

Food safety knowledge, attitude and practices of meat handler in abattoir and retail meat shops of Jigjiga Town, Ethiopia

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Keywords

Food borne disease • Food-handlers • Food safety • Hygienic practices • Meat hygiene • Personal hygiene

Summary

A cross-sectional survey was carried out among 91 meat handlers by using structured questionnaire to determine the food safety knowledge, attitude and practices in abattoir and retail meat shops of Jigjiga Town. The result shows that majority of the meat handlers were illiterate (30.8%) and primary school leaver (52.7%), and no one went through any food safety training except one meat inspector. The food-handlers' knowledge and safety practices were below acceptable level with the mean score of 13.12 ± 2.33 and 7.7 ± 2.1 respectively. Only few respondents knew about *Staphylococcus aureus* (3.3% correct answer), hepatitis A virus (19.8% correct answer), and *E. coli* (5.5% correct answer) as food borne pathogens. About 64% of meat handlers have good attitude about safety of food with mean of total score

14.4 ± 2 . All respondents answer correctly questions about proper meat handling and hand washing but they did not translate into strict food hygiene practices. Chi2 analysis testing for the association between knowledge, attitude and practices did not show any significant association. It may be due to meat handlers' below acceptable level safety practices regardless of sociodemographic characteristics, knowledge and attitude. However, there was strong association between level of education and knowledge, and knowledge and hand washing ($p < 0.05$). There was also association between age and knowledge though it was not statistically significant. Thus, continuous education and hands on training for meat handlers that can enhance good safety practices through better understanding and positive attitude.

Introduction

Food safety that refers to the conditions and practices that prevent contamination of foods from toxic chemicals or microbes remains a major public health concern around the globe [1]. According to WHO global burden of foodborne diseases estimates 600 million people, almost 1 in 10 fall ill every year from eating contaminated food and 420, 000 die as a result [2]. Even in developed countries, every year one third of the total population are likely suffered from food borne diseases and from which 70% of the cases are linked with the consumption of contaminated food [3, 4].

The issue of food safety is much more complicated in developing country due to enormous reasons. Poverty is one of the leading causes of consumption of unsafe food attributing to lack of access to adequate food and clean water, poor arrangement in government structural, perpetuating infectious diseases in the community, inconvenient environmental conditions to assure food safety and poor food handling and sanitation practices [5, 6].

Food borne diseases are preventable, if food protection principles are followed from primary production to the level of consumer. However, it is practically unachiev-

able to apply in developing countries. Ethiopia is not exceptional since the prevailing of poor food handling and sanitation practices, inadequate food safety laws, weak regulatory systems, lack of financial resources to invest on food safety, and lack of education and training for food handlers [6].

A study conducted by Todd et al. revealed that most of the food borne outbreaks occurred worldwide are linked to food handlers [7]. According to Sharif & Al-Malki, food handlers' knowledge, attitude and practice are the three key factors that are playing vital role in food poisoning outbreaks [8]. Other studies also came across with a conclusion that knowledge of food handling is significantly related with food handling practices [9-11], whereas, studies done in Bangladesh, India and Nigeria indicated that food handling practices was related with educational status of food handlers [12-14].

Meat handlers have crucial role in controlling food borne pathogens either from contaminated utensils or from the animal itself such as *E. coli* and other pathogens. They may also carry some human specific food borne pathogens like Hepatitis A, Noroviruses, Typhoidal *Salmonella*, *Staphylococcus aureus* and *Shigella* in their hands, mouth, skin, hair and cuts or sores, and disseminate to

the consumer [4]. In Ethiopia very few studies have been conducted on food safety knowledge, attitude and practices of food handlers but none of them were focused to assess the knowledge, attitude and practices of meat handlers [15]. No study has been conducted on food safety knowledge, attitude and practices among meat handlers in abattoirs and meat retail shops in the country [6, 16]. It is also crucial to address the hygienic status of meat production and distribution as such information will be beneficial in designing any preventive strategies and control measures. It also serves as a baseline data for related researches. With the above motives, the objective of this study was to evaluate the level of knowledge, attitudes and practices among meat handlers from a municipality abattoir and retail shops in Jigjiga, Somali National Regional State of Ethiopia.

