

The Prevalence of some Intestinal Parasites in Food-Handlers of Asian and African Countries: A Meta-Analysis

Aziz Kassani^a, Mohsen Shaterian^b, Gholamreza Sharifirad^c, Rostam Menati^{d,e}, Hedayat Abbastabar^a, Mohammad Ebrahimipour^f, Abbas Rezaianzadeh^{g*}.

^aDepartment of Epidemiology, School of Health, Shiraz University of medical sciences, Shiraz, Iran.

^bDepartment of Sociology, School of Humanities, University of Kashan, Kashan, Iran.

^cPublic Health Department, School of Health, Qom University of medical sciences, Qom, Iran.

^dDepartment of Sociology, School of Humanities, University of Kashan, Kashan, Iran.

^ePrevention of Psychosocial Injuries Research Center, Ilam university of Medical Sciences, Ilam, Iran.

^fDepartment of Medical Parasitology and Mycology, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran.

^gDepartment of Epidemiology, School of Health, Shiraz University of Medical Sciences, Shiraz, Iran.

*Correspondence should be addressed to Dr. Abbas Rezaianzadeh; Email: rezaiana@sums.ac.ir

A-R-T-I-C-L-E I-N-F-O

Article Notes:

Received: Oct 18, 2014

Received in revised form:
Dec 25, 2014

Accepted: Jan 18, 2015

Available Online: May 19,
2015

Keywords:

Meta-analysis

Intestinal parasites

Food-handler

A-B-S-T-R-A-C-T

Background & Aims of the Study: Parasitic infections are common in many countries, especially in developing countries and tropical areas. People who deal with foods can be a threat to health of communities. This meta-analysis study was undertaken to determine the prevalence of parasitic infections, such as *Ascaris lumbricoides*, *Entamoeba coli*, *Entamoeba histolytica*, and *Giardia lamblia*, among the food staff in Asian and African countries.

Materials & Methods: We systematically searched Pubmed, Embase, Cochrane library, Proquest, Scopus, and Springer databases. In this meta-analysis, only the cross-sectional studies conducted from 1970 to October 2013 were selected. After searching by the main keywords, 23 papers were found that after applying the inclusion criteria, 11 articles remained. I^2 and T^2 coefficients were used to find heterogeneity in the studies. Then, random effect model was applied for data analysis by Stata-12 software.

Results: The pooled effect size, T^2 , and I^2 for *E. coli* were 0.041 (CI 95%: 0.009-0.073), 0.004, and 88.9%, respectively. For *A. lumbricoides*, the pooled effect size was 0.017 (CI 95%: 0.012-0.022), T^2 was 0.002, and I^2 was 87.2%. These measures were respectively obtained as 0.026 (CI95%: 0.014-0.038), 0.003, and 88.5% for *E. histolytica*. Ultimately, the pooled effect size, T^2 , and I^2 for *G. lamblia* were 0.033 (CI 95%: 0.022-0.044), 0.004, and 85.7%, respectively.

Conclusions: The prevalence rate of some intestinal parasites was relatively low in the food-handlers in Asian and African countries compared to the previous studies. Also, high heterogeneity was obtained regarding the prevalence rate in these countries.

Please cite this article as: Kassani A, Shaterian M, Sharifirad Gh, Menati R, Abbastabar H, Ebrahimipour M, et al. The prevalence of some intestinal parasites in food-handlers of Asian and African countries: A meta-analysis. Arch Hyg Sci 2015;4(1):49-56.

