EPH - International Journal Of Medical And Health Science
ISSN (Online): 2456-6063
Volume 05 Issue 01 January 2019

DOI: https://doi.org/10.53555/eijmhs.v5i1.60

INFECTION OF COMMON PROTOZOAN AND HELMINTHES PARASITES IN THE INTESTINE, UNDER FINGER NAIL'S CONTENT AND ASSOCIATED PREDISPOSING FACTORS AMONG THE ASYMPTOMATIC FOOD HANDLERS WORKING IN THE STUDENT CAFETERIA OF DILLA UNIVERSITY

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Abstract
Background: *Infection of food borne diseases is a public health problem in developed and developing countries. Ingestion of infective eggs and cysts of faeco- orally transmissible parasites has been linked with the level of knowledge of infection cycle, environmental and personal hygiene. Asymptomatic food- handlers with poor personal hygiene working in the food cafeteria could be potential sources of infection and these individuals need continuous investigation of parasitic infection.*
Objectives: *This study was aimed at investigating the prevalence of common protozoan and helminthes parasitic infections and associated predisposing factors among the asymptomatic food handlers working in the student cafeteria of Dilla University.*
Methods: *A total of 153 asymptomatic food handlers were involved in the study and specimens of the stool and under fingernail's content were examined using the standard parasite and ova method. The specimen collected from under fingernail's content and stool specimens were detected by direct microscopy using saline and iodine wet mount preparation to demonstrate the presence of eggs, and protozoan cysts. Species of parasites were morphologically identified based on their microscopic characteristics and the analysis of the data was made manually using the thematic framework method.*
Results: *From the total of 153 study participants, 60 (39.2%) of the asymptomatic food handlers were found to have either single or double infections due to Ascaris lumbricoides egg, Tsrichuris trichiura egg, Entoamoeba histolytica/dispar cyst, Giardia lamblia cyst, Taenia species egg and Schistosoma mansoni egg. Of the total 60 (39.2%) positive cases, 58 (96.7%) positive cases were identified from the stool specimen and 2(3.3%) positive cases were from the specimen collected from the under fingernail's content. Moreover, of the total 60 infected asymptomatic food handlers, 46(76.7%) had single infection and 14(23.3%) with double infections. Double infection was due to parasites including A.lubricoides with T. trichiura 5(8.3%), A. lumbriodes with T.species 3(5%), A.lubricoides with E.histolytica/dispar cyst 5(8.3%), and E.histolytica/dispar cyst with T.species 1(1.7%). This result also showed knowledge deficiency of food handlers on associated predisposing factors related to infectious cycle working in student cafeteria.*
Concluding Remarks and Recommendation: *The present study indicated a high prevalence of intestinal parasites in asymptomatic (apparently health) food handlers and such infected food handlers of any food service establishment could serve as potential source of infection to consumers via infectious cycles. Therefore, we need to develop a culture of awareness creation on personal hygiene, environmental sanitation, and food and water safety, mode of parasitic infection and frequent screening of food-handlers to monitor parasitic infections. Moreover, parasitic detection also could be cheaply done using direct microscopy of stool examination.*

KeyWords: *Food cafeteria, Food handlers, Infection, Parasites, Prevalence, Specimen.*

