



ECCHYMOSIS (blood splash) in deer carcasses

Influence of pre-slaughter conditions

**A report for the Rural Industries Research
and Development Corporation**

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Foreword

Ecchymosis represents a marketing resistance in the venison industry as it lowers the appeal of meat to buyers, shortens shelf life of the meat and causes carcasses to be condemned for export.

Onkaparinga Valley Venison has been processing deer at the Strathalbyn Abattoir since 1992, during which time various grades of ecchymosis have been noted in the meat. During 1998, the killing system for sheep was updated to enable slaughtering of deer, in an effort to lower the occurrence of ecchymosis.

This report examines the results of a project which involved the collection and comparison of data collected on carcasses slaughtered at Strathalbyn Abattoir both before and after the killing system was changed.

This project was funded from industry revenue which is matched by funds provided by the Federal Government.

This report, a new addition to RIRDC's diverse range of over 450 research publications, forms part of our Deer R&D program, which aims to improve the productivity and profitability of the Australian Deer Industry.

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Peter Core
Managing Director
Rural Industries Research and Development Corporation

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Executive Summary

An experiment was run at Strathalbyn Abattoir from 1997-1999 to determine if improvements to the killing system for deer would reduce the occurrence of ecchymosis in the meat.

Ecchymosis levels in the meat were recorded under the existing killing system in 1997 and the system was updated in 1998. Subsequent measurements were made under the new killing system for the same month period in 1999. Several other factors thought to have a possible influence on the occurrence of ecchymosis were measured during the length of the experiment – weight, sex and carcass fat level.

Whilst fat levels and sex of animals was found to be related to occurrence of ecchymosis, by far the largest ‘effect’ on presence of ecchymosis in this project was the killing method. Under the new killing system developed at Strathalbyn Abattoir, the percent of animals with ecchymosis dropped from 20% to 3%.

Statistical analyses indicated that fat levels and sex of the animals was also significantly related to the presence of ecchymosis in the meat and was found to be higher in castrates of medium fat level. The weight of the animals was found to be unrelated.

The alterations to the killing system at Strathalbyn Abattoirs have been found to significantly reduce the occurrence of ecchymosis in venison meat, presumably due to a significant reduction in the time between killing, bleeding and hanging the animals during the slaughtering process

These alterations could be carried out at other venison processing facilities throughout Australia to aid in improving the quality of both the Australian and export markets.

1. Introduction

The Strathalbyn Abattoir commenced processing deer in 1981. The existing facilities for slaughtering beef and sheep were not suitable for deer and so a portable 'knocking box' was constructed for use on animals immediately as they were unloaded from the truck.

This system was used for six years, during which time various grades of ecchymosis were noted in the meat. Ecchymosis (blood splash) appears as a spotting in the meat and is caused by blood vessels bursting under pressure immediately after the animal is shot. Ecchymosis represents a marketing resistance in the venison industry as it lowers the appeal of meat to buyers, shortens shelf life of the meat and causes carcasses to be condemned for export.

There is a general consensus of growers in the industry that there are four main factors that could affect the ecchymosis levels in venison, being:

- time between killing and hanging carcasses;
- carcass fat levels;
- stress levels of animals pre-slaughter; and
- distance travelled prior to slaughter.

This project was designed to test the first two of these four factors. The main aim of the project was to introduce a new killing system that reduced the time between killing and hanging carcasses and monitor the effect on ecchymosis levels in the meat. At the same time, a number of other factors including carcass fat levels were also investigated.

2. Objectives

1. To compare and contrast the incidence of ecchymosis levels in deer carcasses under two alternative slaughtering systems.
2. To determine the influence of the animal's weight, sex and carcass fat level on the occurrence of ecchymosis in the meat.

3. Methodology

The presence/absence of ecchymosis in the meat was recorded for all fallow deer processed at Strathalbyn Abattoir from May – July 1997. Additionally the fat level, sex and weight of the carcasses was recorded (see Table 1). The fat level was recorded as a score from 1-3 (see Table 2).

Table 1: Mechanism for recording carcass information at Strathalbyn Abattoir.

Location	Activity
Knocking Box	Sex of animals was recorded
Grading Station	Carcasses were weighed and graded for Fat Score (see Table 2). Carcasses were subsequently tagged with this information before going into the chillers.
Boning Room 1	The diaphragm muscle was checked for ecchymosis and its presence/absence was recorded on the carcass tag.
Boning Room 2	During the ‘boning out’ of the carcass, presence/absence of ecchymosis was noted in the separate meat cuts.

Table 2: Grading system used to determine carcass ‘Fat Score’.

Fat Score	Definition
1 = Lean	No fat on rump of carcass
2 = Medium	Less than 1cm depth of fat on rump of carcass
3 = High	Over 1cm depth of fat on rump of carcass

Alterations were made to the killing system at Strathalbyn Abattoir during 1998. These alterations are described in the following section.

Whilst using the new killing system, the presence/absence of ecchymosis, fat level, sex and weight of animals processed from May – July 1999 was recorded as before.

