

ORIGINAL ARTICLE

Faeco-oral parasitic infection in street food vendors in Tamale, Ghana

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Poor environmental sanitation, personal and food hygiene practices of food vendors are major causes of street food contamination and outbreak of foodborne illness. The unregulated and rapid growth of the street food industry in the Tamale Metropolis with its associated health risk calls for strict public health surveillance to prevent the outbreak of foodborne diseases. Stool samples were collected from 150 street food vendors in the Tamale Metropolis in May 2015 and screened microscopically for gastro-intestinal parasites. 47(31.3%) food vendors were infected. Parasites identified and prevalence of infection were *Giardia lamblia*, 23 (16%), *Entamoeba histolytica* 11(9.3%), *Hymenolepis nana* 5(3.3%) and *Strongyloides stercoralis* 8 (5.3%). The highest prevalence involved typical faeco-oral parasites: *Entamoeba histolytica* and *Giardia lamblia*. Prevalence of parasite species in Tamale Central and Tamale South were not significant different. Multiple infection was significantly higher in Tamale South 5(6.7%) than Tamale Central 0(0.0%). Formal education, knowledge of food hygiene practices and medical screening (though poorly patronized) reduced infections among street food vendors. Intensified public health education on and enforcement of food hygiene regulations are recommended to eradicate food contamination and infection.

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INTRODUCTION

Most people in developing countries depend on street food for their daily dietary needs due to generally low income levels. In many cities and towns of developing countries, the street food industry is a large source of employment (Choudhury *et al.*, 2011). Most of the street food vendors in this women-dominated business who often are forced into the industry for economic reasons, have little or no formal education and lack knowledge on personal hygiene and hygienic food handling practices (Choudhury *et al.*, 2011).

The street food is prepared on the streets or at home and consumed on the streets. Street foods are appreciated for their unique flavors, convenience, accessibility, affordability and the role they play in the socio-cultural heritage of societies (Muzaffar *et al.*, 2009). It is also important and essential for maintaining

nutritional status of populations (Muzaffar *et al.*, 2009). The street food industry is easy to operate, depending on structures constructed with cheap local technology and does not require any certificate to operate (Muzaffar *et al.*, 2009). In the siting of the industry basic environmental sanitation and hygiene conditions of the area of operation, availability of toilet facilities and potable water are often not considered. Personal and food hygiene practices including the washing of hands after visiting the toilet and used utensils with soap and clean water are compromised, placing the consumer at high risk of food borne illnesses. Street food vendors therefore play a significant role in the transmission of faeco-oral parasites and epidemics of diarrhoea diseases in general.

Gastro-intestinal parasites have been reported to cause about 450 million infections per annum in developing world with an incidence of about 50 million and 100,000 deaths (Ravdin, 1988). Gastro-intestinal parasites isolated from food handlers in Abeokuta, Nigeria include *Entamoeba histolytica*, *Giardia duodenale*, *Trichuris trichiura*, *Ascaris lumbricoides*

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and *Enterobius vermicularis* (Idowu and Rowland, 2006). A worldwide prevalence of about 1–30 percent has been reported for *Ameobiasis* and *Giardiasis* (Woo and Paterson, 1986). *Ascarasis* is the commonest nematode of man especially in tropical Africa with a prevalence of about 40% in Ogun State of Nigeria (Reinthal *et al.*, 1988) and may be as high as 96–100 in the rural communities in Ogun State. *Strongyloidis stercoralis* is an intestinal helminth that infect human worldwide. In normal host the parasite regularly causes chronic infections with mild or no symptoms with uncontrolled multiplication and migration of larvae throughout the body, with rare fetal conditions (Celedon *et al.*, 1994).