Background

Intestinal parasites are the microorganisms that live in the gastro-intestinal tract of humans and other animals (1,2). In the world, approximately 3.5 billion people are

infected with intestinal parasites, 450 millions of whom have clinical symptoms. Besides, more than 200,000 deaths occur due to these infections every year (3). Although intestinal parasites can live anywhere in the body, they most prefer to live in the intestinal lumen. In general, individuals may be exposed to intestinal parasites through eating uncooked meat, drinking polluted water, and skin penetration. Two main types of intestinal parasites are helminth and protozoa. Intestinal parasites can harm their hosts through injury or illness (1,4). Distribution of food-borne diseases is a common and important problem in the world (5,6). A lot of communicable diseases and microorganisms can enter the body through foods and cause infection (7). Many outbreaks of diarrhea and vomiting also occur by eating raw foods, raw material composition of foods, or foods from unsafe sources (8,9). In 1920, the Rockefeller Foundation to fight Hookworms in Mexico used anthelmintic drugs to eliminate the human Hookworms, which was very effective. However, adequate and effective preventive measures have not been proposed for the infected individuals. Therefore, the rate of re-infection was extremely high and the project evaluated through many of scientific methods was a marked failure. This proves the necessity to educate people about the importance of wearing shoes, building toilets, and promotion of the health of the environment (10).

Parasitic infections are common in many countries, especially in developing and tropical countries. Although the prevalence of parasitic infections has been almost determined in the general population of these countries, there is not stable and accurate information about the prevalence of these infections among the food staff. The

individuals who deal with foods can be an important source of transmission of intestinal parasites to the rest of the population (11,12).

Aims of the study: Hence, the present meta-analysis aims to determine the prevalence of parasitic infections, such as *Ascaris lumbricoides*, *Entamoeba coli*, *Entamoeba histolytica*, and *Giardia lamblia*, among the food staff in several Asian and African countries.

Materials & Methods

This meta-analysis study aimed to determine the prevalence rate of *A. lumbricoides*, *E. coli*, *E. histolytica*, and *G. lamblia* in the food-handlers in several Asian and African countries. We performed electronic searches of the English-language literatures on the prevalence of intestinal parasites among food-handlers in Pubmed, Embase, Cochrane library, Proquest, Scopus, and Springer databases using combined text words related to intestinal parasites; i.e., intestinal parasite, intestine parasite, bowel parasite, intestinal guest, and bowel guest.

The words related to cookery, such as food-handlers, food staff, and food vendors, were used, as well. Only the related cross-sectional studies conducted from 1970 to October 2013 were entered into this meta-analysis. After searching using these key words, 23 papers were found and after applying the inclusion criteria, 11 articles remained. The inclusion criteria were: (1) cross-sectional studies conducted on food-handlers and (2) including the prevalence rate and sample size of the intended parasites. On the other hand, the studies

without a cross-sectional design and those, which were conducted on individuals other than food handler, were excluded.

It should be noted that the researchers contacted the authors in case insufficient data were reported. The main outcome measure in this study was the prevalence rate of intestinal parasites.

Data analysis: The study data were analyzed using random effect method. In this study, the researchers did not distinguish between point and period prevalence in the reports because they intended to attain a general prevalence of the intestinal parasites.

The 11 papers that expressed in the “Results” section have been written by Babiker M.A, Wakid M.H, Abahussain N.A, Algamdi K.S, Kusolsuk T, Andargie G, Zaglol D.A, Kumi A, Saki J, Dash M and Nuchprayoon S, respectively (13-23).

Results

The analyzed results on *A. lumbricoides* showed that the pooled effect size of the studies was equal to 0.017 (95% CI: 0.012-0.022). In addition, the results of Chi-square test showed a significant difference among the studies’ results. The findings of Tau-squared also revealed a significance true difference between the studies’ results. Besides, the results of I-squared test cleared

that more than 87% of the total difference among the studies’ results was due to true variance (Figure 1).

The heterogeneity coefficients were attained :chi-squared=88.59 (d.f=8), P=0.0001, Tau-squared=0.002, I-squared)=87.2%, Test of ES=0, z=6.23, P=0.0001.

The analyzed results on *E. coli* showed that the pooled effect size of the studies was equal to 0.041 (95% CI: 0.009-0.073). Additionally, the results of Chi-square test showed a significant difference among the studies’ results. Moreover, the findings of Tau-squared demonstrated a significance true difference among the studies’ results.

Also, the results of I-squared test indicated that approximately 89% of the total difference among the studies’ results was due to true variance (Figure 2).

