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ASSOCIATIONS OF FEED EFFICIENCY WITH FERTILITY AND SEXUAL MATURITY IN YOUNG BEEF BULLS

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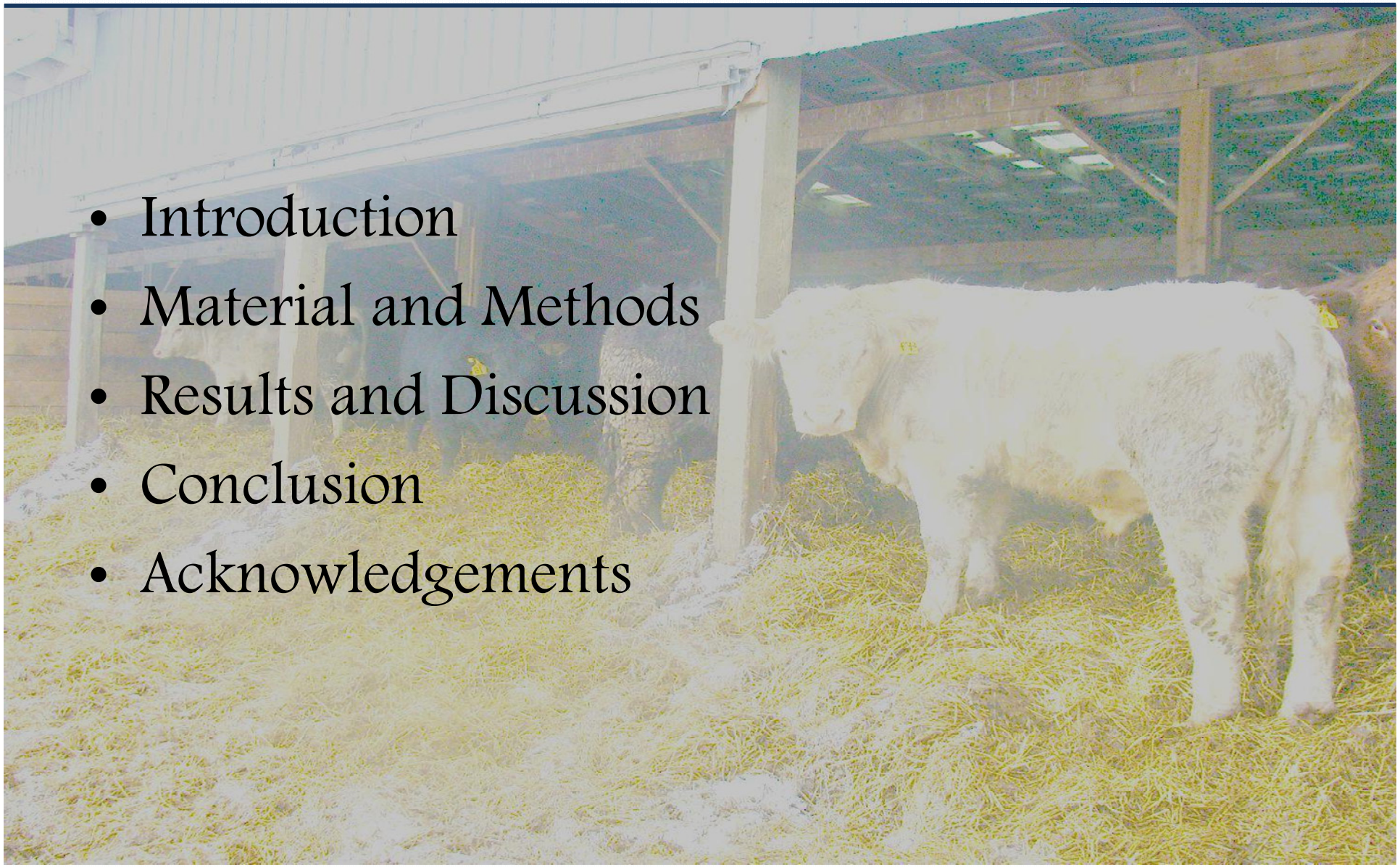
Outline



- Introduction
- Material and Methods
- Results and Discussion
- Conclusion
- Acknowledgements

