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Isolation and Identification of *Escherichia coli* from Raw Meat of Cattle and Possible Source of Contamination in Haramaya Univerity Slaughterhouse, Eastern Harerge, Ethiopia

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Abstract: A cross sectional study was conducted from November 2014 to April 2015 on apparently healthy slaughtered cattle in Haramaya University Slaughter House to isolate *Escherichia coli* (*E. coli*) from carcass of cattle and other possible source of contamination in Haramaya University slaughter house. A total of 160 different samples were collected including fecal contents, carcass and environment sample slaughter house worker's hand, knife and cutting board equally for each 32 samples were collected and *E. coli* and *E. coli* O157: H7 were identified by the method slightly modified to ISO-16654 (2001). Out of 160 different samples examined, the overall prevalence of 34.75 % (comprising of 43.75%, 28.13%, 37.5%, 37.5% and 25% of fecal contents, carcass swab, table swab, knife swab and worker hand swab samples respectively) had positive results for *E. coli* and the overall prevalence of 4.375% (comprising of 12.5%, 0%, 3.125%, 0% and 6.25% of fecal contents, carcass swab, table swab, knife swab and hands swab samples respectively) had positive results for *E. coli* O157:H7. There was no statistically significant difference ($P > 0.05$) among the different samples; however, the highest results were in fecal sample for *E .coli* and *E. coli* O157:H7. This study has also attempted to cast light on features about the knowledge, attitudes and practices of slaughter staff's pertaining food safety and general hygiene in questioner form and observational survey. The results indicated that there were poor personal and general hygiene measures in place and that the workers not focus on hygienic practice. All of slaughter house workers did not take job related training and acquired their respective skills from observations and 70% of them had only a primary school education.The presence of *E. coli* O157:H7 in raw meats reaching to consumers indicated possible risks of infection to people through the consumption of raw and cross contamination of other food products. Therefore, control measures at all stages of food chain was recommended.

Key words: Carcass · Environments · *E. coli* · *E. coli* O157:H7 · HU · Slaughter house

INTRODUCTION

Food-borne pathogens are one of the leading causes of illness and death in the world. They place heavy burden costing billions of dollars in medical care, social costs and overall economic and infrastructure effects of countries [1]. Trends in foodborne illness in the industrialized and developing countries indicate that the incidence of food-borne illness is increasing. Centers for Disease Control and Prevention [2] estimated that 76 million people get sick, more than 300, 000 are hospitalized and 5, 000 die each year from foodborne illness in USA. However, the disease has significant social and economic impact in the developing countries, due to major contributing factors such as overcrowding, poverty, changes in eating habits, mass catering, complex and lengthy food supply procedures with increased international movement, inadequate sanitary conditions and poor general hygiene practices [3].

Access to a nutritionally adequate and safe food supply has long been regarded as a basic human right or, at least, an aspiration. Among the foods capable of meeting such a need, meat has a highly important part to play throughout the world. Over the last 20 years, contaminated raw or undercooked meat products have been shown to be a critical link in transmitting more than 200 known zoonotic diseases [4]. The emergence of major food-borne pathogens such as *Escherichia coli* and

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Salmonella have persisted as a major public health concerns [5]. For this reason, any sector that work on meat production and consumption need to ascertain its microbiological and hygienic qualities of beef in order to prevent any public health hazard have paramount importance. The microbiology of red meat and poultry is determined by conditions which the animals are reared, slaughtered and processed. The most critical stage for meat contaminations are the slaughter procedures [6].

A wide range of microorganisms coming from different sources are introduced to surfaces which contain abundant nutrients and which have high water availability. Predominance of different groups of micro-organisms on meat depends on the characteristics of the meat, the environment in which meat is stored [7]. *Escherichia coli* O157:H7 have frequently been linked to a number of human illness [8]. This pathogen is uniquely adapted to the conditions established by meat production and distribution systems and may easily be introduced into slaughter houses by farm animals that harbor them, by meat handlers or pests [9]. The slaughter process contributes to the prevalence of pathogen contamination of the carcass and cross contamination between infected and uninfected carcass [10].

