International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG(USA) Volume 5, Issue 10 - 2018

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2018.05.10.014

Escherichia coli O157:H7: Prevalence, Identification and Antimicrobial Resistance in Cattle Slaughter at Addis Ababa Municipal Abattior, Ethiopia

Muhammed Hamid[1], Yalew Tefera[3], Tadese Eguale[2] and Yalelet Worku[3*]

[1]College of Veterinary Medicine, Samara University, P.O.BOX, 132, Semera Ethiopia
[2]Aklilu Lemma Institute of Pathobiology, Addis Ababa, Ethiopia
[3]School of Veterinary Medicine, Wollo University, Dessie, Ethiopia
[*]***Corresponding Author:*** **Yalelet Worku,** School of Veterinary Medicine, Wollo University, Dessie, Ethiopia
E-mail: *yaleletworku@yahoo.com*

Abstract

Escherichia coli O157:H7 is recognized as an important cause of diarrhoea hemorrhagic colitis and haemolytic-uremic syndrome worldwide. Meat, meat products, dairy products, vegetables and drinking water contaminated with animal faeces are probably the major sources of *Escherichia coli* O157:H7 infection. A cross sectional study was conducted from October to April 2006 E.C. at Addis Ababa Abattoir with aim of to investigate the prevalence and antimicrobial drug resistance of *Escherichia coli* O157:H7. The samples used for this study research were 186 faecal samples were collected from cattle slaughtered at Addis Ababa Municipal Abattoir for prevalence investigation. For isolation and identification of *Escherichia coli* O157:H7 strain isolates 186 faecal samples, 25 carcass swab samples and 3 waste water samples were used for culturing on different medias. Culturing on of these samples on different microbial Medias was conducted used for isolation and identification of *Escherichia coli* O157:H7. From a total 186 faecal samples 6.4% (n=12/186) were positive for *Escherichia coli* O157:H7, 12% (n=3/25) of carcass samples were positive and 33.3% (n=1/3) water samples were positive. A total of 16 *Escherichia coli* O157:H7 positive isolates (12 from faecal, 3 from carcass swaps and 1 from waste water were used for antimicrobial susceptibility testing on 18 antimicrobial drugs. The isolated strains were 100% susceptible to amikacin and gentamicin. Multidrug resistance (MDR) to two or more drugs was detected in 75% (n=12/16) of the strains. In conclusion the occurrence of *E. coli* O157:H7 strain and *the presence of* antimicrobial resistant strains indicate as there may be a risk for the consumers' health. Thus, rational use veterinary drugs in livestock production. So based on the data reported by this study it is advisable to carry out large scale research works on the area of meat hygiene and pharmaco-epidemiological surveillance in food animals.

Keywords: Antimicrobial resistance, cattle, *E. coli* O157:H7, isolation, prevalence, Addis Ababa Municipal Abattoir, Ethiopia

Introduction

The causes of food-borne diseases in human often follow the consumption of contaminated food-stuffs especially from animal products such as meat from infected animals or carcasses contaminated with pathogenic bacteria (Nouichi and Hamdi, 2009; Pal, 2012). Among the different zoonotic pathogenic bacteria that have different serotypes are *E. coli*, *Salmonella* and *Camplylobacter* species (Humphrey

