



FACULDADE DE VETERINÁRIA  
DEPARTAMENTO DE CLÍNICAS VETERINÁRIA



# NUTRIÇÃO, METABOLISMO E FERTILIDADE EM VACAS LEITEIRAS: FONTE DE ENERGIA DIETÉTICA E FUNÇÃO OVARIANA

Garnsworthy, P.C.; Lock, A.; Mann, G. E.; Sinclair, K. D.; Webb, R.  
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**Orientador:** Marcio Corrêa

**Co-orientador:** Augusto Schneider

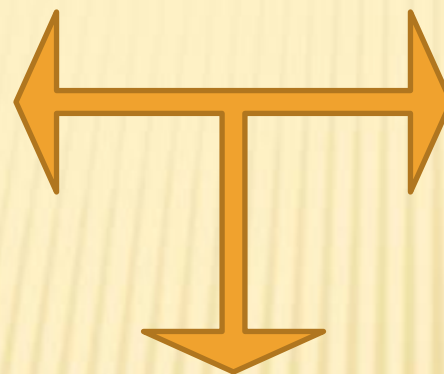
# INTRODUÇÃO



↑ Produção



↓ Fertilidade



- ✓ Correlações genéticas (-)
- ✓ Desequilíbrio de nutrientes

→ Stress Metabólico

# INTRODUÇÃO

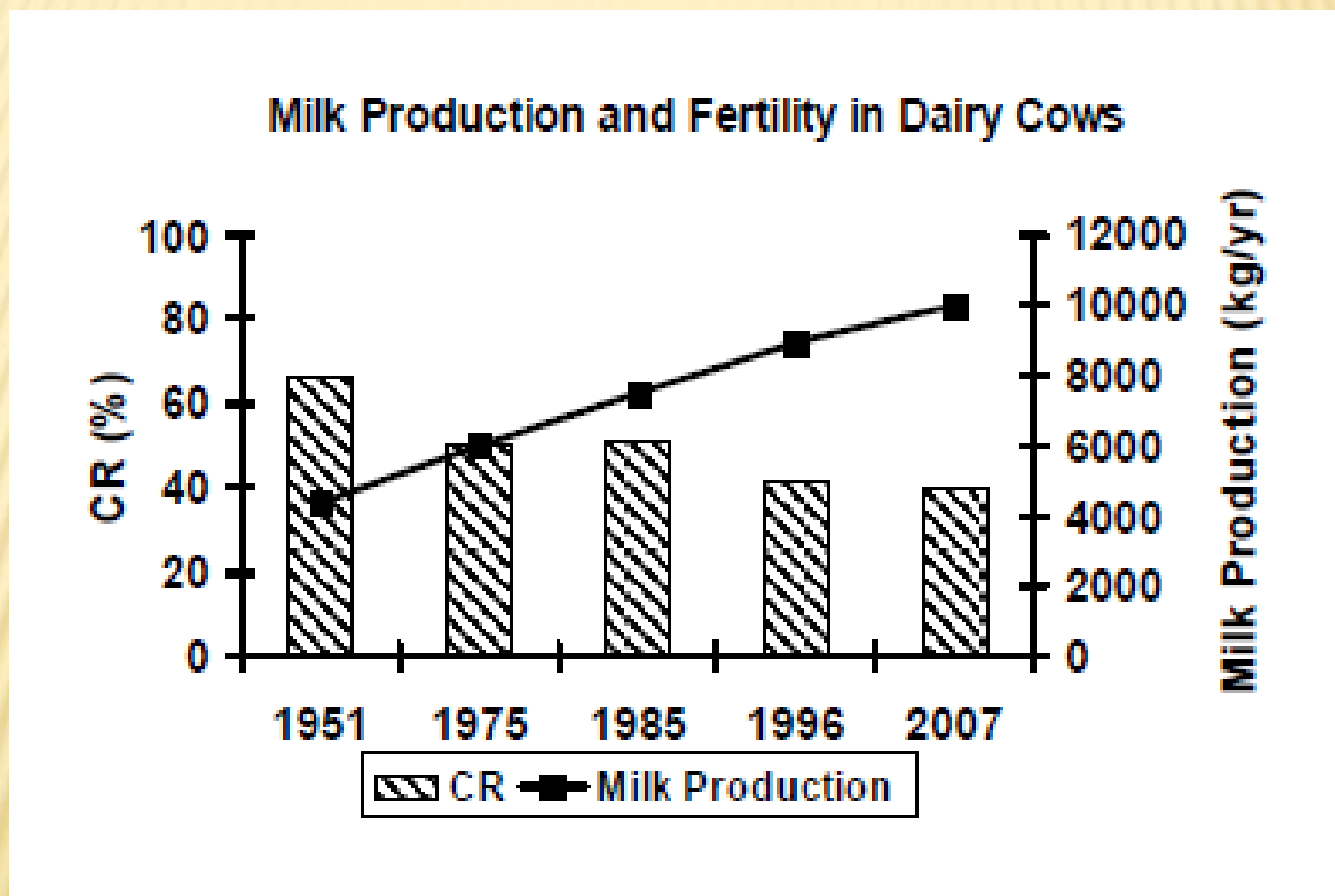


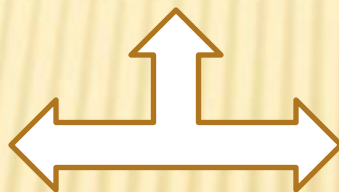
Figura: Relação entre taxa de concepção e e produção de leite em vacas holandesas em Nova Iorque

