Factors associated with food safety practices among food handlers: facility-based cross-sectional study

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Abstract

Objective: The primary objective of this study was to assess factors associated with food safety practices among food handlers in Gondar city food and drinking establishments. The facility-based cross-sectional study was undertaken from March 3 to May 28, 2018, in Gondar city. Simple random sampling method was used to select both establishments and the food handlers. The data were collected through face-to-face interview using pre-tested Amharic version of the questionnaire. Data were entered and coded into Epi info version 7.0.0 and exported to SPSS version 22 for analysis.

Results: One hundred and eighty-eight (49.0%) had good food handling practice out of three hundred and eighty-four food handlers. Marital status (AOR: 0.36, 95% CI 0.05, 0.85), safety training (AOR: 4.01, 95% CI 2.71, 9.77), supervision by health professionals (AOR: 4.10, 95% CI 1.71, 9.77), routine medical checkup (AOR: 8.80, 95% CI 5.04, 15.36), and mean knowledge (AOR: 2.92, 95% CI 1.38, 4.12) were the factors significantly associated with food handling practices. The owners, managers and local health professionals should work on food safety practices improvement.

Keywords: Food handlers, Food safety, Hygiene practices, Food establishment, Food-borne diseases, Ethiopia

Introduction

Food safety continues as a critical problem in developed and developing nations for people, food companies and food control officials [1, 2]. Food-borne diseases (FBD) are associated with outbreaks and threatens global public health security and has got an international concern [3]. Food safety is a growing public health issue [4]. FBD is responsible for significant morbidity and mortality rates [5]. The worldwide incidence and financial expenses of food-borne diseases are hard to determine [6]. However, reports estimate that 2.1 million individuals died each year as a result of foodborne disease [5].

According to the WHO, FBDs in developing nations are serious because of bad hygienic food handling methods, bad understanding and absence of infrastructure [7]. This is due to the prevailing poor food handling and sanitation practices, inadequate food safety laws, weak regulatory systems, lack of financial resources, etc. [6, 8]. Evidence revealed that around 70% of diarrhoea cases were attributed to food-borne routes in developing countries [6]. Like other developing countries, the burden of food-borne diseases is growing in Ethiopia [18].

Approximately 10 to 20% of FBD outbreaks are because of contamination due to poor food handling practice of the food handlers [9]. In the absence of well-maintained and proper food handling practices in mass catering establishments have the potential to impart a disastrous effect on human health [6, 11].

Good personal hygiene and food handling practices are important for preventing the transmission of pathogens from food handlers to the consumers [12–14]. Close to 75% of food-borne illness outbreaks are attributed to lack of safe food handling practices by food handlers in food service establishments [5]. Food handlers play a key role in ensuring strict adherence to food safety principles throughout the whole process [15].
There is a high expansion of food establishments observed in the country including Gondar city. But ensuring safe food service has been one of the major challenges and concerns for producers, consumers and public health officials. Studies revealed that lack of basic sanitary facilities/infrastructures, poor knowledge and practice of hygiene and sanitation among food handlers in food service establishments, and negligence in safe food handling are major reasons of poor food safety practice in food establishments [16, 17]. Therefore, it is very essential to identify factors affecting safe food handling practices, especially during preparation and serving. Thus, this study aimed to evaluate factors associated with food safety practice among food handlers in Gondar city food establishments.

Main text

Methods

This facility-based cross-sectional study was conducted from March 3 to May 28, 2018 at Gondar city. Gondar city is one of the highly populated cities in northwest Ethiopia. There were a total of 326 food establishments and 4232 food handlers in Gondar city according to tourism office data. The city is found at 738 km away from Addis Ababa the capital city of Ethiopia. Ninety-eight food establishments were included using the rule of thumb by taking 30% of the total food establishments.

The sample size was computed using a single population proportion formula with 95% CI, 5% marginal error (d) and \( p = 52\% \) proportion of food handlers having good food handling practice from the previous study [19]. Based on these assumptions, 384 food handlers were included in the study.

To select food establishments and food handlers, a simple random sampling technique was used. In each institution, four food handlers were interviewed. After adaptation from similar literature [12, 19–21], the questionnaire was first prepared in English and translated to local language Amharic version. The pre-test was performed on 5% food handlers out of the study area before actual data collection. Then, correction and modification were undertaken based on the gaps identified during the pre-test. Reliability of the questionnaire was also evaluated. The information was gathered via a face-to-face interview using the questionnaire's Amharic version. Four Environmental Health Officers have been engaged as data collectors and the principal investigator was involved as a supervisor. Food safety practice was the dependent variable in this research. Socio-demographic variables and behavioural factors were the independent variables.

