



(RESEARCH ARTICLE)



Meat safety practice and associated factors among butchery workers of Yeka Sub City, Addis Ababa, Ethiopia, January 2023

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Abstract

Meat is animal flesh eaten as food that is safe for consumers when properly prepared and consumed. This study aimed to describe meat safety practice and identify associated factors among butchery workers.

Cross-sectional study using stratified random sampling conducted on 293 proportionally allocated butchery workers at Yeka Sub City, Addis Ababa, Ethiopia.

Butchery workers have a 50.2% rate of practicing meat safety. Males were 68% less likely to practice good meat safety (AOR = 0.32, 95% CI = 0.13–0.80). Those with only primary education were 85% less likely to practice good meat safety compared to those with education above the secondary level (AOR = 0.15, 95% CI = 0.05–0.17). Workers serving fewer than 100 customers per day were 1.82 times more likely to practice good meat safety (AOR = 1.82, 95% CI = 1.06–3.13). Those with satisfactory meat safety knowledge were 2.19 times more likely to practice good meat safety (AOR = 2.19, 95% CI = 1.22–3.94). Workers who had frequent sanitary visits within three months were 2.74 times more likely to practice good meat safety (AOR = 2.74, 95% CI = 1.57–4.77).

Compared to other studies, observed a relatively poor practice of meat safety. Frequent sanitary visits were associated with better practices among butchery workers, indicating the need for strengthened education supplemented by visits from the regulatory agency. Additionally, assigning a separate person to handle money in meat retail shops is essential to improve meat safety practices.

Keywords: Meat; practice; Meat safety; Butchery workers; Yeka sub city; Addis Ababa

1. Introduction

Meat is animal flesh that is eaten as food. Meat safety is the assurance that meat will not cause any harm to the consumer when it is prepared and/or consumed according to its intended use[1].

Fresh meat is a limited shelf-life commodity if not freeze and therefore should be treated with care. The shelf life of fresh meat which is related to the growth of spoilage microorganisms depends on the initial microbial load or contamination, storage time and temperature, the intrinsic properties of the meat (Potential of hydrogen, nutrient content), the degree of processing and handling [2].

People with diseases like HIV/AIDS, tuberculosis, malaria, and other illnesses are vulnerable to the effects of unsafe meat due to compromised immune systems. Ensuring meat safety is crucial to improving their quality of life. Repeated meat-borne diseases can also lead to malnutrition, severely affecting the growth and immune systems of infants and children. [3].

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The main government bodies overseeing meat safety in Ethiopia include the Federal Ministry of Health, Ministry of Agriculture and Rural Development, and Quality and Standardization Authority. MoARD, under Proclamation No. 274 (1970) and Meat Inspection Proclamation No. 81/1976, conducts inspections at export and local abattoirs. The meat inspection mandates require stamped carcasses certified fit for human consumption, with guidelines for disposal of unusable parts(4). In 45% of cases, meat inspection authorities stamp the meat. In Addis Ababa, there's no formal carcass quality classification or premium for stamped items. Packages lack quality information, consumers are unaware of food safety logos, increasing salmonella risks. Discarded meat attracts scavenger birds, creating a vast wasteland [5].

Legal notice No. 25/1943, which is issued under proclamation No.26/1942 and public health amendment proclamation No. 111/1950, prohibits the consumption of foods that have the probability of affecting the health of the public. But in Addis Ababa more than half of butcheries simply keep all meat regardless of the timeframe until it is sold. The safety concerns from pathogens, chemicals, and physical hazards are not continuously controlled [6, 7].

The public health proclamation of Ethiopia, Proclamation number 200/2000 section 12 in its waste handling and disposal section indicated that the proclamation is enacted for the protection of the health of the people and the sanitation of the cities in Ethiopia [8]. But the butcheries in Addis Ababa sometimes sell bones but more frequently simply discard them into the street for stray dogs and disposed of bones to waste containers that leads to environmental pollution and respiratory tract infections [7].

Public Health Proclamation No. 200/2000 requires food packaging to preserve food composition in clean conditions. In Addis Ababa butcheries, meat is often packaged in newspaper pieces stored on shop floors, contrary to guidelines. Raw animal products should be stored between one and four degrees Celsius as per the regulations(8). However, Addis Ababa butcheries are rarely equipped with refrigeration, only 8.8% of the butcheries had refrigerators for nightly storage, 91.2% of the meat was stored at room temperature for an average of two and a half days, with a frequent maximum of five days [7].

In Ethiopia, QSAE sets national standards, but food control is fragmented across multiple bodies, lacking coordination, and with low consumer awareness of food safety. Health inspectors must enforce restrictions and treatment for those with foodborne infections. Regular inspections by sanitary officers of meat premises are essential to ensure compliance with standards in hygiene, equipment, and materials [1].

1.1. Statement of the problem

Globally meat related illness is a growing public health problem because of increasing global trade in meat, changes in the way meat is produced and handled. These changing patterns cause new challenges in the way of meat safety management[9, 10].