INTRODUCTION
1.1 Background and Justification

Most parasitic infections are found in underdeveloped, tropical and subtropical countries, due to the habits and customs of poor sanitary conditions, contaminated food and water sources, inadequate vector control, and toilet facilities, poor public health practices, and unhygienic personal behavior, and these factors work together and enhance the parasitic transmission (1-3). There are more than 250 different food borne diseases in the world wide. Most of these diseases are infectious, caused by a variety of bacteria, viruses, and parasites. Other food borne diseases can be poisonings, caused by harmful toxins or chemicals like poisonous mushrooms and enterotoxins of some bacteria (4). The World health organization estimates that in developed countries, up to 30% of the population suffers from food borne diseases each year, whereas in developing countries up to 2 million deaths are estimated per year (5,6). Studies have also shown that asymptomatic food- handlers with poor personal hygiene working in the food service establishments could be potential sources of infection due to pathogenic organisms (7). Ingestion of infective eggs and cysts of faeco- orally transmissible parasites has been linked with the level of environmental and personal hygiene and hence transmission of intestinal parasites and enteropathogenic bacteria is possible directly or indirectly through objects contaminated with faeces. These objects include food, water, air and fingernail's content indicating the importance of faecal-oral to human-to-human transmission (8). Accordingly, food-handlers with poor personal hygiene working in foodservice establishments could be potential sources of infections of many intestinal helminthes, protozoa, and enteropathogenic bacteria (9,10),because food handlers are usually asymptomatic carriers of any parasitic infection and act as continuous source of infection(35, 11). Food contamination may occur at any point during production, processing, distribution, and preparation and hence the risk of food getting contaminated depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene (12). Moreover, food handlers who harbor and excrete intestinal parasites may contaminate foods from their faeces via their fingers, then to food processing, and finally to healthy individuals (10). Compared to other parts of the hand, the area beneath fingernails, harbors, the most microorganisms and is most difficult to clean (Lin *et al*.2003 cited in 7).Furthermore, reports also show, the presence of ova, larvae and cysts of intestinal parasites under fingernail's content of the study participants (13,14). The spread of disease via food handlers is a common and persistent problem worldwide (15,16). The centers for disease control and prevention have stated that associated predisposing factors of infection such as poor personal hygiene and environmental sanitation are commonly reported factors contributing to food-borne diseases (17) and it is estimated that 3.5 billion people are affected and 450 million people are ill as a result of intestinal parasites and protozoan infections (12). According to the Centers for Disease Control, foodborne diseases cause an estimated 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths in the U.S. each year. The cost of the most common food borne illnesses in the United States is estimated at $6.5–$34.9 billion annually (4).Furthermore,the World Health Organization estimates 30% of the population suffers from the foodborne diseases in developing countries, and two million deaths occur each year (18). The problem is more severe in developing countries because of lack of resources for environmental sanitation and personal hygienic practices (19). In developing countries, 70% of cases of diarrhea are associated with the consumption of contaminated food (20). Studies also indicate, numerous outbreaks of gastroenteritis have been associated with ingestion and consumption of raw foods, foods incorporating raw ingredients or foods obtained from unsafe sources (20, 21). The number of studies also indicate giardia- related water and food borne outbreaks including, waterborne giardiasis were observed among travellers in Eastern Europe and the former Soviet Union. Food borne giardiasis related to food preparation, probably caused by infected food handlers with *G. lamblia* or contact of food handlers with infected people, particularly children and raw sliced vegetables in the employee cafeteria, were probable the cause of the outbreak (22,23).Moreover, A study conducted in Malaysia also showed that approximately 10-20% of food-borne disease outbreaks are due to contamination by the food handlers (15).Therefore, parasitic infections in asymptomatic food-handlers, often, may pose a real threat to those who are more susceptible to infection, and this threat needs greater attention. Prevalence of intestinal parasitic infection has been widespread and causes serious public health problem in Africa including Ethiopia. In Ethiopia, many reports illustrate that *A. lumbricoides* is the most prevalent intestinal parasite in different communities usually occurring together with *Trichuris trichiura* infection (24). Hookworm infection, *Strongyloides stercoralis* and enterobiasis are also public health problem, though; the magnitude is less compared to ascariasis. The prevalence of taeniasis alone accounts 1-48% and the infection rate with Hymenolepis nana is 3-61% (25). Schistoeomiasis is very common in northern region of Ethiopia as compared to south and south west region of Ethiopia (Lo. *et al*., 1988, cited in 26). Amoebiasis and giardiasis are common causes of protozoan infection throughout the nation. The prevalence of amoebiasis ranges from 0-4% that of girdiasis is 323% (25). Moreover, among sub-Saharan African countries, Ethiopia has the second- and the third-highest burden of *Ascaris lumbricoides* and hookworm, respectively (27, 28). Studies also indicate in different parts of Ethiopia, reports show 29%–49.4% of food handlers working in various food establishments had intestinal parasites (29) indicating the need to intervene in fighting against the infection of intestinal parasites targeting the food handlers. In general, morbidity associated with acute intestinal parasitic infections, urinary schistosomiasis, and the burden of chronic infections may affect physical fitness, cognitive performance, malnutrition causing stunted growth, and defective school attendance of school aged children.(30). Therefore, we need an integrated and wide spectrum scaled research work and diagnosis of parasites in public at large and food handlers in particular to mitigate parasitic infection. Therefore, this study was aimed at to assess the prevalence of intestinal parasitic infection in asymptomatic food-handlers working in the student cafeterias of Dilla University (Ethiopia).