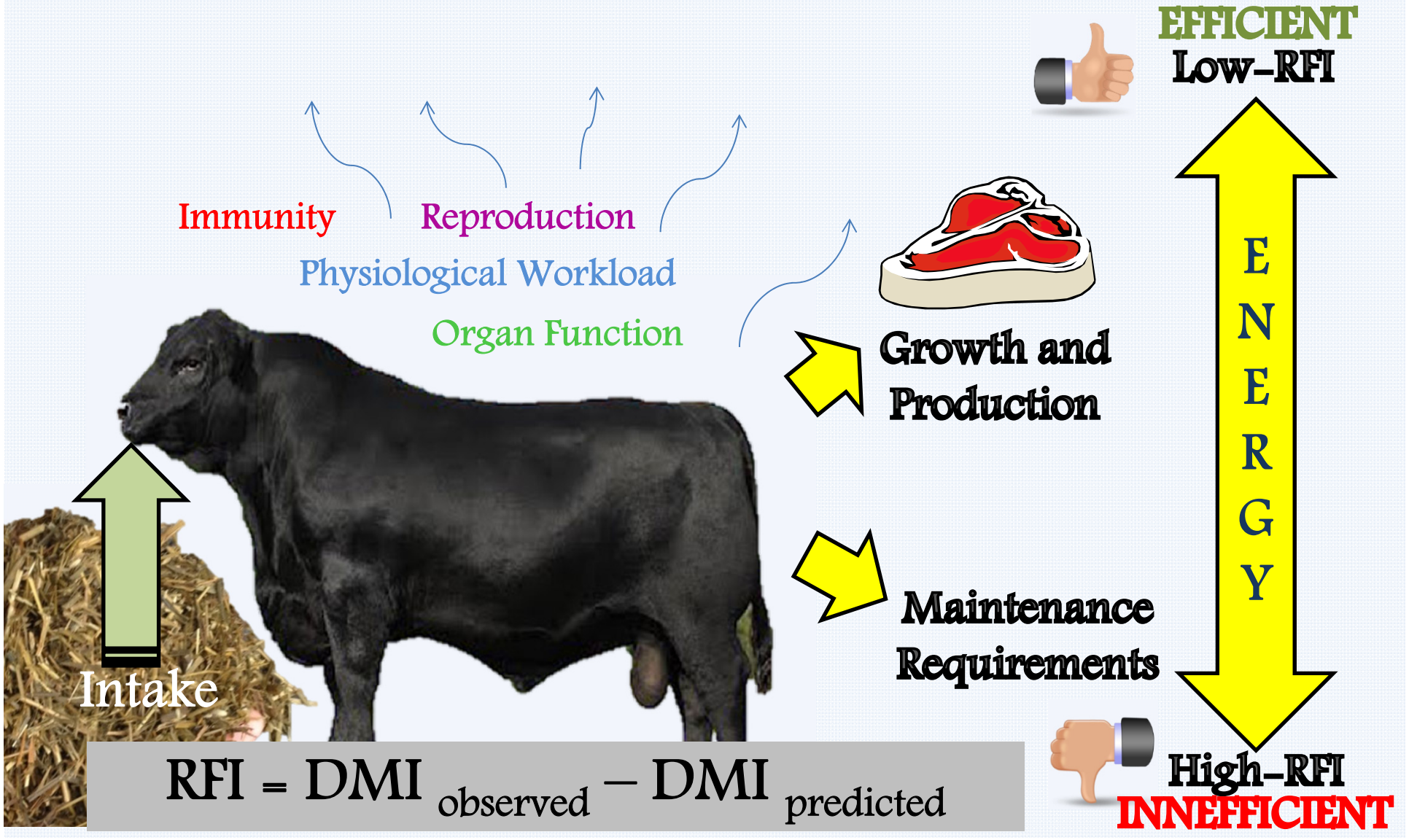
Introduction

Assessing Feed Efficiency

Breeding Programs

Colateral response to selection

Residual Feed Intake (RFI)

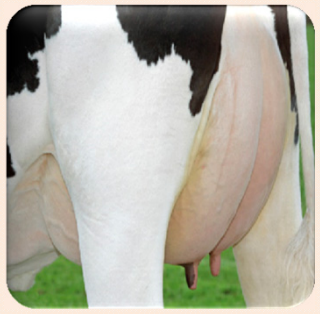


Production vs. Fertility

PRODUCTION

↑ Leanness
↓ Sexual Maturity

↑ Body weight line
↓ Semen quality



↑ Milk
↓ Fertility

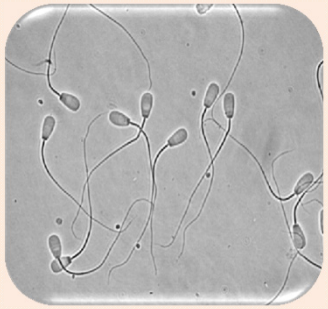
FERTILITY

(Hutchens et al, 1981; Marini and Goodman, 1969; Butler, 2000)

Production vs. Fertility

PRODUCTION

↑ Feed Efficient heifers
↓ Pregnancy rates



↑ Feed Efficient bulls
↓ Semen Morphology

↑ Feed Efficient bulls
↓ Semen Motility

FERTILITY

(Basarab et al, 2011; Hafla et al, 2012; Awda et al, 2013)