In developed countries, up to 30% suffer from foodborne diseases annually, while in developing countries, up to 2 million deaths occur yearly. In the US, contaminated animal flesh causes 70% of food poisoning cases, with diseases like E. coli, Salmonella, and Campylobacter leading to 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths annually [11]. Meat sourced from pork, beef, goat, lamb and other small ruminants are important source of non-typhoidal salmonella species, Shiga toxin-producing Escherichia coli, Campylobacter species, Toxoplasma gondii and Brucella species that are contributing to 34.5% and 23.8% of this illness in adults and children, respectively [12]. Consequently, the economic losses due to foodborne diseases has been estimated \$77billion annually [3].

Risk of food borne diseases is more severe in low and middle-income countries linked to poor hygiene, and inadequate conditions in food production and storage, lower level of literacy and education, preparing food with unsafe water and insufficient food safety legislation or implementation of such legislation [11].

2. Literature Review

2.1. Practice

Meat borne diseases are preventable, if food protection principles are followed from primary production to the level of consumer. However, it is practically unachievable to apply in developing countries. Of the foods consumed by humans, those of animal origin tend to be most hazardous unless the principles of food hygiene practice are employed[6].

Food borne diseases are common in developing countries because of the prevailing poor food handling knowledge and sanitation Practices, inadequate food safety laws, weak regulatory systems, lack of financial resources to invest safer equipment's, and lack of education for food or meat handlers[14].

Mishandling and disregard of hygienic measures on the part of the butchery handlers may enable pathogenic bacteria to meet food in some cases survive and multiply in enough numbers to cause illness in the consumer. The hands of food service employees can be vectors in the spread of food borne diseases because of poor personal hygiene or cross-contamination[15].

Studies done in Gondar, Dangila town, Ethiopia showed that 30.3% and 52.5% of food handlers respectively had good practice of food handling[16, 17]. This is lower than Terengganu, Malaysia 77.7% had good food handling practice[18].

2.1.1. Factors affecting practice of butchery workers

Meat handler's knowledge have crucial role in controlling meat borne pathogens either from contaminated utensils or from the animal itself such as *Escherichia 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 [16].

A study done in Mekelle town, Bahir Dar town (Ethiopia) and Ankara(Turkey) indicated that knowledge of food handling is significantly related with food handling practices [15, 19].

Studies conducted in different countries indicate that 59.3% of butchery workers in Jigjiga Ethiopia [14], 65% in Fars, Iran [20] and 73.4% in Terengganu, Malaysia [18] had satisfactory knowledge of food safety. A study done in Jimma, South East Ethiopia indicated that age, educational background, service year and food safety training taken affect the knowledge of food handlers [21].

Attitude is a measure of degree to which a person has favorable or unfavorable evaluation towards behavior. Person thinking that preparing and handling food hygienically is important and necessary, they are likely intended to engage the behavior[3]. Finding from different countries; 64% in Jigjiga, Ethiopia [14] and 91.7% in Terengganu, Malaysia[18] indicated that butchery workers had positive attitude towards food safety.

Study showed that no differences between food handlers who attended educational course with those who did not[22]. This is supported by a studies done in Brazil and it shows that although training may increase the knowledge of food safety, but it might not always turn out positive change in food handlers attitude [3]. A study conducted in United Kingdom pointed out that knowledge alone is not enough to promote positive attitudes and safe behaviors among food handlers[23]. Similarly, a study done in Malaysia states that attitude scores of the food handlers toward foodborne diseases prevention and control was poor as well as hygiene practices scores were even low[18]. To bring improvement on attitude the requirement of alternative educational strategies such as those based on motivational health education and promotion models are important[23].

A study done in Gondar, Ethiopia where food handlers who attended secondary school (grade 9–12) was 2.91 times higher as compared to those food handlers who were no formal education[17]. A study in central India, Bangladesh, and Nigeria found that butchery workers with lower education levels may struggle with understanding and following strict sanitation practices to prevent meat contamination. Workers with at least a basic education (primary level) generally have better hygiene practices compared to illiterate workers. Educational status significantly influences food handling practices among food handlers [10, 24, 25].

Studies in Mekele and Addis Ababa, Ethiopia indicated that sanitary practice of food and drink establishment workers were significantly associated with the presence of inspection by regulatory bodies respectively[10, 25]. Again, frequent inspection visits of food service establishments supplemented by education is an effective mechanism to improve and maintain sanitary practices of food service workers[16, 26].

A study done in Nigeria and Kenya in 2009 showed that work responsibility was factors affecting food handling practices[10, 24]. Protective clothing is dressed to protect not only meat handlers from injury but also protect the food from contamination. A study in Mekelle, Ethiopia; indicated that 88.7% of butcher workers use protective clothing while selling meat but in Nairobi, Kenya 62.5% of the butchery workers did not use protective clothing while selling meat[19, 27]. Butcher's shops serve as the crucial link ensuring safe meat reaches consumers. Hygienic practices in these shops directly impact consumer health. To operate, shops must obtain licenses confirming adherence to safety standards.

Requirements include adequate space, durable and cleanable surfaces, proper ventilation and lighting, clean utensils stored correctly, and approved methods for waste disposal. [28].

In Ethiopia, uninspected beef, sheep, and goat meat enter formal markets in butcheries without chilling facilities. Meat quality and freshness are affected by storage temperatures. Sheep and goat carcasses sell within a day, while beef may take over two days. Unsold beef is later sold to restaurants at discounted prices [29].

