



UNIVERSITEIT • STELLENBOSCH • UNIVERSITY
jou kennisvenoot • your knowledge partner

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



Louw Hoffman

Department of Animal Sciences, Stellenbosch University, South Africa

SARChI Chair: Meat Science

9th International Wildlife ranching Symposium
12-16 September 2016

SARChI
MEAT SCIENCE
GENOMICS TO NUTRIOMICS



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



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





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





Carcass composition & yields of wild Fallow deer (*Dama Dama*) in South Africa





Sexual dimorphism present



Parameter		Male (n = 8)	Female (n = 14)	p-value
Live weight	kg	47.4 ± 4.37	41.9 ± 1.96	0.023
Warm carcass	kg	29.6 ± 2.73	25.2 ± 1.15	0.006
Cold carcass	kg	29.2 ± 2.72	24.7 ± 1.13	0.006
Chiller shrink (16h) ¹	kg	0.5 ± 0.04	0.5 ± 0.06	0.590
	%	1.6 ± 0.00	2.0 ± 0.00	0.244
Dress-out ²	%	61.5 ± 0.52	59.0 ± 0.57	0.006

¹ Cold carcass weight relative to warm carcass weight

² Cold carcass weight as percentage of live weight

Age not taken into account



Bone & meat contributions



Mean (\pm standard error) bone and meat contributions (kg and %) from fallow deer (n = 11) as influenced by gender.

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

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





Fatty acid composition



The average, minimum and maximum values (mean \pm standard error) calculated for fatty acid groups.

Fatty acid groups	mg/g meat		
	Average	Minimum	Maximum
SFA	10.20 \pm 0.616	6.08	15.30
MUFA	6.46 \pm 0.439	3.98	11.23
PUFA	13.57 \pm 0.669	9.67	21.60
PUFA:SFA	1.40 \pm 0.073	0.68	1.97
n-6 PUFA	9.47 \pm 0.424	6.28	14.36
n-3 PUFA	4.10 \pm 0.265	2.87	7.23
(n-6)/(n-3)	2.38 \pm 0.075	1.79	3.02

(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