3.1 Study design

This experimental design including cross sectional study was done in the dietary section of Dilla University where 170 food handlers were involved in preparation and distribution of food to students. The cafeteria food handlers were selected for the study because mass provisions of food was expected to be probably a potential source of transmitting parasitic infections to the consumers/students/. The parasitological techniques involving examination was conducted at the Zoology laboratory of the University. All the permanent administrative workers of food handlers were screened by the cafeteria coordinating unit for the parasitological examination. Parasitological examination was conducted starting from May 2016 to June 2016 over a period of two months. All of the investigation of parasitic infections, all data analysis and interpretations was done by the investigator himself.

3.1.1 Study participants and techniques of sampling.

The technique of sampling was purposive type and therefore all food handlers (n=170) who work in the student cafeteria were involved in the study for parasitological stool test and under fingernail's content (=for checking of the intestinal parasitic infections and under fingernail's content test for parasites).Techniques of sampling of the study participants included eligibility criteria having both exclusion and inclusion criteria i.e. Inclusion **criterion** includes:

☞ All the food handlers working (= permanent workers) in the student cafeteria of the university (main campus, Odaya campus and Referal Hospital). **Exclusion** criterion includes: food handlers who:

[1]. were absent from their duties due to illness

[2]. took treatment/antiparastic drug for any intestinal parasitic infection within the three months prior to the study

[3]. Showed clinical symptoms such as diarrhea, abdominal discomforts etc. were intentionally excluded from the data collection.

3.1.2. Specimen Collection, and Diagnosis of parasites

After completing, structured questionnaire that included socio demographic data including age sex, level of education, marriage status and infection associated with predisposing factors were considered to collect information from all selected food handlers (**Fig.1**).

