Meat Quality of First and Second Cross Capretto Goat Carcasses

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ABSTRACT: Thirty-four capretto carcasses slaughtered from nine genotypes were used in the present study to evaluate their meat quality. The nine genotypes were Feral X Feral (FF) as a control, Boer X Saanen (BS), Boer X Feral (BF), Saanen X Angora (SA), Saanen X Feral (SF), and Boer sired second crosses BBBA, BBBS, BBSF and BBSA. In general, BBSF tended to have higher ultimate pH, darker meat color, lower shear force resistance, and greater tenderness than other genotypes. In contrast, BBBS were likely to have lower ultimate pH, paler meat color, higher cooking loss, higher shear force resistance, and lower subjective tenderness scores than other genotypes.

Key Words: Goats, Boer Goats, Feral, First-Cross, Second-Cross, Capretto, Meat Quality.

INTRODUCTION

Goat producers in Australia are aware that to keep Australia's position as the world's largest exporter of goat meat, and to increase the export values of goat meat, they should not rely on captured feral goats. One of the ways to improve goat meat production and to be liberated from the dependency on feral goats is to create new crossbreeds that are fecund, grow rapidly, and have desirable carcass and meat characteristics.

The South African Boer goat, acknowledged as having many desirable characteristics as a potential meat goat (Casey and Van Niekerk, 1988), has recently been imported into Australia. Boer bucks have been crossed with Feral, Saanen, and Angora does in an attempt to improve the productivity, carcass characteristics and meat quality of their kids. Feral and Angora does have also been mated to Saanen bucks for meat production purposes. The dressing percentage of the first crosses was reported to be lower than that of Feral goats (Dhanda et al., 1999a,).

The female progeny of the first crosses were mated to Boer bucks to produce kids with better carcass and meat characteristics. The growth and carcass characteristics of the second crosses were reported to be better than those of the controls (Feral goats) and the first crosses (Husain et al., 2000), but their meat quality had not been evaluated. Goat carcasses from young suckling kids are called capretto having a weight of 5-12 kg with pink flesh that is tender and lean.

The objective of this study was to evaluate the meat quality of these first and second crosses of goats reared to produce capretto carcasses, and compare them with Feral goats, raised under the same conditions.

MATERIALS AND METHODS

Thirty-four capretto carcasses obtained from nine genotypes of kids were used in the present study. The first four genotypes were first crosses, namely Boer X Saanen (BS), Boer X Feral (BF), Saanen X Angora (SA), and Saanen X Feral (SF). The next four genotypes were the progeny of first cross does crossed with Boer bucks (second crosses). They are BBBA, BBBS, BBSF and BBSA. The last genotype tested was Feral bucks mated to Feral does (FF), as a control. The kids were born during July-August 1998 under grazing conditions at The University of Queensland, Gatton Campus. Kids were selected from a population based on the kid's growth rate to 14 days of age, representing a range of slow to rapidly growing kids. BA and BBBF kids were not included in the present study, because of their slow growth. Most of BA and BBBF kids did not achieve the minimum capretto slaughter weight of 15 kg by the time they were 6 months old. Before slaughtering, kids were fasted for 18 hours with free access to water. Kids were slaughtered and dressed using standard commercial techniques (Colomer-Rocher et al., 1987). Carcasses were chilled in a room with an air temperature of 2-4 °C for 24 hours. The cold carcasses were split down the dorsal midline and left sides were used for the present study.

Muscle colour was measured on the cross section of the longissimus muscle at the 12th/13th rib site, using a Minolta CR 100 chroma-meter where L* depicts relative lightness, a* indicates relative redness, and b* represents relative yellowness. Hue angles of the meat (h°) were derived from a* and b* values (h°=arctan b*/a*) (Murray, 1995). For reflectance values, muscle colour was measured using a TBL fibre optic meat probe at the same site.
Table 1. Meat quality attributes of Feral, first cross and second cross kids (Means ± SEM)

