final report

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The Effect of Electrical Stimulation on the bleeding of cattle at slaughter

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1.0 INTRODUCTION

Conventional upward pulling hide strippers are being replaced in a large number of Australian abattoirs by hide strippers of the downward pulling type to reduce labour requirements, produce cleaner carcasses, and reduce length of head chains (1). These advantages are achieved because the forequarters and head of the carcass are 'sock-skinned' by hide strippers.

When the hide is pulled away from the forequarters and head, the carcass has to withstand a large tensile force. Resistance to this force can be increased by electrical stimulation of the back muscles of the carcass with a voltage applied between electrodes in contact with the lumbar and thoracic regions.

The area of floor adjacent to downward hide strippers becomes heavily soiled with blood and, if the blood is expressed from the muscle tissue during stimulation, saleable product is lost. If this is the case, then it is analagous to the situation in chillers, where a loss of 0.1% of the carcass weight is considered economically significant.

Our aim was to determine:

a) If electrical stimulation causes an increase in blood loss.

b) If electrical stimulation causes blood to be expressed from the muscle tissue.

2.0 BACKGROUND

The nature of the operations and the equipment used in any abattoir prevent direct measurement of the amount of blood which flows from the stick wound when the carcass is electrically stimulated at the downward hide puller.

A previous study (2) suggested that the weight of blood collected in the first 20 seconds after sticking was about 96% of the total weight collected in the first 60 seconds (Fig.1). Stimulation of the carcass at the bleeding area 30 seconds after sticking should therefore show whether electrical stimulation resulted in increased blood loss.

3.0 EXPERIMENTAL

3.1 BLOOD YIELD OF UNSTIMULATED CARCASSES

When the sticking knife was removed from the carcass, an open container was placed below the stick wound and the blood was collected for 60 seconds and weighed. This was repeated for a number of carcasses. Dressed carcass weights were recorded.

4.2 BLOOD CONTENT OF MUSCLE

The results of the muscle pigment analyses are tabulated in Table 2. These show haemoglobin as a percentage of the total pigment. Sample numbers are recorded with the samples in the order they were taken (i.e. alternately).

The ratio of haemoglobin to myoglobin in the muscle is affected by the amount of blood in the muscle. If blood is removed, the overall haemoglobin concentration is lowered, whereas the concentration of myoglobin is unaltered. This means that a significantly lower percentage of haemoglobin would have indicated that blood had been expressed from the muscle as a result of the treatment. This was not the case.

5.0 CONCLUSIONS

Electrical stimulation of the carcass after sticking increases the weight of blood discharged from the carcass, but, the additional amount of blood released by the carcass is not expressed from muscle tissue. The extra blood must therefore result from more effective drainage of the blood vessels and internal organs of the carcass.

6.0 ACKNOWLEDGMENTS

We wish to express our appreciation to management and staff of Teys Bros (Beenleigh) Pty Ltd and K.R. Darling Downs (Brisbane) for their co-operation during the course of these experiments.

We also wish to thank other members of the Industry Section for their technical and professional assistance.

7.0 REFERENCES

1. B.Y. Johnson (1973): Recent Developments in Mechanical Skinning. CSIRO Report. Restricted Distribution.

2. A. Graham & N.G. McPhail (1974): Blood - Collection and Processing for Edible Purposes. CSIRO Meat Research Report No.4/74.

3. U. Götze (1969): Determination of Myoglobin and Haemoglobin in Meat Extract of Slaughter Animals. Die Fleischwirtschaft 49, pp.901-906.

8.0 APPENDICES

APPENDIX 1: DESCRIPTION OF THE PROCEDURE USED TO DETERMINE THE RATIO OF HAEMOGLOBIN TO MYOGLOBIN IN MUSCLE

To determine the ratio of haemoglobin to myoglobin in the muscle samples, the method described by Götze (3) was used, the procedure being as follows:

1) The total pigments were extracted by blending the sample (20g) with chilled water (25g) and allowing it to stand at 0°C for 24 hours.

2) After the sample was centrifuged, sodium hydroxide was used to adjust the pH of the supernatant (liquid fraction) to 7.0. Basic lead acetate was then added to precipitate the protein which was then removed by centrifuging.

3) The supernatant was filtered through a 1.2 µm millipore filter and the optical density (O.D.) for the total pigment concentration was read at a wavelength of 525 nm (extract 1).

4) Dipotassium hydrogen phosphate (2.80g) and potassium dihydrogen phosphate (2.56g) were used to adjust the pH of this solution to 6.6, to precipitate haemoglobin which was removed by centrifuging.

5) The supernatant was filtered through a 1.2 µm millipore filter and the O.D. for the myoglobin concentration was read at a wavelength of 525 nm (Extract 2).