Hypothesis

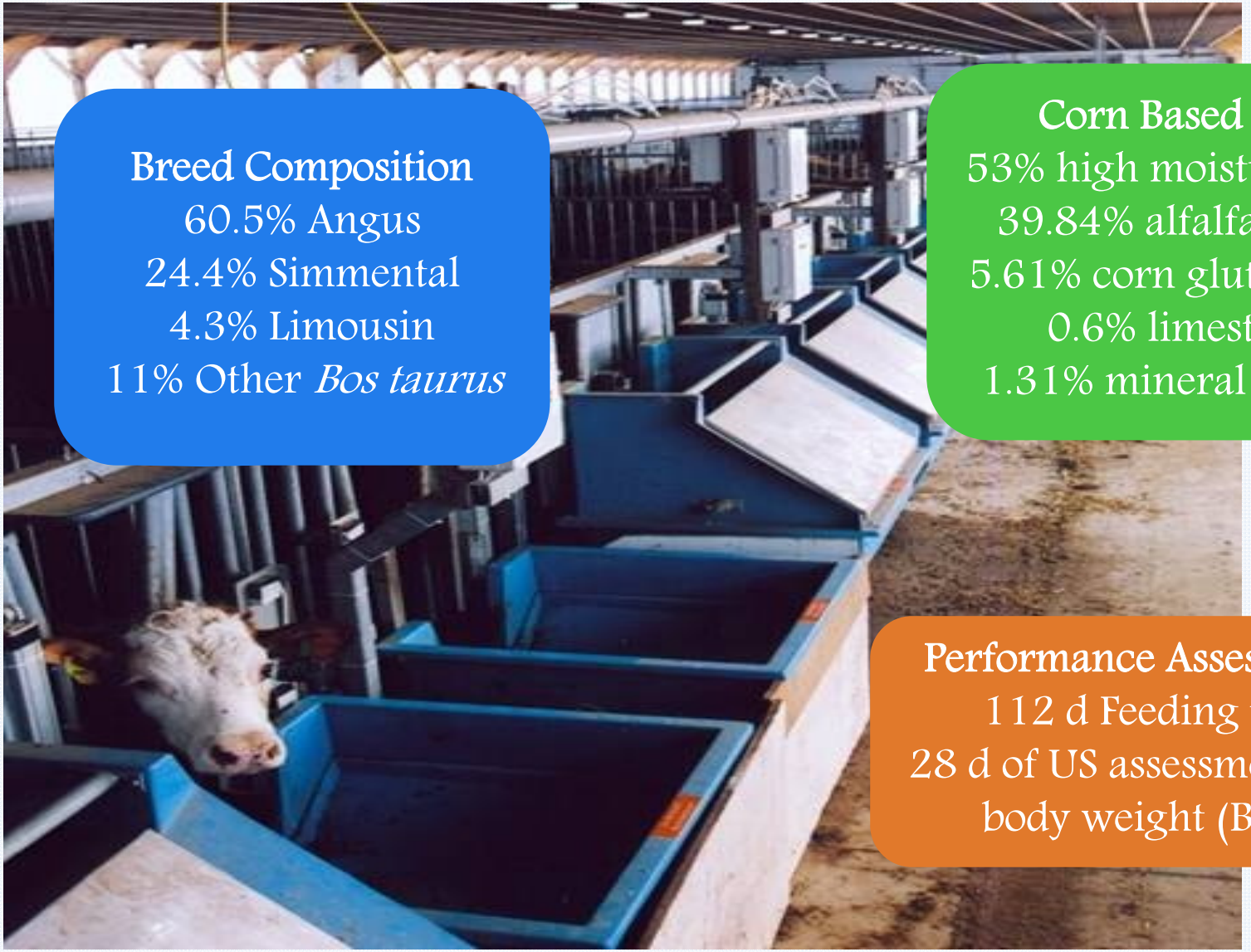
Considering that cattle with divergent feed efficiency have metabolic differences and that sexual maturity influences energy partition, one can hypothesize that young bulls varying in feed efficiency may also differ in fertility and sexual development indirect measures.

Objective

To measure fertility and sexual maturity related phenotypes in the context of feed efficiency (RFI).

Material and Methods

Feed Efficiency Assessment



Breed Composition
60.5% Angus
24.4% Simmental
4.3% Limousin
11% Other *Bos taurus*

Corn Based Diet
53% high moisture corn
39.84% alfalfa silage
5.61% corn gluten meal
0.6% limestone
1.31% mineral premix

Performance Assessment
112 d Feeding test
28 d of US assessment and body weight (BW)

Feed Efficiency Assessment

RFI_{koch}

$R^2 = 0.84$

$DMI_{predicted}$ = 1.05 + 1.74*(daily gain; kg/d) + 0.03*(mid-body weight) + RFI (kg/d)