Multiple lines of evidence reveal that foods exposed for sale on the roadside may become contaminated either by spoilage or pathogenic micro-organisms (WHO, 1984; Bryan *et al.*, 1992; Ashenafi, 1995). Street vended foods have shown epidemiological links with illness (El-Sherbeeney *et al.*, 1985; Saddik *et al.*, 1985; Abdussan and Kafertein, 1993) and has raised serious concern on the potential for food poisoning outbreak. Street food vendors are mostly uninformed of Good Hygiene Practices (GHP) and are major causes of diarrhea diseases (Mensah *et al.* 2002). The activities of street food vendors can increase the risk of street food contamination (Bhaskar *et al.*, 2004; Tambekar *et al.*, 2009).

General manifestation of these food-borne infections is diarrhea, the treatment of which is an additional financial burden to the poor consumer. The role of the domestic fly in the transmission of these food borne pathogens is often not considered in the service of street foods. Street vended foods like rice, rice and beans, banku, makoroni (talia), kenkey, fufu tuo zaafi and kose are sold in all the cities throughout Ghana including Tamale and some are served with bare hands. The environment where the food is prepared, stored and or sold can also be a source of microorganisms facilitated by flies, cockroaches and other insects where sanitation is poor, especially nearby toilet or refuse dump. The food vendor of questionable health status and of poor food hygiene practices can introduce microorganisms into the food in performing his/her duties.

Even though people are aware that food borne diseases could occur due to consumption of contaminated street food, the majority disregard the health hazards associated with the street food industry as it is practiced in developing countries (Bryan, 1998). Street food vending is on the increase in the Tamale metropolis. The high illiteracy rate, high unemployment rate, low income and numerous social programmes in the Tamale Metropolis tend to promote the street food industry. The foods sold are prepared, handled and processed using traditional method with no attention to minimal sanitary standards. As a result of ignorance many do not see the need for regular medical screening instituted by local government authorities. This suggests that their personal health status is questionable and could be patients or carriers of infectious agents including faeco-oral parasites which they transmit ignorantly to consumers through contamination of the food they sell.

Mensah *et al.*, (2002) noted that street food vendors are mostly uninformed of GHP and are major causes of diarrhoeal diseases. Street food vendors are therefore a potential danger in the transmission of foodborne infections and outbreaks especially diarrhea agents to their steaming consumers in the Tamale Metropolis through food contamination if not monitored. This study was undertaken to investigate the prevalence of faeco-oral parasites in particular and gastro-intestinal parasites in general in street food vendors in the Tamale Metropolitan area. Information on environmental sanitation, educational status, personal hygiene, food hygiene practices, knowledge of food infection and environmental conditions which contribute significantly to food safety will also be collected.

MATERIALS AND METHODS

The study site and people

The Tamale Metropolitan Assembly was established by Legislative Instrument (L.I. 2068). It is one of the six Metropolitan Assemblies in Ghana and the only Metropolis in the Northern sector of the country. Tamale Metropolitan Area comprises two Sub-Metros (Tamale Central and Tamale South). It

is located in the central part of the Region and shares boundaries with the Sagnarigu District to the North-West, Mion District to the East, East Gonja to the South and Central Gonja to the South West. The major economic activities are trade and agriculture. The Metropolis lies between latitude 9°16 and 9° 34 North and longitudes 0° 36 and 0° 57 west and has a total estimated land size of 646.9sqkm (PHC Report, 2010).

The Metropolis is located about 180 metres above sea level and receives a single rainfall pattern in a year from May to October. There are a total of 116 communities in the Metropolis of which 41 (35%) are urban communities, 15 (13%) being peri-urban and 60 (52%) being rural in nature. The population of the Tamale Metropolis is 223,252 with 111,109 (49.7%) males and 112,143 (50.2%) females, and comprises of all the ethnic groups of the country with the majority been the Dagomba tribe who are the indigenes. Majority (90.5%) of the population in Tamale Metropolis is Muslim followed by Christians. About (0.2%) has no religious affiliation (Tamale Metropolitan Assembly Planning Unit, 2010).