Also, heterogeneity indices were attained that included: chi-squared=136.44 (d.f=7) P=0.0001, Tau-squared=0.004, I-squared =88.9%, Test of ES=0, z=2.48, P=0.013.

The analyzed results regarding *E. histolytica* showed that the pooled effect size of the studies was equal to 0.026 (95% CI: 0.014-0.038).

Also, the results of Chi-square test showed a significant difference among the studies’ results.

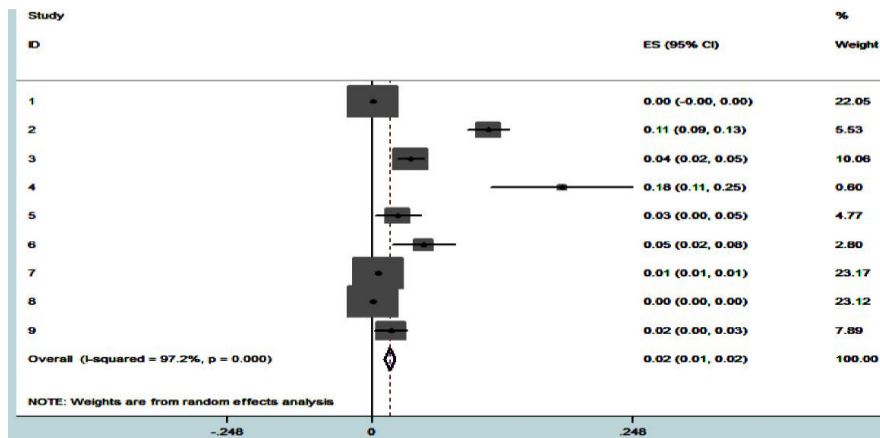


Figure 1) Forest plot for *A. lumbricoides* using random effects meta-analyses. CI indicates confidence interval.

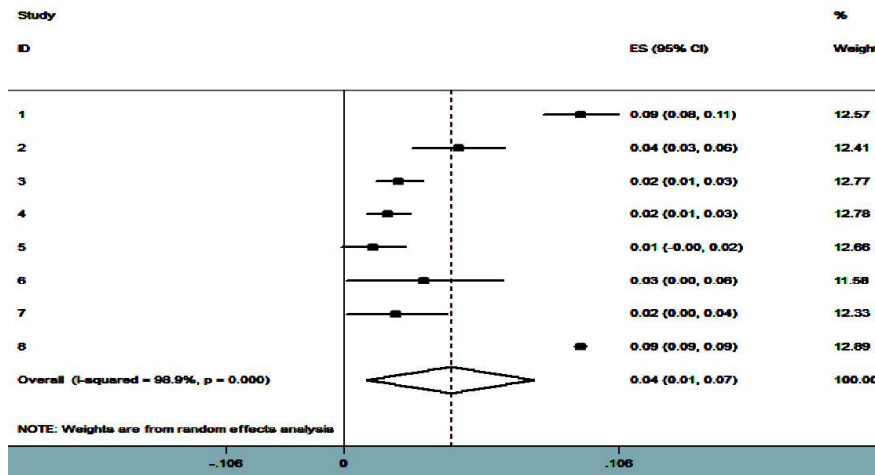


Figure 2) Forest plot for *E. coli* using random effects meta-analyses. CI indicates confidence interval.

In addition, the findings of Tau-squared revealed a significance true difference among the studies' results. Furthermore, the results of I-squared test cleared that

approximately 89% of the total difference among the studies' results was due to true variance (Figure 3).

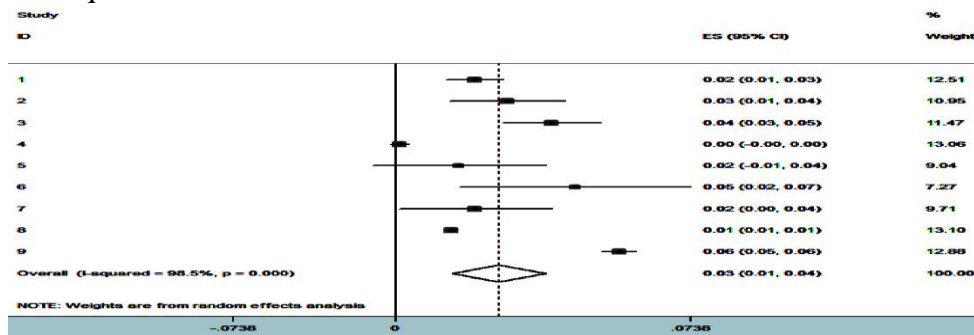


Figure 3) Forest plot for *E. histolytica* using random effects meta-analyses. CI indicates confidence interval.