and Jorgensen, 2006; Pal, 2007). *E. coli* O157:H7, is one of the serotype strain that *E.coli* species has (Pal, 2007). Domestic and wild animals are the sources of *E. coli* O157, but the major animal carriers are domesticated ruminants, primarily cattle and, to lesser extent, sheep, and possibly goat (Sima *et al*., 2009; Kiranmayi *et al*., 2010; Rahimi *et al*., 2012a). Outbreak of human cases due to *E. coli* O157 have been linked to beef meat and raw milk and also other dairy products, vegetables, unpasteurized fruit juices and water (Sima *et al*., 2009). There are also traceable links between human infection and ruminant faeces via water or direct contact (Licence *et al*., 2001; Strachan *et al*., 2001), and evidence that contact with animal faeces is a strong risk factor for sporadic *E. coli* O157:H7 infection (Locking *et al*., 2001). Red meat animals can be infected or carry a wide range of microorganisms, which are potentially pathogenic for man (Pal, 2012). The enteric habitat of *E. coli* in animals provides easy access to animal-derived meats at slaughter and at points downstream in the food production process (Olatoye e*t al*., 2012). Possible contamination of edible carcass tissue is the most significant challenge to food safety, and the extent and nature of such contamination are related to the *E. coli* O157:H7 status of the pre slaughter animal, and any processes which distribute the organism within or between carcasses during dressing operations (McEvoy *et al*., 2003). Antimicrobial resistance has emerged in the past few years as a major problem and many programs have been set up for its surveillance in human and veterinary medicine. These programs are aimed mainly at human pathogens, agents of zoonoses, and indicator bacteria of the normal intestinal flora from animals. However, little attention has been paid to the resistance in specific animal pathogens (Lanz *et al*., 2003). Limited studies on the ecology of *E. coli* O157:H7/NM have been reported, particularly from developing countries (Rahimi and Nayebpour, 2012). The magnitude of the public health burden due to resistant food borne pathogens is complex and is influenced by a number of variables such as antimicrobial use practices in farming, process control at slaughter, storage and distribution systems, the availability of clean water, and proper cooking and home hygiene, among others (WHO, 2000). The major concern on the public health threat of food borne illness is infection by antimicrobial resistant strains that lead to more intractable and severe disease (Helms *et al*., 2002; Martin *et al*., 2004). This situation is further complicated by the potential of resistant bacteria to transfer their resistance determinants to resident constituents of the human microflora and other pathogenic bacteria (Olatoye *et al*., 2012). Several studies have suggested that foods might be a source of human acquired antimicrobial-resistant *E. coli*. The food supply is an established vehicle for certain other antimicrobial resistant and/or pathogenic bacteria including *E. coli* O157:H7 (Oliver *et al*., 2011; Rahimi and Nayebpour, 2012). In developing countries of the world, where there is still an alarming rate of insanitary conditions, malnutrition and poor health facilities, there is an urgent need to study this organism and its characteristics with an aim to reduce the human hazard caused by this emerging pathogen (Isibor *et al.,* 2013). It might seem paradoxical to discuss on the subject of food safety when millions are suffering from lack of food and of the most inferior quality. In Ethiopia at a national level however, both food shortage and lack of appropriate food safety assurance systems are problems that have become obstacles to the country‟s economic development and public health safety (FAO/WHO, 2007; Ayalew *et al*., 2013). Food borne diseases commonly occur without being reported and Ethiopia is no exception. The lack of vigorous surveillance of food pathogens in Ethiopia meat and meat products presents a challenge for risk-based approaches to improve food safety, as it becomes difficult to demonstrate the magnitude of contamination with this pathogen. However, in the presence of this situations, little is known about the prevalence, distribution and associated virulent genes of *E. coli* O157: H7 in in foods of animal origin in Ethiopia (Hiko *et al*., 2008; Mersha *et al*., 2010; Taye *et al*., 2013). In this study for isolation and identification of *E. coli* serotype culturing method on different Medias were used such as sorbitol MacConhkey (SMAC) agar, cefixime-SMAC agar or SMAC agar supplemented with cefixime and tellurite (CT-SMAC) with subsequent stereotyping. Accurate diagnosis of EHEC O157 infections requires the isolation of the pathogen to clarify the aetiology of disease and the infectiousness of patients as well as to allow sub-typing of strains for epidemiological purposes. Thus, the objectives of this study were to estimate the prevalence of *E. coli* O157:H7 from faecal samples of cattle slaughtered at *E. coli* O157:H7, to isolate and identify *E. coli* O157:H7 serotype from samples taken from cattle faeces, carcass swab and water and also to determine the antimicrobial susceptibility pattern of *E. coli* isolates at Addis Ababa Municipal Abattoir.

Materials and Methods

Study Area

The study was carried out at Addis Ababa Municipal Abattoir which is located in the capital city of the Federal Democratic Republic of Ethiopia. Addis Ababa has an area of 51,000 hectare in the central highlands. Its altitude ranges from 2000-2560 meters above sea level .The area is characterized by bimodal rainfall with an average of 1100 mm, the highest percentage of rain falls is during the long rainy season from June to September. The short rainy season is from February to April. Its annual average minimum and maximum temperature are 10.7^0c and 23.4^0c, respectively (ENMSA, 2003).

Addis Ababa Municipal Abattoir was established in 1956. The types of species of animals slaughtered in the abattoir are bovine, ovine, caprine and swine. The source of these animals is from different part of the country. The main purpose of the abattoir are processing of fresh meat for human consumption, hygienic processing and storage of meat and edible by products, exercise close control over environmental condition at all stages of processing and break down the transmission of meat borne disease through meat inspection. In this abattoir on average daily 700 cattle, 250 sheep and 75 goats are slaughtered and 153,000 cattle, 39,000 sheep, 3200 goats and 750 pigs are slaughtered annually.

Study population

The study animals were cattle brought from different parts of the country especially around Addis Ababa. Cattle of different age groups, mainly male and local breed cattle slaughtered at Addis Ababa abattoir were included in the study.

Study design and sample size calculation

A cross sectional study design was conducted to estimate the faecal prevalence and antimicrobial resistance test on the isolated *E coli O157:*H7 strains from cattle slaughtered at the abattoir.

The required sample size of the study animal is determined by the formula given by (Thrusfield, 2005) with 95% of confidence interval and 5% desired precision level.

$$N = \frac{1.96^2 \times P_{exp}(1 - P_{exp})}{d^2}$$

Where:-
N=number of sample size
P_{exp}=expected prevalence
d^2=Absolute precision
CI=Confidence interval (95%)

Expected prevalence of 4.2% reported by (Hiko *et al*., 2008) was used

Based on this $N = \frac{(1.96)^2 \times 0.042\ (1-0.042)}{0.05^2} = 62$

Therefore the minimum sample size was 62 but in order to increase the precision three fold of the minimum sample size was taken 186 of animals were used for the study.

Sampling strategy and sample collection

Systematic random sampling technique was employed while selecting animals to collect faecal samples from the total number of cattle presented and slaughtered Addis Ababa Municipal Abattoir on daily basis. During ante-mortem examination, the associated risk factors such as age, sex, breeds, body condition, and origin of cattle were assessed and recorded in data recording book prepared for this study. The cattle were grouped into three age groups: young (<2 years), young adult (3 – 6 years) and adult (> 6 years). Body condition score was made according to Nicolson and butter worth and recorded as poor, medium and good (Nicolson and Butterworth, 1986).

