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Lefapha la Disaense tša Tlhago le Temo

Effects of feeding systems and maturity type on gonadal development and semen quality of young breeding rams

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Introduction

1. Widespread practice in SA to condition rams prior to auction.
2. Conditioned rams look healthier = attain better prices (Bester *et al.*, 2004, Fourie *et al.*, 2004)
3. Animals should be “fit not fat” (Combrink & Schoeman, 1993)
4. High energy diets (11 MJ ME/kg DM) fed to young breeding bulls
    - Detrimental effects on seminal traits
    - Increased fat deposition
    - Irreversible pathology of seminiferous tubules (Swanepoel *et al.*, 2008)

Introduction

5. Body weight α Testis weight (r = 0.09), Testis weight α Sperm production (r = 0.08)
   - Measure scrotal circumference (SC) = testes size = spermatozoa production
   - SC may be misleading due to fat depositioning
6. Bester *et al*. (2004) fed young Dorper rams different dietary concentrations
   - Fat deposited in scrotum, especially around the *Pampiniform venous plexus*
   - Impairs thermoregulation
7. Not much research done on semen quality of young, growing rams of different maturating types fed from weaning until auction.

Experimental procedure

1. Effects of feeding systems during growing phase (5-12m) on gonadal development and semen quality of different maturity type rams.
   - Rangeland feeding, rangeland-intensive feeding, intensive feeding
   - Merino, Dohne Merino, South African Mutton Merino
2. Rangeland feeding
   - Control; most commonly used in ZAR
   - 200 days; rangeland & production lick
3. Rangeland-intensive feeding
   - Example of ZAR ram clubs; rangeland followed by intensive feeding
   - 73 days rangeland + 60 days intensive feeding
4. Intensive feeding
   - 21-day adaptation period
   - Merino rams – 70 days; Dohne Merino and SA Mutton Merino rams – 77 days
5. Growth, anthropometric, scrotal measurements taken; semen and blood samples taken

Growth results

Factors		Variables ($\bar{X}$ ± SD)		
Treatment	**Breed**	**BCS_F**	**$Mass_F$ (kg)**	**Metabolic wt ($W^{0.75}$)**
Range	**Dohne**	4.5 ± 0.5^{A}	52.4 ± 4.3^{A}	19.5 ± 1.2^{A}
	Merino	4.8 ± 0.4^{A}	$50.\ 9 \pm 6.1^{A}$	19.0 ± 1.7^{A}
	SAM	4.4 ± 0.5^{A}	57.7 ± 5.7^{A}	20.9 ± 1.5^{A}
Range-Intensive	**Dohne**	$5.4 \pm 1.2^{A}{}_{a}$	66.0 ± 3.0^{B}	23.2 ± 0.8^{B}
	Merino	$4.0 \pm 1.1^{A}{}_{a}$	$59.9 \pm 7.2^{B}{}_{a}$	$21.5 \pm 1.9^{B}{}_{a}$
	SAM	$6.9 \pm 1.0^{B}{}_{b}$	$73.5 \pm 4.8^{B}{}_{b}$	$25.1 \pm 1.2^{B}{}_{b}$
Intensive	**Dohne**	7.2 ± 0.6^{B}	$72.5 \pm 4,1^{B}$	24.8 ± 1.1^{B}
	Merino	7.0 ± 0.9^{B}	75.3 ± 5.2^{C}	25.6 ± 1.3^{C}
	SAM	7.6 ± 0.7^{B}	80.6 ± 5.4^{C}	26.9 ± 1.4^{B}

$^{A, B, C}$ Different superscripts in the same column within breed differed significantly ($P<0.05$).

$_{a, b}$ Different subscripts in the same column within treatment differed significantly ($P<0.05$).