Sample collection and processing

Fresh stool samples were collected randomly from one hundred and fifty (150) street food vendors in the Tamale Metropolis for the month of May 2015 and analyzed in the laboratory of the School of Medicine and Health Sciences for gastro-intestinal parasites. The fresh stool samples and formol-saline concentrated samples were surveyed microscopically for parasites by direct smear method (saline wet mount of fresh stool for trophozoites and larvae, iodine wet mount for cysts and ova) and formol-saline concentrated samples as described by (Polderman *et al.*, 2008).

A street food vendor was considered infected when such parasite/s was/were found in his/her stool. The sample examination was done in triplicates. Information on age, sex, education level, knowledge on persona and food hygiene practices, medical screening, food handling, toilet facilities, availability of potable water and environmental sanitation were collected by questionnaire and personal observation.

Data Analysis

Type of gastro-intestinal parasite found in any sample was identified with the help of charts and technical assistance. The number of vendors infected with a particular parasite and those with multiple infections for the two Sub-Metropolitan areas were analyzed for prevalence. Environmental and personal data relating to food hygiene were collected by questionnaire and observation. Data analysis was done using the Statistical Package for Social Sciences (SPSS). The results were expressed in percentages and were significantly different at 5% when $P < 0.05$.

RESULTS

Sex distribution of 150 street food vendors sampled showed that both males and females were engaged in the industry with females 115(76.7%) population higher than that of males 35(23.3%) (Table 1). The ages of the vendors were between 15 and 60 years with most (77.3%) found in the age 20-39 years (Table 2).

Table 1: Sex distributions of participating street food vendors

Sub-Districts	Male (%)	Female (%)
Tamale South	16 (21.3%)	56 (74.7%)
Tamale Central	19 (25.3%)	59 (78.0%)
Total	35 (23.3%)	115 (76.7%)

Table 2: Age distributions of participating street food vendors

Age range (yrs)	Total (%)
15-19	7 (4.7)
20-24	30(20.0)
25-29	30 (20.0)
30-34	29 (19.3)
35-39	28 (18.7)
40-44	14 (9.3)
45-49	2 (1.3)
≥ 50	10 (6.7)
Total	150 (100.0)

The prevalence of gastrointestinal parasites in street food vendors in Tamale Metropolis was 34.7% with Tamale Central 22(29.3%) and Tamale South 25 (33.3%) (Table 3). The parasite species found in Tamale Metropolis in order of decreasing prevalence were: *Gardia lamblia* (16.0%), *Entamoeba histolytica* (10.0%), *Strongyloides stercoralis* (5.3%) and *Hymenolepis nana* (4.0%). There was no significant difference

Table 4: Multiple parasitic infections in Street food vendors

Zone	Parasite/ Infected vendors	Multiple infection (%)	Uninfected
Tamale Central	22/22	0(0.00)	53
Tamale South	30/25	5(6.7)	50
Total	52/47	5(10.64)	

Table 3: Prevalence of Gastro-intestinal parasitic species stratified by location

Parasite	Tamale Central (n=75)	Tamale South (n=75)	Total (n=150)	P values
Entamoeba histolytica	7 (9.3%)	4 (9.3%)	11 (9.3%)	0.9999
Giardia lamblia	8 (10.7%)	15 (21.3%)	23 (16%)	0.6704
Strongyloides stercoralis	4 (5.3%)	4 (5.3%)	8 (5.3%)	0.9999
Hymenolepis nana	3 (4.0%)	2 (2.7%)	5 (3.3%)	0.9999
Total parasites	22 (29.3)	25 (33.3%)	47(34.7%)	0.5340

($p > 0.05$) in parasitic infections in the two sub-metropolitan areas (Table 3). The same parasites were identified in both Sub Metros. More parasites species were isolated from Tamale South (30) than Tamale Central (22) with more vendors infected in Tamale South (25) than Tamale Central (22) (Table 4). Multiple infections in the infected food vendors in Tamale Metropolitan Area was 5(10.64%) with Tamale South recording 5(6.7%) and none in 0 (0.00%) Tamale Central.