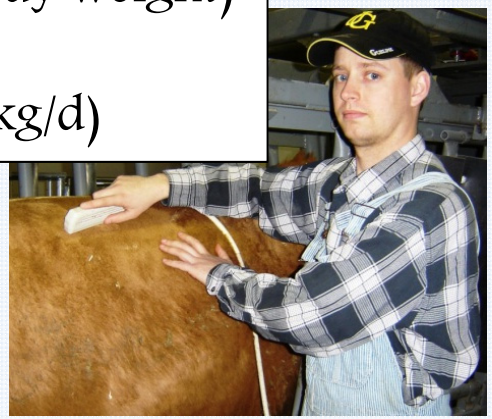
BW ADG US traits

Backfat
Rib eye area
Marbling
Rump fat

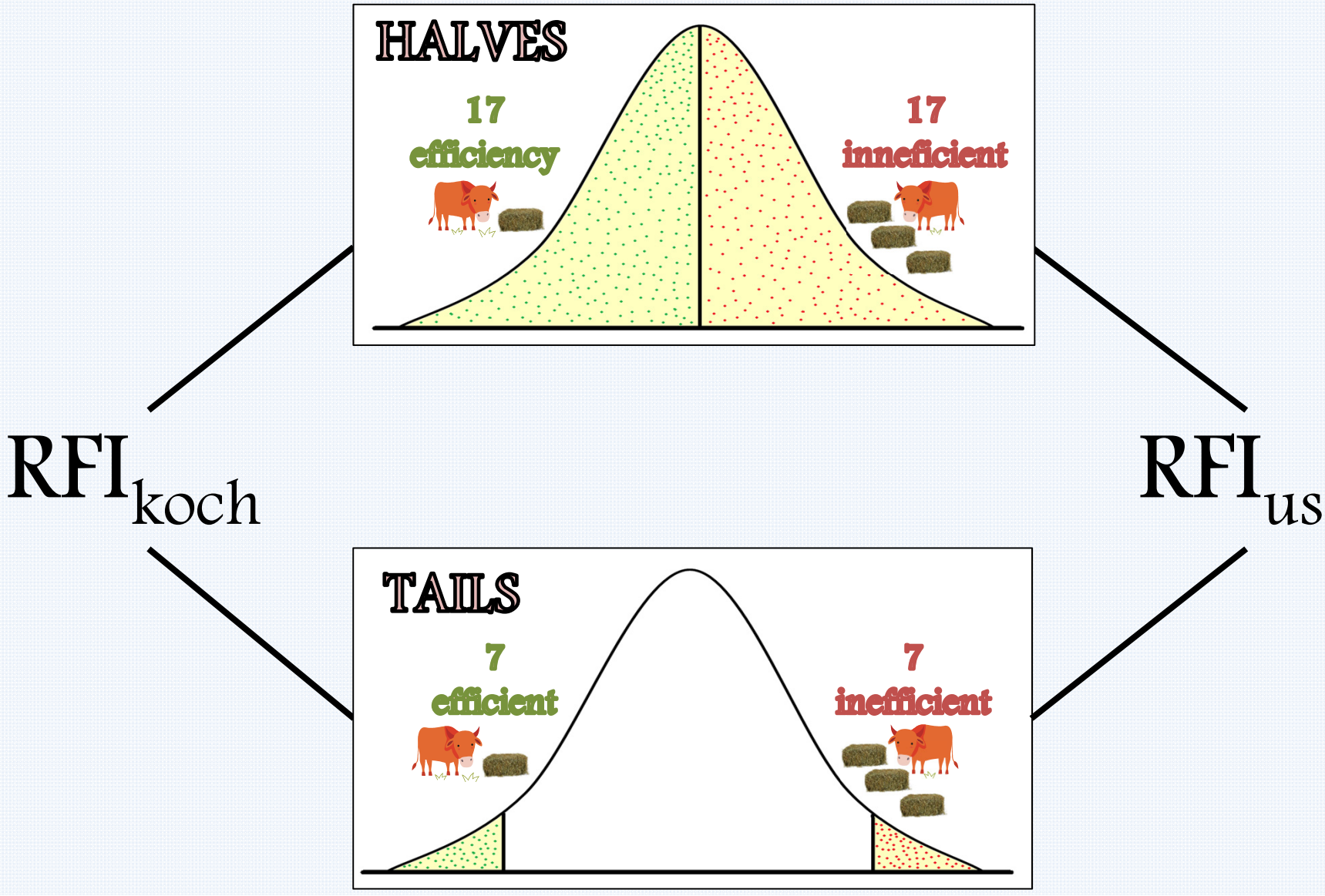
$DMI_{predicted}$ = −7.60 + 1.58*(daily gain; kg/d) + 0.03*(mid-body weight) + 0.87*(backfat thickness; mm) + 0.03*(rib eye area; cm^2) + 1.27*(marbling score) − 0.22*(rump fat gain; mm/d) + RFI (kg/d)