# INTRODUÇÃO

Stress metabólico



**B E N**



- ✓ Supressão de LH
- ✓ ↓ respostas ovarianas ao LH
- ✓ ↓ secreção de E<sub>2</sub> pelo folículo dominante

- ✓ ↑ mobilização gordura
- ✓ ↑ Nefa/BHBA
- ✓ ↓ ECC

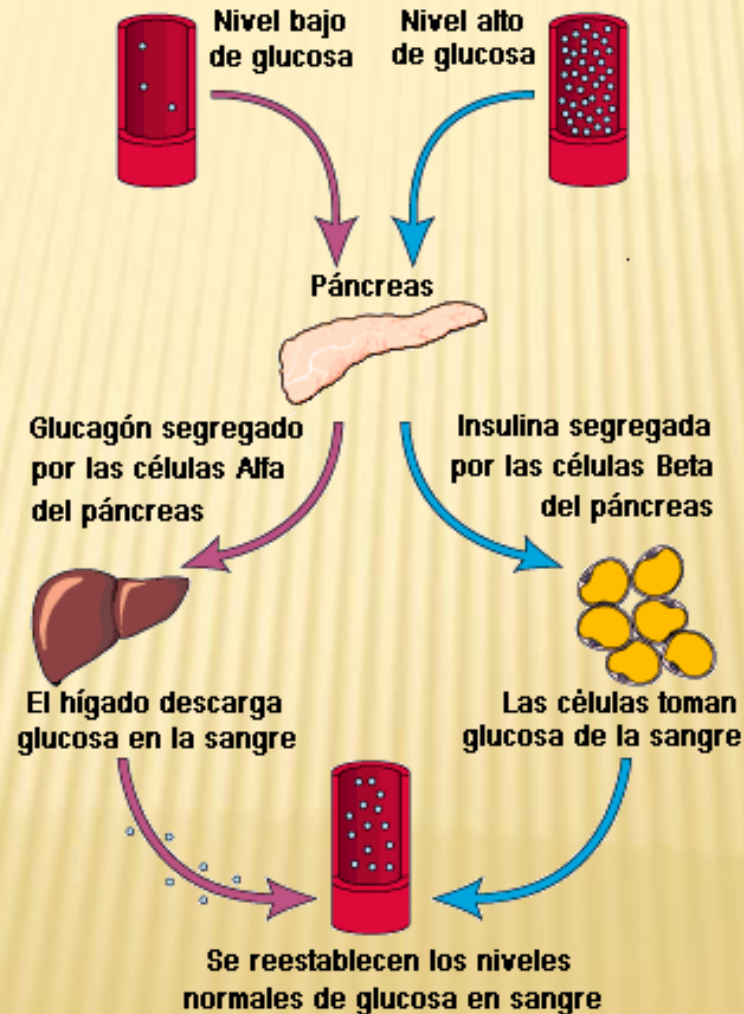
Aumentar CHO e/ou gordura na dieta



# MATERIAL E MÉTODOS

✘ Uma breve revisão.....

