CONSUMER APPRECIATION OF MEAT FROM CALVES SLAUGHTERED BETWEEN
ONE AND TWENTY TWO WEEKS OF AGE

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SUMMARY

Veal chops were prepared from calves reared on milk, concentrates, pellets
and/or grass after weaning at nine weeks of age and slaughtered at one, nine, 16,
20 or 22 weeks of age. These chops were randomly presented to 20 members of
Rutherglen Research Institute staff for cooking in their homes. They were asked
to evaluate the chops in terms of size, meat colour, tenderness and
acceptability.

Chops from veal carcasses with Longissimus-dorsi muscle area greater than
45 cm$^2$ were considered too big, but a large range in objective measurements of
meat colour and tenderness was found to be acceptable by the consumers as a
group. Keywords: veal, meat colour, chop size, tenderness

INTRODUCTION

A study undertaken by McKinna (1984) on consumer attitudes to red meat
recommended that special attention should be given to developing the market for
veal. Veal was perceived to be versatile, interesting, tasty and easy to
prepare. It is low in total lipids and saturated fats (Sinclair 1973) and thus
is attractive to consumers wishing to reduce total fat intake from meat.
However, the supply of veal does not meet the demand for the product all year
around. During 1983, a survey of 92 wholesale and retail butchers in Melbourne
showed that veal carcasses of 51-70 kg were most in demand, whereas carcasses up
to 40 kg made up the bulk of the supply (Bailey, personal communication).

These studies led to a multi-disciplinary research program by the Victorian
Department of Agriculture and Rural Affairs with the aim of improving the supply
of veal. Consumer survey work in Melbourne (Sharp 1987) indicated that to be
acceptable, veal can range in colour from grey through to light pink, provided it'
is paler than beef and the tenderness and low fat status of the meat is
'maintained. A series of calf rearing trials designed to develop the most
economical feeding system(s) for dairy farmers to grow out their bull calves was
set up. The carcasses were examined for meat quality in terms of yield, colour,
tenderness and fat content as well as consumer appreciation.

This paper presents the results of a pilot consumer evaluation of a range of
veal chop types from the calf feeding trials. It was designed to-determine the'
range of meat colour, chop size and meat tenderness that would be considered
acceptable as veal.

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MATERIALS AND METHODS

Consumer group Twenty households were chosen at random from the total staff of 63 at Rutherglen Research Institute. These included married people with families and single people, with occupations including farmwork, laboratory work, officework and research, living within a 70 km radius of Rutherglen.

Calves Friesian bull calves were bought in local saleyards and reared at the Department's Research Institutes at Kyabram and Ellinbank during spring in 1985. One week old calves from Kyabram provided the initial slaughter group of six calves. A pre-weaning group of calves fed milk only was slaughtered at nine weeks of age. Post-weaning calves were fed milk ad lib (two groups), 11 litres per head per day of milk plus concentrates ad lib or ad lib concentrates only in group pens. Five and six calves from each group were slaughtered at 16 and 22 weeks of age respectively, making 10 treatments.

Calves at Ellinbank were fed indoors on pre-weaning diets of 4.5 or 9 litres per head per day of milk with concentrates available to groups in pens. Four calves fed each diet were slaughtered at nine weeks of age and the remainder were allocated to post-weaning feeding regimes of "grass only" or "grass plus pellets". The groups grazed different paddocks. Four or five calves were slaughtered from each group at 16 and 20 weeks of age, making a total of 20 treatments from both locations, with a minimum of four calves per treatment.

All calves were slaughtered at Kyabram Abattoirs following 24 h feed deprivation and overnight lairage at the abattoir. All carcasses were electrically stimulated within 10 mins of stunning and exsanguination, using low voltage electrical stimulation equipment (AIS LVS-4 with nostril-rectal probes).

Carcass measurements Cold carcass weight and meat colour were determined in the boning room 24 h after slaughter. The colour of the meat was measured on the Longissimus dorsi (L. dorsi) at the 12th rib 30 minutes after cutting, using a Minolta Chroma Meter which estimates L (a measure of lightness where 0 = black, 100 = white). The L. dorsi muscle area was determined by tracing the outline of the muscle and measuring the area by planimeter. Meat tenderness measurements were taken on samples from L. dorsi muscles which were frozen 48 hours after slaughter. After the experimental program was completed the samples were thawed, and 100 g samples were cooked for one hour in a waterbath (80°C) and measured using a Warner-Bratzler shear attachment on an Instron Model 4301 (Gaunt and Currie 1988).

Chops Two days after slaughter the 10 to 13 rib set from the left side of each carcass was wrapped in polyethylene wrap and frozen. For, four consecutive weeks, one rib set from each of 20 treatments was given at random to 20 households. The rib sets were thawed in a chiller at 5°C for 48 hours then were cut into chops, trimmed, packed onto polystyrene trays and labelled before distribution.

Questionnaire. Each chop set was accompanied by a questionnaire reminding the consumers that the chops should be either pan fried, grilled or roasted without sauces. The uncooked chop size (Too small = 1 to Too big = 5), and meat colour for veal (Too pale = 1 to Too dark = 6), cooked tenderness (Cold = 1 to Tender = 6) and acceptability were to be evaluated. A further questionnaire asked the consumers for their normal veal buying frequency.