Food handling practice: food handlers were involved as a supervisor. Food safety practice was the dependent variable in this research. Sociodemographic variables and behavioural factors were the independent variables. Food handling practice: food handlers were asked seventeen questions and those who scored less than or equal to the mean value were considered as having poor practice and those who scored greater than the mean value were considered as having good practice [19, 21]. Knowledge: Respondents were asked ten questions and those who scored less than or equal to the mean value were considered as having a poor knowledge [12, 22].

Consistency and completeness of data were verified during collection, entry and analysis. Data were entered and coded into version 7.0.0 of Epi Info and exported for evaluation to version 22 of SPSS. The data were analysed using descriptive (frequency and proportion), bivariate, and multivariable regression analysis. Variables with p-value < 0.25 during bivariate analysis were included in multivariable regression to assess the independent effect after controlling other variables [23].

We did Hosmer and Lemeshow test to check the model fitness. SPSS Cronbach's Alpha test result for practice questionnaire was 0.83. Finally, 95% confidence level, AOR and p-value less than 0.05 were considered for determining statistically significant variables.

Results

Sociodemographic characteristics of study participants

Of the three hundred eighty-four food handlers, 338 (88%) were females, 300 (78.1%) were unmarried; and 318 (82.8%) had an income of 500–1000 Ethiopian birr (28 ETB = 1 USD) (Table 1).

Knowledge of food handlers regarding the cause of food-borne disease, mode of transmission and way of food contamination

Three hundred sixteen (82.29%) of food handlers stated that food-borne diseases are caused by germs. More than half 199 (51.8%) of food handlers found this information from health center about food safety practices (Table 2).

Food handling practice of food handlers in food and drinking establishments

More than half of (51.5%) food handlers use hair net during food preparation. One hundred ninety (49.5%) of food handlers did not attend routine medical checkups. About 37% of the respondents were not wearing a uniform during handling and preparation of food (Table 3).

Factors associated with food safety practices

Multivariable logistic regression analysis revealed that marital status, food safety training, routine medical checkup, supervision by health professionals and knowledge were statistically associated variables with food safety practices.
Single food handlers were 64.0% less likely to practice food safety than the single food handlers (AOR: 0.36, 95% CI 0.05, 0.85). Food handlers supervised by health professionals were 4.10 times more likely to practice good food safety than non-supervised (AOR: 4.10, 95% CI 1.71, 5.27). Knowledgeable food handlers were 2.92 times more likely to practice good food safety than non-knowledgeable (AOR: 2.92, 95% CI 1.38, 4.12). Trained food handlers were 4.01 times more likely to have good food handling practice than non-trained food handlers (AOR: 4.01, 95% CI 2.71, 9.77). Food handlers followed routine medical checkup had 8.80 times more likely to have good food handling practice than not-followed food handlers (AOR: 8.80, 95% CI 5.04, 15.36) (Table 3).

**Discussion**
One hundred eighty-eight (49.0%) food handlers had good food safety practice. This finding is lower than the findings of studies in Bahir Dar (67.6%) [24], Arba Minch (67.4%) [21] and in Dubai (81.74%) [17]. While the finding was close with studies in Dangila town (52.5%), Addis Ababa (52.3%), Imo State, Nigeria (50%) and Turkey (48.4%) [6, 19, 25, 26], respectively. However, it is higher than the studies done in Gondar town (22.1%) [5], South-Western Nigeria (19.0%) [27], Ogun, Nigeria (31.5%) [19]. These variations might be due to the difference in the study design, variation in training, and the provision of food hygiene and safety inputs. About 109 (28.4%) of the food handlers were certified in food safety training. This result is higher as compared with findings from Bahir Dar (21.8%) and Mekelle (15.7%) [12, 28]. Food handler training is seen as one strategy whereby food safety practice can be increased, offering long-term benefits to the food establishments [29]. This finding is supported with studies conducted India [10], Nigeria [30], Ghana [31] and Dubai [32]. The number of food handlers who received food safety training in the current study is higher than with findings from Bahir Dar (21.8%), and Mekelle (5.4%) [12, 28]. Food handlers who received training would have a better understanding of safe food handling practice as they might get professional advice during training. Training could enhance food handlers overall performance in safe food handling practice [21]. In this study, food handlers who got safety training had higher odds of good food safety practice. This might be due to trained food handlers gain good awareness through training. This supported with other similar study done in Sarawak [33]. Training programs are important for improving the knowledge of food handlers [34]. Food safety practice was also positively associated with the level of knowledge. The probability of having a good food safety practice among participants with good level of knowledge was 2.39 times higher with compared to those with a poor level knowledge (AOR = 2.39, 95% CI 1.38, 4.12). Food handlers are expected to have substantial knowledge and skills for handling foods hygienically [12]. This might be due to those food handlers who had a good level knowledge might have a higher chance of good food handling practice. This finding was supported studies conducted in Gondar town, and Malaysia [5, 15]. Marital status was another significantly associated factor with food safety practices. Single food handlers had lower probability of good food safety practices compared with divorced handlers. This is supported with the study done in Gondar town and Dangila town [19].