Materials and methods

STUDY DESIGN AND SAMPLE COLLECTION

A cross-sectional survey was conducted among meat handlers from a municipal abattoir and ten retail meat shops in the Jigjiga town, Somali National Regional State of Ethiopia. Ninety-two meat handlers were interviewed by using structured questionnaire with 100% response rate; however, one questionnaire was filled incomplete during the interview and this questionnaire was excluded from analysis.

All ($n = 92$) workers involved in meat processing in the abattoir and retail meat shops of the town were included in the study and the respondents were interviewed face-to-face on a once-off basis during working hours without prior notice of the interview. Explanation on the purpose of the study was given before and the respondents were assured about the confidentiality of their status. The questionnaire was read and completed by an interviewer in individual interviews. The respondents were given sufficient time (30 min) to answer the questionnaire.

Questionnaire

A structured questionnaire was adopted from previous published research articles in order to meet the objective of this study [17-19]. The language of the questionnaire was translated to the local language (Amharic) in which all the participants can communicate. After pre-testing the questionnaire at a neighbour town (Harar) of the study area with 20 meat handlers the last version was prepared.

The questionnaire structured into four distinct parts including demographic information such as respondents' sex, age, years of experience, responsibility/duty, income, employment status, having health certificate and attending food safety training. The second section of the questionnaire is about food safety knowledge. Questions on knowledge referred to their personal hygiene, cross-contamination, causes and symptoms of food borne diseases, and time temperature control. It contains 22 close-ended questions and each question has three optional answers ("Yes", "No" and "I do not know"). The response

was analyzed as categorical variables (right or wrong answer). A score of one was given to right answer and zero to the wrong and I do not know answer. A scale ranging between 0 and 22 which representing the total number of questions on food safety knowledge. Meat handlers that got overall score ≤ 14 points were considered to have "unsatisfactory" and those scored ≥ 15 points ($\geq 68\%$ accuracy) "satisfactory" knowledge of food safety.

The third part of the questionnaire was about food safety attitude of meat handlers. It comprises 20 questions about hand washing, cross contamination, food handling, storage etc. In this section, the respondents' answers were "agree", "disagree", and "don't know". The response was analyzed as categorical variables (right or wrong answer). A score of one was given to right answer and zero to the wrong and I do not know answer. Each correct answer was given one point whereas incorrect answer including the answer I do not know was awarded zero point. For evaluation, food-handlers that answered 14 or more questions correctly were measured to have "good" attitude whereas respondents answer 13 or less questions correctly were measured to have "poor" attitude.

The last section dealt with food hygiene practices. The question comprises the issues of personal hygiene, hand washing practices, practices against food borne diseases and cross contamination. This section had 20 questions with two possible responses: "yes", and "no". Each correct practice reported scored one (1) point. For evaluation, a score $\geq 70\%$ that means food-handlers practiced 14 or more out of 20 hygienic practices which are listed in the questions was considered as having "good" food hygienic practice [20].

Statistical Analysis

The statistical analyses of the data were performed by using SPSS (Statistical Package for the Social Sciences) software version 20. Descriptive statistics such as frequency (%) for categorical and mean and standard deviation (SD) for numerical data were used to sum up the data. Chi square (χ^2) test was also used to find the relationship between the sociodemographic characteristics with knowledge and practice scores. p -value less than 0.05 was considered statistically significant.

Results

SOCIODEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Sociodemographic profile of respondents is summarized in Table I. Of the 91 respondents participate in this study, 79.1% were males. Those respondents within the age of 31-40 years comprised 36.3% followed by age of 20-30 (31.9%). Average age of respondents was 29.7 ± 5.78 with the minimum age of 16 and maximum 55. Education level of majority of the respondents (52.7%) were at the level of primary followed by considerable number of illiterate (30.8%). Only one person attained tertiary education and the remains (15.4%) were secondary school

Tab. I. Summary of sociodemographic characteristics of respondents (n = 91).

