An alternative beef production system in mountain areas of northern Spain: genotype effect

L.R. Beldarrain, N. Aldai, P. Lavín, R. Jaroso, A.R. Mantecón
Specific collaboration agreement

An alternative beef production and commercialization system in Nansa and Peñarrubia valley (northern Spain)
Nansa Valley, northern Spain

- Traditionally dedicated to beef production
- High breed diversity
- Primarily local breeds

520-580 m above the sea level
PRODUCTION SYSTEMS

TRADITIONAL: Calf production

- Sent to bigger fedlots for intensive fattening
- Limited income for local farmers

Sold at 5-6 months

ALTERNATIVE: Local veal production

- Reared outdoors on local pastures until 6-7 months
- Locally supplemented

✅ Sustainability
✅ Multi-funcionality
✅ Quality veal

QUALITY VEAL
Comparison of carcass and meat quality characteristics of 3 genotypes under this alternative system with special emphasis on the fatty acid (FA) profile
**Asturiana de los Valles**
(AV, n=7)

**Tudanca**
(TUD, n=6)

**Tudanca x Limousin**
(TUDxLIM, n=6)

19 male calves from three local farms in Nansa Valley (Cantabria)
Birth

Outdoor **grazing suckling** calves

- Free access to **concentrate**
  - (no access for mothers)

Weaning
(6-7 months)

Supplemented with medium quality **grass hay** and **ad libitum** access to **concentrate**

Slaughter
(9-12 months)

**Concentrate composition:**
- 40% corn, 45% barley, 10% soybean, 2% fat, 3% vit+min.
Carcass measurements
• Carcass weight
• Conformation (SEUROP 1-18)
• Fat cover degree (1-5)

Meat quality
• Chemical composition
  • FA profile

24 h

longissimus thoracis et lumborum

11 d ageing
**FA PROFILE**

Extraction

2:1 CHCl₃:CH₃OH

+ I.S. (23:0ME)

Derivatization

**Acid** (CH₃OH HCl)

**Basic** (NaOCH₃)

GC (175°C)

GC (150°C)

**Total FA**

**trans-18:1 isomers**

**(SP-2560, 100m)**

(Cruz-Hernandez et al., 2004; Kramer et al., 2008)

**Ionic column**

**CLA (conjugated linoleic acid) isomers**

**(SLB-IL111, 100m)**

(Delmonte et al., 2011)
<table>
<thead>
<tr>
<th></th>
<th>AV</th>
<th>TUD</th>
<th>TUDxLIM</th>
<th>s.e.m</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slaughter age (days)</td>
<td>273</td>
<td>355</td>
<td>337</td>
<td>9.00</td>
<td>***</td>
</tr>
<tr>
<td>Cold carcass weight (kg)</td>
<td>205</td>
<td>203</td>
<td>209</td>
<td>6.62</td>
<td>ns</td>
</tr>
<tr>
<td>Conformation (1-18)</td>
<td>9.57</td>
<td>6.00</td>
<td>6.67</td>
<td>0.52</td>
<td>**</td>
</tr>
<tr>
<td>Fat cover degree (1-15)</td>
<td>3.00</td>
<td>5.00</td>
<td>5.00</td>
<td>0.36</td>
<td>*</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>75.76</td>
<td>75.21</td>
<td>74.80</td>
<td>0.24</td>
<td>ns</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>21.52</td>
<td>21.02</td>
<td>20.67</td>
<td>0.17</td>
<td>ns</td>
</tr>
<tr>
<td>Total fat (%)</td>
<td>1.76</td>
<td>2.90</td>
<td>2.56</td>
<td>0.20</td>
<td>*</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>1.72</td>
<td>1.05</td>
<td>1.02</td>
<td>0.01</td>
<td>**</td>
</tr>
</tbody>
</table>

Sign, significance +p<0.1; *p<0.05; **p<0.01; ***p<0.001
# FATTY ACID COMPOSITION (%)

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<tbody>
<tr>
<td>SFA</td>
<td>45.76</td>
<td>45.22</td>
<td>46.83</td>
<td>0.50</td>
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<tr>
<td>BCFA</td>
<td>1.607</td>
<td>2.35</td>
<td>1.91</td>
<td>0.12</td>
<td>*</td>
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<tr>
<td>MUFA</td>
<td>40.00</td>
<td>43.70</td>
<td>42.48</td>
<td>0.78</td>
<td>ns</td>
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<tr>
<td>cis-MUFA</td>
<td>33.65</td>
<td>36.45</td>
<td>37.20</td>
<td>0.84</td>
<td>ns</td>
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<tr>
<td>trans-MUFA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>10t-18:1</td>
<td>6.35</td>
<td>7.24</td>
<td>5.28</td>
<td>0.31</td>
<td>*</td>
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<tr>
<td>11t-18:1</td>
<td>0.97</td>
<td>0.49</td>
<td>0.34</td>
<td>0.09</td>
<td>**</td>
</tr>
<tr>
<td>10t/11t-18:1</td>
<td>1.35</td>
<td>0.38</td>
<td>0.37</td>
<td>0.24</td>
<td>***</td>
</tr>
<tr>
<td>CLA</td>
<td>0.43</td>
<td>0.51</td>
<td>0.40</td>
<td>0.02</td>
<td>*</td>
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</table>

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**trans-18:1 ISOMERIC PROFILE**

% of total trans-18:1

- **AV**
- **TUD**
- **TUDxLIM**
ISOMERIC PROFILE OF CLA

% of total CLA

9c11t- 7t9c- 9t11c- 10t12c- 12t14c- 11t13t- tt-cla-

AV TUD TUDxLIM

0 10 20 30 40 50 60 70 80 90 100

0 5 10 15 20 25 30

30 25 20 15 10 5 0
# FATTY ACID COMPOSITION (mg/100 g meat)

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<tr>
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<tr>
<td><strong>PUFA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>n-6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>18:2n-6</td>
<td>100.51 b</td>
<td>163.1 a</td>
<td>116.19 b</td>
<td>8.14</td>
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<tr>
<td>20:4n-6</td>
<td>24.02 b</td>
<td>32.46 a</td>
<td>28.48 ab</td>
<td>1.23</td>
<td>*</td>
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<tr>
<td><strong>n-3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18:3n-3</td>
<td>8.09</td>
<td>8.64</td>
<td>7.33</td>
<td>0.32</td>
<td>ns</td>
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<tr>
<td>20:5n-3</td>
<td>6.14 a</td>
<td>2.65 b</td>
<td>3.34 b</td>
<td>0.42</td>
<td>***</td>
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<td>22:5n-3</td>
<td>9.88</td>
<td>7.41</td>
<td>8.13</td>
<td>0.54</td>
<td>ns</td>
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Sign, significance: +p<0.1; *p<0.05; **p<0.01; ***p<0.001
PUFA PROFILE (mg/100g meat)

- 18:3
- 20:5
- 22:5
- 22:6

n-3
AV genotype showed better carcass conformation and leaner carcass and meat compared to the other genotypes.

- **T genotype** had a higher muscle fat content with a healthier *trans-18:1* and **CLA profiles** than AV, while **TxL** presented intermediate values.

- Meat from AV genotype provided the **highest values of n-3 long chain PUFA**, that could be related to a better elongation and desaturation capacity than T and TxL genotypes and a healthier n-3 profile.

- In general, the improved nutritional quality of meat produced under this alternative could provide an added benefit to local beef producers and consumers.
Acknowledgements:

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