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RESEARCH ARTICLE

ANTIMICROBIAL EFFECT OF LIPASE ON THE BACTERIAL COUNTS OF BEEF CARCASSES

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ABSTRACT

The safety and hygienic quality of the carcasses are largely determined by the presence of microorganisms which are ubiquitous in nature. The study investigates the potential of lipase (1%) on the bacterial counts *viz*. total viable count (TVC), coliform count (CC), *Escherichia coli* count (ECC), Enterococcal count (EC) and sulphite reducing clostridium count (SRC) on beef carcass in a meat processing plant in Kerala. On treatment with the sanitizer, the TVC of the control beef carcass (7.42±0.23 $\log_{10}$ cfu/ml) was reduced to 5.03±0.28 $\log_{10}$cfu/ml. There was statistically significant reduction ($P \leq 0.05$) in the *E coli* count from 2.29 ±0.17 $\log_{10}$cfu/ml to 1.01±0.21 $\log_{10}$cfu/ml. However, there was no significant difference in the CC, EC and SRC of beef carcasses on treatment with the sanitizer. The application of lipase did not produce any colour change on the carcass. The result of the study reveals the potential of lipase as a sanitizer in meat processing industry.

INTRODUCTION

Meat and meat products provide excellent growth media for a variety of microflora some of which are pathogens (Jay *et al*., 2005). The safety and hygienic quality of the carcasses are largely determined by the presence of microorganisms which are ubiquitous in nature. During the slaughter and dressing of animals, the carcass gets contaminated with microorganisms from various sources. Ascending trend in consumerism has exposed the industries to consumer's ever demanding requirement for quality. Several intervention strategies have been developed to reduce the bacterial load of carcass surface.

Lipases are used in many products and processes, the most significant industrial applications being mainly in the food, detergent, and pharmaceutical sectors (Houde *et al*. 2004). They are versatile group of enzymes that not only hydrolyses the esters of long chain aliphatic acids from glycerol at oil or water interface but are also involved in the transesterification reaction. Lipases are special kind of esterases belonging to subclass 1 of hydrolytic enzyme class 3 due to their specificity for carboxylic acid ester bond (Pahoja and Sethar, 2002). They are called carboxylic acid esterases and numbered as E.C.3.1.1 according to the classification recommended by enzyme commission of the International Union of Biochemists (Florkin and Stotz, 1965). The antimicrobial effect of cows' urine (Kumar, 2013) and that of human colostrum (Batovska *et al* 2009) is attributed to the presence of lipase in them. The present study investigates the potential of lipase as a microbial inhibitor on beef carcasses. A one per cent solution of lipase was used to study its effect on the various bacterial counts viz. total viable count (TVC), coliform count (CC), *Escherichia coli* count (ECC), enterococcal count (EC) and sulphite reducing clostridium count (SRC) on beef carcass in a meat processing plant in Kerala.

MATERIALS AND METHODS

Collection of samples

A total of eighteen beef carcasses were randomly selected from a meat processing plant to test the antibacterial effect of lipase. Swab samples were taken using 100cm^2 template area each from five sites viz. neck, brisket, loin, flank and outer round region were collected. One half of each carcass was kept as control and the other half was treated with sanitizer before collecting the sample.

Preparation of sanitizer

The sanitizing solution of one per cent lipase (Steapsin, enzyme activity- 40 to 70 units/mg protein, Sisco Research Laboratories, Mumbai) was prepared by dissolving five grams

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of Lipase in 500 ml of potable water.

Table 1 Mean Bacterial Count of Carcasses Treated With Lipase

Bacterial Counts	Mean bacterial counts in beef carcass (log $_{10}$ cfu/cm^2)	
	CONTROL	TREATED
TVC	6.06 ± 0.11	5.03 ± 0.28*
CC	2.50 ± 0.30	0.73 ± 0.21**
ECC	2.41 ± 0.06	1.01 ± 0.21*
EC	2.52 ± 0.04	1.83 ± 0.21
SRC	2.09 ± 0.14	1.37 ± 0.29

** (P ≤ 0.01) * (P ≤ 0.05)

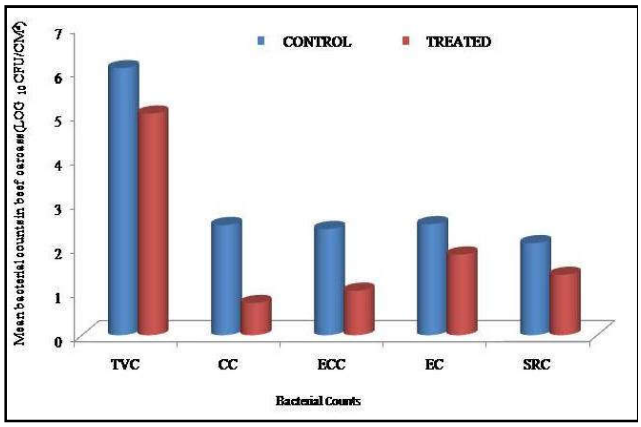

Fig 1 Bacterial Count Of Carcasses Treated With Lipase

Application of Sanitizers on Beef Carcass and Collection of Sample

Decontamination of carcass was carried by spraying the sanitizing solution using a hand held sprayer from a distance of 5 cm on one side of the carcass surface on the regions specified above. Each area was sprayed for 15 sec and the exposure time of each sanitizer was one minute. The swab samples were collected from both sides (control and test) of each carcass so as to evaluate the effect of sanitizing solution by estimating the bacterial counts viz. total viable count, coliform count, Escherichia coli count, enterococcal count and sulphite reducing clostridium count.

Estimation of Bacterial Count

The estimation of bacterial count was done as per the procedure described by APHA, (2002).

RESULT

The mean bacterial count of carcasses treated with lipase is shown in Table-1. The sanitizer had a highly significant (P≤0.01) effect on coliforms. The control sample had a mean CC of 2.50 ± 0.30 log $_{10}$ cfu/cm^{2}which was reduced to 0.73 ± 0.21 log $_{10}$ cfu/cm^2. There was a significant (P≤0.05) reduction in the total viable count and E coli count of beef carcasses. The mean TVC reduced to 5.03 ± 0.28 logs $_{10}$ cfu/cm^2 from 6.06 ± 0.11 log $_{10}$ cfu/ cm^2 The mean *E coli* count showed a 1 log$_{10}$ reduction. Although there was a reduction in the EC and SRC counts from 2.52± 0.04 to 1.83 ± 0.21 log $_{10}$ cfu/cm^2 and 2.09 ± 0.14 to 1.37 ± 0.29 log $_{10}$ cfu/cm^2 (fig.1) respectively there was no statistical significance.

DISCUSSION

Lipase degrades the cell wall of Gram-negative bacteria (Ramakrishnan, *et al.,* 2012) which was evident in the study. Lipase also produced an inhibitory effect on *E.coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* in catheters (Dave *et al*., 2011). Contrary to the findings of this study, Isaacs *et al* (1992) studied the effect of lipase on infant milk formulas and found that lipase-treated formulas inactivated the gram-positive bacterium *viz*. *Staphylococcus epidermidis* but were ineffective against gram-negative Escherichia coli and *Salmonella enteritidis*. In the present study the sanitizer did not produce significant reduction in the enterococcal and sulphite reducing clostridial count which could be due to the affinity of lipase to gram negative bacteria.

CONCLUSION

The study reveals the potential of lipase as a promising sanitizer in meat industry. Studies on the application of lipase on meat are succinct and hence needs to be explored.

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