The widespread habit of raw beef consumption is a potential cause for food borne illnesses. Raw meat is available in open air local retail shops without appropriate temperature control. This is purchased by households and minced meat (Kitfo) is served at restaurants as raw, slightly-cooked or well- cooked [30]. Meat retailing shop is one of the food industries that contributed to possible food borne diseases and potential health hazards associated with meat unless the principle of food hygiene practice is implemented. A study done in Mekelle, Ethiopia and south Africa where there is a gap in the awareness of the butchery shop workers on handling of meat and maintaining hygienic status in their working area[19, 31]. This is supported by other study in Portuguese where 37% of the establishment floor is found contaminated by recent and ingrained dirt [32]. A study conducted in Nigeria and Kenya in 2009 showed that type of premise and unclean equipment was factors affecting food handling practices[10, 24].

Animal products such as meats, fish and their products are generally regarded as high-risk commodity in respect of pathogen contents, natural toxins and other possible contaminants and adulterants[33]. Bacterial contamination of meat products is an unavoidable consequence of meat processing. Recent studies on minced meat in Ethiopia reported a high level of indicator organisms as well as foodborne pathogens including methicillin resistant staphylococcus aureus and multi-drug resistant Salmonella species[7].

2.2. Conceptual framework

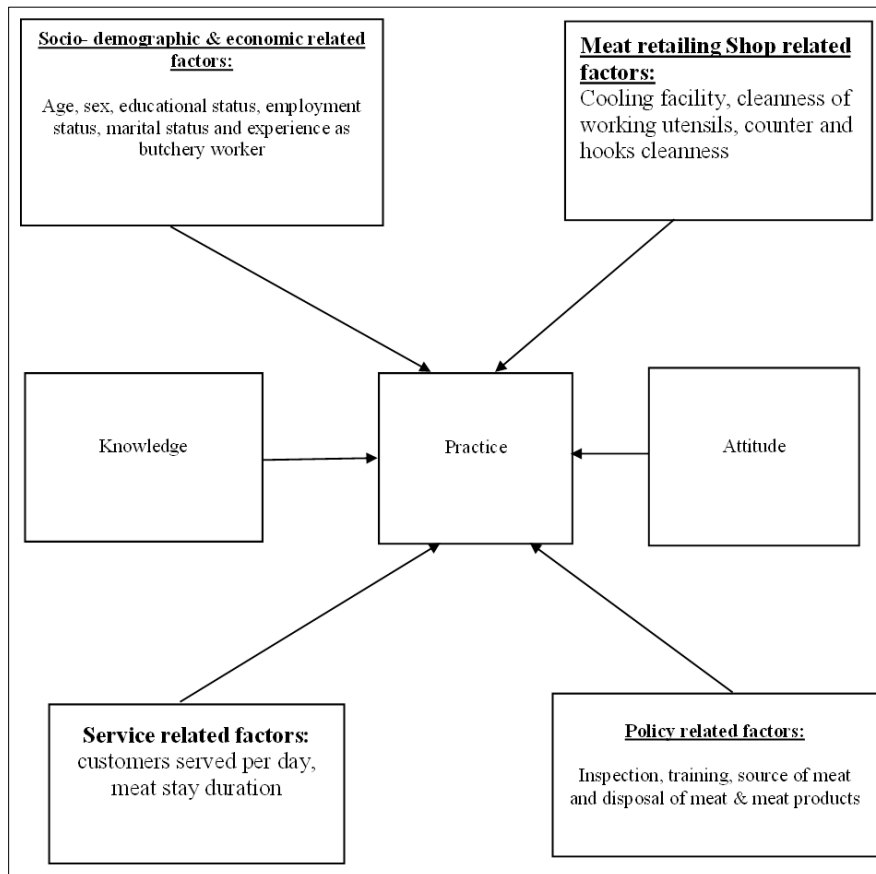


Figure 1 Conceptual framework of variables that can affect practice of butchery workers, January 2022.

This is based on the literatures reviewed [10, 24, 25, 34-36]

2.3. Significance of the study

Studying and explaining meat safety practices among handlers is crucial for consumers to understand how these practices impact meat safety and reduce foodborne illness risks. This research will also guide health workers and multisectoral efforts in promoting community health through evidence-based public health interventions aimed at preventing meat-related illnesses.

2.4. Objective of the study

2.5. General Objective

To assess butchery workers meat safety practice and associated factors in Yeka sub city, Addis Ababa, Ethiopia

2.6. Specific objective

- To determine prevalence of good meat safety practice among butchery workers, Yeka sub city, Addis Ababa, Ethiopia
- To identify associated factors to butchery workers meat safety practice in Yeka sub city, Addis Ababa, Ethiopia.

3. Methods

3.1. Study area and period

Addis Ababa; the capital city of Federal Democratic Republic of Ethiopia has eleven sub cities. Yeka sub city which is one of the eleven sub cities of Addis Ababa is situated at the North East part of Addis Ababa city. Yeka sub city have a total population of 454, 850 and there are 1,088 licensed butchery shops in thirteen woredas of Yeka sub city[37]. The study was carried out from September 05 up to October 02, 2022

3.2. Study design

Cross-sectional study design was applied

3.3. Population

3.3.1. Source population

All butchery workers working in meat retailing shops of Yeka sub city, Addis Ababa.

