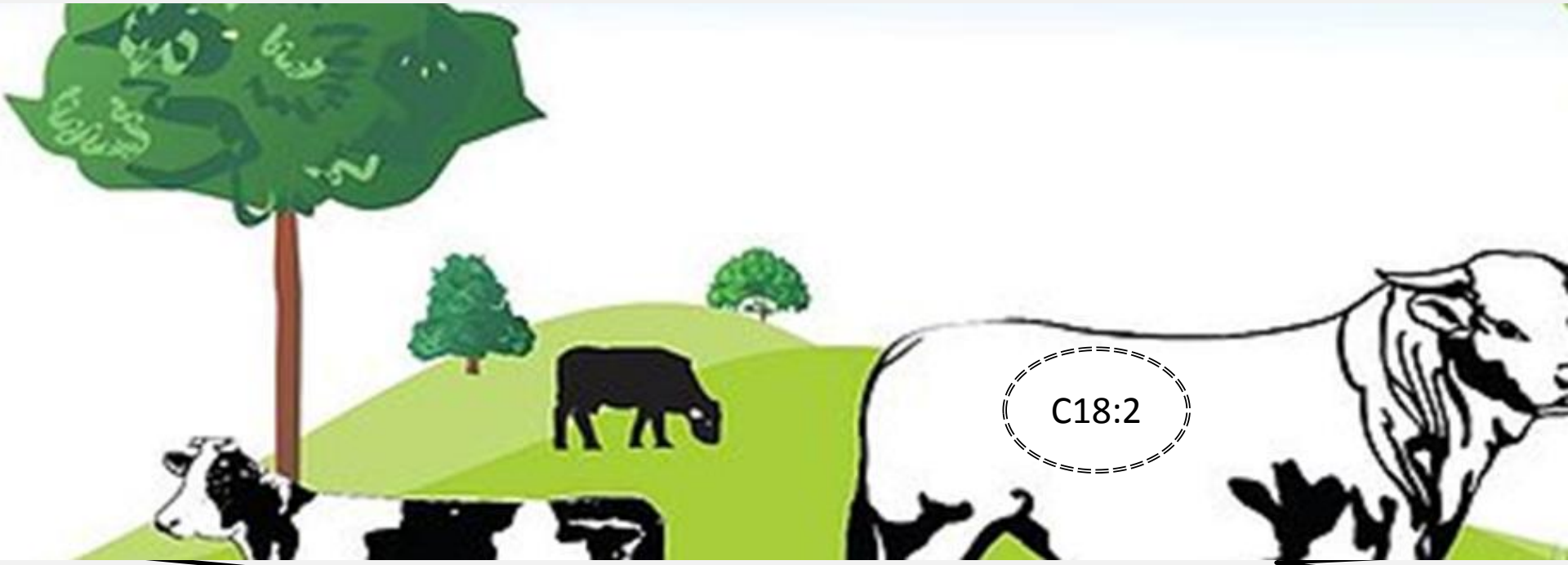
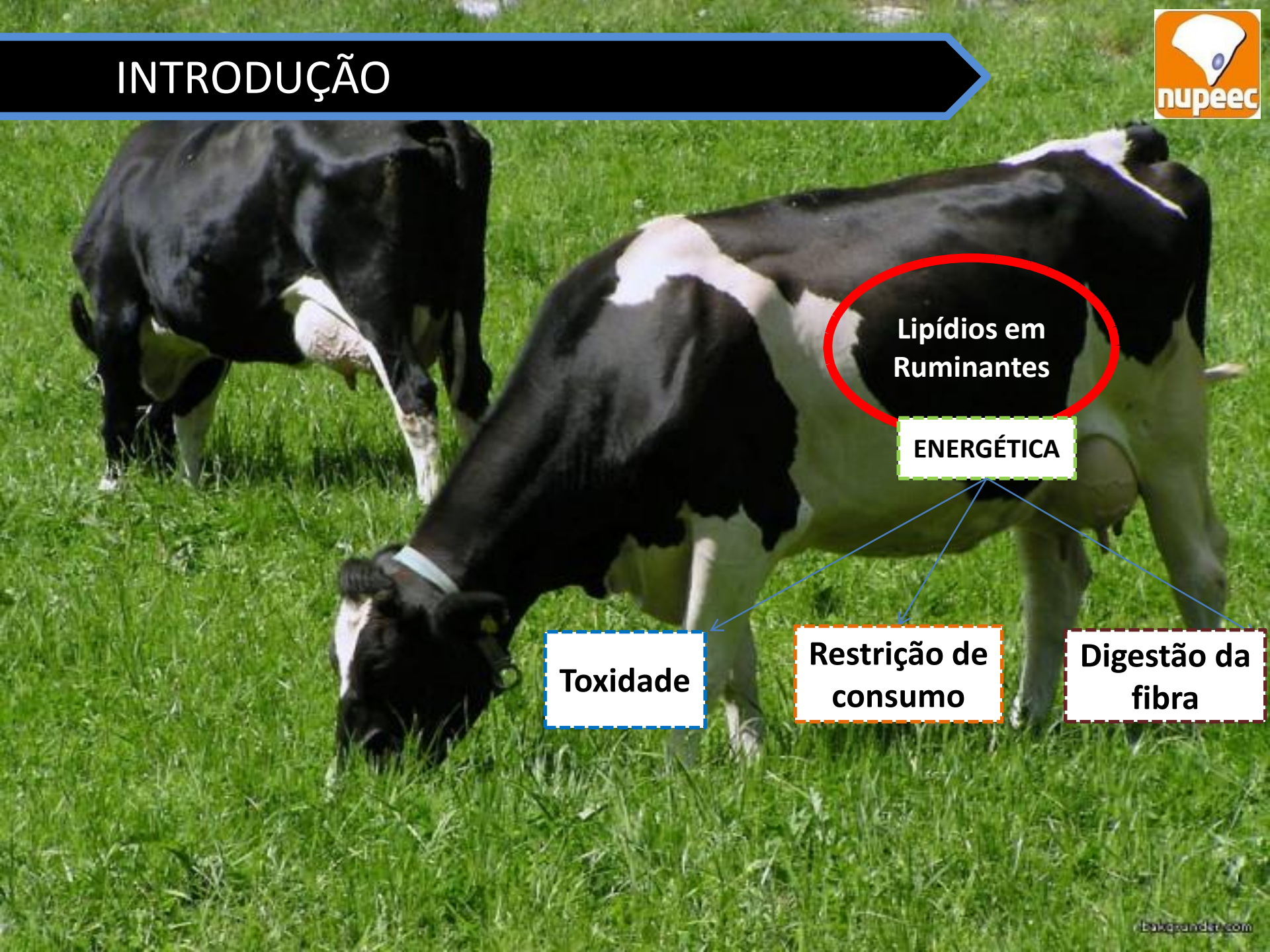
Efeito da utilização de ácidos graxos poli-insaturados sobre o metabolismo, reprodução, produção e composição do leite de ruminantes

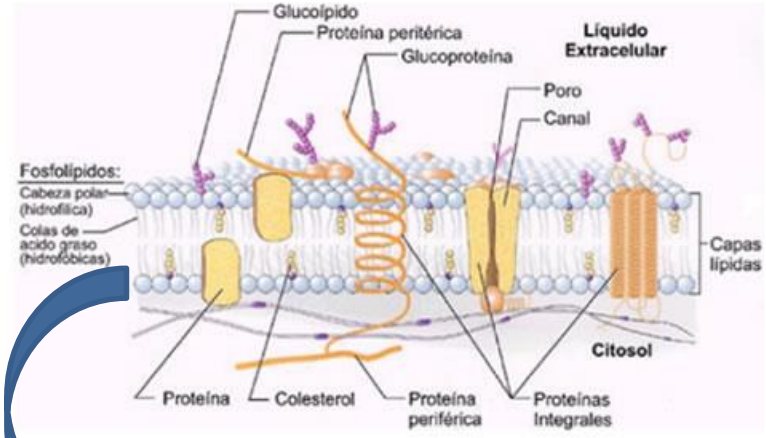


Evandro Schmoeller, Ana Paula Schmidt, Udson G. S. Gonçalves
Orientador: Francisco Del Pino, Eduardo Schmitt

INTRODUÇÃO


Lipídios em Ruminantes
ENERGÉTICA
Toxidade
Restrição de consumo
Digestão da fibra

INTRODUÇÃO



Ácidos graxos ômega 3

Metabolizado

EPA e DHA

COX

LOX

PGG3

TXB3 TXA3

5-HPETE

PGH3

PGI3 PGF3 PGD3 PGE3

LTA5 LTB5 LTC5 LTD5 LTE5

RESULTADOS

J. Dairy Sci. 98:602–617
http://dx.doi.org/10.3168/jds.2014-8805

Effects of altering the ratio of dietary n-6 to n-3 fatty acids on performance and inflammatory responses to a lipopolysaccharide challenge in lactating Holstein cows

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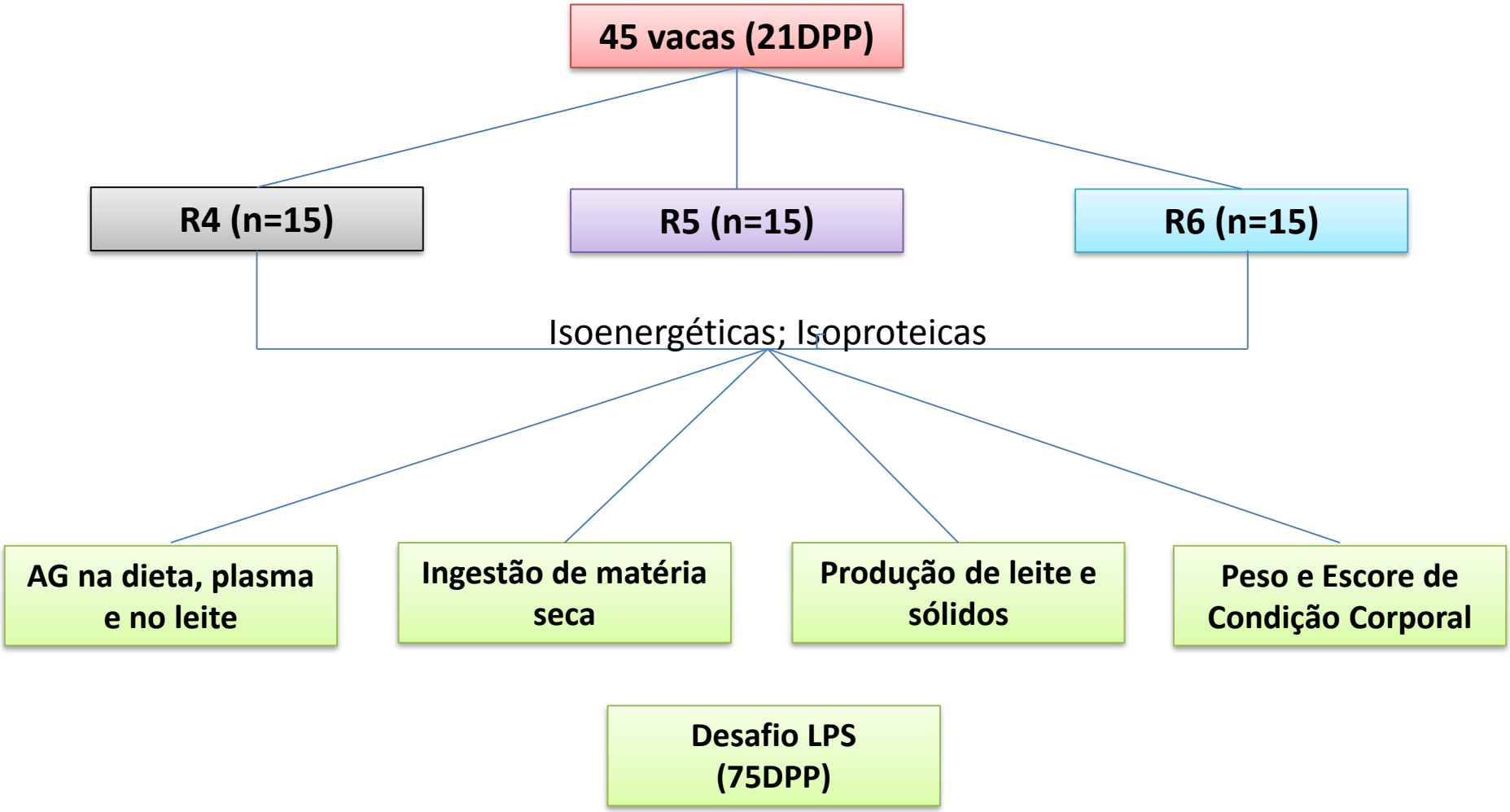
O objetivo deste estudo foi avaliar os efeitos da alteração da relação entre os ácidos graxos n-6 e n-3 (AG) na dieta e a ingestão desses AG por vacas leiteiras em lactação sobre o desempenho da lactação e respostas de fase aguda inflamatória a um desafio com Lipopolissacárido (LPS).

