IMPACTO DA NUTRIÇÃO NA REPRODUÇÃO

Pietro S. Baruselli
Departamento de Reprodução Animal
Faculdade de Medicina Veterinária e Zootecnia
Universidade de São Paulo

Background

- As fêmeas necessitam de reservas de energia adequadas (gordura corporal) para suprir a demanda do metabolismo basal, crescimento, lactação e função reprodutiva

- Uma das habilidades mais importantes das fêmeas é a capacidade de usar a reserva energética corporal durante períodos de balanço energético negativo (BEN)

(Edmonson et al., 1989; Wright et al., 1987)

Background

- Reservas inadequadas de energia corporal ao parto aumentam os dias para a concepção (período de serviço)

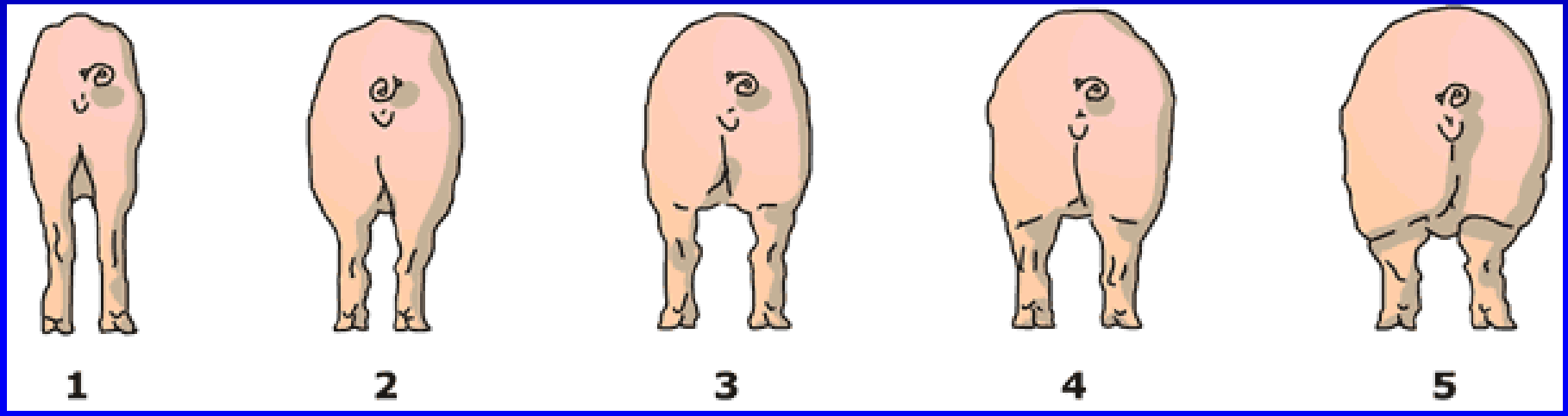
(Richards et al., 1986; Selk et al., 1988)

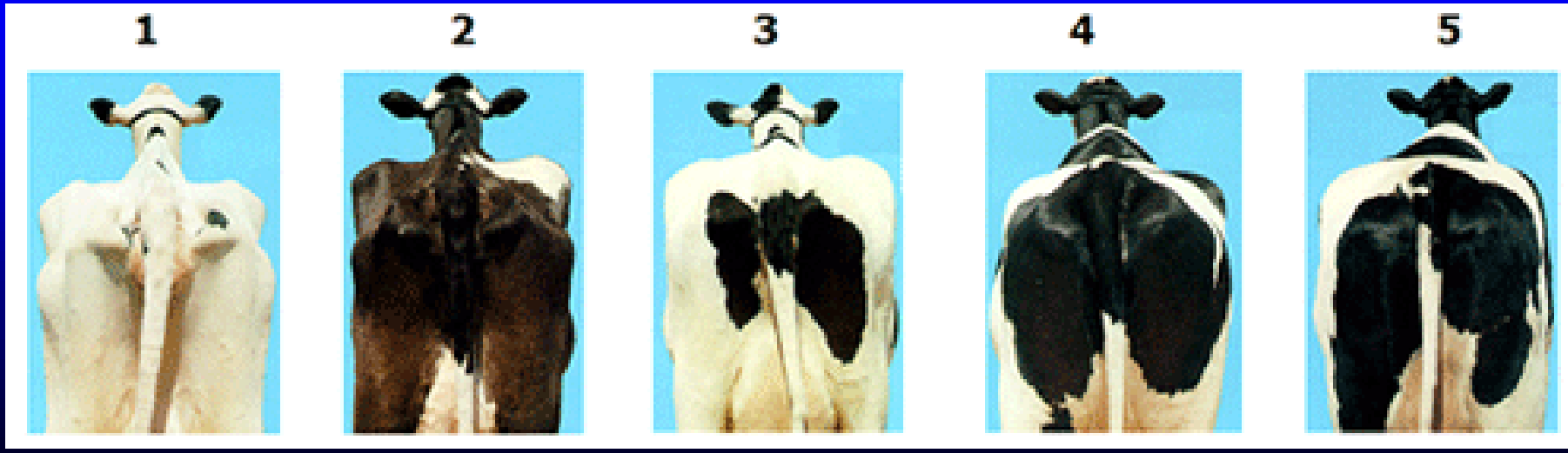
- A avaliação da BCS (Body Condition Score) quantifica subjetivamente as reservas energéticas corporal, que resultam do estado nutricional

(Edmonson et al.,1989; Domecq et al., 1995; Ferguson et al., 1994)

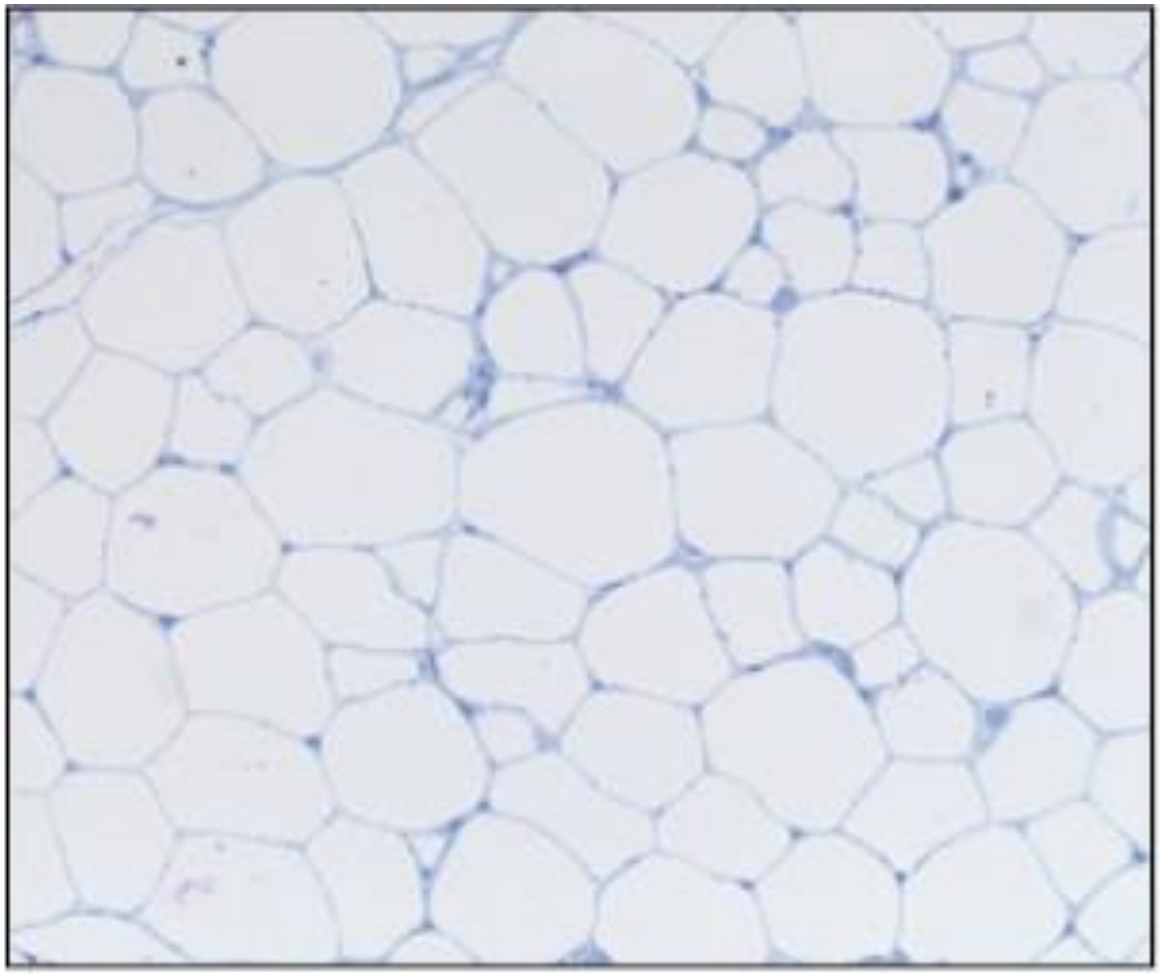
Problemas nutricionais

Carência nutricional **Excesso nutricional**





Adipose (fat)

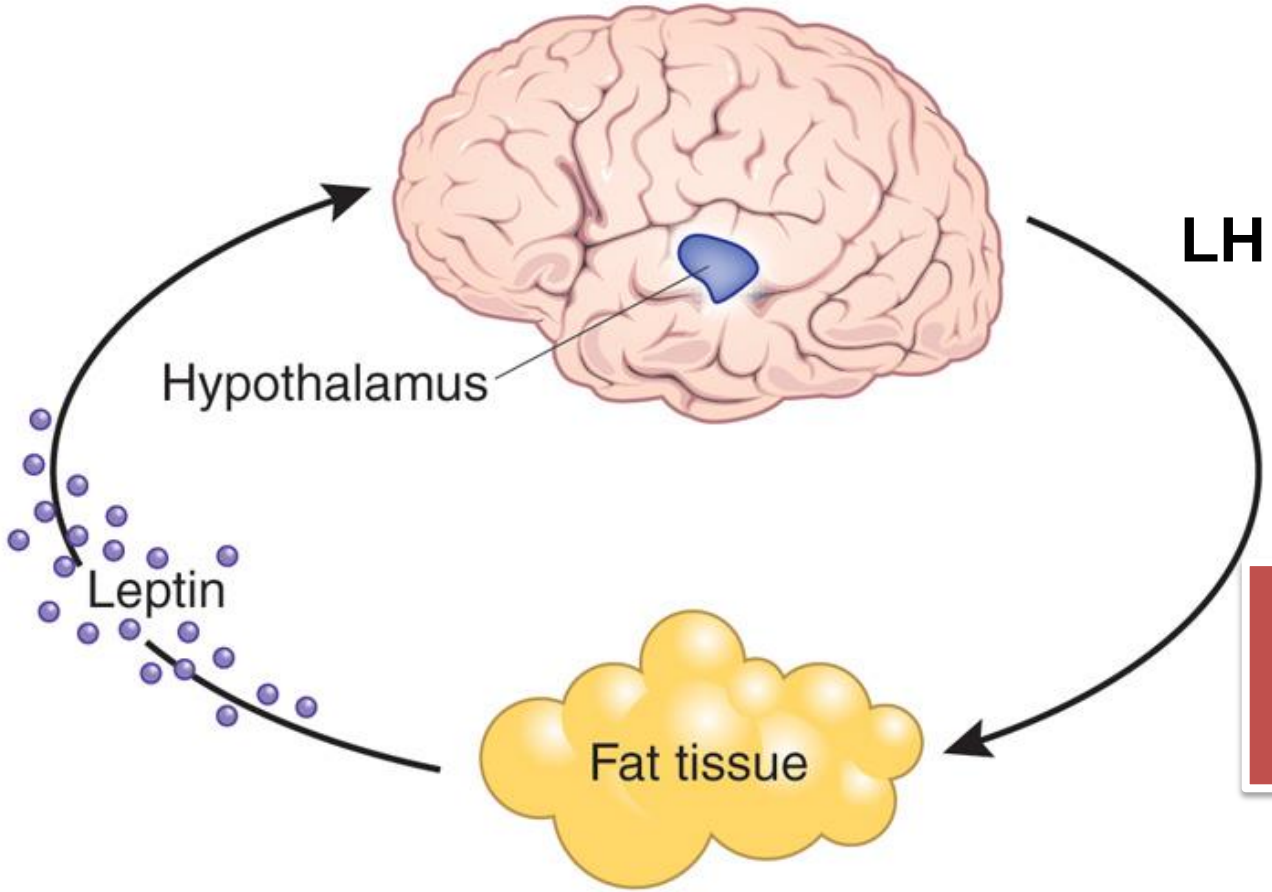


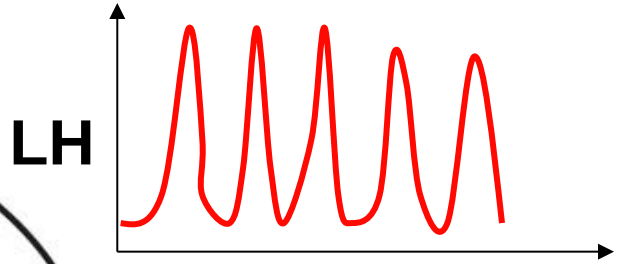
Glândula endócrina?

REPRODUCTION SYMPOSIUM: Hypothalamic neuropeptides and the nutritional programming of puberty in heifers

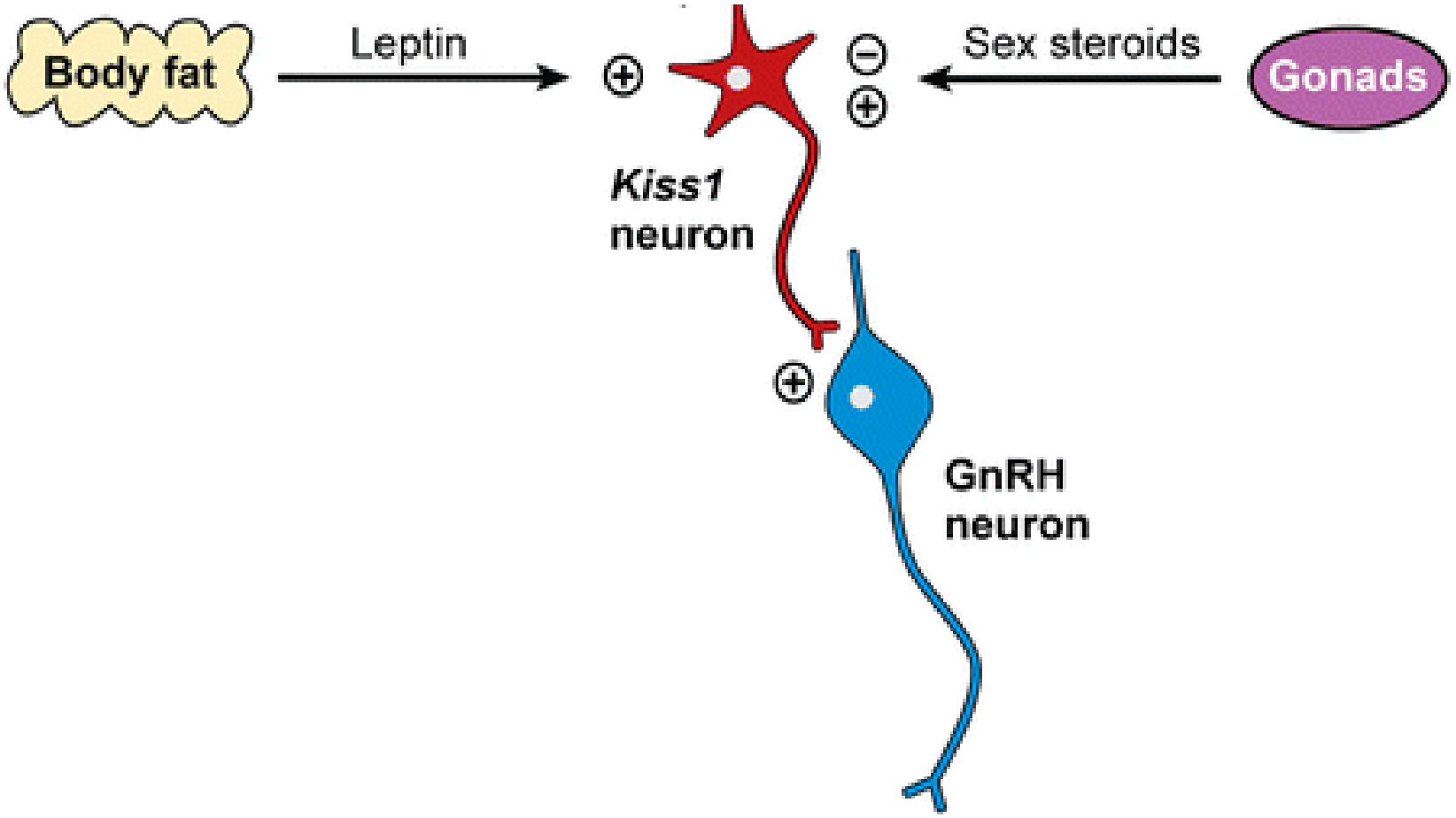
M. Amstalden, R. C. Cardoso, B. R. C. Alves and G. L. Williams

J ANIM SCI 2014, 92:3211-3222.
doi: 10.2527/jas.2014-7808 originally published online June 3, 2014

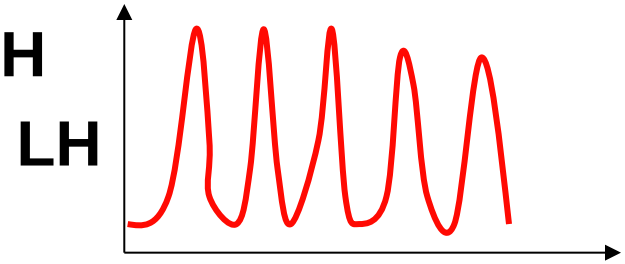




Pulsatilidade de LH



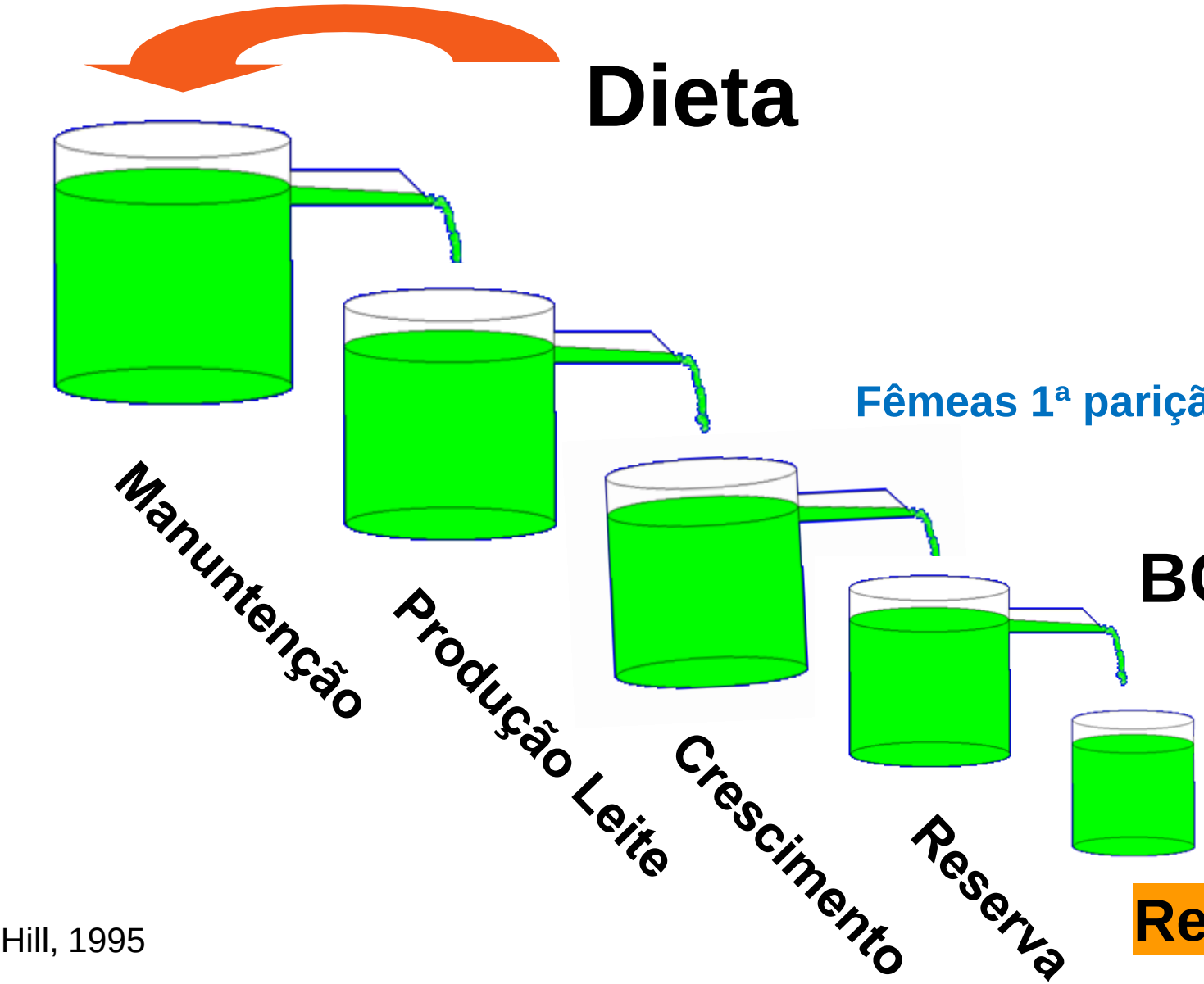
+ LH/FSH



Follicular growth and ovulation

Como os animais direcionam o alimento ingerido para reserva energética corporal?

NUTRIÇÃO E REPRODUÇÃO



Hill, 1995

Tabela. Escore de condição corporal e porcentagem de reserva energética corporal

ESCORES DE CONDIÇÃO CORPORAL		RESERVA ENERGÉTICA CORPORAL
(1-9)	(1-5)	
1	1,0	5,0
2	1,5	9,4
3	2,0	13,7
4	2,5	18,1
5	3,0	22,5
6	3,5	26,9
7	4,0	31,2
8	4,5	35,6
9	5,0	40,0

1 ponto na escala = 36 kg de peso vivo (Whitman, 1975)

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Livestock Science 123 (2009) 175–179

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Validation of body condition score as a predictor of subcutaneous fat in Nelore (*Bos indicus*) cows

Henderson Ayres [a,*], Roberta Machado Ferreira [a], José Ribamar de Souza Torres-Júnior [a,b], Clarice Garcia Borges Demétrio [c], César Gonçalves de Lima [d], Pietro Sampaio Baruselli [a]

Body weight (BW) vs. **Body condition score (BCS)** vs. **Rump fat thikness evaluation (RFAT)**

BCS 5.0

BCS 3.0

BCS 4.5

BCS 2.5

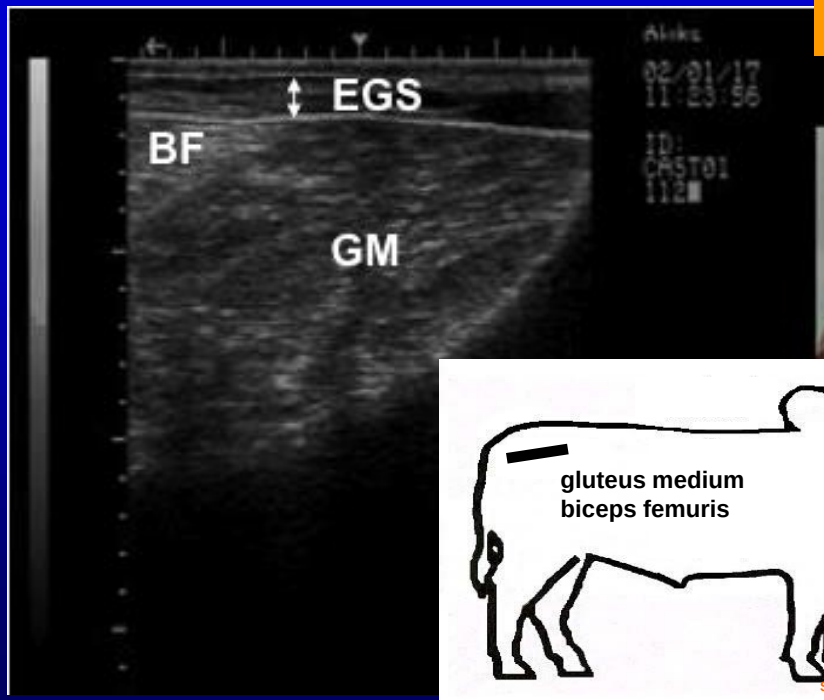
BCS 4.0

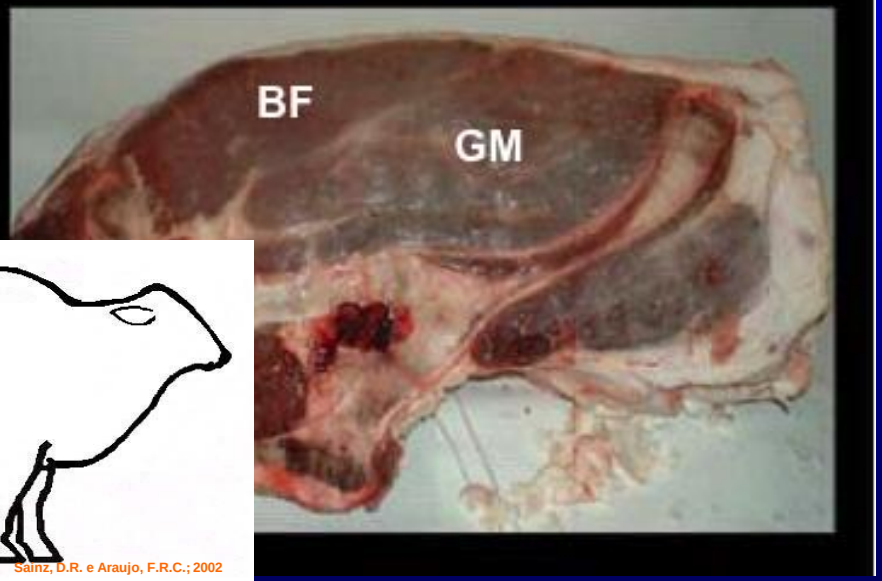
BCS 2.0

BCS 3.5

BCS 1.5

Rump fat thikness evaluation





Sainz, D.R. e Araujo, F.R.C.; 2002

Avaliações

1. Escore de Condição Corporal (ECC)

Escala 1 a 5

(Método Visual)

2. Espessura da Gordura Subcutânea (EGPU)

(Ultra-sonografia na garupa)

3. Peso Vivo (PV)

(Balança; KG)

FLUXOGRAMA DE ATIVIDADES

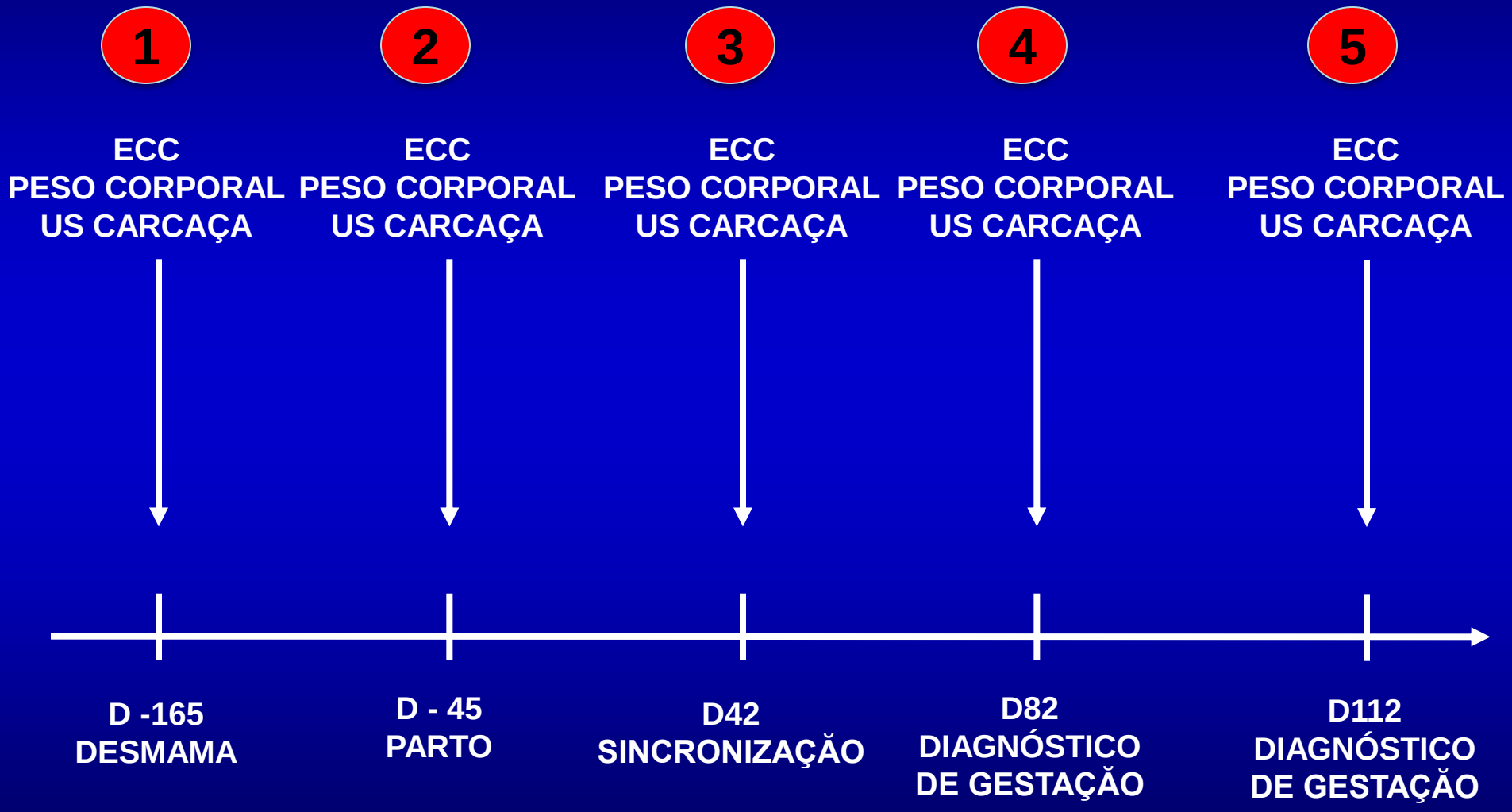


Table 2

Pearson correlation coefficients (r) between body condition score (BCS; $n = 266$).

	Weaning (−165 days before partum)	Parturition	42 days post-partum)	82 days post-partum	112 days post-partum
Correlation between BCS and BFT	0.82 <0.0001	0.93 <0.0001	0.93 <0.0001	0.93 <0.0001	0.88 <0.0001
Correlation between BCS and weight	0.50 <0.0001	0.37 <0.0001	0.47 <0.0001	0.41 <0.0001	0.42 <0.0001
Correlation between BCS BFT and weight	0.42 <0.0001	0.38 <0.0001	0.46 <0.0001	0.41 <0.0001	0.41 <0.0001

Back fat thickness (BFT; $n = 266$) and body weight ($n = 266$) in Nelore cows (*Bos indicus*) evaluated over time (Weaning. parturition. at 42. 82 and 112 days post-partum).

BCS — body condition score; BFT — back fat thickness.

Ayres et al., 2009

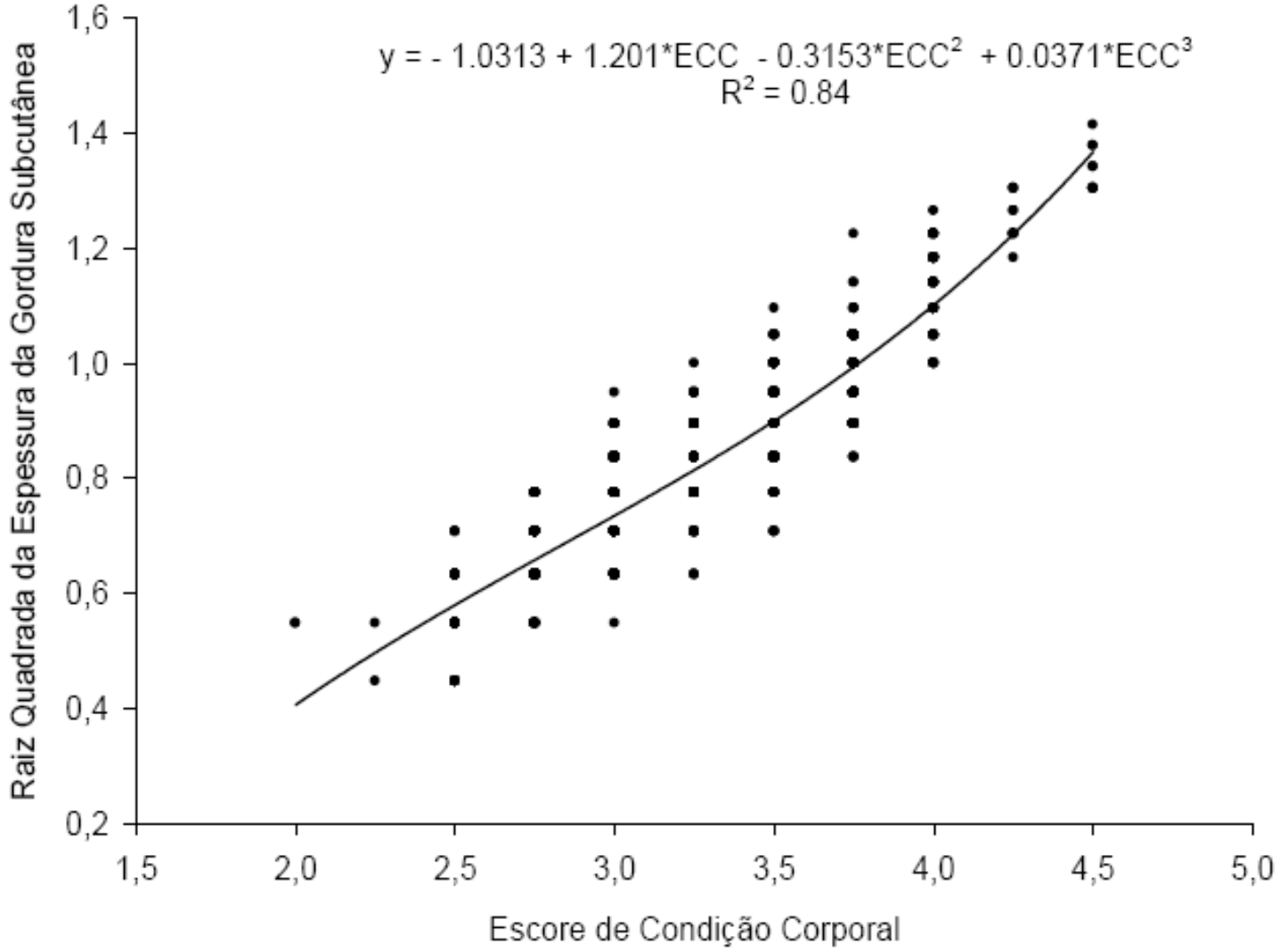


Figura 5 – Gráfico de dispersão do escore de condição corporal pela raíz quadrada da espessura da gordura subcutânea em vacas Nelore (*Bos indicus*) avaliadas em diferentes momentos experimentais (desmame, parto, sincronização, avaliação aos 82 e 112 dias pós-parto) Ayres et al., 2009

BCS vs Peso vivo

Em vacas Nelore (*Bos indicus*) 1 unidade de BCS equivale a:

45 kg de Peso Vivo

Ayres et al., 2009

Conclusão

- O BCS avaliado pelo método visual (escala de 1 a 5 pontos) foi capaz de predizer a espessura da gordura subcutânea (EGS) em vacas Nelore (*Bos indicus*) em diferentes momentos do ciclo de produção

- O BCS apresentou alta correlação e forte relação com a EGS (gordura subcutânea)

- No entanto, tanto o BCS quanto o EGS apresentaram baixa correlação e fraca relação com o peso vivo (PV)

Tabela – Variação do peso ideal (KG) ao primeiro cio das novilhas *Bos taurus* de acordo com o porte da fêmea adulta.

