Prevalence and factors associated with intestinal parasites among food handlers in Medebay Zana District, North West Tigray, Northern Ethiopia.

Kebrom Regassa
Mekelle University

Kiros Tedla
Mekelle University

Gessessew Bugssa
Mekelle University

Gebretsadkan Gebrekirstos
Aksum University

Hailay Gebreyesus
Aksum University

Mebrahtu Shfare (mebrie1216@gmail.com)
Aksum University https://orcid.org/0000-0003-0732-7949

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Abstract

Introduction: Several epidemiological studies suggest that the prevalence of intestinal parasites is high, especially in developing countries, and are amongst the major public health challenges facing Sub-Saharan Africa. The aim of the study was to determine the prevalence of intestinal parasites and its associated factors among food handlers in Medebay Zana District, Tigray, Ethiopia.

Methods: A cross-sectional study was conducted among 401 food handler individuals selected by systematic random sampling. Binary and multivariable logistic regression was used to determine the possible association between the independent variable and outcome variables. Statistical significance was declared at p-value <0.05 with a 95% confidence interval.

Result: The prevalence of intestinal parasites was 33.2% within this sample. The dominant parasite was *Entamoeba coli* 50(37.4%), followed by *Entamoeba histolytica/dispar* 24(18%), *Entamoeba hartmanni* 18(13.5), *Giardia lamblia* 17(12.8%), *Schistosoma mansoni* 8(6%), *Hymenolepis nana* 7(5.3%), *Enteriousvermicularies* 6(4.5%) and *Taenia* species 3(2.5%).

Conclusion: This study revealed a high prevalence of intestinal parasites among food handlers for a range of intestinal parasites. The significant predictors were the source of water, washing hands before food preparation, washing hands with soap and water after visiting the toilet, shower installation at workplace, washing the body regularly, and eating raw vegetables and raw meat. Hence, local health planners should implement appropriate interventional measures for the novel risk factors to mitigate the problem.

Introduction

Infection with intestinal parasites remains a major public health challenge in developing countries where poor environmental sanitation, poor personal hygiene, and a low level of education are prominent [1]. Globally, about one-third of the total population is estimated to be infected with intestinal parasites, the majority being people living in tropical and sub-tropical parts of the world [2]. The World Health Organization (WHO) estimated that at least one-quarter of the world's population is infected with soil-transmitted helminths [3]. Worldwide, about 300 million people suffer from severe helminthic infections, leading to morbidity and over 150,000 deaths annually [4]. The reasons for the incidence of parasites include climatic conditions, local traditions, and the use of human and animal fertilizers in agriculture and vegetable planting [5]. Food sold in markets may be contaminated by hands that have not been washed after defecation or from carriers that land on both food and feces, thereby increasing the risk of transmission of intestinal parasites to consumers [6].

Regarding the etiologies, *Ascaris lumbricoides*, *Trichuris trichiura*, hookworm, *Entamoeba histolytica*, and *Giardia lamblia* were the common causes [7]. As in many developing countries, cases of intestinal

parasites are highly abundant in Ethiopia. The country has the second-highest burden of *Ascariasis*, the third highest burden of hookworm, and the fourth highest burden of *Trichuriasis*in Sub-Saharan Africa [8].

Industrialization and urbanization have promoted people to migrate from rural to urban areas, forcing them to have their meals at any place at an affordable price. In urban areas, there is mushrooming of eating establishments due to increased demand with the concomitant potential to spread of disease via food handlers [9].

The epidemiology of intestinal parasites remains complex because of the diversity of associated factors involved, with the complexities of control highly relevant to addressing this escalating challenge [10]. In Ethiopia, particularly in the study area, intestinal parasitosis is a steadily increasing public health concern [11, 12]. On the other hand, the study area is not researched and there is a paucity of scientific information in the region at large. Therefore, this cross-sectional study was conducted to assess the prevalence and associated factors of intestinal parasites among food handlers in Medebay Zana district Towns, Tigray, Ethiopia which can be an input for timely interventional measures on the actual risk factors.