SAM – South African Mutton Merino; BCS_F – Final body condition score; $Mass_F$ – Final mass

Anthropometric results

Factors		Variables ($\overline{X}$ ± SD)		
Treatment	**Breed**	**Body length$_F$ (cm)**	**Carcass mass (kg)**	**Carcass fat (mm)**
Range	**Dohne**	68.7 ± 3.3^{A}	26.0 ± 2.8^{A}	5.5 ± 1.3
	Merino	68.7 ± 2.7^{A}	24.4 ± 3.5$^{A}_{a}$	4.1 ± 1.6^{A}
	SAM	72.3 ± 3.0	30.4 ± 2.8$^{A}_{b}$	4.5 ± 1.5^{A}
Range-Intensive	**Dohne**	72.9 ± 3.0^{B}	32.1 ± 0.9$^{B}_{a}$	4.9 ± 0.9^{A}
	Merino	69.6 ± 2.5$^{A}_{a}$	29.1 ± 3.4$^{B}_{a}$	4.5 ± 1.3
	SAM	75.6 ± 2.1$_{b}$	39.2 ± 3.1$^{B}_{b}$	5.6 ± 1.9
Intensive	**Dohne**	73.5 ± 1.7^{B}	37.3 ± 2.1$^{C}_{a}$	8.0 ± 1.9^{B}
	Merino	75.9 ± 2.6^{B}	35.8 ± 3.2$^{C}_{a}$	7.4 ± 2.0^{B}
	SAM	76.3 ± 3.5	44.6 ± 4.4$^{C}_{b}$	8.0 ± 2.3^{B}

$^{A, B, C}$ Different superscripts in the same column within breed differed significantly (P<0.05).

$_{a, b}$ Different subscripts in the same column within treatment differed significantly (P<0.05).

SAM – South African Mutton Merino; Body length$_F$ – Final body length; Subcut fat – Subcutaneous fat

Scrotal results

Factors		Variables ($\bar{X}$ ± SD)					
Treatment	**Breed**	**Testes mass (g)**	**SSF (cm)**	**Scrotal fat mass (g)**	**PPC (cm)**	**PPC:SSF**	**EffecPP:Testmas**
Range	**Dohne**	217.6 ± 39.7	1.21 ± 0.30^{A}	27.5 ± 6.7	52.3 ± 4.7^{A}	45.6 ± 11.7$_{a}$	0.21 ± 0.04
	Merino	191.4 ± 42.3	0.99 ± 0.09^{A}	29.3 ± 6.5^{A}	49.3 ± 6.9^{A}	49.7 ± 4.3	0.27 ± 0.08^{A}
	SAM	234.5 ± 46.1	0.98 ± 0.15^{A}	32.2 ± 11.0	57.6 ± 4.7^{A}	59.7 ± 8.0$^{A}_{b}$	0.26 ± 0.06^{A}
Range-Intensive	**Dohne**	258.0 ± 42.4	1.73 ± 0.19$^{B}_{a}$	45.4 ± 17.4^{A}	67.9 ± 6.3^{B}	39.8 ± 6.2	0.16 ± 0.04
	Merino	234.0 ± 30.5	1.36 ± 0.08$^{B}_{b}$	52.5 ± 18.6^{B}	63.8 ± 9.1^{B}	47.0 ± 6.8	0.20 ± 0.02
	SAM	227.4 ± 32.2	1.76 ± 0.17$^{B}_{a}$	46.3 ± 11.5	64.9 ± 9.6	37.5 ± 7.3^{B}	0.16 ± 0.03^{B}
Intensive	**Dohne**	267.2 ± 51.9	1.56 ± 0.19	24.1 ± 8.9^{B}	69.5 ± 6.0^{B}	45.2 ± 7.6	0.17 ± 0.04
	Merino	235.8 ± 47.6	1.65 ± 0.46^{B}	33.1 ± 13.5^{A}	66.9 ± 6.9^{B}	43.0 ± 11.7	0.19 ± 0.07^{B}
	SAM	277.0 ± 45.5	1.55 ± 0.30^{B}	34.6 ± 12.2	68.8 ± 7.7^{B}	46.0 ± 10.7^{B}	0.17 ± 0.06^{B}

$^{A, B}$ Different superscripts in the same column within breed differed significantly (P<0.05).

$_{a, b}$ Different subscripts in the same column within treatment differed significantly (P<0.05).