Peso (Kg)	PORTE DO ANIMAL ("FRAME")				
	1	3	5	7	9
Vaca adulta	400	467	533	600	667
Puberdade	264	297	331	365	400

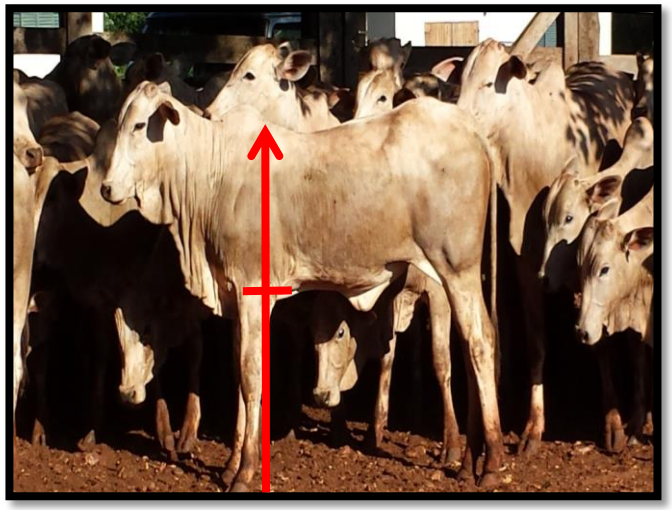
Fox et al., 1988

Manejo nutricional para reduzir a idade à primeira concepção

IATF em novilhas Nelore de 14 meses de idade
– 2013 e 2014 -

Mestrado: Bruno Gonzalez de Freitas
Orientador: Prof. Dr. Pietro Sampaio Baruselli
2013 - 2015

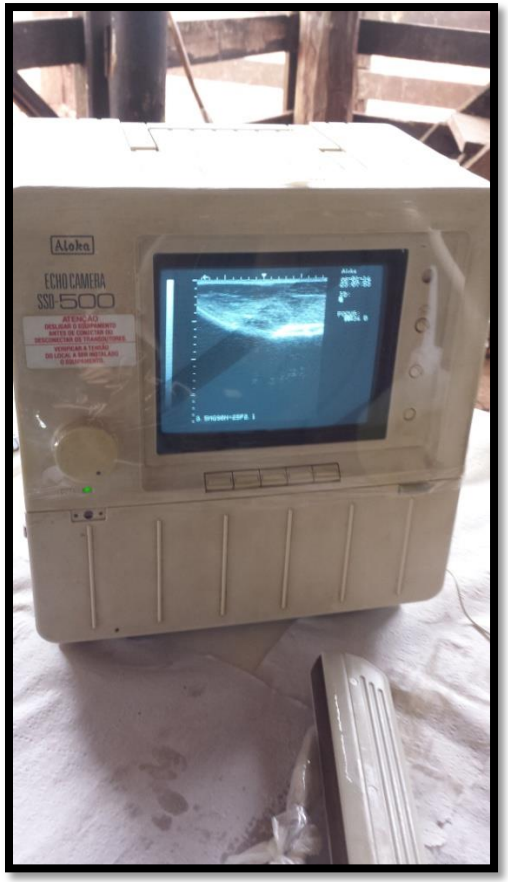
MATERIAL E MÉTODOS



Altura de cernelha e profundidade de costela

Freitas et al., 2015

MATERIAL E MÉTODOS



Dra. Marina Bonin

Ultrassonografia de carcaça – EGPU* (P8)

*espessura de gordura subcutânea na garupa

Freitas et al., 2015

NOVILHAS PRECOCES

Tabela 1. Taxa de concepção de novilhas da raça Nelore com média de 13,8 meses de idade, de acordo com as variáveis estudadas.

Variável	n	Taxa de concepção	Valor de P
Idade			
> 13 meses	391	40,9%	0,01
≤ 13 meses	259	27,8%	
Peso (Dia -10)			
> 248 kg	394	39,8%	0,001
≤ 248 kg	255	29,4%	
ECC (Dia -10)			
> 3,00	249	45,4%	< 0,001
≤ 3,00	400	29,7%	
EGPU (Dia -10)			
> 2,47 mm	378	44,4%	< 0,001
≤ 2,47 mm	265	23,4%	
Prof. de costela (Dia -10)			
> 44,0%	358	41,9%	< 0,001
≤ 44,0%	285	27,0%	

Freitas et al., 2015

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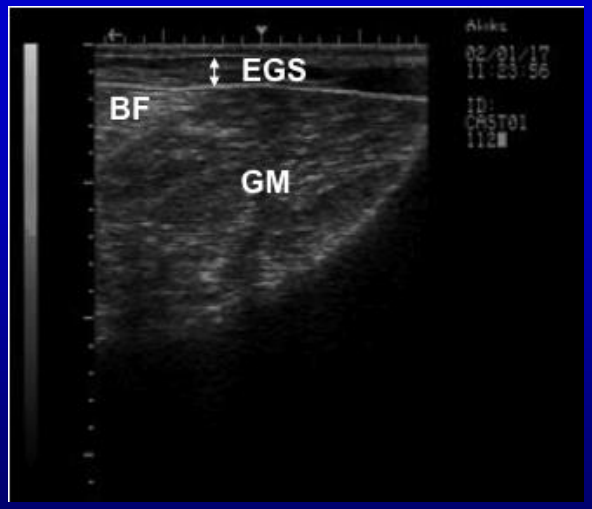
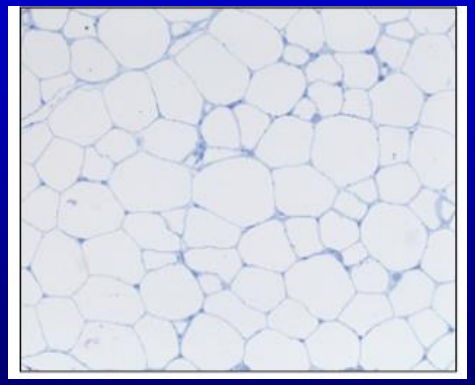
Espessura da Gordura Subcutânea (EGPU)

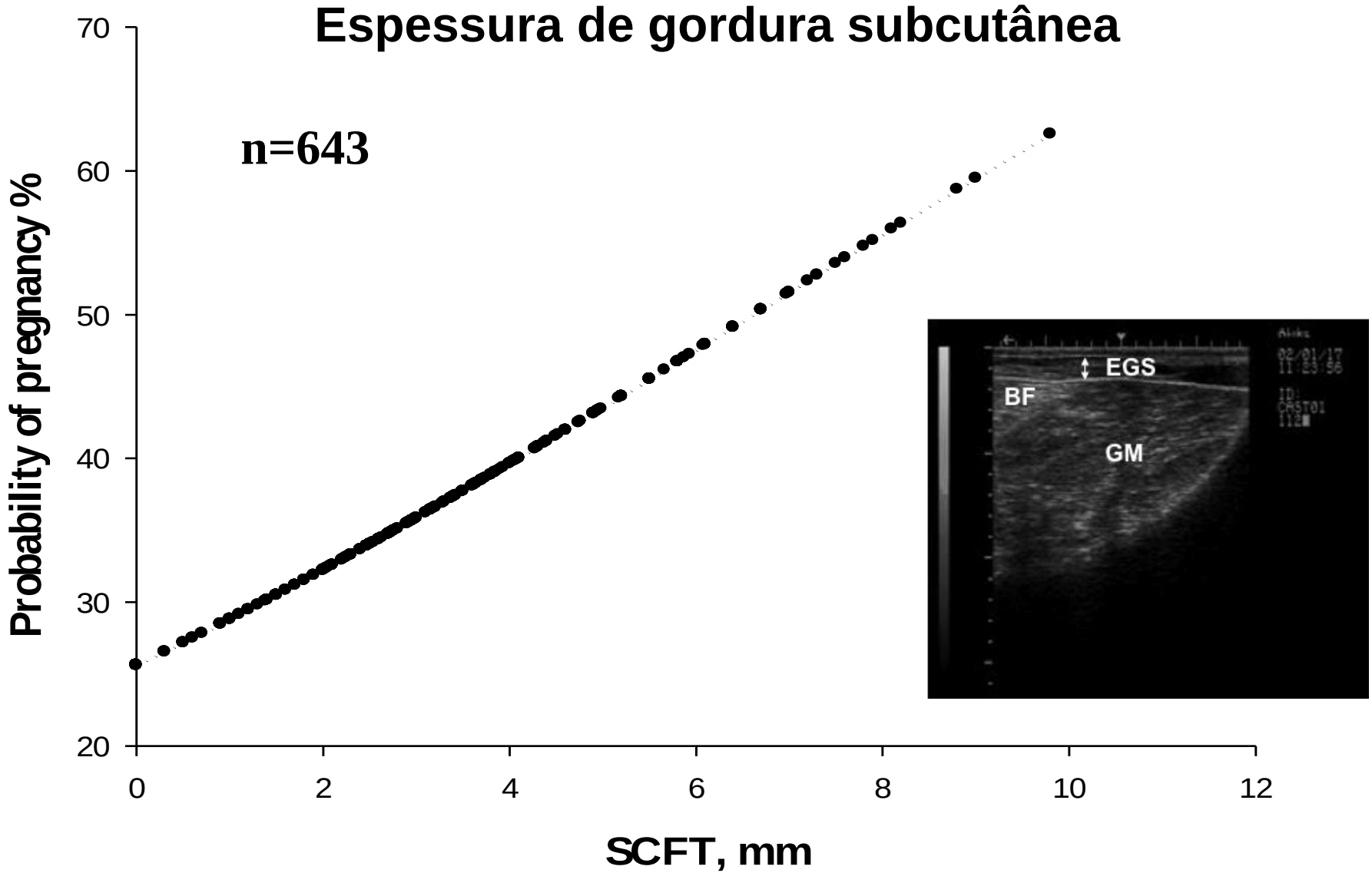
X

Feritilidade



Adipose (fat)



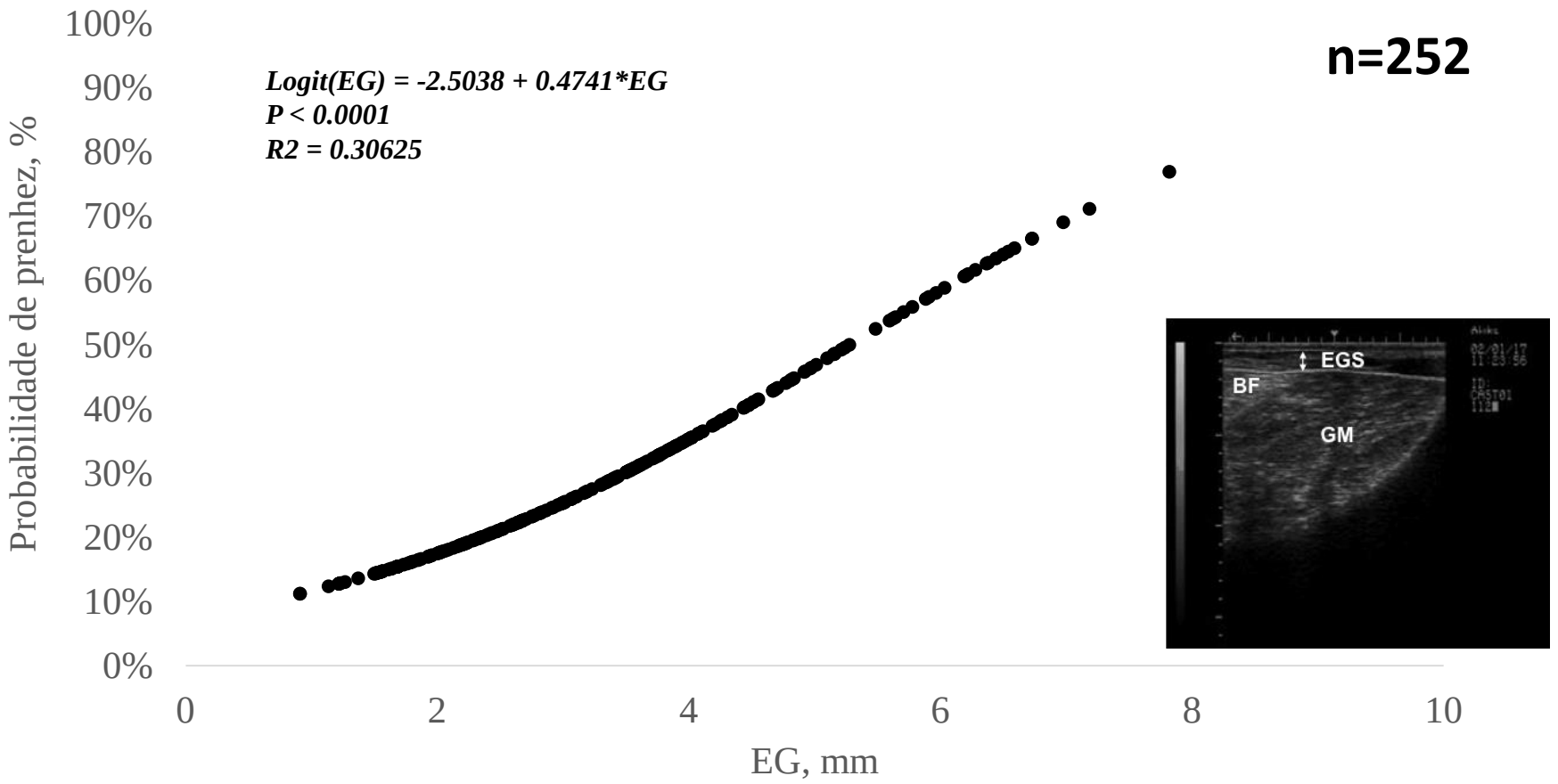


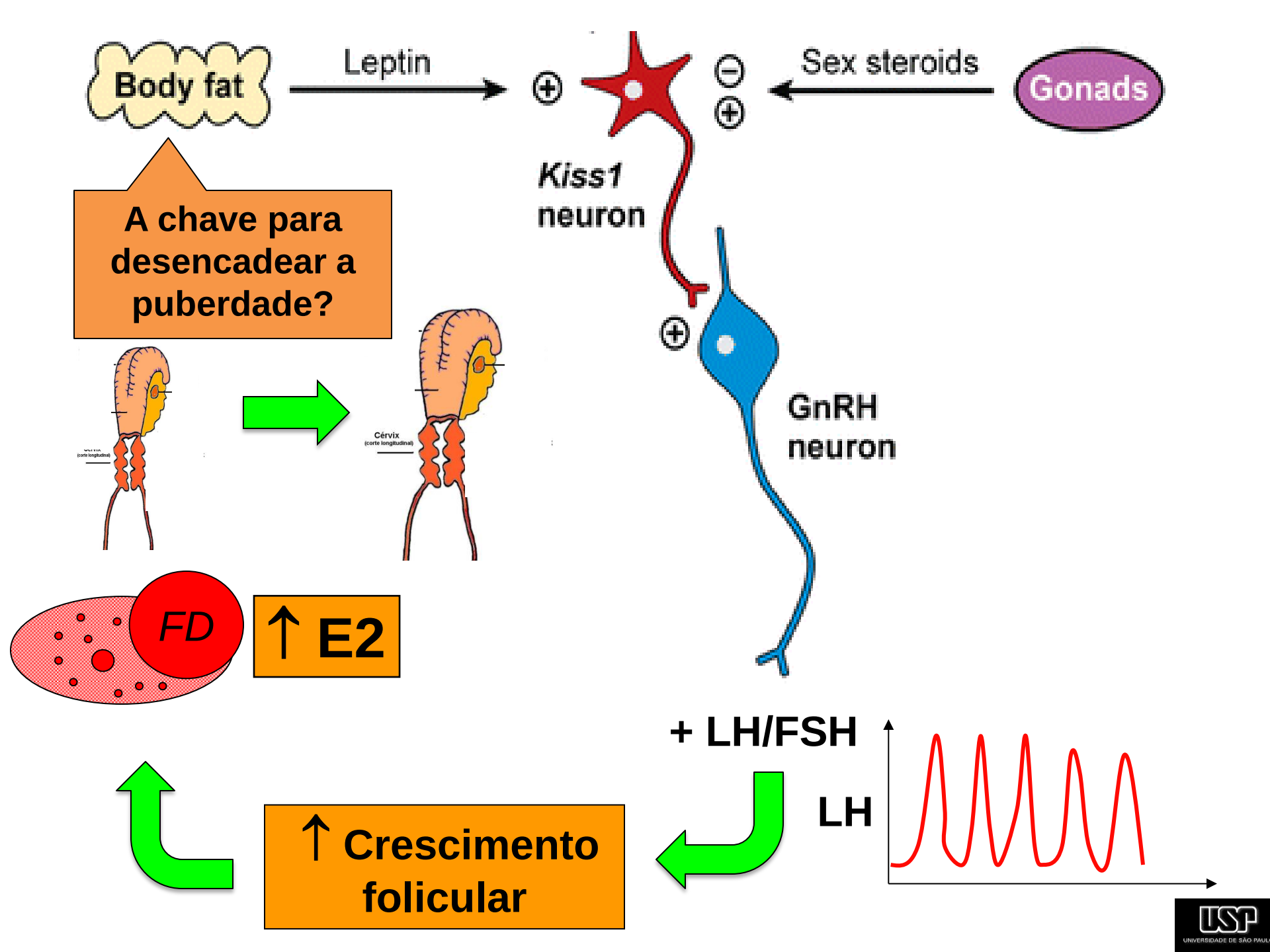
Probability of pregnancy to TAI as a function of the subcutaneous fat thickness (SCFT) of Nelore heifers with a mean of 13.9 months of age [Logit (SCFT)= 1.0662 + 0.1612* SCFT; P=0.0003.

Adapted from Freitas, 2015

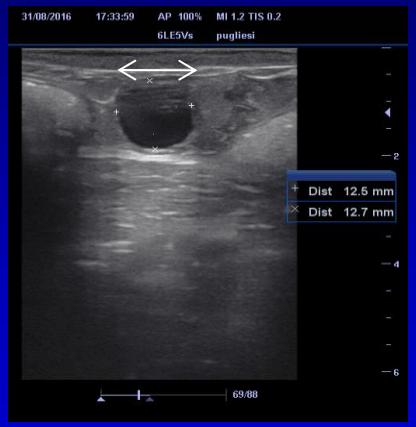
Novilhas Nelore (14 meses)

Probabilidade de prenhez à IATF (%)
(Efeito da EG; mm)




Body fat
Leptin
Sex steroids
Gonads
Kiss1 neuron
GnRH neuron
A chave para desencadear a puberdade?
Cérvix
(corte longitudinal)
FD
↑ E2
+ LH/FSH
LH
↑ Crescimento folicular

Ø do FD dominante no início EM



Avaliação do diâmetro folicular por ultrassonografia

IATF

12 d

n=404

Estação de Monta

FERTILIZA® Consultoria em Reprodução Animal

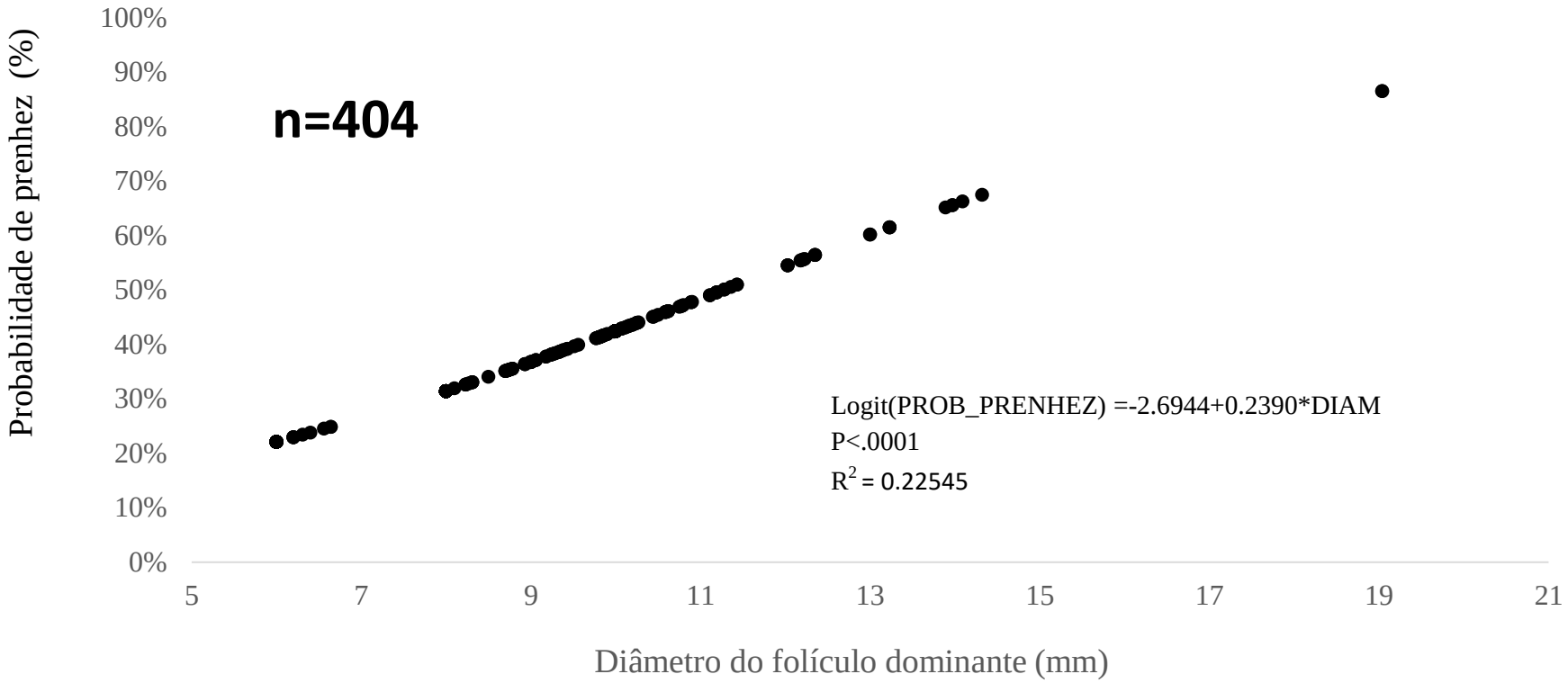
Claudiney Martins

USP UNIVERSIDADE DE SÃO PAULO

IATF Novilhas Nelore precoces

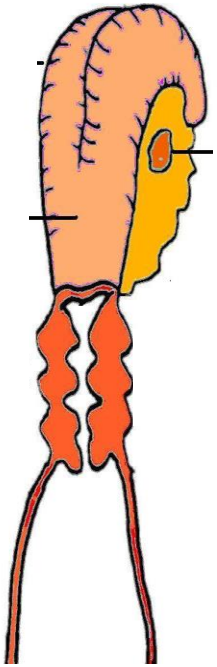
(sem presença de CL)

Diâmetro do maior folículo (FD) no início EM

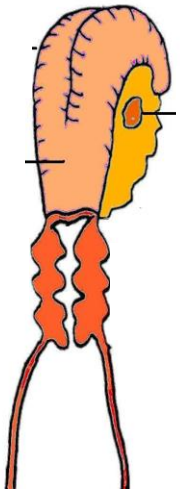


Martins et al., 2017 (SBTE)

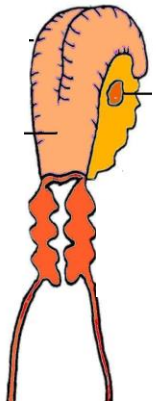
Avaliação do escore do útero em novilhas Nelore



A
(com CL)



B
(> 1,5 cm ∅)
Sem CL



C
(< 1,5 cm ∅)
Sem CL

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Martins et al., 2017 (SBTE)

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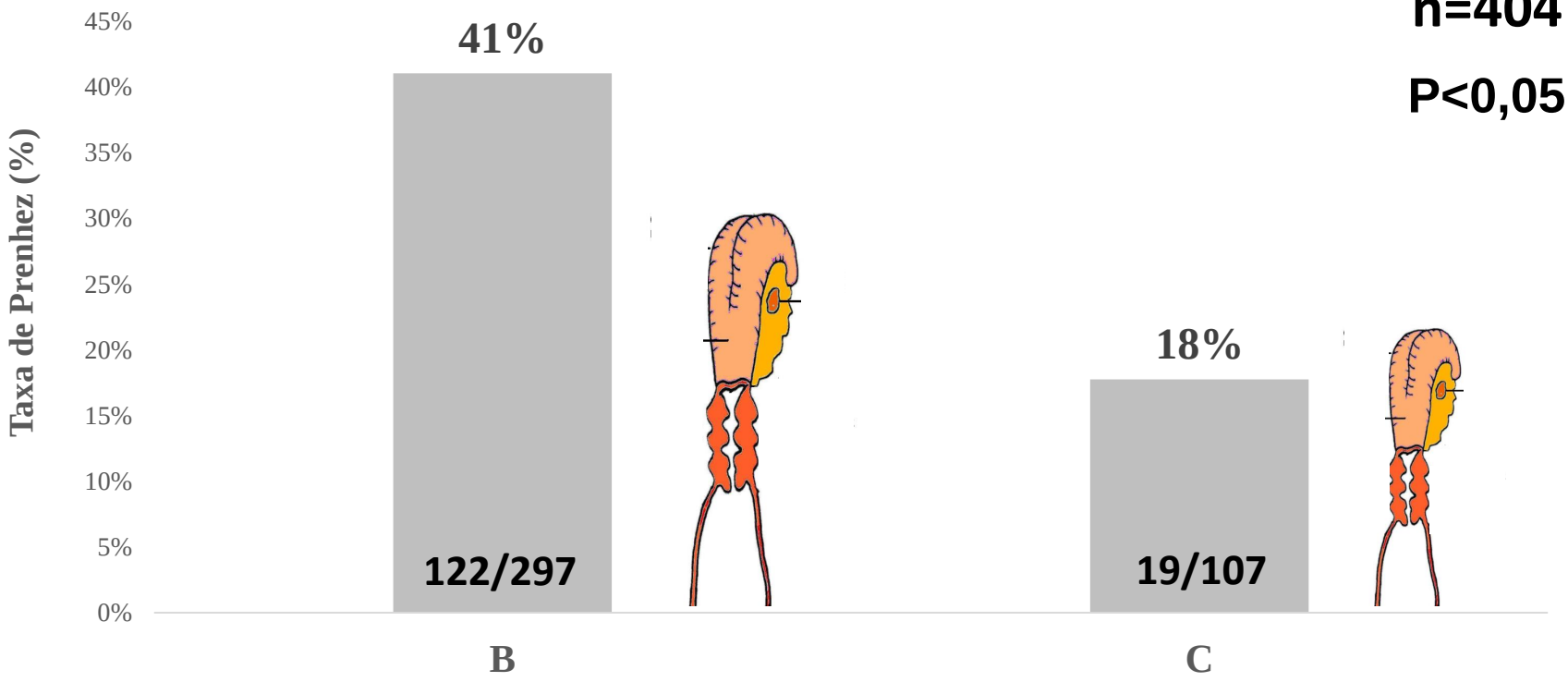
IATF Novilhas Nelore (14 meses)

Escore de útero no início EM (100% prépúbere)



Martins et al., 2017 (SBTE)

Nutrição

X

Perfil metabólico

X

Puberdade

Contents lists available at ScienceDirect

Animal Reproduction Science

2014;140: 134-42

journal homepage: www.elsevier.com/locate/anireprosci

Nutrition, metabolic profiles and puberty in Brahman (*Bos indicus*) beef heifers

F. Samadi [a,1], D. Blache [b], G.B. Martin [b], M.J. D'Occhio [a,c,*,2]

[a] School of Agriculture and Food Sciences, The University of Queensland, Gatton, Queensland, Australia
[b] School of Animal Biology, The University of Western Australia, Crawley, Western Australia, Australia
[c] Cooperative Research Centre for Beef Genetic Technologies, Armidale, New South Wales, Australia

Ganho de peso diário

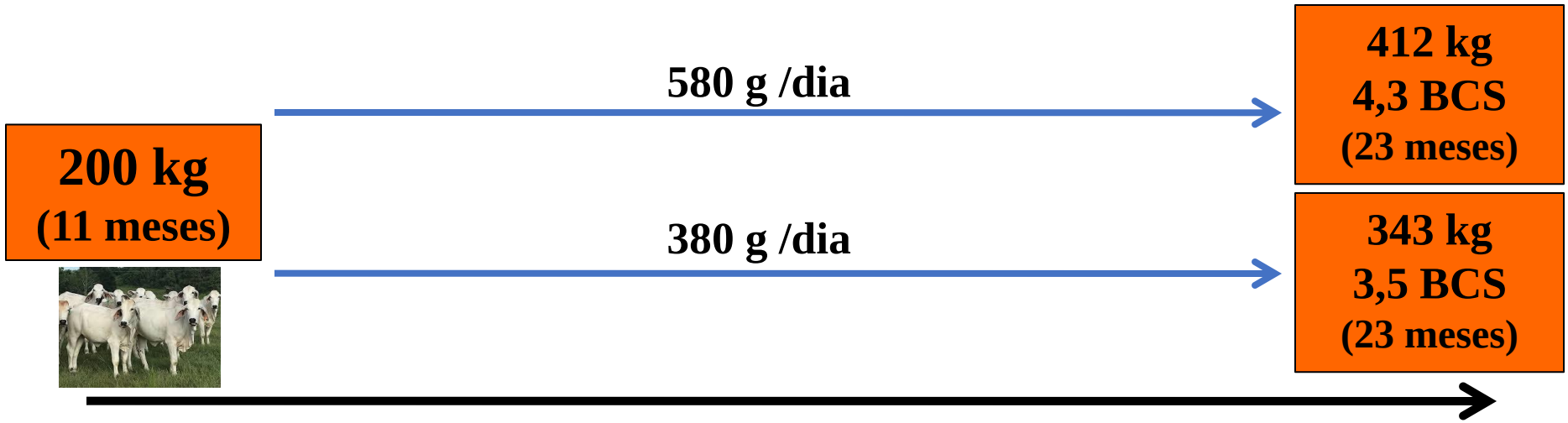
380 g /dia x 580 g /dia

11 aos 23 meses

Table 2

Summary information for body weight and body condition score for Brahman heifers maintained on moderate nutrition ($n = 11$) or improved nutrition ($n = 11$) from 11 to 23 months of age. Results are means ± SEM.

	Moderate nutrition	Improved nutrition	*P* value
Initial body weight (kg)	200 ± 3	200 ± 3	$P = 1.0$
Final body weight (kg)	343 ± 5	412 ± 7	<0.01
Growth rate (kg/day)	0.38 ± 0.1	0.58 ± 0.1	$P = 0.06$
Initial body condition score	2.0 ± 0.0	2.0 ± 0.0	$P = 1.0$
Final body condition score	3.5 ± 0.1	4.3 ± 0.1	<0.01



Samadi et al., 2014 (Anim Reprod Sci 2014;140: 134-42)

0,580 kg/dia

P < 0.01

Tx Ov. 100% (11/11)

Tx Ov. 9,1% (1/11)

0,380 kg/dia

Body weight (kg)

420
340
260
180

11 12 13 14 15 16 17 18 19 20 21 22 23

Age (month)

P < 0.01

0,580 kg/dia

Tx Ov. 100% (11/11)

Tx Ov. 9,1% (1/11)

0,380 kg/dia

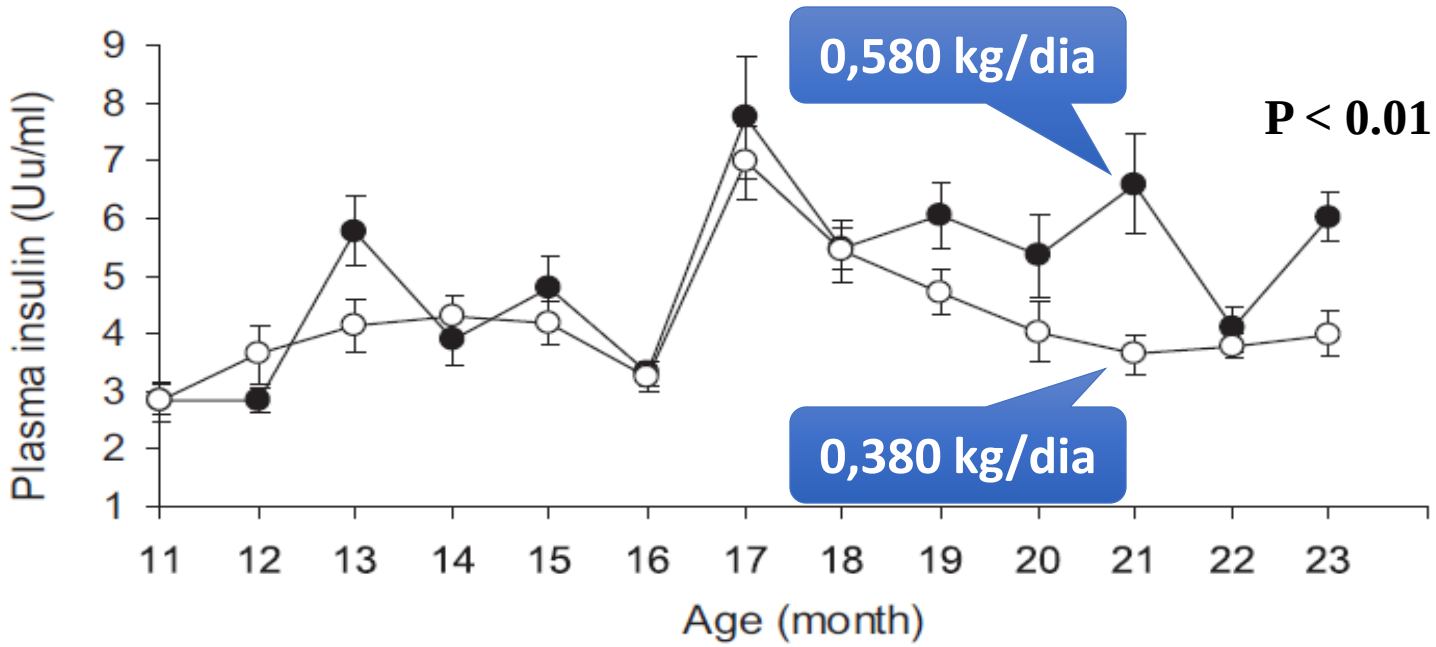
BCS (1-5 scale)

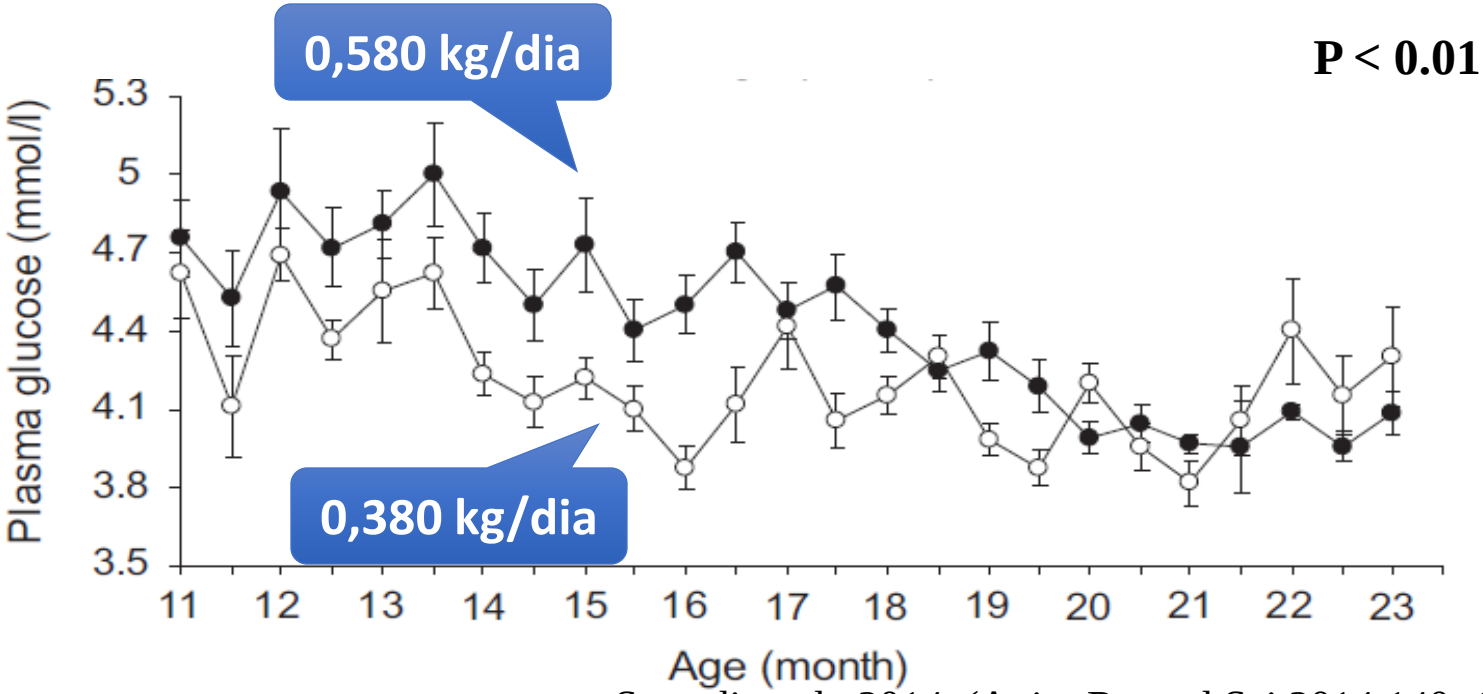
4.5
4
3.5
3
2.5
2
1.5

11 12 13 14 15 16 17 18 19 20 21 22 23

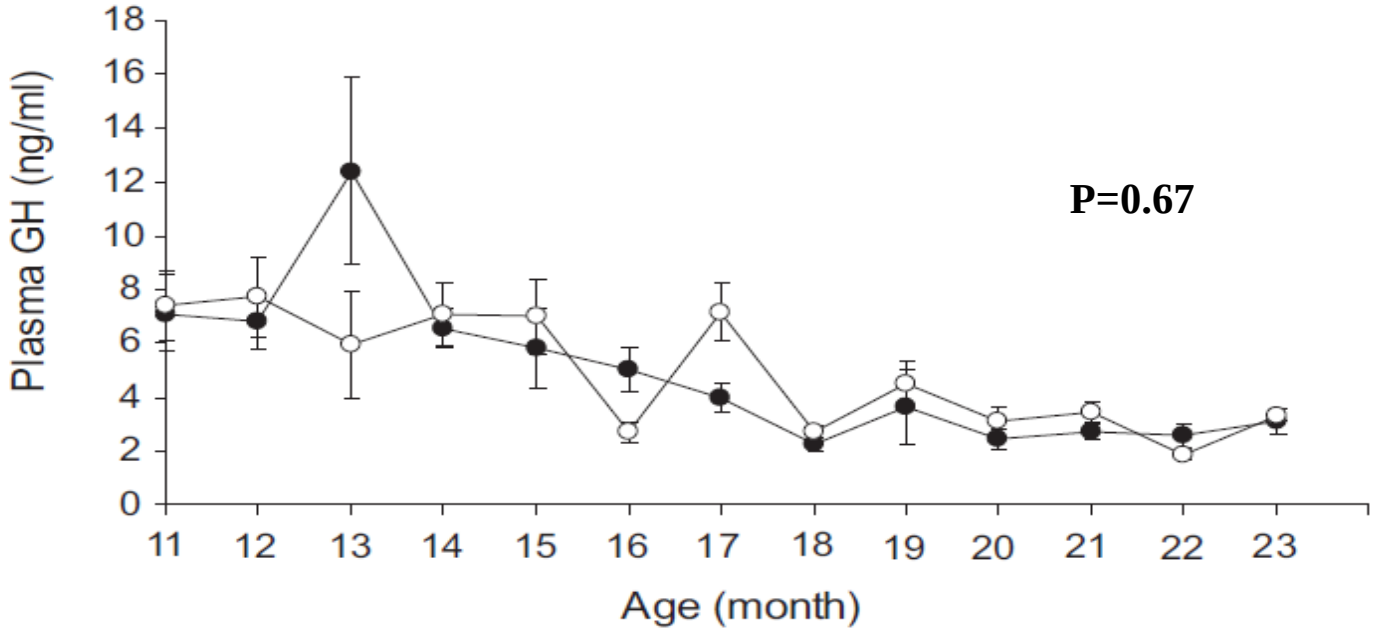
Age (month)

