Fallow deer in southern Africa: a potential meat source or is it just an invasive species?

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Outline

• Background of deer farming
• South Africa game meat industry
• Consumer perceptions
• Carcass composition & yields
• Meat quality
• Conclusions
• Recommendations
Introduction

- **Deer farming**
  - Origins: Far East (3000 years ago)
  - Modern: Over 5 million deer across the world
    - Pioneered in NZ 1970’s (currently dominates market)
    - Largest farmed deer population (1.1 million)
    - Largest farmed venison producer in the world

- **Fastest growing rural industry in USA**
- **USA & Canada:** Fallow deer, wapiti, chital, sika & white tailed deer
- **Arctic regions:** Reindeer
- **Europe:** Fallow deer & red deer
- **Asia:** Sika deer, wapiti, rusa deer, red deer, fallow deer & sambar

Loudon & Fletcher, 1983; Drew et al., 1989; Chardonnet et al., 2002; Volpelli et al., 2003; Anderson et al., 2007; Hoffman & Cawthorn, 2014
Introduction

- **Fallow deer (FD)**
  
  - 2 species
    - European FD (*Dama dama*)
      - Globally distributed
    - Persian FD (*Dama mesopotamica*)
      - Globally endangered

- **Ruminants**
  
  - Largely grazers, but some browsing

- **Form large herds**

- **Rut (4 weeks)**
  
  - Males grow antlers

Chapman & Chapman, 1997; Pitra et al., 2004; Masseti & Mertzanidou, 2008; Bothma, 2014; Werner et al., 2015
Introduction

• **SA game meat industry growing**
  – Feasibility & profitability realised since 1960’s
  – 40-fold increase (21 m game animals vs. 14 m cattle)
  – Springbok, blesbok, greater kudu
  – FD overlooked in SA

• **FD introduction to SA unknown**
  – ca. 1869 Newlands House, Cape Town

• **Adapted well**
  – Grew in numbers & expanded across SA
  – WC, EC, FS, GP, KZN
    Negative attitudes from farmers & even more so from Conservation bodies
  – Thrive in SA conditions (invasive → no nationwide census)
  – Pest-to-profit

Processed meats: 30 000 tons/year
Local hunters: 120 000 tons/year
Trophy hunters: 20 000 tons/year
Sold directly: 1 400 tons/year

Introduction

• Consumer perceptions
  – Meat industry: production to consumer driven
  – Modern consumer increasingly discerning
    • Health, quality, ethical & welfare
  – Trend: low fat, natural, “free-range” products
  – Lack of game meat uptake in SA → limited understanding of health benefits
    • Limited nutritional information on game meat packaging
    • Most information on loin

Dransfield, 2003; Grunert et al., 2004; Hoffman et al., 2005; Radder & Le Roux, 2005; Font-i-Furnols & Guerrero, 2014; Schönfeldt & Jooste, 2015
Carcass composition & yields of wild Fallow deer (*Dama Dama*) in South Africa
Sexual dimorphism present

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Male (n = 8)</th>
<th>Female (n = 14)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live weight</td>
<td>kg</td>
<td>47.4 ± 4.37</td>
<td>41.9 ± 1.96</td>
</tr>
<tr>
<td>Warm carcass</td>
<td>kg</td>
<td>29.6 ± 2.73</td>
<td>25.2 ± 1.15</td>
</tr>
<tr>
<td>Cold carcass</td>
<td>kg</td>
<td>29.2 ± 2.72</td>
<td>24.7 ± 1.13</td>
</tr>
<tr>
<td>Chiller shrink (16h)¹</td>
<td>kg</td>
<td>0.5 ± 0.04</td>
<td>0.5 ± 0.06</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>1.6 ± 0.00</td>
<td>2.0 ± 0.00</td>
</tr>
<tr>
<td>Dress-out²</td>
<td>%</td>
<td>61.5 ± 0.52</td>
<td>59.0 ± 0.57</td>
</tr>
</tbody>
</table>

¹ Cold carcass weight relative to warm carcass weight
² Cold carcass weight as percentage of live weight