Characteristics	n	%	Mean ± SD	Range
Gender				
Male	72	79.1		
Female	19	20.9		
Age				
< 20	18	19.8	29.7 ± 9.6	16-55
20-30	29	31.9		
31-40	33	36.3		
40	11	12.1		
Level of education				
Illiterate	28	30.8		
Primary education	48	52.7		
Secondary education	14	15.4		
Tertiary	1	1.1		
Field of duty				
Butcher	33	36.3		
Helper	39	42.9		
Cook	17	18.7		
Other (meat inspector)	1	1.1		
Employment status				
Daily bases	52	57.1		
Contract	38	41.8		
Permanent	1	1.1		
Income				
< 1000 ETB	17	18.68	1739.3 ± 681.8	500-3500
1000-2000 ETB	46	50.55		
2001-3000 ETB	27	29.67		
> 3000ETB	1	1.09		
Year of service (experience)				
< 5	42	46.15	6.1 ± 4.2	1-19
5-10	34	37.36		
> 10	15	16.48		
Food safety training				
Yes	1	1.1		
No	90	98.9		
Health certificate				
Yes	1	1.1		
No	90	98.9		

leavers. Monthly income of majority of the meat handlers (50.5%) is in the range between 1000 and 2000 Ethiopian Birr (ETB), which is less than 100 USD per month. Only a single person get more than 3000 ETB and 18.68% monthly income were less than 1000 ETB. About 53.84% of respondents have been working in this sector for 5-10 years and 16.5% have more than 10 years' experience with an average length of 6.1 ± 4.2 years of experience.

FOOD SAFETY KNOWLEDGE

The overall knowledge level of respondents about personal hygiene, cross-contamination, causes and transmission of food borne diseases, and time temperature control of food summarized in Table II. About 78% of respondents have unsatisfactory knowledge level with the mean score of 13.12 ± 2.33 , which is below the cut of point 15 ($\geq 68\%$ accuracy). However, almost all meat handlers were aware of how to clean and sanitize food contact surface (95.6%), and hooks and knives (83.53%). Its also known by almost all (91.21 correct

answer) meat handler about the role of insect and pets in food contamination. Many of the meat handler believe that diarrhea can be transmitted by contaminated meat (93.41 correct answer), and cooking with elevated temperature or freezing as safe method to destroy bacteria (91.21% correct answer). From 91 respondents 89% said people with open skin injury, gastroenteritis, and ear or throat diseases should not be allowed to handle meat. On the other hand, the respondents had least knowledge about the importance of using gloves (41.8% correct answer) and rotation of disinfectants for cleaning (20.9% correct answer), the difference between cleaning and sanitization (42.9% correct answer), time and temperature control (44.8% correct answer) and correct storage temperature (24.2%). Almost no respondents knew about *Staphylococcus aureus* (3.3% correct answer), hepatitis A virus (19.8% correct answer), and *E. coli* (5.5% correct answer) as food borne pathogens. A study conducted by Soares et al. [19] mentioned that 56.6% of the food did not know that *S. aureus* is a pathogenic microorganism that is responsible for food-borne disease.

Tab. II. Summary of meat handlers' food safety knowledge in Jigjiga abattoir and retail meat shops.