$R^2 = 0.88$

RFI_{us}



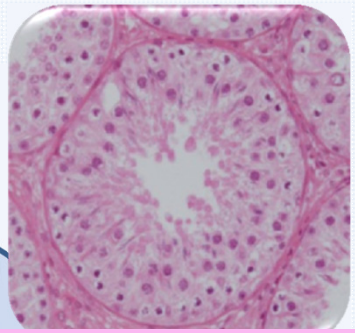
Feed Efficiency Assessment



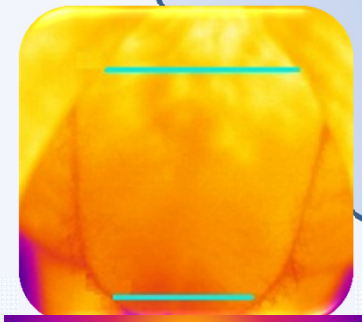
Fertility Related Measures

Organ Biometry

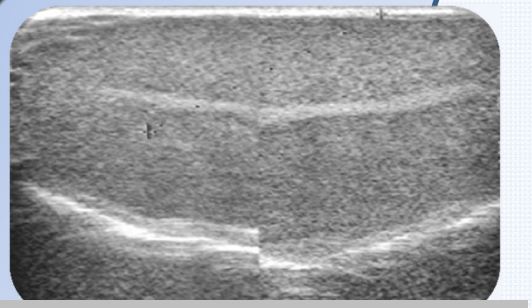
Semen Quality



Testis Tubular Development

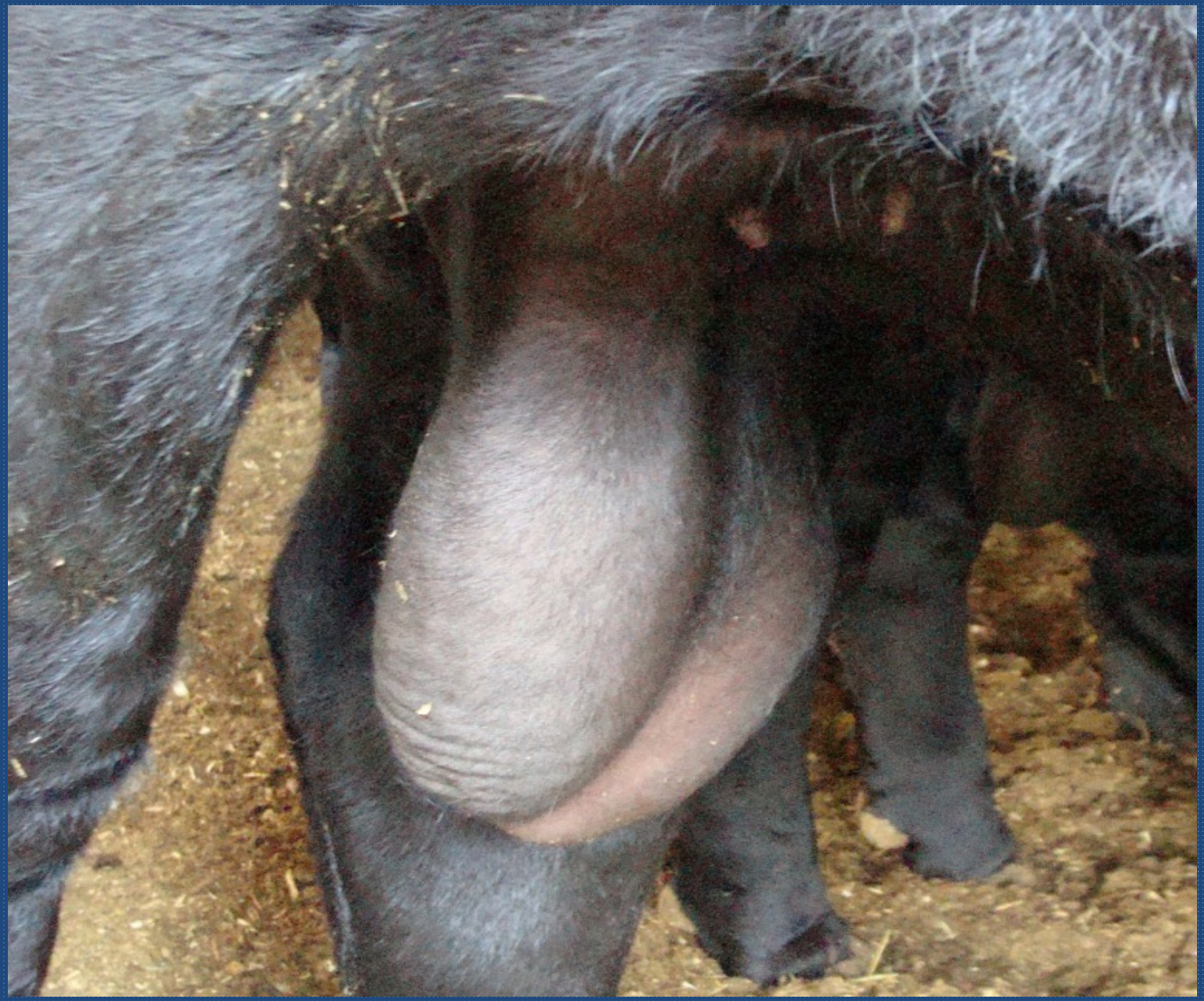


Thermography



Testicular Echogenicity

Results and Discussion

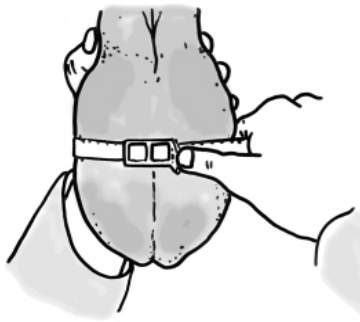


Organ Biometry

0.05<P<0.10

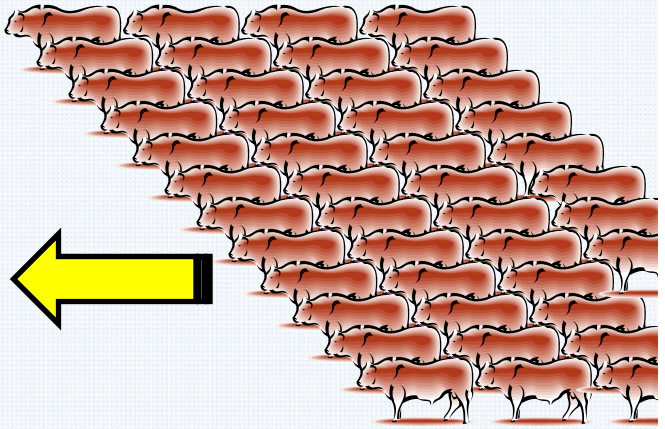
P<0.05

Measure (unit)	HALVES				TAILS			
	RFI_{koch}		RFI_{us}		RFI_{koch}		RFI_{us}	
	Low	High	Low	High	Low	High	Low	High
Scrotal Circumference (cm)	36.8	36.1	37.0	36.0	36.8	36.1	36.2	36.4
Testis Weight (g)	363	358	380	355	361	361	358	358