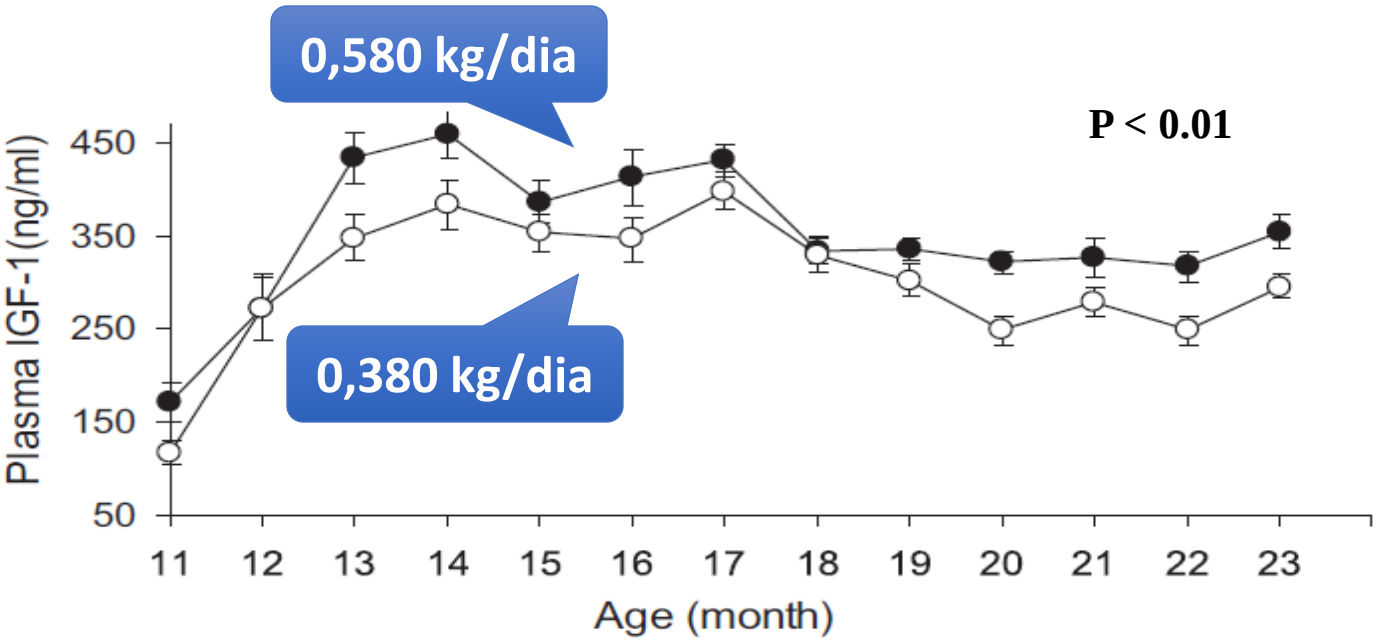
Samadi et al., 2014 (Anim Reprod Sci 2014;140: 134-42)





Samadi et al., 2014 (Anim Reprod Sci 2014;140: 134-42)





Samadi et al., 2014 (Anim Reprod Sci 2014;140: 134-42)

Fig. 5. Longitudinal changes in plasma concentrations of leptin in Brahman heifers maintained on moderate nutrition (○, $n = 11$) or improved nutrition (●, $n = 11$) from 11 to 23 months of age. Results are means ± SEM.

Samadi et al., 2014 (Anim Reprod Sci 2014;140: 134-42)

Metabolismo x puberdade

⇧ BCS
⇧ Leptina
⇧ Glicose
⇧ Insulina
⇧ IGF1

Antecipação da puberdade

Interação

Genética X Nutrição

(fertilidade?)

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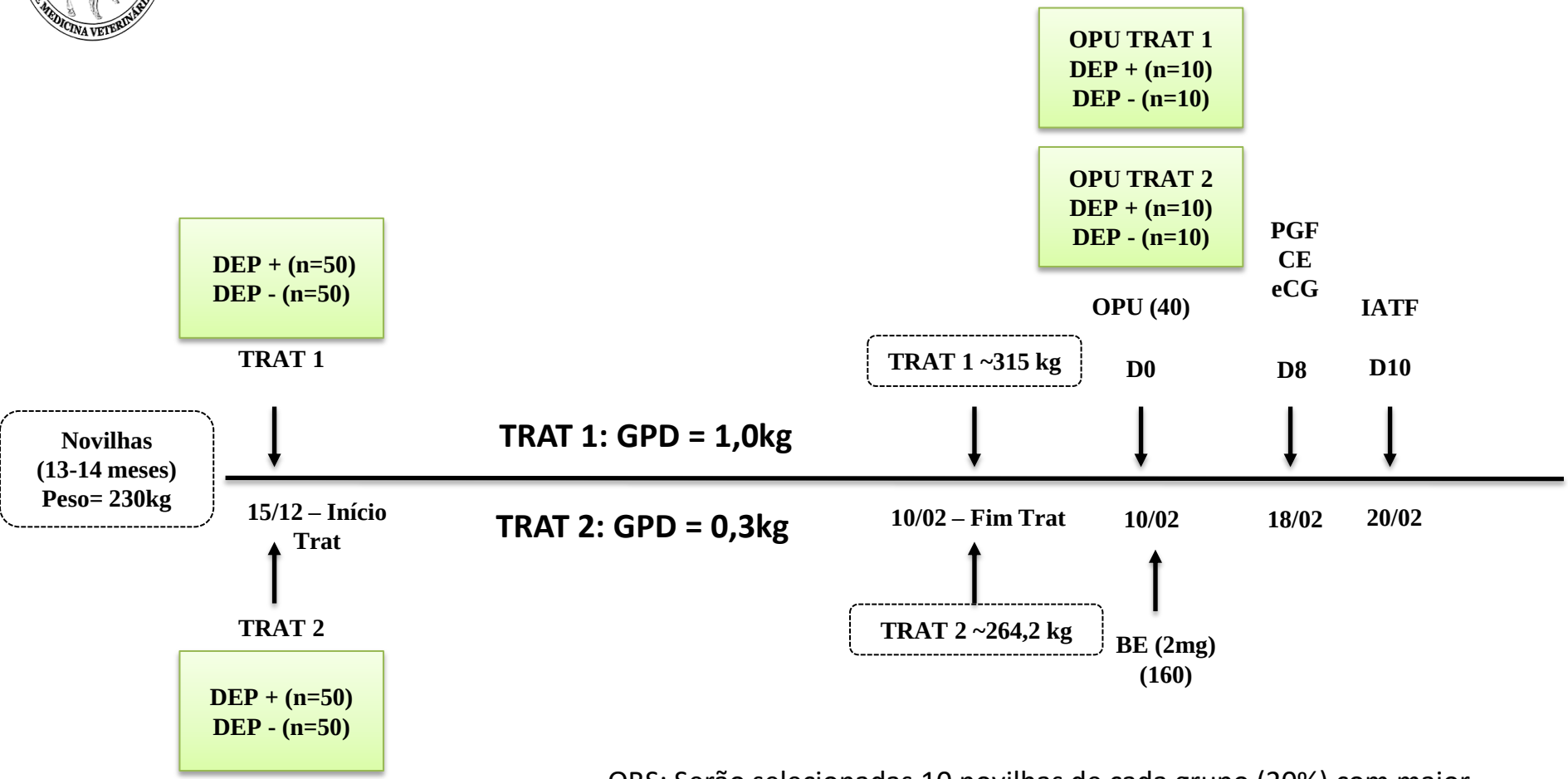
Interação genética x nutrição em novilhas Nelore precoces

Delineamento Experimental – Fatorial 2x2



OBS: Serão selecionadas 10 novilhas de cada grupo (20%) com maior DEP para característica de precocidade e produção (a definir) para OPU e produção in vitro de embriões

TRAT 1: GPD 1,5KG
TRAT 2: GPD 0,6KG

Foto: Laisa Garcia

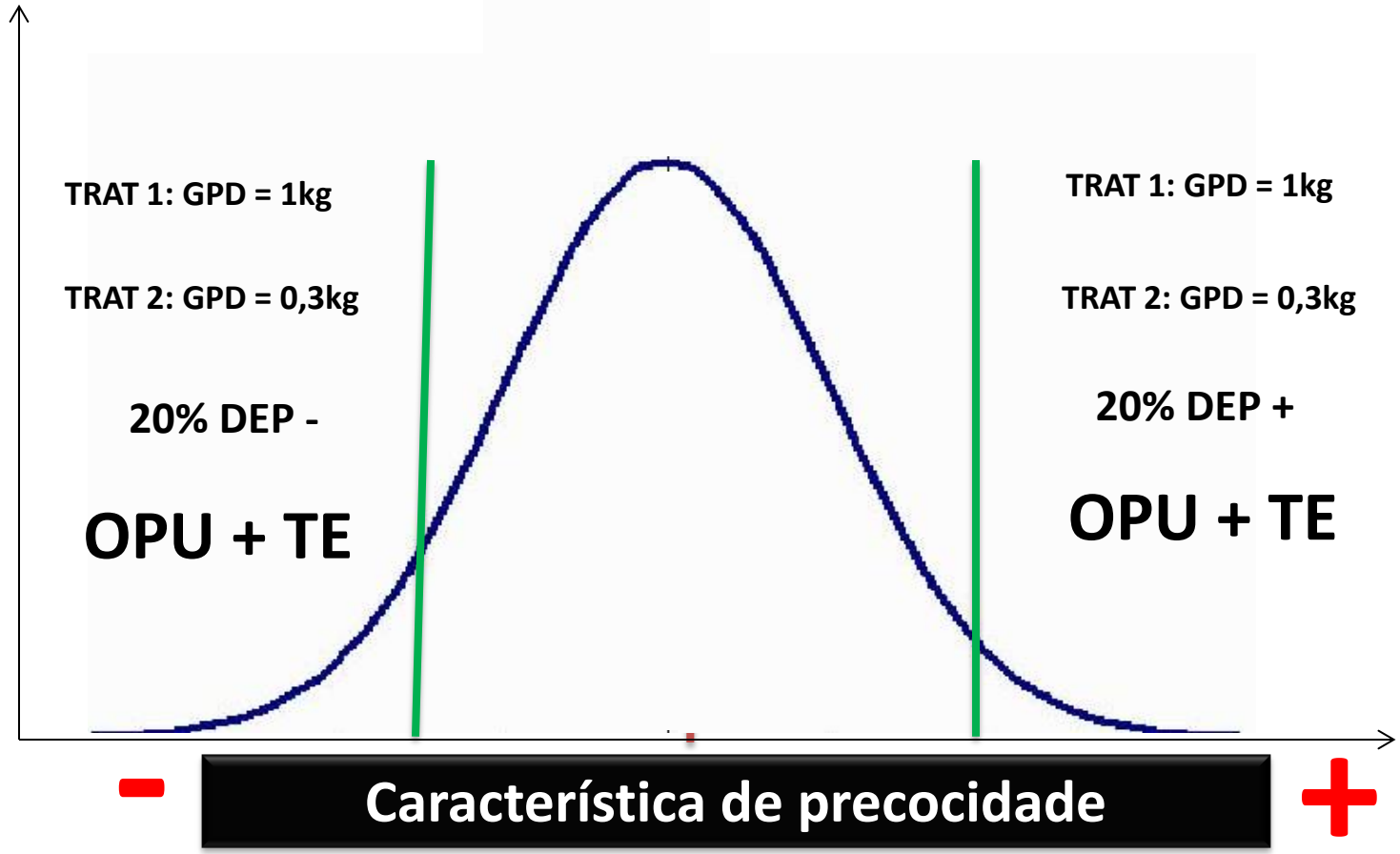
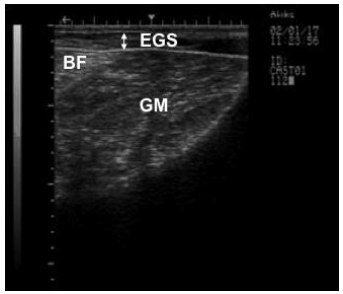
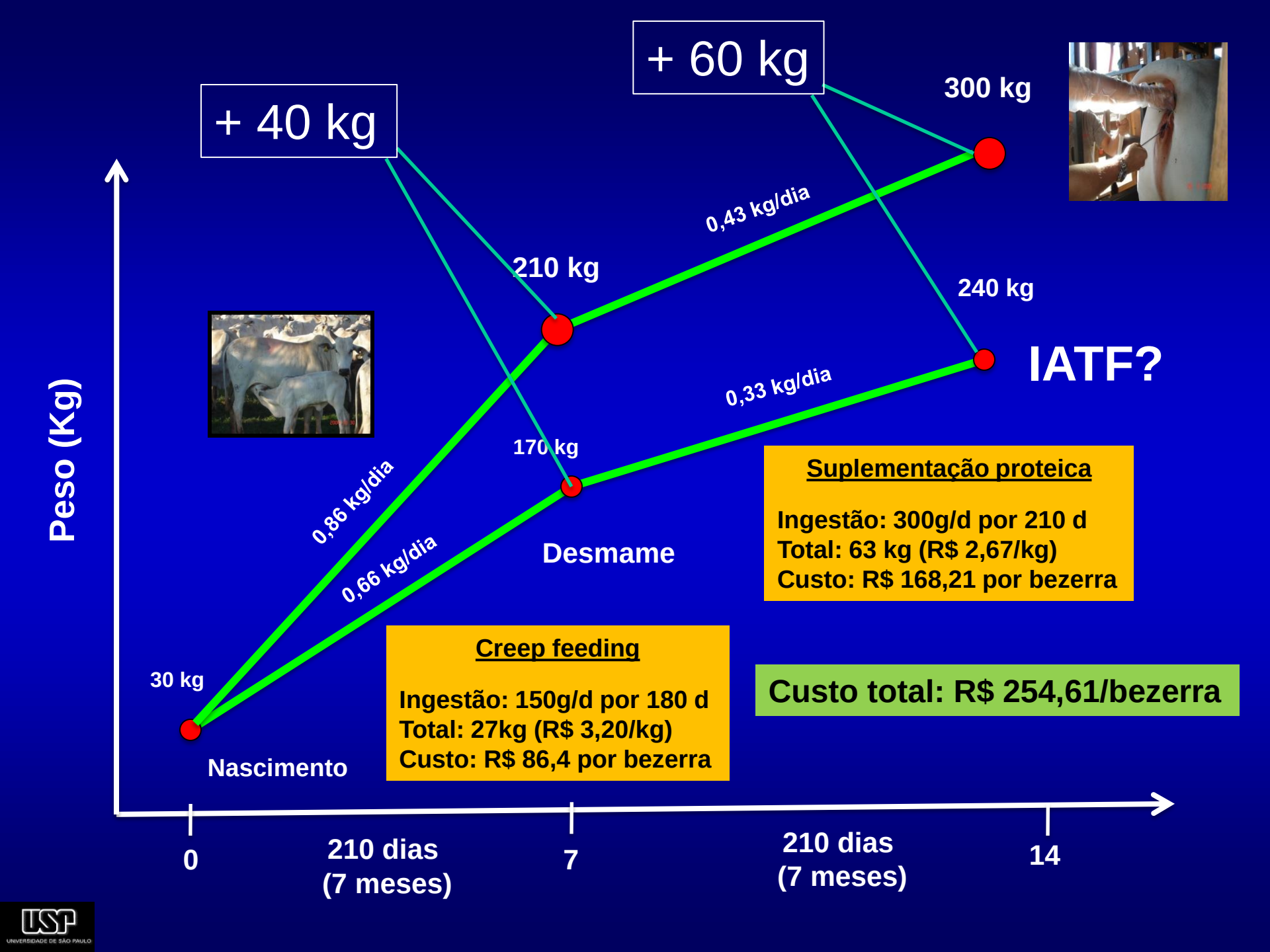

TRAT 1: GPD = 1kg
TRAT 2: GPD = 0,3kg
20% DEP -
OPU + TE
TRAT 1: GPD = 1kg
TRAT 2: GPD = 0,3kg
20% DEP +
OPU + TE
-
Característica de precocidade
+
(MGTe e índice SAM)

Tabela . Espessura de gordura subcutânea (mm) entre a 12ª e 13ª costela (EGS) e na picanha (EGP) obtido por ultrassonografia de carcaça.

	Precoce +		Precoce -				
	Confinamento	Pasto	Confinamento	Pasto	Pprec	Pnut	Prec*nut
EGS (mm)	3,58	0,78	2,70	0.44	0,0006	<0,0001	0,1324
EGP (mm)	6,65	2,56	5,77	2,26	0,0222	0,0001	0,2678

Nutrição + Genética




+ 60 kg
+ 40 kg
300 kg
210 kg
240 kg
0,43 kg/dia
IATF?
0,33 kg/dia
170 kg
0,86 kg/dia
0,66 kg/dia
Desmame
Peso (Kg)
30 kg
Nascimento
Suplementação proteica
Ingestão: 300g/d por 210 d
Total: 63 kg (R$ 2,67/kg)
Custo: R$ 168,21 por bezerra
Creep feeding
Ingestão: 150g/d por 180 d
Total: 27kg (R$ 3,20/kg)
Custo: R$ 86,4 por bezerra
Custo total: R$ 254,61/bezerra
0
210 dias
(7 meses)
7
210 dias
(7 meses)
14

Efeito da condição corporal ao parto (BCS) na eficiência reprodutiva de vacas

Tabela. Percentagem de vacas em cio aos 40, 50 e 60 dias após o parto, de acordo com o estado corporal ao parto.

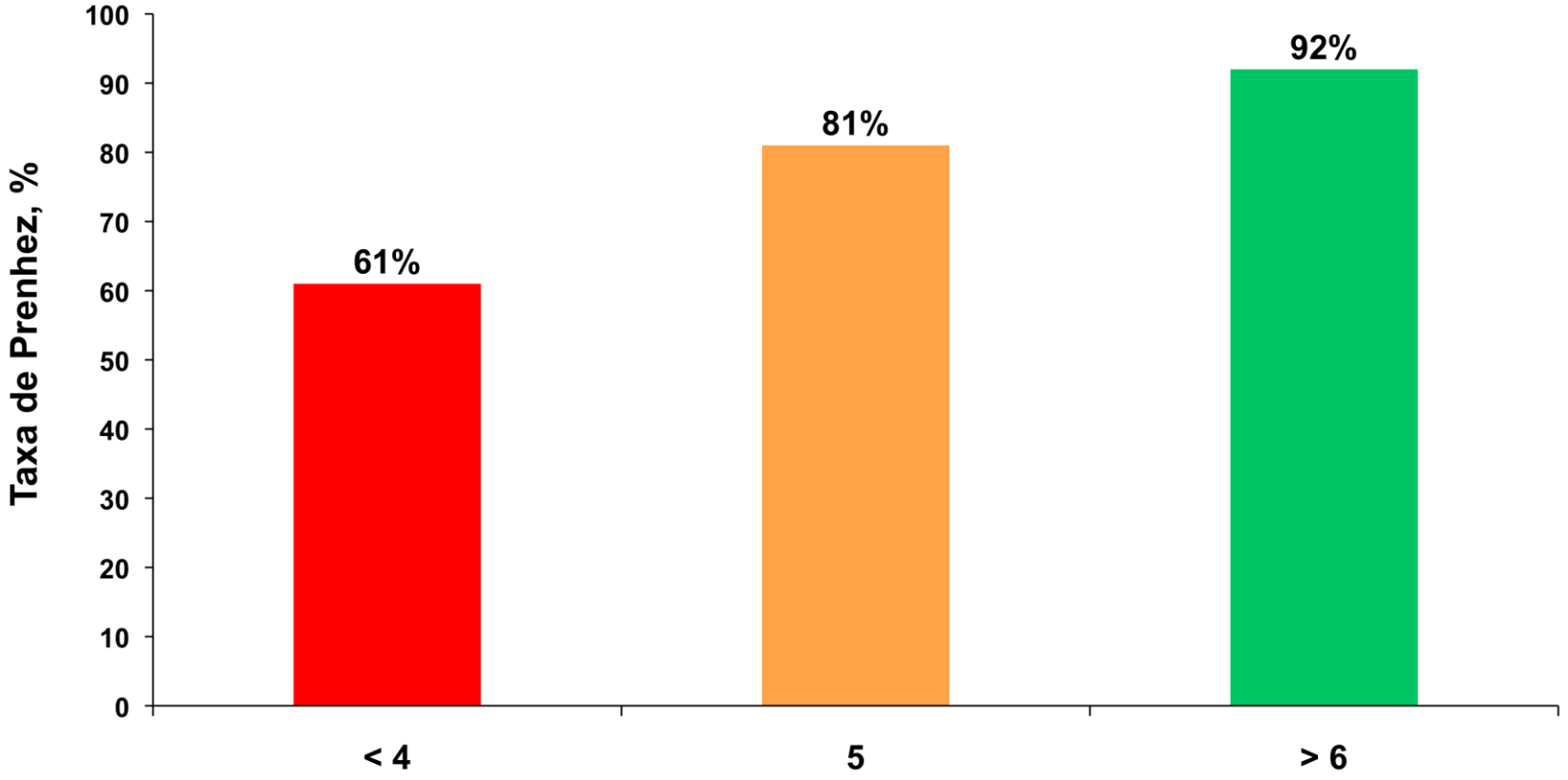
Estado corporal ao parto	Percentagem de cio		
	40 dias	50 dias	60 dias
Magra	19	34	46
Moderada	21	45	61
Boa	31	42	91

Adaptado de Wiltbank (1978)

BCS ao parto e taxa de prenhez ao final da estação de monta em vacas de corte

5 estudos com 1.742 vacas de corte

$P < 0.05$



Rice et al., 1991

Efeito da nutrição no metabolismo e na endocrinologia do pós-parto

Postpartum cow

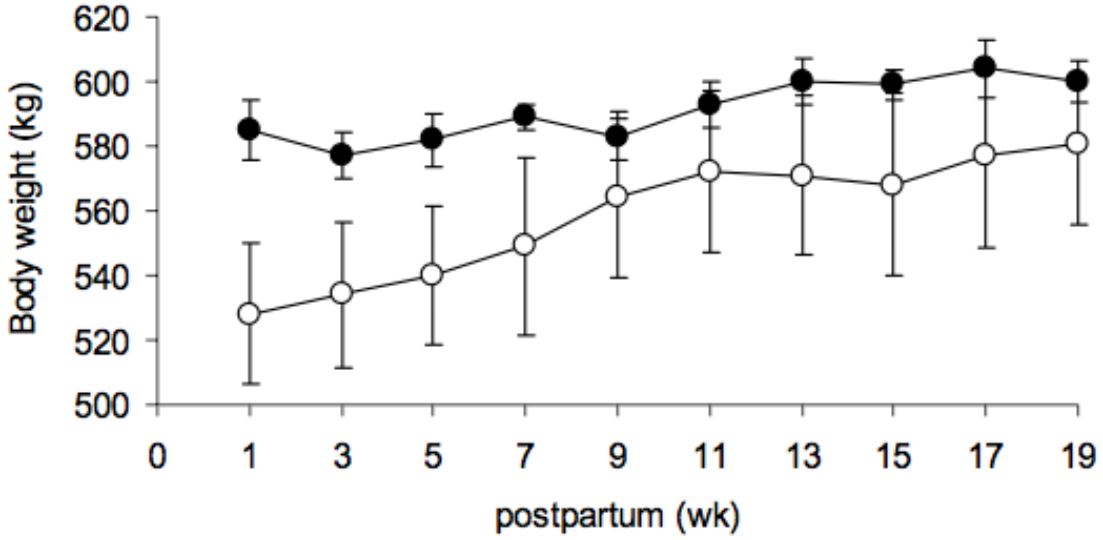
Standard pasture

Improved pasture

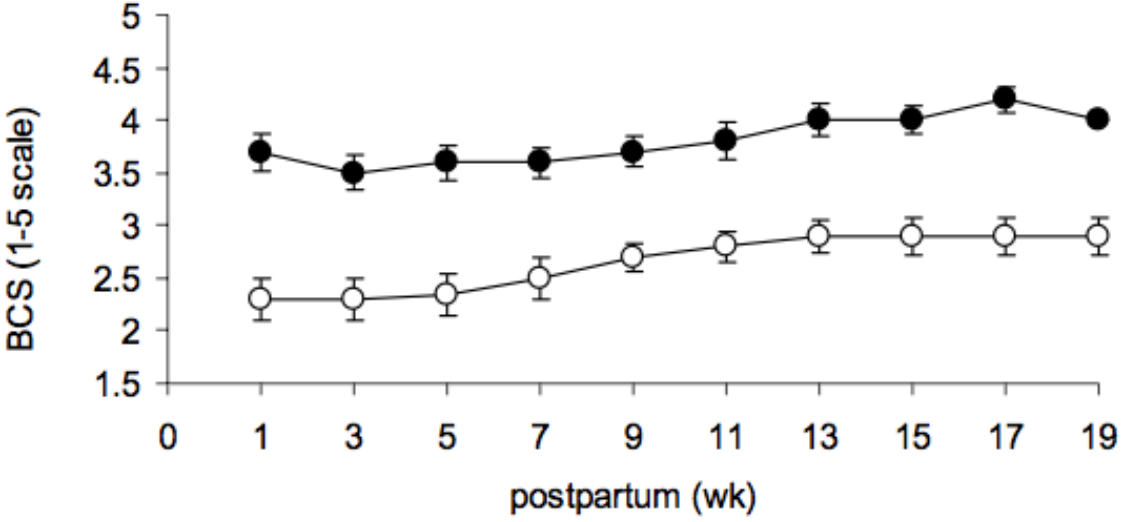
Michael D Occhio

Postpartum cows - body weight

Peso



BSC



● Improved pasture

o Moderate pasture

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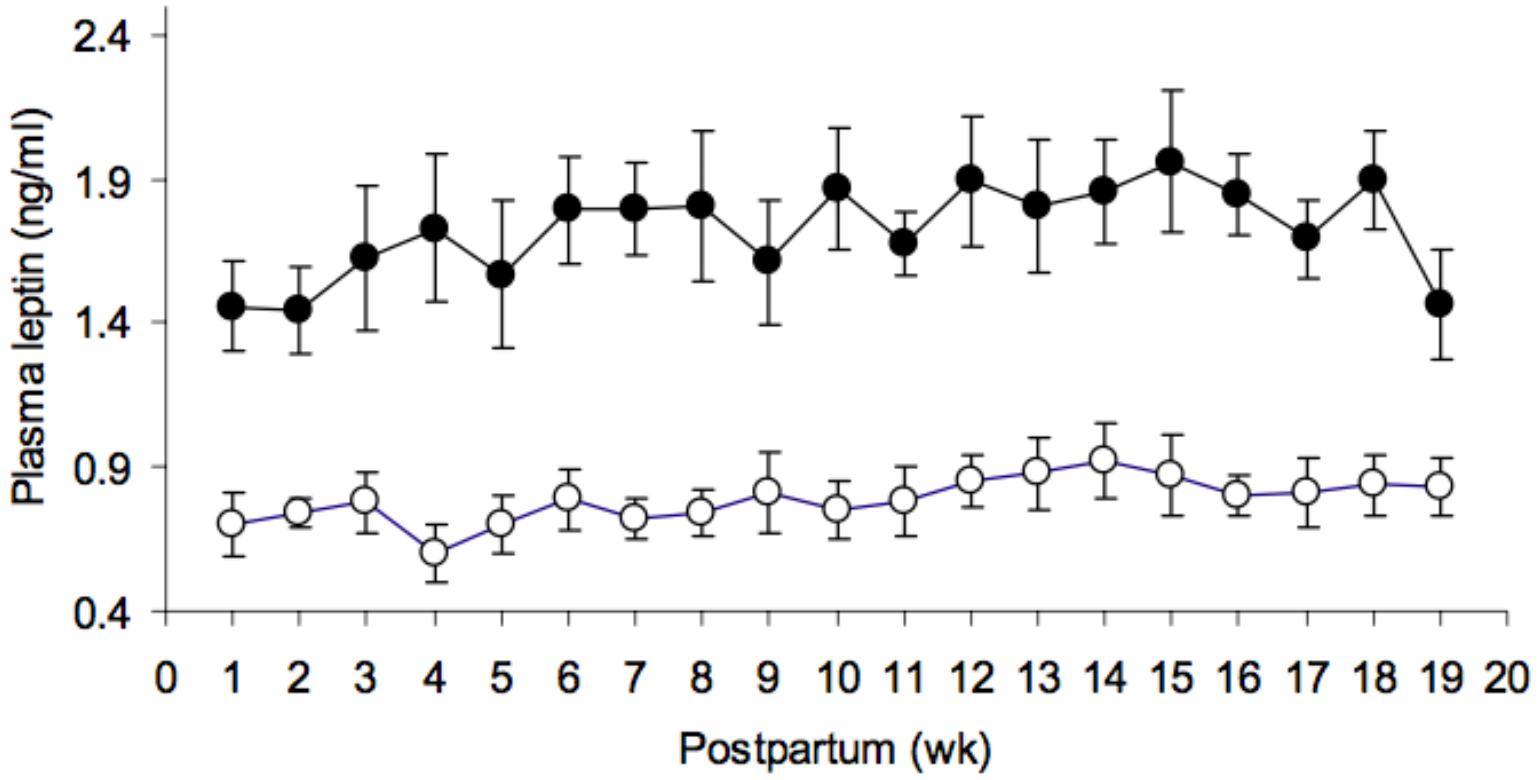
Postpartum cows - leptin



Leptina

● Improved pasture
○ Standard pasture

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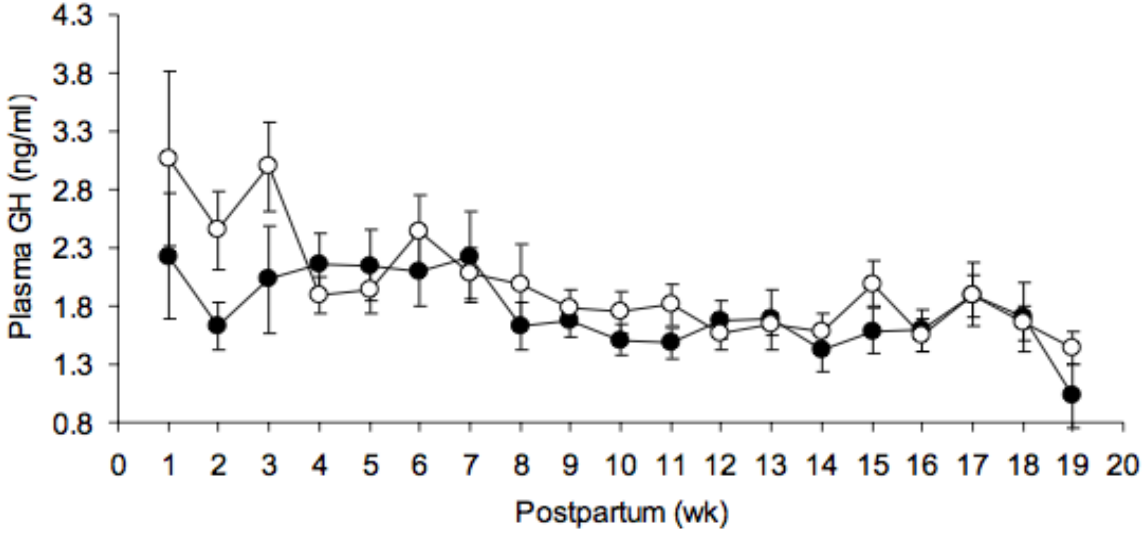
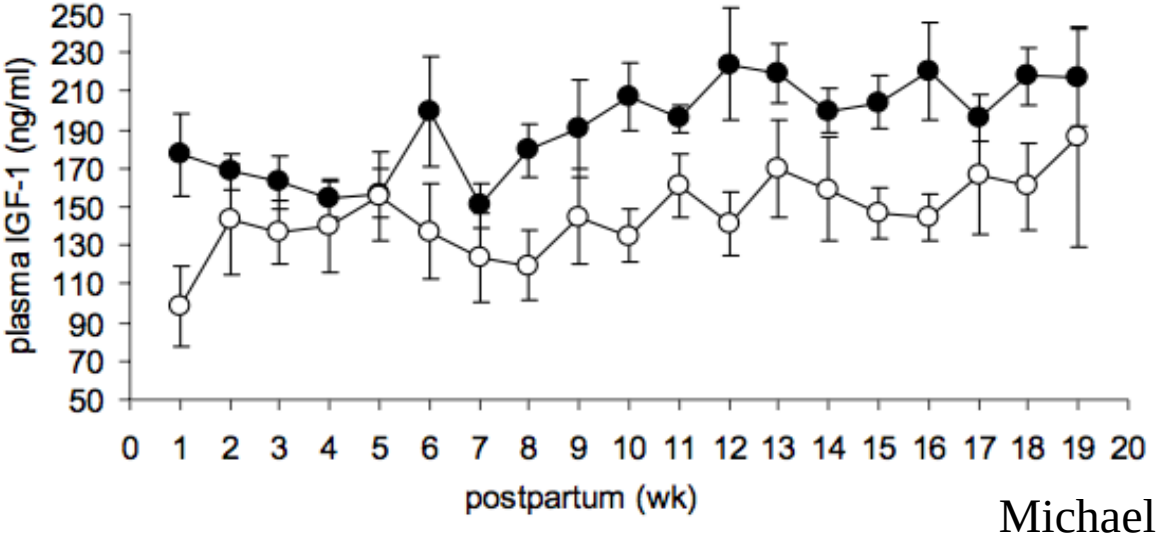
Postpartum cows - Growth hormone