	Statements	Response % (n)		
		Right Answer	Wrong answer	Do not know answer
1	Improper handling of meat could pose health hazards to consumers	100 (91)	0 (0)	0 (0)
2	Regular washing of hands before and during meat processing reduces risk of contamination	100 (91)	0 (0)	0 (0)
3	Using gloves while handling meat reduces the risk of contamination	41.8 (38)	26.4 (24)	31.9 (29)
4	Proper cleaning and sanitization of knives and hooks reduce the risk of meat contaminatio.	83.5 (76)	9.9 (9)	6.6 (6)
5	Eating and drinking in the work place increase the risk of meat contamination	15.4 (14)	72.5 (66)	12.1 (11)
6	Washing and disinfection of working surfaces and tools are important for safety of meat	95.6 (87)	4.4 (4)	0 (0)
7	Regular rotation of disinfectants for cleaning can reduce the risk of meat contamination from working surfaces and cutting tools	20.9 (19)	23.1 (21)	56.1 (51)
8	Insects and pests could be a source of contamination to raw meat	91.2 (83)	6.6 (6)	2.2 (2)
9	Diarrhea can be transmitted by food	93.41 (85)	3.3 (3)	3.3 (3)
10	E.coli is one of the food-borne pathogens	5.5 (5)	12.1 (11)	82.4 (75)
11	Hepatitis A virus is one of the food-borne pathogens	19.8 (18)	35.2 (32)	45.1 (41)
12	Staphylococcus is one of the food-borne pathogens	3.3 (3)	13.2 (12)	83.5 (76)
13	Microbes are on the skin, nose and mouth of healthy meat handlers	86.8 (79)	14.3 (13)	2.2 (2)
14	Clean is same as sanitized	42.9 (39)	36.3 (33)	20.9 (19)
15	Cross contamination is when microorganisms from a contaminated meat are transferred by the meat handler's hands or utensils to another	13.2 (12)	26.4 (24)	60.4 (55)
16	The ideal place to store raw meat is in the refrigerator	45.1 (41)	35.2 (32)	19.8 (18)
17	Freezing kills all the bacteria that may cause food-borne illness	51.7 (47)	46.2 (42)	2.2 (2)
18	High temperature or freezing is a safe method to destroy bacteria	91.2 (83)	7.7 (7)	1.1 (1)
19	The correct temperature for storing perishable foods is 5°C	24.2 (22)	18.7 (17)	57.1 (52)
20	Contaminated meat always have some change in color, odor or taste	94.5 (86)	2.2 (2)	3.2 (3)
21	People with open skin injury, gastroenteritis, and ear or throat diseases should not be allowed to handle meat	89.1 (81)	11 (10)	0 (0)
22	The health status of workers should be evaluated before employment	95.6 (87)	4.4 (4)	0 (0)
	Total percentage mean of correct answer	59.3 ± 36.4		

FOOD SAFETY ATTITUDES

Table III summarized food safety attitude of meat handlers. Around 64% of respondents have good attitude about food safety with the mean of total score 14.4 ± 2 . The overall attitudes of the food handlers were favorable with mean of total percentage scores of 71.4 ± 18.8 . They also had good attitudes toward the cons of improper meat storage. Almost all the respondents said washing hands before and during food preparation is mandatory. Meat handlers' attitude towards taking regular training for better meat safety and hygiene practices were satisfactory (89.1%). High percentage (91.2%) of meat handlers were also aware of keeping working surfaces and utensils clean reduces the risk of illness. Beside this 80.2% were believe the fact that surfaces and equipment should be clean before reusing for meat processing. Approximately 87.9% handlers said knives and cutting boards should be properly sanitized to prevent cross contamination, for 59.3% the reason was hooks, knives and cutting boards can be a source of food contamination. About 78% respondents recommend that wearing protective clothing and shoes could help to improve work safety and hygiene practices whereas 68.1% said put-

ting on hair cover on the head is a good practice in food industry. Higher percentage of the surveyed meat handlers (78%) stated that using potable water to wash meat contact surfaces and utensils. Approximately 71.4% respondents in this study also thought sneezing or coughing without covering noses or mouth could contaminate the meat.

FOOD HANDLER'S PRACTICES TOWARDS FOOD HYGIENE AND SANITATION

In assessing food safety practices 20 questions enquired for 91 meat handlers. It was found that almost no respondents (98.9%) maintained food safety practices with the mean total score of 7.7 ± 2.1 . The mean of total percentage scores of safety practices was 38.5 ± 27.3 . Table IV shows food safety practices of meat handlers in the study area. Per the survey result, 69.2% of respondents eat and drink and 65.9% smoke at their work place. Almost no (98.9%) meat handlers use gloves during meat processing. Most of the respondents do not use aprons (55%), hairnet or cap (62.6%) and mask (98.9%) while doing their work. Concerning sanitizer use, 79.1% respondents do not use any sanitizer to wash utensils such

Tab. III. Summary of meat handlers' food safety attitude in Jigjiga abattoir and retail meat shops (n = 91).