Food safety practice was significantly associated with supervision by health professionals. The probability of having good food safety practice was higher among food handlers supervised by health professionals as compared with non-supervised. This finding was supported by the study conducted in Arba Minch [21]. This might be due to supervisors give advice for food handlers, the owners and to the managers. A routine medical checkup was also another factor significantly associated with good food

| Variables               | Frequency (n) | Percentage (%) |
|-------------------------|---------------|----------------|
| Sex                     |               |                |
| Male                    | 46            | 12.0           |
| Female                  | 338           | 88.0           |
| Age                     |               |                |
| 18–29                   | 340           | 88.5           |
| 30–40                   | 39            | 10.2           |
| Above 40                | 5             | 1.3            |
| Marital status          |               |                |
| Single                  | 300           | 78.1           |
| Married                 | 63            | 16.4           |
| Divorced                | 16            | 4.2            |
| Widowed                 | 5             | 1.3            |
| Educational status      |               |                |
| Not read and write      | 37            | 9.6            |
| Read and write          | 30            | 7.8            |
| Primary school (1–8)    | 112           | 29.2           |
| Secondary (9–10)        | 142           | 37.0           |
| Higher education        | 63            | 16.4           |
| Experience              |               |                |
| < 1 years               | 134           | 34.9           |
| 1–4 years               | 102           | 26.6           |
| > 4 years               | 148           | 38.5           |
| Level of income         |               |                |
| 500–1000                | 318           | 82.8           |
| 1001–1500               | 32            | 8.3            |
| > 1500                  | 34            | 8.9            |

Table 1 Socio-demographic profile of food handlers in Gondar city food establishments, 2018 (n = 384)
The probability of having good food safety practice among food handlers engaged with routine medical checkup was higher than food handlers not engaged in routine medical checkup. This could be the health care workers gave advice for food handlers during examination. This finding is in line with studies conducted in Arba Minch and Dessie towns [20, 21].

Table 2 Knowledge of food handlers regarding food-borne disease, mode of transmission and way of food contamination in food establishments in Gondar city, 2018 (n = 384)

| Variable                                           | Frequency (n) | Percentage (%) |
|----------------------------------------------------|---------------|----------------|
| Source of information about food borne disease     |               |                |
| Mass media                                         113           | 29.4          |
| Health professionals during the inspection         72            | 18.8          |
| Health center                                      199           | 51.8          |
| Cause of food borne disease                        |               |                |
| Germs                                              316           | 82.3          |
| Chemicals                                          43            | 11.2          |
| Do not know                                        25            | 6.5           |
| Route of transmission for food borne disease       |               |                |
| Dirty hand                                         343           | 89.3          |
| Infected food handler                              277           | 72.1          |
| Dirty utensils                                     263           | 68.5          |
| Vectors                                            194           | 50.5          |
| Dirty work environment                             182           | 47.4          |
| Do not know                                        3             | 0.8           |
| The critical times for hand washing                |               |                |
| After using the toilet                             232           | 60.4          |
| Before and after food preparation                  333           | 86.7          |
| After touching anything                            174           | 45.3          |
| After counting money                               143           | 37.2          |
| Route of transmission of food borne disease        |               |                |
| Contaminated food                                  341           | 88.8          |
| Contaminated water                                 253           | 65.9          |
| Vectors                                            172           | 44.8          |
| Do not know                                        9             | 2.4           |
| Ways of food contamination                         |               |                |
| Dirty hand                                         343           | 89.3          |
| Infected food handlers                             | 277           | 72.1          |
| Dirty utensils                                     263           | 68.5          |
| Presence of vectors and rats                       194           | 50.5          |
| Dirty working environment                          182           | 47.4          |
| Symptoms of food borne disease                     |               |                |
| Vomiting                                           162           | 42.2          |
| Fever                                              162           | 42.2          |
| Diarrhea                                           294           | 76.6          |
| Do not know                                        12            | 3.1           |
| Germs found on cutting board                       |               |                |
| Yes                                                335           | 87.2          |
| No                                                 49            |               |
| The food handlers perform correct procedures of washing food utensils | 56  | 14.6  |
| Food handlers properly use single knife            | 50            | 13.0          |
| Total knowledge                                    |               |                |
| Poor                                               214           | 55.7          |
| Good                                               170           | 44.3          |