Methods And Materials

Study area, design and period

This cross-sectional, community-based study was conducted among food handlers working in food service establishments in Medebay Zana district Towns from January 2019 to February 2019. Medebay Zana district is about 1040kms from Addis Ababa. In the district, there were a total of 277 restaurants and hotels, 44 snack bars and 52 food bakeries. These establishments can accommodate a total of 1850 people. In total, in the hotels, restaurants and snack bars found in the district, there are 1050 food handlers.

Population

All food handlers who were working in Medebay Zana district Towns were the source population; randomly selected (see the sampling technique) food handlers formed the study population. Food handlers who were under treatment or those who finished treatment for parasitic infection within two weeks prior to the study were excluded.

Sample size and sampling technique

The sample size was determined using the following assumptions (level of confidence of the population is taken to be 95% and $Z\alpha/2=1.96$). A 5% margin of error ($d=0.05$) and the prevalence of intestinal parasites among food handlers were based on a previously conducted study in Ethiopia, Tigray Mekelle

Town at 49.3 % [11]. Based on these assumptions, the actual sample size for the study is computed using one sample population proportion formula as indicated below.

$n = (Z\alpha/2)^2 P (1-P)/d^2$

Then, the sample size was, **n ≈ 384**+10% contingency=**422**. The total sample size was proportionally allocated according to the number of food handlers working in hotels, snack bars, and bakeries; a systematic random sampling technique was then employed to select the allocated number of study participants from the sampling frame.

Data collection tools

Interviewers administered structured questionnaires were used to collect the data. The content of the questionnaire included socio-demographic characteristics, educational status, economic status, individual behavioral factors, and house characteristics as well as environmental related conditions.

Laboratory investigation

Fecal specimens were obtained from the selected food handlers and transported to the laboratory-based on the standard operating procedures for the collection and transportation of fecal specimens. In the laboratory, the stool was immediately examined by wet mount technique for motile parasites, helminth eggs, cysts, and oocysts of intestinal protozoa followed by Kato-Katz and formol ether concentration technique [13].

Study variables

Dependent variable: Intestinal parasites status

Independent variable: ***Socio demographic variables*****,** such as age, sex, monthly income, educational level, service year; ***Individual factors*****,** such as proper personal hygiene practice, using fresh vegetable salads and meat, use of sanitizer and disinfectants, environmental sanitation, contact with water source, contact with an animal, eating raw meat and vegetables; ***Economic factors*****,** such as quality of housing, isolation from work environment when sick, lack of supply of safe water, lack of access to toilet facility, lack of medical check screening

Data quality assurance

To assure the data quality, the data collection instrument was pretested in nearby towns. Data collectors were trained before the actual data collection period by experts from Tigray Health and Research Institute. Furthermore, the collected data were reviewed and checked for completeness each day. Laboratory investigations were done as per the standard operating procedures for specimen collection, transportation, and analysis of fecal specimen.

Data analysis

After checking for completeness, data were coded, cleaned, and entered into SPSS version 21.0 for analysis. Binary logistic regression was used to determine the possible associations between the independent variables and an outcome variable. Those factors with a p-value of 0.2 and below during the bivariate logistic regression analysis were considered for multivariate logistic regression to control the confounders. Finally, statistically significant was declared at p-value <0.05 with a 95% confidence interval.

Result

Socio-demographic characteristics

From the total of 422 study participants, 401 were included in this research (giving a 95% response rate. Out of the 401 participants, 377(94%) were females and the mean age of all study participants was 28.74 (±SD=4.56).From the total participants, 21(5.2 %) have completed college and above, 78(19.5%) completed secondary school, 273(68.1%) completed primary school, and the remaining 29(7.2%) were unable to read and write. The study also showed that 212 (52.9%) participants had monthly incomes of between 500 and 900 birr and the remaining 189 (47.1%) participants earned ≥ 1000 birr monthly (Table 1).

Hygiene related factors of food handlers

Responses of the study participants showed that 306(76.3%) washed their hands before food preparation, 73(18.2%) washed their hands usually, and 22(5.5%) washed their hands sometimes. Out of the total participants,222(55.4%) washed their hands with soap and water after using the toilet, 378(94.3%) washed their hands after touching dirty materials and different body parts, 180(44.9%) washed their body regularly in their working area, and 284(70.8%) participants had renewed their medical certificate every three months (Table 2).

