

Prevalence of intestinal parasites and *Salmonella* and *Shigella* among food handlers at food service establishments in the main campus and Health Sciences College of Hawassa University, Hawassa, Ethiopia

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Abstract

Background: Food borne diseases such as intestinal parasitosis, salmonellosis and shigellosis remain a major public health problem across the globe. The problem is severe in developing countries due to difficulties in securing optimal hygienic food handling practices. Food handlers may be infected by a wide range of enteropathogens and have been implicated in the transmission of many infections to the public in the community and to patients in hospitals.

Objective: To determine the prevalence of Intestinal Parasites and *Salmonella* and *Shigella* among food handlers at food service establishments in main campus and Health Sciences College of Hawassa University, Hawassa, Ethiopia.

Methodology: Cross sectional study was conducted from February to April 2010 at food service establishments in Main Campus and Health Science College of Hawassa University, Hawassa town, Ethiopia. Stool and blood specimens were collected from 272 food handlers coming consecutively. Microscopic examination and culture were performed on stool specimens for isolation of intestinal parasites and *Salmonella spp* and *Shigella spp*, respectively. In addition, all food handlers were screened for *S. typhi* using Widal test. Data entry and analysis was done using computer with SPSS version 15 software.

Results: Of the total 272 food handlers screened for enteric pathogens, 20.6% were found to be positive for different types of intestinal parasites. Among the parasites, *Ascaris lumbricoides* was the most prevalent parasite (9.5%), followed by *Strongyloides stercoralis* (2.2%) and *Entamoeba histolytica /dispar* (2.2%). *Shigella spp.* was detected in one of food handler. No *Salmonella spp* was detected in stool cultures. Twenty-two (8.1%) of food handlers were positive for Widal test.

Conclusion: The findings of high prevalence of enteric pathogens among food handlers in the present study indicate the hygiene practice of the food-handlers working at food service establishments in the study site is very poor. Education and training in good-hygiene practices should be provided to all food-handling personnel which are effective means of preventing the transmission of enteric pathogens from food-handling personnel via food to consumers. [*Ethiop. J. Health Dev.* 2014;28(1):29-34]

Introduction

Food borne diseases remain a major public health problem across the globe. The problem is severe in developing countries due to difficulties in securing optimal hygienic food handling practices. In developing countries, up to 70% of cases of diarrheal disease are associated with the consumption of contaminated food (1).

Transmission of intestinal parasites and enteropathogenic bacteria is effected directly or indirectly through objects contaminated with feces. These include food, water, nails, and fingers, indicating the importance of faecal-oral human-to-human transmission (2). Over 70 species of protozoan and helminthic parasites can infect humans through food and water contamination (3). Approximately 95% of cases of human Salmonellosis are associated with the consumption of contaminated products (4). Annually, there are 165 million cases of shigellosis resulting in 1.1 million deaths in the developing world (5).

The risk of food borne disease is substantially heightened by biological, physical and chemical contamination of areas where food is produced, processed and consumed (6).

The spread of disease via food handlers is a common and persistent problem worldwide (7). Food handlers may be infected by a wide range of enteropathogens and have been implicated in the transmission of many infections to the public in the community and to patients in hospitals (8). One human carrier of disease, preparing food at home will jeopardize the health of only a small number of persons, mainly members of the family. When such person works in the kitchen of a restaurant, hospital, factory, canteen, school, or other places where meals are prepared and supplied to many people, the number of potential victims will correspondingly be greater so that the need for a high standard of food hygiene and adequate control measures is particularly important in catering establishments of all kinds (9).

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The most frequently reported factor associated with the involvement of food handlers was bare hand contact with the food followed by failure to properly wash hands, inadequate cleaning of processing or preparation equipment or utensils, cross-contamination of ready-to-eat foods by contaminated raw ingredients (10).

Published information about food borne pathogens among food handlers is scarce in Ethiopia. Therefore, this study is aimed at assessing the prevalence of Intestinal parasites, *Salmonella*, and *Shigella* among food handlers at food service establishments in Main Campus and Health Sciences College of Hawassa University, Hawassa, Ethiopia.

Methods

Study Design and Area:

Cross sectional study was conducted from February to April 2010 at food service establishments in Main campus and Health Science College of Hawassa University, Hawassa town, Ethiopia.