Escherichia coli (*E. coli*) are Gram-negative, facultative anaerobic rods that belong to the family Enterobacteriaceae. These organisms were identified and confirmed by their colony morphology and biochemical characteristics. Serological differentiation is based on three major surface antigens: O (somatic), H (flagella) and K (capsule). The K antigen descriptor has been dropped often and only the H and O are commonly employed as descriptors of serotypes [9]. Under refrigeration conditions, E. coli strains do not grow, but can survive for weeks at 4°C or -20°C and grow at temperatures that range between 7 and 46°C with optimum growth at 37°C. The minimum water activity for growth of this microorganism is 0.95 [11] and growth can occur in 0 to 4% sodium chloride and 0 to 400 μg of sodium nitrite per milliliter [12].

Enterohaemorrhagic *E. coli* (EHEC) is the only group that has a definite zoonotic origin, with cattle recognized as the major reservoir for human infection. Other strains of *E. coli* commonly found in the normal microflora of mammals and birds. But, certain strains such as serotype O157:H7 have been associated with gastrointestinal diseases in both humans and animals [13]. Enteropathogenic *E. coli* such as serotype O157:H7 is the most common cause of post diarrheal hemolytic uremic syndrome [14]. The organism does not survive well outside of the intestinal tract. The presence of E. coli in the environment is therefore considered as evidence of recent contamination with mammalian or avian feces [15]. High prevalence of *E. coli* O157:H7 has been reported in fecal samples and the importance of meat as potential sources of human *E. coli* O157:H7 infection [16]. Therefore, the contamination source of *E. coli* O157:H7 in retail raw meat is likely to be insufficient hygiene during slaughter and transportation [17]. Considerable in slaughter houses, the maintenance of slaughter hygiene and regular microbiological monitoring of carcasses are essential tools in minimizing the risk of contamination. Such risks especially exist when other species with lower prevalence of contamination are slaughtered at the same slaughtering line or stored at the same premises as those with higher predisposition to contamination [17].

In Ethiopia, cattle is widely used meat species for human consumption and little is about the microbiological safety and quality of its meat for human consumption. Few previous studies conducted some parts of the country indicated the occurrence of pathogens including *E. coli* O157:H7 in different food of animals, meat and meat products. Also, out breaks of infections related with poor hygiene and consumption of contaminated food were reported in Ethiopia caused by *E. coli* [18]. The widespread habit of raw beef consumption is a potential cause for foodborne illnesses besides the common factors such as overcrowing, poverty, inadequate sanitary conditionsand poor general hygiene slaughterin process. The primary contamination of the meat surface of healthy animals is decisively influenced by the abattoir environment and the condition of the animal. The objectives of the study were: To isolate and identify *E. coli and E.coli* O157:H7 from cattle carcass swab, fecal content and environmental sample (worker's hand, knife and cutting table) at Haramaya University slaughter house. Also, to identify potential sources of contamination of carcass at Haramaya University slaughter house and assess slaughter house worker's knowledge, attitudes and practices towards slaughtering hygiene.

MATERIALS AND METHODS

Description of Study Area: The study was conducted from November 2014 to April 2015 at HU slaughter house. HU is located in the Eastern Hararghe Zone of the Oromia Region of Ethiopia, which are about 511 kilometers from Addis Ababa and 17 kilometers far from the city of Harar and 40 kilometers from Dire Dawa and 5 kilometers from Haramaya town an altitude of 1980 meters above sea level

between latitude 9° 26" N and longitude 42° 3" E. The mean annual rainfall is 870 mm with a range of 560 1260mm and the mean maximum and minimum temperatures are 23.4°C and 8.25°C, respectively [19].

Sampling Unit and Study Population: The study population represents apparently healthy cattle which brought from different origin in to Haramaya slaughter house. Both local and cross breeds cattle are reared in and around the study areas for meat production mostly. In HU slaughter house varies from 5-20 cattle were slaughtered per day depending on the needs of student cafeteria, staff lounge and the days of the weak. The study samples were included raw carcass swab, fecal and environmental pooled swab samples (slaughter house worker's hand, knife and cutting tables).

