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

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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.

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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 anthelminthic 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*, *Entameoba 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, hetrogenity indeces 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.

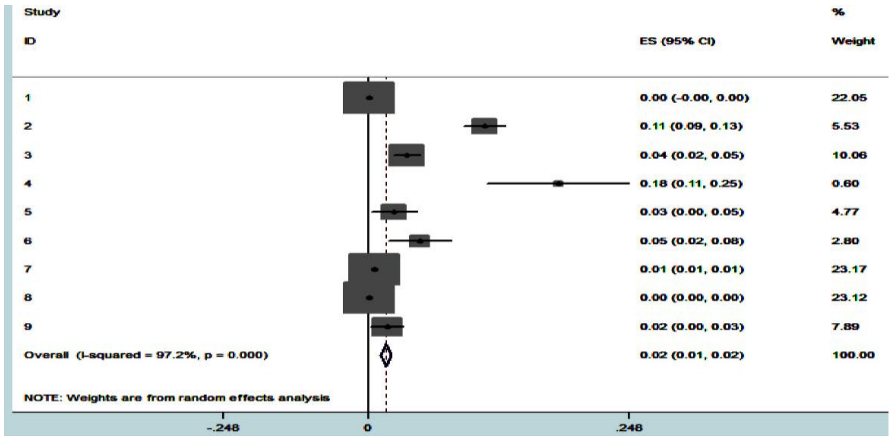

Figure 1) Forest plot for *A. lumbricoides* using random effects meta-analyses. CI indicates confidence interval.

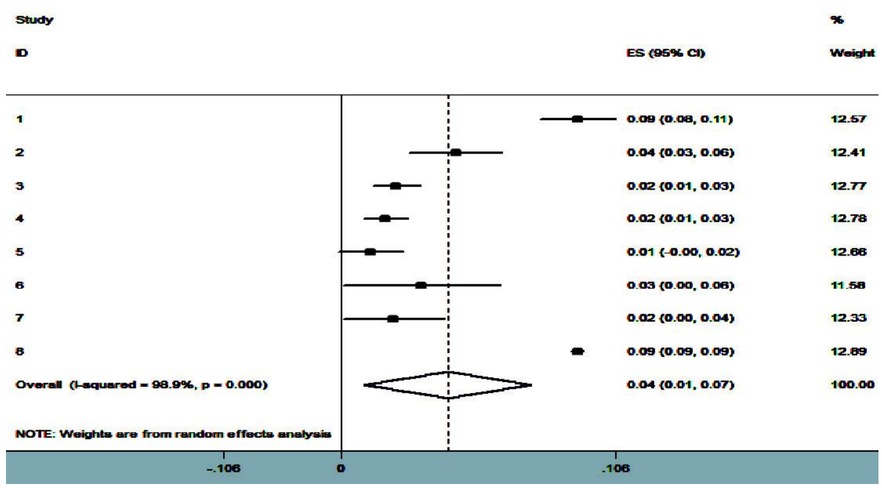

Figure 2) Forest plot for *E. coli* using random effects meta-analyses. CI indicates confidence interval.

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).

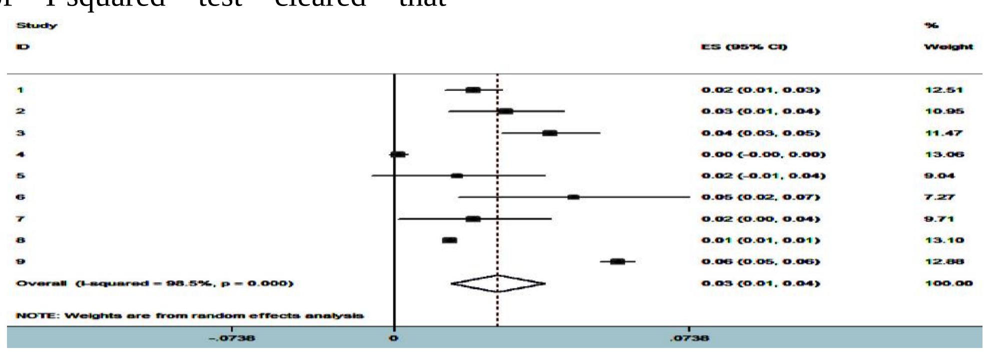

Figure 3) Forest plot for *E. histolytica* using random effects meta-analyses. CI indicates confidence interval.

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).

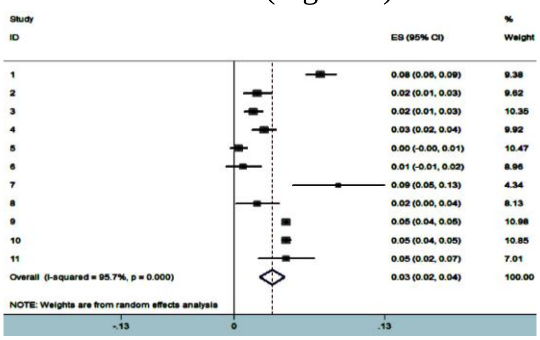

Figure 4) Forest plot for *G. lamblia* using random effects meta-analyses. CI indicates confidence interval

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

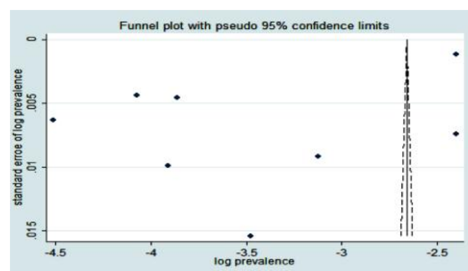

Figure 5) Funnel plot of *A. lumbricoides*

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 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

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Conflict of Interest:

The authors declared no conflict of interest.

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