Then faecal samples were collected from cattle and collected by using sterile universal bottles. The 25 carcass swabs from 25 slaughtered cattle were collected by using 25 screw cupped test tube containing 10 ml of sterile bacteriological peptone samples. All the collected samples brought to the ALIPB microbiology laboratory using in a cool box with frozen gel packs within twenty four hours of sampling for microbiological analysis. In addition to this, three water samples (10ml) were collected from the bucket of water which was used for knives and carcass.

Study methodologies

Isolation and identification: Immediately after arrival in ALIPB microbiology laboratory, 1gm of faecal sample was suspended into 9 ml of modified tryptone soya broth supplemented with novobiocin (Oxoid) (10 mg/l). Then samples were vortexed and incubated for overnight at 37°C. After selective enrichment, 50µl of

product was streaked onto sorbitol MacConkey agar (Oxoid) and the plates incubated at 37°C for twenty-four hours. Up to six colourless colonies (non-Sorbitol fermenters) were picked and separately sub-cultured on MacConkey agar (Oxoid) for twenty-four hours at 37°C for purification. After overnight incubation, the purified and intensely red colonies with a pale periphery were tested for indole production (Oxoid) and indole forming isolates were seeded onto non selective media (nutrient agar) for serological confirmation. The indole test was carried out by inoculation one colony into 4ml of tryptone soya broth (Oxoid), using a straight inoculation wire. Incubation was done for overnight at 37°C. After this one drops of indole reagent were added to the tryptone soya broth culture to test for indole production (red ring-positive). Then they were tested with *E. coli* O157 antibody-coated latex and control latex) according to the procedures recommended by the manufacturer (March and Ratnam, 1986). All the 25 carcass swab and water samples subjected to similar tests for bacteriological analysis as faecal samples.

Antimicrobial susceptibility testing: The Antimicrobial susceptibility test of 16 isolates were performed according to the National Committee for Clinical Laboratory Standards (NCCLS, 2008) method using Kibry-Bauer disk diffusion test on Muller-Hinton agar (Oxoid CM0337 Basing stoke, England). The isolated *E. coli* O157:H7 strains were tested for antibiotic resistance to 18 antimicrobial agents obtained from Oxoid. The selection criteria of antibiotics testing discs depended on the regularly use of antimicrobials in the ruminants, potential public health importance and recommended from the guideline of antimicrobial susceptibility. Resistance testing discs contained Tetracycline (30µg), Chloramphenicol (30µg), Sulfamethoxazole-trimithoprim (25µg), Amoxycilline and clauvlonic acid (30µg), Nitrofurantion (100µg), Ciprofloxacine (5µg), Naldixic acid (30µg), Kanamycine (30µg), Streptomycine (10µg), Cefoxitin (30µg), Amikacin (30µg), Ampicillinm (10µg), Gentamycin (10µg), Cephalothin (30µg), Ceftriaxone (30µg), Sulfisoxazole (1000µg), Trimethoprim (5µg) and Neomycin (30µg). The isolates were considered resistant if the diameter of inhibition zone was less than or equal to the resistance breakpoint provided by (CLSI guidelines, 2013) (Table 1).

Table 1: Antibiotic disks used to test *E. coli* O157:H7 and their respective concentrations

NO.	Antibiotic discs	Disc code	Concentration	Diameter of Zone of inhibition in mm		
				Resistant ≤	Intermediate	Susceptible ≥
1	Tetracycline	TE	30µg	11	12-14	15
2	Chloramphenicol	C	30µg	12	13-17	18
3	Sulfamethoxazole-trimithoprim	SMT	25µg	10	11-15	16
4	Amoxycilline and clauvlonic acid	AMC	30µg	13	14-17	18
5	Nitrofurantion	F/M	100µg	14	15-16	17
6	Ciprofloxacine	CIP	5µg	20	21-30	31
7	Naldixic acid	NA	30µg	13	14-18	19
8	Kanamycine	K	30µg	13	14-17	18
9	Streptomycine	S	10µg	11	12-14	15
10	Cefoxitin	FOX	30µg	14	15-17	18
11	Amikacin	AN	30 µg	14	15-16	17
12	Ampicillin	AM	10 µg	13	14-16	17
13	Gentamycin	GM	10 µg	12	13-14	15
14	Cephalothin	CF	30 µg	14	15-17	18
15	Ceftriaxone	CRO	30 µg	14	15-17	18
16	Sulfisoxazole	G	1000 µg	12	13-16	17
17	Trimethoprim	TRM	5 µg	10	11-15	16
18	Neomycin	N	30 µg	12	13-16	17