Study Design: A cross-sectional study design applying the combination of Hazard Analysis and Critical Control Point (HACCP) frame work and Codex Alimentarius Commission microbiological risk assessment was conducted. The study was aimed to identify *E. coli* microbial hazard potential points of carcass contamination may occur in the raw meat from slaughter house. The study was conducted isolation and identification of *E. coli* from fecal, meat and meat contact surface and hygienic quality of meat samples draw from Haramaya University slaughter house. In addition descriptive and observational study was introduced by checklist and questioner survey on food handlers working at food establishment, to determine the hygienic status of the premises and safety practices of meat handlers.

Sample Size Determination: The sample size required for this study to identify the presence of food-borne *E. coli* and *E. coli* O157:H7 in raw carcass at HU slaughter house was determined according to Thrusfield [20]. By taking expected prevalence of 3% in HU slaughter house [21] and the absolute precision was decided to be 5% at 95% confidence level, the required sample size for the present study were calculated 45 samples. But, to increase the precision 115 samples were added and totally 160 sample were collected.

$$n = \frac{1.96^2 \; x \; P_{exp}(1 - P_{exp})}{d^2}$$

where:

n = The required sample size

P_{exp} = Expected prevalence

d = Desired absolute precision.

Table 1: Types and Number of sample collected

Sample types	Unit/sample	Number of sample
Carcass surface (meat) swab	400 cm^2	32
fecal content	10ml	32
Workers' hand swab	2 hands	32
Knife swab	2 side	32
Cutting tables	400 cm^2	32
Total		160

Sampling Strategy: Based on the number of animal each day's slaughtered at Haramaya University slaughter house the samples were allocated proportionally. A total of 64 samples (32 Carcass swab and 32 fecal samples) were collected using simple random sampling from the cattle population slaughtered on each visit to Haramaya University slaughter house. Environmental samples were collected from abattoir worker hands, table cutting and knife for each equally 32 samples were collected, by rubbing of thoroughly with moistened swab. To determine the hygiene conditions and practices of slaughter house 20 workers from Haramaya University slaughter house were interviewed in the study period.

Questionnaire Survey: Observation and interview were made to obtain information about the hygienic condition of the abattoir, retails and workers in relation to meat processing. During first visit, a list of all the food handlers and personnel working in food establishments were prepared. The subsequent visits, questionnaire were used to collect the demographic details of the food handlers; information related to personal hygiene, personal habits and only the bosses were interviewed for hygienic status of the abattoir and procedures practiced in abattoir. The questionnaire also assessed the individual's knowledge about prevention of food borne illnesses, food hygiene and attitude towards measures for control and prevention of food borne illnesses. An observational checklist was used to assess environmental hygiene, cleanliness of food and food handling practices during each visit. The questions were constructed in English, but during the interviews, the interviewers were translating the questions into the preferred language of the respondent, which was included: Amharic and Afan Oromo. The slaughter house and sanitary worker were included in the study and the respondents were interviewed on a once-off basis during working hours with no prior notice of the interview. Explanation on the purpose of the study was given before and the respondents were also assured about the confidentiality of their status.

Sample Collection Procedure and Transportation

Carcass Sampling: During each visit, different sites of the carcass swab were collected as described in International standard organization (ISO-17604) [22].

For each sampling area, sterile cotton tipped swab fitted with shaft was moistened in an approximately 9 ml of buffered peptone water was rubbed first horizontally and then vertically several times across the carcass surface. On completion of the rubbing process, the shaft was broken by pressing it against the inner wall of the test tube. The four swab samples were collected and transported to Haramaya University Microbiology Laboratory in a cool box with frozen gel packs for microbiological analysis.

Fecal Sampling: The fecal sample was collected immediately after evisceration from cecum contents of slaughtered cattle; an aseptic incision was made with surgical blade in the cecum to obtain a representative sample of the fecal content. The fecal material was aseptically compressed and the resultant liquor decanted in sterile universal bottle (10ml), labeled, transported on ice box to the laboratory with held in a cold storage and placed into sterile stomacher bags, homogenized in a stomacher for 2 minutes [23]. Then put 1ml of liquid fecal sample in the 9 ml buffer peptone water and incubate at 37 °c for 24 hours.