3.3.2. Study population

Butchery workers working in licensed meat retailing shops whose age greater than 18 years and have work experience of more than two weeks, Yeka sub city, Addis Ababa.

3.3.3. Study unit

Sampled butchery workers working in licensed meat retailing shops, Yeka sub city, Addis Ababa.

3.4. Eligibility/Inclusion and Exclusion criteria/

A participant working in licensed meat retailing shops and aged above 18 were included. A butchery worker who worked for less than two weeks was excluded during data collection.

3.5. Sample size and Sampling Procedure

Two alternatives (single population proportion formula and double population proportion formula using Epi Info V.7.) were utilized to determine the required minimum sample size. The largest figure of the calculation; 305 through single population proportion formula was determined as the minimum sample size in this study.

Sample size using single population proportion (38)

$$n = \frac{(Z_{\alpha/2})^2 * P(1 - P)}{d^2}$$

Assumption:

P= Prevalence of Practice of meat handlers’ food safety in Jigjiga abattoir and retail meat shops, 2017[14]. **D** = Margin of sampling error tolerated 5% (0.05) and **α** = Level of significance (5%).

$$n = \frac{(1.96)^2 * 0.385 (1 - 0.385) = 0.927/0.0025 = 371}{(0.05)^2}$$

by using finite population correction formula since the number of butchery workers is less than 10,000 n_{final} will be

$$n_{final} = \frac{n}{1 + \frac{n}{N}}$$

Where

n_f = final sample size

n = initial sample size using practice.

N = Number of butchery shops in Yeka sub city (1088)

$$n_{final} = 371 / (1 + (371/1088)) = 371/1.34 = 277$$

Table 1 Sample size determination using single population proportion, January 2022

Factor	Proportions	Sample size using single population proportion		
		Initial	n_{final}	Including (10%) of non-response rate because of inaccessibility due to high number of woredas
Practice	38.5%	371	277	305

Sample size using double population proportion formula by associated variables

Age (29 – 34 years) and training were found associated with food hygiene practice.

Assumptions:

Confidence level = 95%

Power = 80%

AOR = 3.457 and 10.27 for age group (29 -34) and training respectively(39).

Percent of outcome among exposed group of age is 32.98% and training is 84.3%(39).

Ratio of exposed to unexposed is 0.22 for age (29 – 34) and 0.16 for training.

The result was calculated using StatCalc of Epi Info V.7 (Table 2)

Table 2 Sample size determination using double population proportion in Epi Info, January 2022

Factor	Percent of outcome among exposed group	AOR	Result of double population proportion (Using Epi Info V.7 software)
Age (29 -34)	32.9	3.457	164
Training	84.3	10.27	281

Table 1 and Table 2 were compared to determine the minimum sample size of 305 individuals needed for data collection using the single population proportion formula. This sample size was proportionally allocated across thirteen woredas in Yeka sub-city. Meat retail shops were selected from each woreda using simple random sampling from the Yeka sub-

city Food, Medicine, and Health Care Administration and Control Authority's list of licensed shops. In shops with multiple workers, one worker was selected via lottery method.

Sub City	List of Woredas	Number of butchery shops in the Woreda	Proportionally allocated sample size per Woreda	Total sample size
Yeka	Woreda 1	57	16	305
	Woreda 2	63	18	
	Woreda 3	45	12	
	Woreda 4	39	11	
	Woreda 5	67	19	
	Woreda 6	81	23	
	Woreda 7	49	14	
	Woreda 8	65	18	
	Woreda 9	84	24	
	Woreda 10	109	30	
	Woreda 11	140	39	
	Woreda 12	172	48	
	Woreda 13	117	33	

Figure 2 Schematic presentation of sampling procedure to select butchery workers, January 2022

3.6. Data collection procedures and measurements

In Woreda 8 of Bole sub-city, a questionnaire was pre-tested using 5% of the determined sample size. The sequence of questions was adjusted, and sensitive questions were removed. Data collection involved eight trained diploma health extension workers and two clinical nurse supervisors using structured questionnaires and observation checklists. They received one-day training on study objectives, questionnaires, bias prevention, and interview techniques to establish trust. The researcher coordinated data collection. Attitudes were assessed with 14 Likert-scale questions, categorized as Positive (80%-100%), Neutral (59%-79%), or Negative (<59%) based on scores. Meat safety knowledge and practice were evaluated similarly, with scores determining satisfactory or unsatisfactory levels.

3.7. Study Variables

Set of variables used in this study were: -

Dependent Variables: - Practice of butchery worker

Independent Variables

- Socio demographic and socio economic: Age, sex, marital status, experience as butchery worker educational status, employment status,
- Knowledge of butchery worker
- Attitude of butchery worker
- Service related: customers served per day, meat stay duration
- Meat retailing shop related: cooling facility, working utensils, counter & hooks cleanness
- Policy related: training, source of meat, disposal of meat products, Inspection.

3.8. Operational definition

- Butchery worker: - A person who cut, process and pack meat in meat retailing shops
- Cooling facility: Butchery shops having a functional refrigerator of snow room or temperature gauge reader which will keep cool inside so that meat will stay safe for more than a day.
- Frequent sanitary inspection: butchery workers who are getting sanitary visits at least once within three months interval.