The tests related to heterogeneity were significant: chi-squared=131.67 (d.f=8) P=0.001, Tau-squared=0.003, I-squared =88.5%, Test of ES=0, z=4.36, P=0.001

The analyzed results concerning *G. lamblia* showed that the pooled effect size of the studies was equal to 0.033 (95% CI: 0.022-0.044). Besides, the results of Chi-square test revealed a significant difference among the studies' results. The findings of Tau-squared test also indicated a significance true difference among the studies' results. Moreover, the results of I-squared test cleared that approximately 86% of the total difference among the studies' results was due to true variance (Figure 4).

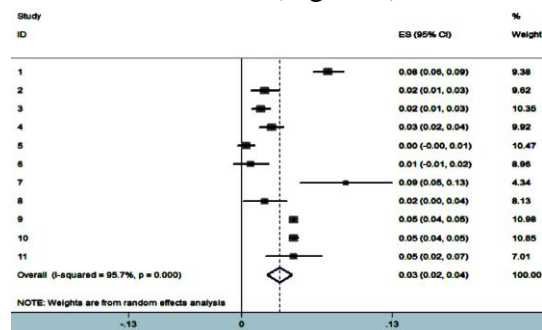


Figure 4) Forest plot for *G. lamblia* using random effects meta-analyses. CI indicates confidence interval

The heterogeneity coefficients were attained: Chi-squared=233.74 (d.f=10)

Discussion

Several researches conducted around the world have emphasized the significance of food-handlers as threats in the transmission of parasite infections (16,18, 24,25). The present meta-analysis sought to estimate the prevalence rates of some intestinal parasites among the

P=0.00, I-squared 85.7%, Tau-squared=0.004 Test of ES=0, z=6.10, P=0.001.

The results regarding the probability of publication bias have been presented in the following funnel plots. Accordingly, the funnel plot of *A. lumbricoides* is asymmetric, indicating the probability of publication bias due to distribution of the prevalence rates reported in the studies (Figure 5).

Similarly, the Funnel plots of *E. coli*, *E. histolytica* and *G. lamblia* are asymmetric, showing the probability of publication bias due to distribution of the prevalence rates reported in the studies that are approximately similar with funnel plot for *A. lumbricoides*

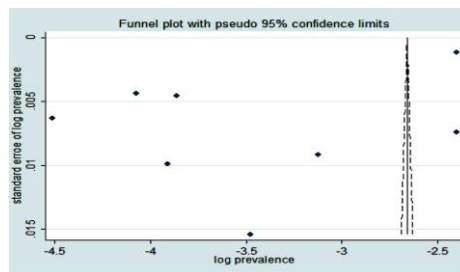


Figure 5) Funnel plot of *A. lumbricoides*

food-handlers in Asian and African countries. The study results showed a marked heterogeneity for all the prevalence estimates of intestinal parasites.

This heterogeneity can be interpreted due to the factors associated with environment, health, and time in different countries (13,25,26).

The results of the current study also demonstrated that the prevalence of intestinal

parasites was various and approximately low in the food-handlers in Asian and African countries, and *E. coli* was the most common parasitic infection among the food-handlers (P:0.041, 95% CI: 0.009-0.073) based on random effect model (due to the heterogeneity among the studies). In the studies conducted by Babike (13) and Kumi (20) the prevalence rates of *E. coli* were reported as 9.1% and 9%, respectively, which were higher compared to the findings of the present meta-analysis (4% and 4.1%, respectively). On the other hand, our study results regarding *E. coli* were in accordance with those obtained by Wakidm (14) in Saudi Arabia (4.1%).