MATERIAIS E MÉTODOS



RESULTADOS

Tabela 2. Composição de ácidos graxos das dietas (média ± DP)

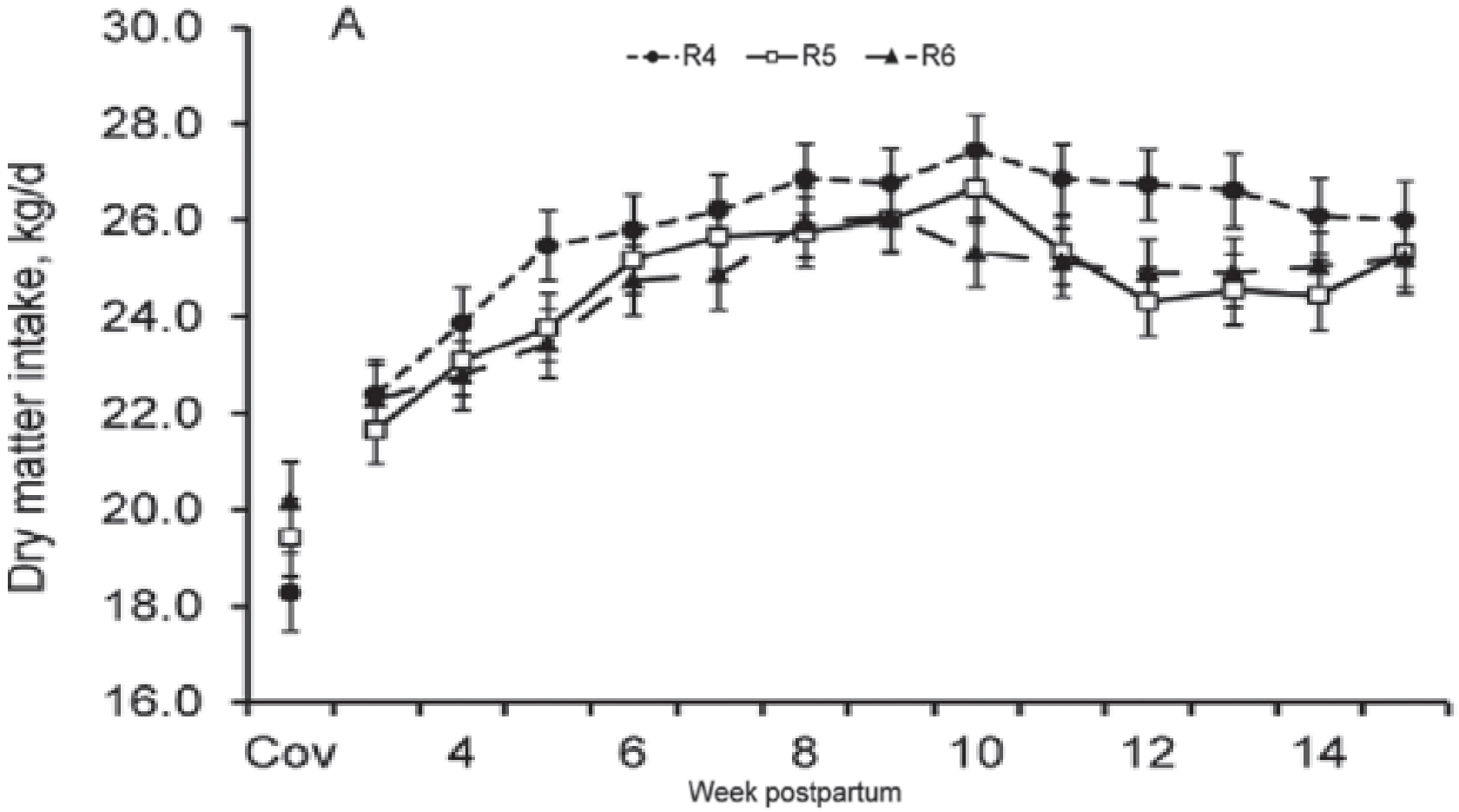
	Treatment[1]		
FA, % of DM	R4	R5	R6
C12:0	0.006 ± 0.017	0.006 ± 0.015	0.006 ± 0.015
C14:0	0.053 ± 0.059	0.045 ± 0.037	0.030 ± 0.037
C15:0	0.006 ± 0.041	0.006 ± 0.040	0.005 ± 0.040
C16:0	0.820 ± 0.531	0.824 ± 0.418	0.776 ± 0.451
C16:1 *cis*-9	0.050 ± 0.053	0.042 ± 0.034	0.027 ± 0.036
C17:0	0.009 ± 0.016	0.009 ± 0.015	0.008 ± 0.015
C18:0	0.135 ± 0.120	0.133 ± 0.114	0.127 ± 0.116
C18:1 *cis*-9	0.708 ± 0.184	0.762 ± 0.174	0.785 ± 0.194
C18:2 *cis*-9,*cis*-12	1.250 ± 0.838	1.431 ± 0.653	1.580 ± 0.670
C18:3 *cis*-9,*cis*-12,*cis*-15	0.238 ± 0.181	0.228 ± 0.163	0.229 ± 0.163
C20:0	0.015 ± 0.026	0.018 ± 0.016	0.018 ± 0.015
C20:3 *cis*-8,*cis*-11,*cis*-14	0.001 ± 0.001	ND[2]	ND
C20:3 *cis*-11,*cis*-14,*cis*-17	0.001 ± 0.003	0.001 ± 0.001	ND
C20:4 *cis*-5,*cis*-8,*cis*-11,*cis*-14	0.004 ± 0.007	0.003 ± 0.007	0.002 ± 0.007
C20:5 *cis*-5,*cis*-8,*cis*-11,*cis*-14,*cis*-17	0.051 ± 0.007	0.040 ± 0.011	0.023 ± 0.008
C22:4 *cis*-7,*cis*-10,*cis*-13,*cis*-16	0.005 ± 0.019	0.005 ± 0.019	0.005 ± 0.019
C22:5 *cis*-7,*cis*-10,*cis*-13,*cis*-16,*cis*-19	0.009 ± 0.002	0.007 ± 0.001	0.004 ± 0.001
C22:6 *cis*-4,*cis*-7,*cis*-10,*cis*-13,*cis*-16,*cis*-19	0.028 ± 0.006	0.022 ± 0.009	0.013 ± 0.005
Others	0.275 ± 0.524	0.225 ± 0.517	0.241 ± 0.592
n-6 total	1.260 ± 0.10	1.447 ± 0.08	1.587 ± 0.08
n-3 total	0.327 ± 0.01	0.298 ± 0.01	0.269 ± 0.01
Ratio of n-6 to n-3	3.9	4.9	5.9

ND: não detectado

RESULTADOS

Tabela 3. Efeito da alteração da razão dietética de FA n-6 a n-3 na ingestão, desempenho de lactação e balanço energético

	Treatment[1]				*P*-value[2]	
Item	R4	R5	R6	SEM	Trt	Trt × Wk
DMI, kg/d	26.1[a]	24.6[b]	24.7[b]	0.5	0.07	0.46



RESULTADOS

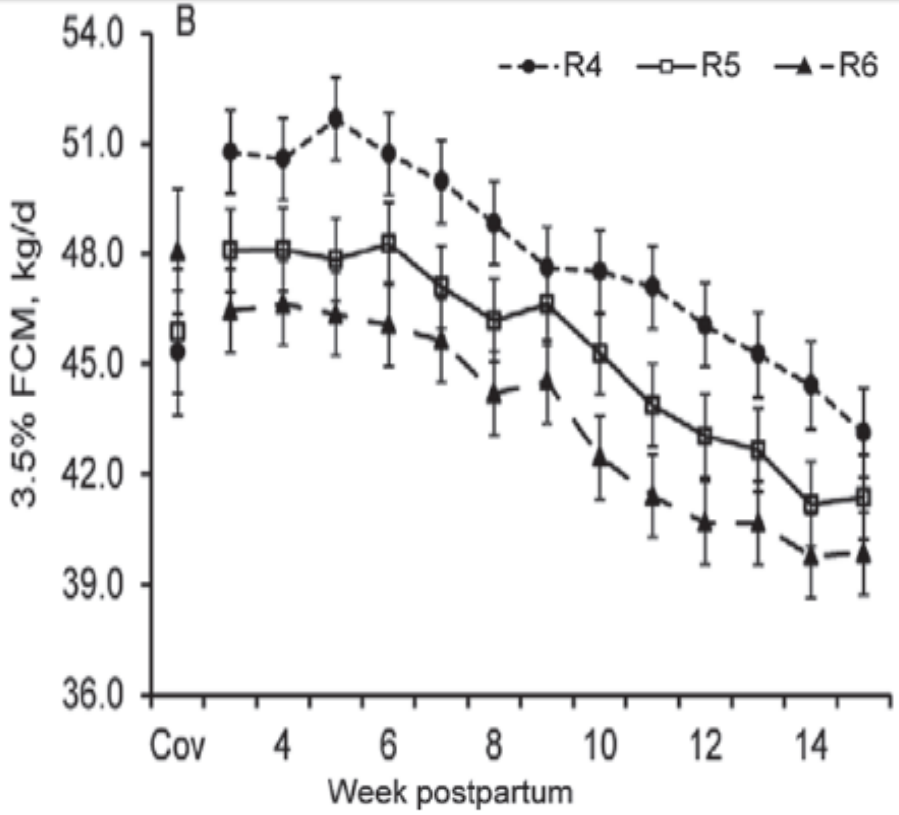
Tabela 3. Efeito da alteração da razão dietética de FA n-6 a n-3 na ingestão, desempenho de lactação e balanço energético

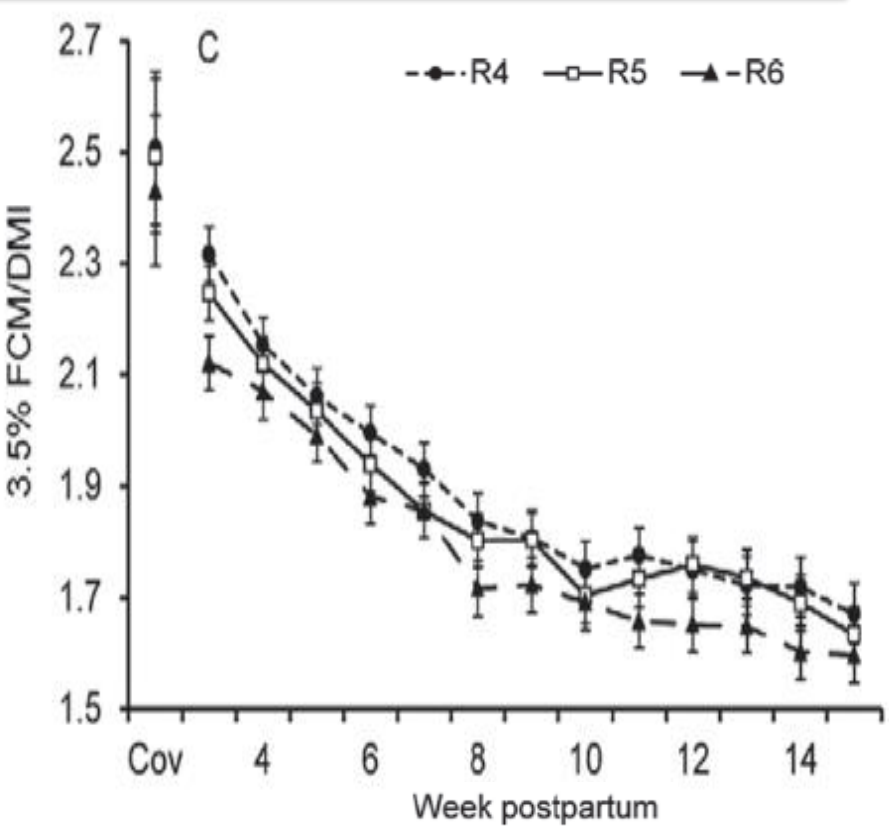
	Treatment[1]				*P*-value[2]	
Item	R4	R5	R6	SEM	Trt	Trt × Wk
DMI, kg/d	26.1^{a}	24.6^{b}	24.7^{b}	0.5	0.07	0.46
FA intake,[3] g/d	931.5	952.9	975.0	24.1	0.45	0.46
Linoleic	298.1^{c}	329.5^{b}	369.4^{a}	8.6	<0.001	0.50
EPA + DHA	21.3^{a}	14.9^{b}	10.0^{c}	0.3	<0.001	0.44
Total n-6	300.6^{c}	332.0^{b}	371.9^{a}	8.6	<0.001	0.50
Total n-3	77.3^{a}	67.3^{b,x}	62.8^{b,y}	1.7	<0.001	0.38
Milk, kg/d	46.8^{a,x}	44.8^{y}	43.2^{b}	0.7	<0.01	0.66
3.5% FCM	48.0^{a}	45.4^{b,x}	43.4^{b,y}	0.8	<0.01	0.79
3.5% FCM/DMI	1.86^{x}	1.87^{x}	1.78^{y}	0.03	0.08	0.95
Milk fat						
%	3.64	3.58	3.54	0.05	0.42	0.17
kg/d	1.71^{a}	1.60^{b}	1.53^{c}	0.03	<0.01	0.73
Milk true protein						
%	2.82	2.86	2.86	0.02	0.23	0.99
kg/d	1.32^{a}	1.28^{ab}	1.24^{b}	0.02	0.03	0.78
Lactose						
%	4.90	4.88	4.88	0.01	0.37	0.83
kg/d	2.29^{a,x}	2.19^{y}	2.12^{b}	0.04	0.01	0.53
Net energy (NE) of milk[4]						
Mcal/kg	0.69	0.69	0.68	0.01	0.68	0.15
Mcal/d	32.3^{a}	30.8^{b}	29.5^{b}	0.6	<0.01	0.82
% of NE intake	78.0^{a}	78.6^{a}	74.4^{b}	1.3	0.04	0.94
Energy balance, Mcal/d	−1.22^{b}	−0.79^{y}	1.03^{a,x}	0.69	0.06	0.81