- Safe disposal of meat products: Disposal to waste collection containers, burial or burning of unconsumed meat and meat products.
- Inspection: Is assessing or examining butchery workers, meat and meat retailing shops to make sure that it meets specific standards set by controlling authorities
- Meat safety attitude: - attitude of butchery workers will be classified into Positive Attitude (80%-100%), Neutral Attitude (59% -79%) and Negative Attitude (Less than 59%) based on bloom's cut off points[18].
- Meat safety knowledge: - Butchery worker who got overall ≤ 6 (<70%) scores out of 10 questions will be considered having "unsatisfactory" and those scored ≥ 7 ($\geq 70\%$) considered as "satisfactory" meat safety knowledge[14].
- Meat safety practice: - Butchery worker who score $\geq 75\%$ that means meat handlers practiced 9 or more out of 12 questions will be considered as having "good" meat handling practice whereas respondents practiced 8 or less (<75%) questions correctly will be considered to have "poor" meat safety practice[18].
- Safe meat stay duration: - the average time that meat will remain safe at room temperature (kept to the maximum of 4 hours at room temperature) or when it is kept in the refrigerator having a freezing room or controlled freezing (kept to the maximum of a month).
- Source of meat: meat retailing shops meat source for retailing. Meats distributed from central government butchers will be confirmed by its stamp or recite received during meat receiving.

3.9. Data analysis procedure

Data were collected, checked, coded, and entered into Epidata 3.1, then analyzed in SPSS version 21. Bivariate and multivariable analyses used logistic regression to show relationships between outcome and independent variables. Variables with p-values ≤ 0.25 in bivariate analysis were included in multivariate regression ($p < 0.05$ considered significant). Results were presented using odds ratios, 95% confidence intervals, texts, graphs, and tables.

3.10. Data quality management

Data collectors and supervisors were trained on study objectives, bias sources, and interview techniques using a standardized Amharic questionnaire. Daily checks ensured completeness, consistency, and protocol adherence. I conducted random supervision to maintain sampling integrity. Data were cleaned, coded, and analyzed using EPI data version 3.1 and SPSS version 21, correcting errors and checking for outliers.

3.11. Ethical consideration

Ethical clearance was obtained from Jimma University ethical review board. Participants were informed about the study's purpose, and verbal consent was obtained. Confidentiality was maintained throughout the research

3.12. Dissemination

The findings of the study were presented to Jimma University, Yeka sub city administration FMHACA and other governmental and non-governmental stakeholders. Based on the findings, it will also be disseminated to different stakeholders that will have a contribution for implementation of the recommendations.

4. Results

4.1. Socio demographic and socio-economic characteristics of study participants

A total of 293 butchery workers were interviewed and included in the analysis with 96% response rate. Two hundred sixty-five (90.4%) of respondents were male with mean (\pm SD) age of 26.6 (6.1) years [Table 3].

Table 3 Socio demographic and socio-economic characteristics of butchery workers working in meat retailing shops of Yeka sub city, Addis Ababa December 2022 (n= 293)

Sociodemographic Characteristics	Frequency	Percent (%)
Sex		
Male	265	90.4
Female	28	9.6
Age (Years)		
18 - 24	116	39.6
25 - 34	148	50.5
≥35 years	29	9.9
Marital status		
Single	143	48.8
Married	129	44.0
Divorced and Widowed	21	7.2
Work experience		
Less than six months	48	16.4
Six months up to two years	195	66.6
Two to four years	41	13.9
More than four years	9	3.1
Educational status		
No education	25	8.5
Elementary school (Grade 1 - 8)	112	38.2
Secondary school (Grade 9 - 12)	134	45.7
Above secondary school (above grade 12)	22	7.5
Employment status		
Daily basis	44	15.0
Contract	178	60.8
Owner	71	24.2

4.2. Knowledge level of butchery workers

One hundred ninety-nine (67.9%) of butchery workers have satisfactory meat safety knowledge.

Table 4 Assessment result of butchery workers knowledge towards meat safety in meat retailing shops of Yeka sub city, Addis Ababa December 2022 (n = 293)

Statement	Response (In number and Percent)	
	Correct answer	Incorrect answer
Hand and knife hygiene prevent meat contamination	284 (96.9)	9 (3.1)

Consumption of under cooked or un cooked meat leads to meat borne illness	85 (29)	208 (71)
Proper cleaning and sanitation of cutting boards, utensils, and countertops is very important in meat safety	288 (98.3)	5 (1.7)
Microbes are on the skin, nose or mouth of healthy meat handlers	65 (22.2)	288 (77.8)
Insects and pests could be a source of contamination to raw meat	255 (87)	38 (13)
Contaminated meat always has some change in color, odor or taste	287 (98)	6 (2)
People with open skin injury, gastroenteritis, ear or throat diseases should not be allowed to handle meat	155 (52.9)	138 (47.1)
The health status of workers should be evaluated before employment	289 (98.6)	4 (1.4)
The ideal place to store raw meat is in the refrigerator and freezing kills bacteria that may cause meat-borne illness	164 (56)	129 (44)
Meat handler with disease such as diarrhea, bleeding and sore throat poses a risk of meat contamination	264 (90.1)	29 (9.9)
Total butchery workers who have satisfactory knowledge		199 (67.9)

4.3. Attitude level of butchery workers

Two hundred one (68.6%) of butchery workers have positive attitude towards meat safety.