Moreover, the prevalence rate of parasitic infection with *A. lumbricoides* was 0.017 (CI 95%: 0.012-0.022). In the previous studies by Alghamdi (16), Abahussain (16), Andargie (19) and Kusolsukt (17), the prevalence rates of *A. lumbricoides* among the food-handlers were 18%, 4%, 5%, and 3%, respectively, which were higher compared to the current study (16.3%, 2.3%, 3.3% and 1.3% respectively).

The prevalence of infection with *E. histolytica* was about 0.026% (CI 95%: 0.014-0.038) among the food-handlers. In addition, the highest (6%) and lowest (0%) prevalence rates of *E. histolytica* were reported in the studies by Saki in Iran (22) and Alghamdi in Saudi Arabia 0% (16), respectively. The results of the present meta-analysis regarding the prevalence of *E. histolytica* were in agreement with the studies conducted by Babike (13) and Kusolsukt (16).

In this study, the prevalence of infection with *G. lamblia* was 0.033 (CI 95%: 0.022-0.044). This measure was obtained as 9%, 8%, 5.1%, 5%, and 5% in the studies by Zaglool in Saudi Arabia (15), Babike in Sudan (9), Saki in Iran (17), Nuchprayoon in Myanmar (19) and Dash

in United Arab Emirates (20), respectively, which were higher compared to the current study (5.7%, 4.7%, 1.8%, 1.7%, and 1.7%, respectively). In addition, the lowest prevalence rate of *G. lamblia* among the food-handlers was reported by Kusolsukt in Thailand (0.5%) (17). Moreover, the pooled prevalence of *G. lamblia* was consistent with the results of some previous reports (14-16,19). Therefore, the results should be interpreted with caution due to this large variability.

The prevalence rate of parasitic infections in the studies entered into this meta-analysis varied from 0% (*A. lumbricoides*) in the studies by Babiker (13) and Kumi (20) to 18% (*E. histolytica*) in the study by Algamdi (16).

Moreover, the findings indicated that the pooled prevalence of parasitic infections was low. The large variability of the prevalence rates of parasitic infections might result from the difference in environmental and health situations in the countries under study.

Also, diversity in the prevalence rate of parasite infections among the food-handlers reported in the studies performed by Saki in Khuzestan (21), Sayyari in Tehran (27), Nasiri in Karaj (28) was corresponding to the findings of our meta-analysis. The studies conducted on the food-handlers in Saudi Arabia also showed different prevalence rates. Accordingly, the prevalence rate of parasite infections was 41-55 % in Riyadh (29,30) 40% in Jeddah (31), and 46% in Abha (32).

The results obtained regarding the prevalence of all the parasites in this study should be interpreted in the context of some limitations. Primarily, the characteristics of the samples (age, sex, and other demographic variables) were not entered into the final meta-analysis (meta-regression), because meta-regression

could not be performed. In addition, other features and geographical location of the countries could not be assessed in our study, while presumably the geographical location of the countries is associated with the prevalence of parasites (20,33) Hence, this issue should be addressed in future studies.

In spite of these restrictions, large heterogeneities were found in the prevalence of parasites among the food-handlers of Asian and African countries. However, other studies have shown that the geographical location of countries may be involved in these heterogeneities (13,33). In addition, the discrepancies in the factors associated with parasite infections, such as socioeconomic conditions, climatic status, improper environmental sanitation, impoverished health services, risks connected with microbial or parasitic contamination, unhygienic habits in food-handlers, and malnutrition, can be explained by heterogeneities (13,16,21,34).

Conclusion

According to the results of the present meta-analysis, the prevalence rate of some intestinal parasites among the food-handlers was relatively low compared to the previous studies carried out in Asian and African countries. Besides, high heterogeneity was obtained in the prevalence rates reported in these countries. The low burden of intestinal parasites in this research does not detract the public health programs, but suggests implantation of control programs, including regularly screening the individuals in contact with foods, personal hygiene practice, and environmental remediation, in the countries under study. Moreover, health education programs are

recommended to be improved to raise the food-handlers' awareness. Yet, further researches are required to sufficiently describe and analyze the epidemiology of intestinal parasite infections in these countries.