Each isolated bacterial colony from pure fresh culture was transferred in to a test tube of 5 ml Tryptone Soya Broth (TSB) (Oxid, England) and incubated at 37^{o}C for 6 hours. The turbidity of the culture broth was adjusted using sterile saline solution or added more isolated colonies to obtain turbidity usually comparable with that of 0.5 McFarland standards (approximately 3x10^{8} CFU per ml). Mueller-Hinton agar (Bacton Dickinson and Company, Cockeysville USA) plates were prepared according the manufacturer's instruction (March and Ratnam, 1986). A sterile cotton swab was immersed into the suspension and rotated against the side of the tube to remove the excess fluid and then swabbed in three directions uniformly on the surface of Mueller-Hinton agar plates. After the plates dried, antibiotic discs were placed on the inoculated plates using sterile forceps. The antibiotic discs was gently pressed onto the agar to ensure firm contact with the agar surface, and incubated at 37^{o}C for 24 hours. Following this the diameter of inhibition zone formed around each disc was measured using a black surface, reflected light and transparent ruler by lying it over the plates (NCCLS, 2008). The result of the test was interpreted as sensitive, intermediate and resistant by using the breakpoints for each antimicrobial according to (CLSI, 2013). The results were classified as sensitive, intermediate, and resistant according to the standardized table supplied by the manufacturer (CLSI, 2012). For the results and discussion, we used the terminology of (Knezevic and Petrovic, 2008): very high rate of resistance (>75% resistant isolates); high rate (50-75%); moderate rate (30-50%); low rate (10-30%); and very low resistance rate (0-10%).

Data analysis

The data obtained from the study was entered to the Microsoft excel spreadsheet and analyzed by version 20 SPSS. Chi-square statistics were used to test the association between variables. The prevalence of *E. coli* O157: H7 was calculated by dividing the number of positive samples to the total number of samples examined multiplied by 100. Pearson chi-square test and Fisher's exact two-tailed test analyses were performed and differences were considered significant at $P < 0.05$.

Results

Prevalence and identification of *E. coli* O157:H7

Out of 186 faecal samples examined, 12 (6.4%) were found to be have *E. coli* O_{157}:H_7. The Prevalence of *E. coli* O157:H7 infection was totally from male cattle and all the female cattle were negative for *E. coli* O157:H7 (Table 2) and the difference between sex was not statistically significant (P>0.05).

The prevalence of *E. coli* O157:H7 was higher in adults than in young's but it was 0% prevalence in old cattle (Table 3); furthermore the variation in the prevalence among age groups was not statistically significant (P>0.05).

Statistically significant difference was not observed (P>0.05) in the Prevalence of *E. coli* O157:H7 among those animals with different body condition scores but The Prevalence of *E. coli* O157:H7 was higher proportion in medium cattle 9(4.8%), then in low cattle 2(1.07%) and finally 1(0.53%) in fat cattle (Table 4).

Table 2*:* Prevalence of *E. coli* O157:H7 Based on Sex

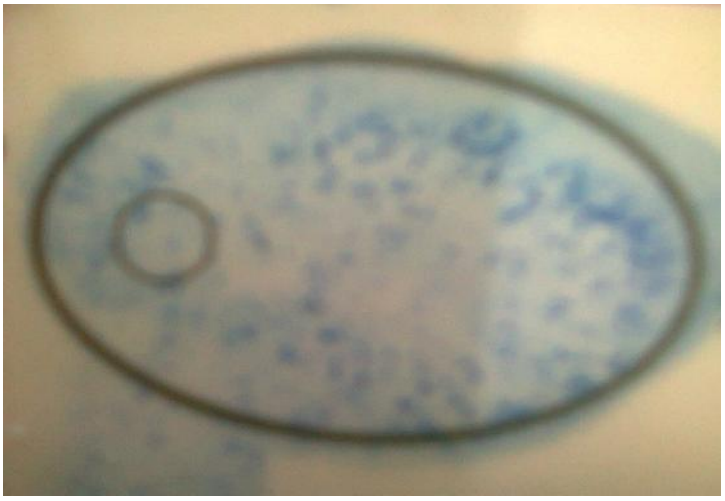
Sex	examined	No of positives	Prevalence	X^2	P value
Male	174	12	6.4%	0.885	0.348
Female	12	0	0%		
Total	186	12	6.4%		

Table 3*:* Prevalence of *E. coli* O157:H7 among the various age groups

Age group	No of examined	No of positives	Prevalence	X^2	P value
Adult	125	8	4.3%		
Old	26	0	0%	3.23	0.199
Young	35	4	2.1%		
Total	186	12	6.4%		

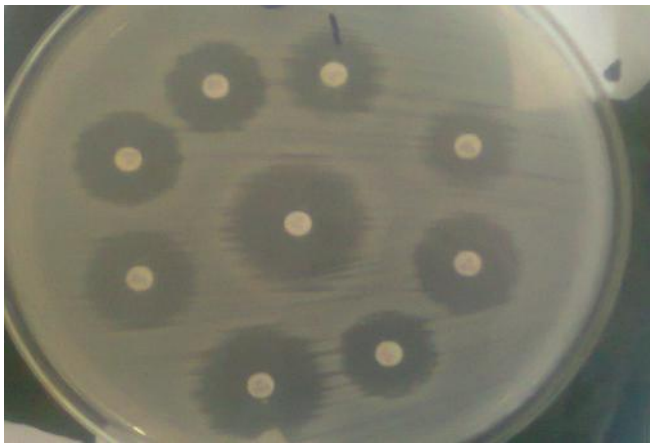
Table 4: Prevalence of *E. coli* O157:H7 Based on Body Condition Scores

Body condition	No of examined	No of positives	Prevalence	X^2	P value
Fat	41	1	0.5%		
Low	43	2	1.1%	2.276	0.321
Medium	102	9	4.8%		
Total	186	12	6.4%		



Antimicrobial susceptibility patterns

The isolated strains *E. coli* O157:H7 were susceptible (100%) to amikacin and gentamicin. Multidrug resistance (MDR) to two or more drugs was detected in 12/16 (75%) of the strains. Of the 10 MDR strains, 2 were resistant to 3 drugs, 3 were resistant to four drugs, 2 were resistant to five drugs and 3 strains were resistant to twelve and above drugs. From the isolated strains 8(50%), 9(56.25%) and 11(68.75) of they were resistant to Amoxycillin and clauvlonic acid (AMC), ampicillin (AM) and cephalothin (CF) respectively.