3.1 Description of the two killing systems

3.1.1 Old Killing System

Animals were killed outside the abattoir. Animals were run through a tunnel directly from the back of the transport truck. They then entered a small compartment one at a time and were shot with a low velocity .22 short bullet from above. The side of the compartment was then opened and the animal fell onto a platform where its throat was cut thoracically. The animal was then carried inside, shackled and lifted onto the kill chain.

3.1.2 Changes to Killing System

It was decided to modify the facilities for killing sheep inside the abattoir, and adapt them for processing deer. The existing sheep train consisted of an L-shaped run from a lairage into a knocking box. The following adaptations were made:

- A loading ramp was built leading up into the sheep lairage, designed for unloading deer from the truck.
- The walls of the existing sheep lairage were enclosed and a removable roof was constructed over the subsequent run leading to the knocking box.

3.1.3 New Killing System

The removable roof over the sheep run is lowered prior to processing deer. The animals are unloaded from the truck into the lairage via the new loading ramp. The animals are then herded through the adapted sheep run inside the abattoir, into the sheep knocking box. Animals enter the box one at a time and are shot with a low velocity .22 short bullet. The knocking box then pivots sideways and the animal's throat is cut thoracically. It is then shackled and immediately hung onto the kill chain.

The main outcome of the alterations to the killing system was a significant reduction in the time taken between killing, bleeding and hanging the animals. A comparison of the time delays involved in the two killing systems is presented in Table 3.

Table 3: Time delays within the killing systems.

	Old Killing System	New Killing System
Approximate time between shooting animal and cutting throat.	15-20 seconds	5-7 seconds
Approximate time between cutting animal's throat and hanging on the kill chain.	1.5-2 minutes	3-5 seconds

4. Results

Data was collected for 334 carcasses processed using the ‘old’ killing system in 1997, and from 426 carcasses processed at the same time of year using the ‘new’ killing system in 1999.

This data was compiled into a matrix and contingency tables were used to test whether the frequency of occurrence of ecchymosis in carcasses varied according to the killing system used or to the fat score, sex or weight of the carcass (see Table 4).

Table 4: Results of statistical analysis.

Variable	Null Hypothesis	X ² value	X ² critical value	Outcome
Kill Method	Kill method is not related to occurrence of ecchymosis.	55.72	3.841	Null hypothesis rejected.
Fat Score	Fat Score is not related to occurrence of ecchymosis.	20.47	5.991	Null hypothesis rejected.
Sex	Sex of animal is not related to occurrence of ecchymosis.	3.99	3.841	Null hypothesis rejected.
Weight	Weight of animal is not related to occurrence of ecchymosis.	1.41	5.991	Null hypothesis accepted.

4.1 Killing System

Under the new killing system developed at Strathalbyn Abattoir, the percent of animals with ecchymosis dropped significantly, from 20% under the ‘old’ killing system to 3% using the ‘new’ killing system (see Figure 1).

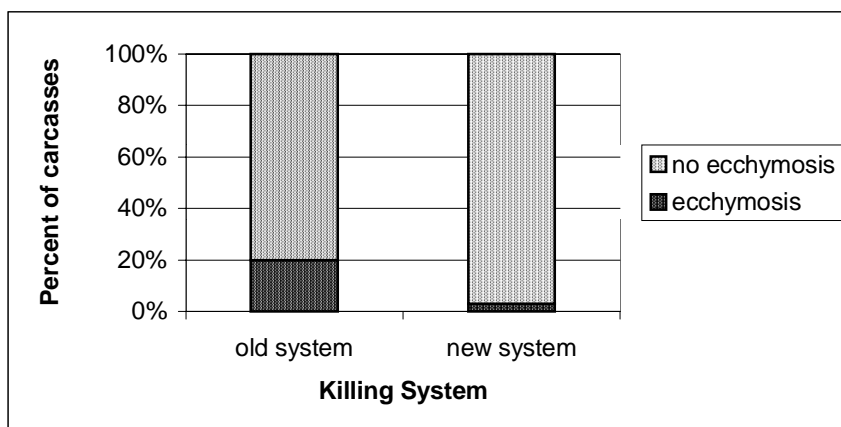


Figure 1: Occurrence of ecchymosis under the two killing systems.

4.2 Fat Levels

The presence of ecchymosis varied significantly between carcasses with different fat scores, with highest frequency of ecchymosis found in animals with a 'medium' fat score (see Figure 2).

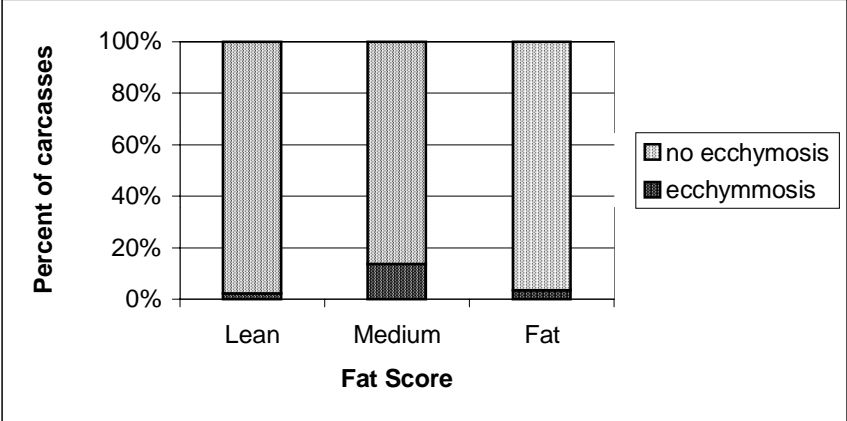


Figure 2: Occurrence of ecchymosis in animals with different Fat Scores.