Footnotes

Acknowledgement:

Hereby, the authors would like to thank Ms. A. Keivanshekouh at the Research Improvement Center of Shiraz University of Medical Sciences for improving the use of English in the manuscript.

Conflict of Interest:

The authors declared no conflict of interest.

References

1. Loukopoulos P, Komnenou A, Papadopoulos E, Psychas V. Lethal *Ozolaimus megatyphlon* infection in a green iguana (*Iguana iguana rhinolopa*). *J Zoo Wildl Med.* 2007;38(1):131-4.
2. Noor Azian My, San YM, Gan CC, Yusri MY, Nurulsyamzawaty Y, Zuhaizam AH, et al. Prevalence of intestinal protozoa in an aborigine community in Pahang, Malaysia. *Trop Biomed* 2007;24(1):55-62.
3. Schuster H, Chiodini PL. Parasitic infections of the intestine. *Current opinion in infectious diseases.* *Curr Opin* 2001;14(5):587-91.
5. Nyantekyi L, Legesse M, Medhin G, Animut A, Tadesse K, Macias C, et al. Community awareness of intestinal parasites and the prevalence of infection among community members of rural Abaye Deneba area, Ethiopia. *Asian Pac J Trop Biomed* 2014;4(Suppl 1):S152-7.
6. Zain MM, Naing NN. Sociodemographic characteristics of food handlers and their knowledge, attitude and practice towards food sanitation: A preliminary report. *Southeast Asian J Trop Med Public Health* 2002; 33(2):410-7.

