)</td>
<td>37(0.61)</td>
<td>18(0.30)</td>
<td>476(7.9)</td>
</tr>
<tr>
<td>2005</td>
<td>8389</td>
<td>390(4.6)</td>
<td>134(1.6)</td>
<td>143(1.7)</td>
<td>8(0.1)</td>
<td>675(7.89)</td>
</tr>
<tr>
<td>2006</td>
<td>7125</td>
<td>349(4.89)</td>
<td>64(0.89)</td>
<td>93(1.30)</td>
<td>14(0.19)</td>
<td>520(7.29)</td>
</tr>
<tr>
<td>2007</td>
<td>4645</td>
<td>151(3.25)</td>
<td>67(1.44)</td>
<td>51(1.09)</td>
<td>27(0.58)</td>
<td>296(6.37)</td>
</tr>
<tr>
<td>2008</td>
<td>8021</td>
<td>181(2.25)</td>
<td>46(0.57)</td>
<td>64(0.79)</td>
<td>24(0.29)</td>
<td>315(3.92)</td>
</tr>
<tr>
<td>2009</td>
<td>4725</td>
<td>16(0.33)</td>
<td>51(1.07)</td>
<td>75(1.57)</td>
<td>23(0.48)</td>
<td>165(3.49)</td>
</tr>
<tr>
<td>Total</td>
<td>62007</td>
<td>2804(4.52)</td>
<td>802(1.29)</td>
<td>865(1.39)</td>
<td>359(0.57)</td>
<td>4830(7.78)</td>
</tr>
</tbody>
</table>

Keys: *H. nana* (*Hymenolepis nana*), *E. his/dis* (*Entamoeba histolytica /dispar*), *A. lumbricoides* (*Ascaris lumbricoides*).
Table 2. The prevalence of IPIs among food handlers in some areas of the world.

<table>
<thead>
<tr>
<th>Author</th>
<th>Sample size</th>
<th>Country</th>
<th>Year</th>
<th>Hook-worms (%)</th>
<th>T. trichiura (%)</th>
<th>S. stercoralis (%)</th>
<th>G. lamblia (%)</th>
<th>E. histolytica (%)</th>
<th>S. mansoni (%)</th>
<th>A. lumbricoides (%)</th>
<th>H. nana (%)</th>
<th>T. saginata (%)</th>
<th>E. vermicularis (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wakid (2006)</td>
<td>1009</td>
<td>Saudi Arabia</td>
<td>2006</td>
<td>14.67</td>
<td>9.61</td>
<td>1.88</td>
<td>4.6</td>
<td>2.97</td>
<td>1.1</td>
<td>1.1</td>
<td>0.8</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Wiwanitkit and Assawawitoontip (2002)</td>
<td>135</td>
<td>Thailand</td>
<td>2002</td>
<td>1.8</td>
<td>-</td>
<td>0.9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Al-Lahham et al. (1990)</td>
<td>283</td>
<td>Jordan</td>
<td>1990</td>
<td>2.5</td>
<td>1.1</td>
<td>-</td>
<td>3.9</td>
<td>(0.7)</td>
<td>2.8</td>
<td>4.9</td>
<td>1.8</td>
<td>0.4</td>
<td>-</td>
</tr>
<tr>
<td>Fallah et al. (2004)</td>
<td>938</td>
<td>Iran</td>
<td>2004</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>14.5</td>
<td>-</td>
<td>39</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sadek et al. (1997)</td>
<td>1700</td>
<td>Egypt</td>
<td>1997</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>16.76</td>
<td>9.76</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Belhadj et al. (1994)</td>
<td>6092</td>
<td>Tunis</td>
<td>1994</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>22.61</td>
<td>23.27</td>
<td>-</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Sanches et al. (1990)</td>
<td>200</td>
<td>Panama</td>
<td>1990</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Garedaghi et al. (2011)</td>
<td>300</td>
<td>Iran</td>
<td>2011</td>
<td>8.1</td>
<td>5.9</td>
<td>14.4</td>
<td>-</td>
<td>1.1</td>
<td>4.8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Majed et al. (2009)</td>
<td>504</td>
<td>Saudi Arabia</td>
<td>2007</td>
<td>7.54</td>
<td>10.70</td>
<td>1.00</td>
<td>1.98</td>
<td>2.78</td>
<td>1.59</td>
<td>(0.8)</td>
<td>0.6</td>
<td>-</td>
<td>0.2</td>
</tr>
</tbody>
</table>

IPIs Intestinal parasitic infections; -, not reported.

Study of Al-Lahham et al. (1990) on 283 food handlers indicated infection rate of 4.9% with A. lumbricoides, 3.9% with G. lamblia, 2.8% with S. mansoni, 2.5% with hookworms, 1.8% with H. nana, 1.1% with T. trichiura, 0.7% with E. histolytica and 0.4% with Taenia saginata.

Sanches et al. (1990) in Panama showed that food handlers were contaminated with G. lamblia (25%), E. coli (10%), A. lumbricoides (9%), T. trichiura (5%), E. nana (4%), I. buetschlii (3%), hookworms (2%), S. stercoralis (2%) and Chilomastix mesnili (1%).

In Tunis study conducted on 6092 stool samples from food handlers over a period of 6 years indicated prevalence rate of 28.7% (Belhadj et al., 1994). The detected pathogenic parasites were: E. histolytica (23.27%), G. lamblia, (22.61%), while H. nana, E. vermicularis, T. saginata, A. lumbricoides, T. trichiura, S. stercoralis and hookworms were each present in less than 5% of samples.

In a study in Qalubia, Al Qalyubiyah, in Egypt (Sadek et al., 1997), protozoan and helminthic infections were observed in the following parasites: E. coli (18%), G. lamblia (16.76%), I. buetschlii (15%), B. hominis (12.5%), E. histolytica (9.76%) and A. lumbricoides (7%). For other parasites, the rate was less than 5%. The study was conducted on 1700 stool samples of food handlers above 20 years of age, using a variety of different stool techniques including Faust, Ritchie and Kato techniques and test tube cultures for larvae.

Wiwanitkit and Assawawitoontip (2002), in screening study of 135 food handler stool samples for parasites and bacteria by direct smear and formalin ether concentration method revealed 2.71% for Opisthorchis viverrini, 1.8% for hookworms, 0.9% for G. lamblia and 0.9% for S. stercoralis. A study in Jeddeh, Saudi Arabia to investigate intestinal parasites among food handlers reported 50.15% of IPIs rate with 17 different intestinal (Wakid, 2006).

Conclusion
This study revealed the valuable reduction of IPIs among food handlers in Khuzestan Province over a period of 10 years (2000 to 2009). The reason can be due to: operating of Non-Governmental educational health institutes beside governmental offices, intensification of supervision on food handlers in all urban and rural regions of the province and compelling of managers to establish health public toilets in food preparation and distribution centers. However, the existent
prevalence signals possibility of transmission of these parasites through these infected food handlers to their customers. Therefore, providing consecutive health education sessions to improve information about food health principles among food handlers and providing public toilets with liquid soap for cleaning of hands after defecation and before food handling should be considered. In addition, using three consecutive stool samples for diagnosis of IPIs, which would provide higher diagnostic sensitivity, is recommended, along with an increase of stool examination periodicity from once to twice per year.

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