Analysis of questionnaire data from street food vendors from the two Sub-Metropolitan areas studied indicated that the number of vendors with knowledge of food hygiene practices was significantly higher ($p < 0.05$) in Tamale Central than Tamale South, while vendors infected without knowledge of food hygiene was significantly higher ($p < 0.05$) in Tamale South and Tamale Central than (Table 5). It is interesting to note that some street food vendors serve cooked food with bare hands with Tamale central recording a higher number 31(41.3%) than Tamale south 21(36.0%) (Table 6).

DISCUSSION

The street food industry has become an area of global concern because of the high patronage in low income groups in developing countries. It has become

a source of worry because the poor environmental sanitation, personal and food hygiene practices associated with these women dominated industry put consumers at risk of infections with food borne pathogens. In the current study of street food vendors in the Tamale metropolitan area it was observed that female population 115(76.7%) was higher than that of males 35 (23.3%) (Table 1). The results agree with Lues *et al.*, (2006) who stated that street food vending is a common income-generating venture particularly for women in developing countries.

The participating vendors were aged 15-60 years with most vendors (78.0%) between 20-39 years (Table 2). The results agree with the finding of Monney *et al.*, (2013) who reported that most (50.0%) of school food vendors sampled in Konongo, Ghana were in the age range of 25-35 years. Out of the 150 street food vendors in the Tamale metropolis screened for the gastrointestinal parasites 47(34.7%) were infected, with Tamale South recording 25(33.3%) and Tamale Central 22 (29.3%) (Table 3). Parasites species isolated and the prevalence were; *Gardia lamblia* (16.0%), *Entamoeba histolytica* (10.0%), significant difference ($p > 0.05$) in parasitic infections in the two Sub-Metropolitan areas (Tamale Central than Tamale

Table 5: Personal and environmental hygiene data of infected street food vendors

Parameter	Totals (%)	Tamale south	Tamale central	p-value
Total vendors with child care activities	25(16.7%)	13 (17.3%)	12 (16.0%)	0.828
Vendors infected with child care activities	8 (27.6%)	5 (38.5%)	3 (18.8%)	0.253
Vendors infected without child care activities	39(32.0%)	20 (31.7%)	19 (32.2%)	0.957
Toilet facility: All near public toilets (Pit) but none with own toilet facility				
Total Vendors with at least basic education level	99(66.0%)	49 (65.3%)	50 (66.7%)	0.864
Vendors infected with at least basic education level	17(17.3%)	9 (18.4%)	8 (16.3%)	0.792
Total Vendors without formal education	51(34.0%)	26 (34.7%)	25 (33.3%)	0.864
Vendors infected without formal education	30(57.7%)	16 (61.5%)	14 (53.8%)	0.583
Vendors with Medical examination certificate	70 (46.7%)	33 (44.0%)	37 (49.3%)	0.516
Vendors infected with Medical examination certificate	15(21.1%)	9 (26.5%)	6 (16.2%)	0.297
Vendors infected without Medical examination certificate	32(40.5%)	16 (39.0%)	16 (42.1%)	0.784
Total Vendors with knowledge of food hygiene	94 (62.7%)	41 (54.7%)	53 (70.7%)	0.043
Hand washing with soap after visiting toilet	132(88.0%)	67 (89.3%)	65 (86.7%)	0.618
Hand washing with soap after visiting toilet and yet infected	17 (13.2%)	7 (10.4%)	10 (16.1%)	0.344
Hand washing without soap after visiting toilet	18 (45.0%)	3 (42.9%)	6 (46.2%)	0.895

Table 6: Food hygiene practices of food vendors

Mode of serving food	Tamale central	Tamale south	Total (%)
Bowls	10 (13.3)	11 (14.7)	21 (14)
Ladles	34 (45.3)	37 (49.3)	71 (47.3)
Hands	31 (41.3)	27 (36.0)	58 (38.8)

