CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

The main aim of the study was to determine the effect of HACCP implementation on the microbiological status of carcasses in a specific C-class abattoir. This was done by statistically analysing the decrease of common meat pathogens. The usefulness of HACCP is apparent from the results of this study in that the implementation had an overall effect of reducing microbial levels on the carcasses. The *Staphylococcus aureus,* total coliforms and *Clostridium perfringens,* counts were significantly reduced ($p < 0.05$) whereas aerobic plate count and *Escherichia coli* counts were not significantly reduced at the splitting step. However, after 24 hours chilling Escherichia *coli* was also reduced significantly ($p < 0.05$). In addition, a consistent positive hygiene trend was achieved for all the microbes after HACCP implementation. Comparisons were also made on the carcasses between the skinning, evisceration and chilling before and after HACCP implementation. At the baseline a significant reduction ($p < 0.05$) was only attained for the aerobic plate counts and total coliforms. However, significant reductions were achieved for all the pathogens after HACCP implementation except for *Clostridium perfringens,* which was not reduced but inspite of this all the carcasses had nil detections after HACCP implementation. *Salmonella* was not detected from any of the samples after HACCP implementation at both the control points.

The reduction and consistency in the pathogen and hygiene levels is important not only from a consumer's safety aspect but also the quality impact of processors' raw material. This is because the carcass is a raw material for further processing and it should therefore have as low microbial loads as possible as the meat passes through many stages of handling with various hygiene strains before ultimately reaching the consumers. Consistent quality ensures supplier reliability. Pathogens even in low numbers are a direct hazard because they have the potential to cross contaminate other meat and to grow to high numbers in the event of poor storage posing a risk of food poisoning to the consumers. From this study it is obvious that total elimination of pathogens from beef products is not possible but it is important

to note that a significant reduction of the microbial levels are achieved by HACCP implementation. It is recommended that to be able to achieve total microbial destruction, decontamination methods, which can be used in conjunction with HACCP, should be explored.

The need for reducing pathogens on carcasses has always been a concern to the meat processing industry but recent increases in cases of food poisoning diseases, some fatal by the food-borne pathogens like *Escherichia coli*, *Clostridium perfringens, Staphylococcus aureus* and *Salmonella* has catalysed this concern. This is further worsened by the fact that a lot of emphasis of carcass microbial control is usually placed in the secondary processing stages while the actual deposition and distribution of pathogens occurs in the slaughter stage. For instance the current study might have reported nil detection of pathogens like *Salmonella* yet this organism might be picked up when analysing minced meat from a bowl chopper due to mixing or redistribution of the pathogens from the carcasses. Unfortunately this has led to less emphasis being placed on the abattoir steps as critical control points yet, the state of the carcass where the introduction occurred, is ignored (Kilsby & Pugh, 1981).

The main limitation with this study is that most of the personnel in the abattoir were illiterate and needed constant training for a longer duration. Achieving immediate positive results were therefore, not easy. The high employee turn -over also calls for constant training and can lead to hygiene fluctuations within the line. The workers remuneration also depended on the number of carcasses they processed hence chain speeds tended to be fairly high and these could compromise the hygiene of the product. There is also still a lack of agreed minimum microbial levels for the meat industry which implies that there is still a lack of yardstick for measuring whether the reductions achieved are significant for a HACCP system. There are also general limitations with the use of minimum microbial limits from other countries due to the conditions e.g. facilities, storage and distribution, which vary tremendously internationally and one standard may not be good enough

It is recommended that for a more comprehensive picture of the performance of a HACCP system in the South African abattoir industry a study on multiple abattoirs

with different conditions should be done concurrently over a longer duration. This will enable conclusive results on the value of HACCP implementation. The results achieved so far can form a basis for implementation of a HACCP system in small red meat abattoirs in South Africa.