Working area related factors of food handlers

From the total of 401 study participants, 386 (96.3%) used private tap water, 349(87%) had a shower facility in their workplace, 287(71.6%) had separate dressing rooms in their working area, 310(77.3%) used water and detergent to clean utensils and drinking cups, and 87(21.7%) cleaned the kitchen floor at least three times per day (Table 3).

Prevalence and type of intestinal parasite

Based on microscopic stool sample examinations, eight species of intestinal parasites were identified with an overall prevalence of 33.2%. From the total species of intestinal parasites detected the most prevalent was *protozoan* 109(81.7%) followed by *helminths* 24(18.3%) (Table 4).

Factors associated with the occurrence of intestinal parasites

The findings from the bivariate analysis showed that 13 variables meet the criteria of p-value < 0.2 to be included for multivariate analysis. From the total of 13 variables that met the criteria only 7 variables were significantly and independently associated with the occurrence of intestinal parasites at a p<0.05 and the 95% confidence interval. The analysis from the multivariate logistic regression showed that food handlers who have the habit of eating raw vegetables and meats were 31.9 times more likely to be positive for intestinal parasites compared to their counterparts [AOR=31.92, 95% CI=10.01-101.80]. Additionally, those food handlers that use public tap water were 11.5 times more likely to be positive for intestinal parasites compared with those that used private tap [AOR=11.59, 95% CI=1.73-77.45], food handlers who washed their hands sometimes before food preparation were 3.25 times more likely to be positive for intestinal parasites compared to those who washed always [AOR=3.25, 95% CI=1.33-7.92]. Those food handlers who washed their hands sometimes by soap and water after visiting the toilet were 3.54 times more likely to be positive for intestinal parasites compared to those washed their hands always [AOR=3.54,95% CI=1.72-7.31]. Similarly, food handlers who have no shower facility at workplace were 3.84 times more likely to be positive for intestinal parasites compared to those who have a shower facility [AOR=3.84, 95% CI=1.47-10.26].

Discussion

The study researched unaddressed areas in Tigray region and generated new findings with regard to the prevalence of intestinal parasites among food handlers and the potential risk factors. The findings will have paramount importance for the evidence-based interventions that ensure food safety, improve the health of food handlers and the public at large. In this cross-sectional study, the overall prevalence of intestinal parasites among food handlers was 33.2% in Medebay Zana District, North West Tigray. The prevalence of intestinal parasites in this study was relatively higher than the studies reported in Ethiopia, Aksum Town at 14.5% [14], Gondar, Northwest Ethiopia at 29.1% [15], North East India at 29.33% [16],Saudi Arabia at 23% [17], Accra, Ghana at 21.6% [18], Kenya at 23.7% [19],Omdurman, Sudan at 6.9% [20], Turkey at 8.8% [21], and Sari and Northern Iran at 15.5% [22]. The prevalence of the intestinal parasite in this current study was lower than a study done in South West Ethiopia 44.1% [23], Bahr Dar Town 41.1% [24], Jima Town 48.2% [25], Tigray Mekelle Town 49.3% [26], and India Tertiary Care Hospital 40.5% [27].The prevalence of intestinal parasites in the current study was consistent with the studies conducted in Southern, Ethiopia which was 36% [28] and a study conducted in Qatar reporting 33.9% prevalence [29].

The variability from our current prevalence may reflect differences in socioeconomic status, climatic conditions, poverty, personal and community hygiene, and period of the study. Differences in the study time might have also contributed as our study was conducted during the time when irrigation movement was high; hence, the entire data set was collected during dry months which may contribute to raising the prevalence of schistosomiasis and other helminths. In many arid or semi-arid habitats, some protozoan parasites are common toward the end of the rainy season [20]. The cultural habit of eating raw meat in some areas may contribute to increasing presence of helminths [5].

In the present study, many intestinal parasitic infections were found with *S.mansoni* being the predominant parasite from helminths followed by *Hymenolepis nana*. This finding was relatively consistent with a similar study conducted in Aksum Town, Ethiopia [14].*E.coli* was the most predominant parasite from protozoan parasites followed by *E.histolytica/dispar* which resembled findings from a similar study conducted in Southern Ethiopia, reporting the prevalence of (36%) [28].