*Insulina/Glucagon*



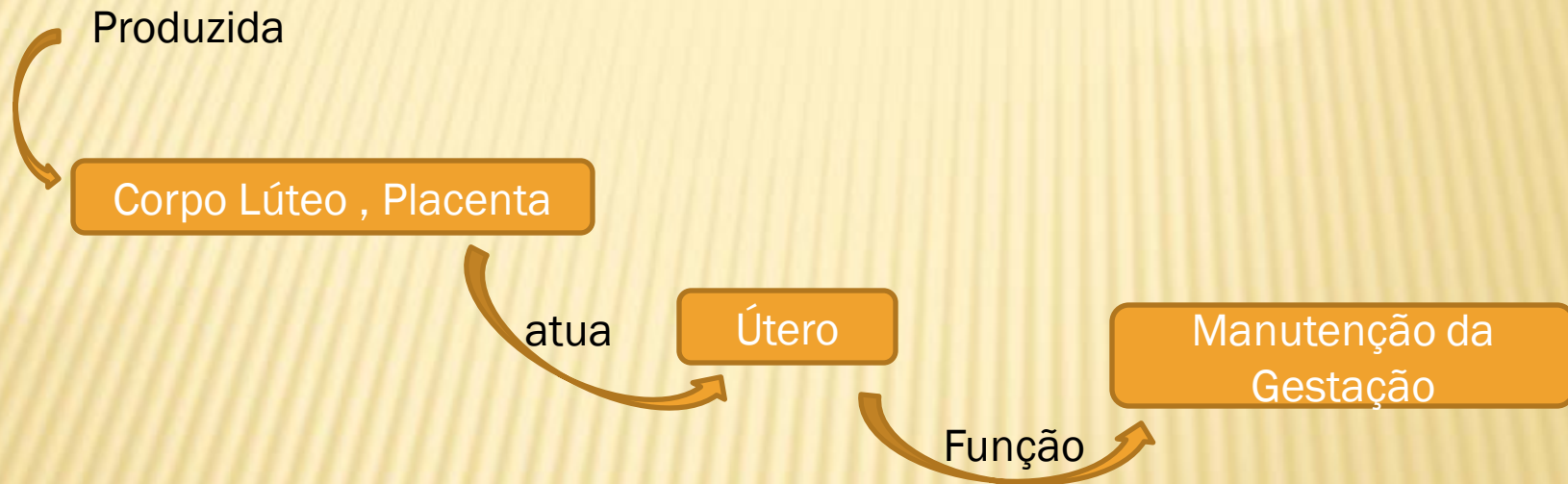
# MATERIAL E MÉTODOS

## × *Leptina:*



# MATERIAL E MÉTODOS

## × Progesterona P<sub>4</sub>:



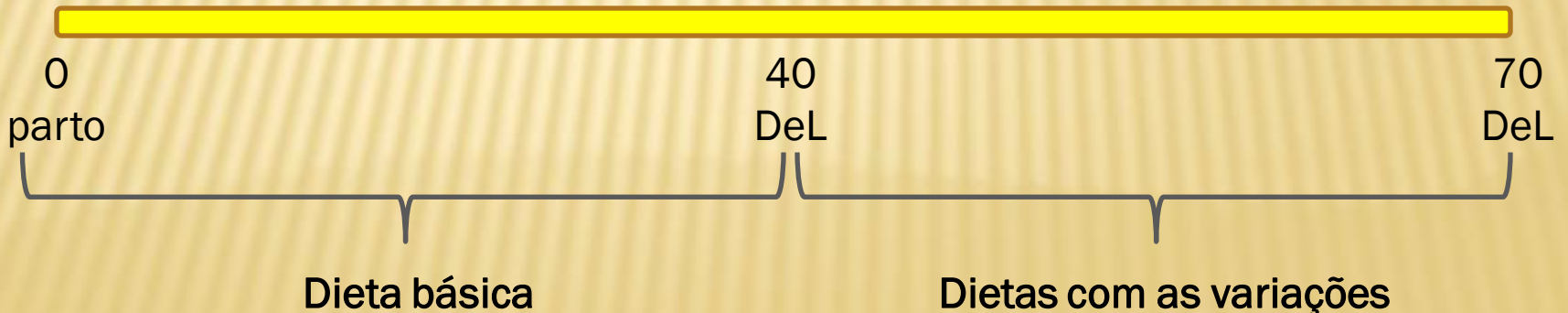
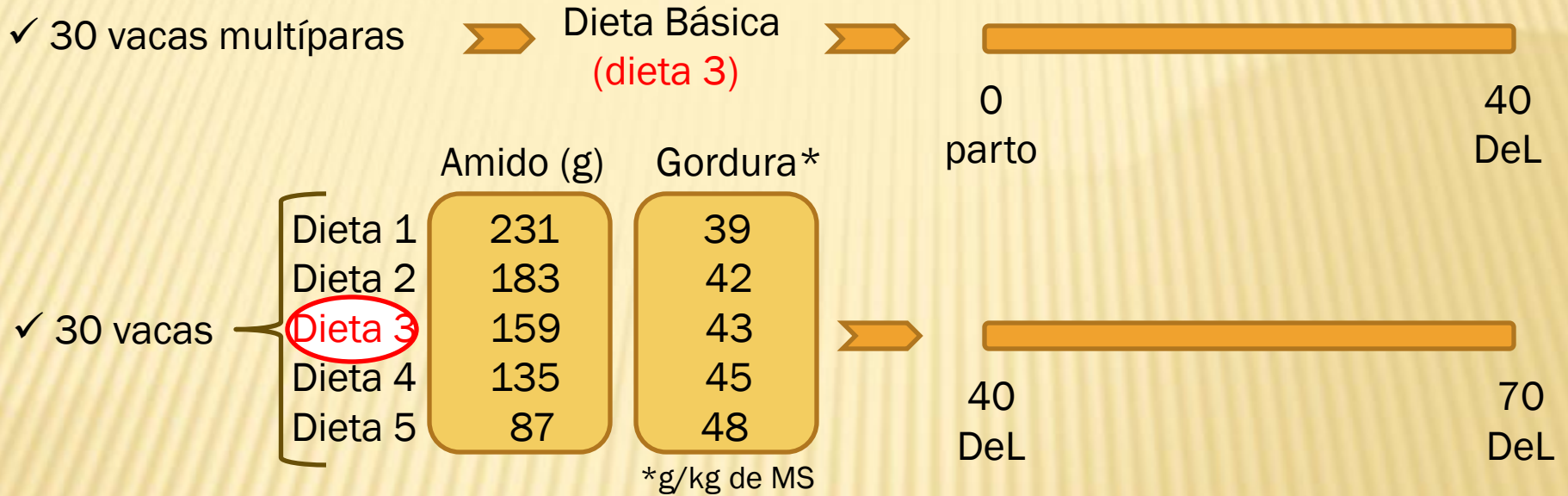
# OBJETIVO

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“....quantificar respostas hormonais e ovarianas do fornecimento de diferentes níveis de amido e gordura na dieta.”