SAM – South African Mutton Merino; SSF – Scanned scrotal neck fat; PPC – *Pampiniform venous plexus* circumference; EffecPP – Effective *Pampiniform venous plexus* to Testes mass

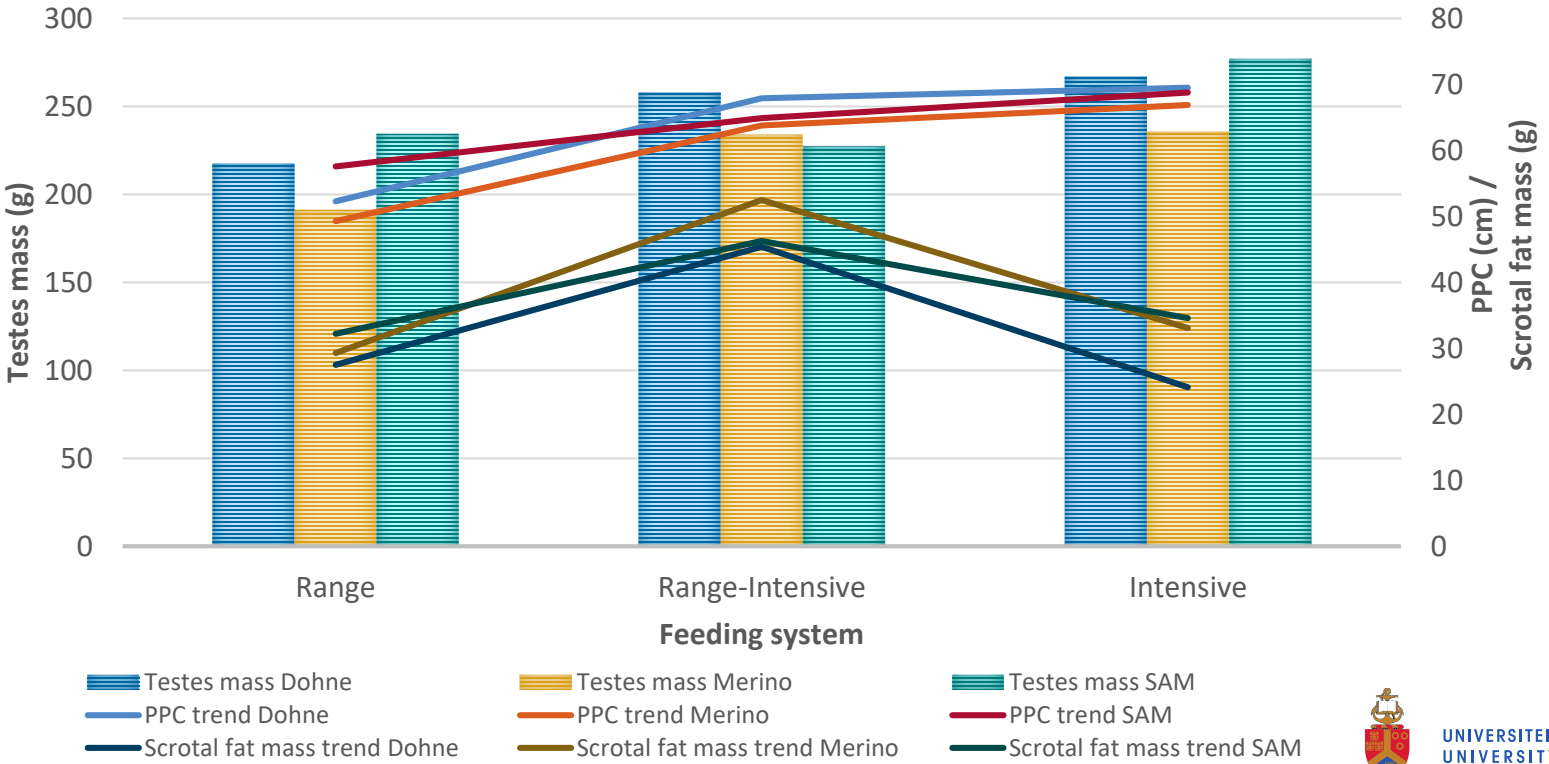
Seminal results

Factors		Variables ($\bar{X}$ ± SD)		
Treatment	**Breed**	**Volume (ml)**	**Progressive Motility (%)**	**Normal sperm (%)**
Range	**Dohne**	1.94 ± 0.95	70.0 ± 25.4	57.9 ± 24.8^{A}
	Merino	1.33 ± 0.56	76.1 ± 21.8	75.4 ± 13.5