Discussion

The prevalence of *E. coli* determined by the present study 12 (6.4%) is found to be greater than values reported by (McEvoy *et al*., 2003) 2.4% from United Kingdom and (Conedera *et al*., 1997) 3% from Irish abattoir in faeces. On the other hand, the findings of the present study is lower than 8.6% and 7.5% reported by (Synge *et al*., 2000; Omisakin *et al*., 2003) respectively from United Kingdom, and 11.3% from United State (Callaway *et al*., 2006). there is also significantly higher reports 23.7%, (40.4%) and 28% by Strachan *et al*., 2005; Paiba *et al*., 2002) from United Kingdom and (Elder *et al*., 2000) from United State respectively.The observed variation in prevalence of *E. coli* among the above studies could be attributed to difference in sampling and isolation procedures, variability in sampled populations, diverse geographical origins of cattle, study design, season and use of antibiotics in the cattle population.

The differences in isolation rate of *E. coli* O157:H7 from faecal samples from abattoir different studies are possibly due to differences in husbandry practices, agro climatic variation, seasonal differences, sampling times, breeds and age of animals, sampling technique and so on. A number of studies have also showed that prevalence of *E. coli* O157:H7 shed from animal faeces can vary significantly in relation to time, age of animals, nature of feeds etc. (Chapman, 1994; Chapman *et al*., 2001; Reid *et al*., 2002).

Although the focus of the current study is on the prevalence of *E. coli* O157:H7 in faces, there are different reports signifying the presence of high risk of contamination of carcasses by *E. coli* O157:H7 from faces of slaughtered animals. Association of several risk factors with carcass contaminations has been reported by several researchers. Associations with feces (Elder *et al*., 2000; Gansher off and O'Brien, 2000) and with skin (Reid *et al*., 2002) and *E. coli* O157:H7 has been reported to spread easily on to carcass surfaces from the hide or during evisceration (Arthur *et al*., 2007; Elder *et al*., 2000; Gun *et al*., 2003). Meat is frequently found to be contaminated due to poor sanitary environment during slaughter, transportation and handling. According to the report by (Bassam *et al*., 2012), the infective dose of the pathogen is < 10 cells for humans.

In the study it was tried to see if there is statistically significant difference in the isolation rate of *E. coli* O157:H7 between age, sex and body condition score of cattle. But statistically significant difference was not seen in any of the above assumed risk factors although higher prevalence was found in medium body condition animals than low and fat animals and all the isolated strains were from adult 8 (4.3%) and 4 (2.1%) from young.

Antimicrobial resistance pattern of *E. coli* O157:H7 isolates from animal and human sources have been reported in Ethiopia by (Hiko *et al*., 2008), In the present study, all of the 16 isolates of animal sources were totally susceptible to amikacin (AN) (30 µg) and gentamicin (GM) (10 µg), and 13(81.25%) of the isolates were susceptible Ceftriaxone (CRO) (30), chloramphenicol (C) (30 µg), Sulfisoxazole (G) (1000 µg) and sulphamethoxazole and trimethoprim (SMT) (23.75 µg and 1.25 µg).

On the other hand, the current study revealed that all isolates were highly resistant to Amoxycillin and clauvlonic acid (AMC), ampicillin (AM) and cephalothin (CF). This might be due to inappropriate use of antibiotics for treatment of diseases (Sharada *et al*., 2010) and also excessive use of antimicrobials for therapeutic and prophylactic treatment (Majalija *et al*., 2010). This variation probably attributed to the expression of resistant gene code by the pathogen which is associated with emerging and re emerging aspects of the isolates with the regards of different agro ecology (Reuben and Owuna, 2013).

In the present study, majority of the isolates 12 (75%) have multiple drug resistance to two or more drugs. This finding comparable related with previous findings (Guerra *et al*., 2003; Zhao *et al*., 2005; Salehi and Bonab, 2006; Akond *et al*., 2009). The occurrence of this multi drug resistance might be due to administration of multiple antibiotics for prophylaxis or infection, in indiscriminate use of antibiotics in the farms and the other possibility is that, cattle are being treated with antibiotics for other conditions, thereby selecting for resistant populations of *E. coli* O157:H7. Such multi drug resistant organisms may ultimately replace the drug sensitive microorganisms from antibiotic saturated environment (Van De Bogard and Stobberingh, 2000).