Environmental Sampling: At each slaughter visit, three types of environmental samples were collected by swabbing the worker's hand, knives and cutting tables) by rubbing of thoroughly with moistened swab. For knives, composite samples were collected from the blade and handle of the knives. The samples were then returned to a test tube containing 9ml sterile buffered peptone water. All samples were transported to the Haramaya University Microbiology Laboratory in an ice box on ice packs and incubated for 24 hours at 37°C and continued next steps of microbiological analysis.

Isolation and Identification of *E. coli* and *E. coli* O157:H7: The *Escherichia coli* O157:H7 detection was carried out according to the protocol of ISO-16654 [24] standard. The pre-enriched (buffered peptone water) collected samples were incubated at 37°C for 24 hours. Then subsequently sub-cultured onto Eosin methylene blue (EMB) agar for primary screening of E. coli and incubated at 37°C aerobically for 24 hours. Suspected colonies of *E. coli* (showing good growth of dark blue-black colonies with metallic green sheen indicating vigorous fermentation of lactose and acid production which precipitates the green metallic pigment) was then sub-cultured onto nutrient agar (non-selective media) and confirmed by Triple Sugar Iron (TSI) and IMViC (Indole, Methyl red, Voges-proskauer, Citrate utilization) tests on tryptone broth (Oxoid, England), MRVP medium (Oxoid, England) and Simmon citrate agar (Oxoid, England), respectively. Then the bacterium that was confirmed as *E. coli* was sub-cultured onto Sorbitol MacConkey agar (Oxoid, England) from nutrient agar (Himedia, India). Sorbitol MacConkey agar plates were incubated at 35°C for 20 to 22 hours [25]. *Escherichia coli* O157:H7 unable to ferment sorbitol. Therefore, they produces colorless colonies. In contrast, most other *E. coli* strains ferment sorbitol and form pink colonies.

Statistical Analysis: The data collected through questionnaire survey and laboratory results of the collected samples were coded and entered in to databases using Micro-Soft Excel computer program and then analyzed using SPSS (SPSS version-19.0) statistical computer software programs. Descriptive statistics were used to describe the nature and the characteristics of the questionnaire survey result. The overall prevalence of *E. coli* and *E. coli* O157: H7 in all samples was determined by dividing total positive samples to the total number of samples examined and multiplied by 100. In addition to these, the prevalence in each sample type was determined in the same way by dividing positive value with corresponding total examined samples. Difference among between different sample type results was determined by chi square (χ^2) test. The p-value <0.05 was considered indicative of a statistical significant difference using 95% confidence interval.

RESULTS

Isolation and Identification of *E. coli* and *E. coli* O157:H7: Out of the total of 160 different samples examined, 55 (34.75%) were positive for *E. coli* and 7(4.375%) were positive for *E. coli* O157:H7. Of these result, 14 (43.75%) and 4 (12.5%) *E. coli* and *E. coli* O157:H7 respectively from fecal contents. The result of isolated *E. coli* and *E. coli* O157:H7 swab sample (table swab, Hand swab, knife swab, meat swab) are listed in the (Table 2).

Table 2: Isolation of *E. coli* and *E. coli* O157:H7 from fecal, carcass and environmental Sample

		E. coli positive		*E. coli* O157:H7 positive			
Sample type	No of sample Examined	Frequency	Percent (%)	Frequency	Percent (%)	χ^2	P-value
Table swab	32	12	37.5	1	3.125	3.325	0.505
Hand swab	32	12	37.5	2	6.25		
Knife swab	32	8	25	0	0		
Meat swab	32	9	28.13	0	0		
Feaces	32	14	43.75	4	12.5		
Total	160	55	34.375	7	4.375		

(χ^2) Chi-Square; P-value=Pearson

Table 3: Educational Status of Meat Handler's in Haramaya University Slaughter House

Factors	Values	Frequency	Percentage (%)
Educational status	Illiterate	2	10
	Grade 1-8	14	70
	Grade 9-12	4	20
	Collage	0	0
Occupation in	Butcher	14	70
	Meat inspector	1	5
	Sanitary	3	20
	Other	1	5
Experience	<1 year	7	35
	2-5 years	9	45
	6-10 years	3	15
	10< years	1	5
Job related training	Yes	20	100
	No	0	0
Meat processing skill	Observation	16	80
	Parents	4	20
	Formal training	0	0