RESULTADOS

Tabela 3. Efeito da alteração da razão dietética de FA n-6 a n-3 na ingestão, desempenho de lactação e balanço energético

	Treatment[1]				*P*-value[2]	
Item	R4	R5	R6	SEM	Trt	Trt × Wk
Milk, kg/d	$46.8^{a,x}$	44.8^{y}	43.2^{b}	0.7	<0.01	0.66
3.5% FCM	48.0^{a}	$45.4^{b,x}$	$43.4^{b,y}$	0.8	<0.01	0.79
3.5% FCM/DMI	1.86^{x}	1.87^{x}	1.78^{y}	0.03	0.08	0.95





RESULTADOS

Tabela 3. Efeito da alteração da razão dietética de FA n-6 a n-3 na ingestão, desempenho de lactação e balanço energético

	Treatment[1]				*P*-value[2]	
Item	R4	R5	R6	SEM	Trt	Trt × Wk
DMI, kg/d	26.1[a]	24.6[b]	24.7[b]	0.5	0.07	0.46
FA intake,[3] g/d	931.5	952.9	975.0	24.1	0.45	0.46
Linoleic	298.1[c]	329.5[b]	369.4[a]	8.6	<0.001	0.50
EPA + DHA	21.3[a]	14.9[b]	10.0[c]	0.3	<0.001	0.44
Total n-6	300.6[c]	332.0[b]	371.9[a]	8.6	<0.001	0.50
Total n-3	77.3[a]	67.3[b,x]	62.8[b,y]	1.7	<0.001	0.38
Milk, kg/d	46.8[a,x]	44.8[y]	43.2[b]	0.7	<0.01	0.66
3.5% FCM	48.0[a]	45.4[b,x]	43.4[b,y]	0.8	<0.01	0.79
3.5% FCM/DMI	1.86[x]	1.87[x]	1.78[y]	0.03	0.08	0.95
Milk fat						
%	3.64	3.58	3.54	0.05	0.42	0.17
kg/d	1.71[a]	1.60[b]	1.53[c]	0.03	<0.01	0.73
Milk true protein						
%	2.82	2.86	2.86	0.02	0.23	0.99
kg/d	1.32[a]	1.28[ab]	1.24[b]	0.02	0.03	0.78
Lactose						
%	4.90	4.88	4.88	0.01	0.37	0.83
kg/d	2.29[a,x]	2.19[y]	2.12[b]	0.04	0.01	0.53
Net energy (NE) of milk[4]						
Mcal/kg	0.69	0.69	0.68	0.01	0.68	0.15
Mcal/d	32.3[a]	30.8[b]	29.5[b]	0.6	<0.01	0.82
% of NE intake	78.0[a]	78.6[a]	74.4[b]	1.3	0.04	0.94
Energy balance, Mcal/d	−1.22[b]	−0.79[y]	1.03[a,x]	0.69	0.06	0.81

RESULTADOS

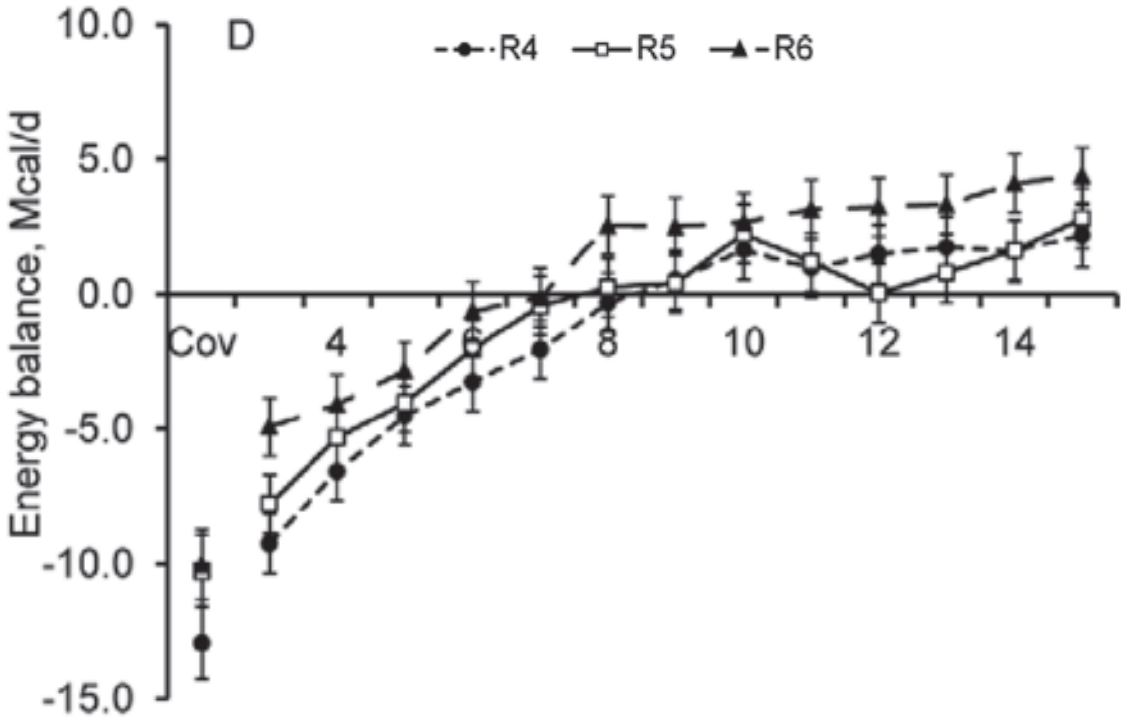
Tabela 3. Efeito da alteração da razão dietética de FA n-6 a n-3 na ingestão, desempenho de lactação e balanço energético

	Treatment[1]				*P*-value[2]	
Item	R4	R5	R6	SEM	Trt	Trt × Wk
DMI, kg/d	26.1[a]	24.6[b]	24.7[b]	0.5	0.07	0.46
FA intake,[3] g/d	931.5	952.9	975.0	24.1	0.45	0.46
Linoleic	298.1[c]	329.5[b]	369.4[a]	8.6	<0.001	0.50
EPA + DHA	21.3[a]	14.9[b]	10.0[c]	0.3	<0.001	0.44
Total n-6	300.6[c]	332.0[b]	371.9[a]	8.6	<0.001	0.50
Total n-3	77.3[a]	67.3[b,x]	62.8[b,y]	1.7	<0.001	0.38
Milk, kg/d	46.8[a,x]	44.8[y]	43.2[b]	0.7	<0.01	0.66
3.5% FCM	48.0[a]	45.4[b,x]	43.4[b,y]	0.8	<0.01	0.79
3.5% FCM/DMI	1.86[x]	1.87[x]	1.78[y]	0.03	0.08	0.95
Milk fat						
%	3.64	3.58	3.54	0.05	0.42	0.17
kg/d	1.71[a]	1.60[b]	1.53[c]	0.03	<0.01	0.73
Milk true protein						
%	2.82	2.86	2.86	0.02	0.23	0.99
kg/d	1.32[a]	1.28[ab]	1.24[b]	0.02	0.03	0.78
Lactose						
%	4.90	4.88	4.88	0.01	0.37	0.83
kg/d	2.29[a,x]	2.19[y]	2.12[b]	0.04	0.01	0.53
Net energy (NE) of milk[4]						
Mcal/kg	0.69	0.69	0.68	0.01	0.68	0.15
Mcal/d	32.3[a]	30.8[b]	29.5[b]	0.6	<0.01	0.82
% of NE intake	78.0[a]	78.6[a]	74.4[b]	1.3	0.04	0.94
Energy balance, Mcal/d	−1.22[b]	−0.79[y]	1.03[a,x]	0.69	0.06	0.81

RESULTADOS

Tabela 3. Efeito da alteração da razão dietética de FA n-6 a n-3 na ingestão, desempenho de lactação e balanço energético

Item	Treatment[1]			SEM	*P*-value[2]	
	R4	R5	R6		Trt	Trt × Wk
Energy balance, Mcal/d	−1.22[b]	−0.79[y]	1.03[a,x]	0.69	0.06	0.81
Linoleic	298.1[c]	329.5[b]	369.4[a]	8.6	<0.001	0.50
EPA + DHA					01	0.44
Total n-6					01	0.50
Total n-3					01	0.38
Milk, kg/d						0.66
3.5% FCM						0.79
3.5% FCM/DMI						0.95
Milk fat						
%					2	0.17
kg/d						0.73
Milk true protein						
%						0.99
kg/d						0.78
Lactose						
%					7	0.83
kg/d						0.53
Net energy (NE)						
Mcal/kg						0.15
Mcal/d						0.82
% of NE intake	78.0[a]		4.4[b]	1.3	0.04	0.94
Energy balance, Mcal/d	−1.22[b]	−0.79	1.03[a,x]	0.69	0.06	0.81



RESULTADOS

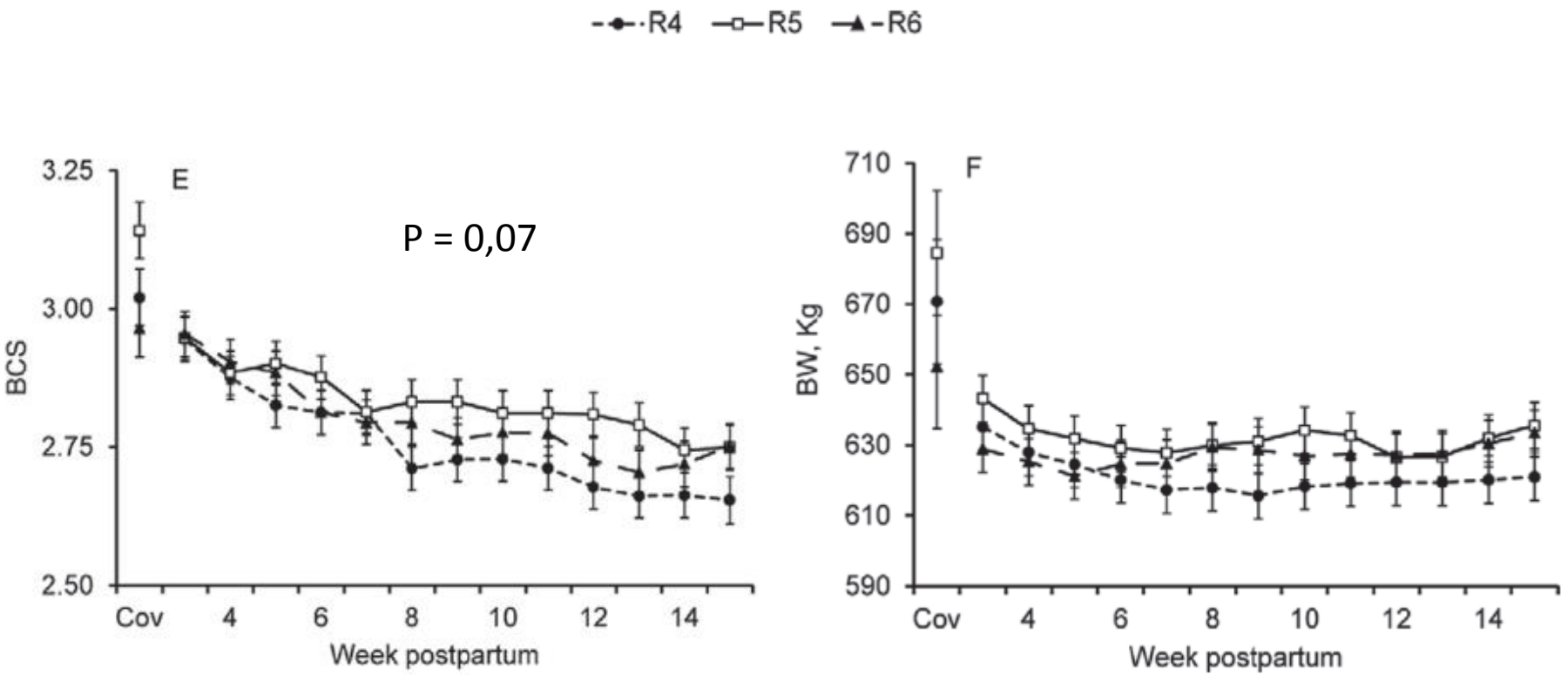


Figura 1. Avaliação de Escore de condição corporal e peso em vacas Vacas holandês alimentadas com dietas de 3,9 a 1 (R 4), 4,9 a 1 (R 5), ou 5,9 a 1 (R 6) proporções de n-6 a n-3 FA. Cov = valor de covariável medido entre 6 e 10 DIM.