	SAM	2.05 ± 0.98	68.5 ± 30.3	73.3 ± 17.6
Range-Intensive	**Dohne**	2.65 ± 1.03	77.5 ± 7.6	82.2 ± 12.2^{B}
	Merino	2.10 ± 1.02	75.5 ± 21.4	80.8 ± 10.6
	SAM	2.05 ± 1.01	78.0 ± 8.2	82.2 ± 7.2
Intensive	**Dohne**	2.00 ± 0.47	81.5 ± 7.8	78.9 ± 13.4^{B}
	Merino	1.45 ± 0.69	79.5 ± 8.3	83.9 ± 7.0
	SAM	1.38 ± 0.83	78.8 ± 6.9	87.1 ± 7.3

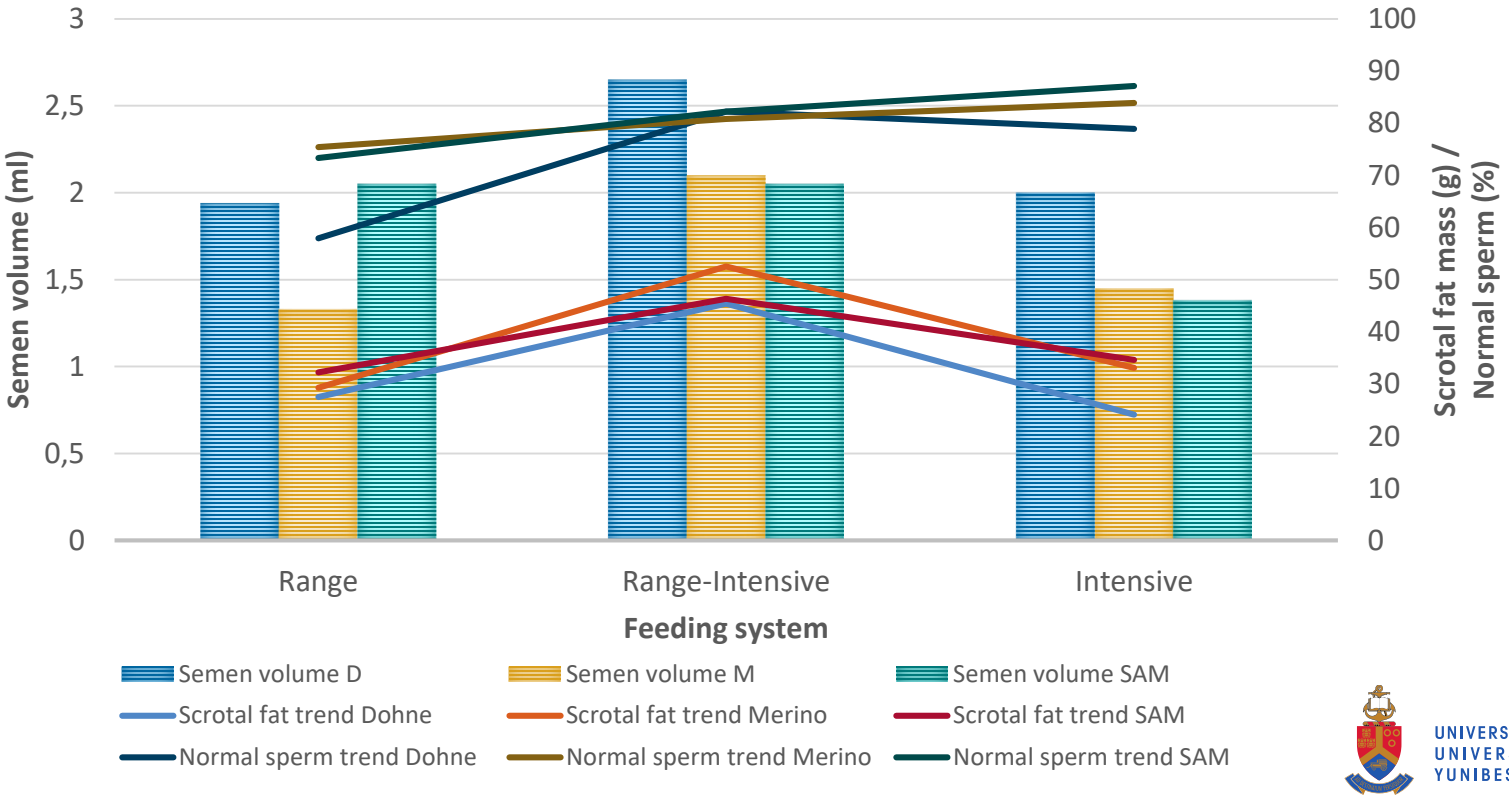
$^{A, B}$ Different superscripts in the same column within breed differed significantly (P<0.05).