Hygienic Practices in Haramaya University Slaughter House

Design and Facility: According to abattoir, cutting and packing plant standard [26] abattoir wall, floor, ceilings, windows, doors, lighting, air conditioning/ventilation, services and equipment must be constructed to withstand and facilitate thorough cleaning and minimize contamination of product. However, HU slaughter house premise has not well designed and constructed structure to satisfy the systematical animal slaughter process and the general requirement and standards. In Haramaya University slaughter premises clear division of slaughtering process into stunning, bleeding, skinning and evisceration have not existed. Horizontal bleeding on killing floor was conducted. The slaughterhouse personnel interviewed to assess the hygienic conditions in the abattoir responded that adequate potable water problem is not their concern and supply for their activities only through pipe water; but hot water, knife sterilizer and retention room not existed. The slaughter house had communal latrine with poor management. In general, Haramaya University slaughter house have no mechanism of ensuring sanitation standards, proper waste disposal mechanism and vermin's and scavenger's protection mechanisms. Therefore, there is opportunities of contamination of slaughter facilities which in turn contaminate the exposed tissues of the carcass with microorganisms.

The Knowledge, Attitudes and Practices of Abattoir Workers at Abattoir and Butchers: It is important to know the educational background, type of employment in the abattoir and how the meat handler acquired their skills to establish their knowledge in handling meat safely. All the respondents in abattoir were employed on a temporary basis which makes it difficult to train the staffs. When assessments on the literacy level the personnel working on food establishment, some of butcher men attend school. In the abattoir few abattoir worker are obtained their skills from their parents, while most of the respondents were taught themselves through visual observation. Training about hygiene during handling of meat is very important. None of the respondents indicated that they had received training on hygienic practices. The 80% of the worker received the skill by observation and the left 20% by parent and no formal training for the worker. Most of the worker educational level elementary school which means 70%, only 20% of the respondent learned to high school and while 10% of them were uneducated (Table 3). More details on worker's knowledge, attitudes and practices of abattoir workers in relation to important parameters that potentially can influence the quality and reason for carcass contamination summarized in (Table 4).

Hygienic Practices and Status of the Meat Processing Environment at Slaughter House: The observational study and face to face interview result in HU slaughter houses indicated that the animal brought to slaughter house from the farm by simply selecting the animal in the night at 10 PM without prior ant mortem inspection was

Table 4: Summary of worker's attitude, knowledge and practices towards hygiene in HU slaughter house

Factors	Value	Frequency	Percent (%)
Cleaning of knife	Before work	4	20
	End of work	13	65
	When excessively soiled	1	5
	Between work	2	10
Manner of cleaning knife	Using soap	0	0
	Water only	20	100
Cleaning floor	Before work	1	5
	End of work	4	20
	Between work	13	65
	When excessively soiled	2	10
Sanitary regulatory system	Yes	3	15
	No	17	85
Smoke cigarette	Yes	7	35
	No	13	65
Wash hand	Yes	11	55
	No	9	45
Manner of washing hand	Using soap	3	15
	Water only	8	40
	Not wash	9	45
Used Protective clothe	Yes	14	70
	No	6	30
Protective clothe	Always	2	10
	Usually	10	50
	Sometimes	2	10
Hair cover	Usually	0	0
	Rarely	4	20
	None	16	80
Gumboots	Yes	15	75
	None	5	25
Jewelry	Worn	2	10
	Not worn	18	90
Finger nails	Short polished	12	60
	Short not polished	6	30
	Long polished	1	5
	Long not polished	1	5
Smoke cigarette	Yes	7	35
	No	13	65
When Smoke cigarette	Before work	0	0
	End of work	0	0
	Between work	6	30
	At break time	1	5
	Not smoke	13	65

done and without fasting of the animal for 12 to 24 hours before slaughter which increase the micro floral load. In general the pre slaughtering process in HU slaughter house is far beyond the acceptable measure, the animal encountered stressful handling during riding on foot from the Haramaya University farm to Haramaya University slaughter house in the night sometimes they even suffered fracture and excitement. In addition these pre slaughter stressful conditions facilitate the rapid multiplication and shading of *E. coli* O157:H7. This could be the major source of contamination of meat.