# MATERIAL E MÉTODOS



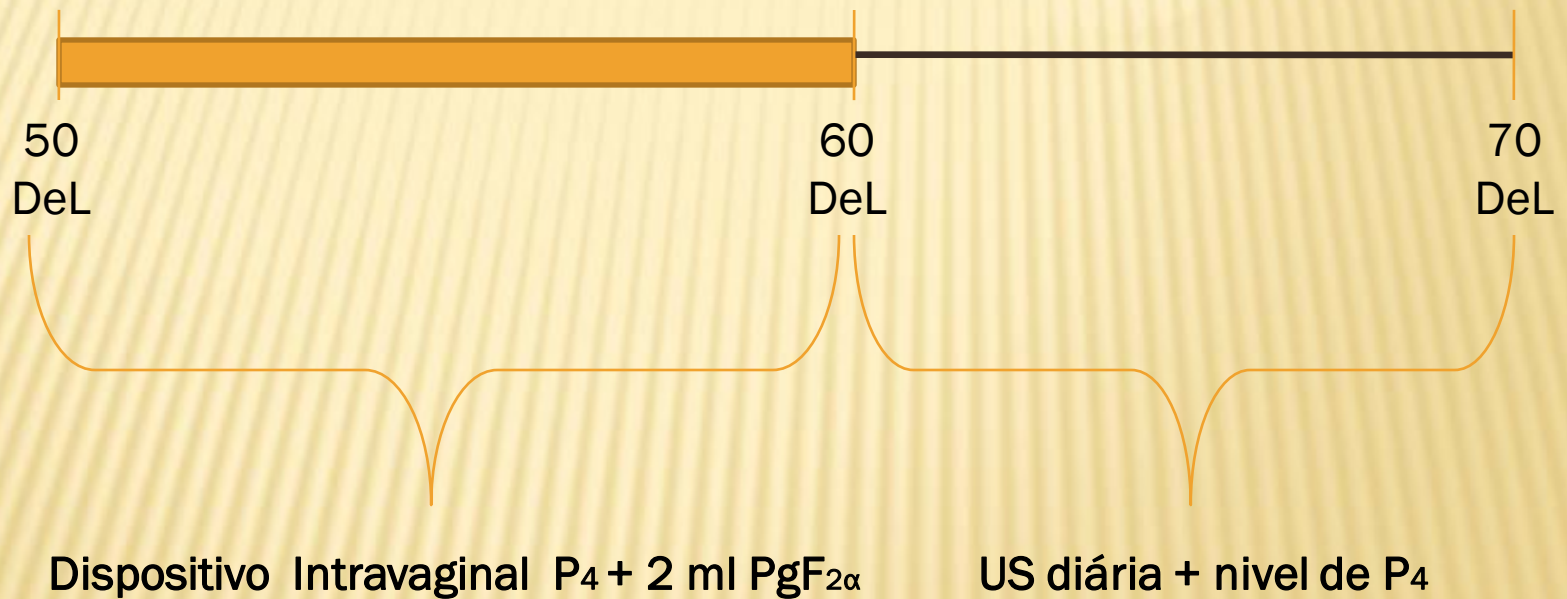
# MATERIAL E MÉTODOS

**Table 1.** Formulation and chemical composition of isoenergetic treatment diets varying from high starch (1) to high fat (5)

Formulation (g per kg of DM)	Diet				
	1	2	3	4	5
Grass <sup>1</sup> silage	334	334	334	334	334
Corn <sup>2</sup> silage	163	163	163	163	163
Brewers grains	55	55	55	55	55
Wheat	249	177	142	106	35
Fatty acid supplement <sup>3</sup>	8	13	15	18	23
Molassed sugar beet pulp	37	99	129	159	220
Soybean meal	78	81	83	85	88
Rapeseed meal	66	68	69	70	72
Minerals and vitamins <sup>4</sup>	6	6	6	6	6
Dicalcium phosphate	4	4	4	4	4
Total	1,000	1,000	1,000	1,000	1,000
Composition <sup>5</sup>					
DM (g/kg)	445	445	446	446	447
ME (MJ/kg of DM)	12.2	12.2	12.2	12.2	12.2
NDF (g/kg of DM)	301	317	324	332	347
Starch (g/kg of DM)	231	183	159	135	87
Rumen bypass starch (g/kg of DM)	84	66	55	49	32
Sugars (g/kg of DM)	58	72	79	86	100
Fat <sup>6</sup> (g/kg of DM)	39	42	43	45	48
CP (g/kg of DM)	181	181	181	181	181
Effective RDP <sup>5</sup> (g/kg of DM)	115	114	113	112	111
Digestible RUP <sup>7</sup> (g/kg of DM)	54	55	56	56	57

# MATERIAL E MÉTODOS

## Sincronização do Estro



# MATERIAL E MÉTODOS

Coletas:

Leite: dias 30 , 35; 60 à 70 DeL

Proteína

Gordura

Lactose

Sangue:

Dias 30 e 38

Linha base

Hormônios e metabólitos  
(IGF-I, GH, P4, glucagon,  
leptina e estradiol)

Dias 60 à 70

Diferentes dietas




# RESULTADOS E DISCUSSÕES

**Table 3.** Least squares means over 60 to 70 DIM, adjusted by covariance for values between 30 and 38 DIM, for plasma concentrations of metabolic hormones and metabolites in cows (n = 6) given diets varying from high starch (1) to high fat (5)