6) Myoglobin as a percentage of total pigments, taking into account a dilution factor, is:

$$= \frac{\text{O.D.525 (Extraction 2)} \times 1.1 \times 100}{\text{O.D.525 (Extraction 1)}}$$

Because the total pigments are haemoglobin and myoglobin, the percent haemoglobin is obtained by the difference, i.e.

$$\% \text{ Hb} = 100 - \% \text{ Mb}$$

TABLE 1

Blood weight, carcass weight and adjusted blood weights for stimulated and unstimulated carcasses. Blood collection time is the first 60 seconds of bleeding.

	Stimulated	Unstimulated
Number of Carcasses	54	67
Mean Carcass Weight (kg)	254.3	232.4
Weight of Blood (kg)	10.96	9.77
Adjusted Weight of Blood (kg)*	10.68	10.00
Difference Between Adjusted Blood Weights (kg)**	0.68	

*Blood weights adjusted for mean carcass weights (new mean carcass weight 242.1 kg, correlation coefficient for all values 0.5)

**Least significant difference (5%) for the comparison of blood weight by the two treatments is 0.62 kg and significant difference (1%) is 0.82 kg.

TABLE 2

Haemoglobin content of muscle as a percentage of total pigment.

Number	Unstimulated	Number	Stimulated
1	43.3	2	52.4
3	46.7	4	49.3
5	45.8	6	37.6
7	40.7	8	42.5
9	41.8	10	41.7
11	50.3	12	48.9
13	43.0	14	49.1
15	49.6	16	54.7
17	43.1	18	39.2
19	59.8	20	55.1
Mean	46.41	Mean	47.05
Standard Deviation	5.69	Standard Deviation	6.37

There is no significant difference between the two sets of results (computed "F" value being 0.056)

