



final report

Project Code: A.MFS.0101
Prepared by: Symbio Alliance
June 2008

Date published:

PUBLISHED BY
Meat and Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Best Practice to Reduce Microbial Contamination at Meat Retail

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government and contributions from the Australian Meat Processor Corporation to support the research and development detailed in this publication.

This publication is published by Meat & Livestock Australia Limited ABN 39 081 678 364 (MLA). Care is taken to ensure the accuracy of the information contained in this publication. However MLA cannot accept responsibility for the accuracy or completeness of the information or opinions contained in the publication. You should make your own enquiries before making decisions concerning your interests. Reproduction in whole or in part of this publication is prohibited without prior written consent of MLA.

CONTENTS

1. INTRODUCTION	2
2. METHODOLOGY	2
2.1 SAMPLE PREPARATION	2
2.2 TRANSPORT TO THE LABORATORY	2
2.3 MICROBIOLOGICAL ANALYSIS	2
3. RESULTS	3
3.1 SUPERMARKET PRODUCT	3
3.2 WHOLESALE/BUTCHER MEAT PROCESSOR	4
3.3 RETAIL BUTCHER SHOP	4
4. DISCUSSION	5
5. REFERENCES	5

LIST OF TABLES

TABLE 1: HYGIENE INDICATORS IN TRIM (N=5) AND PREMIUM MINCED BEEF (N=5)	3
TABLE 2: HYGIENE INDICATORS IN TRIM (N=5) AND HEART SMART MINCED BEEF (N=5)	4
TABLE 3: HYGIENE INDICATORS IN TRIM (N=5) AND MINCED BEEF (N=5) MANUFACTURED FROM CARCASS TRIMMINGS	4
TABLE 4: HYGIENE INDICATORS IN TRIM (N=10) AND MINCED BEEF (N=10) MANUFACTURED FROM VACUUM PACKED BEEF AT A RETAIL BUTCHER SHOP	5

DISCLAIMER

This report is based on observations of the premises and systems on the stated date. Symbio Alliance excludes all liability, whether in contract, tort (including negligence) or otherwise, as a result of reliance by any person or organisation on the information or advice contained in this report.

1. INTRODUCTION

A microbiological survey of retail product conducted by Meat & Livestock Australia (MLA) during 2004/05 indicated that although micro indicators of hygiene and imminent spoilage on carcasses and trim were only present at low frequencies/concentration at retail, levels were higher than expected. *Escherichia coli* (*E. coli*) was detected in nearly 20% of samples, and *Staphylococcus aureus* (*S. aureus*) was detected in 25% of samples. This posed the question: was the product being kept at higher than acceptable temperatures, or was contamination arising from handlers and/or equipment at a retail level? More importantly, what could be done to identify the likely cause of the rise in spoilage indicator organisms on retail product, and subsequently, what could be done to reduce these levels?

Previous reports examined the effect of retail personnel wearing gloves when handling raw product and the use of steam cleaning of utensils, equipment and cutting boards following normal store cleaning procedures in an attempt to reduce overall microbial loads of retail meat products. However, the results of these studies were inconclusive. One outcome from the previous work was that minced meat counts were both high, and appeared to be related to in-going trim. The present project examined in-going trim in greater detail by sampling at three types of retail butcher operations:

- A major supermarket store
- A large meat wholesaler/butcher
- A typical suburban butcher shop

At each venue hygiene indicators were monitored both for in-going trim and for finished product. The present report describes the microbiological counts obtained in this work.

2. METHODOLOGY

2.1 SAMPLE PREPARATION

From each batch of trim or minced meat quintuplicate samples were prepared by excising pieces of meat or mince around 5g and weighing them into a stomacher bag to give a mass of 25-30g.

2.2 TRANSPORT TO THE LABORATORY

Samples were transported to the laboratory in an insulated chest containing frozen ice packs within 1 hour and held under refrigeration until analysis which was carried out within 2 hours of receipt.