Item	Diet <sup>1</sup>					SED <sup>3</sup>	Contrasts <sup>2</sup>		
	1	2	3	4	5		Diet	Linear	Quadratic
Insulin (ng/mL)	0.40 <sup>a</sup>	0.39 <sup>a</sup>	0.38 <sup>ab</sup>	0.34 <sup>b</sup>	0.25 <sup>c</sup>	0.031	<0.001	<0.001	0.019
Glucagon (pg/mL)	102 <sup>a</sup>	108 <sup>a</sup>	108 <sup>a</sup>	115 <sup>b</sup>	119 <sup>b</sup>	5.6	0.037	0.002	0.833
Insulin:glucagon ratio	3.86 <sup>a</sup>	3.78 <sup>a</sup>	3.59 <sup>a</sup>	2.98 <sup>b</sup>	2.06 <sup>c</sup>	0.315	<0.001	<0.001	0.018
IGF-I (ng/mL)	110	71	116	88	102	21.3	0.256	0.921	0.261
Growth hormone (ng/mL)	7.96	7.26	7.86	7.28	7.01	1.474	0.957	0.548	0.989
Leptin (ng/mL)	1.27	1.29	1.43	1.04	1.16	0.174	0.274	0.327	0.609
Albumin (g/L)	34.8	34.4	37.1	36.3	37.4	1.65	0.302	0.082	0.980
Globulin (g/L)	36.3	35.3	36.4	35.1	37.7	1.79	0.616	0.495	0.255
Total protein (g/L)	71	70	73	72	75	3.01	0.446	0.166	0.382
Urea-N (mmol/L)	3.69 <sup>a</sup>	3.01 <sup>b</sup>	2.94 <sup>b</sup>	2.95 <sup>b</sup>	2.75 <sup>b</sup>	0.186	<0.001	<0.001	0.033
BHBA (mmol/L)	0.67	0.70	0.78	1.24	1.15	0.280	0.136	0.027	0.980
NEFA (mmol/L)	0.19 <sup>a</sup>	0.18 <sup>a</sup>	0.19 <sup>a</sup>	0.28 <sup>b</sup>	0.32 <sup>b</sup>	0.039	0.004	<0.001	0.149
Glucose (mmol/L)	3.4	3.6	3.6	3.5	3.4	0.15	0.280	0.672	0.046
Phosphorus (mmol/L)	1.42	1.51	1.55	1.41	1.51	0.120	0.748	0.729	0.759
Magnesium (mmol/L)	1.00	0.90	0.94	0.99	0.97	0.037	0.083	0.769	0.114

<sup>a-c</sup>Means in the same row without a common superscript differ ( $P < 0.05$ ).

 Variação significativa

 Variação não significativa

Dieta 3 = 159g Amido e 43 gordura/kg MS

# RESULTADOS E DISCUSSOES

## Hormônios e Metabólitos:



O que se espera da relação Insulina/glucagon???

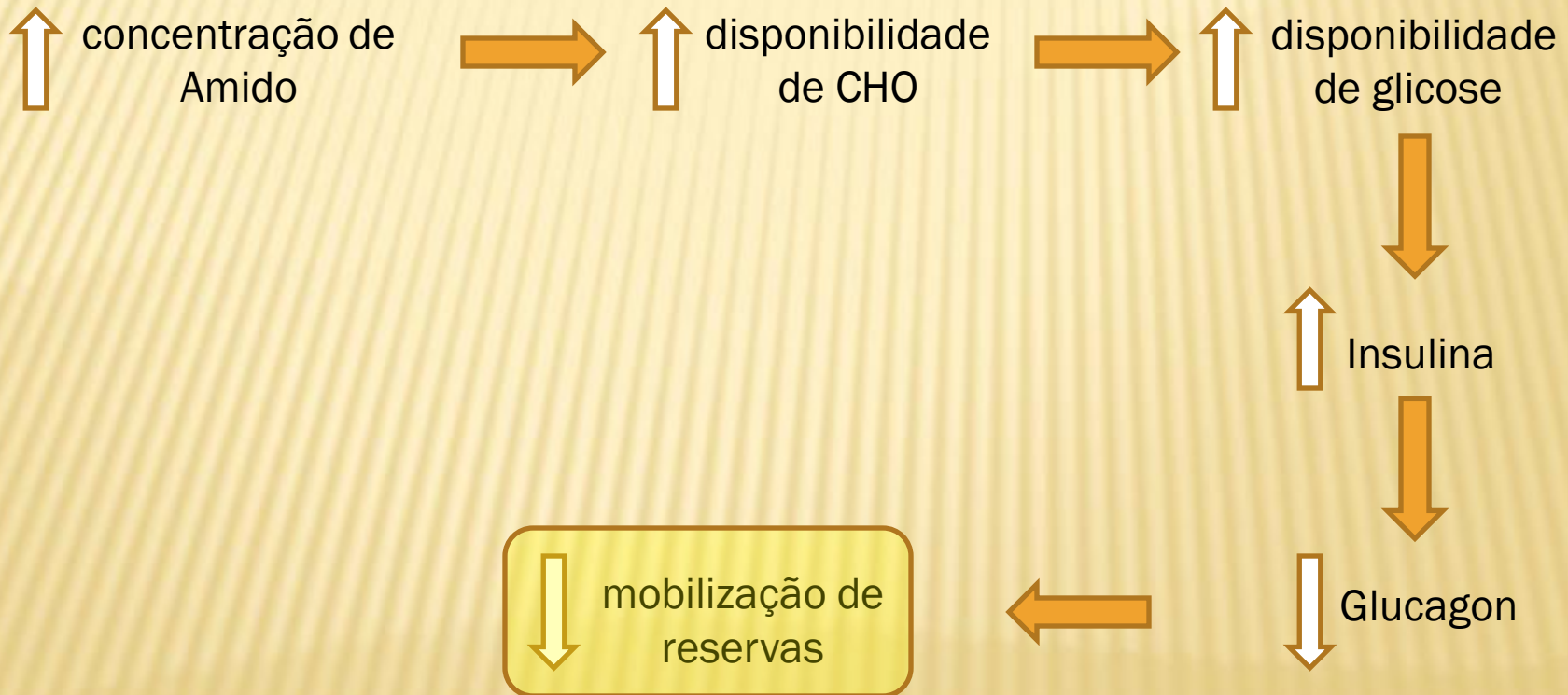
Positiva para Insulina

Qual o fator que determina esse resultado???