SAM – South African Mutton Merino

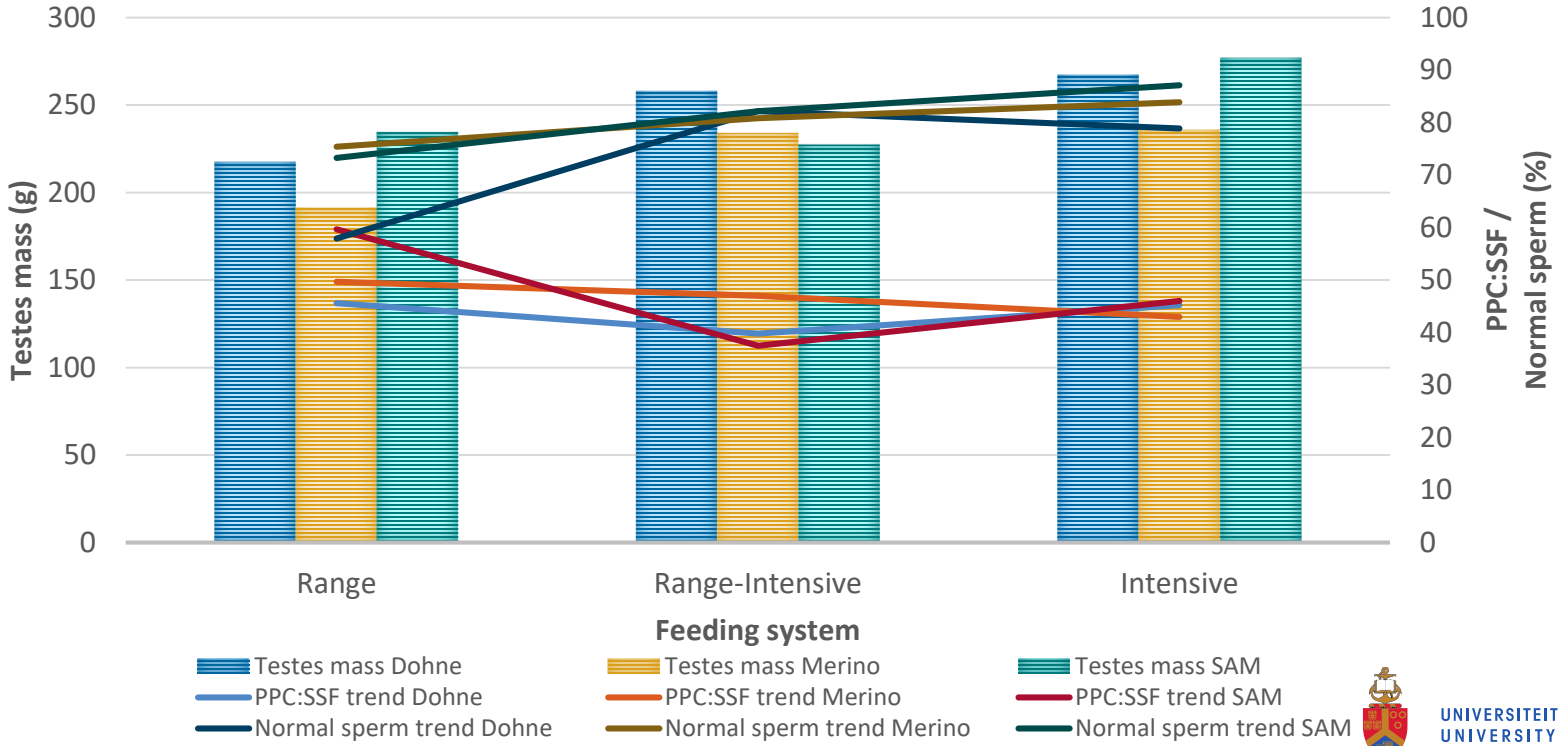
Feeding system's effect on testes mass, PPC and scrotal fat mass