Table 5 Assessment result of butchery workers attitude toward meat safety in meat retailing shops of Yeka sub city, Addis Ababa December 2022 (n = 293)

Statement	Response in number and Percent		
	disagree	uncertain	Agree
Improper meat storage is dangerous to health	3 (1)	2(0.7)	288(98.3)
Hand washing before handling meat reduces the risk of contamination	1(0.3)	2(0.7)	290(99)
Regular training could improve meat safety and hygiene practices	4(1.4)	37(12.6)	252(86)
Safe meat handling to avoid contamination and diseases is part of meat handler job responsibilities	9(3.1)	29(9.9)	255(87)
Keeping working surfaces and utensils clean reduces the risk of illness		5(1.7)	288(98.3)
Inspecting meat for freshness and wholesomeness is valuable	4(1.4)	14(4.8)	275(93.9)
Surfaces and equipment should be cleaned before re-using for meat processing		10(3.4)	283(96.3)
Knives, hooks and cutting boards can be a source of meat contamination			293(100)
Knives and cutting boards should be properly sanitized to prevent cross contamination			293(100)
The same towel cannot be used to clean many places	71(24.2)	112(38.2)	110(37.5)
Sneezing or coughing without covering our noses or mouth could contaminate the meat	0	33(11.3)	260(88.7)
It is important to use potable water to wash working surfaces and cutting tools after disinfection	10(3.4)	19(6.5)	264(90.1)
Putting on hair cover on the head is a good practice in meat processing	71(24.2)	84(27.1)	138(48.1)
Wearing protective clothing and shoes could help improve work safety and hygiene practices		25(8.5)	268(91.8)

Total butchery workers who have positive attitude	201 (68.6)
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4.4. Training and sanitary inspection

Majority; 86% reported as not received any training on meat safety. From those who took the training; 56.1% were less than one year after attended the training. One hundred seventy-eight (60.8%) of the respondents had got sanitary visits with in three months interval by the regulating agency. Fifty-one (17.4%) of meat retailing shops were not supervised (Table 4).

Table 6 Training and inspection status of butchery workers working in meat retailing shops of Yeka sub city, Addis Ababa December 2022 (n= 293)

Variables	Frequency	Percent (%)
Training		
Yes	252	86.0
No	41	14.0
Sanitary regulation by the regulatory team		
Yes	178	60.8
No	115	39.2
Frequency of regulation		
up to three months	178	60.8
3-6 months	57	19.5
6 months up to one year	7	2.4
Not yet supervised	51	17.4

4.5. Meat retailing shops

One hundred eighty-six (63.5%) of meat retailing shops have a cooling facility in their meat retailing shop. Near to three fourth of (73.4%) meat retailing shops meat stay more than two days after receiving for retailing. Out of which 43.9% of meats were sold by mixing with new arrivals. More than three fourth; 266 (77.1%) of meat retailing shops disposed of remaining meat and meat products on nearby waste collection sites (Table 7).

Table 7 Availability of cooling facility, meat stay duration and option for more than two days of meat stay in meat retailing shops of Yeka sub city, Addis Ababa December 2022 (n= 293)

Variable	Frequency	Percent (%)
Cooling facility		
Yes	107	36.5
No	186	63.5
Meat stay duration		
Less than or equal to one day	78	26.6
Greater than or equal to two days	215	73.4
Option for meat stay more than two days		
Those who sell to restaurants by lower price	83	38.6
Those who sell it by mixing with new arrivals	93	43.3
Those who disposed of, sell for dog and cat consumption by lower price	39	18.1

Disposal of remaining meat and meat products		
Nearby waste collection sites	226	77.1
Dispose in open surface	45	15.4
Removal through burning and burial	22	7.5

4.6. Meat source of butchery shops

Two hundred sixty-six (90.8%) of the respondent's meat source were from government slaughterhouses and only 9.2% were self-slaughtering.

4.7. Practice of butchery workers

Half of; 50.2% of butchery workers have good meat safety practice (Table 8).

Table 8 Assessment result of butchery workers practice towards meat safety in meat retailing shops of Yeka sub city, Addis Ababa December 2022 (n = 293)

Statement	Response (In number and percent)	
	Correct answer	Incorrect answer
Hand washing before meat cutting	154 (52.6)	139 (47.4)
Wear of protective cloths during working	288 (98.3)	5 (1.7)
Hairnets wear during working	96 (32.8)	197 (67.2)
Drinking or smoking in a work place	215 (73.4)	78 (26.6)
Avoiding of nail polish, rings and or watches during meat handling	151 (51.5)	142 (48.5)
Use of sanitizer to wash the service utensils	240 (81.9)	53 (18.1)
Use of dry clothes or clean tissues to dry washed service utensils after cleaning	85 (29.0)	208 (71.0)
Change of uniform cloths daily or immediately as it is contact with bad things	263 (89.4)	31 (10.6)
Hand wash after toilet in work place	287 (98)	6 (2.0)
Hand wash option	236 (82.2)	51 (17.8)
Management option of illness & injury	291 (99.3)	2 (0.7)
Use of pest control devices	223 (76.1)	70 (23.9)
Total butchery workers who have good practice	147 (50.2)	

4.8. Observation result

One-time observation was conducted and almost all; 285 (97.3%) of butchery workers wear working cloth or apron. Out of which 166 (56.7%) had worn a clean working cloth. One hundred fifty (51.2%) of meat retailing shops handle meat and money by the same operator (Figure 3).