RESULTADOS

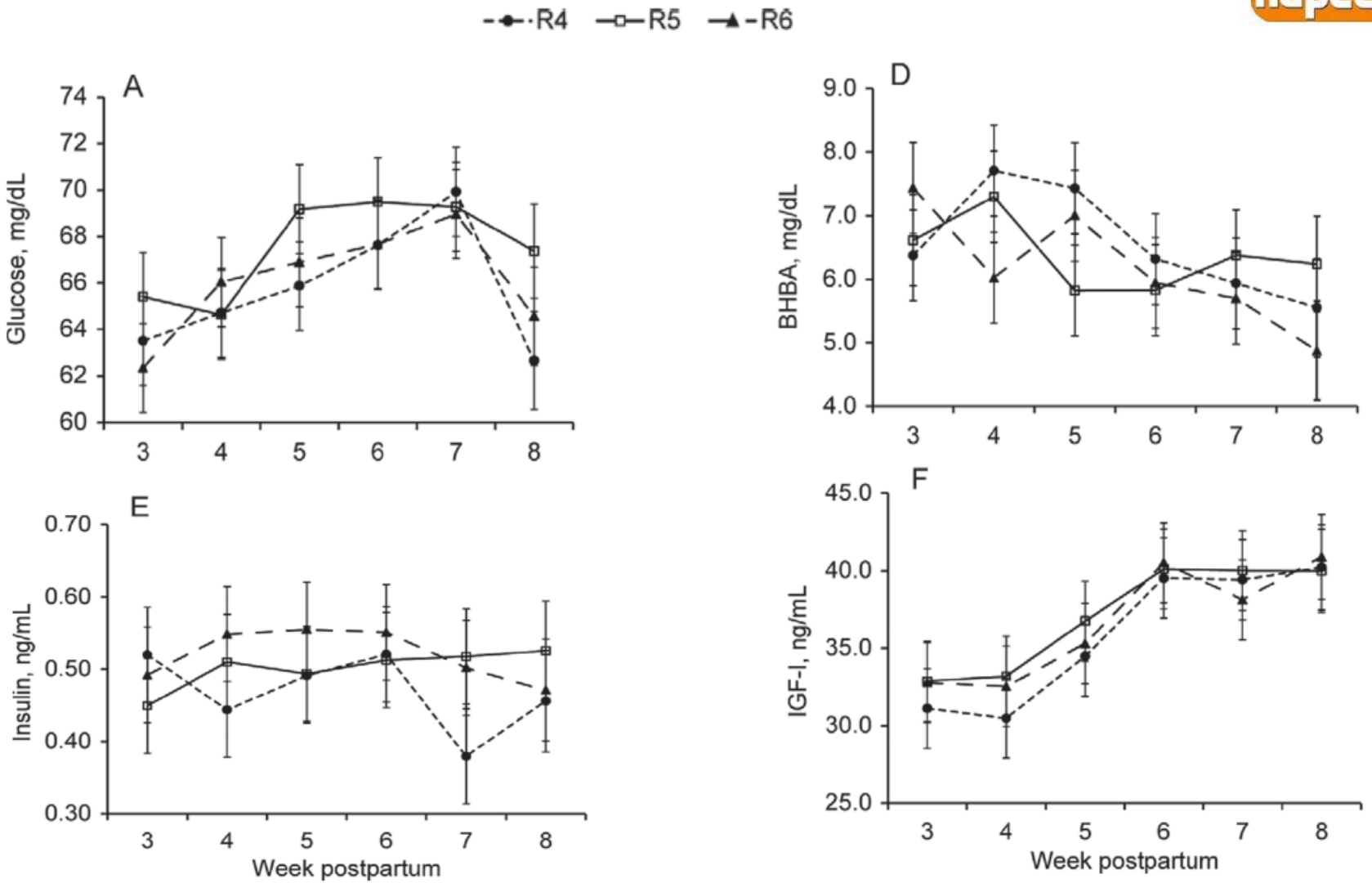


Figura 2: Concentrações de glicose, BHBA, Insulina e IGF-1 no plasma de vacas holândes lactantes alimentadas com dietas de 3,9 a 1 (R 4), 4,9 a 1 (R 5) ou 5,9 a 1 (R 6) de n-6 a n-3.

RESULTADOS

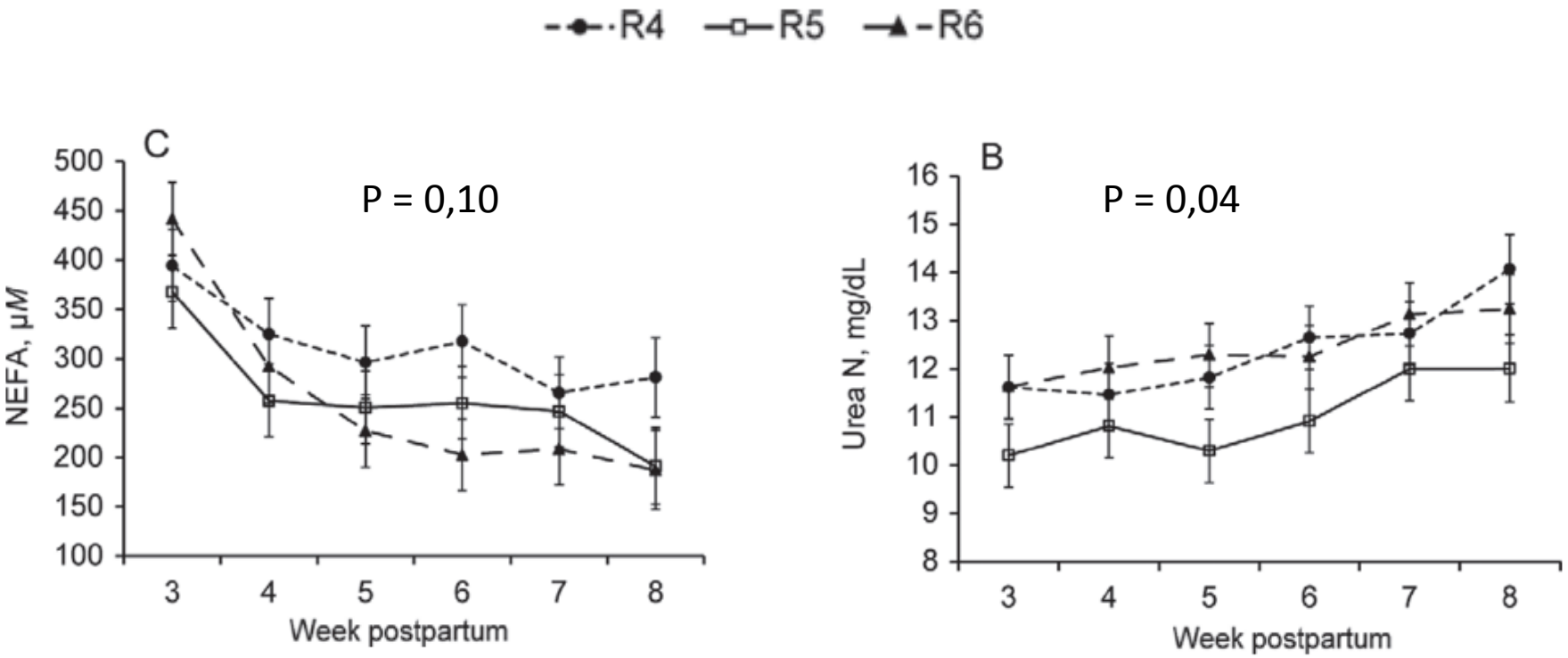


Figura 2: Concentrações de NEFA e uréia no plasma de vacas holândes lactantes alimentadas com dietas de 3,9 a 1 (R 4), 4,9 a 1 (R 5) ou 5,9 a 1 (R 6) de n-6 a n-3.

RESULTADOS

Tabela 4. Efeito da alteração da proporção de acidos graxos dietético n-6 n-3 no perfil de acidos graxos plasmático

	Treatment[1]				
FA, g/100 g of FA	R4	R5	R6	SEM	*P*-value
C8:0	0.01	0.01	0.01	0.01	0.93
C10:0	0.02	0.02	0.03	0.01	0.30
C12:0	0.01	0.01	0.01	0.01	0.65
C14:0	0.49	0.48	0.44	0.02	0.12
C15:0	0.51	0.500	0.49	0.02	0.68
C16:0	11.52^{a}	11.13^{a}	10.30^{b}	0.29	0.02
C16:1[2]	1.10	1.01	0.79	0.12	0.16
C17:0	0.67	0.62	0.68	0.03	0.26
C17:1 *cis10*	0.01	0.01	0.01	0.01	0.87
C18:0	11.89^{b}	12.32^{ab}	12.89^{a}	0.23	0.02
C18:1[2]	6.02	5.94	5.53	0.41	0.67
C18:2 *cis*-9,*cis*-12	47.13^{b,y}	48.73^{x}	48.83^{a}	0.59	0.08
C18:3 *cis*-6,*cis*-9,*cis*-12	0.41^{b}	0.51^{b}	0.68^{a}	0.04	<0.001
C18:3 *cis*-9,*cis*-12,*cis*-15	3.57^{a}	3.13^{b}	2.98^{b}	0.09	<0.001
C20:0	0.03	0.03	0.04	0.01	0.33
C20:2 *cis*-11,*cis*-14	0.08	0.08	0.08	0.01	0.37
C20:3 *cis*-8,*cis*-11,*cis*-14	1.25^{b}	1.46^{b}	1.82^{a}	0.10	0.001
C20:4 *cis*-5,*cis*-8,*cis*-11,*cis*-14	1.98	1.89	1.90	0.08	0.67
C20:5 *cis*-5,*cis*-8,*cis*-11,*cis*-14,*cis*-17	1.79^{a}	1.20^{b}	0.85^{c}	0.10	<0.001
C22:5 *cis*-7,*cis*-10,*cis*-13,*cis*-16,*cis*-19	0.80	0.78	0.69	0.09	0.68
C22:6 *cis*-4,*cis*-7,*cis*-10,*cis*-13,*cis*-16,*cis*-19	0.52^{a}	0.35^{b}	0.24^{c}	0.04	<0.001
C24:1 *cis*-15	0.05	0.04	0.06	0.02	0.82
Other FA	9.73	9.76	10.69	0.54	0.36
Total SFA	25.15	25.13	24.87	0.31	0.77
Total MUFA	7.18	7.00	6.39	0.50	0.51
Total PUFA	57.93	58.12	58.06	0.69	0.98
Total n-6	50.85^{b}	52.66^{a}	53.30^{a}	0.54	0.01
Total n-3	7.09^{a}	5.46^{b}	4.76^{b}	0.34	<0.001
n-6 to n-3 ratio	7.60^{c}	9.84^{b}	11.3^{a}	0.40	<0.001

RESULTADOS

Tabela 5. Efeito da alteração da proporção de acidos graxos dietético n-6 em FA n-3 no perfil acidos graxos do leite