	Statements	Responses % (n)		
		Right answer	Wrong answer	Not sure
1	Meat handlers with wounds, bruises or injuries on their hands must not touch or handle meat	98.9 (90)	1.1 (1)	0(0)
2	Using watches, earrings and rings will increase the risk of meat contamination	40.7 (37)	45.1 (41)	14.3 (13)
3	Improper meat storage is dangerous to health	87.9 (80)	12.1 (11)	0 (0)
4	Hand washing before handling meat reduces the risk of contamination	93.4 (85)	6.6 (6)	0 (0)
5	Regular training could improve meat safety and hygiene practices	89.1 (81)	7.7 (7)	3.3 (3)
6	Safe meat handling to avoid contamination and diseases is part of meat handler job responsibilities	75.8 (69)	9.9 (9)	3.3 (3)
7	Keeping working surfaces and utensils clean reduces the risk of illness	91.2 (83)	7.7 (7)	1.1 (1)
8	Using different knives and cutting boards for meat and offal is worth	51.7 (47)	38.5 (35)	9.9 (9)
9	It is unsafe to leave meat out of the refrigerator for more than 2 hour.	68.1 (62)	20.9 (19)	11 (10)
10	Inspecting meat for freshness and wholesomeness is valuable	76.9 (70)	13.2 (12)	9.9 (9)
11	Surfaces and equipment should be clean before re-using for meat processing	80.2 (73)	15.4 (14)	4.4 (4)
12	After processing meat, any leftovers should be kept in a cool place within	44 (40)	14.3 (13)	41.8 (38)
13	Raw meat is healthier and nutritious than cooked	33 (30)	67 (61)	0 (0)
14	Knives, hooks and cutting boards can be a source of food contamination	59.3 (54)	37.4 (34)	3.3 (3)
15	Knives and cutting boards should be properly sanitized to prevent cross contamination	87.9 (80)	12.1 (11)	0 (0)
16	The same towel can be used to clean many places	53.8 (49)	44 (40)	2.2 (2)
17	Sneezing or coughing without covering our noses or mouth could contaminate the meat	71.4 (65)	23.1 (21)	5.5 (5)
18	Wearing protective clothing and shoes could help improve work safety and hygiene practices	78 (71)	19.8 (18)	2.2 (2)
19	Putting on hair cover on the head is a good practice in food industry	68.1 (62)	24.2 (22)	7.7 (7)
20	It is important to use potable water to wash working surfaces and cutting tools after disinfection	78 (71)	22 (20)	0 (0)
	Total percentage mean of correct answer	71.4 ± 18.8		

Tab. IV. Summary of meat handlers' food safety practices in Jigjiga abattoir and retail meat shops (n = 91).

	Food safety practices questions	Responses % (n)	
		Yes	No
1	Do you eat or drink at your work place?	69.2 (63)	30.8 (28)
2	Do smoke inside meat processing areas?	65.9 (60)	34.1 (31)
3	Do you use gloves while handling meat? If no, go to question no. 5?	1.1 (1)	98.9 (90)
4	Do you wash your hands properly before or after using gloves?	1.1 (1)	NA
5	Do you wash your hands before and after handling meat?	40.7 (37)	59.3 (54)
6	Do wash hands after handling waste/garbage?	35.2 (32)	64.8 (59)
7	Do wash hands after using toilet?	86.8 (79)	13.2 (12)
8	Do you wash your hand after smoking, sneezing or coughing?	13.2 (12)	86.8 (79)
9	Do you wear an apron while working?	45.1(41)	55 (50)
10	Do you wash your aprons after each day's work?	30.8 (28)	69.2 (63)
11	Do you wear a mask while working?	1.1 (1)	98.9 (90)
12	Do you wear a hairnet or a cap while working?	37.4 (34)	62.6 (57)
13	Do you wear nail polish when handling meat?	7.7 (7)	92.3 (84)
14	Do you properly clean the meat storage area before storing new products?	74.7 (68)	25.3 (23)
15	Do you use the sanitizer when washing service utensils (knives, hooks and cutting boards)?	20.9 (19)	79.1 (72)
16	Do you replace knives or sterilize them after each meat processing?	14.3 (13)	85.7 (78)
17	Do you remove your work equipment when using toilets?	51.6 (47)	48.4 (44)
18	Do you remove your personal stuffs such as rings, necklaces, watch etc. while processing meat?	79.1 (72)	20.9 (19)
19	Do you handle/process meat when you are ill?	44 (40)	56 (51)
20	Do you handle/process meat when you have cuts, wounds, bruises or injuries on your hands?	50.6 (46)	49.5 (45)
	Total percentage mean of practices	38.5 ± 27.3	