<table>
<thead>
<tr>
<th>Genotype</th>
<th>pH</th>
<th>L*</th>
<th>a*</th>
<th>b*</th>
<th>h_ab</th>
<th>FOP value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF</td>
<td>5.9±0.12</td>
<td>42±2.2</td>
<td>12.3±0.85</td>
<td>2.9±0.53</td>
<td>0.23±0.040</td>
<td>42±6.5</td>
</tr>
<tr>
<td>BF</td>
<td>6.0±0.10</td>
<td>42±1.9</td>
<td>12.4±0.73</td>
<td>3.4±0.46</td>
<td>0.27±0.035</td>
<td>28±5.6</td>
</tr>
<tr>
<td>SF</td>
<td>6.1±0.10</td>
<td>41±1.9</td>
<td>13.0±0.73</td>
<td>2.8±0.46</td>
<td>0.20±0.035</td>
<td>42±5.6</td>
</tr>
<tr>
<td>BS</td>
<td>5.9±0.10</td>
<td>41±1.9</td>
<td>13.8±0.73</td>
<td>3.0±0.46</td>
<td>0.21±0.035</td>
<td>44±5.6</td>
</tr>
<tr>
<td>SA</td>
<td>5.9±0.10</td>
<td>42±1.9</td>
<td>12.4±0.73</td>
<td>3.2±0.46</td>
<td>0.26±0.035</td>
<td>40±5.6</td>
</tr>
<tr>
<td>BBSF</td>
<td>6.2±0.10</td>
<td>40±1.9</td>
<td>14.8±0.73</td>
<td>2.6±0.46</td>
<td>0.17±0.035</td>
<td>49±5.6</td>
</tr>
<tr>
<td>BBBS</td>
<td>5.8±0.09</td>
<td>45±1.7</td>
<td>12.9±0.66</td>
<td>4.0±0.41</td>
<td>0.30±0.031</td>
<td>51±5.0</td>
</tr>
<tr>
<td>BBSA</td>
<td>5.8±0.12</td>
<td>39±2.2</td>
<td>12.3±0.85</td>
<td>2.6±0.53</td>
<td>0.21±0.040</td>
<td>40±5.6</td>
</tr>
<tr>
<td>BBBA</td>
<td>5.9±0.12</td>
<td>44±2.2</td>
<td>13.7±0.85</td>
<td>3.3±0.53</td>
<td>0.23±0.040</td>
<td>37±6.5</td>
</tr>
</tbody>
</table>

Means within the same column with different superscripts are significantly different (P<0.05).

Table 2. Cooking loss, shear force resistance and sensory attributes of Feral, first cross and second cross kids

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Cooking loss (%)</th>
<th>Shear Force (kg/cm²)</th>
<th>Tenderness</th>
<th>Juiciness</th>
<th>Flavour</th>
<th>Overall Acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF</td>
<td>29.2±1.78 b</td>
<td>2.9±0.34 ab</td>
<td>6.7±0.40 ab</td>
<td>6.1±0.43 ab</td>
<td>6.1±0.49</td>
<td>6.4±0.49</td>
</tr>
<tr>
<td>BF</td>
<td>27.0±1.54 b</td>
<td>2.6±0.29 b</td>
<td>7.3±0.40 a</td>
<td>5.4±0.43 b</td>
<td>5.7±0.49</td>
<td>5.9±0.49</td>
</tr>
<tr>
<td>SF</td>
<td>25.4±1.54 b</td>
<td>2.6±0.29 ab</td>
<td>6.6±0.40 ab</td>
<td>6.7±0.43 b</td>
<td>5.7±0.49</td>
<td>6.0±0.49</td>
</tr>
<tr>
<td>BS</td>
<td>29.0±1.54 b</td>
<td>3.2±0.29 ab</td>
<td>5.6±0.40 ab</td>
<td>5.8±0.43 ab</td>
<td>6.1±0.49</td>
<td>5.9±0.49</td>
</tr>
<tr>
<td>SA</td>
<td>27.3±1.54 b</td>
<td>2.6±0.29 ab</td>
<td>6.7±0.40 ab</td>
<td>6.2±0.43 ab</td>
<td>5.8±0.49</td>
<td>6.2±0.49</td>
</tr>
<tr>
<td>BBSF</td>
<td>28.9±1.54 b</td>
<td>1.6±0.29 f</td>
<td>7.3±0.40 b</td>
<td>5.7±0.43 ab</td>
<td>5.9±0.49</td>
<td>6.1±0.49</td>
</tr>
<tr>
<td>BBBS</td>
<td>33.5±1.38 a</td>
<td>3.7±0.26 f</td>
<td>5.4±0.40 f</td>
<td>5.7±0.43 ab</td>
<td>5.6±0.49</td>
<td>5.6±0.49</td>
</tr>
<tr>
<td>BBSA</td>
<td>27.1±1.78 b</td>
<td>2.9±0.34 ab</td>
<td>5.9±0.40 b</td>
<td>5.9±0.43 b</td>
<td>5.9±0.49</td>
<td>5.9±0.49</td>
</tr>
<tr>
<td>BBBA</td>
<td>26.0±1.78 b</td>
<td>3.8±0.34</td>
<td>6.9±0.40 ab</td>
<td>6.7±0.43</td>
<td>6.7±0.49</td>
<td>6.8±0.49</td>
</tr>
</tbody>
</table>

Means within the same column with different superscripts are significantly different (P<0.05).

Muscle pH was determined after colour measurements using a TPS-MC80 pH meter with a combined electrode, by insertion into the longissimus muscle, at the same site.

Cooking loss and shear force resistance were determined using the vastus muscle samples. The muscle samples were weighed and then cooked in a plastic bag in a water bath at 85 °C for 45 minutes or until an internal temperature of 70 °C was achieved. Samples were cooled and weighed and percent loss in weight was recorded as cooking loss. Muscle cores with cross sections of 1 X 1 cm and at least 3 cm length were cut parallel to the muscle fibres and shear force resistance was taken using a Warner-Bratzler shear force apparatus.