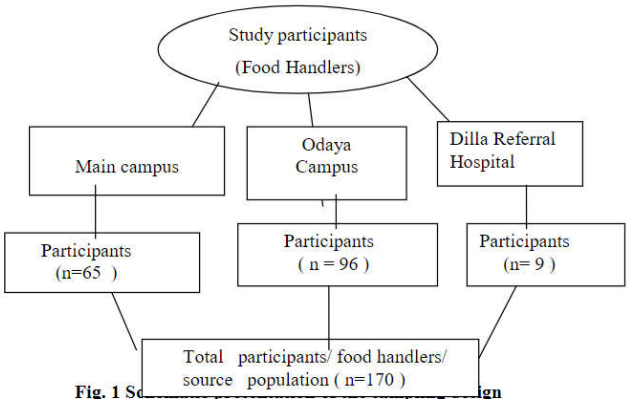

Fig. 1 Schematic presentation of the sampling design

All the participants provided the non-living content beneath/under fingernails. Fingernail's contents were collected using sterile thin cotton swab and collected on a clean slide having a drop of physiological saline (0.85% NaCl). Stool samples, were collected/ obtained in a clean, sterile, plastic container/cup with a top cover. Each container was labeled with participant name and date of collection. The specimen collected from under fingernail's content and stool specimens were detected by direct microscopy using physiological saline and iodine wet mount preparation to demonstrate the presence of eggs, and protozoan cysts. Species of parasites were morphologically identified based on their microscopic characteristics. Moreover, double normal physiological saline wet mount smear or direct microscopy (stained and unstained) for each specimen were employed for the stool and under fingernail's content examination in order to minimize the error of false negatives. Furthermore, wet mount smear/direct fecal smear (DFS) and fingernail's content were so thin enough that newspaper print can be read through the smear of a slide, which is the best smear for specimen examination (53). The smear was then examined under the microscope using 4× objective lens to select the area to be scanned(field of vision), followed by 10x, ,40x objective lenses to locate any parasitic objects as required (Fig.2).

Fig.2 Diagnosis of parasites: Specimen collection, processing and identification

3.1.3. Data analysis

Descriptive statistics including Tables and proportions were used to give a clear picture of background characteristics such as age, sex, educational background, marriage status infection cycle, associated predisposing factors of infection and the distribution of the parasites among the food handlers and data analysis was done manually using both quantitative and qualitative research methods involving thematic framework method.

3.1.4 Ethical consideration.

Prior to research conduction, ethical approval was obtained from the Dilla University Research and Dissemination Office (RDO). Moreover, verbal consent was also obtained from each food handlers before recruiting them and examination of parasitic infections. All the food handlers were given an overview, concerning the objectives of the study, and only those who agreed to participate were included in the study. Besides, explanation was given about the procedure of examination that it would be noninvasive and has no harm to the study participants and the aim of the study result may benefit the study participants as well as the community. All the food handlers, who were found positive for any of the suspected parasitic infection, were given antiphrastic drugs as per the prescription of the physician, and were told to report if they encounter any side effects.

4.1 Results

4.1.1 Background information of the respondents

The total number of asymptomatic food handlers who were expected to be included in the study was 170. However, due to an avoidable reasons (e.g. annual work leave, clinical cases, and incomplete responses), 17 participants were not included in the data collection. Therefore, a total of 153 asymptomatic food handlers were included in the study. Majority of the food handlers 116(75.8%) were females and the rest 37(24.2%) were males. The majority of food handlers 90(58.8%) were in the age group of 15-26 and the background information of the participants was shown in **Table 1**

Table 1.Socio-demographic characteristics of food handlers working in Dilla University student's cafeteria from May 2016 to June 2016

No.	Characteristics	Frequency	%
1	Sex		
	Male	37	24.2
	Female	116	75.8
	Total	153	100
2	Age (years)		
	15-20	50	32.7
	21-26	40	26
	27-32	32	20.9
	33-38	21	13.7
	39 and above	10	6.5
3	Marital Status		
	Married	94	61.4
	Unmarried	59	38.6
4	Educational background		
	Grade Level: Illiterate	-	-
	1-6	21	13.7
	7-8	45	29.4
	9-12	76	49.7
	Above 12	11	7

In **Table 1**, The study result also indicated that food handlers having a total of 50 (32.7%) were in the age group of 15-20,40 (26%) in the age group 21-26, 32 (20.9%) in the age group 27-32,21(13.7%) in the age group 33-38 and 10 (6.5 %) in the age group 39 and above. Moreover, nearly half of the study participants 76 (50.7%) were secondary school level and 11 (7%) of the participants were above grade 12

4.1.2 Parasitic infection among the asymptomatic food handlers

From the total of 153 study participants, 60 (39.2%) of the asymptomatic food handlers were found to have either single or double parasitic infections (**Table 3**) whilst 93(60.8%) were found to be free of the suspected parasites. Of the total 60 (39.2%) positive cases, 58 (96.7) positive cases were from the stool specimen and 2(3.3%) positive cases were from the specimen collected from the under fingernail's content. The result indicated different types of intestinal parasites including protozoan and helminthes from the stool sample and fingernail content and the result was shown in **Table 2.**