7. Scott E. Food safety and foodborne disease in 21st century homes. *Canada J Infect Dis* 2003;14(5):277-80.
8. Schlipkötter U, Flahault A. Communicable diseases: achievements and challenges for public health. *Public Health Rev* 2010;32:90-119.
9. Newell DG, Koopmans M, Verhoef L, Duizer E, Aidara-Kane A, Sprong H, et al. Food-borne diseases—the challenges of 20 years ago still persist while new ones continue to emerge. *Int J Food Microbiol* 2010;139:Suppl 1:S3-15.
10. Wadl M, Scherer K, Nielsen S, Diedrich S, Ellerbroek L, Frank C, et al. Food-borne norovirus-outbreak at a military base, Germany, 2009. *BMC Infect Dis* 2010;10:30.
11. Birn AE, Solorzano A. Public health policy paradoxes: science and politics in the Rockefeller Foundation's hookworm campaign in Mexico in the 1920s. *Soc Sci Med* 1999;49(9):1197-213.
12. Ortega YR, Sanchez R. Update on *Cyclospora cayentanensis*, a food-borne and waterborne parasite. *Clinic Microb Rev* 2010;23(1):218-34.
13. Danchaivijitr S, Rongrungruang Y, Kachintorn U, Techasathit V, Pakaworavuthi S, Kachintorn K. Prevalence and effectiveness of an education program on intestinal pathogens in food handlers. *J Med Assoc Thai* 2005;88(Supl 10):S31-S5.
14. Babiker M, Ali M, Ahmed E. Frequency of intestinal parasites among food-handlers in Khartoum, Sudan. *East Mediterr Health J* 2009;15(5):1098-104.
15. Wakid D, Azhar E, Zafar TA. Intestinal Parasitic infection among Food Handlers in Holy City Makkah during Hajj Season 1428 Hegira (2007). *Med Sci* 2009;16(1).
16. Abahussain NA. Prevalence of intestinal parasites among expatriate workers in Al-Khobar, Saudi Arabia. *Middle East J Fam Med*. 2005;3:17-21.
17. Al-Ghamdi KS, Maipanich W, Nuamtanong S, Pubampen S, Sa-nguankiat S, Rojekittikhun W, et al. Parasitic and bacterial infestation among food handlers in Jubail, eastern region of Saudi Arabia. *J Fam Commun Med* 1996;3(2):64-70.
18. Kusolsuk T, Maipanich W, Nuamtanong S, Pubampen S, Sa-nguankiat S, Rojekittikhun W, et al. Parasitic and Enteric Bacterial Infections among Food Handlers in Tourist-area Restaurants and Educational-institution Cafeterias, Sai-Yok District, Kanchanaburi Province, Thailand. *J Trop Med Parasitol* 2013;34:49-53.
19. Andargie G, Kassu A, Moges F, Tiruneh M, Huruy K. Prevalence of bacteria and intestinal parasites among food-handlers in Gondar town, northwest Ethiopia. *J Health Popul Nutr* 2008;26(4):451.
20. Zagloul D, Khodari Y, Othman R, Farooq M. Prevalence of intestinal parasites and bacteria among food handlers in a tertiary care hospital. *Niger Med J* 2011;52(4):266.
21. Ayeh Kumi PF, Quarcoo S, Kwakye Nuako G, Kretchy JP, Osafo Kantanka A, Mortu S. Prevalence of intestinal parasitic infections among food vendors in Accra, Ghana. *J Trop Med Parasitol* 2009;32(1):1-8.
22. Saki J, Khademvatan Sh, Masoumi K, Chafghani M. Prevalence of intestinal parasitic infections among food handlers in Khuzestan, Southwest of Iran: A 10 year retrospective study. *Afr J Microbiol Res*. 2012;6(10):2475-80.
23. Dash N, Al-Zarouni M, Anwar K, Panigrahi D. Prevalence of Intestinal Parasitic Infections in Sharjah, United Arab Emirates. *Human Parasit Dis* 2010;2.
24. Nuchprayoon S, Sanprasert V, Kaewzaithim S, Saksirisampant W. Screening for intestinal parasitic infections among Myanmar migrant workers in Thai food industry: A high-risk transmission. *J Immigr Minor Health* 2009;11(2):115-21.
25. Feglo PK, Frimpong EH, Essel-Ahun M. Salmonellae carrier status of food vendors in Kumasi, Ghana. *East Afr Med J* 2004;81(7):358-61.
26. Salih SY, Abdalla RE. Symptomatic giardiasis in Sudanese adults and its treatment with tinidazole. *J Trop Med Hyg* 1977;80(1):11-3.
27. Kasim A, Elhelu M. Giardiasis in Saudi Arabia. *Acta Tropica* 1983;40(2):155-8.
28. Sayyari AA, Imanzadeh F, Bagheri Yazdi SA, Karami H, Yaghoobi M. Prevalence of intestinal parasitic infections in the Islamic Republic of Iran. *East Mediterr Health J* 2005;11(3):377-83.
29. Nasiri V, Esmailnia K, Karim G, Nasir M, Akhavan O. Intestinal parasitic infections among inhabitants of Karaj City, Tehran province, Iran in 2006-2008. *Korea J Parasitol* 2009;47(3):265-8.
30. Abu Al Saud A. Faecal parasites in non-Saudi catering and domestic staff at the Riyadh military hospital. *Saud Med J* 1983.
31. Abdelhafez M, Elkady N, Noah M, Bolbol A, Baknina M. Parasitic infection in Expatriates in Riyadh, Saudi-Arabia. *Ann Sau Med* 1987;7(3):202-6.
32. Al-Fayez S, Khogheer Y. A follow-up study on prevalence of parasitic infections among patients

attending King Abdulaziz University Hospital, Jeddah. Saud Med J 1989;10(3):193-7.

33. al-Madani AA, Mahfouz AA. Prevalence of intestinal parasitic infections among Asian female house keepers in Abha District, Saudi Arabia. Southeast Asian J Trop Med Public Health 1995;26(1):135-7.

34. Stepek G, Buttle DJ, Duce IR, Behnke JM. Human gastrointestinal nematode infections: Are new control methods required? Int Exp Patho J 2006;87(5):325-41.

35. Sures B. Environmental parasitology: relevancy of parasites in monitoring environmental pollution. Trends Parasit J. 2004;20(4):170-7.