Table 3 Determinants of food safety practice among food handlers working in food and drinking establishments in Gondar City, 2018 (n = 384)

| Variables                                      | Food safety practice | COR (95% CI) | AOR (95% CI) |
|                                               | Good | Poor | Good | Poor |
| Sex                                           |      |      |      |      |
| Male                                          21   | 25   | 0.86 (0.46, 1.60) | 0.62 (0.26, 1.50) |
| Female                                        167  | 171  | 1    | 1    |
| Marital status                                 |      |      |      |      |
| Single                                        142  | 158  | 0.36 (0.14, 0.95) | 0.36 (0.05, 0.85)* |
| Married                                       31   | 32   | 0.08 (0.13, 1.13) | 0.34 (0.08, 1.54) |
| Divorced                                      15   | 6    | 1    | 1    |
| Educational status                            |      |      |      |      |
| Not read and write                            18   | 19   | 0.14 (0.02, 1.21) | 0.45 (0.16, 1.33) |
| Read and write                                15   | 15   | 0.14 (0.02, 1.31) | 0.54 (0.16, 1.77) |
| Primary education                             46   | 66   | 0.10 (0.01, 1.84) | 0.51 (0.23, 1.14) |
| Secondary education                           71   | 71   | 0.20 (0.02, 1.93) | 0.38 (0.04, 1.91) |
| Higher education                              38   | 25   | 1    | 1    |
| Experience                                    |      |      |      |      |
| < 1 year                                      58   | 76   | 0.52 (0.42, 1.41) | 0.71 (0.33, 1.53) |
| 1–4 years                                     75   | 27   | 1.89 (0.28, 1.90) | 0.80 (0.39, 1.65) |
| > 4 years                                     88   | 60   | 1    | 1    |
| Level of income (ETB, 1 USD = 28 ETB)         |      |      |      |      |
| 500–1000                                      160  | 158  | 1.01 (0.50, 2.05) | 0.94 (0.36, 2.45) |
| 1001–1500                                     11   | 21   | 0.52 (0.19, 1.41) | 0.39 (0.11, 1.37) |
| > 1500                                        17   | 17   | 1    | 1    |
| Food safety training                          |      |      |      |      |
| Yes                                           79   | 30   | 4.01 (2.47, 6.51) | 4.01 (2.71, 9.77)** |
| No                                            109  | 166  | 1    | 1    |
| Supervision by health professionals           |      |      |      |      |
| Yes                                           106  | 47   | 4.09 (2.65, 6.34) | 4.10 (1.71, 5.27)** |
| No                                            82   | 149  | 1    | 1    |
| Level of knowledge                            |      |      |      |      |
| Good                                          108  | 62   | 2.90 (1.92, 4.43) | 2.92 (1.38, 4.12) * |
| Poor                                          80   | 134  | 1    | 1    |
| Routine medical checkup                       |      |      |      |      |
| Yes                                           142  | 52   | 8.55 (5.40, 13.5) | 8.80 (5.04, 15.36) ** |
| No                                            46   | 144  | 1    | 1    |

* Statistically significant at p < 0.05

** Statistically significant at p < 0.001 [Hosmer and Lemeshow test = 0.684 showed that the model fitted well]
The study revealed that there was poor food handling practice among food handlers. Marital status, food safety training, supervision by health professionals, routine medical checkup, and level of knowledge of food handlers were significantly associated with good food handling practice. Owners, managers and local health professionals should enhance the level of knowledge of food handlers, provide food hygiene, safety training, undertake periodic supervision, and routine medical checkup.

Limitations
This study was not without limitations. Some of the limitations include inherent weakness of cross-sectional study to establish a cause–effect relationship, social desirability bias and recall bias.

Abbreviations
WHO: World Health Organization; OR: adjusted odds ratio; CI: confidence interval; COR: crude odds ratio; SPSS: Statistical Package for Social Sciences; ETB: Ethiopian Birr; IRB: Institutional Review Board.

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Authors’ contributions
JA took part in the research development proposal, data collection tools, entered data into Epi-info, analyse and interpret the data, and write various parts of the research report. MG and HD advised from the starting to the end. All authors read and approved the final manuscript.

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Availability of data and materials
We will make data available upon request the primary author.

Ethics approval and consent to participate
We got ethical clearance from the Institutional Review Board (IRB/47/2010) of the Institution of Public Health, University of Gondar. Written informed consent was obtained from each study participant. The consent of the city administrator, the manager of the food and drinking establishments, and the respondents took part willingly. We kept the confidentiality of the respondents and for the food and drinking establishments by asking the participants not to write their names on the questionnaires and codes to conceal the identity of the food and drinking establishments. We used the collected data for this research purpose only. We forwarded health educations to the study participants by data collectors and the principal investigator at the end of the data collection.

Consent to publication
This manuscript does not contain an individual person and institutional data.

Competing interests
The authors declare that they have no competing interests.

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