Table 2. Parasitic infection among the asymptomatic food handlers (n=60) of the student's cafeteria of Dilla University, May to June 2016

	Specimen collection	Types of Parasites	Frequency	%
1	Stool specimen	*Ascaris lumbricoides* egg	39	52.7
		Tsrichuris trichiura egg	6	8.1
		Entoamoeba histolytica/dispar cyst	18	24.3
		Giardia lamblia cyst	2	2.7
		Taenia species egg	6	8.1
		Schistosoma mansoni egg	1	1.4
2	Specimen from under fingernail's content	*Ascaris lumbricoides* egg	1	1.4
		Entoamoeba histolytica/dispar cyst	1	1.4
		Total parasite load of infection	74	100

4.1.3 Parasitic Load of infection

Parasitic Load of infection of the individual asymptomatic food handlers was determined and the results of single and double infection was shown in **Table 3**

Table 3. **Parasitic Load of individual parasitic infection among the asymptomatic food handlers (n=60) in Student cafeteria of Dilla University, May to June, 2016**

Magnitude of infection	Protozoan and Helminthes parasites	Number of Food handlers infected with parasitic load	Percent (%)
Single infection	*Ascaris lumbricoides* egg	27	45
	E.histolytica/dispar cyst	13	21.7
	Taenia species	2	3.3
	Trichuris trichiura egg	1	1.7
	Schitosoma mansoni egg	1	1.7
	Giardia lamblia cyst	2	3.3
	Total number of food asymptomatic handlers with single infection	46	76.7
Double Infection	*A.lumbricoides* and *T. trichiura*	5	8.3
	A. lumbricoides and *T.*species	3	5
	A.lumbricoides and *E.histolytica/dispar* cyst	5	8.3
	E.histlytica/dispar and *T.*species	1	1.7
	Total number of asymptomatic food handlers with double infection	14	23.3
	Total number of food handlers infected	60	100

In **Table 3**, the result showed cysts and eggs of protozoan and helminthic parasites involving single and double infections. Of the total 60 infected asymptomatic food handlers, 46(76.7%) asymptomatic food handlers had single infection and 14(23.3) with double infections. Double infection was due to parasites including *A.lubricoides* with *T. trichiura* 5(8.3),*A. lumbriodes* with *T.*species 3(5%), *A.lubricoides with E.histolytica/dispar* cyst 5(8.3), and *E.histolytica/dispar* cyst with *T.*species 1(1.7%). In Table 2, and 3, both stool specimen and under fingernail content of the asymptomatic food handlers, showed different intestinal parasites including protozoa and helminthes parasites. The parasitic load of infection accounts a total of 74 (both single and double infections) individual parasites that infected asymptomatic food handlers. When the total load of individual parasitic infection was taken into account, *A.lumbricoides was 40*(54%), followed by *E.histolytica/dispar* 19(25.7%),*T.*species 6(8.1%),*T.trichiura* 6(8.1%),*G. lamblia* 2(2.7%) *and S. mansoni* 1(1.4%).

4.1.4 Responses of the participants on the predisposing factors

Information on the responses of the participants on the associated predisposing factors of the parasitic infection was collected and the data were indicated on **Table 4**

Table .Response rates of the participants on the habits/skills related to associated factors to the parasitic infection, May 2016 to June 2016

No.	Factors Related to infection cycle	Frequency	Percentage (%)
1	Do you properly practice hand washing		
	Habits/ skills using water and soap?		
	a)I seldom practice it	37	24.2
	b)I always practice it	114	74.5
	c) I never practice it	2	1.3
	Total	153	100
2	If your answer for the question number 1 is 'b', among the following four hand washing skills, which one do you practice? Hand washing skills:		
	a) After defecation	21	13.7
	b) After handling baby's faeces	1	0.7
	c) Before feeding	27	17.6
	d) Before preparing food and distributing food to the customers	19	12.4
	e) All of the above	84	54.9
	f) I never practice them	1	0.7
	Total	153	100
3	When do you think food pollution/contamination would occur?		
	a) At any time and any place	22	14.4
	b) During food preparation	48	31.4
	c) During the food distribution to the customer(s)	13	8.5
	d) All are possible answers	70	45.5
	Total	153	100
4	Maintaining personal, food and water hygiene can prevent food pollution and infection from the infection cycle		
	c)True	115	75.2
	b) False	38	24.8
	Total	153	100