Teor de amido

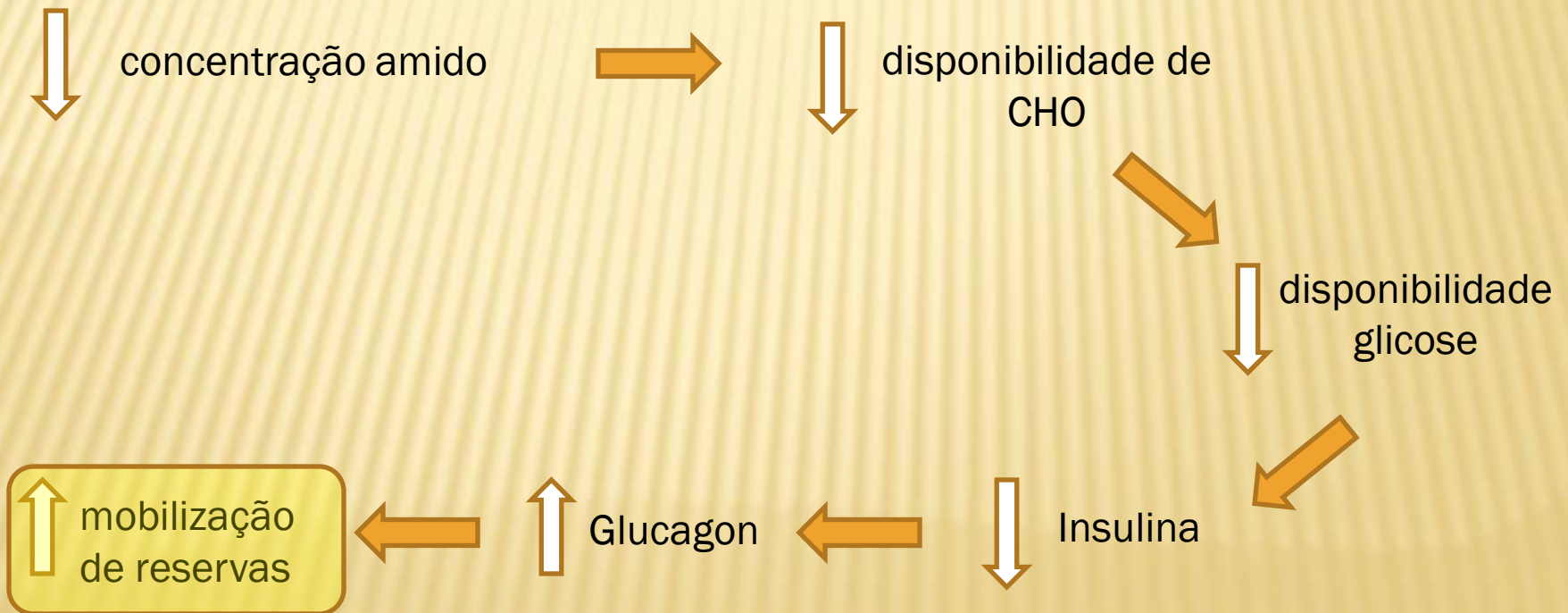
# RESULTADOS E DISCUSSOES

## Relação Insulina/Glucagon +



# RESULTADOS E DISCUSSOES

## Relação Insulina/ Glucagon —





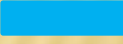
# RESULTADOS E DISCUSSÕES

**Table 4.** Treatment means<sup>1</sup> relative to a synchronized estrus at around 60 DIM for plasma concentrations of estradiol before ovulation and progesterone from d 3 to 5 postovulation, as well as follicle numbers, ovulatory follicle diameter, and corpus luteum (CL) diameter in cows (n = 6) given diets varying from high starch (1) to high fat (5)

Item	Diet <sup>2</sup>					SED <sup>3</sup>	P-value <sup>4</sup>
	1	2	3	4	5		
Progesterone (ng/mL)	2.7 <sup>a</sup>	5.9 <sup>b</sup>	4.2 <sup>ab</sup>	5.6 <sup>b</sup>	4.3 <sup>ab</sup>	1.26	0.043
Estradiol (pg/mL)	1.3	1.4	1.1	1.2	1.3	0.26	0.988
Maximum small (<5 mm) follicles preovulation	13.0 <sup>a</sup>	15.7 <sup>a</sup>	11.8 <sup>ab</sup>	8.0 <sup>b</sup>	8.7 <sup>b</sup>	2.03	<0.001
Maximum small (<5 mm) follicles postovulation	14.2 <sup>ab</sup>	17.2 <sup>a</sup>	11.8 <sup>b</sup>	9.5 <sup>c</sup>	11.5 <sup>bc</sup>	2.14	0.004
Maximum medium-sized (5 to 10 mm) follicles postovulation	2.6 <sup>a</sup>	3.5 <sup>a</sup>	6.0 <sup>b</sup>	4.2 <sup>ab</sup>	4.8 <sup>ab</sup>	1.23	0.044
Ovulatory follicle diameter (mm)	19	26	24	23	22	2.7	0.109
CL diameter <sup>5</sup> (mm)	26 <sup>a</sup>	32 <sup>b</sup>	26 <sup>a</sup>	29 <sup>ab</sup>	28 <sup>ab</sup>	3.1	0.041