In conclusion, this study shows the presence of *E. coli* O157: H7 strain isolates from the faeces and carcass swab cattle slaughtered at Addis Ababa Abattoir. And majority of the isolated strains of *E. coli* O157:H7 have developed multi drug resistance to two or more antibiotics. Thus, consumers can have high risk of infection by this pathogen. Therefore, based on this

research output remarks care should be taken during evisceration in order to prevent contamination of the carcass by the gastrointestinal contents, awareness creation should be done for abattoir workers about the risk of food borne diseases and appropriate slaughter procedures. In general, it is advisable to use the information obtained from this study so as to conduct large scale and detailed investigations on farm risk factors that lead to the development of drug resistance bacteria and for food safety risk assessment modelling in all of Abattoirs of Ethiopia to minimize public health risk.

Acknowledgments

Authors sincerely acknowledge all smallholder farmers at the study area since they allowed to take blood samples from their animals. We are also grateful to thank the Akililu Lemman Institute of Pathobiology (ALIPB), Addis Ababa University for their financial support and they also allowed us to use all the necessary facilities. We would like to express our heartfelt gratitude to all abattoir workers of Addis Ababa Municipal Abattoir. Lastly but not the least we would like to thank Mr. Haile Alemayehu for supporting us during the laboratory work of the study at Akililu Lemman Institute of Pathobiology (ALIPB).

Conflict of interest

There is no any conflict of interest among the authors.

References

Akond, M., Alam, S., Hasan, S., Mubassara, S., Uddin, S. and Shirin, M. (2009): Antibiotic resistance of *Escherichia coli* isolated from poultry and poultry environment of Bangladesh. Lab of environmental bioscience, and department of biological chemistry, faculty of Agriculture, Yamaguchi University. American *Journal of Environmental Science.*, **5:** 47-52.

Arthur, T., Bosilevac, J., Brichta-Harhay, D., Guerini, M., Kalchayanand, N., Shackelford, S., Wheler, T. And Koohmaraie, M. (2007): Transportation and lairage environmenteffects on prevalence, numbers, and diversity of *Escherichia coli* O157:H7 on hides and carcasses of beef cattle at processing. J Food Prot., **70:** 280-286.

Ayalew, H., Birhanu, A. and Asrade, B. (2013). Review on food safety system: Ethiopian perspective. *African Journal of Food Science*, **7**: 431-40.

Bassam, Y., Khudaier, B., Abbas, A. and Khulood, A. (2012): Prevalence and antimicrobial susceptibility of *E. coli* O157:H7 isolated from human and animal sources in Basrah province. *J. Vet. Res*., **11**: 2.

Callaway, T., Carr, M., Edrington, T., Anderson, R. and Nisbet, D. (2009): Diet, *Escherichia coli* O157:H7, and cattle: a review after 10 years. *Curr Issues MolBiol.*, **11**: 67-79.

Chapman, P., Cerdán, A., Ellin, M., Ashton, R. and Harkin, M. (2001): *Escherichia coli* O157 in cattle and sheep at slaughter, on beef and lamb carcasses and in raw beef and lamb products in South Yorkshire, UK. *Int. J. Food Microbiol*., **64:** 139-150.

Chapman. P., Wright, D. and Siddons, C. (1994): A comparison of immunomagnetic separation and direct culture for the isolation of verocytotoxin-producing Escherichia coli O157 from bovine faeces. *J. Med. Microbiol*., **40:** 424–427.

Clinical and Laboratory Standards Institute (2012): Performance standards for anti microbial susceptibility testing; Twenty-Second Informational supplement. CLSI document. M100-S22.

Clinical and Laboratory Standards Institute (2013): Performance standards for Antimicrobial Susceptibility Testing; Twenty-third informational supplement. M 100–S 23.

Conedera, G., Dalvit, P., Martini, M., Galiero, G., Gramaglia, M., Goffredo, E., Loffredo, G., Morabito, S., Ottaviani, D., Paterlini, F., Pezzotti, G., Pisanu, M., Semprini, P. and Caprioli, A. (2004): Verocytotoxin producing escherchia.coli O157 in minced beef and dairy product in Italy. *Int. J. Food Microbiol.*, **96**: 67-73.

Elder, R., Keen, J., Siragusa, G., Barkocy, G., Koohmaraie, M. and Laegreid, W. (2000): Correlation of Enterohemorrhagic *Escherichia coli* O157 prevalence in faeces, hides and carcasses of beef cattle during processing. *Proc. Natl. Acad. Sci. USA*, **97**:2999–3003.

Ethiopian National Metrological Centre Agency (2003): Rainfall, humidity and temperature data. Addis Ababa Ethiopia.

FAO/WHO (2007): Joint FAO/WHO Food Standards Programme FAO/WHO coordinating committee for Africa, seventeenth session, Rabat, morocco, Pp. 23-26.

Gansheroff, L. and O'Brien, A. (2000): *Escherichia coli* O157:H7 in Beef Cattle Presented for Slaughter in the U.S. Higher Prevalence Rates than Previously Estimated. *Proc. Natl. Acad. Sci*., **97**: 2959–2961.

Guerra, B., Junker, E., Schroeter, A., Malorny, B., Lehmann, S. and Helmuth, R. (2003): Phenotypic and genotypic characterization of antimicrobial resistance in German Escherichia coli isolates from cattle, swine and poultry. *J. Anti. Chem*., **5**: 489-92.