IGF-1

IGF-1



- ● Improved pasture
- ○ Standard pasture

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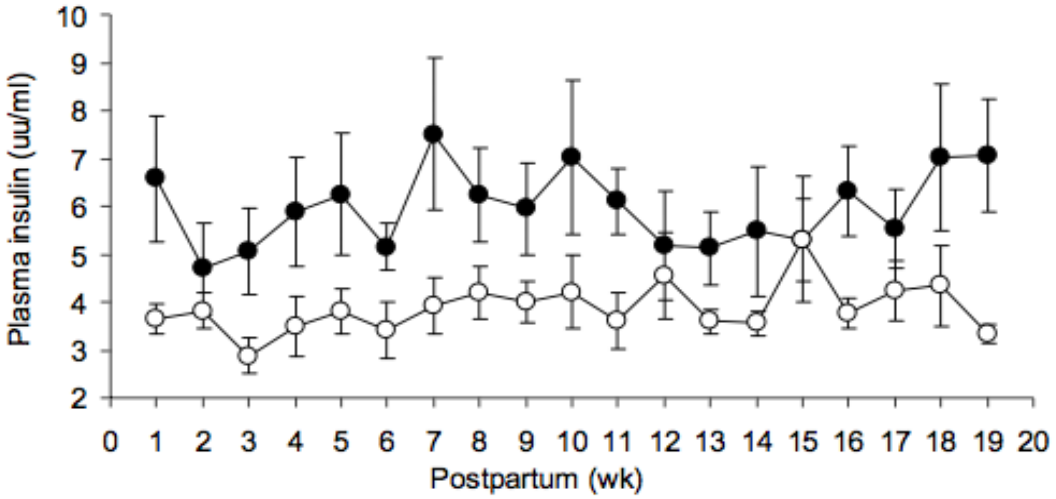
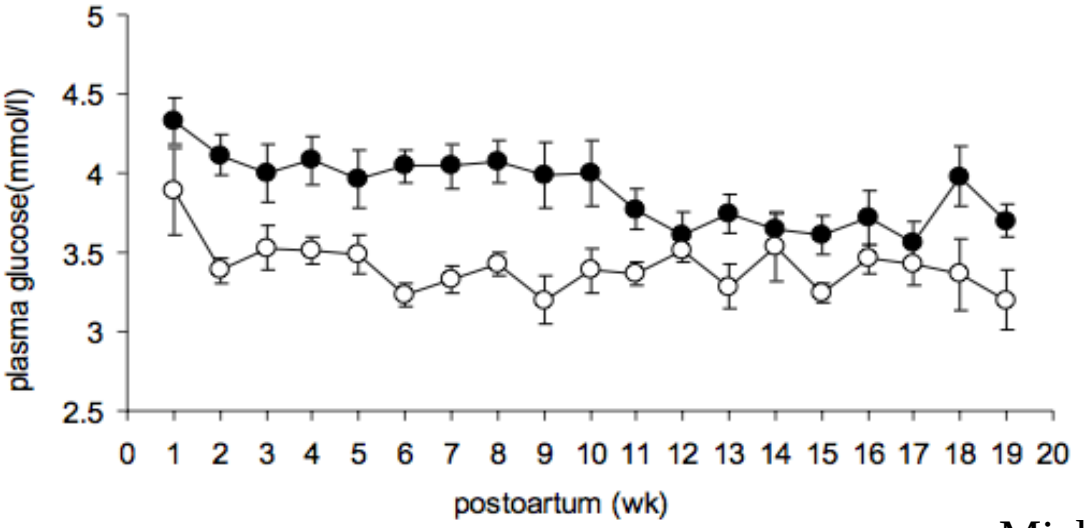
Postpartum cows - insulin

Insulina



Glucose

Glicose



● Improved pasture
○ Standard pasture

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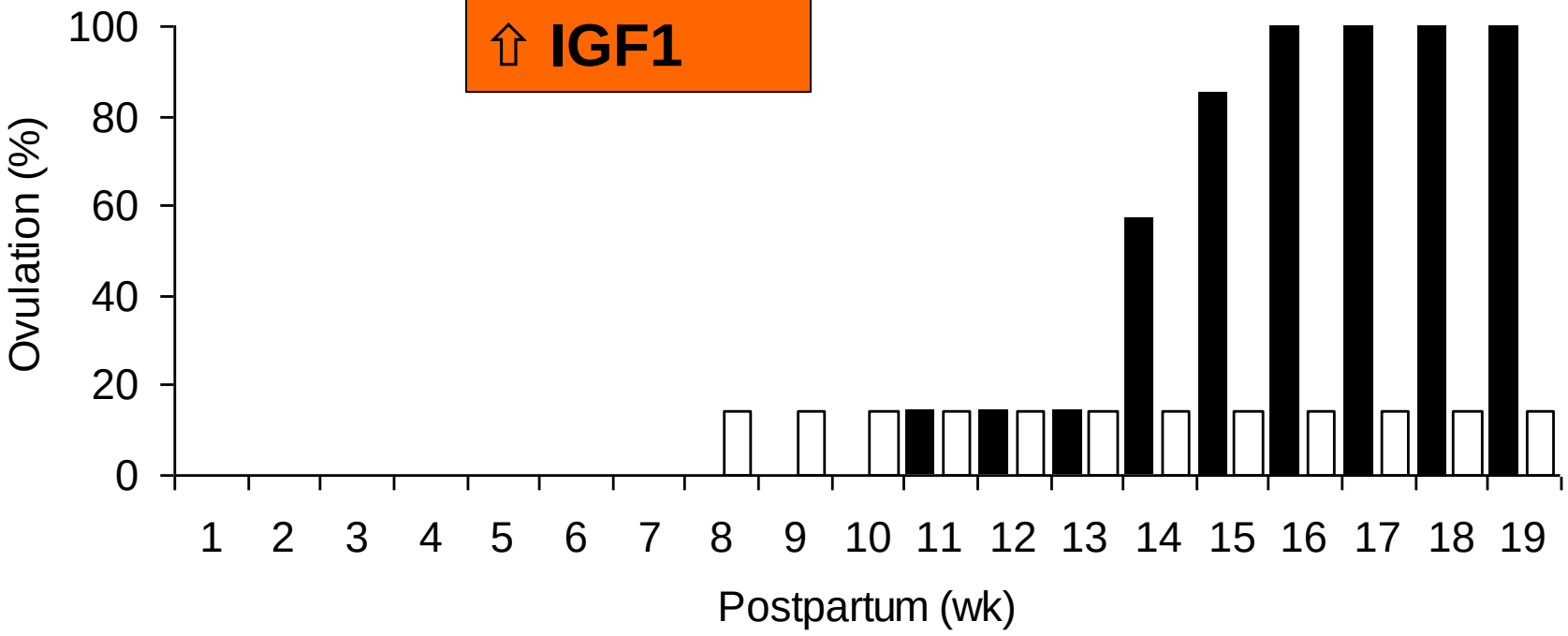
⇧ BCS
⇧ Leptina
⇧ Glicose
⇧ Insulina
⇧ IGF1

Antecipação da ciclicidade



Michael D Occhio

Efeito do escore de condição corporal (BCS) na taxa de prenhez durante a estação reprodutiva

BCS< 3.0 (n = 263)

X

BCS ≥ 3.0 (n = 244)

FTAI + natural service

(n = 263)

(n = 244)

Figure. Survival curves for proportion of non pregnant cows by days of breeding season (BS) classified according to body condition score (BCS) as low (BCS < 3.0; dashed line; N 1⁄4 263) or medium (BCS ! 3.0; solid line; N 1⁄4 244) in suckled beef cows bred by natural service or timed AI at beginning of the BS, followed by natural service during a 90-day BS (experiment 2). Median intervals to pregnancy for low BCS and medium BCS cows were 79 days and 33 days (adjusted hazard ratio, 1.70; 95% confidence interval, 1.34–2.17), respectively.

Sá Filho et al., Theriogenology 79 (2013) 625–632

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Figure. Survival curve illustrating the interval between the onset of the breeding season and conception for primiparous beef cows with low (≤ 2.75) or high (≥ 3.0) during a breeding season of 105 days.

Ferreira et al., 2015 (SBTE)

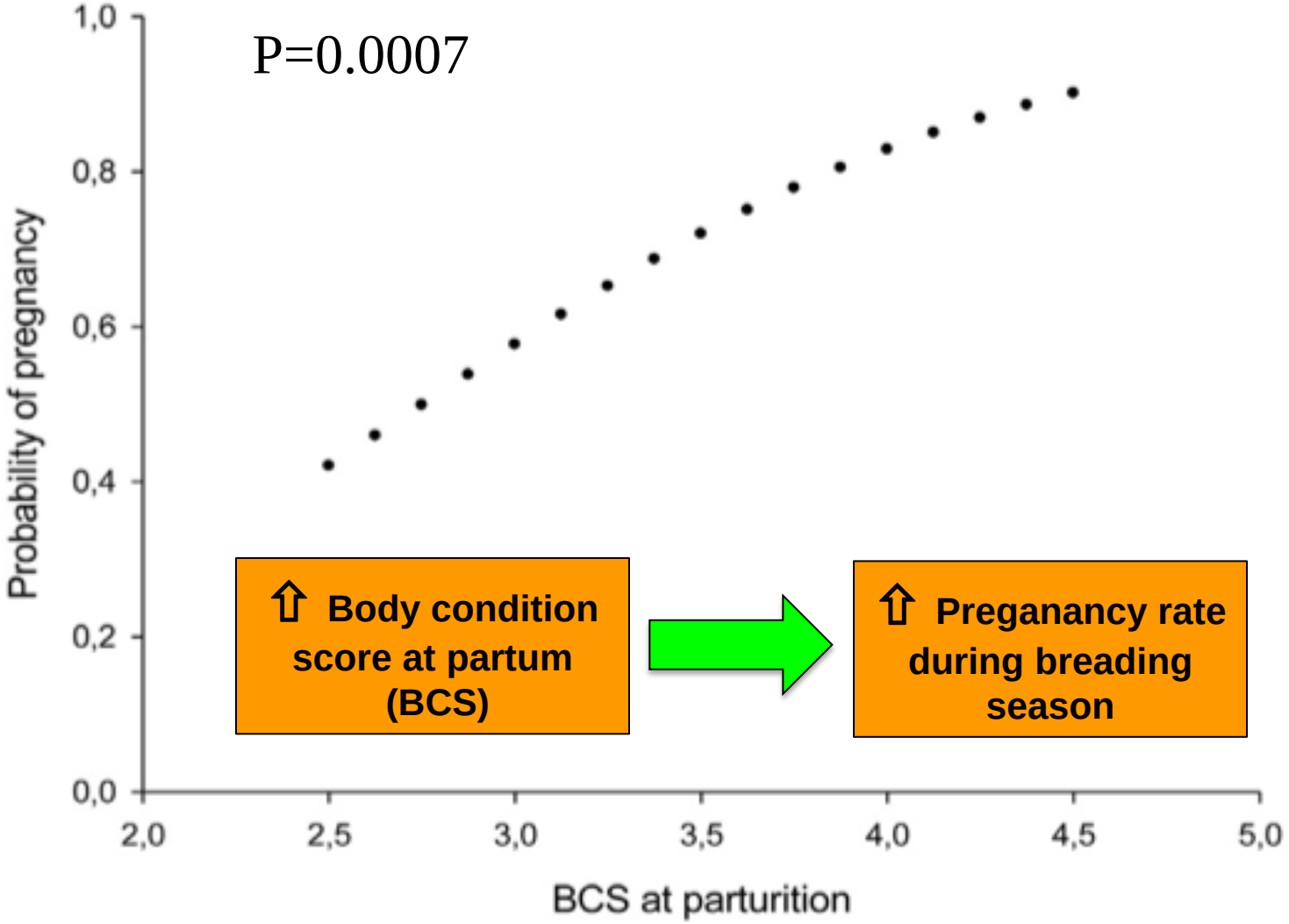
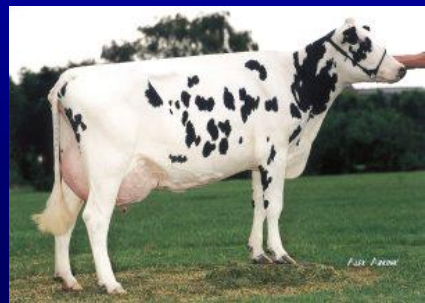


Fig. 1. Probability of pregnancy rate according to the BCS at parturition in suckled *Bos indicus* cows subjected to TAI after natural mating [probability of pregnancy = exp(−2.2959 + 0.9944 × BCS at parturition/ 1 + exp(−2.2959 + 0.9944 × BCS at parturition); P = 0.0007)]. BCS, body condition score; TAI, timed artificial insemination.

Fertilidade

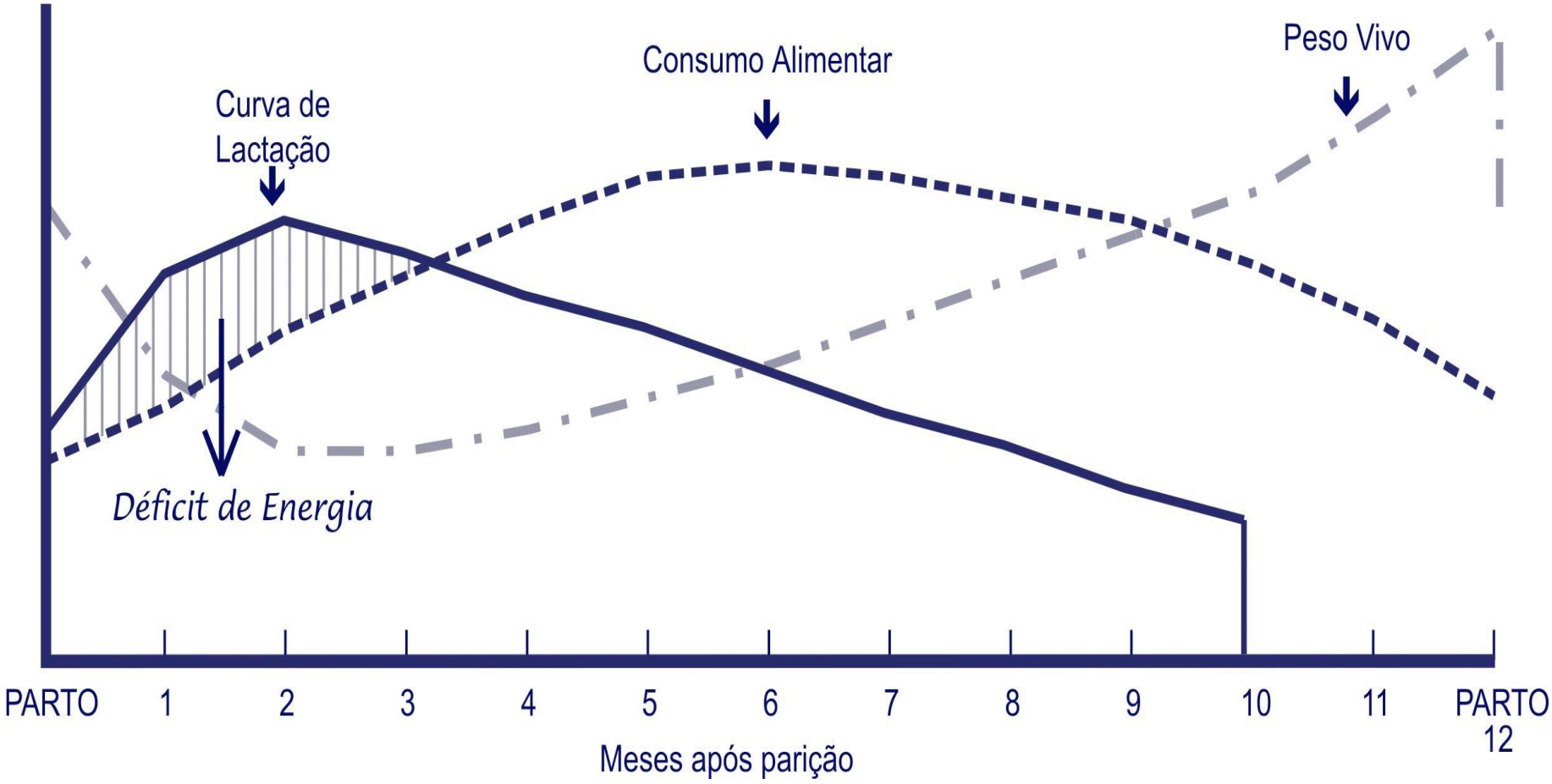
X

Escore de condição corporal (BCS)



O que é balanço energético negativo?

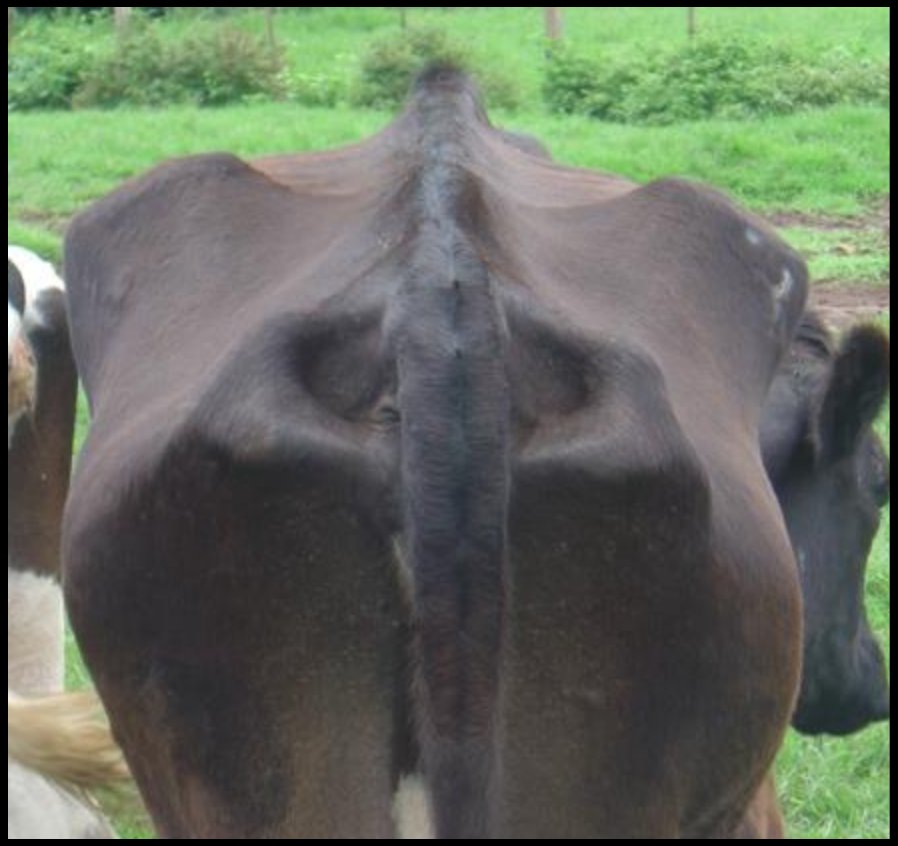
A energia consumida é maior que a energia obtida na dieta



✓ **Bal. Energ. (Mcal) = $E_{ingerida}$ - (E_{leite} + $E_{manut.}$)**

CONDIÇÃO CORPORAL x FERTILIDADE

BAIXA CONDIÇÃO CORPORAL



ALTA CONDIÇÃO CORPORAL

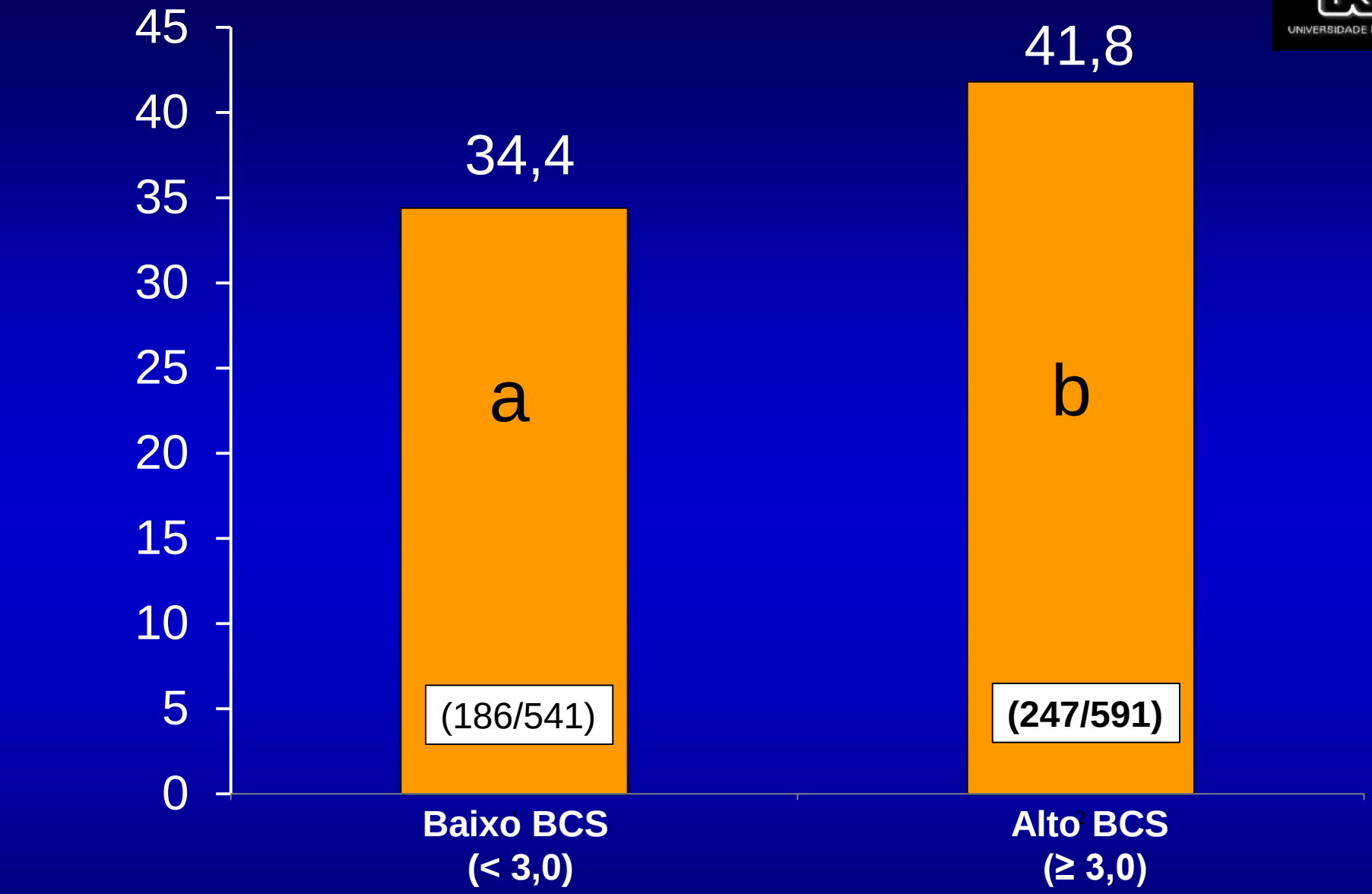
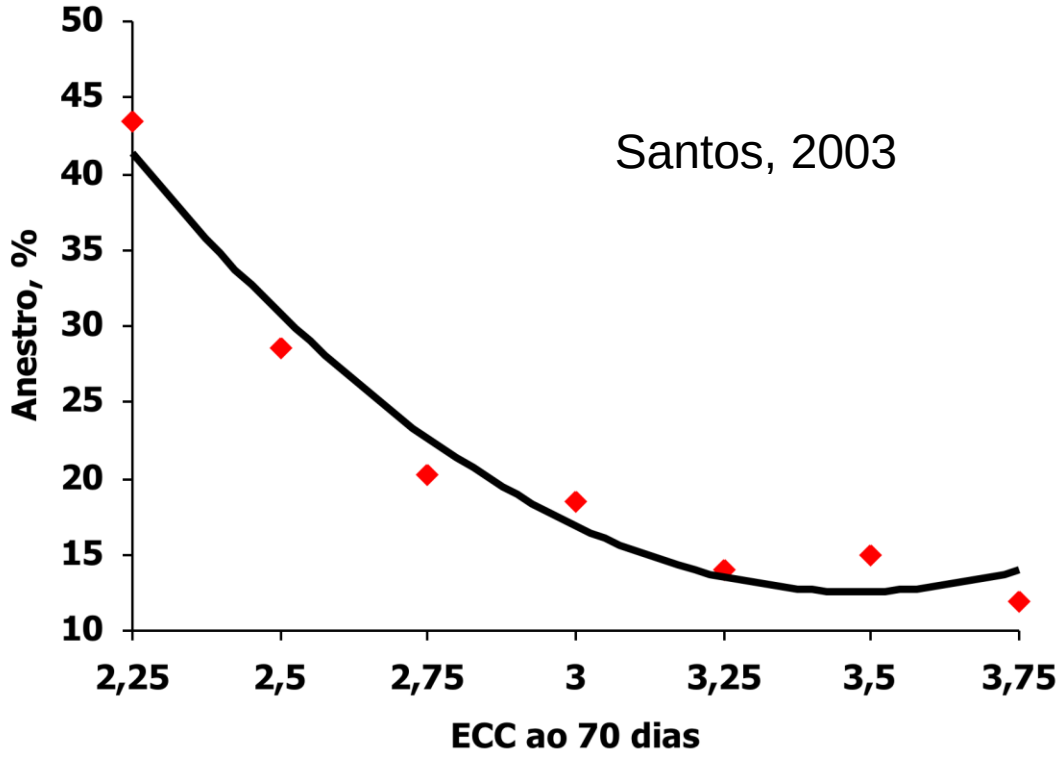


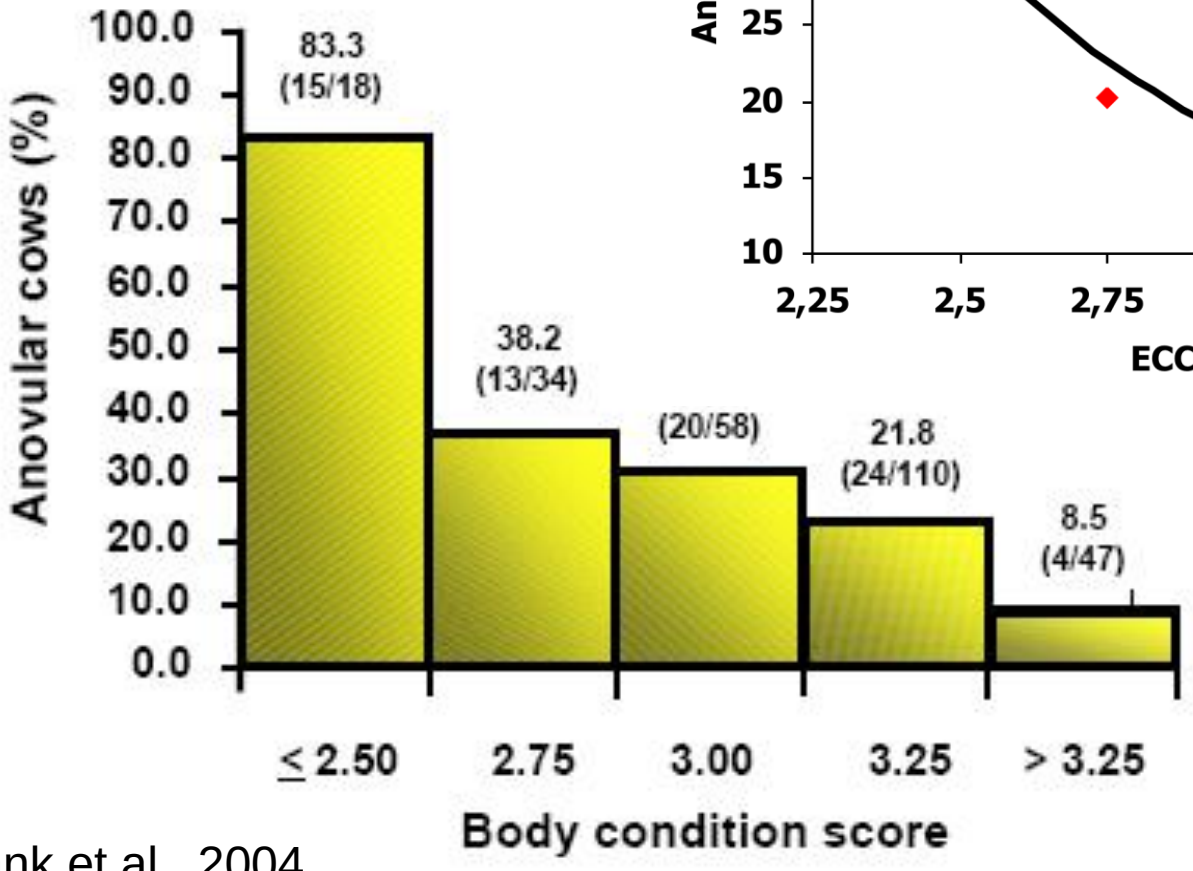
Gráfico. Efeito do escore de condição corporal (BCS) na taxa de concepção de vacas holandesas inseminadas em tempo fixo com o protocolo Ovsynch.

Ayres, 2011

Relação entre BCS e anestro em vacas de leite

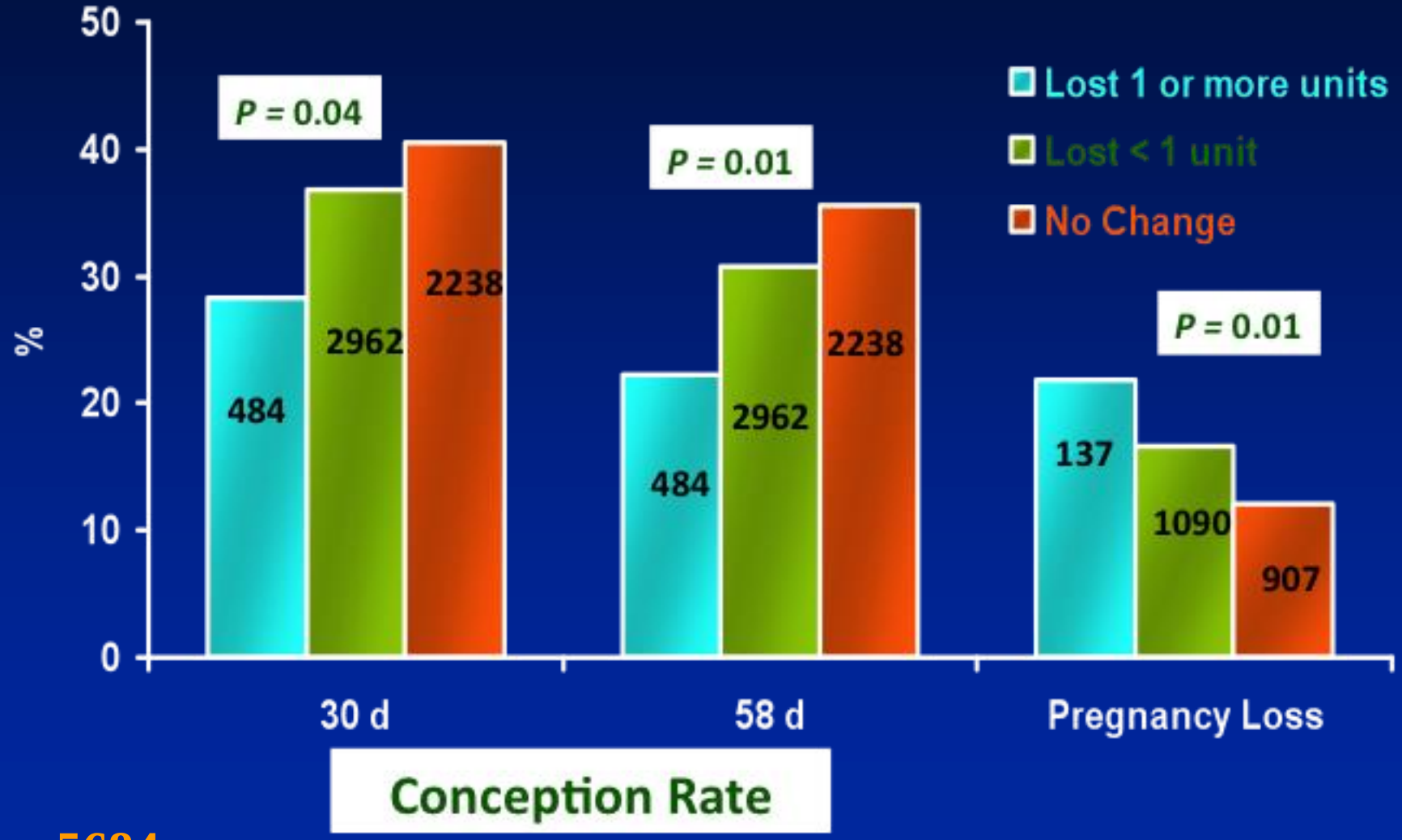


Santos, 2003



Wiltbank et al., 2004

Relação Entre a Perda de Condição Corporal, Concepção e Perda de Prenhez



n=5684

Santos et al. *Anim. Reprod. Sci.* (2009)

Low BCS is associated with low reproductive efficiency ✓

Overconditioned (fat) cows

?

Overconditioned (fat) cows are at high risk for health problems

- Low feed dry matter intake (DMI) after calving
- Greater body fat loss after calving; higher ketones and liver fat
- Higher oxidative stress, impaired immune function

Reproductive problems

EFFECT OF BODY CONDITION SCORE AT CALVING ON POSTPARTUM REPRODUCTIVE PERFORMANCE IN BUFFALO

P.S. BARUSELLI* , V.H. BARNABE, R.C. BARNABE, J.A. VISINTIN, J.R. MOLERO-FILHO, R. PORTO

Department of Animal Reproduction, Faculty of Veterinary Medicine, University of São Paulo, 05508-000, São Paulo, Brazil

Buffalo Journal 17 (1), 53-66, 2001

USP
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BCS
(1 to 5 scale)

Calving

Estrus detection + AI (4 service)

+

+

Natural service

D0

D150

476 buffalos cows

Does the BCS at calving influence the interval between calving to 1st postpartum estrus in buffalo cows?

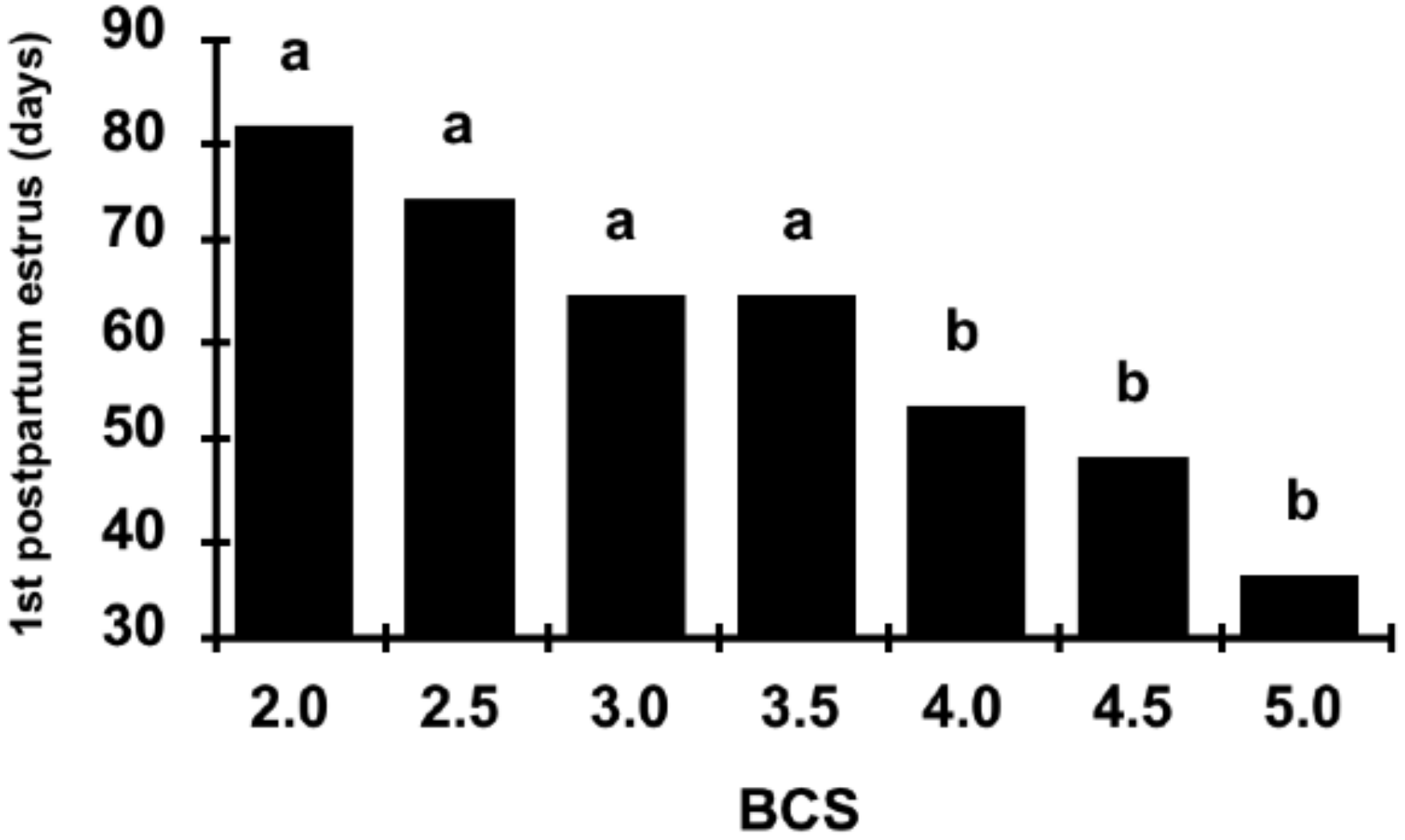


Figure: Influence of body condition score at calving on calving to first post partum estrus interval (n=412).

Baruselli et al., 2001 (Buffalo Journal 17 (1), 53-66)

Does the BCS at calving influence the postpartum anestrous in buffalo cows?