Testis Volume (mL)	331	322	348	321	325	329	329	324



Population Size	Low	High
204	33.9	34.0
328	38.3	35.3

(Adapted from Hafla et al, 2012; Awda et al, 2013)



Semen Quality

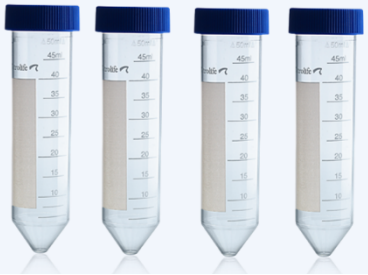
0.05<P<0.10

P<0.05

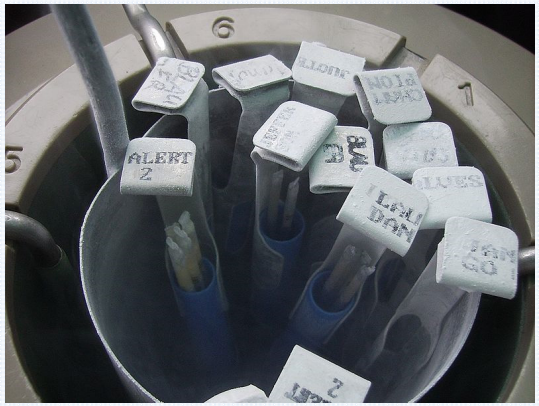
Measure (unit)	HALVES				TAILS			
	RFI_{koch}		RFI_{us}		RFI_{koch}		RFI_{us}	
	Low	High	Low	High	Low	High	Low	High
Motility (%)	61.2	62.2	68.9	60.7	67.1	56.3	65.0	62.0
Progressive Motility (%)	53.9	53.7	61.7	51.8	59.9	47.3	58.0	53.0
Semen Concentration (sperm/mL)	314	298	347	252	295	318	301	383

	Low	High	P-value
Motility (%)	44.0	20.0	0.002
Progressive Motility (%)	26.0	11.0	0.02

(Adapted from Awda et al, 2013)



Vs.