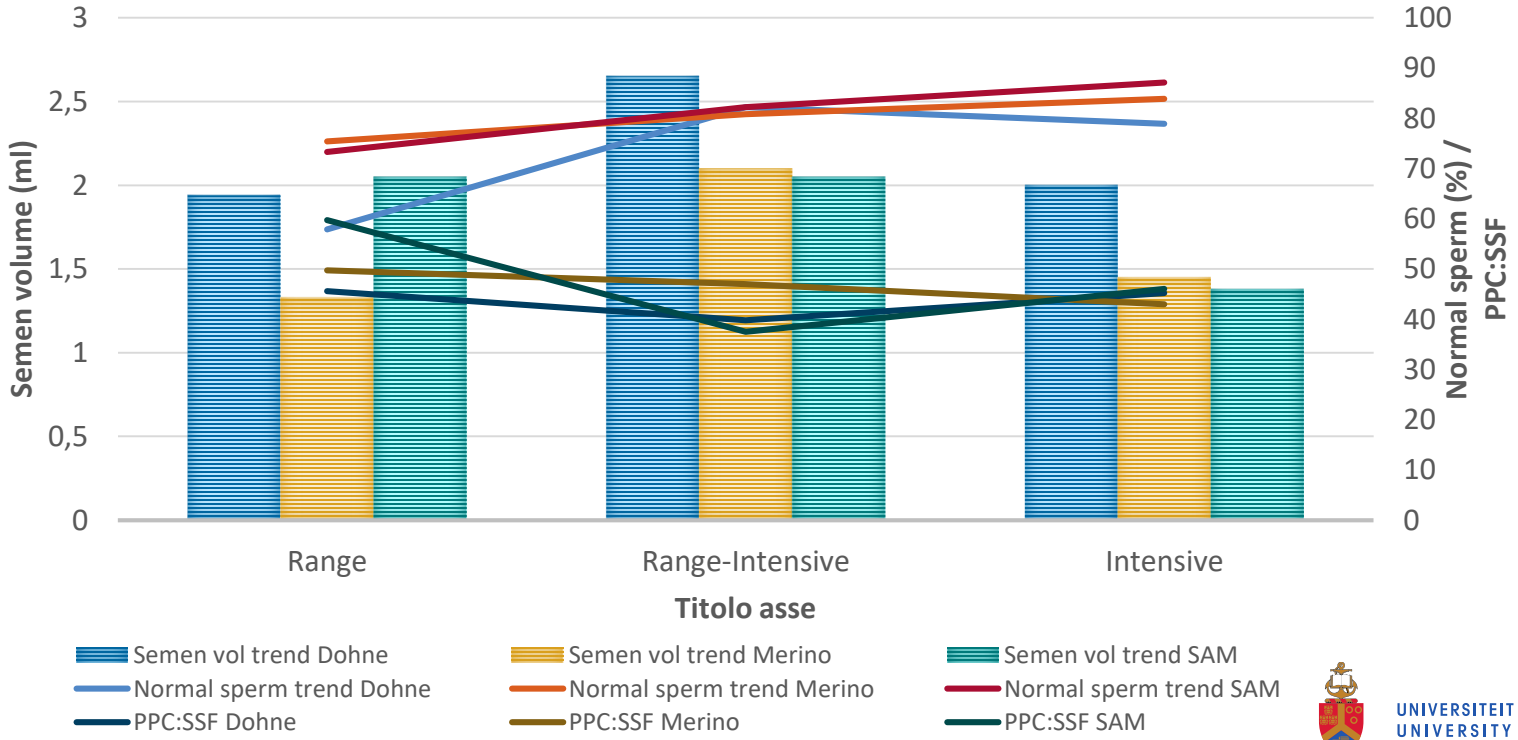
Feeding systems' effects on semen volume, scrotal fat mass, and percentage normal sperm