In **Table 4**, responses of the food handlers on the Preventive habits/skills related to parasitic infection showed mixed responses i.e. 114.5(74.5%) participants always practice hand washing using water and soap, whilst 37(24.2%) practice it seldom, and 1(1.3%),never practice it. On the other hand, 84(54.9%) of the respondents practice all four of the hand washing skills, but 21(13.7%) practice it after defecation, 27(17.6%), practice it before feeding, 19(12.4) before preparing food and distributing it to the customers and 1(0.7%) of the respondents never practice all of the hand washing skills. Furthermore, the respondents also reflected their habits/skills on the time when the food gets polluted. Accordingly, 70(45.5%) of the respondents reflected pollution of food would occur at any time, and any place, during food preparation, and food distribution to the customer, while,22(14.4%),said food gets polluted at any time, any place,48(31.4%),during food preparation and 13(8.5%),during food distribution to the customer. Moreover, 115(75.2%) of the respondents agreed, ''maintaining personal, food and water hygiene'' can prevent food pollution and infection cycle, but 38(24.8%) of the respondents did not agree with this fact.

4.2 Discussion

Studies show infection of healthy carriers (asymptomatic persons), especially workers dealing with food (food handlers), could become a potential cause of dissemination of variety of pathogens including intestinal parasites. The present study results indicated, of the total 153 study participants, 60 (39.2%) of the asymptomatic food handlers were found to have either single or double infections. This result indicated higher prevalence rate compared to similar studies done in North West Ethiopia, Gondar town with the prevalence of 29% (7), in Sudan, 29.4%, (54) and in Wolyta, 33.68% (11).However, compared to this study, higher prevalence of intestinal parasites were reported in Ethiopia from Hawassa, 63%, (55),and from Mekele University 49.4%,(56),from Nigeria 97%, (57).Furthermore, this finding was relatively in line with the studies conducted in Jimma, 44.1%(58), in Addis Ababa University, 45.3 % (59). In comparison with this study**,** similar study conducted on under fingernail content of food handlers working in the student cafeteria in Jima shows higher prevalence 11(10.9%) of intestinal parasites(60).In this study, the intestinal parasites observed from the fingernail content were *A.lumbricoides* egg 1(1.7%) and *E. histolytica/dispar* cyst 1(1.7%). Furthermore, in comparison with this study**,** similar studies also show the presence of ova, larva and cysts of intestinal parasites under fingernail content of the study participants (61,60).However, another similar studies conducted in Gonder Town, Northwest Ethiopia and Alnoor