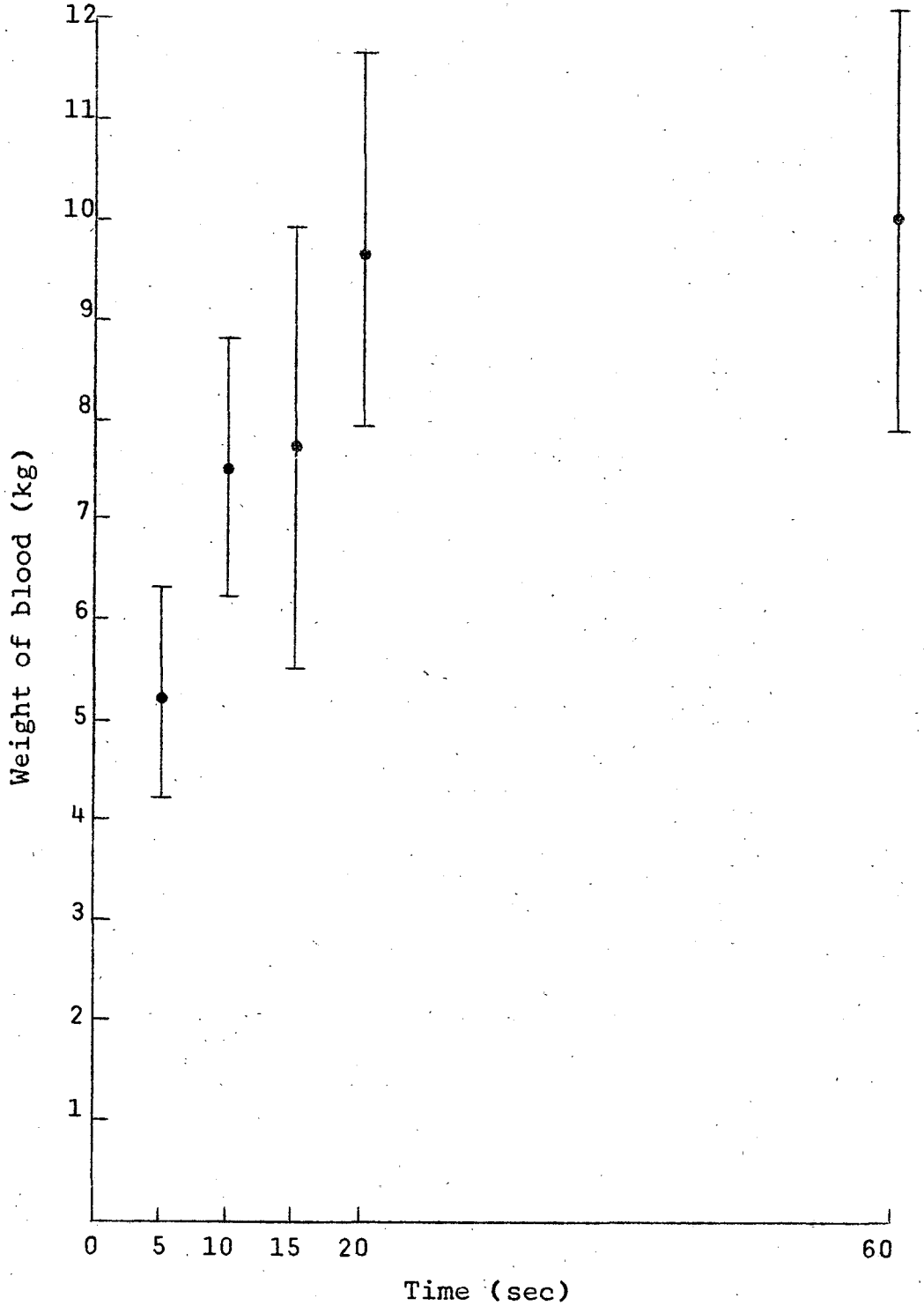

FIG.1 Plot of mean weights of blood collected at nominated times showing one standard deviation either side of the mean.

(Source: CSIRO Meat Research Report 4/74: Blood - Collection & Processing for Edible Purposes)

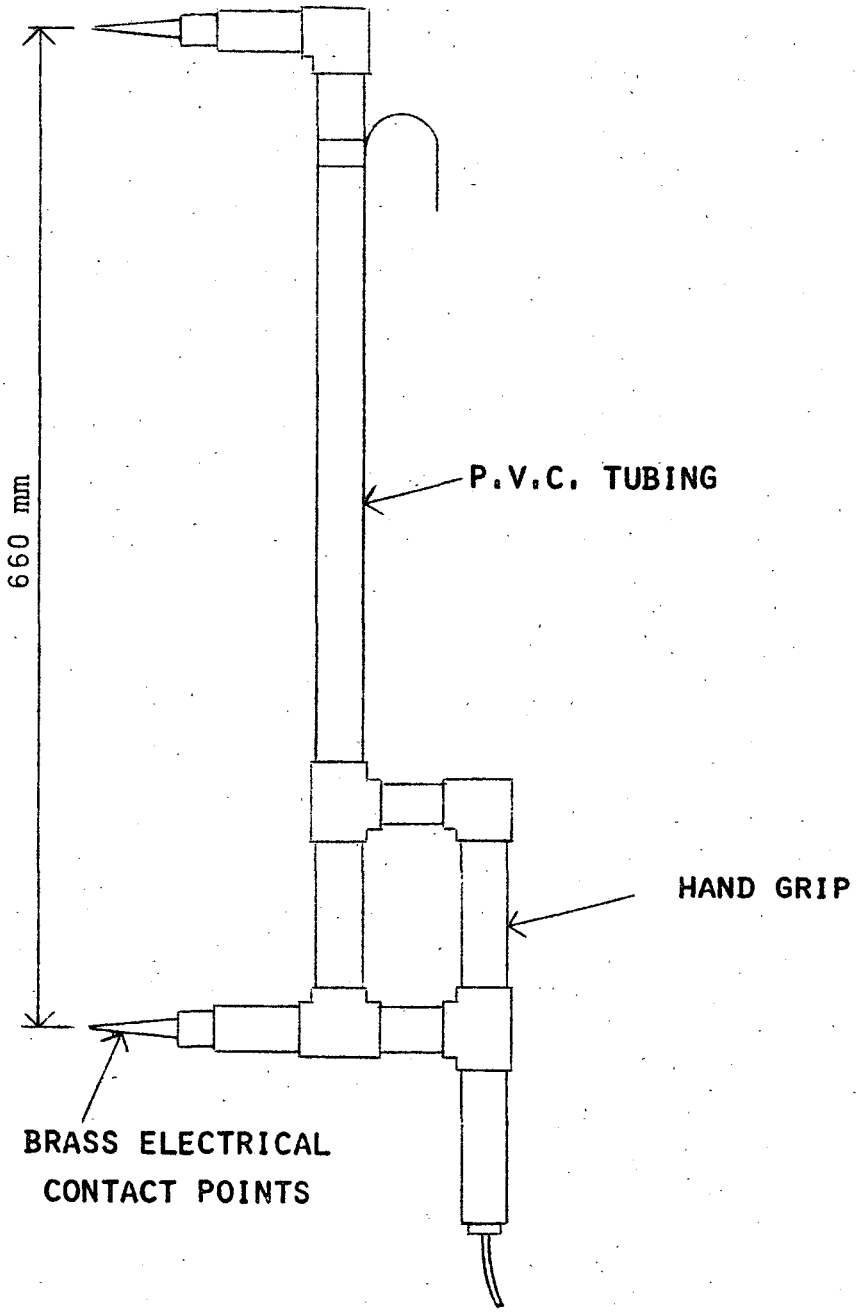

FIG.2 HAND HELD ELECTRICAL STIMULATOR