At the time of the study, Hawassa University enrolled a total of 13,653 students in four campuses; Main campus, Health Science College, Agricultural College and Wondogenet Forestry college. The majority of students (88%) of the university were the in Main campus and Health Science College. Eight food service establishments are found in the Main Campus and Health Science College of Hawassa University including cafeterias' of the Hawassa Referral Hospital.

Study Population:

During the study period a total of 272 food handlers working at food service establishments in the Main Campus and Health Science College of Hawassa University who fulfilled the inclusion criteria were consecutively selected and screened for enteric pathogens. One hundred eighty three food-handlers were from the Main campus, while the remaining food-handlers (n=89) were from the Health Science College.

The sample size (n) was calculated, assuming that the prevalence of *Shigella* in food handlers was 13.3% (8). The expected margin of error (d) was 0.05 and the confidence interval ($Z\alpha/2$) was 95% and a contingency of 10%.

Food-handlers who did not take treatment for any intestinal ailment within the three months prior to the study were included.

Written informed consent was obtained from every study participant. A pre tested structured questionnaire was used for collecting information on age, sex, educational level, hygienic status and also used for collecting laboratory data on microscopy, culture and Widal test results of each food-handler.

Sample Collection and Handling:

Stool

Stool specimens were aseptically obtained from food handlers and put into screw capped containers and transported to Microbiology Laboratory of Hawassa Referral Hospital for microscopic examination and culture.

Blood

Two ml of venous blood was collected from food handlers and serum was separated from venous blood after clotting the blood using plane tube for Widal screening test.

Culture and identification of *Salmonella* and *Shigella* species

A faecal suspension of stool samples from each food handler were prepared by suspending approximately 1g of the stool sample in a tube containing 1 ml of sterile saline. If the stool sample is liquid, saline does not need to be added. Three or more loopfuls of faecal suspension of each foodhandler were inoculated into selenite F broth (Oxoid, UK) and incubated for 24 hours at 37°C followed by subculture a loopful of broth on xylose-lysine-deoxychocolate agar (XLD) (Oxoid, UK) at 37°C for 24 hours for isolation of *Shigella spp* and *Salmonella spp*. The bacteria were identified by their characteristic appearance on their respective media and confirmed by the pattern of biochemical reaction used for identification of enterobacteriaceae as per standard (11).

Direct microscopy technique for stool examination

Direct stool examination at collection sites was carried out using techniques previously described (12). Briefly, two wet preparations of fresh stool from the same foodhandler were made as follows: a drop of fresh normal saline was placed on one end of a microscopic glass slide and a drop of Lugol's iodine on the other end. The proper amount of stool specimen (2 mg) was picked with an applicator stick and emulsified with the normal saline on one end of a glass slide; the same size stool sample was treated in the same way with the Lugol's iodine on the opposite end of the same slide. The two preparations were then covered with glass cover slips (22 mm×22 mm) and examined under an ordinary light microscope for the presence of any parasites.

Formol - ether concentration technique for stool examination

The concentration technique was carried out using procedures previously described (12). Briefly, 0.5 g of fresh stool sample was emulsified in 7 ml of 10% formalin. The resulting suspension was filtered through three layers of wet cotton gauze in a funnel into a centrifuge tube and 3ml of ether was added. The centrifuge tube was corked, shaken vigorously and then centrifuged at 1000 g to 2500 g for 3-5 min. The plug was dislodged with an applicator stick and the supernatant poured off. Two wet preparations were made

out of the deposit after it was slightly shaken, covered using a glass cover slip (22 mm×22 mm) and examined for the presence of parasites as above.

Widal test

Widal test was done using *S. typhi* O and H antigens according to the manufacturer's instruction. In brief, the test was done by mixing one drop of serum with one drop each of O and H antigens separately on glass slide. After rocking the slide back and forth, the mixture was observed for macroscopic agglutination. If there was agglutination within one minute it was reported as positive, otherwise as negative.

Quality control

Reference strain of *E. coli* (ATCC 25922) was used as a quality control for culture. The quality of data collection was ensured through daily on the spot-checking of the questionnaires for errors.

Statistical Analysis:

Data entry and analysis was done using computer with SPSS version 15 software. Prevalence figures were calculated for the total study population and separately by sex and age groups. Chi-square test was used to compare results between the sexes and with the previous findings from the literature. P-values less than 0.05 were considered statistically significant.