	Treatment[1]				
FA, g/100 g of FA	R4	R5	R6	SEM	*P*-value
C6:0	4.33	5.16	4.11	0.63	0.45
C8:0	1.10	1.30	1.13	0.07	0.12
C10:0	2.23	2.38	2.36	0.13	0.69
C11:0	0.02	0.03	0.02	0.01	0.62
C12:0	2.83	3.01	3.00	0.16	0.68
C14:0	11.79	11.17	11.84	0.59	0.66
C14:1 *trans*-9	0.24	0.24	0.24	0.01	0.98
C14:1 *cis*-9	0.95	0.81	0.86	0.07	0.44
C15:0	1.10^{a}	0.97^{b}	1.00^{ab}	0.04	0.10
C15:1 *trans*-10	0.19	0.19	0.21	0.01	0.13
C16:0	38.63	38.05	36.56	0.96	0.30
C16:1 *trans*[2]	0.10	0.08	0.08	0.01	0.38
C16:1 *cis*-9	0.58	0.50	0.39	0.08	0.25
C17:0	1.49	1.62	1.62	0.05	0.15
C18:0	7.24	8.02	8.39	0.51	0.29
C18:1 *trans*-8	0.29	0.26	0.31	0.03	0.55
C18:1 *trans*-9	0.31	0.31	0.30	0.04	0.95
C18:1 *trans*-10	1.28	0.85	1.06	0.37	0.73
C18:1 *trans*-11	1.40	1.32	1.47	0.12	0.65
C18:1 *cis*-9	17.27	17.51	15.23	1.47	0.47
C18:1 *cis*-10	0.59^{b}	0.63^{ab}	0.73^{a}	0.04	0.08
C18:1 *cis*-11	0.62^{a,x}	0.50^{y}	0.48^{b}	0.04	0.05
C18:1 *cis*-12	0.30^{b}	0.39^{a}	0.42^{a}	0.02	<0.01
C18:2 *cis*-9,*cis*-12	2.66^{b}	2.71^{b}	3.22^{a}	0.17	0.05
C18:2 conjugated[2]	0.14^{a}	0.12^{ab}	0.11^{b}	0.01	0.06
C18:3 *cis*-9,*cis*-12,*cis*-15	0.39	0.41	0.43	0.01	0.12
C20:0	0.15	0.15	0.14	0.01	0.61
C20:1 *trans*11	0.72	0.66	0.70	0.07	0.84
C20:4 *cis*-5,*cis*-8,*cis*-11,*cis*-14	0.10	0.11	0.11	0.01	0.81
C20:5 *cis*-5,*cis*-8,*cis*-11,*cis*-14,*cis*-17	0.08^{a}	0.06^{a}	0.04^{b}	0.01	<0.01
C22:0	0.04	0.05	0.05	0.01	0.65
C22:1 *trans*-11	0.05^{a}	0.03^{ab}	0.02^{b}	0.01	0.10
C22:5 *cis*-7,*cis*-10,*cis*-13,*cis*-16,*cis*-19	0.12^{a}	0.10^{b}	0.07^{c}	0.01	0.001
C24:1 *cis*-15	0.14	0.13	0.17	0.02	0.42
Other FA	0.04	0.05	0.01	0.02	0.51
<C16	24.77	25.26	24.77	0.99	0.92
C16	40.53	39.77	38.13	0.96	0.20
>C16	34.65	34.92	37.09	1.34	0.37
Total SFA	70.13	70.92	69.23	1.44	0.70
Total MUFA	26.31	25.50	26.77	1.30	0.77
Total PUFA	3.52	3.53	3.99	0.19	0.15
Total n-6	2.90^{b}	3.13^{ab}	3.45^{a}	0.14	0.03
Total n-3	0.62	0.60	0.54	0.03	0.23
n-6 to n-3 ratio	4.74	5.41	6.37	0.16	<0.001

RESULTADOS

Tabela 6. Temperatura corporal, concentrações plasmáticas de hormônios, metabólitos, citocinas, proteínas de fase aguda e atividade de neutrófilos no sangue de vacas Holandesas lactantes que recebem dietas que variam na proporção de ácidos graxos n-6 n-3 após um desafio intramamário com LPS

	Treatment[1]				*P*-value[2]		
Item	R4	R5	R6	SEM	Trt	Hour	Trt × Hour
Temperature, °C	39.06	39.26	39.12	0.08	0.20	<0.001	<0.01
Peak temperature,[3] °C	40.80	41.33	40.78	0.21	0.14	—	—
Time to peak temperature,[3] h	5.08[y]	4.83[y]	6.23[x]	0.66	0.07	—	—
Duration temperature ≥39.5°C,[3] h	4.69	5.92	6.15	0.84	0.43	—	—
Glucose, mg/dL	65.70	68.77	66.69	1.68	0.42	<0.001	0.39
Acid-soluble protein, μg/mL	50.87	50.67	50.44	5.03	0.99	<0.001	0.77
Interferon-γ, pg/mL	10.33	29.92	17.85	8.99	0.36	0.001	0.93
Phagocytosis, %	53.41	54.93	52.53	2.40	0.77	0.40	0.80
Oxidative burst, %	28.93	29.91	30.96	2.64	0.86	0.04	0.89

RESULTADOS

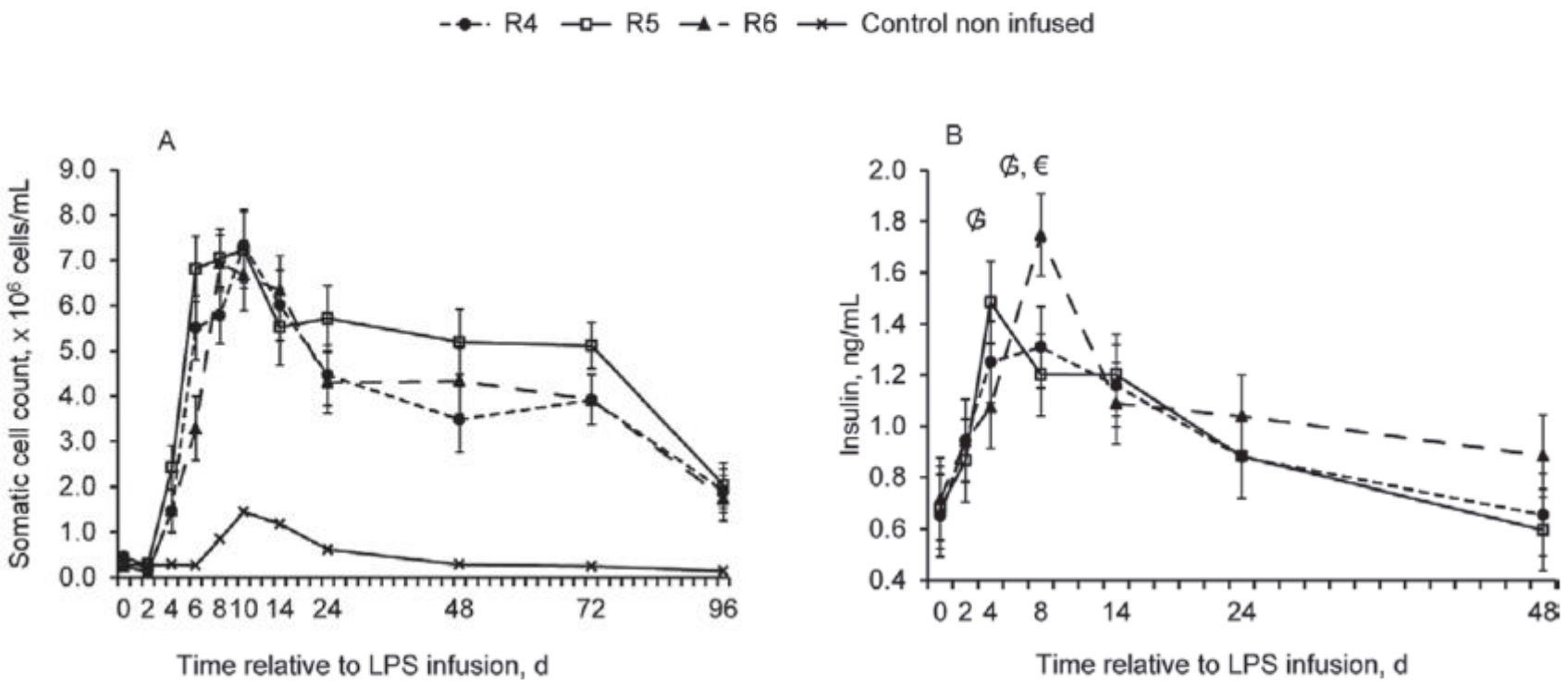


Figura 3: Concentrações de insulina e contagem de células somáticas de vacas Holandês lactantes alimentadas com 3,9 a 1 (R 4), 4,9 a 1 (R 5) e 5,9 a 1 (R 6) proporção de n-6 a n-3 FA na dieta, desafiadas por via intramamária com 10 µg de LPS de Escherichia coli.

RESULTADOS

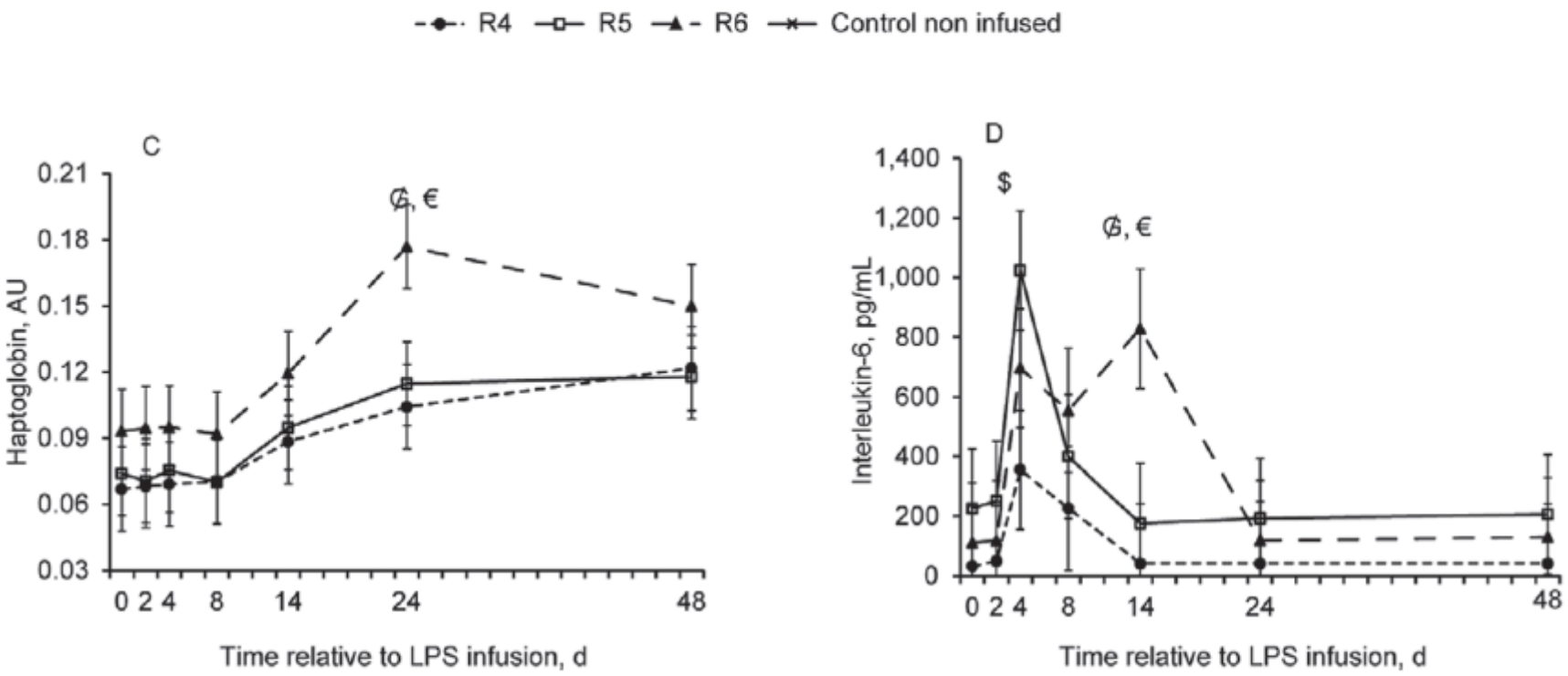


Figura 3: Concentrações de haptoglobina e interleucina-6 de vacas Holandês lactantes alimentadas com 3,9 a 1 (R 4), 4,9 a 1 (R 5) e 5,9 a 1 (R 6) proporção de n-6 a n-3 FA na dieta, desafiadas por via intramamária com 10 µg de LPS de Escherichia coli.