2.3 MICROBIOLOGICAL ANALYSIS

Ten grams of meat was added to 0.1% peptone water (90ml) and macerated in a Seward Stomacher BA 7021 (Seward, United Kingdom) for 2 minutes. Serial dilutions were prepared in 0.1% peptone water using 1ml aliquots and plated for APC, generic *E. coli* and *S. aureus*.

For APC, petrifilm plates were prepared according to the AOAC method 990:12 and incubated at 27°C for 96h at which time the colonies were counted and the count/g recorded.

Generic *E. coli* were estimated by placing 1ml aliquots of appropriate dilutions onto *E. coli* Petrifilm (3M, Sydney, Australia) and incubating at 37°C for 48h. Colonies were counted as per the manufacturer's instructions and AOAC method 991.14.

Coagulase positive staphylococci were determined using Australian Standard method AS1766.2.4 (5) where 0.1ml aliquots were spread onto dried plates of Baird Parker agar (Merck, Melbourne, Australia) and incubated at 37°C for 48h. Colonies with typical morphology (grey-black, shiny, convex colony with a narrow entire margin surrounded by a zone of clearing) were picked off the plate for coagulase testing using rabbit blood plasma.

The limits of detection were 10 CFU/g for APC, *E.coli* and *S. aureus*.

3. RESULTS

3.1 SUPERMARKET PRODUCT

At the supermarket store minced meat was manufactured prior to store opening by passing vacuum packed trim twice through a grinder and portioning in trays, then over wrapping. Vacuum packed trim was used to make two grades of minced beef, “Premium” (90% CL) and “Heart Smart” (95% CL). Two 10kg batches of each of each grade were manufactured, using vacuum packed trim of varying age. The microbiological profile of Premium minced beef is presented in Table 1, and of Heart Smart minced beef in Table 2.

With one exception, mean TVCs were around log 7/g both for trim and minced beef. For Batch 1 of Heart Smart minced beef there was an increase in count of almost two log units during the grinding process. The most plausible explanation is that ingoing trim of mean count log 4.75/g picked up contamination from surfaces previously in contact with product in excess of log 7/g, together with addition of residual minced meat of similar count in the mechanism of the grinder. Heating in the grinder may be eliminated as a cause as samples were taken immediately after mincing.

Prevalence of *E. coli* increased during mincing of Premium trim but not after mincing Heart Smart trim where only 1/20 samples of trim and mince was positive for the indicator organism. Mean concentrations of *E. coli* in positive samples of Premium mince varied between log 1.68 and log 2.69/g.

S. aureus was isolated from 1/20 samples of Premium mince and 2/20 samples of Heart Smart minced beef.

Table 1: Hygiene indicators in trim (n=5) and Premium minced beef (n=5)

	Age of trim (days)	TVC*	<i>E. coli</i> **	<i>S. aureus</i> ***
Batch 1				
Trim	14	6.69 (0.02)	1/5 (2.69)	0/5
Mince		6.87 (0.05)	4/5 (1.68)	0/5
Batch 2				
Trim	18	7.73 (0.01)	4/5 (2.07)	1/5 (1.0)
Mince		7.59 (0.02)	5/5 (2.57)	0/5

* Mean log/g (SD)

** Prevalence (mean log of positive samples)

*** Prevalence (log count/g of positive samples)

Table 2: Hygiene indicators in trim (n=5) and Heart Smart minced beef (n=5)

	Age of trim (days)	TVC*	<i>E. coli</i> **	<i>S. aureus</i> ***
Batch 1				
Trim	7	4.75 (0.08)	1/5 (1.0)	0/5
Mince		6.67 (0.02)	0/5	0/5
Batch 2				
Trim	17	7.19 (0.01)	0/5	2/5 (2.0, 3.25)
Mince		7.43 (0.01)	0/5	0/5

* Mean log/g (SD)

** Prevalence (mean log of positive samples)

*** Prevalence (log count/g of positive samples)

Ten samples of Organic minced beef packaged by an external manufacturer were analysed. The mean TVC was log 5.04/g, *E. coli* was isolated from 1 sample and *S. aureus* was not isolated from any sample.