Direct observations revealed the absence of hot water, sterilizer and carcass retention room in the slaughter house. During slaughtering equipment's are placed on unclean surfaces. Knives were placed on the floor, on the skin of killed and in the anus of a slaughtered

animals. All reported that they use a single knife for cutting meat and edible offal. The protective clothes were unclean, blood tinged and frequently in contact with carcasses. Veterinary meat inspectors were always present in the slaughter house for inspection. However, all of the workers placed their equipment on dirty surfaces during their work and they washed them in bucket water instead of flowing water.

Assessment on the procedures and frequency of cleaning and disinfection of the equipment in slaughter house is important. The result indicated that, the procedures of cleaning and disinfection of the surface, a notably low percentage and the respondents indicated that predominantly running water was used to clean the surfaces. Majority of them cleaned their knives whenever they were excessively and visibly soiled with fat or blood before the commencement of work each day.

The respondents were also questioned on the frequency of cleaning and disinfection of the working surfaces. Almost all respondents reported that the surfaces were cleaned before the commencement of work each day. Washing the hands before handling meat is practiced by only 55% of the interviewees and 80% of the worker did not used hair cover at work (Table 4) and 45% of the worker did not wash hand before start work. Most of the worker not uses protective cloths. These all cause carcass contamination in slaughter house. The personal hygiene practice of slaughter house worker reason for carcass contamination during slaughtering which is summarized in (Table 4).

DISCUSSION

Mostly pathogenic *E. coli* of human infections have been recognized to be from food products with animal origin [27]. Domestic ruminants mainly, cattle, sheep and goats, have been established as major natural reservoirs for *E. coli* and play a significant role in the epidemiology of human infections [28]. In previous study of HU slaughter house; the overall prevalence of carcass contamination with *E. coli* species in the slaughtered animals was (30.97 %) and (2.65%) *E. coli* O157:H7. In the present study over all (34.75%) were positive for *E. coli* and 7(4.375%) were positive for *E. coli* O157:H7, which is higher than prevalence reported in Haramaya university slaughter house. This might be due to reducing strict hygienic measures taken in Haramaya University slaughter house, different sampling techniques and laboratory methodologies. Additional the overall prevalence *E. coli* on the surface of catting table, cutting knife and butcher hand from butcher shops of Mekelle city was (32%) reported by Endale and Hailay [29], which compared similar with my result means (33.33%).

Many studies determined the prevalence of *E. coli* O157:H7 on cattle carcasses which were from 0.0% to 27.8% was reported by Chapman *et al*. [30] and Abong'o and Momba [31]. The prevalence of *E. coli* (28.13%) isolated from carcass in this study was in close agreement with the reported prevalence (24.48%) in Dire Dawa Municipality abattoir [32]. These differences could be ascribed to the differences in the hygienic statuses of the abattoirs. Furthermore, sampling techniques employed and laboratory methodologies used might also account for the variation in such different setups and times.

Of the sample types taken from each worker during this study period, slaughter house worker hand palm samples proved to be useful indicators of infection *E. coli* 0157:H7. The prevalence distribution *E. coli* and *E. coli* O157:H7 of isolate was 37.5% and 6.25% in slaughter house worker hand palm in Haramaya university slaughter house respectively, which is lower than 13.33.0 % of *E. coli* O157:H7 prevalence reported by Ayalew *et al.* [33] in Jijiga municipal abattoir. In Mekelle city the prevalence of *E. coli* from butcher hand worker was 25% was reported by Endale and Hailay [29], which was lower than my result. This might be due to hygienic practice and number of sample.

In present study 25% *E. coli* prevalence from knives obtained is the same with the 25 % prevalence of knives study in Mekele city butcher shop house by Endale and [29]. The prevalence of *E. coli* O157:H7 on surface of knife in municipal abattoir of Jijigatwon (6.67%) was reported by Ayalew*et al.* [33], which was higher than my result (0%). These differences might be due to be due to the differences in the hygienic statuses of the abattoirs.

The isolation of *E. coli* in fecal contents of slaughtered cattle is of significance in food safety as this can easily result in contamination of carcasses and edible organs. In this study prevalence of *E. coli* and *E. coli* O157:H7 in fecal contents were (43.75%) and (12.5%) respectively, which was less than in previous reported in Nigeria 25.63% of *E. coli* O157:H7 by Akanbi and Kerry [34]. This difference might be due to sample method, farming, slaughter regimes, area and transportation of animals.