Age not taken into account
Mean (± standard error) bone and meat contributions (kg and %) from fallow deer (n = 11) as influenced by gender.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Effect = Gender</th>
<th>Male (n = 4)</th>
<th>Female (n = 7)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kg</td>
<td></td>
<td>2.4 ± 0.48</td>
<td>1.5 ± 0.12</td>
<td>0.038</td>
</tr>
<tr>
<td>%¹</td>
<td></td>
<td>6.7 ± 0.67</td>
<td>5.6 ± 0.33</td>
<td>0.120</td>
</tr>
<tr>
<td>Total meat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kg</td>
<td></td>
<td>20.4 ± 2.14</td>
<td>16.0 ± 0.49</td>
<td>0.028</td>
</tr>
<tr>
<td>%¹</td>
<td></td>
<td>57.9 ± 1.33</td>
<td>60.5 ± 0.93</td>
<td>0.139</td>
</tr>
<tr>
<td>Total bone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kg</td>
<td></td>
<td>9.1 ± 0.46</td>
<td>6.9 ± 0.35</td>
<td>0.005</td>
</tr>
<tr>
<td>%¹</td>
<td></td>
<td>26.2 ± 1.70</td>
<td>26.1 ± 1.08</td>
<td>0.934</td>
</tr>
<tr>
<td>Meat / bone ratio</td>
<td></td>
<td>2.2 ± 0.04</td>
<td>2.3 ± 0.02</td>
<td>0.617</td>
</tr>
</tbody>
</table>

¹ Parameters as a percentage of cold carcass weight
Significant differences (p < 0.05) are indicated in bold
Meat quality

• As per most animal species
  – Ante mortem stress influences meat quality
    • Post mortem pH changes
    • Colour
      – $L^*<40$, high $a^*$ & low $b^*$ values
      – Typical of meat from wild ungulates
    • Drip loss
    • Toughness
    • Flavour
    • Males during rut
    • etc.
Chemical composition

• Typical of most wild ungulates
  – Lean meat
    • 73-76 % for moisture
    • 20-23 % for protein
    • 2-3 % for total lipids

Depending on season, deer are known to have subcutaneous fat cover

• ~1 % for ash
The average, minimum and maximum values (mean ± standard error) calculated for fatty acid groups.

<table>
<thead>
<tr>
<th>Fatty acid groups</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFA</td>
<td>10.20 ± 0.616</td>
<td>6.08</td>
<td>15.30</td>
</tr>
<tr>
<td>MUFA</td>
<td>6.46 ± 0.439</td>
<td>3.98</td>
<td>11.23</td>
</tr>
<tr>
<td>PUFA</td>
<td>13.57 ± 0.669</td>
<td>9.67</td>
<td>21.60</td>
</tr>
<tr>
<td>PUFA:SFA</td>
<td>1.40 ± 0.073</td>
<td>0.68</td>
<td>1.97</td>
</tr>
<tr>
<td>n-6 PUFA</td>
<td>9.47 ± 0.424</td>
<td>6.28</td>
<td>14.36</td>
</tr>
<tr>
<td>n-3 PUFA</td>
<td>4.10 ± 0.265</td>
<td>2.87</td>
<td>7.23</td>
</tr>
<tr>
<td>(n-6)/(n-3)</td>
<td>2.38 ± 0.075</td>
<td>1.79</td>
<td>3.02</td>
</tr>
</tbody>
</table>

(SFA) total saturated fatty acids; (MUFA) total monounsaturated fatty acids; (PUFA) total polyunsaturated fatty acids; (n-3 PUFA) total omega-3 polyunsaturated fatty acids; (n-6 PUFA) total omega-6 polyunsaturated fatty acids; (PUFA:SFA) polyunsaturated to saturated fatty acid ratio; (n-6:n-3) omega-6 to omega-3 polyunsaturated fatty acid ratio.

# Averages were calculated irrespective of main effects (muscle and gender) or interactions [MxG].
Conclusions

• FD alternative species
  – Undervalued due to lack of information
  – Negative perception

• Many attributes important to modern consumer
  – Free roaming (“free-range”) & free from human intervention

• FD could contribute to national food security
  – DP Compete with indigenous game & domestic stock
  – DP 58-60%; edible offal 9% (excluding stomach & intestines)

• Physical characteristics compare favourably with SA game
  – Muscle variation & some gender variations
    NB for meat industry (prime vs. processed)
  – 3 of 6 muscles “tender” & all 6 low drip loss
  – LTL desirable physical attribute scores
Conclusions

• Chemical characteristics
  – High protein values
  – Low lipid, but slightly higher than indigenous game
    • Juicy, tender & flavoursome
    • Highly variable (intrinsic & extrinsic)
    • PUFAs higher than SFAs (EFAs – LA, ALA & LC PUFAs)

• FD appears to be a healthy, good quality meat source

• Supply various income classes
Recommendations

- **Initial results indicate**
  - Meat quality of this species is of highest standard
  - Typical of wild game animals

- **Distribution of this species**
  - Requires quantification to develop strategies for use as a sustainable protein source for human consumption

- **The ecological impact of this species**
  - Needs to be quantified so that adequate legislation can be developed to either curb or grow the potential deer farming industry