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Semen Quality

0.05<P<0.10

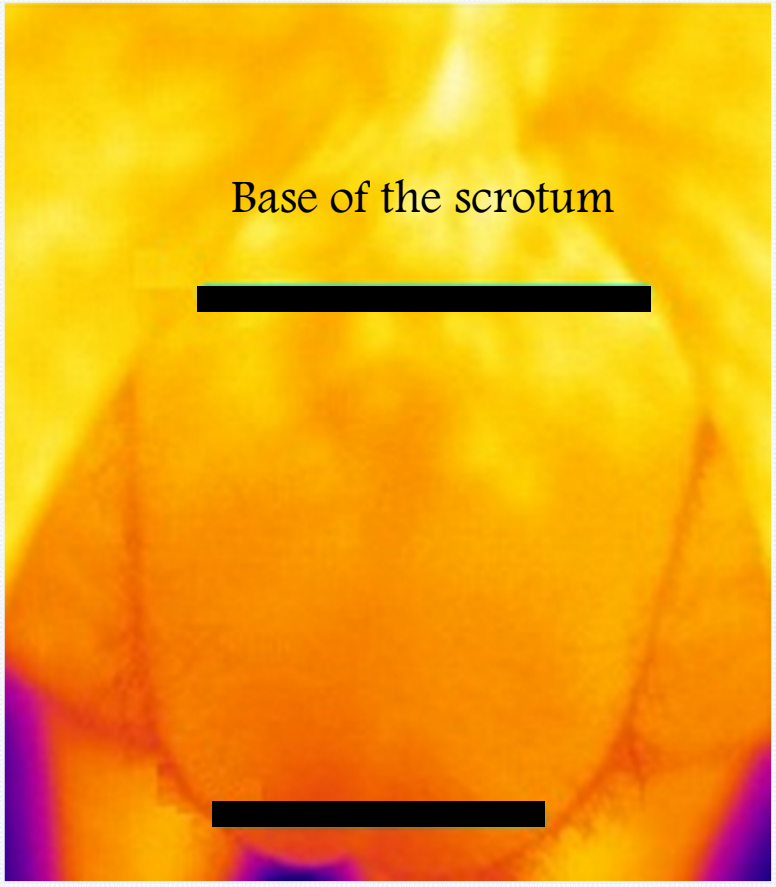
P<0.05

Measure (unit)	HALVES				TAILS			
	RFI_{koch}		RFI_{us}		RFI_{koch}		RFI_{us}	
	Low	High	Low	High	Low	High	Low	High
Normal Morphology (%)	70.8	68.5	73.1	66.2	73.2	65.9	73.7	62.1
Head Pathologies (%)	5.6	6.1	5.7	5.6	6.3	5.4	6.4	4.8
Tail Pathologies (%)	2.3	3.8	1.3	5.3	1.8	4.3	1.8	4.8
Midpiece Pathologies (%)	10.1	7.6	6.3	7.1	7.6	10.3	7.0	13.6

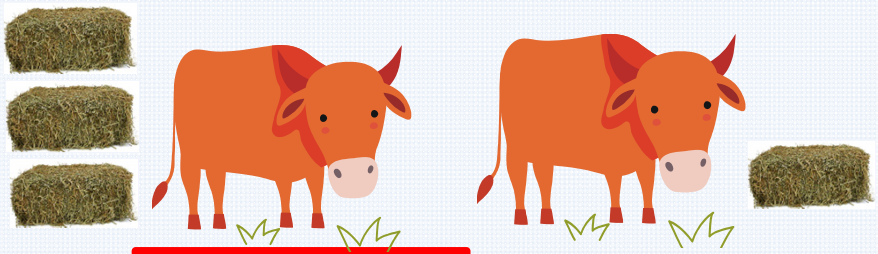
Normal Morphology (%)	Low	High	P-value
	77.2	74.0	0.09

(Adapted from Hafla et al, 2012)

Thermography



Larger Temperature Variation



29.8 ± 1.16 °C

30.0 ± 0.62 °C

2X

Ultrasound

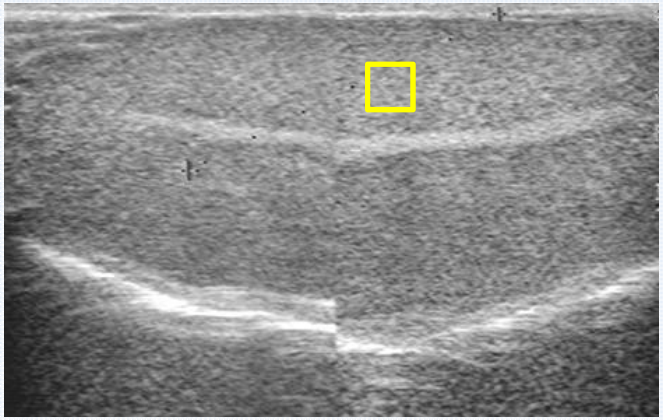
0.05<P<0.10

P<0.05

HALVES

TAILS

Measure (unit)	RFI_{koch}		RFI_{us}		RFI_{koch}		RFI_{us}	
	Low	High	Low	High	Low	High	Low	High
Minimum Pixel Intensity (pixels)	90.0	79.7	89.7	69.8	89.2	81.2	89.6	78.0
Maximum Pixel Intensity (pixels)	198.1	184.3	198.0	175.5	193.4	189.7	195.3	184.3



Testicular echogenicity

Mature cells

Sexual maturity

(Evans et al, 1996; Brito et al, 2012; Kastelic and Brito, 2012)