There was no statistically significant prevalence variation of the pathogen noted among different sample analyzed in the present study, though, much more data need to be collected to determine whether it is real or simply an artifact of limited sampling. However, in this

study slightly higher isolation rate (43.75%) and (12.5%) *E. coli* and *E. coli* O157:H7 were respective observed in feces incomparison with sample from meat swab samples (7.8%) and (0%) and environment samples (33.33%) and (3.125%) *E. coli* and *E. coli* 0157:H7 respectively. This could be associated with stress from stunning method used which increases the shedding of *E. coli* with feces. This seems to be quite logical as the main source of contamination is the feces of the animal which found its way to the surface of the carcass due to poor hygienic conditions during slaughtering and environmental sanitation of the slaughter house under study. Thus the isolation of *E. coli* in fecal contents of slaughtered cattle is significant in food safety as this can easily result in contamination of carcasses and edible organs.

A hygienic practice is the major concern of the slaughterhouse but still has poor practice. Basically, hygienic status of dressed carcasses is largely dependent upon the general slaughter house hygiene and the skills of the workers. Slaughterhouse workers play a role in carcass contamination during the slaughter process. Of more importance to avoid carcass contamination are their level of knowledge, attitude and practices towards hygiene. In the present study 70% of slaughter house workers had only a primary school education. Surprisingly all of slaughter house workers and butchers 100% did not have job related training as regards to food hygiene but acquired their respective skills from observations. The results are in agreement with reports of Mekonnin *et al* .[35] and Endale and Hailay [29] who reported a primary school education and lack of job relating trainings in more than half of the slaughter house workers and butchers in Mekele city, Ethiopia. Food handlers should be trained in the basic concepts and requirements of food and personal hygiene as well as those aspects particular to the specific food-processing operation [36].

The slaughtering process was unhygienic and unsanitary. There was no hot water, sterilizer, soap and retention room and equipment's rest on dirty surfaces and as well as dressing is done on floor and the floor was not disaffected only rising with water. This could cause high carcass contamination with different foodborne pathogens unless it is solved. At slaughter area, the slaughter processes are done in the same area without separate dirty and clean zone. Thus, still can make cross contamination. Workers have less concern on hygienic practice from observation and interview. From the survey conducted, 45% of the respondent doesn't wash their hand and 40% wash their hand by water only. This clearly indicates that slaughter staff's negative attitude towards hygiene. Personal and general hygienic practice is extremely vital to ensure production of safe food to consumers [37].

CONCLUSIONS

This study showed that slightly higher isolation rate of *E. coli* from fecal of slaughtered cattle than environmental sample examined. In addition, the results showed the risk of this pathogen to consumers due to unhygienic meat processing most commonly practiced in Haramaya University slaughter house. The presence of *E. coli* is being reported for all sample types (fecal contents, carcass swab and environmental samples) with slightly higher occurrence in fecal, which is possibly the key source of microbial contamination of the cattle meat. In genera the poor sanitary conditions during meat processing appear to highly contribute to carcass contamination by *E. coli* and *E. coli* O157:H7. This study has also attempted to cast light on features about the knowledge, attitudes and practices of slaughter staff's pertaining food safety and general hygiene. The results indicated that there were poor personal and general hygiene measures in place and that the workers not focus on hygienic practice.

In light of the above conclusions the following recommendation are forwarded:

- Abattoir facilities such as adequate supply of potable water, hot water and other disfectants should be fulfilled.
- Training of slaughter personnel should be given to ensure that all workers including management take ownership of hygiene practices during animal slaughter and during further processing.
- There should be separated room for stunning, dressing, evisceration and the animals should hanging before slaughter after stunning.
- Control measures to reduce the public health risk arising from *E. coli* cattle meat chain needs to be addressed at abattoir level by reducing carcass contamination at various stages of the slaughter process.
- Detailed inspections and monitoring of slaughter houses for meat hygiene; handling and sanitary practices should be a priority as an immediate intervention.
- The manager of the abattoir should be professionals who well equipped with the concept of food quality and food safety.

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