Gun, H., Yilmaz, A., Turker, S., Tanlasi, A. and Yilmaz, H. (2003): Contamination of bovine carcasses and abattoir environment by *E. coli* O157:H7 in Istanbul. *Int. J. Food. Microbiol*., **84**: 339-44.

Helms, M., Vastrup, P., Gerner-Smidt, P. and Molbak, K. (2002): Excess mortality associated with antimicrobial drug resisitant *S. typhimurium*. *Emerging Infectious Diseases*, **8**:490-495.

Hiko, A., Asrat, D. and Zewde, G. (2008): Occurrence of Escherichia coli O157:H7 in retail raw meat products in Ethiopia. *J. Infect. Dev. Ctries.*, **2**: 389-393.

Humphrey, T. and Jorgensen, F. (2006): Pathogens on meat and infection in animals: Establishing relationship using *Campylobacter* and *Salmonella* as examples. *Meat Science*, **74**:89-97.

Isibor, J. O., Ekundayo, A. O., Ohenhen, R. E. and Orhue, P. O. (2013.): *E. coli* O157:H7- Prevalence and risk factors of infection in Edo State, Nigeria. *American Journal of Research Communication*, **1**: 35-49.

Kiranmayi, C. B., Krishnaiah, N. and Mallika, E. N. 2010. *Escherichia coli* O157:H7 - An emerging pathogen in foods of animal origin. *Veterinary World*, **3**: 382-389.

Knezevic, P. and Petrovic, O. (2008): Antibiotic resistance of commensal *Escherichia coli* of food-producing animals from three Vojvodinian farms, Serbia. *International Journal of Antimicrobial Agents*, **31**:360-363.

Lanz, R., Kuhnert, P. and Boerlin, P. (2003): Antimicrobial resistance and resistance gene determinants in clinical *Escherichia coli* from different animal species in Switzerland. *Veterinary Microbiology*, **91**: 73-84.

Licence, K., Oates, K. R., Synge, B. A. and Reid, T. M. S. (2001): An outbreak of *E. coli* O157 infection with evidence of spread from animals to man through contamination of a private water supply. *Epidemiology and Infection*, **126**: 135- 138.

Locking, M. E., O"Brien, S. J., Reilly, W. J., Wright, E. M., Campbell, D. M., Coia, J. E., Browning, L. M. & Ramsay, C. N. (2001): Risk factors for sporadic cases of *Escherichia coli* O157 infection: the importance of contact with animal excreta. *Epidemiology and Infection*, **127**: 215-220.

Majalija, S., Francis, O., Sarah, W., Lubowa, M., Vudriko, P. and Nakamya, F. (2010): Antibiotics susceptibility profiles of faecal Escherichia coli isolates from Dip-Litter broilers chickens in Northern and Central Uganda. Department of veterinary parasitology and microbiology. *Vet. Res*.**, 3**: 75-80.

March, S. and Ratnam (1986): Sorbitol MacConkey medium for detection of Escherichia coli o157:h7 associated with hemorrhagic colitis, *j. clin. Microbial*. **23:** 869–872.

Martin, L. J., Fyfe, M., Dore, K., Buxton, J. A., Pollari, F., Henry, B., Middleton, D., Ahmed, R., Jamieson, F., Ciebin, B., McEwen, S. A. and Wilson, J. B. (2004): Multi-provincial *Salmonella Typhimurium* case-control study steering committee: Increased burden of illness associated with antimicrobial resistant *Salmonella enterica* serotype *typhimurium* infections. *Journal of Infectious Disease*, **189**:377- 384.

McEvoy, J. M., Doherty, A. M., Sheridan, J. J., Thomson-Carter, F. M., Garvey, P., McGuire, L., Blair, I. S. and McDowell, D. A. (2003): The prevalence and spread of *Escherichia coli* O157:H7 at a commercial beef abattoir. *Journal of applied microbiology*, **95**:256-66.

Mersha, G., Asrat, D., Zewde, B. and Kyule, M. (2010): Occurrence of Escherichia coli O157:H7 in faeces, skin and carcasses from sheep and goats in Ethiopia. *Letters Appl. Microbiol*., **50:** 71–76.

National Committee for Clinical Laboratory Standards (2008): Performance standards for anti microbial disc and dilution susceptibility tests for bacteria isolated from animals and humans.ApprovedStandards. NCCLS document M31 A,NCCLS, Villanova, PA.

Nicolson, M. and Butterworth, M. (1986): A guide to condition scoring of zebu cattle. International livestock centre for Africa, Addis Ababa, Ethiopia.

Nouichi, S. and Hamdi, T. M. (2009): Superficial bacterial contamination of ovine and bovine. carcasses at El-Harrach slaughterhouse (Algeria). *European Journal of Scientific Research,* **38**: 474-485.

Olatoye, I. O., Amosun, E. A. and Ogundipe, G. A. (2012): Multidrug resistant *Escherichia coli* O157 contamination of beef and chicken in municipal abattoirs of Southwest Nigeria. *Nature and Science*, **10**:125-32.

Oliver, S. P., Murinda, S. E., Jayarao, B. M. 2011. Impact of antibiotic use in adult dairy cows on antimicrobial resistance of veterinary and human pathogens: A comprehensive review. *Foodborne Pathogen and Diseases* **8**:337-355.