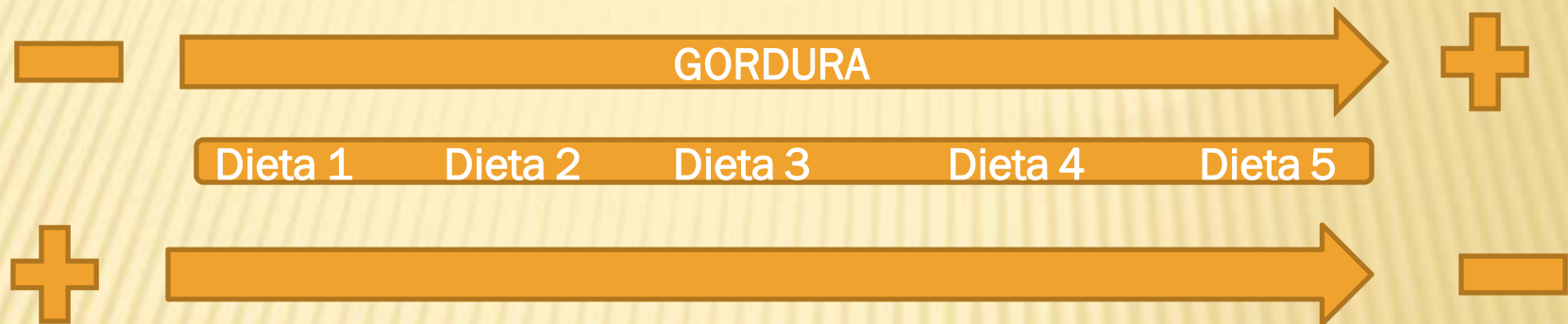
<sup>a-c</sup>Means in the same row without a common superscript differ ( $P < 0.05$ )

 Variação significativa

 Variação não significativa

# RESULTADOS E DISCUSSÕES

Hormônios e Metabólitos:



*O que esses resultados nos sugerem???*

*O aumento de gordura da dieta estimulou o crescimento dos folículos*

# RESULTADOS E DISCUSSÕES

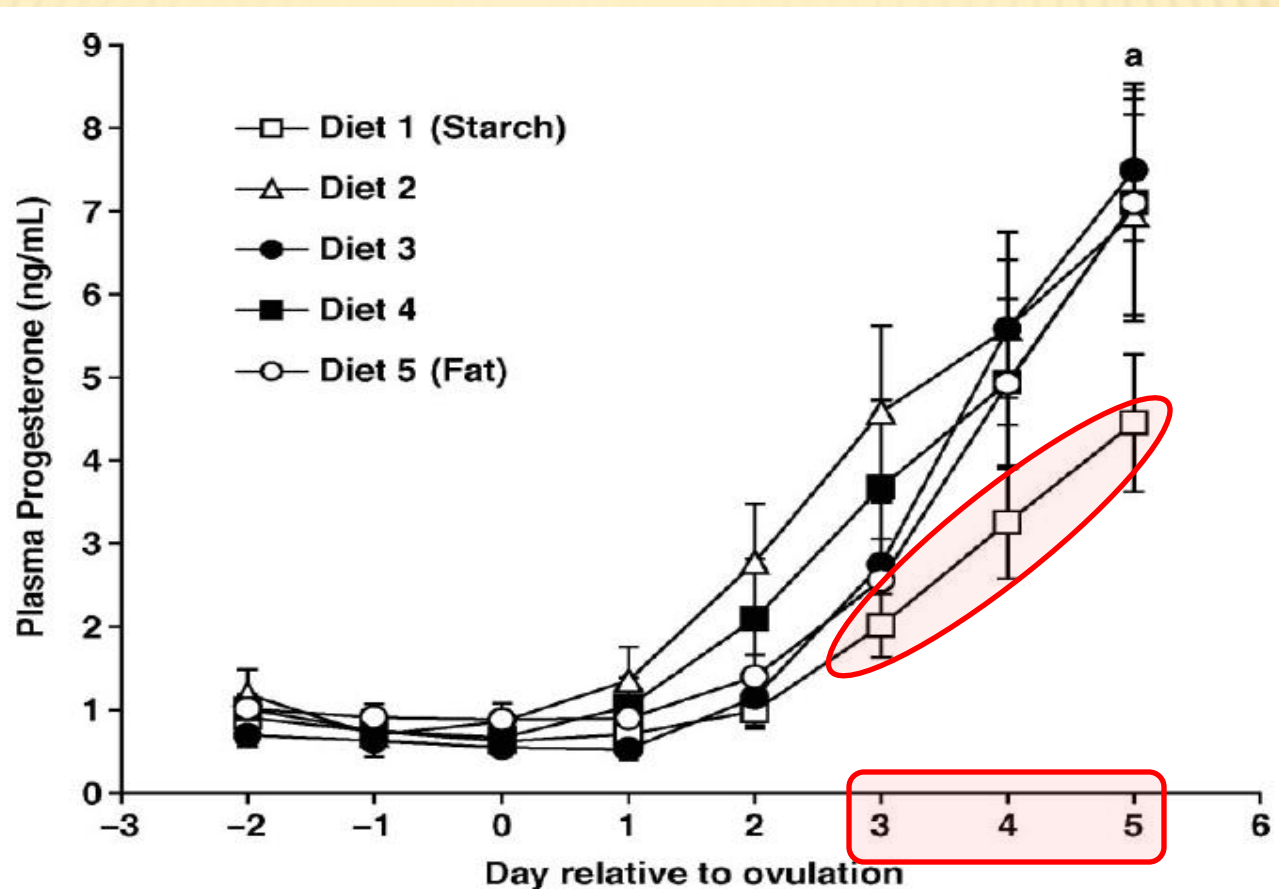
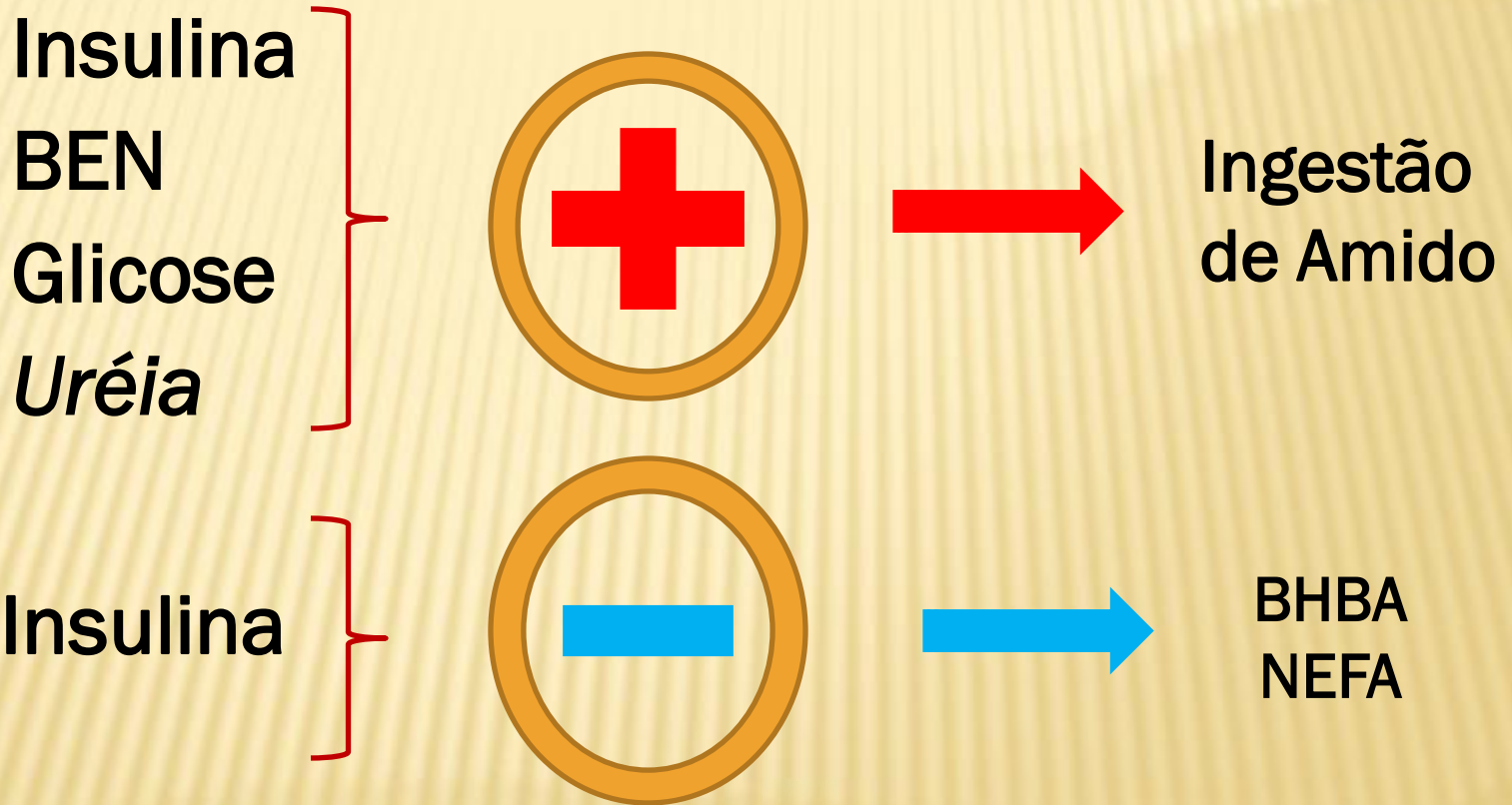


Figure 1. Mean plasma concentrations of progesterone in groups (n = 6 per group) of lactating Holstein-Friesian cows fed diets varying from high starch (1) to high fat (5). Cycles were synchronized and data then aligned to day of ovulation. Diets 1 to 5 contained 231, 183, 159, 135, and 87 g of starch and 39, 42, 43, 45, and 48 g of fat/kg of DM, respectively. <sup>a</sup>Mean progesterone was lower ( $P = 0.039$ ) for diet 1 than for the other diets on d 5.

# RESULTADOS E DISCUSSÕES

## Relação entre as variáveis





# CONCLUSÃO

## ✓ Relação Insulina/Glucagon

dieta ideal seria  $> 159\text{g}$  amido e  $< 44\text{g/kgMs}$



Dieta 1

Dieta 2

## ✓ Relação aos Parâmetros Reprodutivos



Dieta 2

Dieta 4

Dieta 5

A Melhor associação entre Variáveis Metabólicas e Reprodutivas

**Dieta 2: 183g Amido e 42g de gordura/kg MS**

**OBRIGADO PELA ATENÇÃO!!**