RESULTADOS

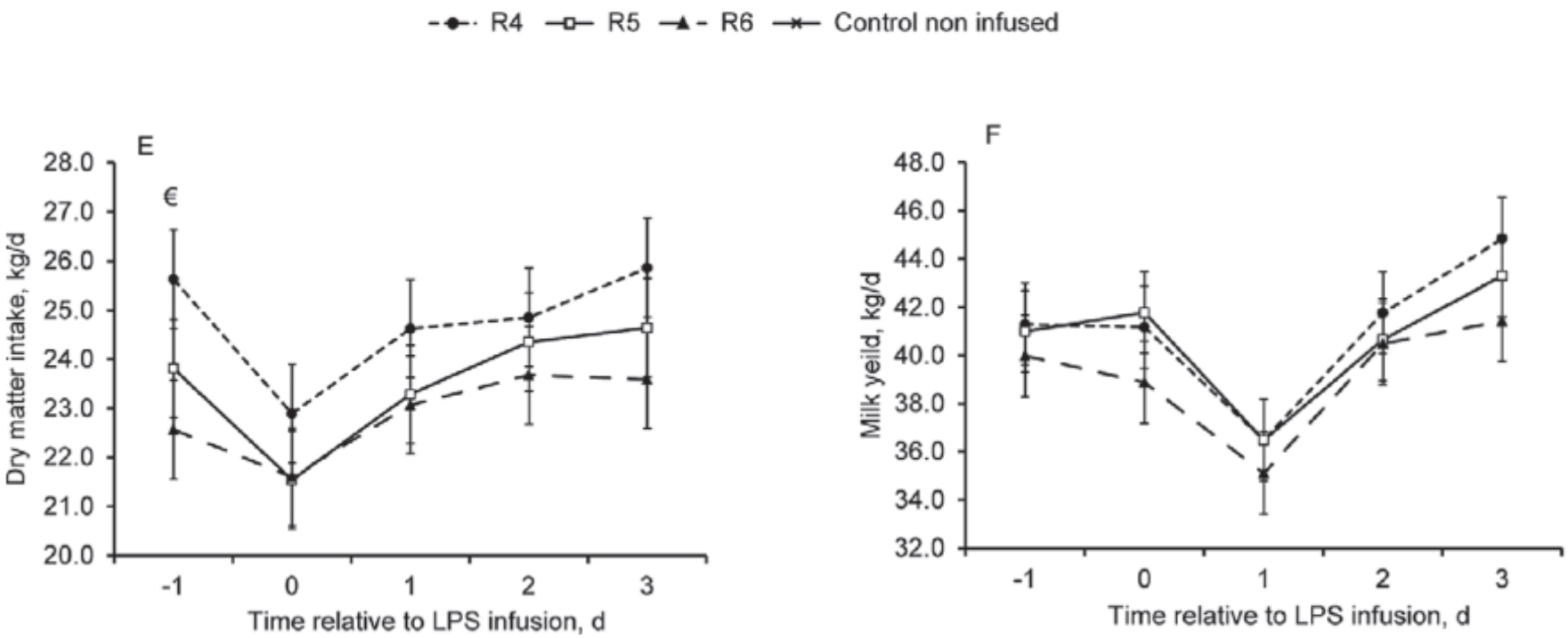
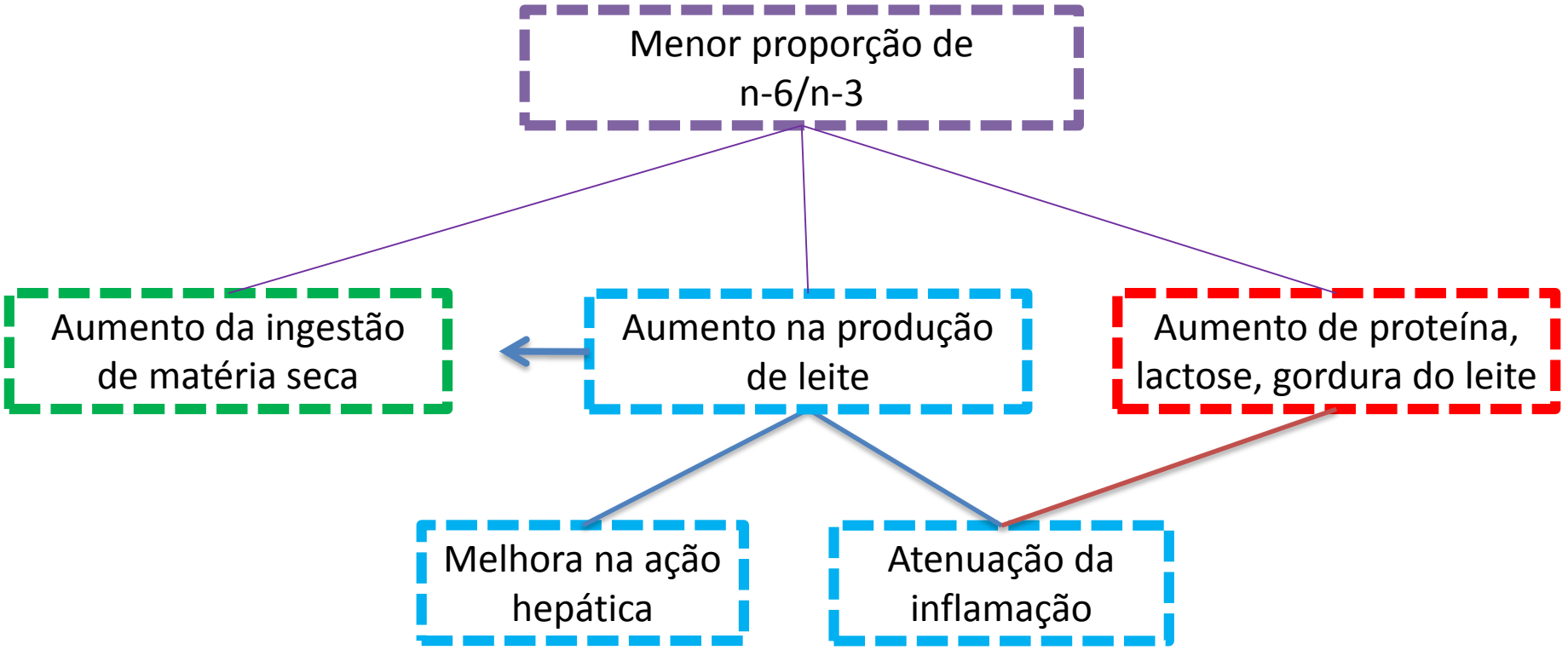
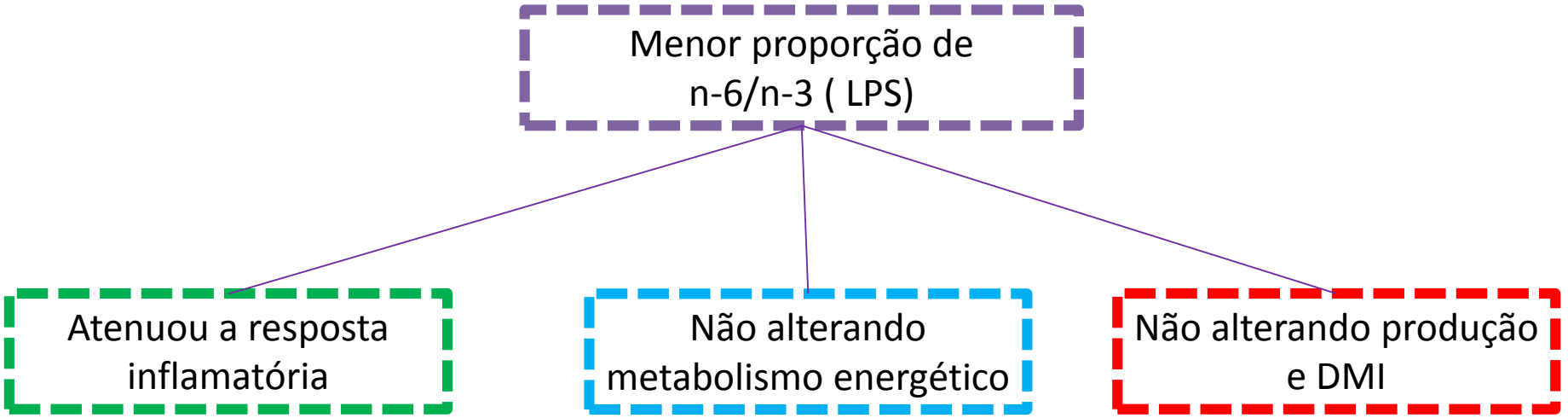


Figura 3: Ingestão de matéria seca e produção de leite de vacas holândes alimentadas com 3,9 a 1 (R 4), 4,9 a 1 (R 5) e 5,9 a 1 (R 6) proporção de n-6 a n-3 FA na dieta, desafiadas por via intramamária com 10 µg de LPS de Escherichia coli.

Síntese


Menor proporção de n-6/n-3
Aumento da ingestão de matéria seca
Aumento na produção de leite
Aumento de proteína, lactose, gordura do leite
Melhora na ação hepática
Atenuação da inflamação

Síntese


Menor proporção de n-6/n-3 (LPS)
Atenuou a resposta inflamatória
Não alterando metabolismo energético
Não alterando produção e DMI

Artigo

J. Dairy Sci. 94:189–204
doi:10.3168/jds.2010-3370

Effects of differential supplementation of fatty acids during the peripartum and breeding periods of Holstein cows: I. Uterine and metabolic responses, reproduction, and lactation

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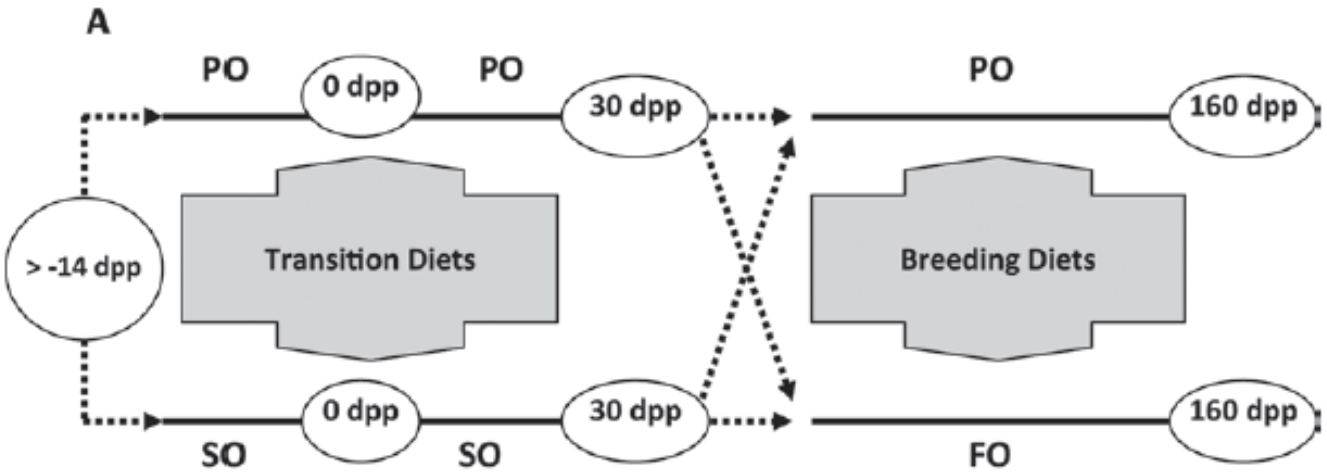
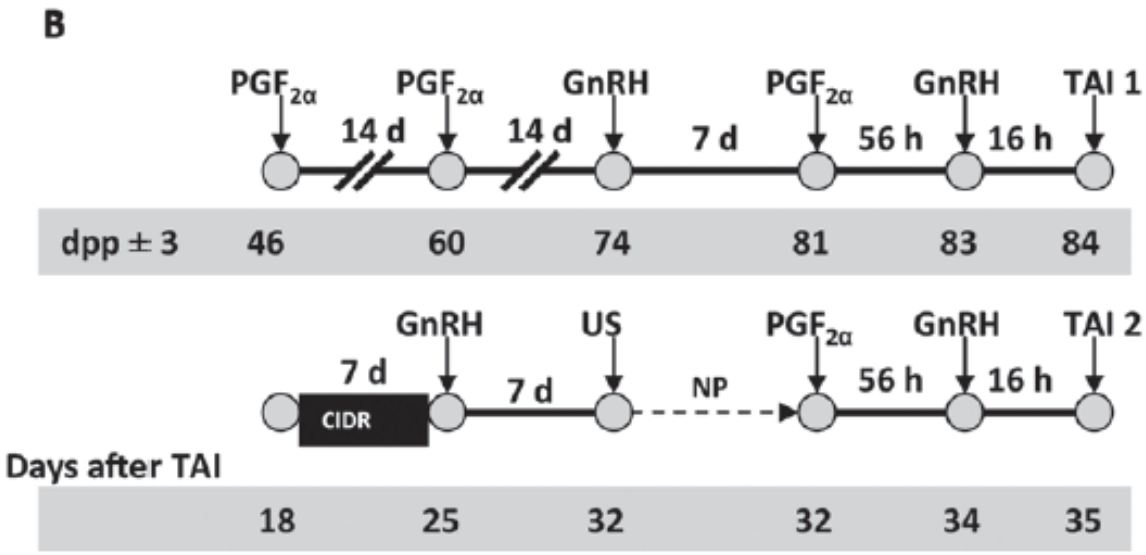
Os objetivos foram avaliar os efeitos de tempo de suplementação de diferentes sais de Ca (CS) de ácidos graxos (AG) em perfis de AG de tecidos cotiledonário-caruncular, estado metabólico, saúde uterina, prenhes, perda de prenhes após 2 inseminações artificiais (IA) e produção de leite.