More than half; 150 (51.2%) of cutting tables were composed of innocuous material which does not have pluck during meat cutting and chopping.

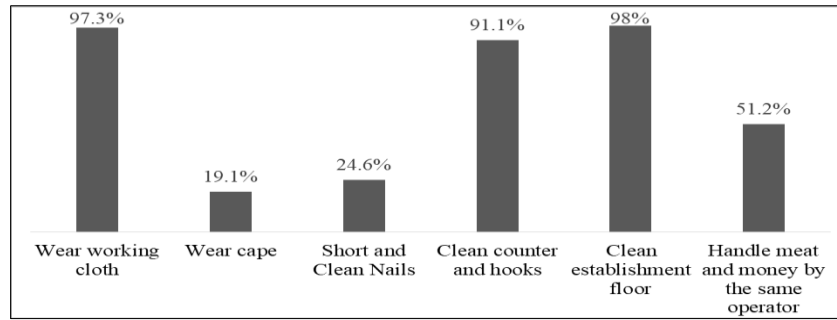


Figure 3 Observation result of butchery workers practice and meat retailing shops in meat retailing shops of Yeka sub city, Addis Ababa, December 2022 (n = 293)

4.9. Factors associated with practice of butchery workers

On bivariate logistic regression analysis; sex, marital status, educational status, employment status, customers served per day, meat source, disposal of remaining meat and its products, cooling facility, frequent sanitary visits, knowledge and attitude were found associated with butchery workers meat safety practice. Sex, level of education, customers served per day, frequent sanitary visits and knowledge were associated with butchery workers meat safety practice on multivariate analysis.

Table 9 Factors associated with practice of butchery workers working in meat retailing shops of Yeka sub city, Addis Ababa, December 2022 (n = 293)

Variable	Practice		COR (95% CI)	AOR (95% CI)	P
	Good	Poor			
Sex					
Male	127	138	0.37 (0.16, 0.87)	0.32(0.13, 0.80)	0.016*
Female [1]	20	8	1	1	
Level of Educational					
No formal education	12	13	0.21 (0.05, 0.78)	0.28 (0.07, 1.18)	0.08
Primary (1-8)	46	66	0.15 (0.05, 0.49)	0.15 (0.05, 0.17)	0.002*
Secondary (9-12)	71	13	0.25 (0.08, 0.78)	0.22 (0.07, 0.25)	0.013*
Above secondary (> 12) [1]	18	4	1	1	
Customers served per day					
≤100	99	76	1.9 (1.18, 3.05)	1.82 (1.06, 3.13)	0.030*
100 – 200 [1]	48	70	1	1	
Frequent sanitary visits					
Yes	109	69	3.20 (1.96, 5.23)	2.74 (1.57, 4.77)	0.001*
No [1]	38	77	1	1	
Knowledge					
Satisfactory	118	81	3.27 (1.94, 5.50)	2.19 (1.22, 3.94)	0.009*
Unsatisfactory [1]	29	65	1	1	
Attitude					
Positive	109	92	1.68 (1.02, 2.78)	1.15 (0.65, 2.03)	0.621
Neutral [1]	38	54	1	1	

*Variable association with meat safety practice of butchery workers on multi variable analysis

5. Discussion

The result indicated that mean age of respondents was lower than a study done in Jigjiga, Ethiopia [14] and higher than Mekele, Ethiopia [19]. This might be because of differences in demographic characteristics of study participants.

Lower than this study finding; meat handlers had less satisfactory knowledge of food safety in Jigjiga, Ethiopia [14] and Fars, Iran [20]. The difference might be because of variation of educational status and limited food safety training attended status of study participants in both studies. This study finding is lower than a study done in Malaysia [18]. As indicated in previous studies, this might be related to food safety training since majority of the study participants of Malaysia attended one or more food safety training [18].

Attitude of meat handlers have important role to decrease meat borne diseases and outbreaks. The finding from this study was close to a study done in Jigjiga, Ethiopia [14] and significantly lower than Terengganu, Malaysia [18]. This might be because of the difference in demographic characteristics of study participants.

In this study finding; half of butchery workers had good practice of meat safety. This is close to a study done in Dangila Town, Ethiopia [16] and markedly higher than a study in Gondar, Ethiopia [17] and lower than Terengganu, Malaysia [18]. The difference might be because of different demographic characteristics of respondents and provision of frequent visits by the abattoir heads respectively. Males had 68% less likely to have good meat safety practice as compared to Females. Similar with this study finding; A study in Ankara, Turkey [40] indicated that females have better food handling practices as compared to males. Against with this study; males have a better practice of compliance with abattoir laws than females [18]. This might be because of difference in gender composition of the sample size.