4.3 Sex

The presence of ecchymosis was found to be significantly higher in castrated males than in females (see Figure 3).

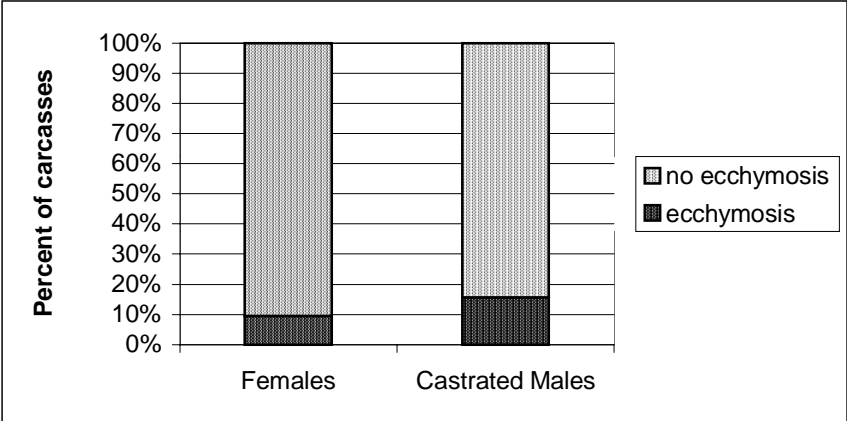


Figure 3: Occurrence of ecchymosis in females and castrated males.

4.4 Weight

The presence of ecchymosis was found to be unrelated to carcass weight (see Figure 4).

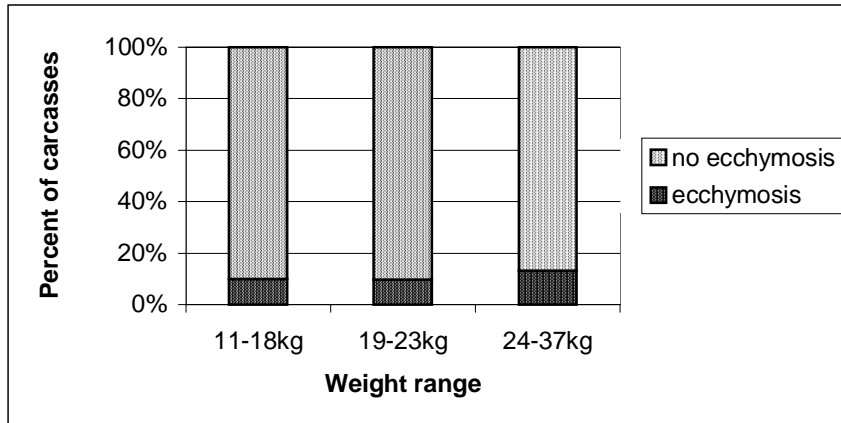


Figure 4: Occurrence of ecchymosis in animals of varying weight.

5. Discussion

The main outcome of this study was the finding that killing animals under the new system resulted in significantly reduced frequency of occurrence of ecchymosis in the meat.

As outlined in the above sections, the main factor changed in the new killing system was a large reduction in the time taken between killing, bleeding and hanging the carcasses. Essentially this reduces the blood pressure levels in the muscles immediately after the animal is shot and therefore the blood capillaries are less likely to burst and result in ecchymosis.

The relationship found between Fat Score and sex of the animal and the occurrence of ecchymosis in the meat is an interesting discovery but has little bearing on farm management. In addition, the effect of these factors was found to be minimal in comparison with the effect of changing the killing system. It is likely that any other factors thought to influence the occurrence of ecchymosis (eg. Stress of animals pre-slaughter) will also have a minimal effect in comparison with speeding up the bleeding process during animal slaughter.

6. Implications

The alterations made to the deer killing system at Strathalbyn Abattoir resulted in a substantial reduction in the time taken between killing, bleeding and hanging carcasses. Similar alterations could be carried out at other venison processing facilities throughout Australia to aid in improving the quality of both the Australian and export markets.

7. Glossary

The following terms are used at Strathalbyn Abattoir and are referred to in this report:

Lairage	A room used for storing animals prior to slaughtering
Knocking Box	The restraining box where animals are killed
Shackles	Used for hanging carcasses on the killing chain
Killing Chain	Rod along which carcasses are hung and conveyed along to different sections of the abattoir
Ecchymosis (blood splash)	Spotted bruising in meat caused by blood vessels bursting under pressure immediately after the animal is shot