MEAT PRODUCTION POTENTIAL OF IMPALA

(Aepyceros melampus)

R.A. Engels & Prof. L.C. Hoffman
Introduction

- Game farming - a successful enterprise
- Game animals:
  - Well-adapted to arid environments
  - Can utilize natural vegetation effectively
  - Less input requirements
  - Better disease & parasite resistance
  - Different feeding niches
Introduction

• Game industry is based on four pillars
  • Initial success due to hunting & ecotourism
  • Expansion in breeding → growth in industry
  • More stud breeders: stronger genetic selection
  • Surplus of splits & inferior colour variants
  • Potential for expansion in meat production
    • Game meat: sustainable resource
    • Marketing opportunity for fresh game meat
      • Fresh meat quality cues: important for consumer
Introduction: Impala

- Most abundant
- Wide distribution
- Variety of habitats
- Rapid reproductive rate
- Sustainable cropping
- Knowledge of fresh meat quality traits required

Problem: Many factors not yet quantified

- Required to increase meat production
Research Aim

To quantify factors influencing impala meat quality:

- Sex
- Muscle type
- Production system
- Post-mortem ageing
Experimental locations

- Castle de Wildt, Limpopo
- Bredasdorp, Western Cape
Part A: Methodology

11 Male and 11 female impala

Harvested during the day using .22 or .243 rifles

Skinned and eviscerated

Physical & chemical analysis

Deboned after 24h: 6 main muscles

Carcasses hung in cool room (4°C)

- 11 Male and 11 female impala
- Harvested during the day using .22 or .243 rifles
- Skinned and eviscerated
- Physical & chemical analysis
- Deboned after 24h: 6 main muscles
- Carcasses hung in cool room (4°C)
### Part A: Sex Comparison

<table>
<thead>
<tr>
<th></th>
<th>Male Impala</th>
<th>Female Impala</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Undressed carcass weight (Kg)</strong></td>
<td>36.38(^a)</td>
<td>37.80(^a)</td>
</tr>
<tr>
<td><strong>Dressed carcass weight (Kg)</strong></td>
<td>21.55(^a)</td>
<td>21.00(^a)</td>
</tr>
<tr>
<td><strong>Dressing percentage</strong></td>
<td>59.13(^a)</td>
<td>55.63(^b)</td>
</tr>
<tr>
<td><strong>Shear Force (N)</strong></td>
<td>23.18(^b)</td>
<td>29.75(^a)</td>
</tr>
</tbody>
</table>

**Male impala:**
- Higher dressing percentage
- More tender meat
- Higher intramuscular fat

**Female impala:**
- Higher protein content
- Redder meat

\(^{a,b,c}\) Mean values with no common superscript in the same column are significantly different from each other (P < 0.05)
# Part A: Muscle Comparison

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Muscle type</th>
<th>Hindquarter</th>
<th>Forequarter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LTL</td>
<td>BF</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td>0.85\textsuperscript{a}</td>
<td>0.61\textsuperscript{c}</td>
</tr>
<tr>
<td>Shear force (N)</td>
<td></td>
<td>25.49\textsuperscript{b}</td>
<td>30.14\textsuperscript{a}</td>
</tr>
<tr>
<td>Protein (%)</td>
<td></td>
<td>22.07\textsuperscript{b}</td>
<td>22.90\textsuperscript{a}</td>
</tr>
<tr>
<td>IM fat (%)</td>
<td></td>
<td>1.53\textsuperscript{b}</td>
<td>1.46\textsuperscript{b}</td>
</tr>
</tbody>
</table>

**Impala meat**

- Tender: N<43
- High protein
- Low intramuscular fat: <3%

\textsuperscript{a,b,c} Mean values with no common superscript in the same row are significantly different from each other (P < 0.05)
Production System Effect
Part B: Production Systems

Intensive
- Boma system at Castle de Wildt
- High human intervention
- Only supplied feed

Semi-extensive
- Camp systems at Castle de Wildt
- Moderate human intervention
- Supplementary feed

Extensive
- Natural ecosystem at Bredasdorp
- Minimal human intervention
- Only natural vegetation

All impala harvested at ±15 months of age
12 Sub-adult male impala per production system

Harvested during the day using .22 or .243 rifles

Skinned and eviscerated

Carcasses hung in cool room (4°C)

Deboned after 24h: LTL muscles removed

Physical, sensory and chemical analysis

Part B: Methodology
Part B: Production System Effect

No significant differences:
• Carcass weights of intensive vs semi-extensive
• Dressing percentages