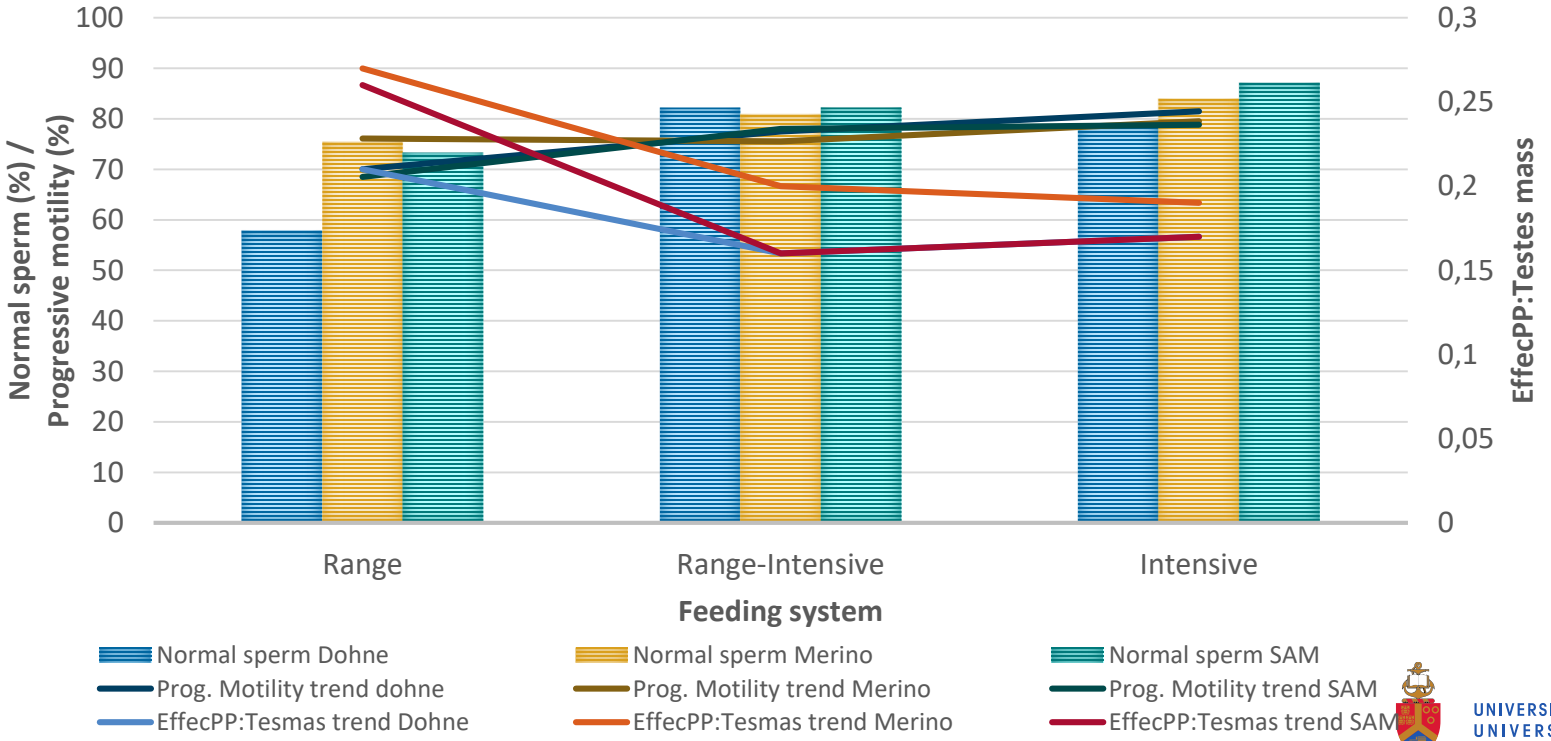
Feeding systems' effects on testes mass, PPC:SSF, and percentage normal sperm