Sensory evaluation was carried out on supraspinatus, triceps brachii and gastrocnemius muscle samples after using the same cooking method as for shear force measurements. The flavour, tenderness, juiciness and overall acceptability were assessed by eight semi-trained panellists, using a 9-point hedonic scale with 1 being dislike extremely and 9 being like extremely.

Data on meat quality parameters were subjected to univariate analysis of variance to test the effect of genotype. Data were analysed using the General Linear Model (GLM) procedures of the Statistical Analysis computer package (SAS 1989), with results expressed in terms of means (±SE).

RESULTS

There were significant differences between genotypes for meat quality parameters in the current study (Tables 1 and 2).

BBBS and BBSA were found to be significantly lower in the ultimate pH of meat compared to BBSF (Table 1). A significant difference was also detected in pH between BBBS and SF. However, all genotypes, both first- and second crosses, were found to be not significantly different from the control (FF).

L* values of BBBS were significantly higher than that of BBSA and BBSF (Table 1). L* values of other genotypes ranged between those extreme values and were not significantly different from each other and to BBBS and BBSA. BBSF was found to have a significantly higher a* value than the control (FF), BF, SA and BBSA. In terms of b* value, no genotypes were found to be significantly different to control (FF). However, BBBS was significantly higher than BBSA and BBSF. h_ab values of BBBS were significantly higher than that of BS, SF, and BBSF, but not significantly different to controls and other genotypes. BBBS and BF had the highest and the lowest fibre optic probe values, respectively amongst genotypes observed, and they were significantly different, whereas other genotypes were intermediate and not significantly different both to each other and to BBBS and BF.

BBBS cooking loss was significantly higher than other genotypes, whereas cooking loss of the other
genotypes were not significantly different from each other (Table 2). Except BBSF, no genotypes showed a significantly different shear force resistance to FF. Shear force resistance of BBBA and BBBS were found to be significantly higher than that of BF, SF, SA and BBSF.

Sensory evaluation for tenderness showed that BF, SA and BBSF were more desirable to the sensory panel than controls (FF) and other genotypes. However for juiciness, SF and BBBA were preferred to controls (FF) and other genotypes. The sensory panel was not able to distinguish significant differences in the flavour and the overall acceptability of meat from all genotypes served.

**DISCUSSION**

The differences in the ultimate muscle pH may partly be due to stress conditions pre-slaughter. The kids in the current study were handled with the same treatment, under optimum conditions. The differences in the ultimate pH of muscle between genotypes in the present study may, therefore, be due to differences in the genotype responding to pre-slaughter handling. The differences in pH induced by genotype in the current study may also be associated with differences between genotype in either the basal concentrations of glycogen or the glycolytic potential. In sheep, Merino lambs have been reported to have a higher ultimate pH than first and second cross lambs associated with a lower muscle glycogen level at slaughter (Gardner *et al*., 1997).

Significant differences were found consistently between BBSF and BBBS in terms of L*, b*, and h_ab, showing that BBBS meat was paler than BBSF, and based on the h_ab values BBBS, meat was closer to a pink colour. Thus BBBS muscle would definitely meet the capretto requirement for pale muscle colour, whereas the BBSF would not. According to the a* values, BBBS did not significantly differ to BBBS, but was significantly different to control (FF). This was contradicted by the results of measurements using L*, b* and h_ab and suggests that a* value is not a good index in judging the redness of meat. A difference in a* value at a similar a*/b* ratio indicates no difference in redness (Murray, 1995). This means that BBSF meat colour was not redder than control (FF). The present study confirmed the redness-pH relationship, where BBBS had lower ultimate pH and paler meat than BBSF possessing a high pH and red meat.

The higher cooking loss in BBBS than other genotypes in the present study was similar to those noted by Schonfeldt *et al*., (1993a) where meat from Boer goats showed a higher cooking loss compared to that of Angora goats. Similarly Dhanda *et al*., (1999b) noted that chevon meat from Boer X Angora goats had a significantly higher cooking loss than the other genotypes they studied. The high cooking loss of BBBS may also be explained from their low ultimate pH.

The presence of a genotype effect on shear force resistance in the present study is in line with those noted by Schonfeldt *et al*., (1993b) and Swan *et al*., (1998) in that shear force of meat samples from Boer goats was higher than that of Angora or Cashmere goats. The lower shear force resistance of meat from BBSF compared to BBBS may be due to the earlier onset of rigor mortis as shown by their high ultimate pH and the low cooking loss (Aalhus, 1995). The shear force resistance between genotypes in the present study is in line with the sensory evaluation score for tenderness, where BBSF, BF, and SA were scored higher than control (FF) and other genotypes.

**CONCLUSIONS**

In this study there were some variations in meat quality of second cross capretto goat carcasses, but those extreme values were not significantly different from the control (Feral) goats.

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