Poor personal and environmental hygiene, including using public tap water and eating raw vegetables and meat among food handlers is a common practice that contributes to food and water-borne as well as skin transmitted diseases [26]. Parasite eggs in the environment can contaminate water source, vegetables , hands and subsequently ingested with foods[22]. Hence, in this study, the untrimmed source of water, washing hands before food preparation, washing hands with soap and water after visiting toilet, shower facilities in the workplace, regular washing of one's body, habit to eat raw vegetables & meat and kitchen floor cleaned were identified as determinant factors for intestinal parasites among food handlers. In comparison with other studies, poor hand washing practice was similarly found to be a significant predictor of intestinal parasitosis among food handlers in Southwest Ethiopia [7].

Conclusion

In conclusion, this study revealed a high prevalence of intestinal parasite among food handlers who tested positive for different intestinal parasites. Source of water, hand washing after visiting the toilet and before food preparation, shower facilities, washing one's body regularly, practices related to eating raw vegetables & meat, and kitchen floor cleaned were the identified factors affecting food handlers for the risk of acquiring the intestinal parasite in the study area. Hence, local health planners should implement appropriate interventional measures for the novel risk factors to mitigate the problem. We also recommend researchers to conduct large scale follow up studies in a regional context.

Declarations

Ethics approval and consent to participate: Ethical clearance was obtained from the Ethical Review Board, Institute of Biomedical Science Mekelle University. The respondents were informed about the objective and purpose of the study and written consent was obtained from each respondent. The confidentiality of the information was assured.

Consent for publication: Not applicable

Availability of data and materials: All data generated or analyzed during this study is included in this published article.

Competing interests: We, the authors, declare no conflict of interests

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Authors' contribution: KR, KT, GB& MT: Conceived and designed the proposal analyzed the data and wrote the initial version of the manuscript; **HG, GG& MT**, Wrote the final version of the manuscript. All authors read and approved the final version of the manuscript.

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Tables

Table 1: Socio-demographic characteristics of study participants (n=401) among food handlers in Medebay Zana district (February-March, 2019)

Characters	Category	Frequency	Percent
Sex	Female	377	94
	Male	24	6
Age	<21	28	7
	21-30	254	63.3
	31-40	110	27.4
	>40	9	2.2
Religious	Orthodox	398	99.3
	Muslim	3	0.7
Educational level	College and above	21	5.2
	Secondary school	78	19.5
	Primary school	273	68.1
	Unable to read and write	29	7.2
Monthly income	500 - 900 birr	212	52.9
	1000 -1500 birr	189	47.1
Service in year	1-5 year	332	82.8
	6-9 year	69	17.2

Table 2: Personal hygiene characteristics of study participants (n=401) among food handlers in Medebay Zana district Towns (February-March, 2019).

Characters	Category	Frequency	Percent
How often do you wash your hands before food preparation?	Always	306	76.3
	Usually	73	18.2
	Sometimes	22	5.5
Do you wash your hands by soap and water after visiting toilet?	Always	222	55.4
	Usually	147	36.7
	Sometimes	32	8
Do you wash your hands after touching dirty materials and different body parts?	No	23	5.7
	Yes	378	94.3
Do you wash your body regularly in your working area?	No	221	55.1
	Yes	180	44.9
Do you have a medical checkup certificate?	No	0	0
	Yes	401	100
How frequent do you come to health center for medical checkup?	Every three month	284	70.8
	Every six month	70	17.5
	Every nine month	47	11.7
Do you wear clean aprons during food preparation?	N0	137	34.2
	Yes	264	65.8
Do you wear clean hair garment during food preparation?	No	122	30.4
	Yes	279	69.5
How frequent do you cut your fingernails?	Two times per week	29	7.2
	One times per week	75	18.2
	One times per two week	295	74.1

Table 3: Working area related factors of food handlers (n =401) in Medebay Zana district Towns (February-March, 2019)

Variables	Category	Frequency	Percent
What is the source of water in your working area?	Private tap	386	96.3
	Public tap	15	3.7
Does your working area have shower facility?	No	52	13
	Yes	349	87
Does your working area have separate dressing room?	No	114	28.4
	Yes	287	71.6
What do you use to clean utensils and drinking cup?	Only water	53	13.2
	Water and detergent	310	77.3
	Hot water and detergent	38	9.5
How frequently is the kitchen floor cleaned?	One times per day	115	28.7
	Two times per day	199	49.6
	Three times per day	87	21.7
Do you have toilet facility in your working area?	No	0	0
	Yes	401	100