Materiais e Métodos

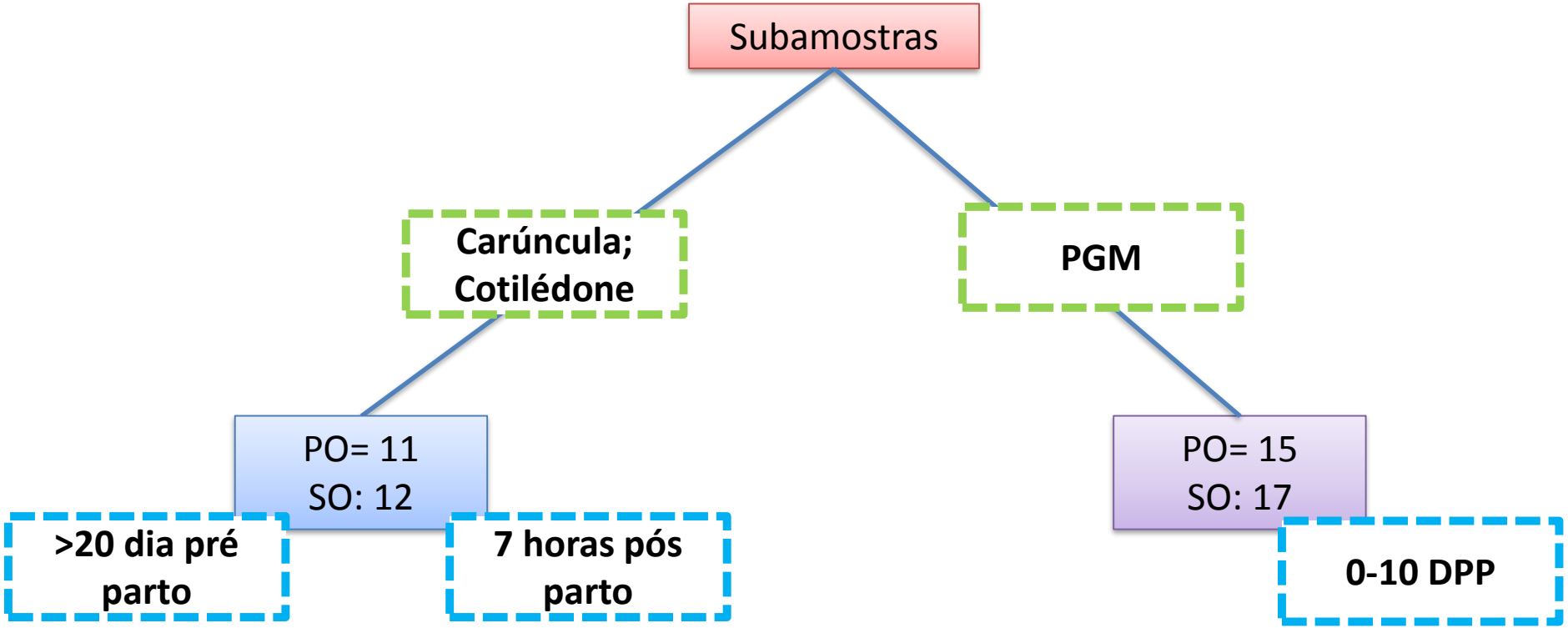
N= 1582



G1: PO-PO
G2: PO-FO
G3: SO-PO
G4: SO-FO



Materiais e Métodos



- **Análise da composição da dieta**
- **Descarga cervical**

Resultados

Table 3. Fatty acid (FA) profiles of fat supplements

	Fat supplement[1] (g/100 g of FA)		
Fatty acid	PO	SO	FO
C14:0	1.2	1.0	4.5
C16:0	46.6	12.9	38.7
C16:1	0.0	0.1	0.0
C17:0	0.1	0.1	0.3
C18:0	4.3	4.2	4.6
C18:1 *cis*-9	38.2	16.7	30.8
C18:2 n-6	9.3	63.6	8.0
C18:3 n-3	0.3	0.2	1.0
C20:4 n-6	0.0	0.0	0.4
C20:5 n-3	0.0	0.6	5.4
C22:5 n-3	0.0	0.1	0.9
C22:6 n-3	0.0	0.4	5.3
n-6/n-3	31.0	48.9	0.7

[1]PO (palm oil; EnerGII); SO (safflower oil; Prequel 21); FO (fish oil; StrataG). All fat supplements were manufactured as Ca salts by Virtus Nutrition, LLC, Corcoran, CA.

Resultados

Table 4. Fatty acid (FA) profiles of diets[1]

	Prepartum[2] (g/100 g of FA)		Postpartum[3] (g/100 g of FA)		Breeding[4] (g/100 g of FA)	
Fatty acid	PO	SO	PO	SO	PO	FO
C14:0	0.69	0.65	0.66	0.51	0.67	1.50
C16:0	28.11	19.61	27.34	16.55	27.76	24.52
C18:0	3.54	3.30	3.51	3.24	3.47	3.61
C18:1 *cis*-9	23.59	18.32	23.50	17.76	23.52	21.62
C18:2 n-6	37.91	50.28	37.24	53.04	37.82	40.74
C18:3 n-3	6.16	7.84	7.76	8.90	6.75	5.86
C20:5 n-3	0.0	0.0	0.0	0.0	0.0	1.03
C22:5 n-3	0.0	0.0	0.0	0.0	0.0	0.22
C22:6 n-3	0.0	0.0	0.0	0.0	0.0	0.92
n-6/n-3	6.15	6.41	4.79	5.95	5.60	5.07

[1]Diets contained one of the following fat supplements: PO (palm oil; EnerGII), SO (safflower oil; Prequel 21), or FO (fish oil; StrataG). All fat supplements were manufactured as Ca salts by Virtus Nutrition, LLC, Corcoran, CA.

[2]Diet fed for at least 14 d before parturition.

[3]Diet fed from parturition to 30 d postpartum.

[4]Diet fed from 30 to 160 d postpartum.

Resultados

Table 5. Frequency distribution of cows (% and number of cows) among cervical discharge categories diagnosed between d 8 to 10 postpartum

	Cervical discharge			
Variable	Clear or flecks	Mucopurulent	Purulent	*P*-value
Diet[1]				
PO (total n = 554)	57.6 (319)	14.4 (80)	28.0 (155)	
SO (total n = 562)	59.6 (335)	10.0 (56)	30.4 (171)	NS
Parity				
Multiparous (total n = 768)	65.8 (505)	12.6 (97)	21.6 (166)	
Primiparous (total n = 348)	42.8 (149)	11.2 (39)	46 (160)	<0.01
Calving assistance[2]				
No (total n = 841)	65.3 (549)	10.7 (90)	24 (202)	Ref.[3]
Minor (total n = 141)	46.1 (65)	14.2 (20)	39.7 (56)	<0.01
Major (total n = 121)	27.3 (33)	21.5 (26)	51.2 (62)	<0.01
RFM[4]				
No (total n = 892)	63.7 (568)	11.8 (105)	24.5 (219)	
Yes (total n = 91)	9.9 (9)	11.0 (10)	79.1 (72)	<0.01

[1]PO (palm oil; EnerGII); SO (safflower oil; Prequel 21). All fat supplements were manufactured as Ca salts by Virtus Nutrition, LLC, Corcoran, CA.

[2]Calving assistance: No = no assistance; Minor = use of minor force; Major = use of a jack with minor or major force.

[3]Referent category.

[4]Retained fetal membranes.

Resultados

Table 6. Least squares means and pooled SE of fatty acid profiles (% of the total fatty acid; g/100 g of fatty acid) of cotyledonary and caruncular tissues collected at the time of parturition from cows supplemented with palm oil or safflower oil[1]

	Palm oil		Safflower oil		Statistical analysis			
Fatty acid	Cotyledon	Caruncle	Cotyledon	Caruncle	SE	Diet	Tissue	Interaction
C14:0	0.71	0.93	0.66	0.85	0.04	NS	**	NS
C15:0	0.59	0.44	0.61	0.41	0.02	NS	**	NS
C16:0	17.04	16.66	16.21	14.89	0.35	**	**	NS
C16:1	0.69	0.64	0.92	0.73	0.07	*	NS	NS
C17:0	1.08	1.10	1.09	1.08	0.03	NS	NS	NS
C18:0	13.60	21.10	13.66	20.64	0.33	NS	**	NS
C18:1 *trans*-11	0.19	0.68	0.29	0.84	0.04	**	**	NS
C18:1 *trans*-12	0.72	0.66	0.69	0.58	0.05	NS	NS	NS
C18:1 *cis*-9	24.58	15.8	24.5	15.93	0.54	NS	**	NS
C18:1 *cis*-11	3.98	2.7	4.24	2.84	0.12	†	**	NS
C18:2 n-6	5.10	9.8	5.53	11.06	0.46	†	**	NS
CLA[2] *cis*-9, *trans*-11	0.05	0.08	0.0	0.13	0.01	NS	**	**
CLA *trans*-9, *trans*-11	1.04	0.51	0.75	0.45	0.07	**	**	NS
C18:3 n-3	0.20	0.30	0.0	0.29	0.02	**	**	**
C20:0	0.67	0.64	0.34	0.73	0.05	*	**	**
C20:5 n-3	0.09	0.10	0.10	0.15	0.02	NS	NS	NS
C22:0	5.66	5.51	5.59	5.13	0.29	NS	NS	NS
C22:1	4.07	8.20	3.87	7.13	0.31	*	**	NS
C22:4 n-6	0.80	1.06	0.83	0.99	0.04	NS	**	NS
C22:5 n-3	2.33	1.42	2.07	1.30	0.07	**	**	NS
C22:6 n-3	2.14	0.50	1.91	0.51	0.09	NS	**	NS
C24:0	0.56	0.70	0.62	0.67	0.04	NS	NS	NS
Others	13.8	10.4	15.4	12.5	0.33	**	**	NS

[1]Diets fed from 33 d prepartum to 30 d postpartum. Diets contained fat supplements: palm oil (EnerGII) or safflower oil (Prequel 21). All fat supplements were manufactured as Ca salts by Virtus Nutrition, LLC, Corcoran, CA.

[2]Conjugated linoleic acid.

*$P \leq 0.05$; **$P \leq 0.01$; †$P \leq 0.10$.

Carúncula

Cotilédone

Resultados

Table 7. Least squares means and pooled SE for total fatty acids (g/100 g of freeze-dried tissue) and different fatty acid percentages (% of the total fatty acid; g/100 g of fatty acids) in the cotyledon and caruncle tissues collected at the time of parturition for cows supplemented with palm oil or safflower oil[1]

	Palm oil		Safflower oil		Statistical analysis			
Fatty acid[2]	Cotyledon	Caruncle	Cotyledon	Caruncle	SE	Diet	Tissue	Interaction
Total	4.3	8.6	4.7	8.7	0.26	NS	**	NS
SFA	39.9	46.8	38.8	44.5	0.40	**	**	NS
UFA	46.5	42.6	45.7	43.0	0.60	NS	**	NS
MUFA	34.7	28.9	34.5	28.1	0.57	NS	**	NS
PUFA	11.8	13.8	11.2	14.9	0.50	NS	**	NS
n-6/n-3	1.3	5.4	1.6	6.3	0.04	*	**	NS

[1]Diets fed from 33 d prepartum to 30 d postpartum. Diets contained fat supplements: palm oil (EnerGII) or safflower oil (Prequel 21). All fat supplements were manufactured as calcium salts by Virtus Nutrition, LLC, Corcoran, CA.

[2]SFA = saturated fatty acids; UFA = unsaturated fatty acids; MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids; n-6/n-3 = (C18:2 + C22:4)/(C18:3 + C20:5 + C22:6).

*$P \leq 0.05$; **$P \leq 0.01$.

Resultados

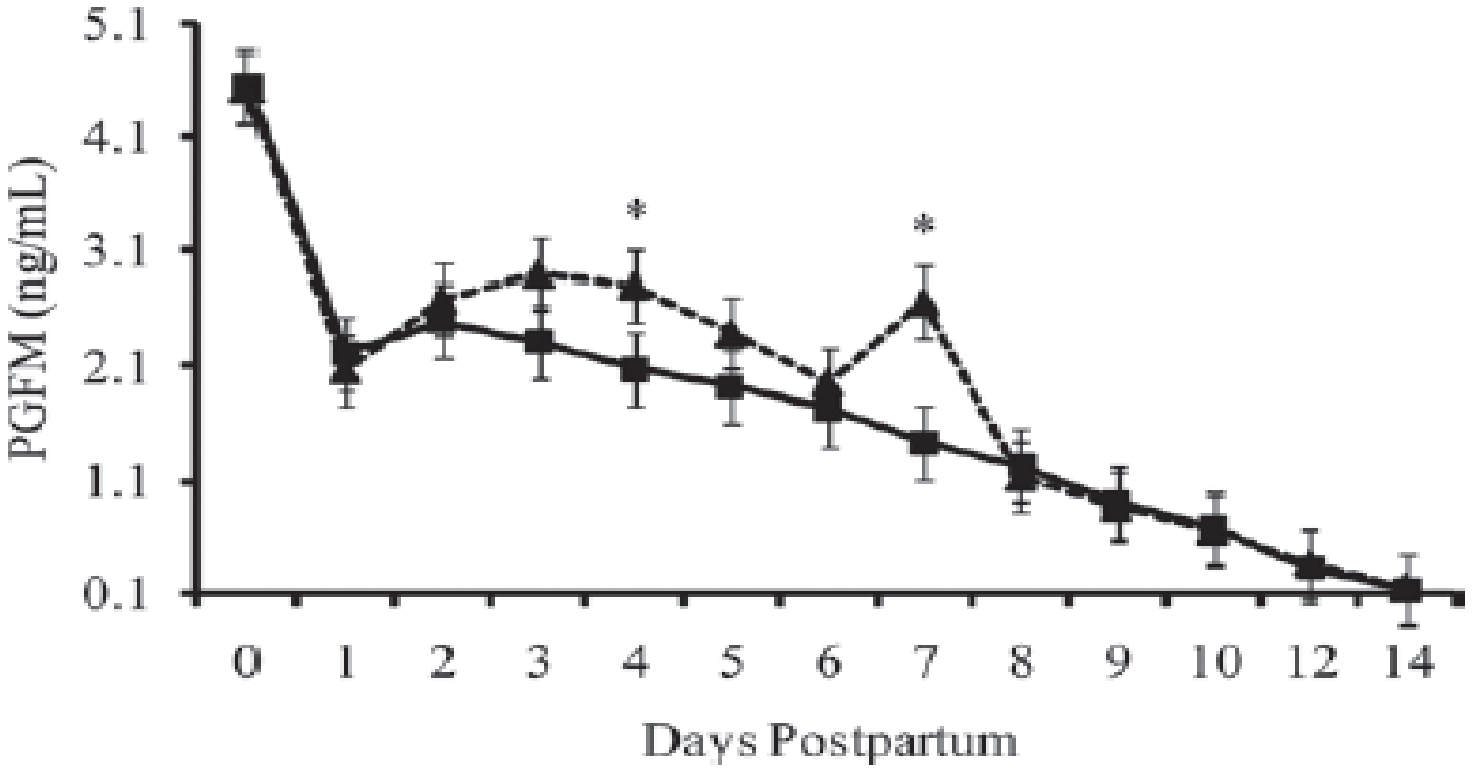


Figure 2. Least squares means (±SE) for plasma concentrations of 15-keto-13,14-dihydro-prostaglandin-$F_{2\alpha}$ metabolite (PGFM) for the first 14 d postpartum in a subsample of cows fed Ca salts of palm oil (—; n = 15) or safflower oil (---; n = 17) during the prepartum period (at least 20 d) to 35 d postpartum. * $P < 0.05$.