Feeding system's effect on PPC:SSF, percentage normal sperm, and semen volume



Feeding system's effect on EffecPP:Testes mass, percentage normal sperm, and progressive motility



Correlations: Rangeland

Breed	Variable 1	Variable 2	r	P
Dohne Merino	Semen volume (ml)	Scanned scrotal neck fat (cm)	0.75	0.03
	Normal sperm (%)	Scanned scrotal neck fat (cm)	-0.80	0.02
	Normal sperm (%)	Semen volume (ml)	-0.71	0.05
	PPC:SSF	Normal sperm (%)	0.90	0.002
Merino	Subcutaneous fat (cm)	Normal sperm (%)	-0.81	0.03
	PPC:SSF	Testosterone (g/ml)	-0.80	0.03
SAM	PPC:Testes mass	Normal sperm (%)	-0.68	0.04
	EffecPP:Testes mass	Normal sperm (%)	-0.70	0.04

SAM – South African Mutton Merino; SSF – Scanned scrotal neck fat (g); PPC – *Pampiniform venous plexus* circumference (cm)*;* EffecPP:Testes mass – Effective *Pampiniform venous plexus* to Testes mass

Correlations: Rangeland-Intensive

Breed	Variable 1	Variable 2	r	P
Dohne Merino	Normal sperm (%)	Scrotal mass (g)	-0.69	0.04
	PPC:SFM	Normal sperm (%)	0.76	0.02
	PPC:Testes mass	Normal sperm (%)	0.66	0.05
	EffecPP:Testes mass	Normal sperm (%)	0.73	0.03
Merino	PPC:Testes mass	Normal sperm (%)	0.82	0.01
	EffecPP:Testes mass	Normal sperm (%)	0.72	0.03
	PPC:Testes mass	Progressive motility (%)	0.93	0.00
	EffecPP:Testes mass	Progressive motility (%)	0.66	0.05

SAM – South African Mutton Merino; SFM – Scrotal fat mass (g); PPC – *Pampiniform venous plexus* circumference (cm); EffecPP:Testes mass – Effective *Pampiniform venous plexus* to Testes mass

Correlations: Intensive

Breed	Variable 1	Variable 2	r	P
Dohne Merino	Semen volume (ml)	Normal sperm (%)	-0.76	0.02
Merino	Scrotal fat mass (g)	Normal sperm (%)	-0.71	0.03
	EffecPP:Testes mass	Progressive motility (%)	-0.85	0.004
SAM	Subcutaneous fat (cm)	Semen volume (ml)	-0.88	0.01
	EffecPP:Testes mass	Progressive motility (%)	0.75	0.05

SAM – South African Mutton Merino; EffecPP:Testes mass – Effective *Pampiniform venous plexus* to Testes mass

Conclusion

- Intensive feeding = Improved growth & gonadal development
  - BUT adversely affected fertility of early maturing rams
- Rangeland followed by intensive feeding at a higher chronological age may be more detrimental on the fertility of rams.
  - Especially in earlier maturing rams
- Adverse effects in rams are reversible as opposed to bulls
  - No significant pathology observed in testicular samples
  - Thermoregulatory effect
  - Allow enough time for new spermatogenic wave
- Efficient feeding programs should make provision for
  - Maturity types
  - Wooled vs mutton breeds
  - Fattening rate
  - Semen quality

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