Butchery workers who have; primary level of education 85% and secondary level of education 78% less likely to have good meat safety practice as compared to above secondary level of education. This is similar with a study done in North West Ethiopia [39] where food handlers who attended secondary school (grade 9–12) was higher level of food handling practice as compared to those food handlers who were no formal education. Like this study finding; studies done in Bangladesh, India, Ghana, and Nigeria indicated that the low level of education of butchery workers could make it difficult for them to comprehend and adhere to strict sanitation and hygienic meat handling practices necessary for prevention of microbial contamination of meat [17, 18, 22].

In this study finding; butchery workers who had satisfactory knowledge of meat safety were 2.19 times more likely to have good meat safety practice as compared with those who did not have satisfactory knowledge of meat safety. This is in line with other studies [16, 41] in which food safety knowledge of food handlers significantly related with food handling practices.

Butchery workers who serve hundred and less customers per day were 1.82 times more likely to have good meat safety practice as compared to those who serve more than hundred customers per day. This might be because of their overwhelmed engagement and focus in serving customers rather than applying hygiene and sanitation practices for safe handling of meat. Regular or routine inspections should be conducted to provide enough information to butchery workers on meat hygiene practices, and to support legal action in case of violation of some food laws and guidelines [5]. In this study finding; butchery workers who got frequent sanitary visits with in three months interval were 2.74 times more likely to have good practice of meat safety than those who did not get. Similarly, on other study in Mekele, Woldia, and Addis Ababa, Ethiopia; sanitary practice of food and drink establishment workers were significantly associated with the presence of inspection by regulatory bodies [19, 26, 42]. Again, frequent inspection visits of food service establishments supplemented by education is an effective mechanism to improve and maintain sanitary practices of food service workers [17, 26]. This is in line with the Ethiopia food and nutrition policy that have a need to strengthen the capacity of the regulatory agencies at national, regional, local levels and ports through skilled and trained human power, equipment, laboratory facilities and other required inputs [43].

In this study butchery workers have a good protective clothing practice than a study conducted in Mekelle, Ethiopia and Nairobi, Kenya [19, 27]. This might be because of the frequent sanitary inspection visits provided by the regulating agency here in Yeka Sub City of Addis Ababa. Contrary to this wearing hair nets were less practiced than a study in Mekelle, Ethiopia [19].

Money harbor potentially pathogenic bacteria and fungi that may pose a public health risk. In this study finding; lower than other studies conducted in Isiolo and Nairobi, Kenya [27] meat and money handled by the same operator. This might be because of the frequent sanitary inspection visits provided by the regulating agency.

A strength of this study was its use of various tools to gather data, providing insights into butchery workers' practices. This study fills a gap in the literature for Addis Ababa, serving as a foundational resource for planning environmental health activities in meat retail shops.

A limitation is that the study focused only on licensed meat retail shops. Given that customers may not distinguish between licensed and unlicensed shops, future research should assess the knowledge, attitudes, and practices of butchery workers in unlicensed shops.

Abbreviations/Acronym

- ABH: Alliance for Better Health
- AOR: Adjusted Odds Ratio
- COR: Crude Odds Ratio
- E.C: Ethiopian Calendar
- FAO: Food and Agriculture Organization of the United Nations
- FMHACA: Food, Medicine, Health Care Administration and Control Authority
- G.C: Gregorian Calendar
- HIV/AIDS: Human Immunodeficiency Virus Infection and Acquired Immune Deficiency

Syndrome

- lb.: Libra (A pound by weight)
- MoARD: Ministry of Agriculture and Rural Development
- No.: Number
- QSAE: Quality and Standardization Authority of Ethiopia
- SD: Standard Deviation
- USDA: United States Department of Agriculture
- WHO: World Health Organization

6. Conclusion

In this study, the main source of meat for meat retailing shops was central government slaughterhouses, ensuring safe meat distribution for human consumption. Overall, butchery workers demonstrated practice levels above fifty percent regardless of demographic characteristics. Compared to other studies, higher knowledge levels, similar attitudes, and poor meat safety practices were observed. Butchery workers showed unsatisfactory knowledge concerning raw meat's role in foodborne illness, microbial presence on healthy handlers, and health conditions affecting meat handling. This suggests limited training on meat safety. Despite satisfactory knowledge and positive attitudes towards hygiene and cleaning, adherence to practices like wearing hairnets and handling money varied. Butchery workers generally followed good practices in protective clothing and handwashing but showed poor adherence to hairnet use and changing contaminated uniforms promptly. Sanitary visits every three months significantly improved meat safety practices, influenced by factors like gender, education, daily customer interactions, and knowledge levels.

Recommendation

Butchery workers should apply their knowledge and attitudes by wearing hairnets, keeping nails short, and having a separate person handle money. As a researcher, I recommend meat retail shop owners assign dedicated individuals for money handling to prevent disease-causing bacteria. This requires follow-up by Yeka sub-city's FMHACA regulatory agency.

Yeka sub-city's FMHACA should increase the frequency of sanitary visits to ensure compliance with standards and educate butchery workers on meat safety principles and personal hygiene rules. This will enhance their meat handling practices, ensuring consumers consistently receive high-quality, safe meat. FMHACA should collaborate with local media to educate and improve butchery workers' understanding of safe meat handling.

Given the varied knowledge, attitudes, and practices among butchery workers in shops where meat often stays for over two days, future research should include microbiological analysis of meat samples. It should also focus on unlicensed meat retail shops for similar studies.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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