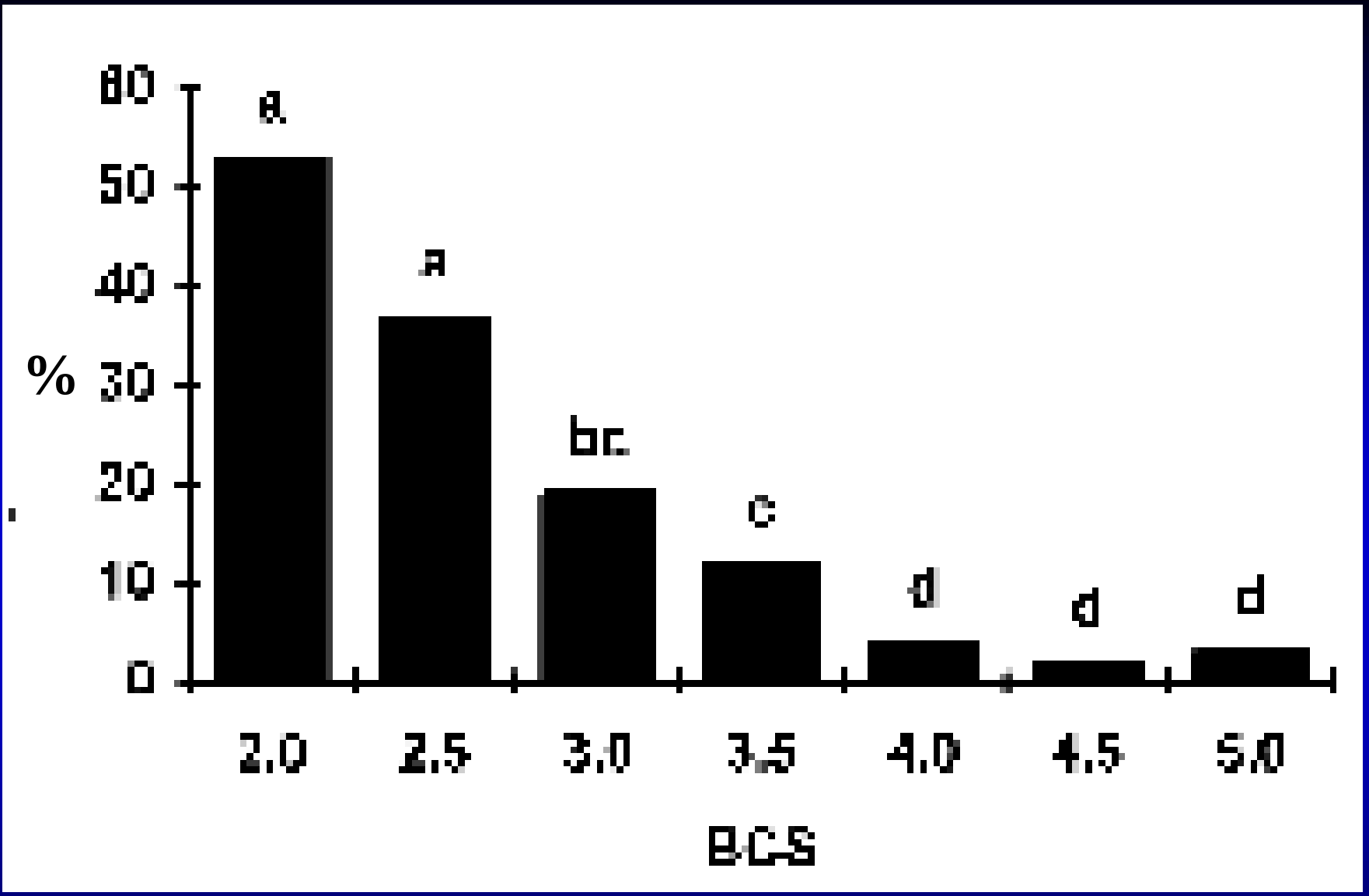


Figure: Effect of body condition score on post partum anestrus (n=412/476).

Baruselli et al., 2001 (Buffalo Journal 17 (1), 53-66)

Does the BCS at calving influence the the interval calving to conception (service period) in buffalo cows?

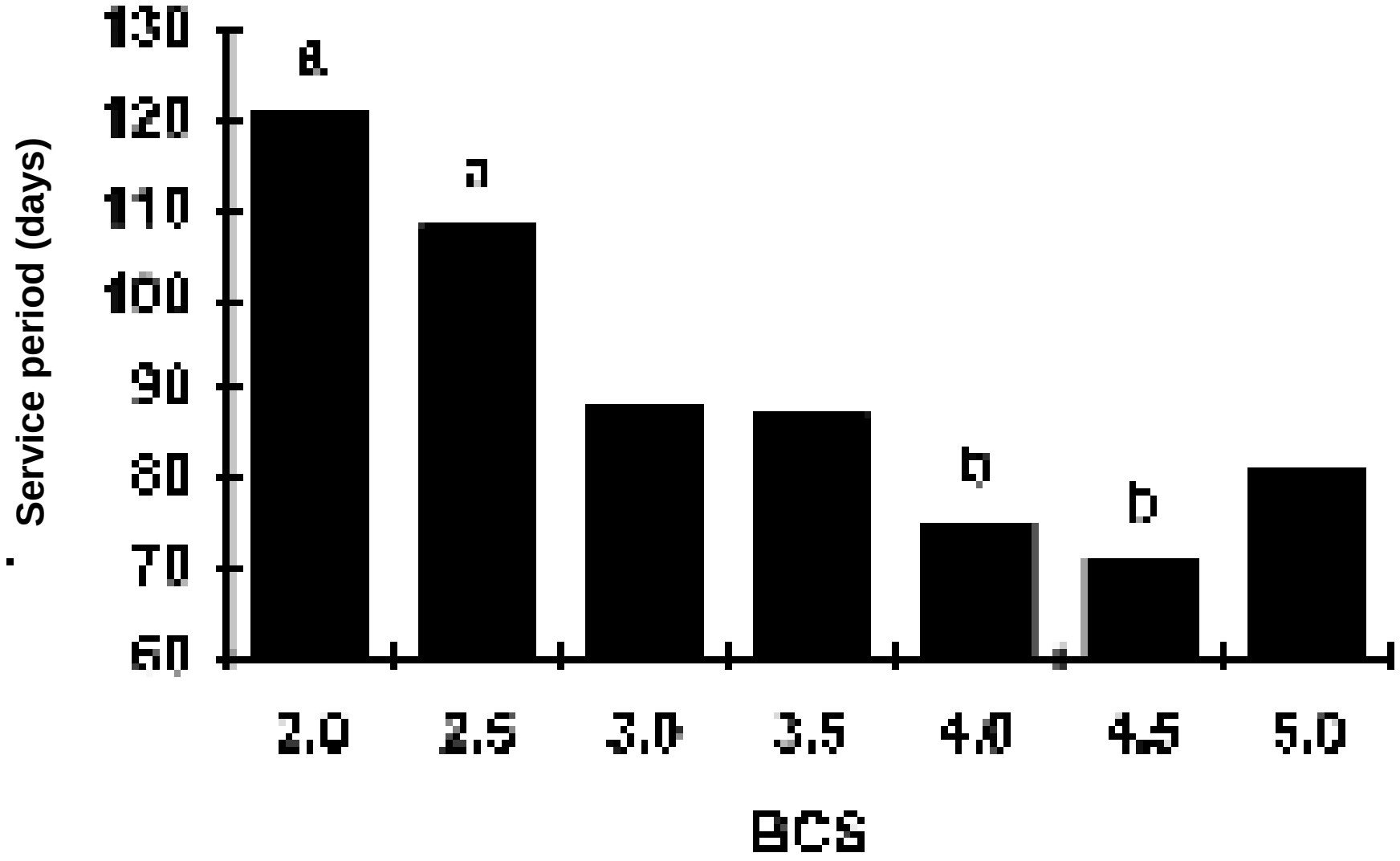


Figure: Interval from calving to pregnancy (service period) achieved by AI relation to body condition score (n=353).

Baruselli et al., 2001 (Buffalo Journal 17 (1), 53-66)

Does the BCS at calving influence the pregnancy per AI in buffalo cows?

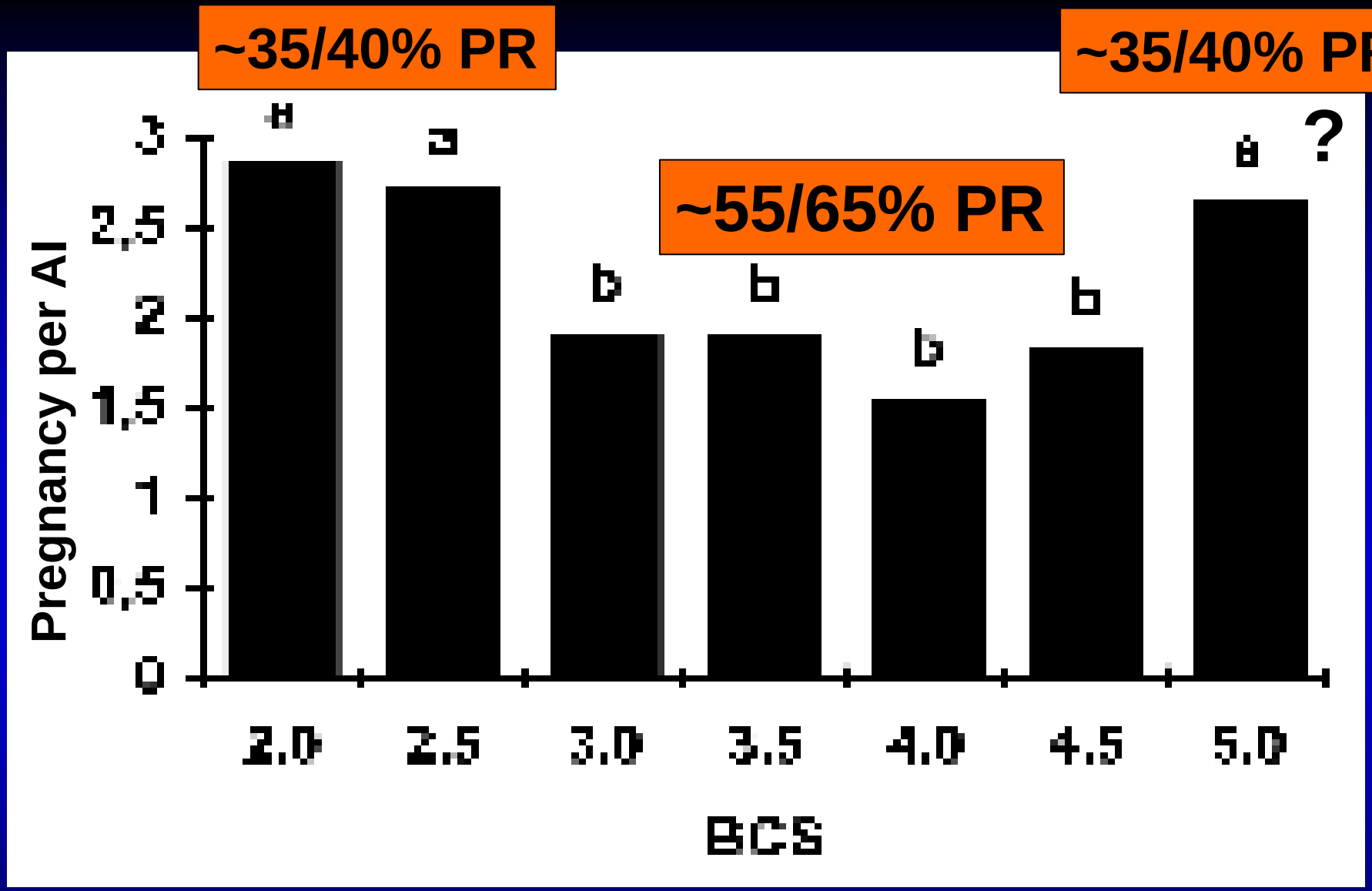


Figure: AI services per conception in relation to body condition score (n=405).

Baruselli et al., 2001 (Buffalo Journal 17 (1), 53-66)

Does the BCS at calving influence the pregnancy rate at AI program in buffalo cows?

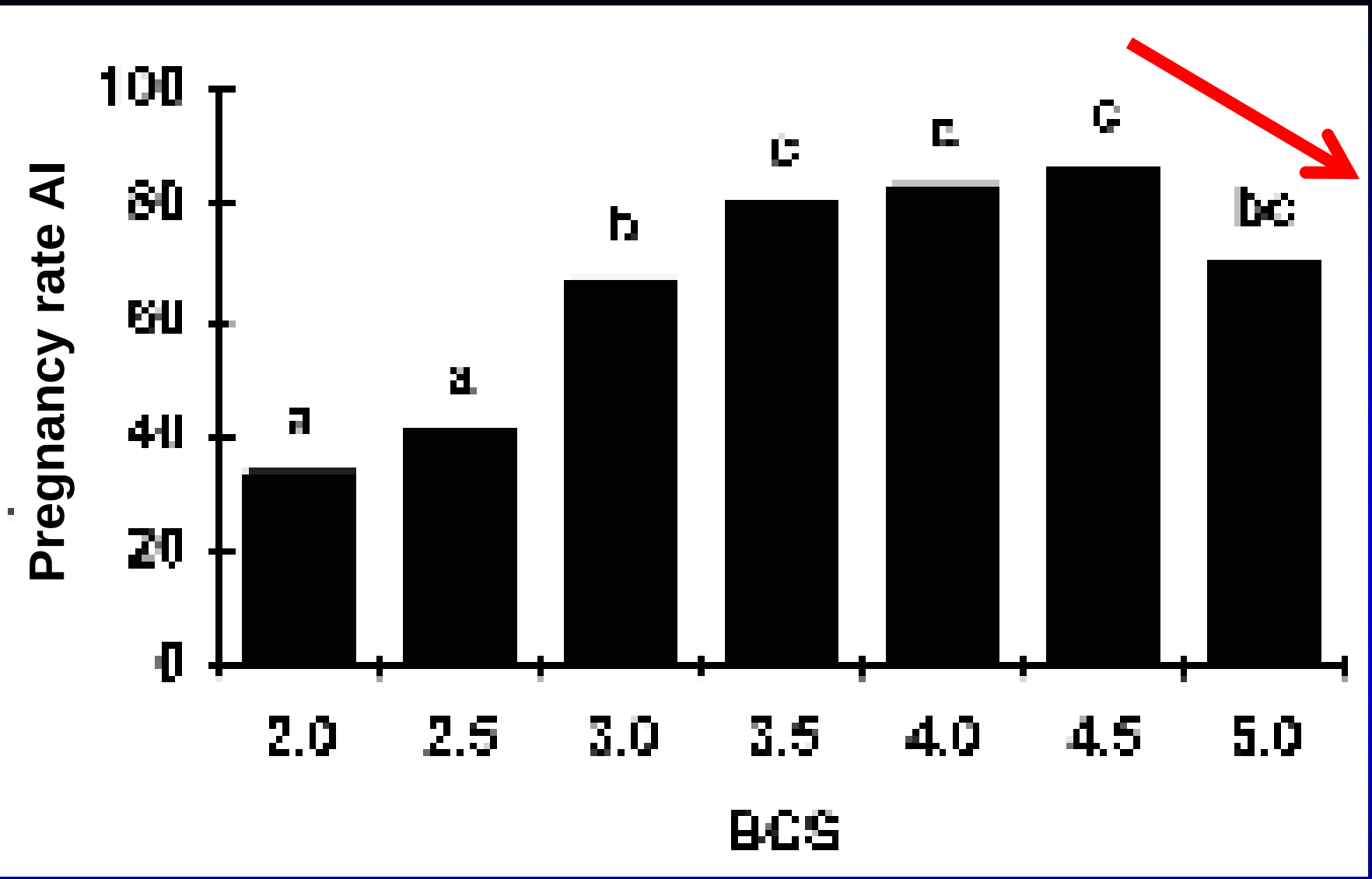


Figure: Pregnancy rate (%) following artificial insemination at the end of AI program in relation to body condition score (n=353/476).

Baruselli et al., 2001 (Buffalo Journal 17 (1), 53-66)

Does the BCS at calving influence the pregnancy rate (AI + natural service) in buffalo cows?

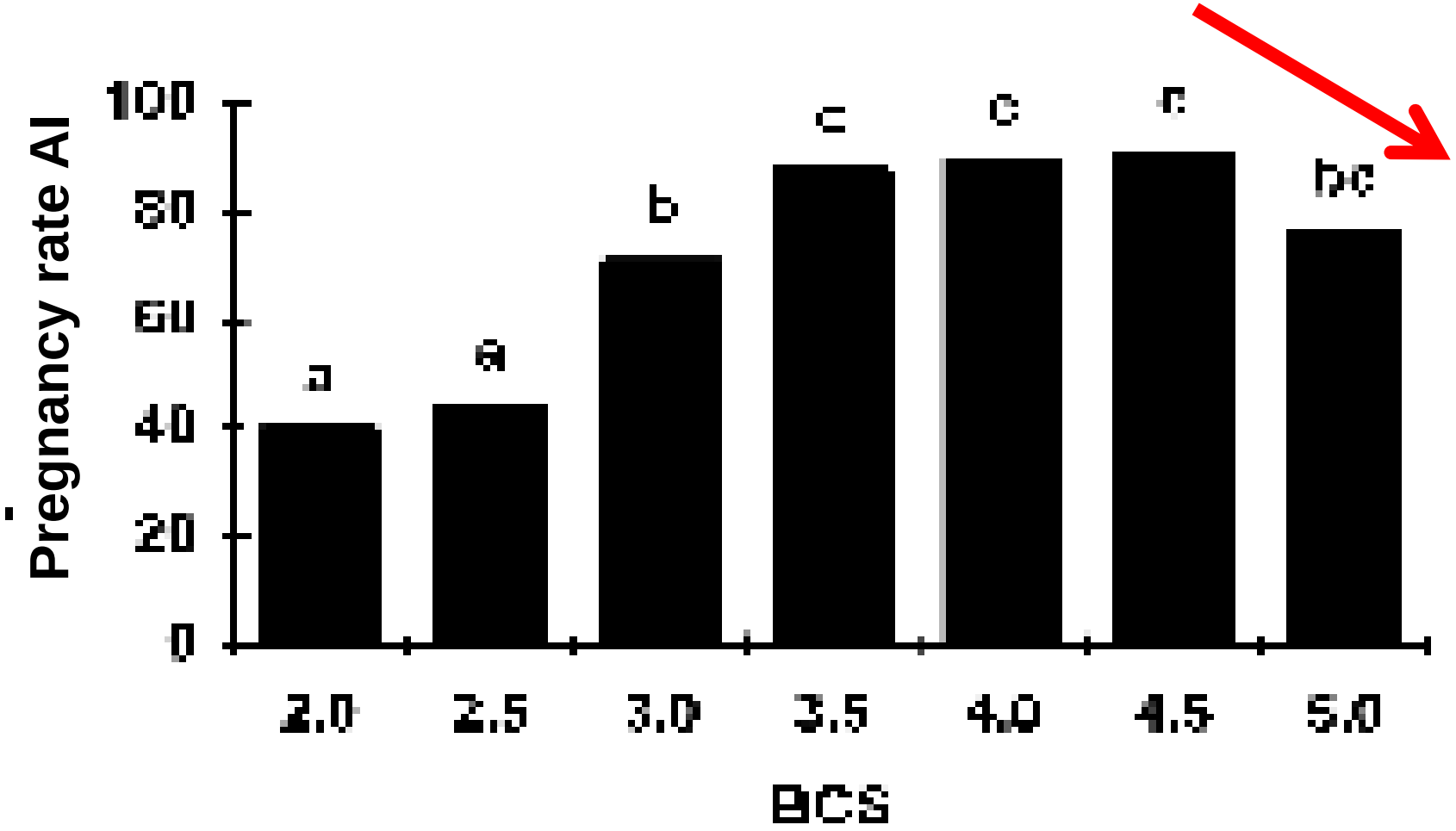
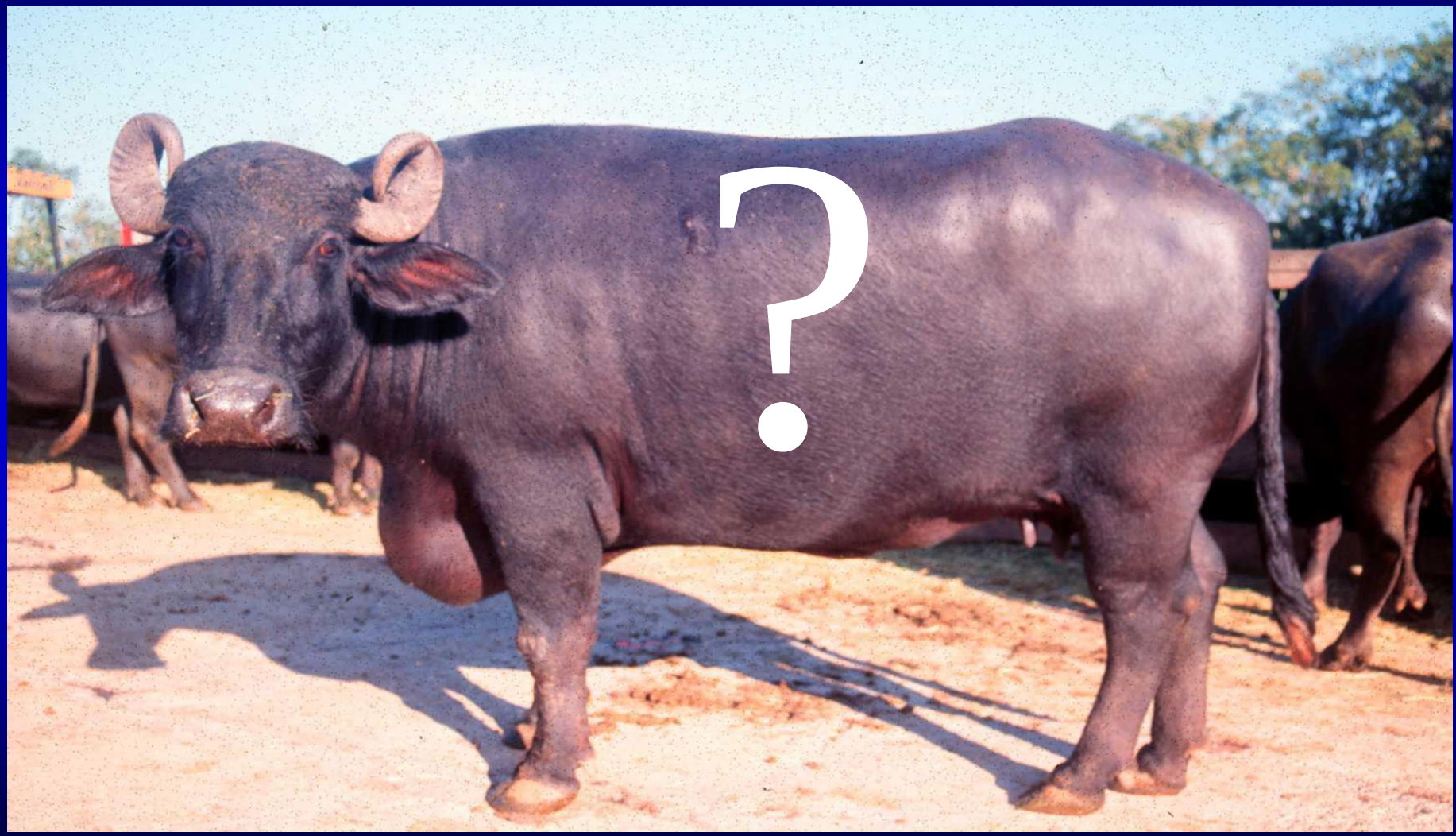


Figure: Pregnancy rate (%) at the end of the breeding season (AI plus natural mating) in relation to body condition score (n=380/476)

Baruselli et al., 2001 (Buffalo Journal 17 (1), 53-66)

Não utilizar biotecnologias de reprodução em búfalos com baixa condição corporal

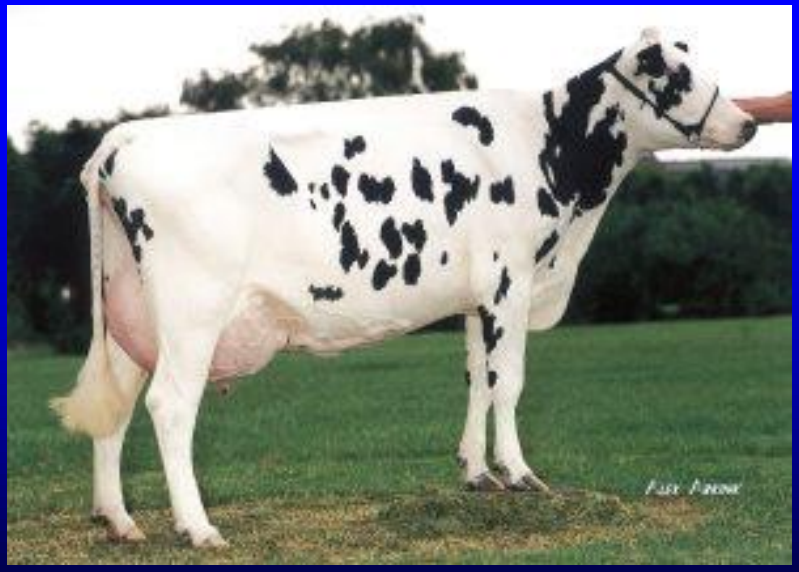
Não utilizar biotecnologias de reprodução em búfalos com baixa condição corporal



J. Dairy Sci. 98:3086–3099
http://dx.doi.org/10.3168/jds.2014-8858

Effects of a high-energy diet on oocyte quality and in vitro embryo production in *Bos indicus* and *Bos taurus* cows

J. N. S. Sales,*†[1] L. T. Iguma,‡ R. I. T. P. Batista,‡ C. C. R. Quintão,‡ M. A. S. Gama,‡ C. Freitas,‡ M. M. Pereira,‡ L. S. A. Camargo,‡ J. H. M. Viana,‡ J. C. Souza,† and P. S. Baruselli*[1]
*Department of Animal Reproduction, Faculdade de Medicina Veterinaria e Zootecnia, Universidade de São Paulo (FMVZ-USP), Rua Prof. Orlando Marques de Paiva, 87, 05508-000 São Paulo, SP, Brazil
†Department of Veterinary Medicine, Departamento de Medicina Veterinaria (DMV), Universidade Federal de Lavras, 37200-000, Lavras, MG, Brazil
‡EMBRAPA Gado de Leite, 36038-330 Juiz de Fora, MG, Brazil



Sales, 2010 (PhD Thesis, USP)

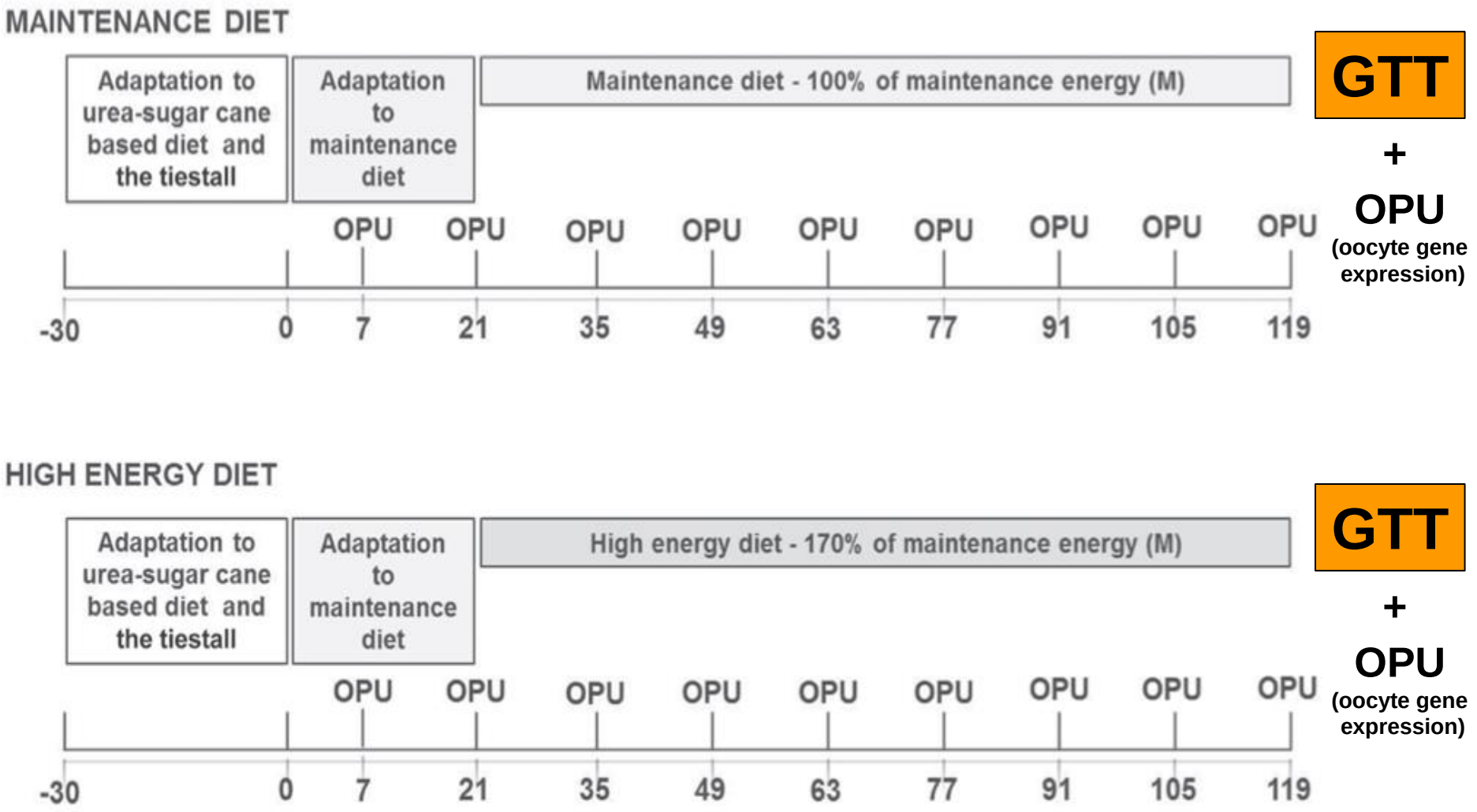
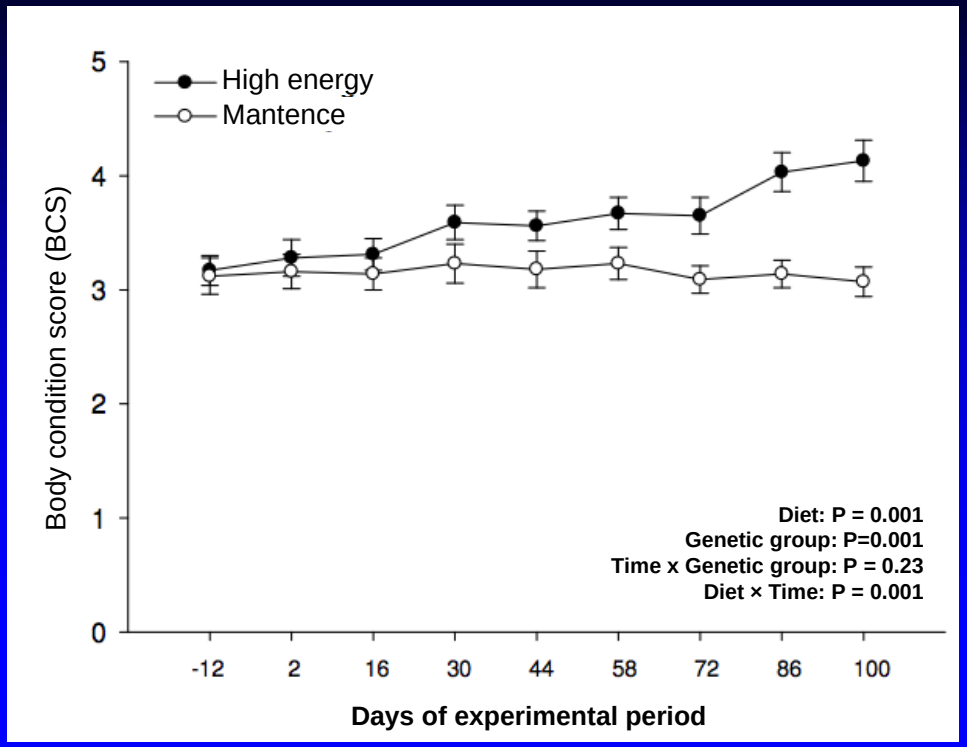
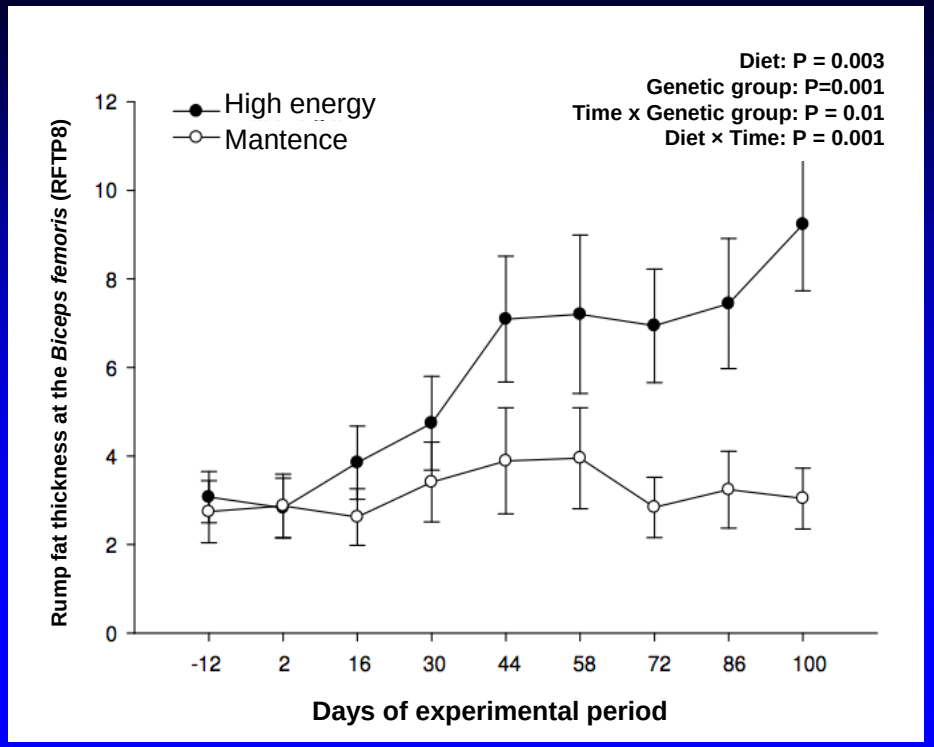


Figure 1. Experimental design of the different phases of the trial and ovum pick-up (OPU) for in vitro embryo production.

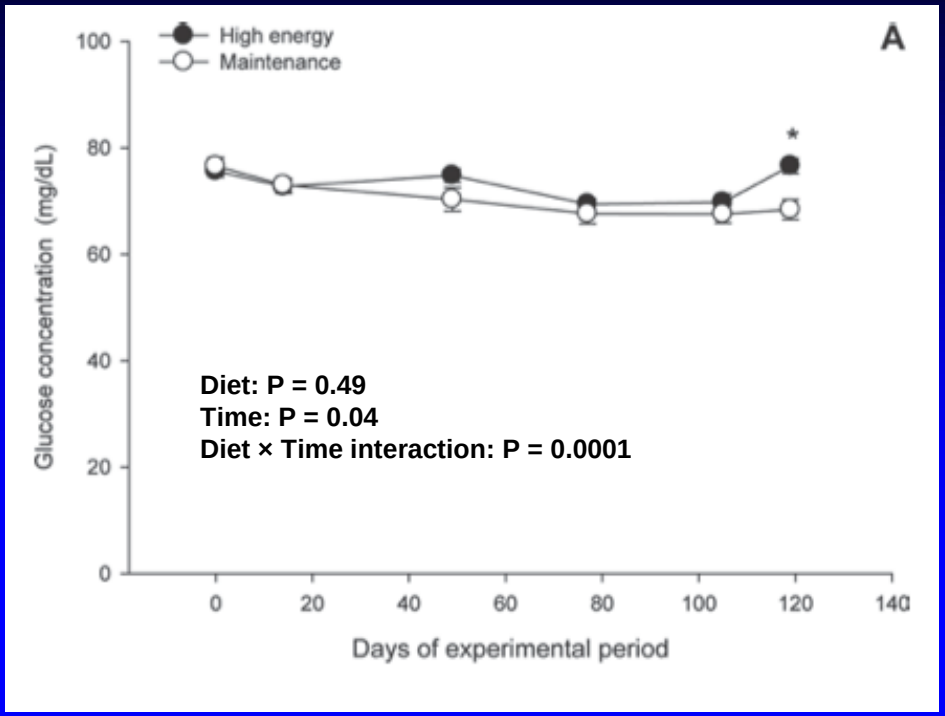
Sales et al. J Dairy Sci 98:3086–3099, 2015.





The BCS (P = 0.001) were greater in the 1.7M group compared with the M group The RFAT was greater in animals that received the 1.7M diet (P = 0.003) and in *Bos indicus* cows (P = 0.001). Additionally, an interaction effect was noted between genetic groups and diet for RFAT (P = 0.008) such that the increase in RFAT was greater in *Bos indicus* than in *Bos taurus* cows on the 1.7M diet. A positive correlation between BCS and RFAT was observed (r = 0.85; P = 0.0001); however, no correlation between RFAT and BW was seen (r = 0.02; P = 0.69).