Omisakin, F., MacRae, M., Ogden, I. and Strachan., N. (2003): Concentration and Prevalence of *Escherichia coli* O157 in Cattle Feces at Slaughter Society for Microbiology *United Kingdom* **5**: 2444–2447

Paiba, G., Giddens, J., Pascoe, S., Kidd S., Byrne A., Ryan, B., Smith R., McLaren I., Futter, R., Kay A., Jones Y., Chappell S., Willshaw, G. and Cheasty T.(2002): Faecal carriage of verocytotoxin-producing *Escherichia coli* O157 (VTEC) in cattle and sheep at slaughter in Great Britain. Vet. Rec. 150:593–598.

Pal, M. (2007): Zoonoses. 2nd Edition. Satyam Publishers, Jaipur, India. Pp. 100-134.

Pal, M. (2012): Raw meat poses public health risks. *The Ethiopian Herald*, May 15, Pp. 2-3.

Radostits, O., Gay, C., Blood, D., Hinchcliff, K. (2000): Veterinary Medicine. A Textbook of Diseases of cattle, sheep, pig, Goats and Horses 9th (ed) Bailler Tindal. London. Pp. 703-739

Rahimi, E. and Nayebpour, F. (2012): Antimicrobial resistance of *Escherichia coli* O157:H7/NM isolated from feaces of ruminant animals in Iran. *Journal of Cell and Animal Biology*, **6**:104-108.

Rahimi, E., Kazemeini, H. R., Salajegheh, M. (2012a): *Escherichia coli* O157:H7/NM prevalence in raw beef, camel, sheep, goat, and water buffalo meat in Fars and Khuzestan provinces, Iran. *Veterinary Research Forum*, **3**: 13 -17.

Reid, C., Small, A., Avery, S. and Buncic, S. (2002): Presence of Foodborne Pathogens on Cattle Hides. *Food Control*, **13:** 411–415.

Reuben, R. and Owuna, G. (2013): Antimicrobial resistance patterns of *E. coli* O157:H7 from Nigerian fermented milk samples in Nasarawa state, Nigeria. *Int. J. Pharma. Sci. Invention*., **2:** 2319–6718.

Salehi, T. and Bonab, S. (2006): Antibiotics susceptibility pattern of Escherichia coli strains isolated from chickens withcolisepticemia i n Tabriz Province, Iran. Department of microbiology and immunology, Faculty of VeterinaryMedicine, Tehran University. *Inter. J. Poult. Sci*., **5:** 677-684.

Sharada, R., Ruban, S. and Waran, M. (2010): Isolation, characterization and antibiotic resistance pattern of *Escherichia coli* isolated from poultry. American-Euresian J Scientific Research, **5:**18-22.

Sima, H., Ebrahim, R. and Hasan, M. (2009): A 3-year study of *Escherichia coli* O157:H7 in cattle, camel, sheep, goat, chicken and beef minced meat. *International Conference on Food Engineering and Biotechnology*, **9**: 162-166.

Smith, G. C. (2000): Providing assurance of quality, consistency, safety and a caring attitude to domestic and international consumers of U.S. Beef Department of Animal Sciences, Colorado State University.

Strachan, N., Doyle, M., Kasuga, F., Rotariu, O. and Ogden, I. (2005): Dose response modelling of *Escherichia coli O157* incorporating data from food borne and environmental outbreaks. *Int. J. Food Microbiol*., **103**:35–47.

Synge, B., Gunn, G., Ternent, H., Hopkins, G., Thomson-Carter F., Foster G. and McKendrick, I. (2000): Preliminary results from epidemiological studies in cattle in Scotland,. *In* Zoonotic infections in livestock and the risk to public health, United Kingdom Pp.10–17

Taye, M., Berhanu, T., Berhanu, Y., Tamiru, F. and Terefe, D. (2013): Study on carcass contaminating *Escherichia coli* in apparently healthy slaughtered cattle in Haramaya University slaughter house with special emphasis on *Escherichia coli* O157:H7, Ethiopia. *Journal of Veterinary Science and Technology*, **4**: 132.

Thrusfield, M. (2005): Veterinary Epidemiology. 3rd ed, Blackwell Science Ltd., London. Pp. 232-242.

VanDe, Bogaard, A. and Stobberingh, E. (2000): Epidemiology of resistance to antibiotics links between animals and humans. *Int. J. Antimicrob. Agents*. **14:** 327-335.

Zhao, S., Maurer, J., Hubert, S., De Villena, J., Mcdermott, P., Meng, J., Ayers, S., English, L. and White, D. (2005): Antimicrobial susceptibility and molecular characterization of avian pathogenic Escherichia coli isolates. *Vet. Microbiol*., **107:** 215-24.

Access this Article in Online	
	Website: www.ijarbs.com
Quick Response Code	Subject: Veterinary Medicine
DOI:10.22192/ijarbs.2018.05.10.014	

How to cite this article:
Muhammed Hamid, Yalew Tefera, Tadese Eguale and Yalelet Worku. (2018). *Escherichia coli* O157:H7: Prevalence, Identification and Antimicrobial Resistance in Cattle Slaughter at Addis Ababa Municipal Abattior, Ethiopia. Int. J. Adv. Res. Biol. Sci. 5(10): 136-146.
DOI: http://dx.doi.org/10.22192/ijarbs.2018.05.10.014