Ethical Considerations:

The research project was ethically cleared by the Institutional Review Board (IRB), College of Health Sciences of Addis Ababa University. Official permission from the study site as well as written informed consents from study participants were obtained. Food handlers who were found to be positive for enteric pathogens were referred to Hawassa University Referral Hospital for appropriate antimicrobial treatment and advised on good hygienic practice when handling food.

Results

Socio-demographic Characteristics:

The socio-demographic characteristics of the 272 food handlers are presented in Table 1. Majority of the food-handlers (81.2%) were young adults aged 20-40 years. The number of female food handlers (68.8%) was almost twice compared to the male food handlers (31.2%). One hundred eighty one (66.5%) food handlers had education above elementary school and nineteen (7%) of the food-handlers did not have the habit of hand-washing before touching food. The majority (60.3%) of food handlers had served for 1-5 years. During data collection time no

report of acute gastrointestinal symptom from all food handlers.

Table 1: **Socio-demographic characteristics of the 272 food-handlers, Hawassa University, Hawassa, Ethiopia (February - April 2010)**

Characteristics	Frequency	%
Age(years)		
<20	20	7.4
20-40	221	81.2
>40	31	11.4
Sex		
Male	85	31.2
Female	187	68.8
Educational Status		
Illiterate	14	5.1
Read and Write	11	4.0
1-6 grade	66	24.3
7-10 grade	145	53.3
11-12 grade	26	9.6
>12 grade	10	3.7
Service year		
<1 year	56	20.6
1-5 years	164	60.3
6-10 years	36	13.2
11-20 years	12	4.4
>20 years	4	1.5
Hand washing practice before touching food		
Yes	253	93
No	19	7

Etiologic Agents:

Intestinal parasites

Direct microscopic and concentration techniques were used for identifying intestinal parasites from the 272 stool specimens. Fifty-six (20.6%) stool specimens were positive for different intestinal parasites. *A. lumbricoides* was the most prevalent parasite (9.5%), followed by *S. stercoralis* (2.2%) and *E. histolytica/dispar* (2.2%) and five (1.8%) stool specimens were positive for two parasites each (Table 2.). Frequency of parasitic infection among food handlers by sex, age, educational status, and service year and hand hygiene is presented in Table 3.

Shigella and Salmonella

Out of 272 food-handlers screened, stool cultures yielded only one *Shigella* isolate. No *Salmonella* species was isolated from any of the stool samples obtained from food handlers. Widal test result showed that 22(8.1%) food handlers were positive for O or/and H antigens of *Salmonella typhi*.

Table 2: **Type and prevalence of intestinal parasites isolated from stool specimens of food handlers, Hawassa University, Hawassa, Ethiopia (February – April, 2010)**

Parasites	Frequency	%
<i>Ascaris lumbricoides</i>	26	9.5
<i>Strongyloides stercoralis</i>	6	2.2
<i>Giardia lamblia</i>	3	1.1
<i>Entamoeba histolytica/dispar</i>	6	2.2
Hook worm	4	1.5
<i>Taenia spp.</i>	1	0.4
<i>Schistosoma mansoni</i>	5	1.8
<i>Ascaris lumbricoides</i> and <i>Trichuris trichiura</i>	2	0.7
<i>Ascaris lumbricoides</i> and <i>Strongyloides stercoralis</i>	1	0.4
<i>Ascaris lumbricoides</i> and <i>Taenia spp.</i>	1	0.4
<i>Ascaris lumbricoides</i> and <i>Schistosoma mansoni</i>	1	0.4
No ova or parasite	216	79.4

Table 3: **Frequency of parasitic infection among food handlers by sex, age, educational status, service year and hand hygiene, Hawassa University, Hawassa, Ethiopia (February -April 2010)**

Variable	Number of examined	Number of infected	%
Sex			
Male	85	15	17.6
Female	187	41	21.9
$\chi^2=0.65, df = 1, P=0.419$			
Age(years)			
<20	20	6	30.0
20-40	221	45	20.4
>40	31	5	16.1
$\chi^2=1.47, df = 2, P=0.48$			
Educational status			
Illiterate	14	1	7.1
Read & Write	11	7	63.6
1-6 grade	66	22	33.3
7 -10 grade	145	25	17.2
11-12 grade	26	1	3.8
Above 12	10	0	0
$\chi^2=28.62, df = 5, P=0.000$			
Service year			
< 1year	56	9	16.1
1-5 year	164	40	24.4
6-10 year	36	6	16.7
11-20 year	12	1	8.3
>20 year	4	0	0
$\chi^2=4.63, df = 4, P=0.328$			
Hand washing before touching food			
Yes	253	53	20.9
No	19	3	15.8
$\chi^2=0.29, df = 1, P=0.592$			

Discussion

In this study, 20.6%, 8.1% and 0.4% of the 272 food handlers were positive for intestinal parasites, *Salmonella typhi* and *Shigella*, respectively. These indicate the hygiene practice of the food-handlers working at food service establishments in the study site is poor.