Specialist Hospital, Makkah, Saudi Arabia also show, no intestinal parasites were detected from the under fingernails contents and this was may be due to the limitation of the study (7, 34),practices of personal hygiene and environmental sanitation**.** Though the present findings of parasites from the under fingernail content showed the lowest prevalence of parasites 2((3.3%) compared to 58 (96.7%) from the stool specimen of the asymptomatic food handlers, and other similar study of the fingernail content which shows 11 (10.9%), these finding specifically magnified the fact that the asymptomatic food handlers can be potential sources of parasitic infections and fingernail content may contaminate foods and finally the healthy individuals via consumption (10).Moreover, studies show, food contamination may occurs at any point during production, processing, preparation, distribution, and the risk of food getting contaminated depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene (64) which emphasize greater attention to personal, food and water hygiene. In the present study, when the total load of the parasitic infection was taken into account, *A. lumbricoides* egg was the dominant parasite 40(54%), followed by *E.histolytica/dispar* cyst 19(25.7%),which again followed by *T.*species egg 6 (8.1%) , *T.trichiura* 6(8.1%) , *G.lamblia* cyst 2(2.7%) and *S.mansoni* egg 1(1.4%) showed the frequency of parasitic distribution. On the other hand, other similar study shows the prevalence of *A. lumbricoides* (50%), which is in line with this study while *E. histolytica* (42.86%) and *G. lamblia* (21.43%) with higher prevalence rate while *Taenia* species (7.14%) (62) Which agreed with this study. Moreover, another similar study also shows the lower prevalence of *A.lumbricoides* 18(6.25%) in Walyta Sodo(11) and lower prevance of *A. lumbricoides* (5.3%) followed by *E. histolytica* (1.5%), *Giardia lamblia*(1.5%),*T. Trichura* (0.8%) in India (12). Studies have also shown that positive fecal samples often involve more than one infection of pathogens (63). In line with this study, this result also showed mixed/double infections of intestinal parasites with the prevalence rate of 14 (23.3%) ,which is higher compared to similar study conducted on food handlers in Wolyta Sodo with the prevalence rate of 12(12.4%) with mixed intestinal parasitic infection(11) and 4.1% mixed infections in India (12). These findings emphasized the importance of food handlers as potential sources of infections and showed health institutions and food service establishments should take appropriate hygienic and sanitary control measures.Studies also show the incidence of parasitic infection and discrepancy rates may be largely due to environmental distribution differences of parasites, poor personal hygiene practices, environmental sanitation and ignorance of health-promotion practices in the previous studies (7, 59, 11) and current studies needs greater attention including appropriate personal hygienic and sanitary control measures. Moreover, responses of the food handlers on the associated predisposing factors related to parasitic infection showed mixed responses on a personal hygiene including hand washing skills and practical knowledge on when the food gets polluted. This result showed knowledge deficiency on preventive habits/skills of the food-handlers working in student cafeteria which is not in agreement with the study result that food contamination may occur at any point during production, processing, distribution, and preparation and the risk of food getting contaminated depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene (64).Furthermore, Studies also shows, personal hygiene status was significantly associated with presence of intestinal parasites and highest prevalence of intestinal parasites were present in food handlers with poor score on personal hygiene (12),which needs attention and integrated interventions on this field of study.

Concluding Remarks and Recommendation:

a) **Concluding Remarks: -** The present study indicated a high prevalence of intestinal parasites in asymptomatic (apparently health) food handlers 60(39.2%), working in the student cafeteria. Such infected food handlers can contaminate food, drinks, soil contaminated by faces containing the cysts and eggs (65) and could serve as source of infection to consumers via food chain (infectious cycles). Therefore, we need to develop a culture of awareness creation on personal hygiene, environmental sanitation, and food and water safety, mode of parasitic infection and frequent screening of food-handlers to monitor parasitic infections. Parasitic detection could be done easily and cheaply by using direct microscopy of stool samples, which is sufficient to screen a high proportion of infestations *(*54*).*

b) Recommendations

[1]. Awareness creation training on personal hygiene, environmental sanitation, and food and water safety should be given to all food handlers (kitchen staffs).

[2]. All food handlers should follow and practice hand washing skills using water and soaps.

[3]. Finger nail status (nonliving part) should be always checked and regularly trimmed completely.

[4]. Gloves, caps and gowns should be worn by all food handlers during food preparation, and distribution.

[5]. Universities and other food service providing individuals or organizations/institutions should develop a culture of employing individuals having a qualification of food sciences.

[6]. Screening food handlers to detect intestinal parasitic infection should be undertaken at least two times in a year to control parasitic infection.

Acknowledgements:

I would like to thank Dilla University, for facilitating ground to a research work, and financing the research activity. I am also grateful to graduate assistants Mr Beyisa Benti and Mr Kuma Diribsa for their collaborative practical assistance, in specimen collection, and all other individuals who contributed their share to the success of this study.

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