Extensive system:
• Higher carcass weights
Part B: Production System Effect

Meat colour

- **L***
  - Intensive: a, a
  - Semi-extensive: a, b
  - Extensive: b

- **a***
  - Intensive: a, ab
  - Semi-extensive: a
  - Extensive: a

- **b***
  - Intensive: b
  - Semi-extensive: a
  - Extensive: a

**Significance levels:**
- Lighter
- Redder

**Observations:**
- No colour differences
- Darker
- Less red
Part B: Sensory Analysis

Descriptive Sensory Analysis:
Aroma, flavour, texture & overall eating quality

Consumer perspective:

Desirable
- Beef-like
- Sweet-associated

Undesirable
- Gamey
- Metallic
- Liver-like

Sample preparation
### Part B: Descriptive Sensory Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Intensive</th>
<th>Semi-extensive</th>
<th>Extensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall aroma intensity</td>
<td>65.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>66.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>69.1&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Gamey aroma</td>
<td>54.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>56.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>58.5&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Beef-like aroma</td>
<td>37.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>38.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>42.4&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Metallic aroma</td>
<td>6.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.4&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Liver-like aroma</td>
<td>1.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.5&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Herbaceous aroma</td>
<td>6.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>13.2&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sweet-associated aroma</td>
<td>8.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>11.5&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Overall flavour intensity</td>
<td>62.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>64.2&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>65.7&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Gamey flavour</td>
<td>54.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>55.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>56.7&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>8.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
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<td>1.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.6&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>7.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>12.1&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sweet-associated taste</td>
<td>10.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>12.6&lt;sup&gt;a&lt;/sup&gt;</td>
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**Extensive:**
- Highest overall aroma & flavour intensity
- Highest gamey, beef-like, herbaceous and sweet-associated aromas
- Highest beef-like, herbaceous flavours and sweet-associated taste
- Lowest metallic aroma & flavour

**Intensive vs. Semi-extensive:**
- No significant differences except gamey & liver-like flavour

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<sup>a,b,c</sup>Mean values with no common superscript in the same row are significantly different from each other (P < 0.05)
# Part B: Meat quality parameters

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<th>Semi-extensive</th>
<th>Extensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear force (N)</td>
<td>52.48&lt;sup&gt;a&lt;/sup&gt;</td>
<td>37.21&lt;sup&gt;b&lt;/sup&gt;</td>
<td>52.33&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>22.73&lt;sup&gt;b&lt;/sup&gt;</td>
<td>22.02&lt;sup&gt;c&lt;/sup&gt;</td>
<td>23.38&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>IM fat (%)</td>
<td>1.97&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.76&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.52&lt;sup&gt;c&lt;/sup&gt;</td>
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Less tender
Moderate protein
Highest fat

Most tender
Lowest protein
Moderate fat

Less tender
Highest protein
Lowest fat
Part C: Post-mortem ageing of meat

Meat tenderness & weep loss

- Weep loss (%)
- Shear force (N)

No difference between male & female impala

- High weep loss:
  × Unattractive to consumers

- Low shear force:
  ✓ High tenderness
  ✓ Desirable for consumers

✓ Optimum ageing period at 4°C: 8 days
# General conclusions

## Part B: Production system effect

### Intensive
- Lower gamey & liver-like flavours
- Highest IM fat content
- No substantial advantage i.t.o. carcass yields, meat quality or production

### Semi-extensive
- Most tender meat
- Lighter, redder meat
- Flavour & aroma attributes similar to intensive system

### Extensive
- Darker, less tender meat
- Highest aroma & flavour intensity
- Highest protein content
- Lowest IM fat content

## Part A

### Sex & muscle comparison:
- Male impala have higher dressing % than females
- All muscles produce tender meat with high protein & low IM fat

## Post-mortem ageing:
- 8 days post-mortem is optimum ageing period for ideal meat tenderness
General conclusions

**Impala overall:**

<table>
<thead>
<tr>
<th>Desirable physical, sensory &amp; nutritional meat quality traits</th>
<th>High dressing percentage (±58%)</th>
<th>High protein, low intramuscular fat</th>
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- Desirable physical, sensory & nutritional meat quality traits
- High dressing percentage (±58%)
- High protein, low intramuscular fat
Recommendations

• Repetition of the experiment with impala of different age groups (sub-adult vs. adult)
• Investigate the effect of different diets/biomes on sensory meat quality
• Compare different cropping methods to evaluate ante-mortem stress effect on meat quality & production
Acknowledgements

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Thank you! Questions?