The high 20.6% prevalence of intestinal parasites in the stools of the food-handlers in this study was in agreement with the findings of other studies conducted elsewhere e.g. in Accra, Ghana (21.6%) (3), Irbid, Jordan (18.1%) (13), Jeddah, Saudi Arabia (13.5%) (14), Aydin, Turkey

(29.31%) (15), Gondar, Northwest Ethiopia (29.1%) (2), Khartoum, Sudan (30.5%) (16) and Egypt (19%) (17). Studies in different part of the world also showed higher and lower prevalence of intestinal parasites in the stools of food handlers compared to the present study. Higher prevalence of intestinal parasites were reported in Hawassa, Ethiopia (63%) (18), Abeokuta, Nigeria (97%) (19), Uberlândia, Brazil (47.1%) (20) and Sanliurfa, Southeastern Anatolia (52.2%) (21).

Lower prevalence were reported in Omdurman, Sudan (6.9%) (22), Manisa, Turkey (8.8%) (23). High
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prevalence of intestinal parasites is largely due to poor personal hygiene practices and environmental sanitation and ignorance of health-promotion practices.

Among intestinal parasites, *A. lumbricoides* was the most common parasites isolated alone or in combination with other parasites (11.4%) from food handlers. Similar finding has been reported in previous study conducted in Ethiopia (18.11%) (2).

Another study conducted in Irbid, Jordan, *A. lumbricoides* was the leading intestinal parasite detected in stool samples of food handlers (4.9%) (13).

In the present study only one *Shigella* spp. (0.4%) was isolated from stool culture of food handlers. Low prevalence of *Shigella* spp. in food handlers was also reported in some studies e.g. in Irbid, Jordan (1.4%) (13), Omdurman, Sudan (1.3%) (22) and Ethiopia (3.1%) (2). In other studies, no *shigella* was recovered from stool specimens of food handlers' (21, 24). However, *Shigella* was the most common bacteria isolated among food handlers in a tertiary care Hospital of North India (13.3%) (8).

In this study, no *salmonella* spp. was recovered from stool culture of all food handlers, even though 8.1% of them were positive for Widal test. Similar finding has been reported in previous study conducted in Ethiopia (2), North India (24), Southeastern Anatolia (21). Studies done elsewhere showed the prevalence of salmonellosis among food handlers ranges from 0.032-11% (22, 25, 26, 27).

No statistically significant association was found between the frequency of parasite infection and age, sex, service year and hand washing before touching food. Similarly, finding in Khartoum, Sudan showed that no statistical significant association was observed particularly parasitic infection comparable for age, sex and service year (16). The present study showed an equal distribution of parasitic infection among all ages, both sexes and among all service years of food handlers.

The prevalence of parasite infections among illiterate (7.1%) food handlers was lower than the prevalence of parasite infections among food handlers grouped under read and write (63.6%), 1-6 grade (33.3%) and 7-10 grade (17.2%). This may be due to low sample size in each categories of educational status.

Limitations of the study were the use of Widal test that gave high positive finding that might be due to the false positivity, the use of small sample size and factors associated with the farmable environmental or facility conditions were not addressed.

In conclusion, one of the most common complaints recorded in the student clinics of the Main Campus and

the Health Science College was gastrointestinal problem. The high prevalence of intestinal parasites among food handlers in the present study indicates the poor hygiene practice of the food-handlers working at food service establishments in the study site. Such infected food handlers can contaminate food and drinks and serve as source of infection to students or other consumers via food chain. It is recommended that the Administration of Hawassa University should implement interventions such as food handler's training on food safety, institute periodic focused medical checkup for food handlers and regular deworming. Hygienic practices of food handlers are very important not only at work place but also at home. A large scale study using different standard laboratory methods and risk factors is highly recommended.

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