Sales et al. J Dairy Sci 98:3086–3099, 2015.



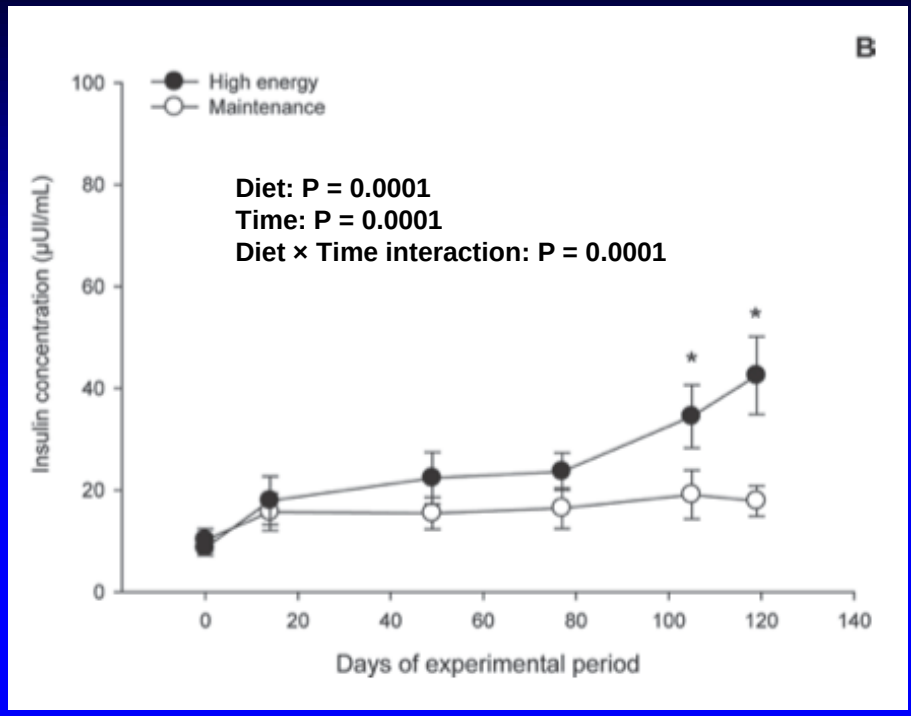
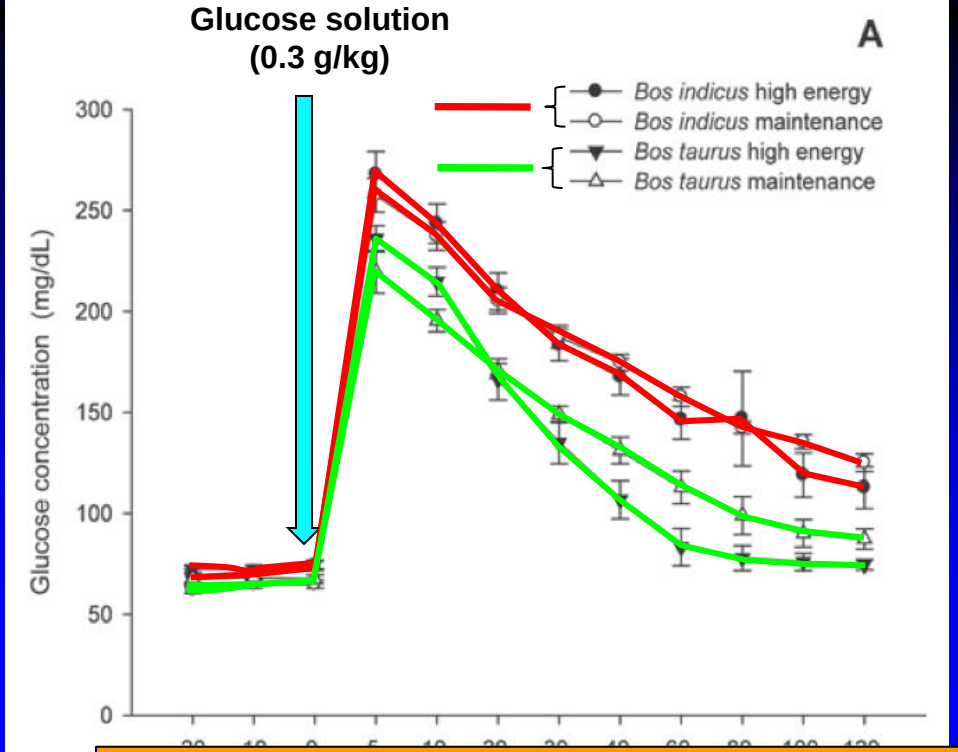
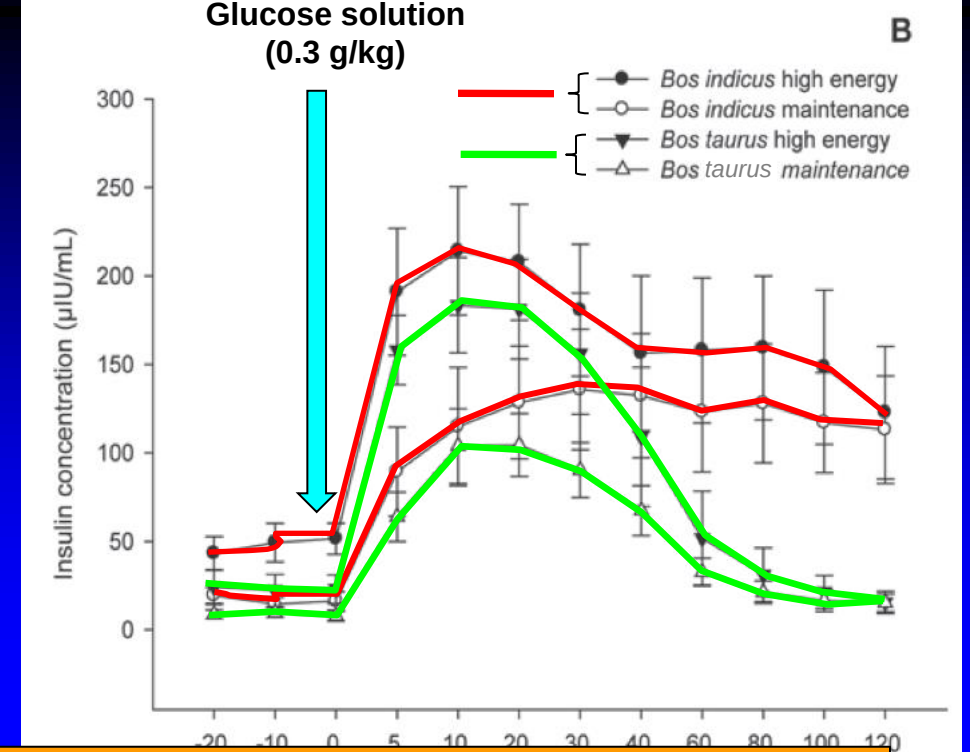


Figure. Serum concentrations of glucose (A) and insulin (B) in nonlactating cows fed diets to meet 100 (maintenance) or 170% (high energy) of the energy required for maintenance. An asterisk (*) means diet × time differ ($P < 0.0001$). Data are presented as means ± SEM.

Sales et al. J Dairy Sci 98:3086–3099, 2015.





Insulin resistance can be identified when greater insulin concentrations (peak, Dmax insulin, AUC) are necessary to reduce glucose concentrations to euglycemic levels during the GTT

Figure. Serum concentrations of glucose (A) and insulin (B) after i.v. infusion of sterile glucose solution at 0.3 g/kg of *Bos indicus* cows (Gir; n = 14) and *Bos taurus* cows (Holstein; n = 14) fed diets to meet 100 (maintenance) or 170% (high energy) of the energy required for maintenance. Data are presented as means ± SEM.

Sales et al. J Dairy Sci 98:3086–3099, 2015.

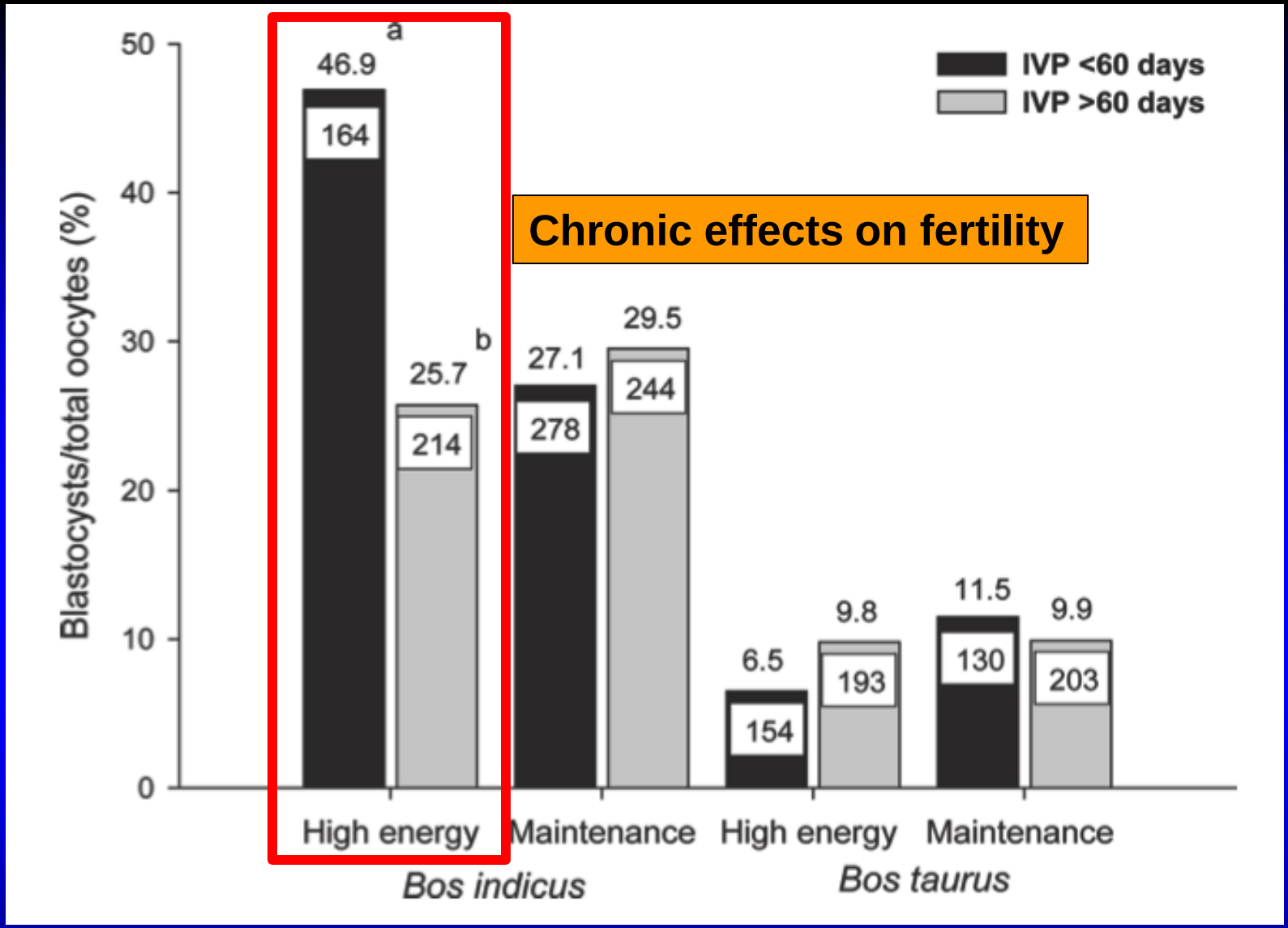


Figure. In vitro embryo production (IVP) of *Bos indicus* (Gir, n = 14) and *Bos taurus* (Holstein, n = 14) donors receiving high-energy diets (170% of maintenance) or maintenance (100% of maintenance) during the experimental period. Time 1 = IVP up to 60 d after the beginning of the experiment; time 2 = IVP 60 d after the beginning of the experiment. P-values were P = 0.21 for diet, P = 0.01 for genetic group, P = 0.24 for time, P = 0.01 for diet × genetic group interaction, and P = 0.01 diet × genetic group × time interaction. Different letters (a,b) represent significant differences (P = 0.01); numbers inside bars are viable ooyctes.

Sales et al. J Dairy Sci 98:3086–3099, 2015.

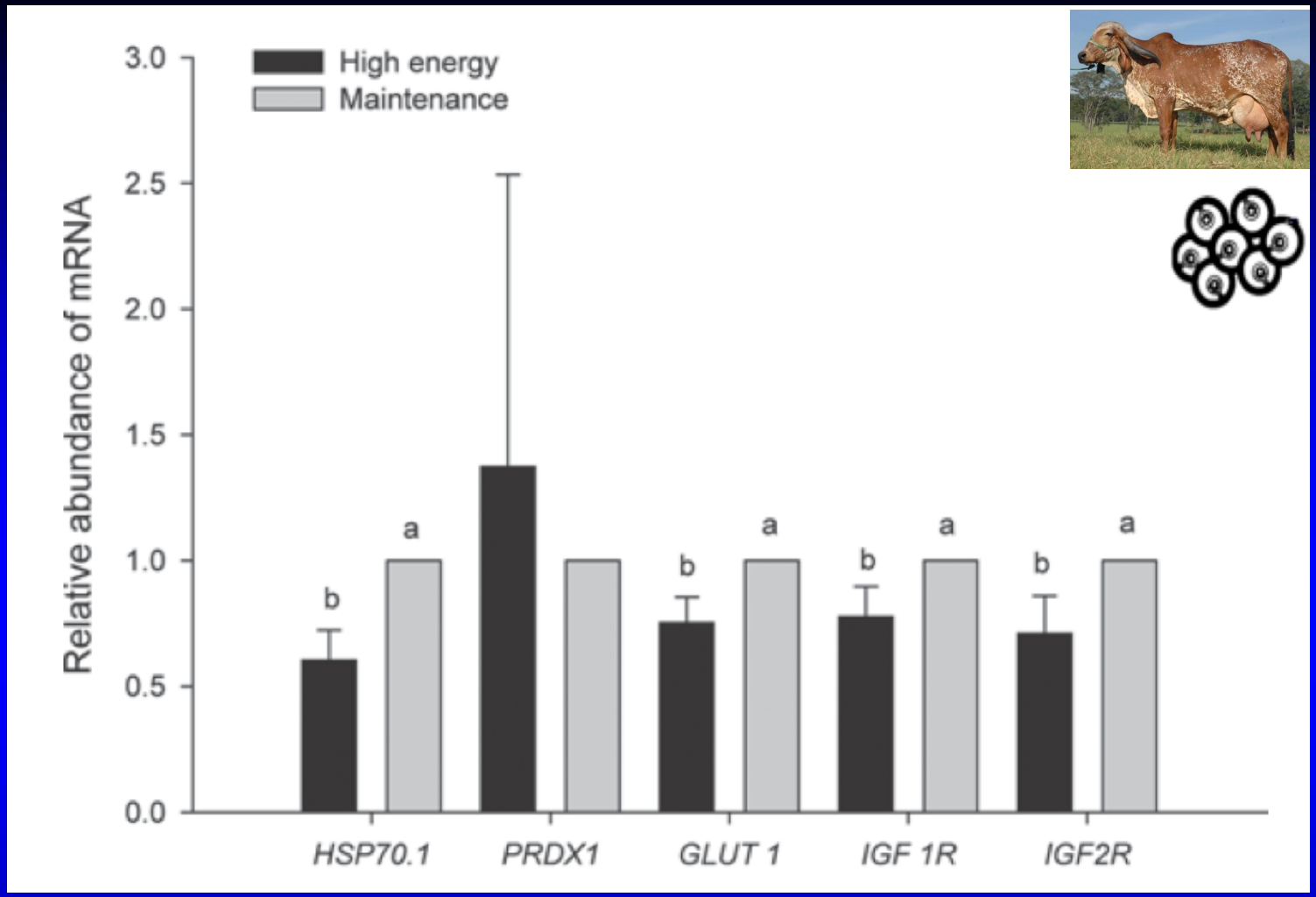


Figure. Relative abundance of transcripts (means ± SEM) associated with cellular stress (PRDX1 and HSP70.1) and metabo- lism (GLUT1, IGF1R, and IGF2R) were obtained by real-time PCR of oocytes of Bos indicus fed diets to meet 100% (maintenance, n = 90) or 170% (high energy, n = 90) of the energy required for maintenance. Different letters (a,b) represent significant differences (P = 0.01).

Sales et al. J Dairy Sci 98:3086–3099, 2015.

Overfeed cows

(chronic effect)

Vacas ↑ Ingestão Energia → ↑ Glicose → ↑ Insulin

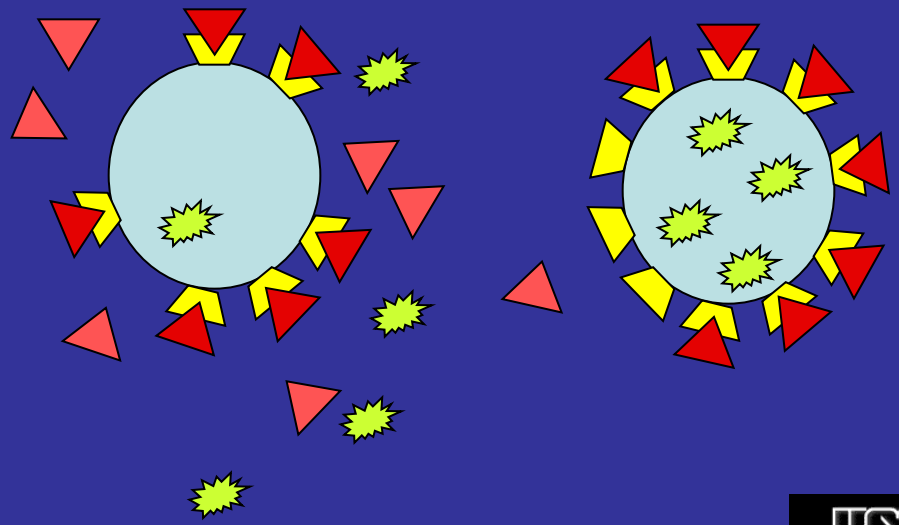
↓ Down regulation

↑ Hiperinsulinemia

↑ IGF-1

↓ Glicose (célula)

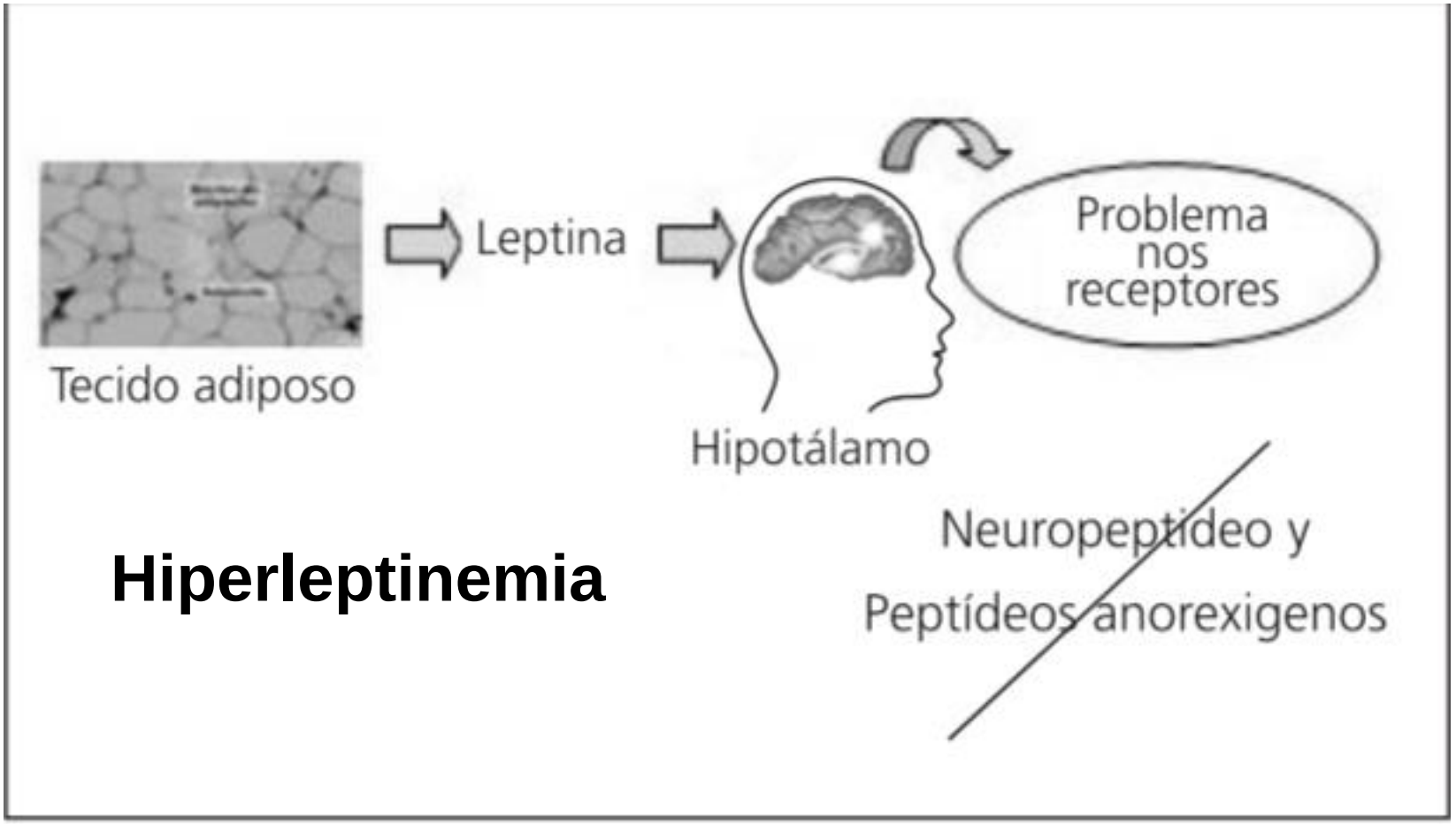
↓ Qualidade oócito



Indivíduos obesos apresentam elevados níveis plasmáticos de Leptina

Leptina reduz o apetite a partir da inibição da formação de neuropeptídeos relacionados ao apetite

Entretanto….

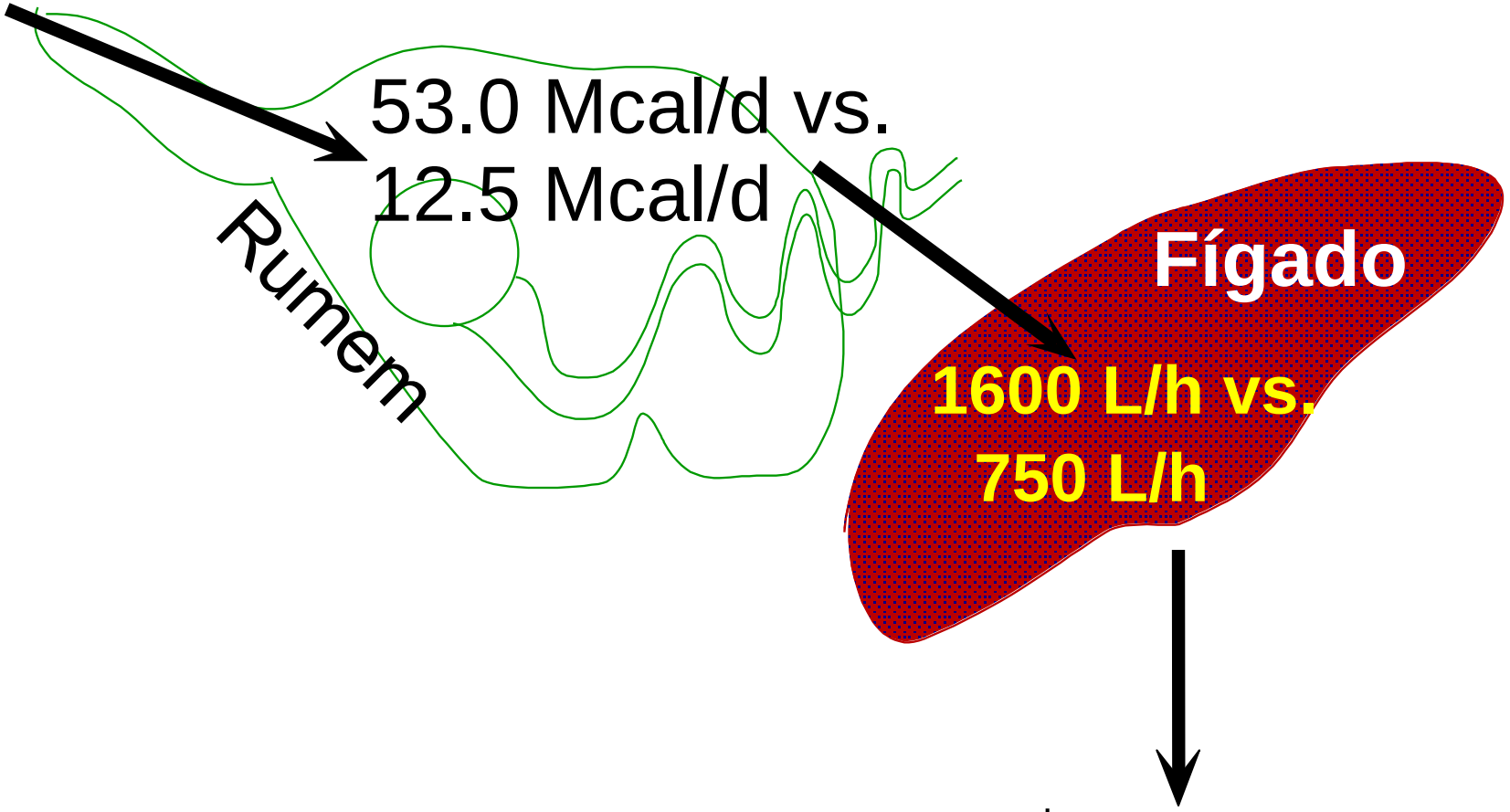


Hiperleptinemia

Metabolização de esteróides (P4 e E2)

?

Metabolismo dos esteróides



↓ Estradiol

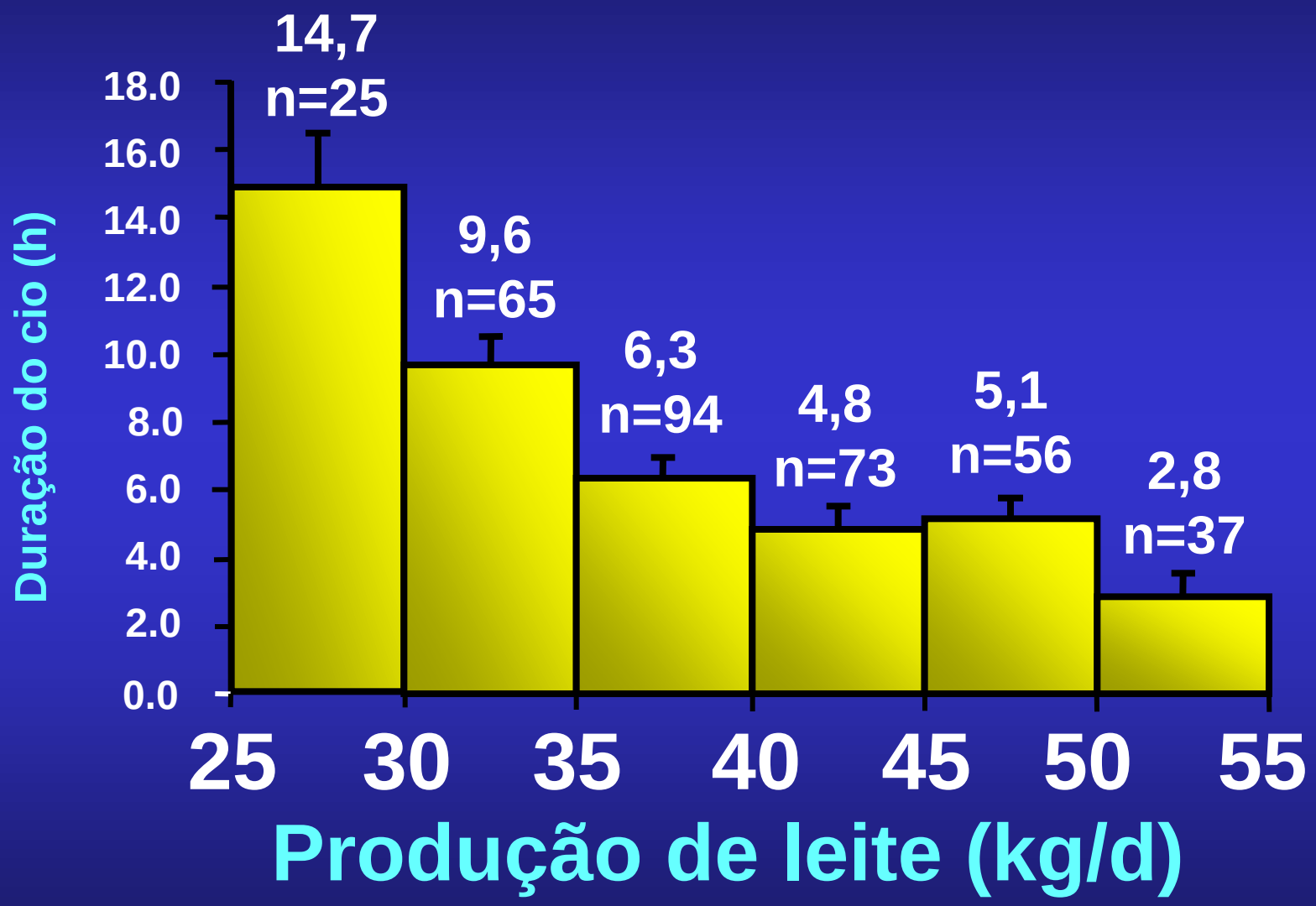
↓ Duração do estro

↓ Progesterone

↓ Manutenção da gestação

Wiltbank et al., 2006

Duração do cio conforme a produção de leite



- Análise incluiu todas simples ovulações (n=350) exceto primeira ovulação pós-parto
- Média de produção de leite durante os 10 dias antes do cio

Lopez et al., 2004 (An Reprod Sci)

UNIVERSIDADE DE SÃO PAULO
Faculdade de Medicina Veterinária e Zootecnia
DEPARTAMENTO DE REPRODUÇÃO ANIMAL

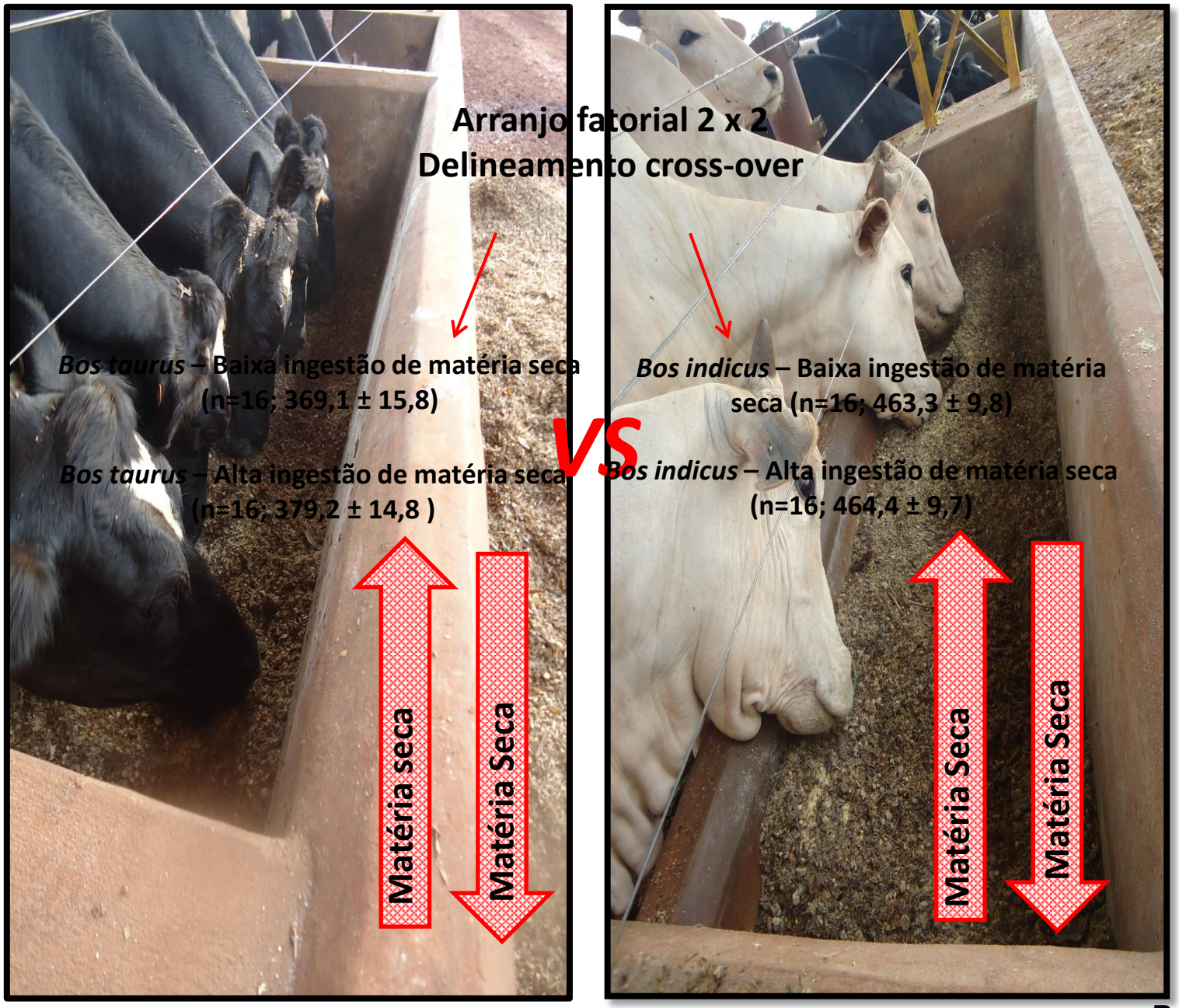
RESPOSTA OVARIANA, ENDÓCRINA E MOLECULAR DE NOVILHAS TAURINAS E ZEBUÍNAS SUBMETIDAS A DIFERENTES NÍVEIS NUTRICIONAIS DE INGESTÃO DE MATÉRIA SECA

Tese apresentada ao Programa de Pós – Graduação em Reprodução Animal da FMVZ – USP para obtenção do título de Doutor em Ciências

Doutoranda: Emiliana de Oliveira Santana Batista
Orientador: Pietro Sampaio Baruselli

-2015-

GRUPOS EXPERIMENTAIS



Batista, 2015

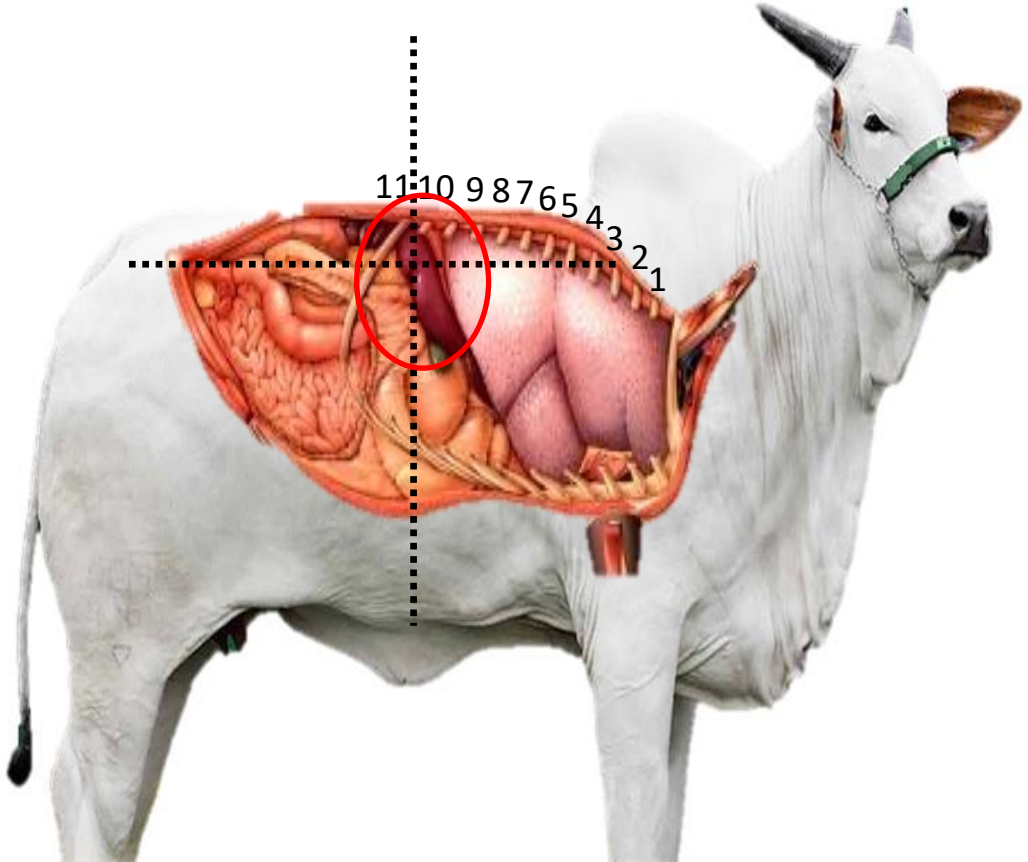
Batista, 2015

BIÓPSIA HEPÁTICA

32 novilhas

16 novilhas *Bos indicus*
- Alta ingestão MS (n=8)
- Baixa ingestão MS (n=8)