3.2 WHOLESALE/BUTCHER

Sampling at a large wholesale butcher was undertaken on two batches of trim, 65CL and 85CL, both produced from carcass trimming five days before mincing. The microbiological profiles of both batches are presented in Table 3. In both cases the mincing process reduced the mean TVC by around 1 log unit, possibly a reflection of the fact that small portions with high surface area:volume ratio were excised from trim. Despite this reduction during mincing 65CL minced beef had a mean TVC of log 7.1/g, while 85CL was 5.36/g. *E. coli* was detected in 2/20 samples of trim and mince, and *S. aureus* was not detected.

Table 3: Hygiene indicators in trim (n=5) and minced beef (n=5) manufactured from carcass trimmings

	Age of trim (days)	TVC*	<i>E. coli</i> **	<i>S. aureus</i>
65CL				
Trim	5	7.94 (0.04)	1/5 (1.30)	0/5
Mince		7.10 (0.02)	1/5 (1.00)	0/5
85CL				
Trim	5	6.65 (0.09)	0/5	0/5
Mince		5.36 (0.05)	0/5	0/5

* Mean log/g (SD)

** Prevalence (mean log of positive samples)

3.3 RETAIL BUTCHER SHOP

At a retail butcher shop vacuum packed trimmings of unknown age were ground in a mincer. The microbiological profile is presented in Table 4 from which it can be seen that TVC fell slightly during grinding to give a minced product with mean log 5.03/g. *E. coli* was not detected from trim but was detected in 6/10 minced samples possibly due to contamination during grinding from sausage meat previously passed through the grinder; *S. aureus* was not detected in any of 20 trim or minced samples.

Table 4: Hygiene indicators in trim (n=10) and minced beef (n=10) manufactured from vacuum packed beef at a retail butcher shop

	Age of trim (days)	TVC*	<i>E. coli</i> **	<i>S. aureus</i>
Trim	Not known	5.32 (0.02)	0/10	0/10
Mince		5.03 (0.02)	6/10 (1.25)	0/10

4. DISCUSSION

The present work confirms the finding of Phillips *et al.* (2007) that a wide range in TVC exists in minced beef with TVC being related to that of ingoing trimmings. Overall, minced samples (n=50) had a mean TVC of log 6.26/g with *E. coli* present on 34% (mean of positive samples 1.71/g) and *S. aureus* on 6% of samples (mean of positives 2.08/g). In comparison with the national survey of Phillips *et al.* (2007) prevalence and concentration of *E. coli* were both higher (17.8% and mean log 1.49/g) while the prevalence of *S. aureus* was lower (28.1%) with little difference in concentration.

The present study confirms the trend in *S. aureus* reduction established by Phillips *et al.* (2008) following introduction of gloves to the slaughter, dressing and processing sectors of the industry.

It is of interest that the TVC of minced beef has remained similar for the past three decades. Sumner *et al.* (1981) reported mean TVC of 140 samples of minced beef from supermarkets and retail butchers as log 6-7/g, with counts ranging from log 5/g to log 8/g.

5. REFERENCES

- Phillips, D., Jordan, D., Morris, S., Jenson, I. and Sumner, J. (2007) A national survey of the microbiological quality of retail raw meats in Australia. *Journal of Food Protection* 71 (6): 1232-1236.
- Phillips, Jenson, I. and Sumner, J. (2008) Controlling *Staphylococcus aureus* on beef and sheep carcasses in Australia. *Food Protection Trends* 28 (9): 16-20.
- Sumner, J.L. Gorczyca, E. and Lim, K.B. (1981) The hygienic status of minced meat in Melbourne. *Food Technol. in Aust.* 33:416