Analyses Chi-square analyses showed that the consumer opinions on chop size, meat colour and meat tenderness were not distributed randomly amongst the objective measurements. Frequencies of ratings of 1 and 2, 3 and 4, 5 and 6 have been pooled for these attributes. Regression analyses were performed.
on the objective data and cold carcass weight (CCWT). Treatments have not been compared because some confounding of treatments occurred.

RESULTS

Five of the 20 households normally bought and cooked veal in their homes. The frequency ranged from monthly to weekly. Five of the households never ate veal and the remainder occasionally ate veal in hotels or restaurants.

The slaughter ages resulted in a wide range of carcass weights, L. dorsi muscle areas, meat colour, meat tenderness and thus chop types to evaluate. Eight out of eighty questionnaires were not returned.

Most people preferred chop sizes up to 45 cm² for the 12th rib (Table 1a). Linear regression of CCWT (kg) on L. dorsi muscle area (LDMA) gave:

\[ \text{CCWT} = 8.77 (\pm 3.63) + 1.99 (\pm 0.09) \text{ LDMA}, \quad (r = 0.91, \text{ RSD} = 11.7) \]

<table>
<thead>
<tr>
<th>LDMA (cm²)</th>
<th>No. in range</th>
<th>Consumer opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-25</td>
<td>10</td>
<td>Too small 8</td>
</tr>
<tr>
<td>25-35</td>
<td>26</td>
<td>Too big 18</td>
</tr>
<tr>
<td>35-45</td>
<td>19</td>
<td>Too big 15</td>
</tr>
<tr>
<td>45-55</td>
<td>10</td>
<td>Too big 1</td>
</tr>
<tr>
<td>55-65</td>
<td>6</td>
<td>Too small 6</td>
</tr>
<tr>
<td>68.4</td>
<td>1</td>
<td>Too small 1</td>
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</table>

<table>
<thead>
<tr>
<th>L* value</th>
<th>No. in range</th>
<th>Consumer opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.1</td>
<td>1</td>
<td>Too pale 1</td>
</tr>
<tr>
<td>30-35</td>
<td>8</td>
<td>Too pale 2</td>
</tr>
<tr>
<td>35-40</td>
<td>25</td>
<td>Too pale 16</td>
</tr>
<tr>
<td>40-45</td>
<td>30</td>
<td>Too pale 22</td>
</tr>
<tr>
<td>45-50</td>
<td>7</td>
<td>Too pale 6</td>
</tr>
<tr>
<td>51.2</td>
<td>1</td>
<td>Too pale 1</td>
</tr>
</tbody>
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* L = 0 is black, L = 100 is white

A wide range in L values (Table 1b) was accepted by the majority of consumers for veal meat colour. Twenty nine percent of those receiving meat with an L value of 29.1-40.0 felt the colour was too dark for veal. Twelve percent of the colour ratings were "too pale", but 73.7% of those receiving samples in the L range 40-51.2 felt the colour was acceptable for veal.

"Tender" and "tough" ratings were given for 58% and 17% of samples, respectively. These ratings were over the whole range of Warner-Bratzler peak shear force (WB) values (1.8 to 6.1 kg) for the chops cooked in consumers' homes.
(Table 2). Nine households roasted some sets of chops and gave 11 tender ratings out of a total of 15.

DISCUSSION

The consumers in this evaluation of veal chops are part of the market segment that frequently consumes beef and lamb but rarely or never buy veal. However, the high acceptability scores given for the chops indicate that market development may encourage them to buy and cook veal.

Most of the consumers considered chops were too big when the L dorsi muscle area of the 12th rib chop exceeded 45 cm². According to the regression equation this related to carcases of about 80 kg and confirmed that carcases in the range 51 to 70 kg (those in demand in Melbourne) would be accepted by the majority of consumers in terms of chop size.

Meat colour, as represented by the lightness value L, was accepted by the majority from L = 30 through to L = 51.2 (dark cutting through to very pale veal, Warner, unpublished data). The 29.4% who considered the meat with an L value of 30-40 to be too dark for veal are in agreement with members of the project team and other research into the visual appraisal of veal meat colour (Currie and Warner, unpublished data). No ratings of "too dark" were received for samples with L values above 45. This suggests a possible lowest L value for veal between 40 and 45. The 12.5% who considered the meat to be "too pale" across the range of L values must prefer dark coloured meat and may not be potential veal buyers.

Though the carcases were all electrically stimulated to overcome possible cold shortening problems, 17% of the chops were rated as "tough". These were spread across the whole range of WB values measured. As none of the tough chops had been roasted and it is known that cooking temperature and time effect the mechanical properties of meat (Bouton and Harris 1972), it is probable that various cooking techniques in consumers' homes would have changed the inherent meat tenderness. Thus a close relationship between WE values and tenderness ratings from this evaluation would not be expected.

This study showed that beef and lamb consumers found a variety of chop types acceptable as veal. However, it indicated that a product from calves less than 80 kg carcass weight of L values 40 to 45 or more and electrically stimulated could be promoted and well accepted as veal. Some carcases from all treatments were in this category although the majority of the 20 and 22 week old calves had L values less than 40.

ACKNOWLEDGEMENTS

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