16 novilhas *Bos taurus*
- Alta ingestão MS (n=8)
- Baixa ingestão MS (n=8)



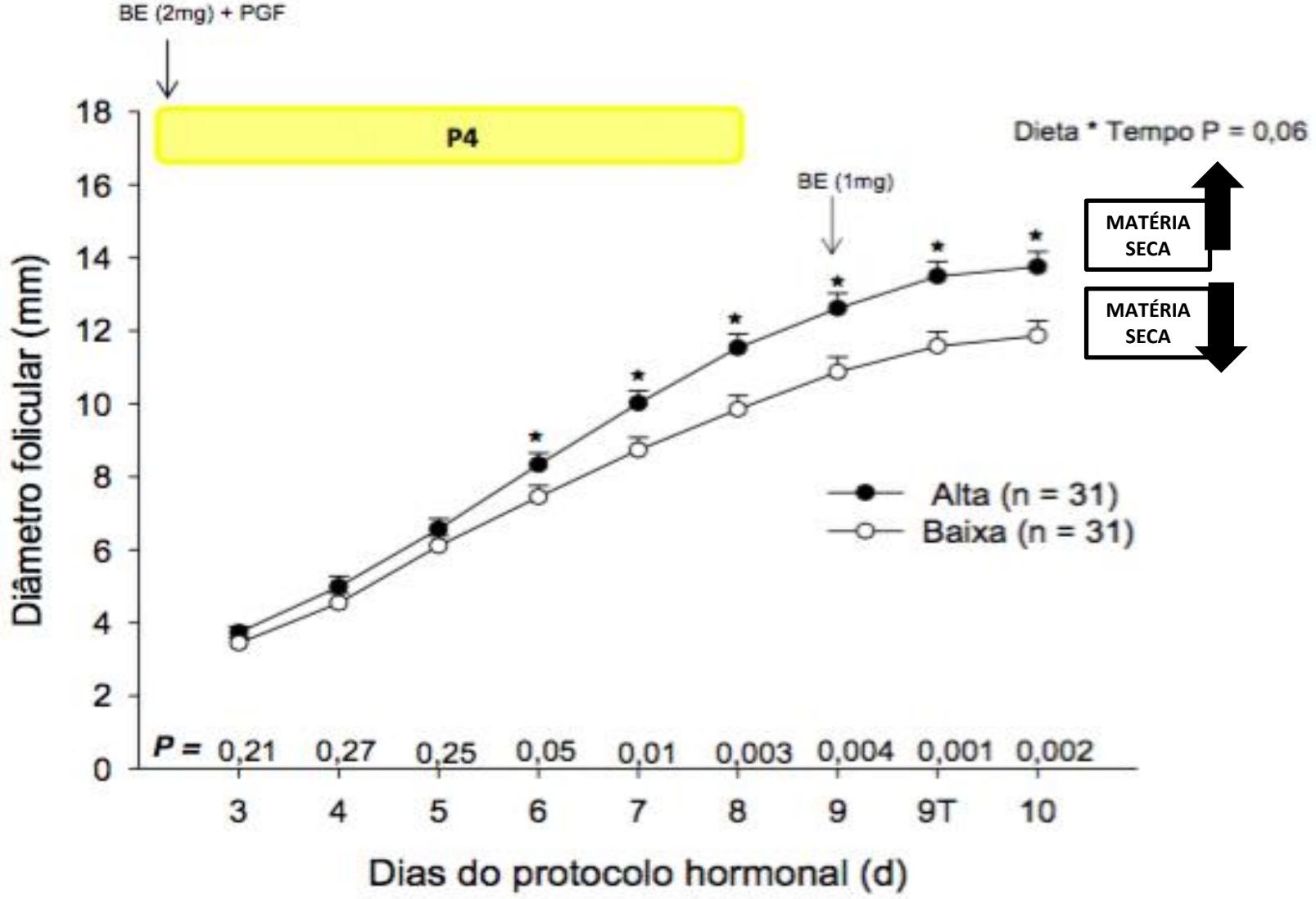
Batista, 2015

BIÓPSIA HEPÁTICA

Instrumento automático e agulhas Pro-Mag Ultra ™

Batista, 2015

DIÂMETRO FOLÍCULO DOMINANTE



Legenda: * P < 0,05

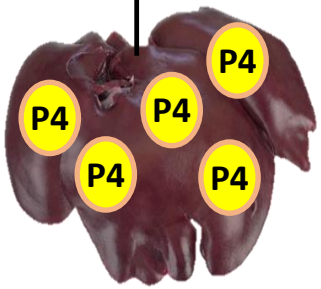
Fonte: Batista, E.O.S. (2015)

Batista, 2015

Redutases

MATÉRIA SECA

Redução



AKR1D1 → 5β-pregnane-3,20 dione

AKR1C4 → 3α-hidroxi, 5β-pregnane-20one

3 α/20β hidroxiesteróide desidrogenase → *Pregnanediol*

Jin et al., 2011

AKR1C1
AKR1C3 → 20α-hidroxiprogesterona

AKR1D1 → *20α*-hidroxi 5β-pregnan-3one

AKR1C4

SRD5A1
SRD5A3 → 5α-pregnane-3,20 dione

AKR1C4 → 3α- hidroxi, 5α-pregnan-20 one

3 α/20β hidroxiesteróide desidrogenase

20 α hidroxiesteróide desidrogenase → 5α-pregnan-20α- ol-3-one

AKR1C3
AKR1C4 → 5α-pregnane- 3α, 20α diol

MATÉRIA SECA

P2C19 → *21 α hidroxiprogesterona*

CYP3A4 → *6 β hidroxiprogesterona*

Lemley et al., 2008; Lemley et al., 2010; Murray et al., 1992; Jin et al., 2011; Sangrsitavong 2002

Batista, 2015

http://www.kegg.jp

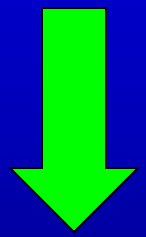
Eficiência reprodutiva vs BCS

Baixo BCS

Elevado BCS

Vacas em baixo BCS têm redução nos padrões de liberação de LH

Alta incidência de anestro pós-parto



⬇ Baixa taxa de prenhez

Ferramentas para melhorar a a taxa de prenhez à IATF em vacas com baixa condição corporal em anestro

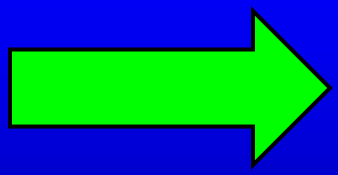
IATF  ↑ Eficiência reprodutiva

Tabela. Diâmetro do folículo dominante no momento da retirada do dispositivo de progesterona (Dia 8) na taxa de prenhez em vacas Nelore.

BCS category	LF on Day 8[6], mm mean±SEM	*P*	P/AI, % (n/n)	*P*
Low (2.0–2.5)	10.3 ± 0.3	0.002	42.9 (63/147)	0.04
Moderate to high (>2.5)	11.4 ± 0.2		53.4 (158/296)	

Vacas com baixo BCS possuem menor diâmetro do folículo dominante na sincronização para IATF

Sales et al., 2014 (Therogenology)

BCS vs ocurrence of estrus

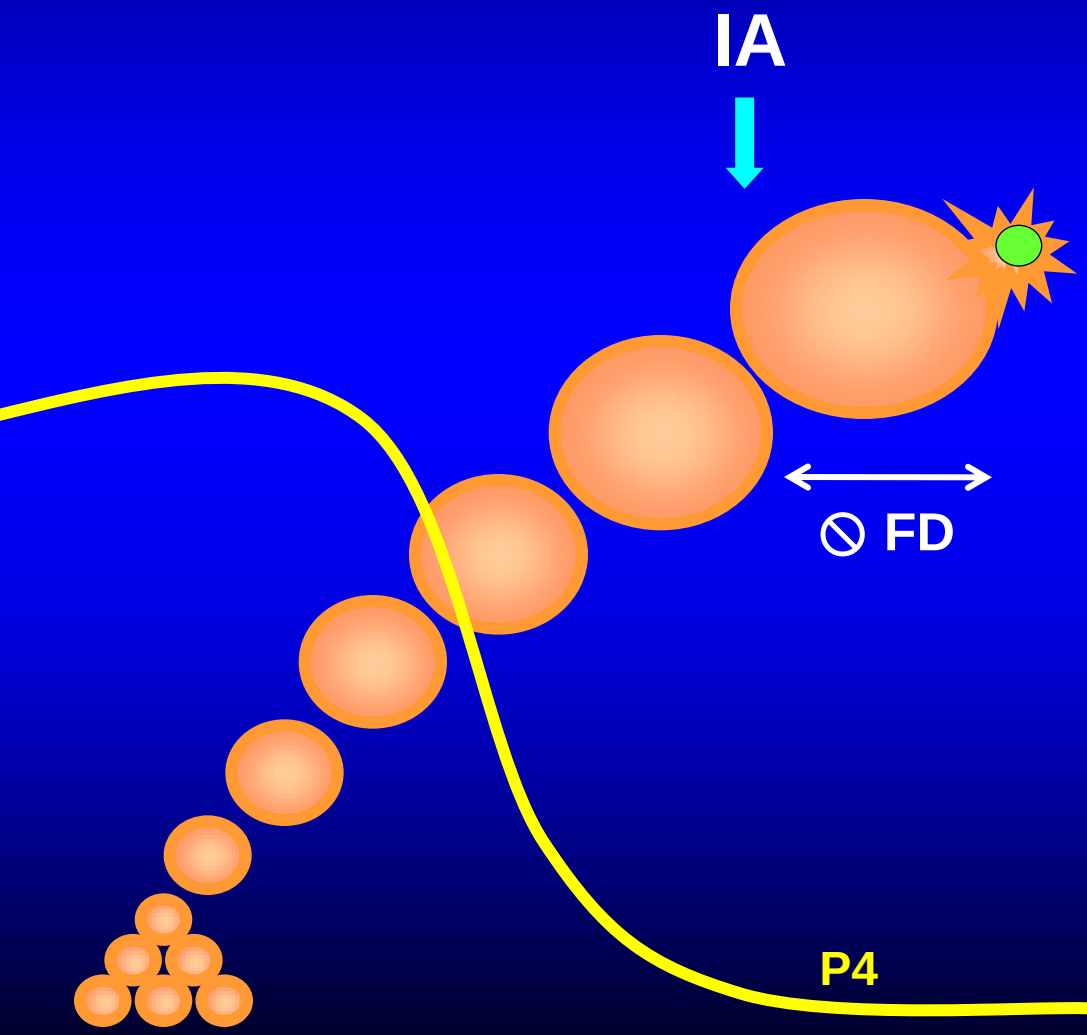
Table 2
Risk factors for occurrence of estrus following an estradiol/progesterone-based synchronization protocol in suckled *Bos indicus* cows (data from Experiments 2 and 3).

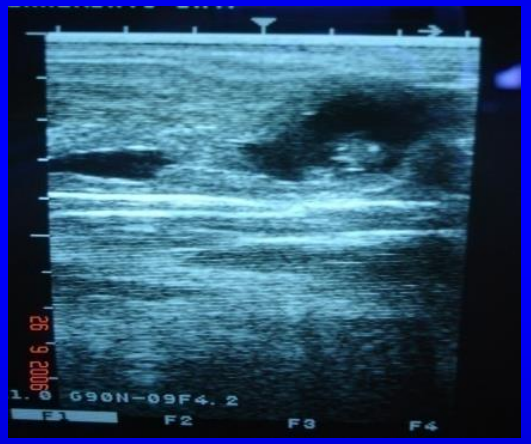
Variable	Estrus, % (N/N)	Adjusted OR (95% CI)	P
Farm			
A	46.3 (126/272)*	Referent	
B	54.0 (87/161)†	1.82 (1.16–2.86)	
C	67.9 (36/53)†	2.95 (1.54–5.65)	
D	68.9 (73/106)†	2.88 (1.72–4.82)	<0.0001
E	70.1 (131/187)†	3.10 (2.01–4.77)	
Breed			
Nelore (*Bos indicus*)	56.6 (310/548)	Referent	
Crossbred (*Bos indicus* × *taurus*)	61.9 (143/231)	1.61 (1.12–2.31)	0.01
Parity			
Primiparous	37.1 (45/124)	Referent	
Multiparous	62.1 (407/655)	2.39 (1.49–3.83)	0.0003
BCS category			
Low to moderate (2.0 to 3.0)	54.9 (257/468)	Referent	
High (>3.25)	63.0 (196/311)	1.41 (1.00–2.00)	0.05

Vacas com baixo BCS possuem menor manifestação de estro ao final da sincronização para IATF

Sá Filho et al., 2012 (Animal Reprod. Sci)

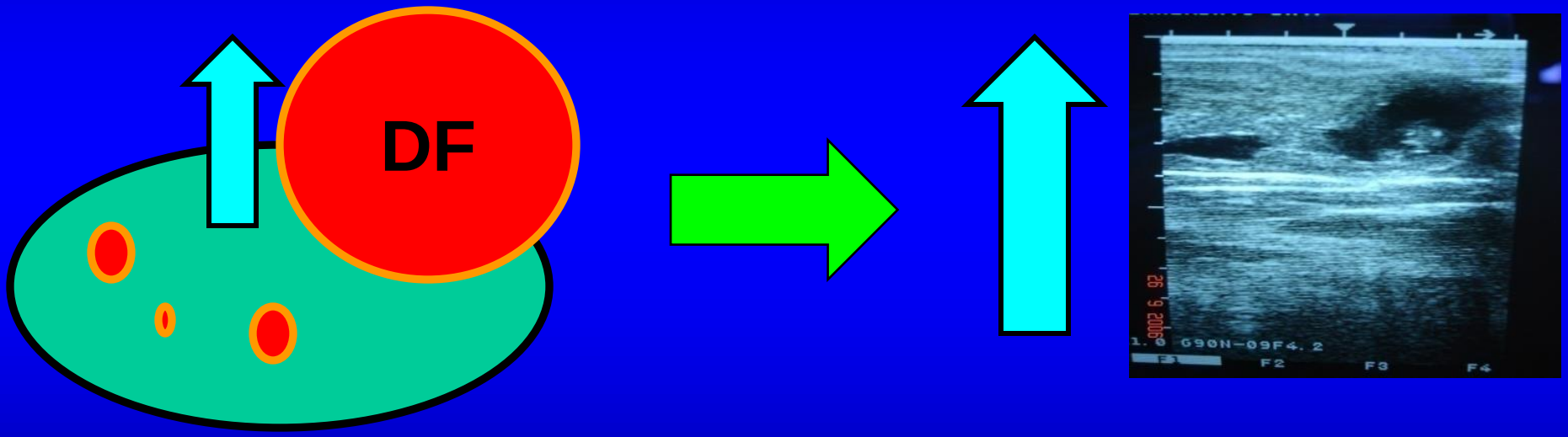
O diâmetro do folículo dominante na IA está associado à qualidade do ovócito e à taxa de concepção?



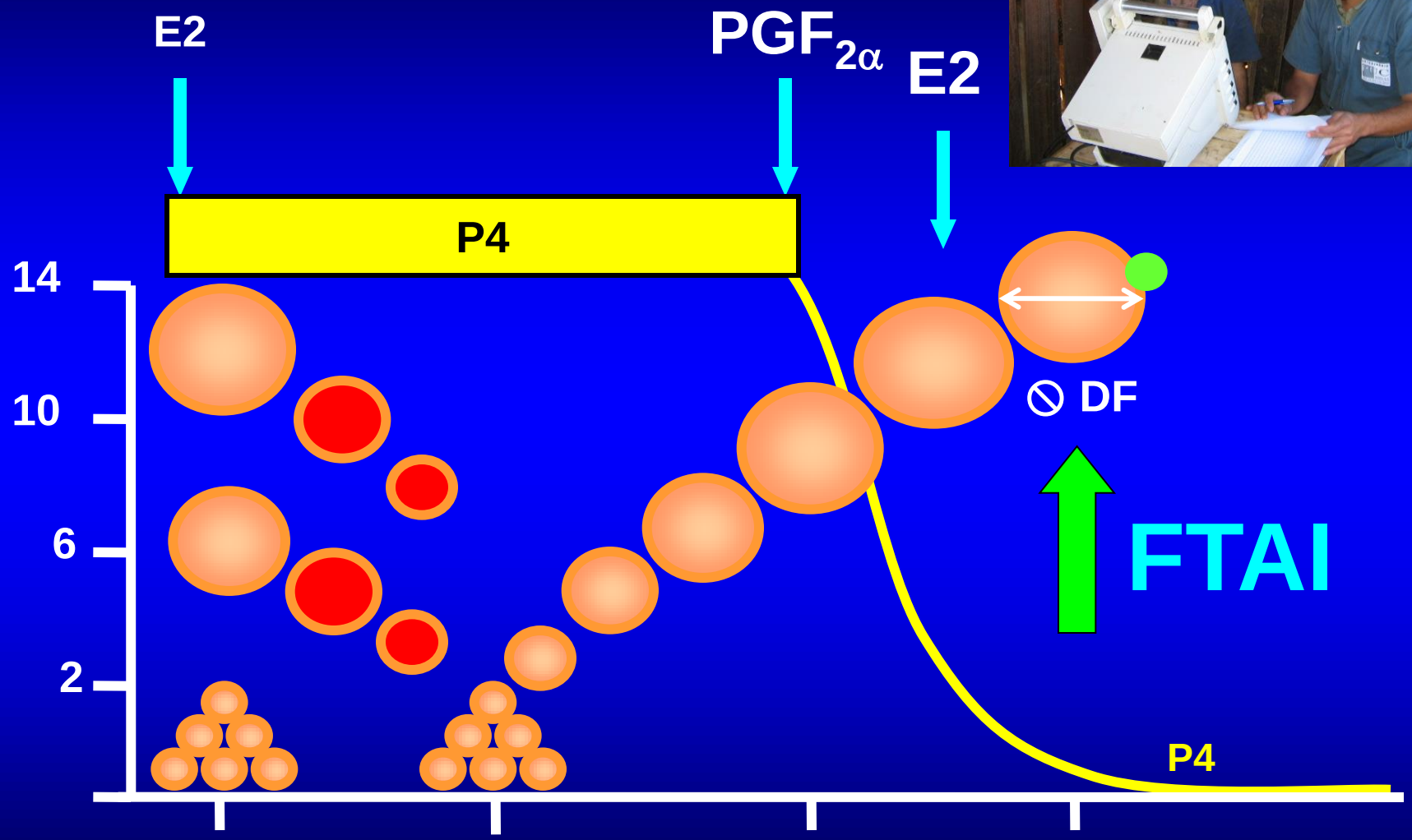


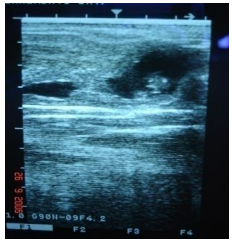
TP

Experimental hypothesis



n = 2,388 Nelore cows





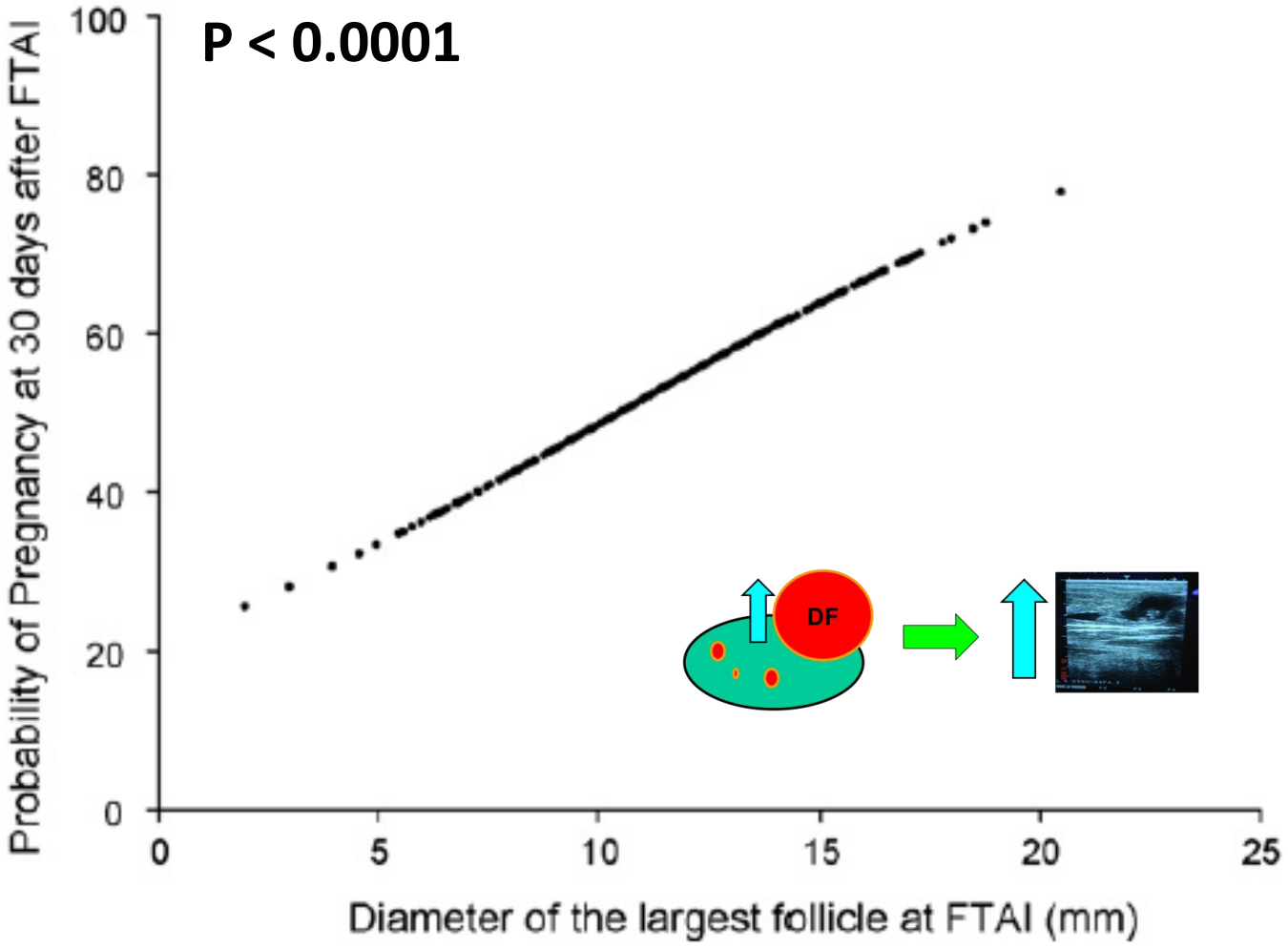
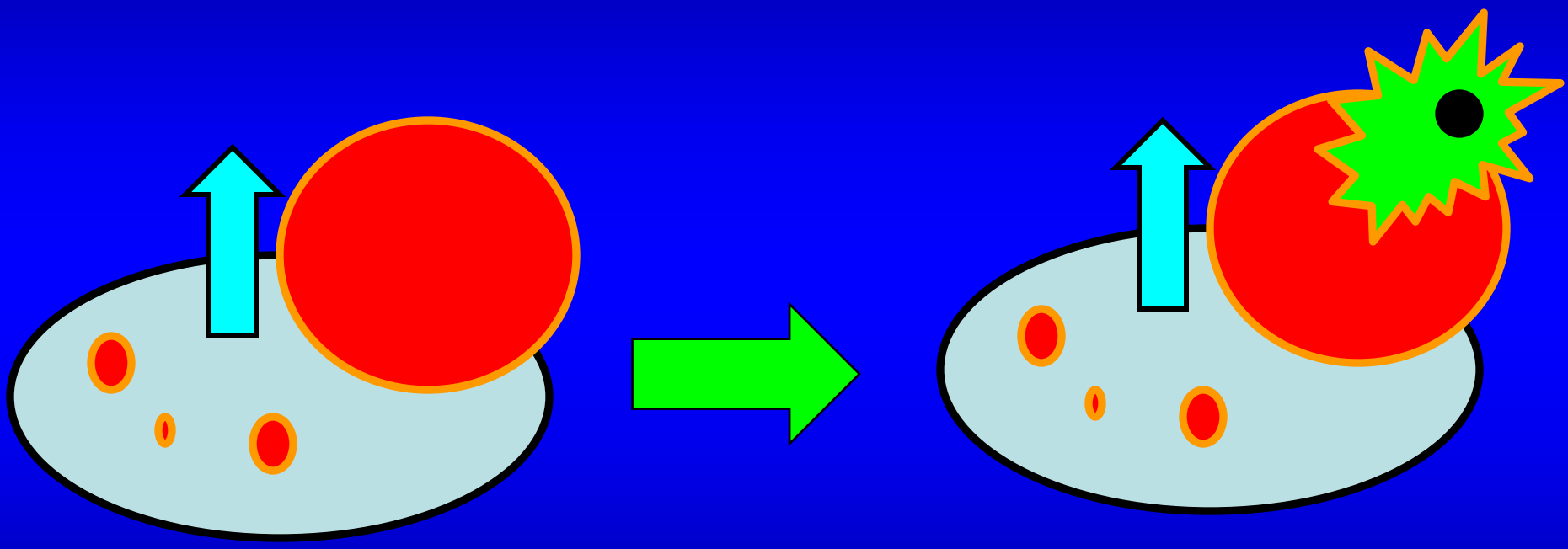


Fig. **Probability of pregnancy** on day 30 after fixed-time artificial insemination (FTAI) in suckled Bos indicus cows **(n = 2388)** according to the diameter of the largest follicle (LF) at FTAI [probability of pregnancy at 30 days = exp(−1.3282 + 0.1256×diameter of the LF at FTAI/1+exp(−1.3282 + 0.1256×diameter of the LF at FTAI)].

Sá Filho et al., (2010) Animal Reproduction Science, 120, p. 23–30

Experimental hypothesis



n = 813 Nelore cows

E2

$PGF_{2\alpha}$

E2

48h

P4

14

10

6

2

DF

?

FTAI

Dia 0

Dia 3 to 4

Dia 8

Dia 10

Dia 12

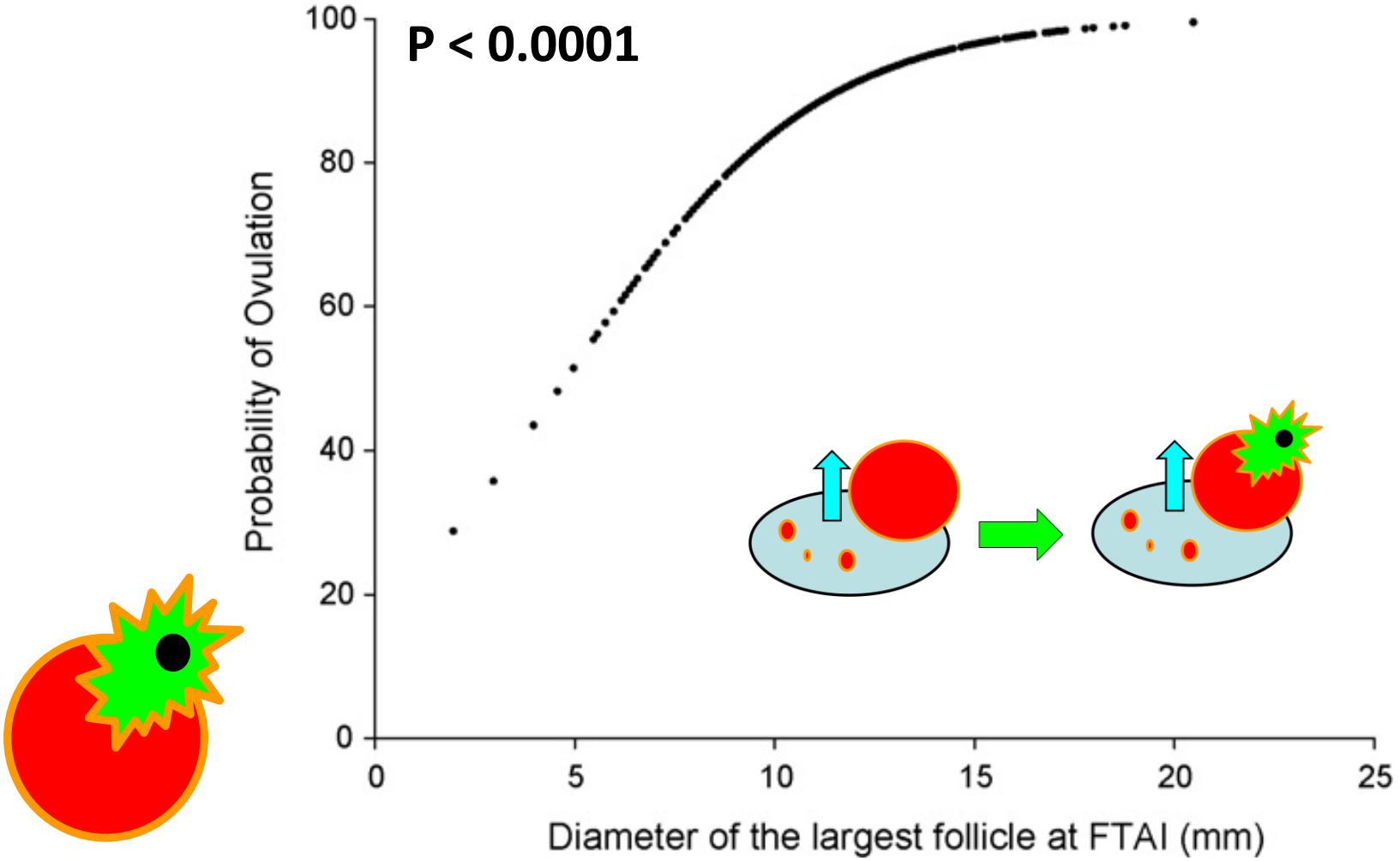


Fig. Probability of ovulation after estrous synchronization protocol for fixed-time artificial insemination (FTAI) in suckled Bos indicus cows **(n = 813)** according to the diameter of the largest follicle (LF) at FTAI [probability of ovulation = exp(−1.5536 + 0.3201×diameter of the LF at FTAI/1 + exp(−1.5536 + 0.3201×diameter of the LF at FTAI)].

Sá Filho et al., (2010) Animal Reproduction Science, 120, p. 23–30

Importância da nutrição mineral e vitamínica na eficiência reprodutiva

USP
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EFEITO DA SUPLEMENTAÇÃO COM MINERAIS QUELATADOS NA ATIVIDADE OVARIANA E EFICIÊNCIA REPRODUTIVA PÓS-PARTO DE VACAS NELORE

Desenvolvimento: Manoel Francisco de Sá Filho

Mestrando, Dep. de Reprodução Animal, FMVZ-USP

Coordenação: Prof. Dr. Pietro Sampaio Baruselli

MSc. Marcos Sampaio Baruselli

2004

UNIVERSIDADE DE SÃO PAULO

USP - PIRASSUNUNGA

UNIVERSIDADE DE SÃO PAULO

Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

DESENHO EXPERIMENTAL

97 vacas Nelore (*Bos indicus*)

Terço final de gestação

Mineral tortuga

(Orgânico)

Mineral Inorgânico

UNIVERSIDADE DE SÃO PAULO

Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

Rotação semanal das pastagens

(Período pré e pós-parto)

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Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

Avaliação ultrassonográfica

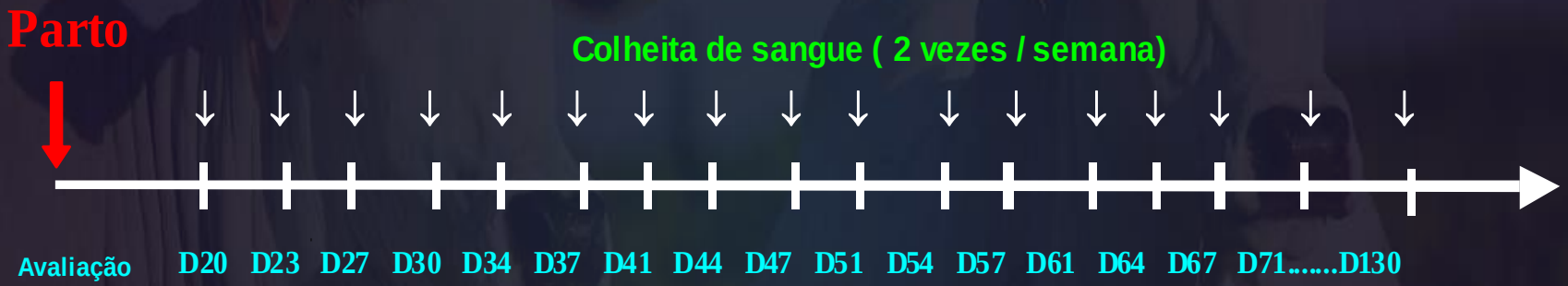
Pesagem das vacas e dos bezerros

UNIVERSIDADE DE SÃO PAULO

Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

Diagrama Esquemático do Experimento

Observação do comportamento sexual (12/12 h)



Pesagem dos Animais + Avaliação ECC (a cada 14 dias)

Avaliação Ultra-sonográfica cada 3 a 4 dias

Suplementação Pré parto (40 dias)

Rotação dos piquetes a cada 7 dias

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Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

Protocolo de Indução da ovulação para IATF

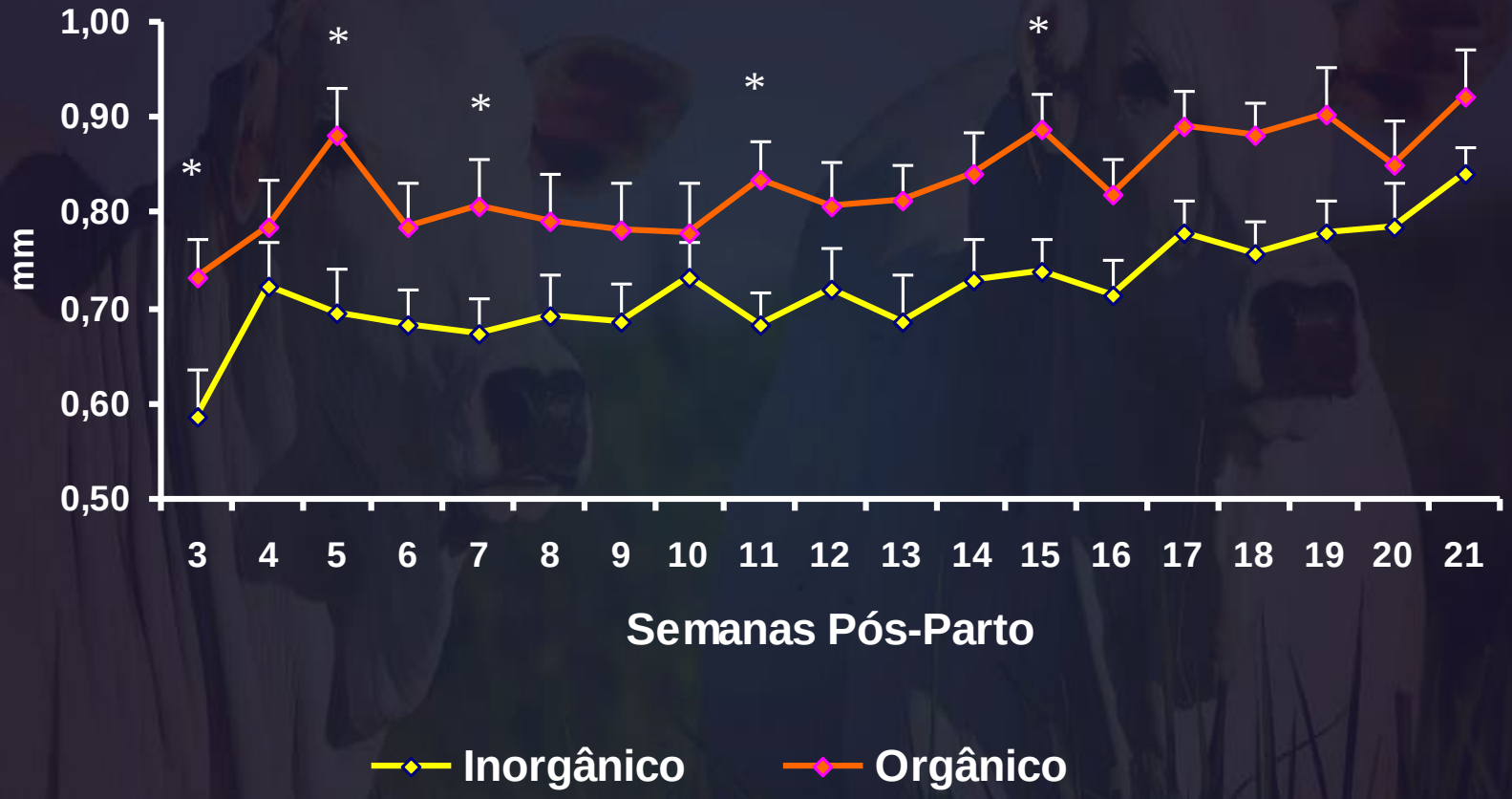
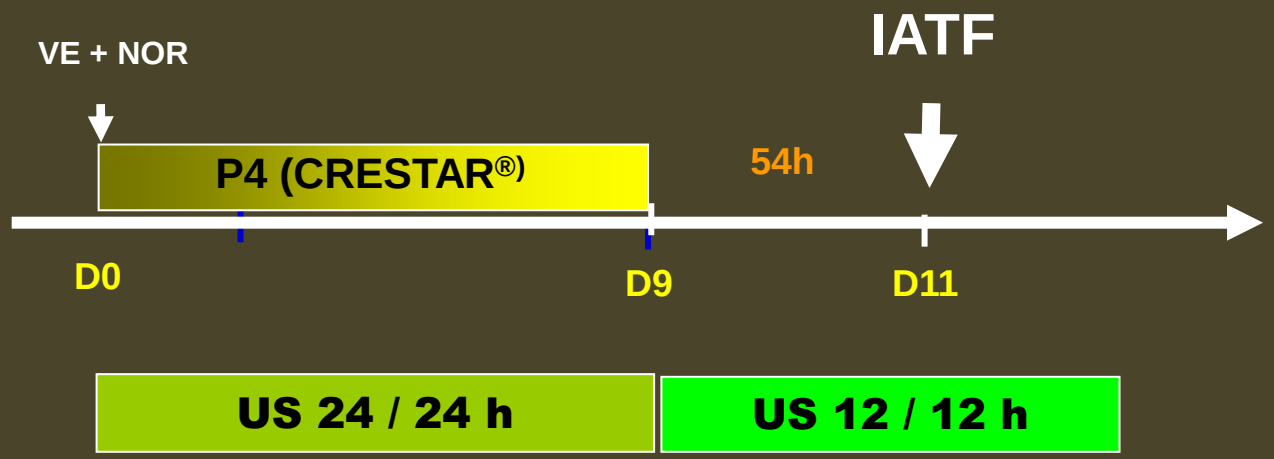