Table 4: Prevalence and type of intestinal parasites among the positive participants in District Medebay Zana district towns (February-March, 2019)

Parasites category	Number (%)
Protozoan	109(81.7)
Entamoeba coli	50(37.4)
Entamoeba histolytica/dispar	24(18)
Entamoeba hartmanni	18(13.5)
Giardia lamblia	17(12.8)
Helminths	24(18.3)
Schistosoma mansoni	8(6)
Hymenolepis nana	7(5.3)
Enterviousvermicularies	6(4.5)
Taenia species	3(2.3)
Total	133(100%)

Table 5: Factor associated with occurrence of intestinal parasite from the results of bivariate and multivariate logistic regression among the study participant in Medebay Zana district Towns (February-March, 2019)

Variables	Category	Intestinal parasite		COR(CI)	AOR(CI)
		No (%)	Yes (%)		
What is the source of water in your working area?	Public tap Private tap	4(26.7%) 264(68.4%)	11(73.3%) 122(31.6%)	5.95(1.86-19.06) 1	11.59(1.73-77.45)* 1
How often you wash your hands before food preparation?	Sometimes Usually Always	8(36.4%) 34(46.6%) 226(73.9%)	14(63.6%) 39(53.4%) 80(26.1%)	5.95(1.91-5.48) 4.95(1.99-12.22) 1	3.25(1.33-7.92)* 4.12(1.13-15.05)* 1
Do you wash your hands by soap and water after visiting toilet?	Sometimes Usually Always	6(18.8%) 74(50.3%) 188(84.7%)	26(81.2%) 73(49.7%) 74(15.3%)	5.45(3.34-8.88) 23.96(9.17-62.57) 1	3.54(1.72-7.31)* 6.05(1.67-21.92)* 1
Have you use your sick leave properly to obtain treatment?	No Yes	56(47.9%) 212(74.6%)	61(52.1%) 72(25.4%)	3.21(2.04-5.03) 1	
Does your workplace have shower facility?	No Yes	18(34.6%) 250(71.6%)	34(65.4%) 99(28.4%)	4.77(2.57-8.84) 1	3.84(1.47-10.26)* 1
Do you wash your body regularly in your working area?	No Yes	116(52.4%) 152(84.4%)	105(47.5%) 28(15.6%)	4.91(3.03-7.95) 1	2.48(1.09-5.61)* 1
Do you have habit to eat raw vegetables &meat?	Yes No	6(12.8%) 264(74%	41(87.2%) 92(26%)	19.46(7.99-47.34) 1	31.92(10.01-101.80)* 1
Does your working area have separate dressing room?	No Yes	55(48.2%) 213(74.2%)	59(51.8%) 74(25.8%)	3.08(1.96-4.85) 1	
Do you wear clean aprons when you preparing food?	No Yes	63(46%) 205(77.7%)	74(54%) 59(22.3%)	4.08(2.61-6.36) 1	
Do you wear hair garments during preparing food?	No Yes	59948.4%) 209(74.9%)	63(51.6%) 70(25.1%)	3.18(2.04-4.98) 1	
How frequent you cut your fingernails? (per week)	One times One times Two times	184(62%) 62(82.7%) 22(75.9%)	113(38%) 13(17.3%) 7(24.1%)	1.93(0.79-4.66) 0.65(0.23-1.86) 1	
How frequently the kitchen floor cleaned?	One times Two times	35(30.4%) 152(76.4%)	80(69.6%) 47(23.6%)	30.85(12.30-77.38)	13.73(4.21-44.77)*

(per day)				4.17(1.71-10.18)	
	Three times	81(93.1%	6(6.9%)	1	2.51(0.85-7.39)
					1
Monthly income (birr)	500 – 900	119(56.1%)	93(43.9%)	2.91(1.87-4.52)	
	1000 – 1500	149(78.8%)	40(21.2%)		
				1	

Note: CI=Confidence interval AOR=Adjusted odds ratio COR=Crude odds ratio * =Significant associated factors