GROWTH RATE AND MEAT QUALITY IN CATTLE

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Summary

A slaughter experiment is described in which Angus weaner steers were grown along three different pathways from 300 to 440 kg. The growth rates studied were high growth rate (0.8 kg/day), low growth rate (0.4 kg/day), and high growth rate followed by a period during which liveweight was kept constant. The Mm. longissimus dorsi and psoas major were dissected from each carcass, cooked under standard conditions and assessed for meat quality. The results of these tests showed (i) no significant effect of growth rate on meat quality and (ii) an increase in tenderness with increasing age and weight of the animals.

I. INTRODUCTION

Current information available on the effect of growth rate on meat quality in cattle is somewhat confused. In a review, Tayler (1964) cites experiments where rapid growth rate has been found to improve meat quality and others where no such effect was observed. In this experiment, the relationship between growth rate and meat quality has been investigated.

II. MATERIALS AND METHODS

(a) Experimental Design

The experimental design is illustrated in Figure 1. After reaching 300 kg, animals were grown along three growth paths (i) high growth rate-0.8 kg/day, (ii) low growth rate-0.4 kg/day and (iii) high maintenance-high growth rate followed by a period during which liveweight was kept constant. Animals from each of the three groups were allocated to four slaughter weights-330, 363, 399 and 439 kg. In addition, two animals were killed at 300 kg.

(b) Animals and Management

Twenty nine individually fed Angus weaner steers were used in the experiment. The animals were fed the experimental diet for at least three months before reaching the starting liveweight (300 kg) at an age of 13-14 months. Animals were weighed thrice-weekly and the individual rations adjusted according to the required weight gain. The experimental diet consisted of 0.9 kg/day of hammer-milled oaten straw together with a variable amount of commercial cattle pellets.*

(c) Slaughter and Muscle Dissection

Animals were slaughtered and dressed according to commercial practice. The carcasses were stored at 2-3°C for 24 h after which the Mm. longissimus dorsi

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and psoas major of the right side were dissected out and trimmed of external fat. After being wrapped in heavy gauge polyethylene bags (0.1 mm thick), the muscles were frozen and stored at -20°C.

(d) Muscle Quality

Tests were made on both muscles at the C.S.I.R.O. Meat Research Laboratory, Cannon Hill, Brisbane. Grilled samples were evaluated by a taste panel of ten members for tenderness, juiciness and flavour. An 8 point scale was used; 1 and 8, respectively, representing low and high desirability. The individual panel scores of tenderness, juiciness and flavour for each muscle were pooled within animals. Tenderness ratings for both the Mm. longissimus dorsi and psoas major were also obtained on samples deep-fried in oil by using a mechanised shearing device, similar in design to the Warner-Bratzler Shear. With this equipment, the lower the shear values the more tender is the meat.

III. RESULTS

(a) Taste Panel

Mean taste panel scores for the three groups are presented in Table I. Information from the two animals killed at 300 kg is excluded from the analysis so that group comparisons are made over similar weight ranges.

There were no significant differences between treatments in muscle tenderness,
juiciness and flavour. However, there was a significant difference between muscles, the M. psoas major being more tender than the M. longissimus dorsi. Tenderness scores of the M. longissimus dorsi from the three groups showed a similar increase with increasing slaughter weight while those of the M. psoas major failed to show this trend. The pooled linear regression of M. longissimus dorsi tenderness score on liveweight at slaughter was:

\[ Y = 32.5 + 0.05X \] (P < 0.05)

where \( X \) = liveweight at slaughter (kg), and

\( Y \) = tenderness score.

(b) Shear Values

Shear values of the Mm. longissimus dorsi and psoas major from individual animals of the three groups are plotted against their respective weights at slaughter in Figures 2a and 2b.

The shear values for the M. psoas major were unrelated to weight at slaughter and remained almost the same throughout the weight range studied. In contrast, the shear values of the M. longissimus dorsi decreased with increasing killing weight. There was no significant difference between groups in this relationship and all data were pooled to give the following linear regression:

\[ Y = 29.9 - 0.12X \] (P < 0.001)

where \( X \) = liveweight at slaughter (kg), and

\( Y \) = shear value (kg).

Overall, the shear values from the M. longissimus dorsi samples were greater (P < 0.05) than those from the M. psoas major samples. The difference between muscles, however, was less marked than that obtained by the taste panel on grilled samples.

IV. DISCUSSION

The results indicate that the meat from each of the treatments was of similar standard in tenderness, juiciness and flavour. Although they presented no figures, comments of Hendrickson, Pope and Hendrickson (1965) support the findings presented here. These authors found that meat from animals grown from 220 to 400 kg at either 0.8 or 0.6 kg/day showed little difference in quality. Winchester
and Howe (1955) have also demonstrated the independence of meat quality on prior growth rate. In their study, animals of 160 kg were restricted in food intake for a period of six months in order to slowly gain weight. They were then allowed to recover to the same slaughter weight (450 kg) as their continuously well grown controls. The meat quality in both groups was similar.

Shear values and taste panel scores of the *M. longissimus dorsi* in the current experiment indicate a significant improvement in tenderness with increasing live-weight and age. Field, Nelmo and Schoonover (1966) in a study primarily concerned with sex differences in meat quality report a similar though non-significant decrease in shear values of the *M. longissimus dorsi* from 10 to 24 months. In a comparison of 6 and 18-month old animals, Tuma *et al.* (1963) also observed a superior tenderness of the older animals although aging the carcasses for 14 days at an unspecified temperature was found to reverse the order of tenderness in the two groups.

Fig. 2.—The relationship between shear value and liveweight in (a) *M. longissimus dorsi* and (b) *M. psoas major.*
The reason for the enhanced tenderness in the larger animals reported here is not known. It may be related to increasing carcass fatness, although intramuscular fat in muscle appears poorly related to their tenderness (Blumer 1963).

V. ACKNOWLEDGMENTS

The author wishes to acknowledge the C.S.I.R.O., Meat Research Laboratory, Cannon Hill, Brisbane for kindly conducting the quality tests. Thanks are also due to Dr. N. M. Tulloch for his constructive criticism of this manuscript and to Mr. H. Moog for his dedicated care of the animals.

The financial assistance of the Australian Meat Research Committee is gratefully acknowledged.

VI. REFERENCES