Gráfico - Dinâmica folicular durante o período pós-parto de vacas Nelore suplementadas com mineral quelatado, Pirassunga-SP, 2004

USP
UNIVERSIDADE DE SÃO PAULO

Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

Protocolo de Indução da ovulação para IATF



Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

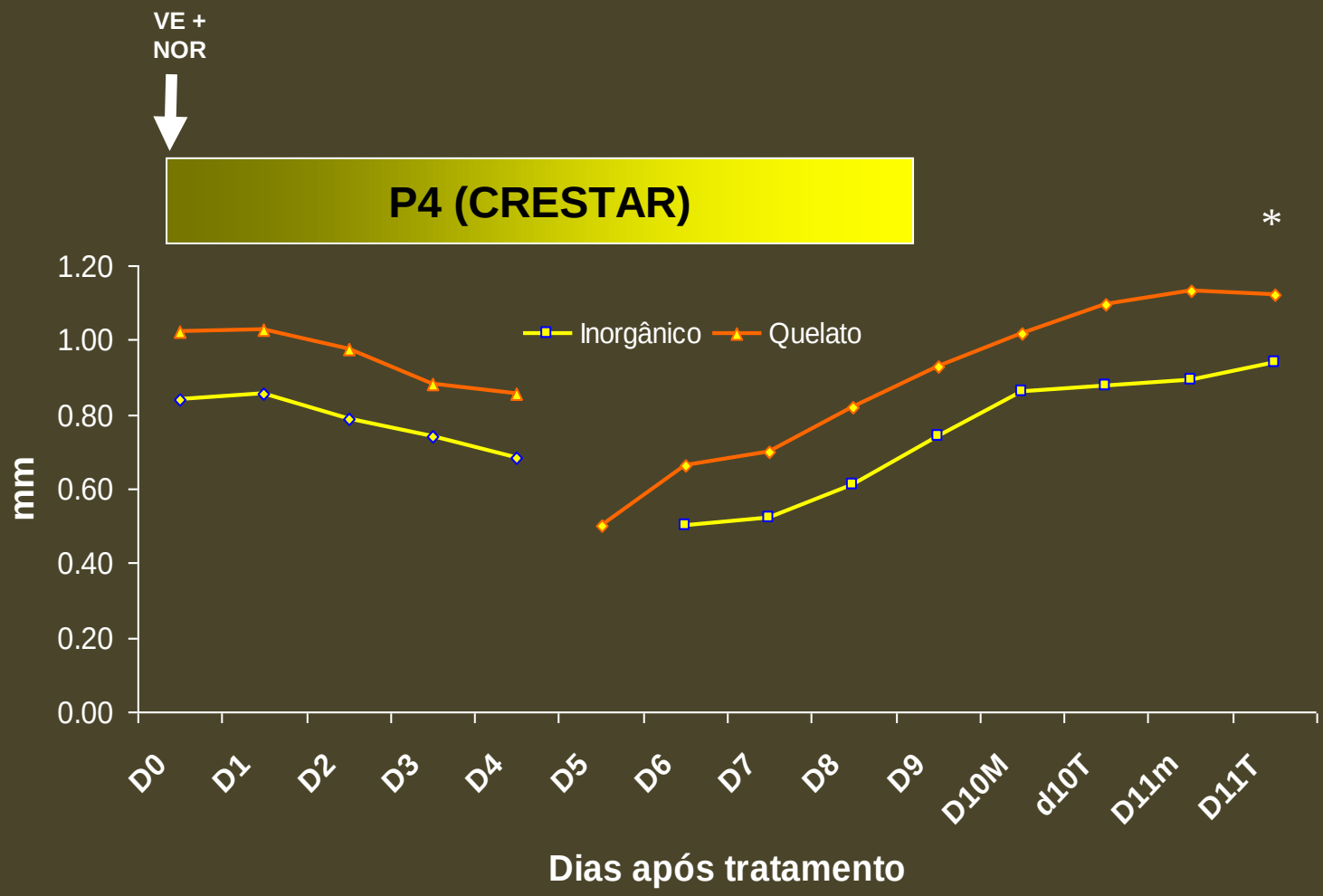


Gráfico - Dinâmica folicular de vacas Nelore suplementadas com Mineral Quelatado durante protocolo de sincronização para IATF, Pirassunga-SP, 2004.

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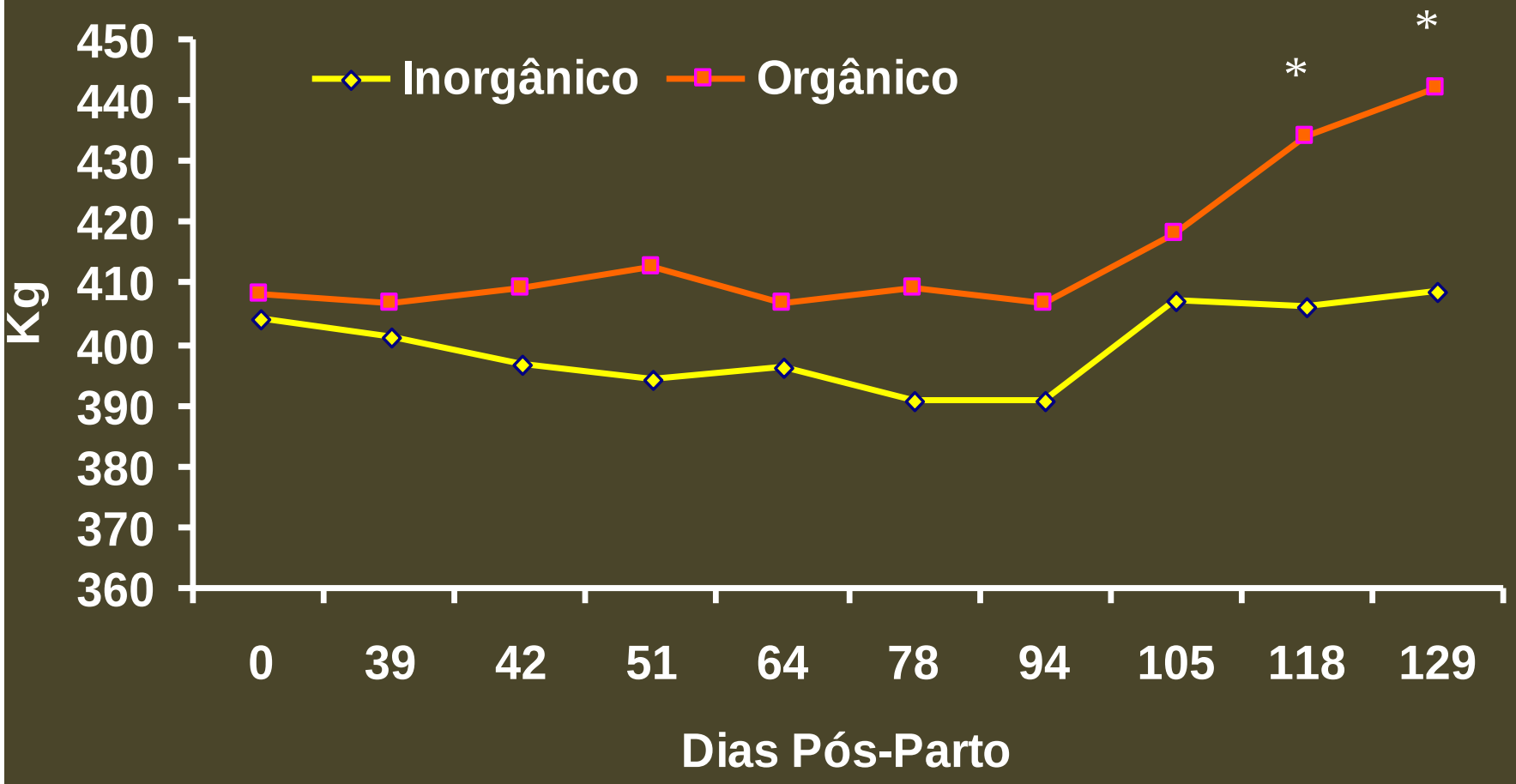
Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

Peso corporal das vacas Nelore no período pós-parto suplementadas com Mineral Quelatado, Pirassunga-SP, 2004.



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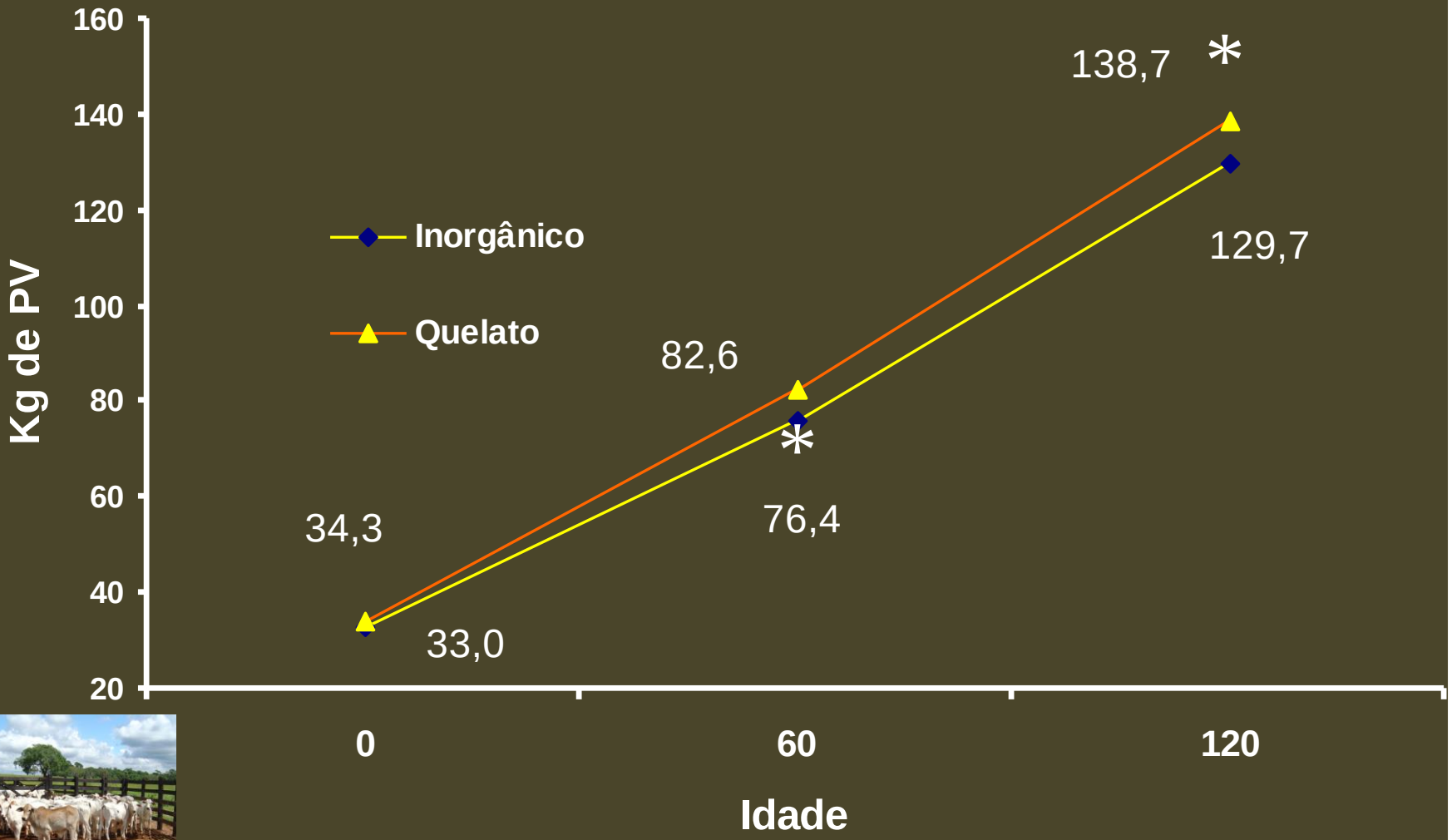
Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

Peso vivo ajustado aos 60 e 120 dias de idade de bezerros de vacas Nelore (Bos indicus) suplementadas com minerais quelatados, Pirassununga-SP, 2004



UNIVERSIDADE DE SÃO PAULO

Sá Filho et al., 2005 (Hora Veterinária, n 143, p. 52-55)

CONCLUSÕES

- O mineral quelatado aumenta o diâmetro folicular durante o período pós-parto em vacas Nelore.

- O mineral quelatado aumenta o diâmetro do folículo dominante no protocolo de IATF.

- O mineral quelatado aumenta o peso das vacas e dos bezerros

Livestock Science 217 (2018) 30–36

Contents lists available at ScienceDirect

Livestock Science

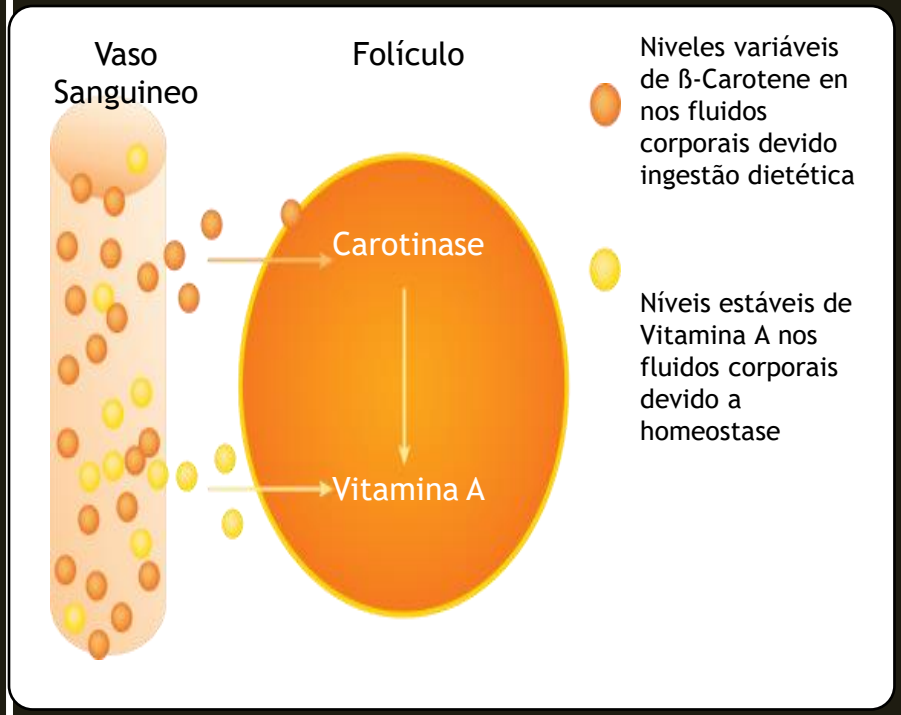
journal homepage: www.elsevier.com/locate/livsci

The combination of β-carotene and vitamins improve the pregnancy rate at first fixed-time artificial insemination in grazing beef cows

Vinícius Nunes de Gouvêa[a,1,*], Marcos Henrrique Alcantra Colli[b,1], Walter Antonio Gonçales Junior[b], Jéssica Cristina Lemos Motta[c], Tiago Sabella Acedo[a], Guilherme de Souza Floriano Machado de Vasconcellos[a], Luis Fernando Monteiro Tamassia[a], Flávia Morag Elliff[b], Rodolfo Daniel Mingoti[b], Pietro Sampaio Baruselli[b,*]

[a] DSM Produtos Nutricionais Brasil S.A., São Paulo, SP 01541-905, Brazil
[b] Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo, São Paulo, SP 05508-270, Brazil
[c] Departamento de Zootecnia, Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo, Piracicaba, São Paulo 13418-900, Brazil

B-CAROTENO É O PRECURSOR DE VITAMINA A NO FOLÍCULO E NO CORPO LÚTEO



O incremento temporário da demanda de vitamina A no folículo e no corpo lúteo somente pode ser obtido através da conversão local de B-caroteno em vitamina A no folículo

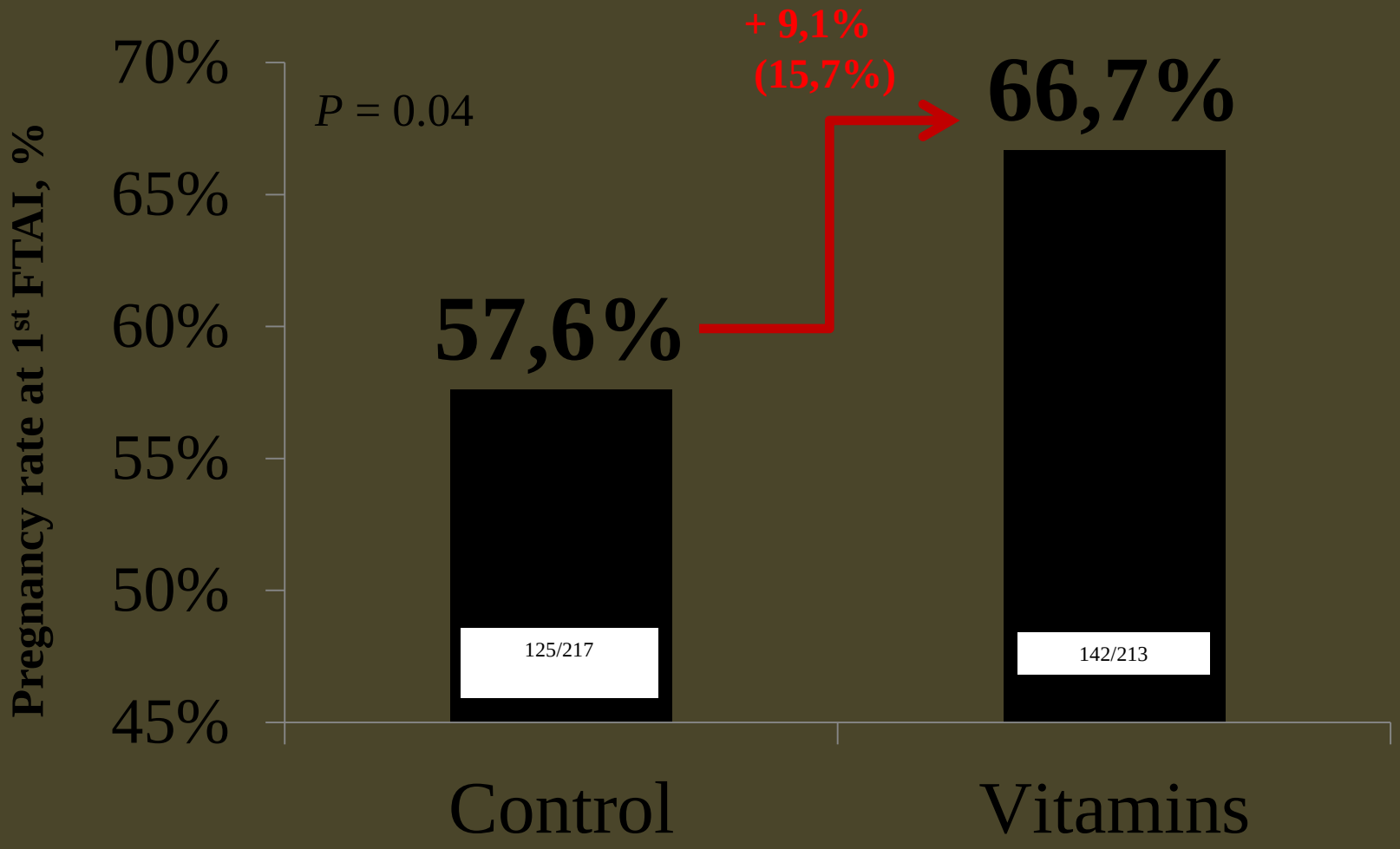
B-CAROTENO E FERTILIDADE

Falta de ß-Caroteno diminui a síntese hormonal

- Sinais de cio reduzidos (cios silenciosos)
- Ovulação atrasada
- Função reduzida do corpo lúteo
- Enfermidades pós parto

Gouvêa et al., 2018 (Livestock Science, V. 217, P, 30-36

Taxa de prenhez à 1ª IATF



Effect of β-carotene and vitamins supplementation on pregnancy rate 30 days after first FTAI protocol of grazing beef cows.

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Gouvêa et al., 2018 (Livestock Science, V. 217, P, 30-36)

Concentração sanguínea de βcaroneto

X

Taxa de prenhez à IATF

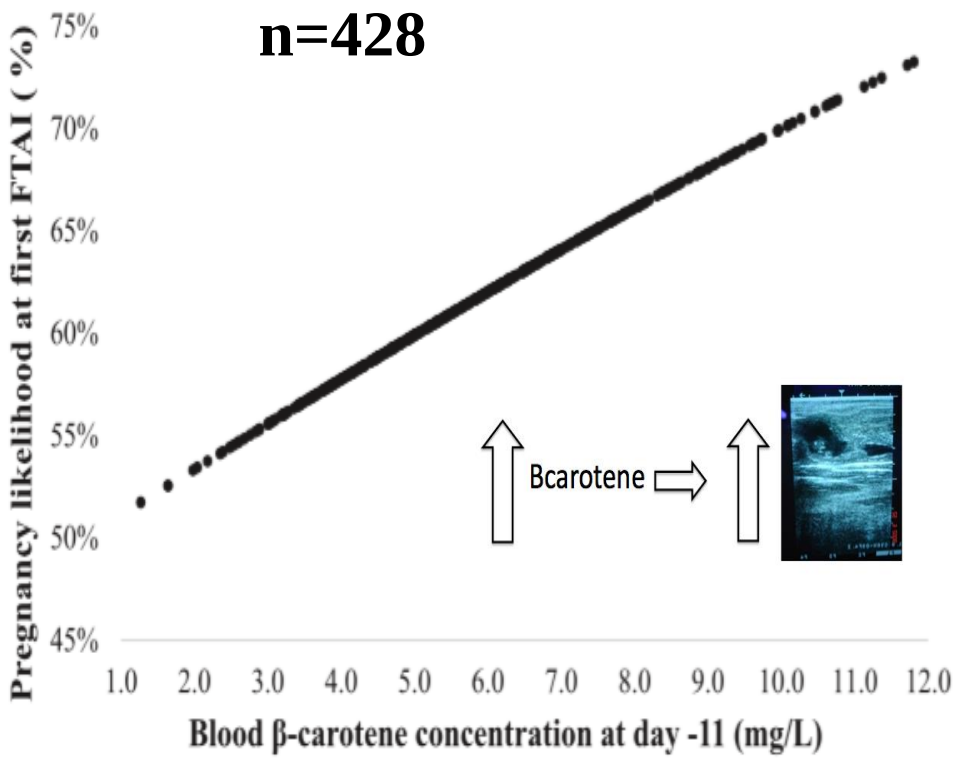


Fig. 5. Correlation between pregnancy rate at first fixed-time artificial insemination (FTAI) and blood β-carotene concentration [β] at the beginning of the protocol (day −11). Logit ([β] day −11) = Exp[−0.33 + 0.0866*[β] day −11]/1 + Exp[−0.33 + 0.0866*[β] day −11]. $P = 0.060$. $R = 0.09103$. $n = 428$.

USP UNIVERSIDADE DE SÃO PAULO

Gouvêa et al., 2018 (Livestock Science, V. 217, P, 30-36)

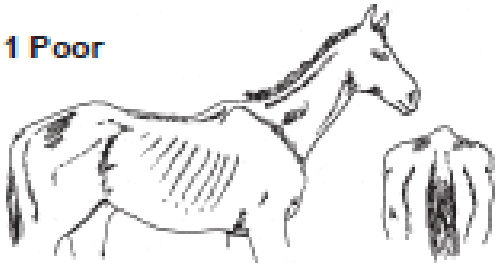
EQUINOS

BAIXA CONDIÇÃO CORPORAL

0 Very poor

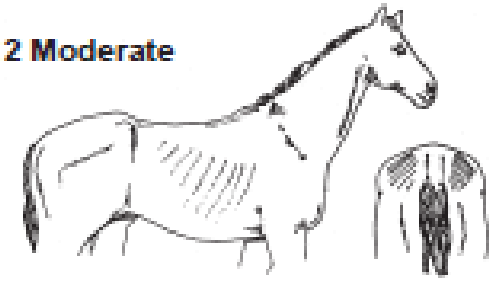
Very sunken rump, deep cavity under tail, skin tight over bones, very prominent backbone & pelvis, marked ewe back.

1 Poor



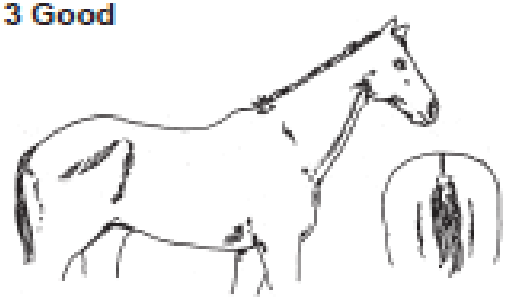
Sunken rump, deep cavity under tail, ribs easily visible, prominent backbone & croup, ewe neck - narrow & slack.

2 Moderate



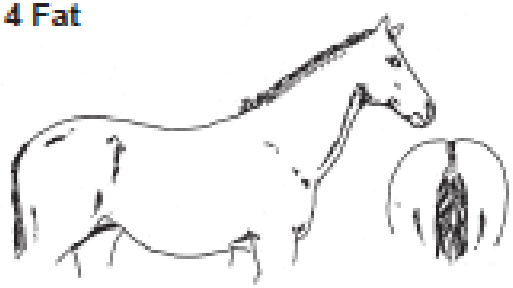
Flat rump either side of backbone, ribs just visible, narrow but firm neck & backbone well covered.

3 Good



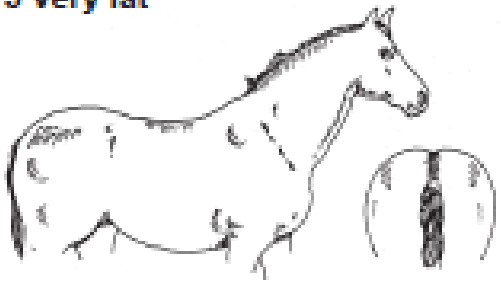
Rounded rump, ribs just covered but easily felt and no crest, firm neck.

4 Fat



Rump well rounded, gutter along back, ribs and pelvis hard to feel and slight crest.

5 Very fat



Very bulging rump, deep gutter along back, ribs buried, marked crest fold and lumps of fat.

ATRASO RETORNO CICLICIDADE

CONDIÇÃO CORPORAL

Vet Res Commun (2010) 34 (Suppl 1):S41–S45
DOI 10.1007/s11259-010-9407-0

EXTENDED ABSTRACT

Relationship between body fat and body condition score and their effects on estrous cycles of the Standardbred maiden mare

I. Vecchi • A. Sabbioni • E. Bigliardi • G. Morini •
L. Ferrari • F. Di Ciommo • P. Superchi • E. Parmigiani

Table 2 Effects of the mare's body condition on ovulation onset

Subcutaneous fat thickness class	Subcutaneous fat thickness (mm)	BCS	Ovulation onset (days)
1	6.25a	1.81a	97c
2	9.00b	2.14b	96c
3	14.40c	2.70c	69b
4	18.80d	3.30d	29a
5	23.00e	3.75e	44ab

a,b,c,d,e different for $P<0.05$

CONDIÇÃO CORPORAL

ECC ao parto ou início estação	No.	Taxa Prenhez	N ciclo para prenhez
3	16	56	3.66
3.5	36	55	3.4
4	39	79	2.77
4.5	67	74	2.58
5	175	89	1.52
5.5	167	96	1.38
6	222	92	1.48
6.5	103	97	1.24
7	63	94	1.43
7.5	26	100	1.61
8	13	100	1.38

Henneke et al., Theriogenology 1984

SUÍNOS

UNIDADES FUNCIONAIS NA GRANJA

UNIDADE DE MATERNIDADE

MATRIZ

LEITÕES

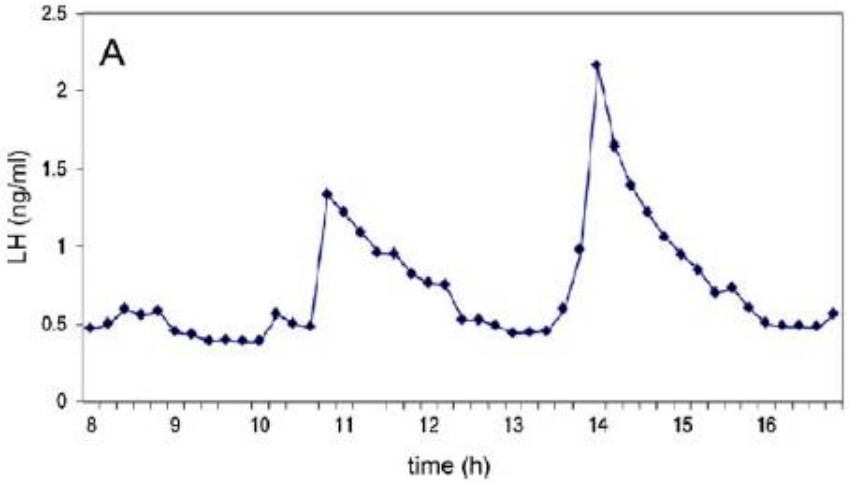
UNIDADE GESTAÇÃO

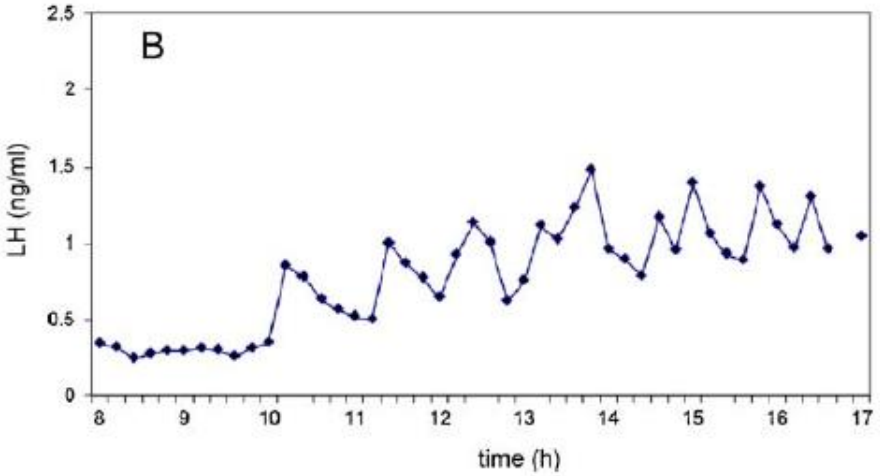
Intervalo Desmame-Estro (IDE)
3 a 5 dias (max. 7 dias)

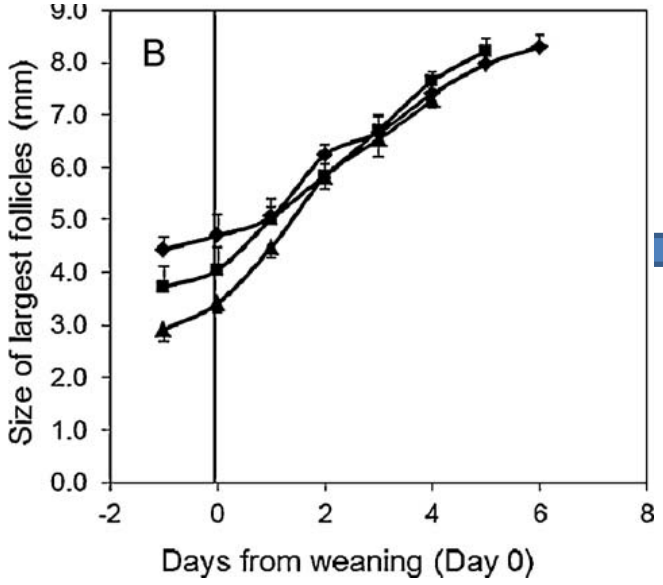
UNIDADE CRECHE

Creche (63 a 70 dias de idade)

PULSATILIDADE DE LH E DESENVOLVIMENTO FOLICULAR PÓS DESMAME

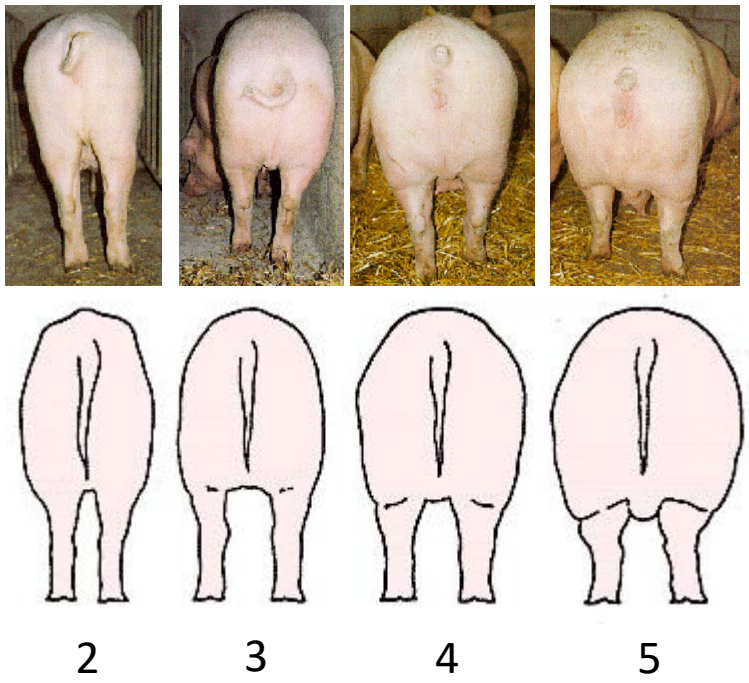






Soede et al, Animal Reproduction Science 124 (2011) 251–258

BAIXA NUTRIÇÃO DURANTE LACTAÇÃO



Recomendado entre 2,5 a 3,5
Ao parto: 3-3.5, 80% ECC 3
Lactação e desmame: 2.5-3.5

Perda condição corporal durante lactação

↓

Redução e atraso no estro pós desmame (**primíparas)

↓

Menor eficiência reprodutiva

Vargas AJ, et al, 2009 a, b

Theriogenology

Volume 125, February 2019, Pages 277-284

Influence of nutrition, body condition, and metabolic status on reproduction in female beef cattle: A review

Michael J. D'Occhio [a], Pietro S. Baruselli [b], Giuseppe Campanile [c]

[a] School of Life and Environmental Sciences, Faculty of Science, The University of Sydney, Camden, New South Wales, Australia

[b] Department of Animal Reproduction, Faculty of Veterinary Medicine and Zootecnia, University of Sao Paulo, Sao Paulo, Brazil

[c] Department of Veterinary Medicine and Animal Production, University of Naples Federico II, Naples, Italy

Conclusão

- A correta nutrição é imprescindível para elevada eficiência reprodutiva

- O BCS representa a reserva energética das fêmeas

- Baixo ou muito elevado BCS são relacionados à redução da eficiência reprodutiva

- A sincronização com eCG pode colaborar no aumento da taxa de prenhez em fêmeas em anestro com baixo BCS