South). Prevalence of typical faeco oral parasites identified 23(16.0%), were *Giardia lamblia* 8(10.7%) and 15(21.3%) for Tamale Central and Tamale South respectively, and *Entamoeba histolytica* 7(9.3%) and 4 (9.3) for Tamale Central and Tamale South respectively. The most prevalent gastro-intestinal parasites identified were the faeco oral parasites, *Giardia lamblia* and *Entamoeba histolytica* (25.3%). This agrees with the work of Idowu and Rowland, (2006) who reported high prevalence of *Entamoeba histolytica* and *Giardia lamblia* among the intestinal parasites found in street food vendors in Abeokuta, Nageria. Of the 22 infected food vendors in Tamale central, none (0.00%) was found with multiple infections or infection with more than one parasite, among the 25 vendors infected in Tamale south, 30 parasitic infections were identified, giving multiple infection of 5(6.7%) of the infected food vendors (Table 4). The above results agree with Idowu and Rowland, (2006) who reported multiple gastro-intestinal parasitic infections among food vendors in Abeokuta, Nigeria.

It was observed in the study that formal education has impact on the prevalence of infection among street food vendors. Out of the 99 (66.0%) with formal education only 17 (17.2%) were infected, while out of a total of 51(34.0%) of street food vendors without formal education 30 (58.8%) were found infected. Out 70(46.7) of Vendors who had undergone medical examination 15(21.1%) were infected, while out of 47 street food vendors infected 32(68.1%) were without medical examination (Table 5). This suggests that formal education and medical screening have positive impact on the reduction of parasitic infection among food vendors. It is likely that those with basic education and medical examination understood and appreciated the role of environmental sanitation, personal and food hygiene on food contamination and infection. Previous knowledge of food hygiene was significantly higher among food vendors in Tamale central 53 (70.7%) than in Tamale south metro 41(54.7%). This could account for generally lower prevalence of infection especially multiple infections in Tamale central 0(0.00%) than Tamale south 5(6.7%). The current study noted low patronage of medical examination by street food vendors in Tamale metropolis 70(46.7%). This is in agreement with Ackah, (2011) who noted that only 40% of food

vendors in Accra had medical certificate. Musah and Akande, 2002 also reported low patronage of medical examination by street food vendors 30 out of 141 street food vendors had medical certificate representing 21% in Accra, Ghana. It was observed that hand washing with soap after visiting the toilet reduces parasitic infections among food vendors and the chances of transmission to consumers through food contamination (Table 5).

The high number of respondents who washed their hands with soap after visiting toilet (88%) is in agreement with Ackah, (2011) who reported 96% of the respondents practiced the use of soap always for hand washing in Accra, Ghana. Serving food with bare hands was noted to be practiced by some food vendors with Tamale central recording highest 31 (41.5%) than Tamale south 27(36%) (Table 6). Washing hands without soap (45%) (Table 5) and serving food with bare hands (38.8%) (Table 6) among food vendors in the Tamale Metropolis are some of the activities that put consumers at risk of consuming contaminated food. These results agree with Bhaskar *et al.*, (2004) and Tambekar *et al.*, (2009) who reported that the activities of street food vendors can increase the risk of street food contamination. Food vendors therefore need to be educated on the role of bare hands in food contamination.

CONCLUSION

The study observed that though street food vending is female dominated, some few males were found operating in the industry in the Tamale metropolis. Most of the vendors sampled were in the age range of 20-39 years. Gastro-intestinal parasitic infections were detected in some street food vendors in the Tamale metropolis. Food borne parasites (*Entamoeba histolytica*, *Giardia lamblia* and *Hymenolepis nana*) were predominant among parasites identified. Infections in the two sub-metros were not significantly different from each other. Formal education and medical examination were observed to reduce infections among food vendors. Knowledge of food hygiene was generally high with no significant difference between the two sub-metros. The low patronage of medical examination was however not affected by formal education and level of knowledge of food

hygiene. The study observed high prevalence of faeco oral parasites (*Entamoeba histolytica* and *Giardia lamblia*) in both sub-metropolitan areas, which can easily be transmitted to consumers through food contamination.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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