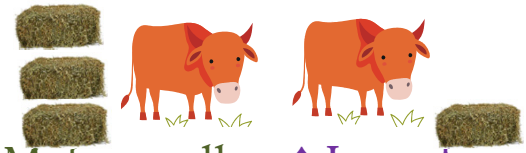
Histology

0.05<P<0.10

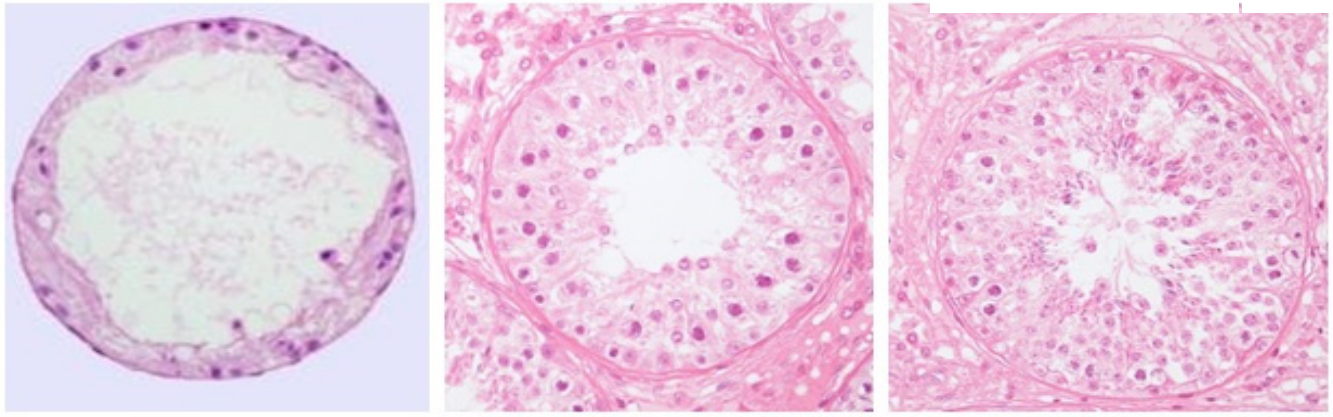
P<0.05

Measure (unit)	HALVES				TAILS			
	RFI_{koch}		RFI_{us}		RFI_{koch}		RFI_{us}	
	Low	High	Low	High	Low	High	Low	High
Immature (%)	4.9	7.4	5.1	7.8	5.3	6.6	5.3	6.2
Reaching Maturity (%)	13.0	19.0	12.8	17.0	13.6	17.3	18.1	16.9
Mature (%)	34.1	27.5	34.8	29.5	34.1	29.5	32.1	24.2

- Percentage of Maturity Stages



↑Mature cells ↑ Immature cells



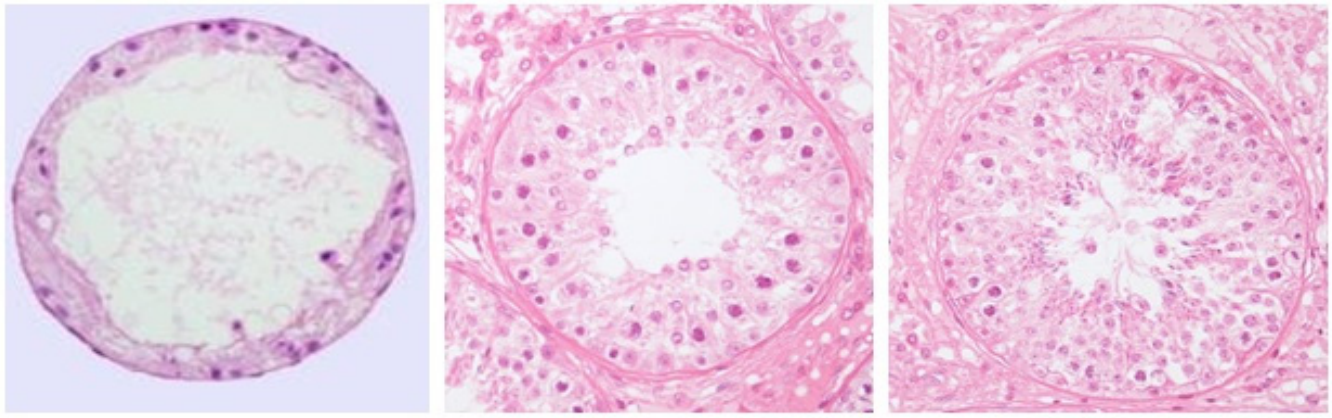
Histology

0.05<P<0.10

P<0.05

Measure (unit)	HALVES				TAILS			
	RFI_{koch}		RFI_{us}		RFI_{koch}		RFI_{us}	
	Low	High	Low	High	Low	High	Low	High
Immature Size (mm^2)	36.1	38.5	32.1	38.6	26.7	51.1	29.0	50.2
Reaching Maturity Size (mm^2)	38.1	33.5	31.7	35.9	25.4	51.8	25.12	48.7
Mature Size (mm^2)	48.7	46.7	38.5	53.9	31.6	67.2	32.63	62.1

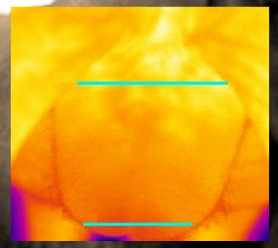
- Size of Tubules



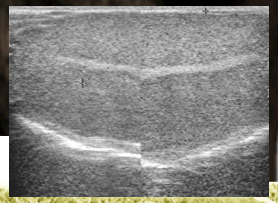
Conclusion

↓ Progressive motile

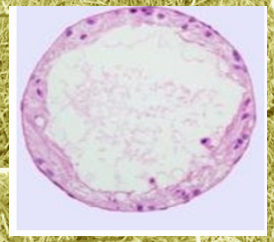
↓ Normal morphology



Poor Thermoregulation



Lower Echogenicity



↕ Tubule Diameter

Acknowledgments


Tak!
Thank You!
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