Escherichia coli O157 serotype in beef carcasses post slaughterhouse in Nairobi and Eldoret, Kenya

John Kago[1], Erastus Kang'ethe[2], John Wangoh[1], Kohei Makita[3]

[1]University of Nairobi, Dept. of Food Science, Nutrition and Technology, Kenya
[2]University of Nairobi, Dept. of Public Health, Pharmacology and Toxicology, Kenya
[3]Rakuno Gakuen University, Veterinary Epidemiology, Japan

Introduction

Meat is an important source of protein in human nutrition. The production and consumption trends show an increase in the demand for meat in developed and developed countries (de Haan, 2009). Population increase in Kenya may push the industry to process most of the meat for preservation and distribution instead of consuming freshly slaughtered meat. This offers a challenge especially due to the zoonoses arising from contamination with pathogenic microorganism during handling and processing. *Escherichia coli* O157:H7 has been associated with food poisoning outbreaks in various parts of the world. Most of them are from contaminated meat that has being undercooked(Lake *et al*, 2002). Prevention of contamination and cross contamination of meat during slaughter and distribution is critical in prevention of these outbreaks. As carcasses in Kenya are distributed to various retail shops after slaughter, the transportation chain need special attention!

The objectives of the study were to determine the probability of and identify the risk factors that lead to carcass contamination with *E. coli* O157 serotype during transportation to the butchery.

Figure 1: **Pictures showing meat transportation chain in Kenya.**

Materials and methods

Two slaughterhouses from Nairobi and one from Eldoret were purposively chosen. Randomly selected 250 beef carcasses were sampled in a cross sectional study. Swab samples from a single carcass were obtained from three sites during loading and off loading of meat to carriers. A fault tree was used as a guide on possible areas of contamination. A total of 1500 samples were obtained. *E. coli* O157 serotype was isolated and purified using sorbital MacConkey, MacConkey and nutrient agar. Serotyping was by card agglutination test. Oxoid verotoxin test kit was used to test for verotoxin (VT1 and VT2) production. The meat carrier environment (humidity and temperature) was monitored. Knowledge, attitude and practices of meat transporters was assessed through a semi structured questionnaire and observations. The probability of contamination was modeled and run through Monte Carlo simulation using winBUGS®. Prevalence of *E. coli* O157 serotype contaminated carcasses and data from the questionnaire were analysed using SPSS ver17.

Results

***E. coli* O157 serotype carcass contamination**

The level of *Escherichia coli* O157 serotype contaminated carcasses was significantly higher at offloading than at loading ($p=0.05$). The prevalence of contaminated carcasses at loading and offloading was 0.4% and 2.4% respectively. There was no significant difference on level of contamination among the three abattoirs at the two levels of sampling.

Monte Carlo simulation gave the probability of obtaining an *E. coli* O157 serotype contaminated carcass as shown in figure 2.

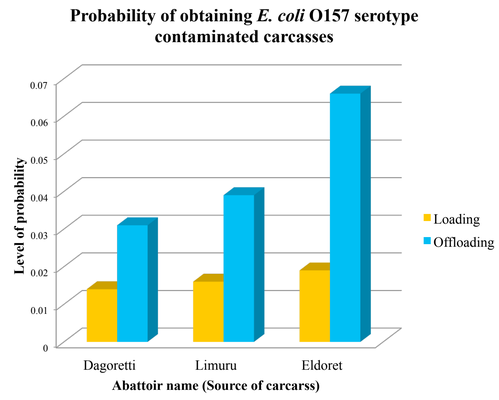

Figure 2: **Graph showing the probability of obtaining an *E. coli* O157 serotype contaminated carcass.**

None of the isolates from contaminated carcasses at loading produced verotoxin. At offloading, one of the isolate produced both VT1 and VT2 while another produced VT1.

Practices

Most of the personnel transporting meat (59.37%) had not being trained on basic hygiene practices

Carcasses were heaped in transportation boxes. The boxes were always washed with cold water and soap after work and rinsed with cold water only before commencement of work the following morning.

The boxes had no refrigeration facilities. The average transportation time was 65 minutes at an average temperature of 23^{0}C.

Reused kraft papers (Figure 3) bought From vendors outside the abattoir and of unknown microbiological quality were sometimes used to separate the carcasses.

Figure 3: **A picture of carcasses inside a transportation box**

One person could load and offload several carcasses destined to different retail outlets into a vehicle without change over of the soiled protective clothing (Figure 4) The clothing was made of white fabric that could not be easily rinsed after getting soiled.

Figure 4: Meat being offloaded from transportation box

Conclusions

-The prevalence at loading is low may be due to the short time taken by the carcass after the slaughter process before dispatch. The washing after evisceration could have contributed to low levels as a previous study done in the abattoir showed high carcass contamination (Mwai 2012, Kang'ethe 1993)

Prevalence at offloading increased due to bacterial growth and the cross contamination during transportation. The factors leading to this are as shown in figure 5.

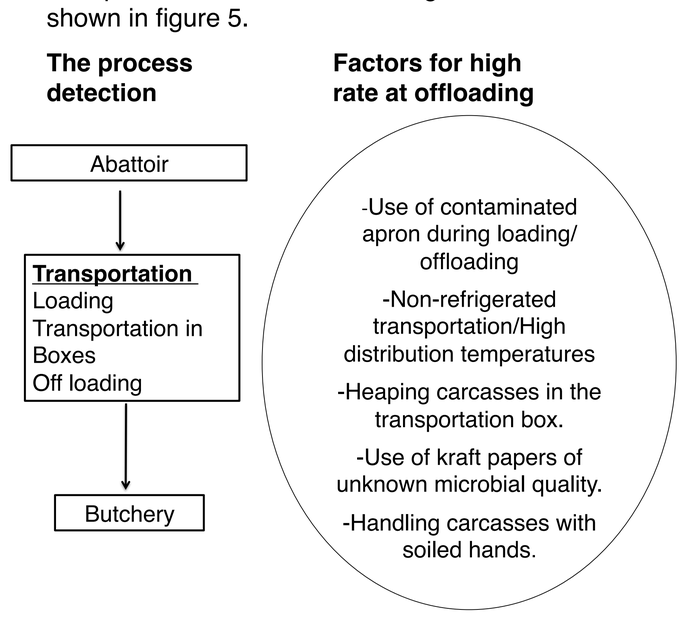

Figure 5: Factors that lead to high prevalence at offloading as compared to loading.

Training of the meat transporters to sensitize them on good hygiene and manufacturing practices could reduce the high prevalence at offloading. FAO (2006) identifies control of temperature and good hygiene practices as practical risk management tools towards eliminating pathogen from carcasses. Martins et al (2012) conclude that training is key if food handlers are to practice good hygiene.

Refrigeration of carcasses before transportation and/or proper construction of transportation boxes according Kenya Meat Control Act Cap356 would ensure controlled temperature and slow microbial growth.

The kraft papers used to separate carcasses could be contaminated. The carcasses should be transported hang on rail. Other easily sterilized food grade material like films and aluminium foils could be used.

The risk the *E. coli* O157 contamination pose to the consumers has not been quantified. The actual burden of the disease this could be causing in Kenya needs to be quantified and the control measures identified. The effects may not be so pronounced now as few reports on illnesses have been reported. The increased population and demand for food that require minimum preparation time, may revert this situation unless carcass contamination and bacterial proliferation is controlled.

Literature cited

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