as knives, hooks cutting boards and the floor surface as well. Most of the handlers (86.6%) did not wash hands after smoking, coughing, and sneezing.

Discussion

Unlike other food processing, males most likely involved in meat processing [17, 21]. This is also true for our finding. The mean age of the respondents in this study is lower (29.7 ± 5.78) than the study conducted by Akabanda et al. [20] (41.5 ± 9.5), Soares et al. [19] (43.9 ± 8.4), and Sharif & Al-Malki [8] (43.9 ± 8.4) but higher than Farahat, El-Shafie, & Waly [22] (25.1 ± 9.6). Olumakaiye & Bakare [23] mentioned that food handlers at their older age have better hygienic practice score than their younger colleagues. In our study literacy rate of food handler were much lower than the finding of other studies [20, 21, 24]. However, a previous study indicated that regardless of educational level food safety knowledge was unacceptable that may trigger public health concern [20]. In our finding also there is not significant association between educational status and knowledge level. Lack of training among food handlers have negative consequence on performing behaviors [25], it was found that none of respondents attended training related to food safety except only one meat inspector working in the municipality. Several studies mentioned that food safety trainings should be provided to improve knowledge, attitude and safety practices of food handlers [20, 26].

All (100%) meat handlers have same thought and answer the question correctly about proper meat handling and hand washing which is similar finding to a study conducted by Haapala & Probart [28] reported that most participants gave correct answers for hand washing question. The overall knowledge level of meat handlers in our study area were lower (13.12 ± 2.33) comparing with a study conducted in Camaçari, Brazil schools' food handlers, which reported the mean score of food safety knowledge 16.3 ± 2.6 [19]. Our result also lower than the finding by Jianu [21], Siau [24] and Webb & Morancie [27]. The study conducted by Sani & Siow [29] mentioned that 98.2% of the respondents knew it is necessary to wash hands before processing or handling foods. Knowing the importance of proper handling of meat, proper hand washing and other important hygienic procedures by the meat handlers is very important since meat-handlers can serve as vehicles for cross contamination and spread of foodborne pathogens [30]. According to Xavier, Oporto, Silva, Silveira, & Abrantes [31], proper hand washing among meat handlers have significant impact on reducing threat of diarrheal disease transmission.

Improper temperature in meat processing and storage will also lead to the proliferation of microbes which ensuing to food borne infection and intoxication [32, 33]. Our result agrees with the findings by Baş et al. [9] that many of the respondents unaware of the correct refrigerator temperatures for food storage. Like our finding in

a study by Akabanda et al. [20], 70.6% of food handler did not know/remember that hepatitis A is a foodborne pathogen. The motive of dealing with this question was to know whether the respondents are conscious about it and able to connect with disease outbreaks that occurred throughout the world [34]. Several studies reported isolation of methicillin-resistant *S. aureus* (MRSA) strains from food producing animals, processing plants and food handlers. The cross contamination of meat and its products mainly by infected food handlers at the time of further processing [35]. However, in our study most of the respondents were not aware in this regard. A study conducted in Malaysia reported that 73.4% of food handlers had acceptable knowledge of food borne pathogens [36]. This might be related to food safety training since majority of them (94.3%) attended one or more food safety training. Previous studies show that food safety training increased knowledge regarding food safety issues [37]. Training and education may be an effective tool to increase food safety knowledge among food handlers and thus improve food safety practices [38].

Attitude of meat handlers have key role that may influence food safety practice that helps to decrease the chance of food borne diseases outbreaks. Akabanda et al. [20] mentioned a strong linkage between positive attitudes and maintaining safe food handling practices. About 98.9% meat handlers agreed that a person with wounds, bruises or injuries on their hands must not touch or handle meat and 75.8% believe safe meat handling to avoid contamination and diseases is part of their responsibilities. Our finding was higher than Al-Shabib et al. [18] and Zanin, da Cunha, Stedefeldt, & Capriles [39], 82 and 85% of their respondents were aware of the risk of touching food with cut hands or fingers respectively. Around 53% of the workers thought that same towel can be used to clean many places. This observation divergent with the report by Sani & Siow [29] where 97.4% respondents recommended that use of different clean clothes to wipe different food utensils. Abdul-Mutalib et al. [36] and Al-Shabib et al. [18] did similar observation, where 49% and 40% of respondents use the same towel to clean different utensils respectively.

Personal hygiene practices play vital role to ensure safety of food and safeguard the consumer from food borne infection and intoxication. High percentage (86.8%) of respondents in this study said, they always wash their hands after using toilets. This result is lower than the finding by Soares et al. [19] and higher than Adesokan & Raji [17] who reported around 90 and 78.2% respondents wash their hands after using toilets respectively. About 79.1% of respondents removed personal stuffs such as watches, rings and jewelry during meat processing. Çakiroğlu & Uçar [40] demonstrated similar results that 84.2% indicated that they did not wear jewelry during food production. As per the CAC - Codex Alimentarius Commission [41], improper food handling and poor hand hygiene is the main risk factor in the occurrence of food contamination that leads to food borne diseases. The codex recommended that food handlers should al-

ways wash their hands at every stage of food production to safeguard the consumer from diarrheal and other food borne diseases. Particularly, before handling meat, after eating, smoking, coughing, sneezing, touching garbage and using toilet are critical time the meat handler should wash their hands. Meat handler with open skin injury, gastroenteritis, and ear or throat diseases should not deal with any meat production [41]. In our study, more than half of respondents (56%) handle meat while they are sick or having wounds and cuts. This is a substantial risk involved with the contamination of food by the sick and wounded.

As limitation, assessing hygienic practices would have been better through observational study rather than interview to avoid information bias. Due to this motive, the investigators had designed both observation and interview as sample collection tools. However, the vendors at retail meat shops did not allow any observer while they process meat. On the other hand, we had chance to see how the slaughtering practice looks like in the municipality abattoir.

In our finding regardless of any demographic characteristics, level of knowledge and attitude the hygienic practices by all respondents were much lower than the acceptable level. In our study there was significant association between level of education and knowledge, and knowledge with handwashing at the value of $p < 0.05$. There was association between age group and knowledge though it's not significant. According to Nigusse & Kumie [10] food safety knowledge of food handlers significantly related with food handling practices. Rabbi & Dey [13] indicated that food handling practices was related with educational status of food handlers. Nonetheless, more knowledge does not always lead to positive changes in food handling behaviors [30, 42].

Conclusions

In conclusion, meat handlers had unsatisfactory knowledge mainly on food borne pathogens, time temperature control, cross contamination, and difference between cleaning and sanitation. It may be due to high proportion of illiterate and primary school leaver meat handlers in the study area. Furthermore, no meat handler had taken any food safety training except one meat inspector. Though most of the meat handler have basic understanding and good attitude about personal hygiene, hand washing and proper cleaning, they did not translate into strict food hygiene practices. Therefore, continuous food safety education and hands on training for meat handlers should be given that can enhance good safety practices through better understanding and positive attitude. The last but not the least, the information gained from this study can be utilized to formulate essential safety measure to safeguard the consumer from food borne infection and intoxication.

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Authors' contributions

TH conceived, designed, coordinated and supervised the research project including data collection. PH performed the data quality control, performed the statistical analyses and evaluated the results, wrote the manuscript. Both authors revised the manuscript, gave their contribution to improve the paper and approved the final manuscript.

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