Resultados

Table 8. First, second, and accumulated pregnancy (% and number of cows) per AI at 32 and 60 d after AI and pregnancy loss of cows fed fat supplements in 4 different sequences

	Diet[1]				Diet contrast[2] (*P*-value)		
AI	PO-PO	SO-PO	PO-FO	SO-FO	C1	C2	C3
First AI							
d 32	38.7 (107/276)	35.8 (96/268)	39.1 (103/263)	35.8 (89/248)	NS	NS	NS
d 60	33.7 (92/273)	29.7 (79/266)	37.0 (97/262)	32.8 (81/247)	NS	NS	NS
Loss	11.5 (12/104)	15.9 (15/94)	4.9 (5/102)	7.9 (7/88)	NS	<0.05	NS
Second AI							
d 32	27.7 (43/155)	26.7 (41/154)	30.3 (44/154)	43.3 (65/150)	NS	<0.05	0.10
d 60	21.0 (38/152)	22.5 (34/151)	27.3 (39/143)	41.3 (62/150)	NS	<0.01	<0.05
Loss	5.0 (2/40)	10.0 (4/38)	7.1 (3/42)	4.6 (3/65)	NS	NS	NS
All AI							
d 32	54.4 (152/279)	50.5 (138/273)	53.8 (147/273)	59.5 (154/259)	NS	NS	0.10
d 60	48.3 (132/273)	42.5 (114/268)	50.3 (136/270)	55.4 (143/258)	NS	<0.01	0.07
Loss	9.6 (14/146)	14.3 (19/133)	5.5 (8/144)	6.5 (10/153)	NS	<0.01	NS

[1]PO (palm oil; EnerGII); SO (safflower oil; Prequel 21); FO (fish oil; StrataG). All fat supplements were manufactured as calcium salts by Virtus Nutrition, LLC, Corcoran, CA.

[2]Contrasts are C1 (transition diets; PO-PO + PO-FO vs. SO-PO + SO-FO); C2 (breeding diets; PO-PO + SO-PO vs. PO-FO + SO-FO); and C3 (interaction of diets; PO-PO + SO-FO vs. PO-FO + SO-PO). NS = nonsignificant.

Resultados

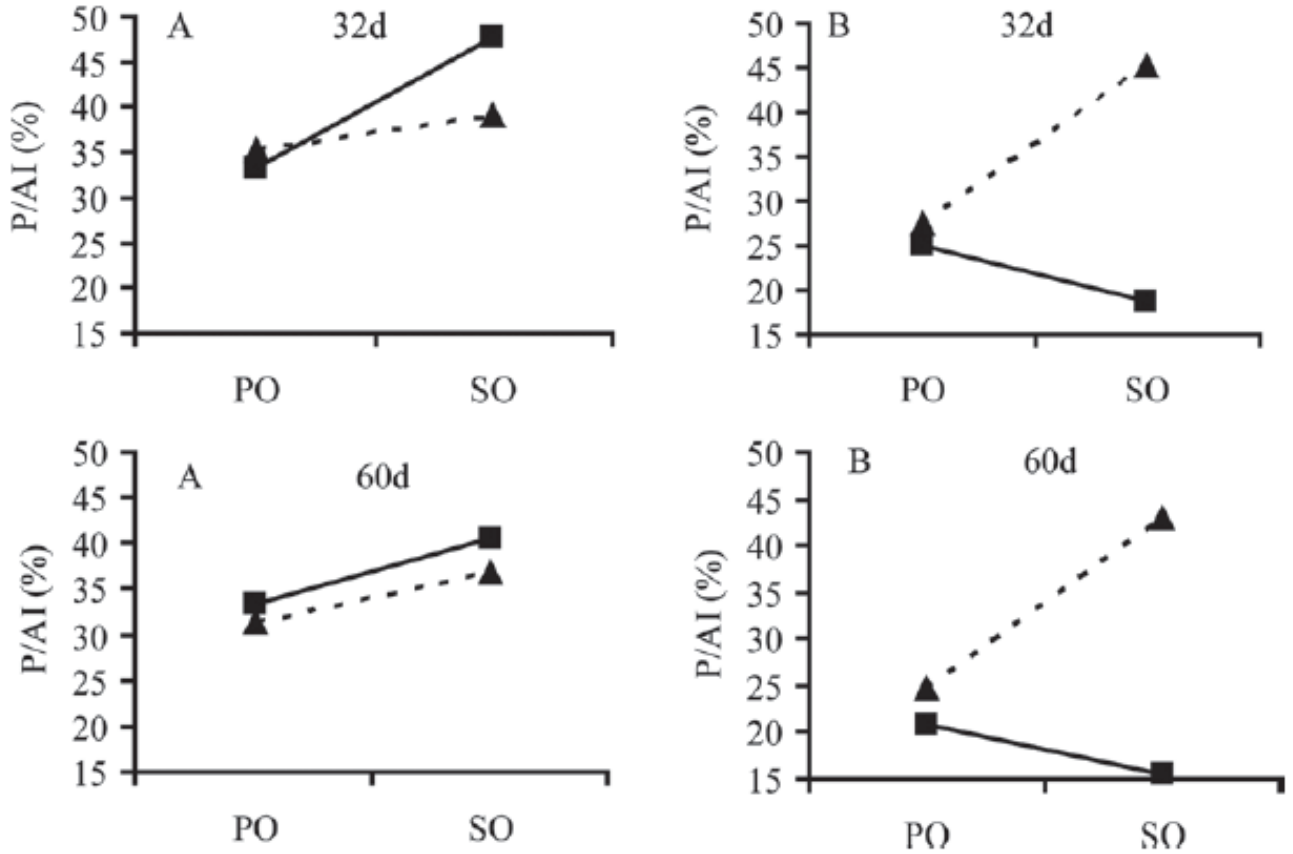
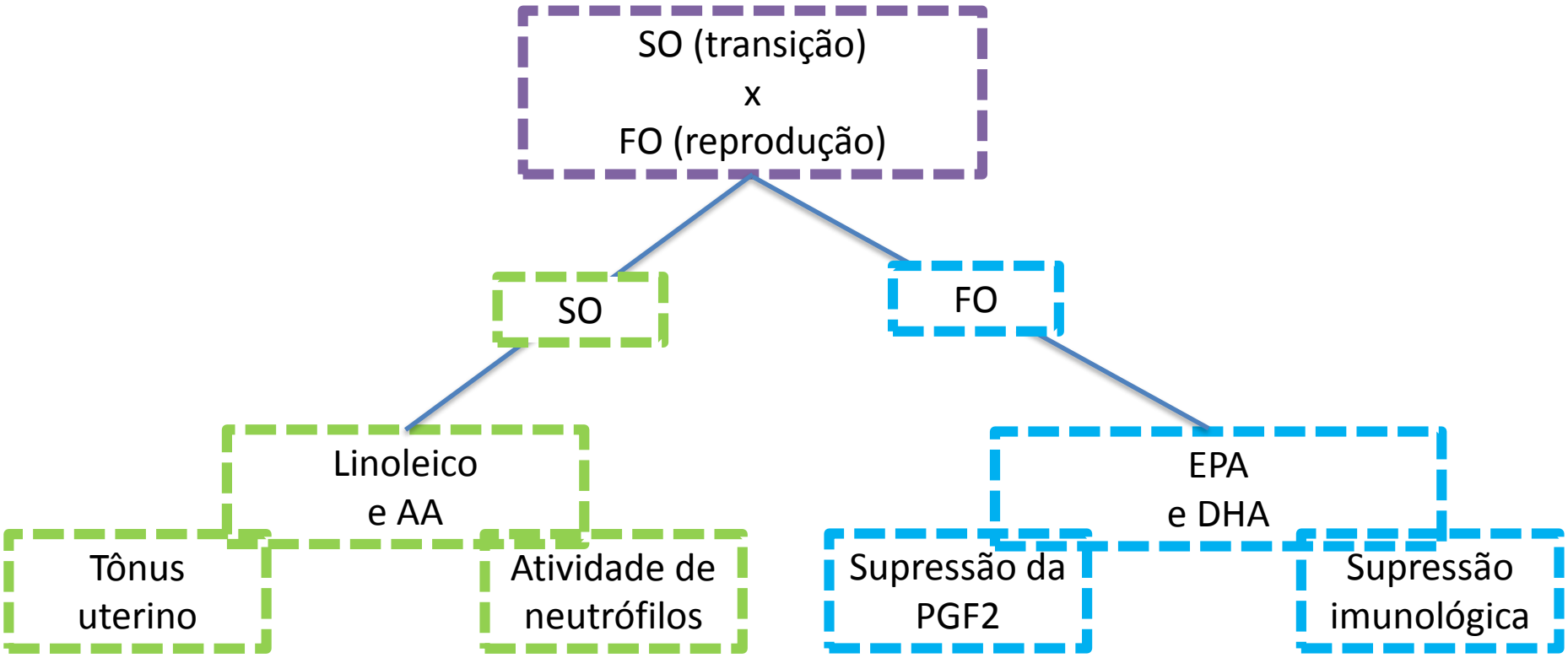


Figure 3. Interaction of transition and breeding diets by season ($P < 0.05$) for proportion of second service pregnancy per AI (P/AI) examined at 32 and 60 d after timed AI. Transition diets are shown on the x-axis (PO, palm oil; SO, safflower oil); symbols indicate breeding diets (PO, palm oil, ■; FO, fish oil, ▲). In A panels, cows were inseminated during the cool season (temperature-humidity index <72); in B panels, cows were inseminated during the warm season (temperature-humidity index ≥72).

Síntese


SO (transição)
x
FO (reprodução)
SO
FO
Linoleico
e AA
EPA
e DHA
Tônus
uterino
Atividade de
neutrófilos
Supressão da
PGF2
Supressão
imunológica

Projeto

Modulação da resposta inflamatória aguda e ganho de peso de bezerras em desaleitamento suplementadas com ácidos graxos poli-insaturados.

Modulation of acute inflammatory response of calves weaning weight gain supplemented with polyunsaturated fatty acids.

Evandro Schmoeller[1]; Aline Gassenferth[2]; Cleder Gouveia Bartz[3]; Diana Feldhaus [2]; Marcio Nunes Correa[1], Nicole Regina Capachi Hlavac[4]; Patricia Martins Machado[2];Rubens Alves Pereira[1]; Vinicius Coitinho Tabeleão[4]

O objetivo do trabalho foi avaliar o efeito da suplementação de AGPI na alimentação de bezerras durante o período de transição do desaleitamento sobre o metabolismo e no desenvolvimento corpóreo.

MATERIAIS E MÉTODOS

Tabela 1: Formulação dos ingredientes (kg) das dietas propostas para o arraçoamento de bezerras Jersey dos grupos GC e GP.

INGREDIENTES	GC (Kg)	GP (Kg)	
Milho moído	0,300	0,250	
Casquinha de soja	0,074	0,050	**Isoproteica e Isoenergética**
Alfafa pelet	0,300	0,300	
Farelo de soja	0,200	0,150	
Calcário	0,010	0,010	
Fosfato	0,010	0,010	
Mistura mineral[1]	0,030	0,030	
Feno alfafa	0,074	0,188	
Sabão de cálcio [2]		0,012	
TOTAL	1,000	1,000	

[1] Royal Lac® bezerra [2] Megalac-E®

MATERIAIS E MÉTODOS

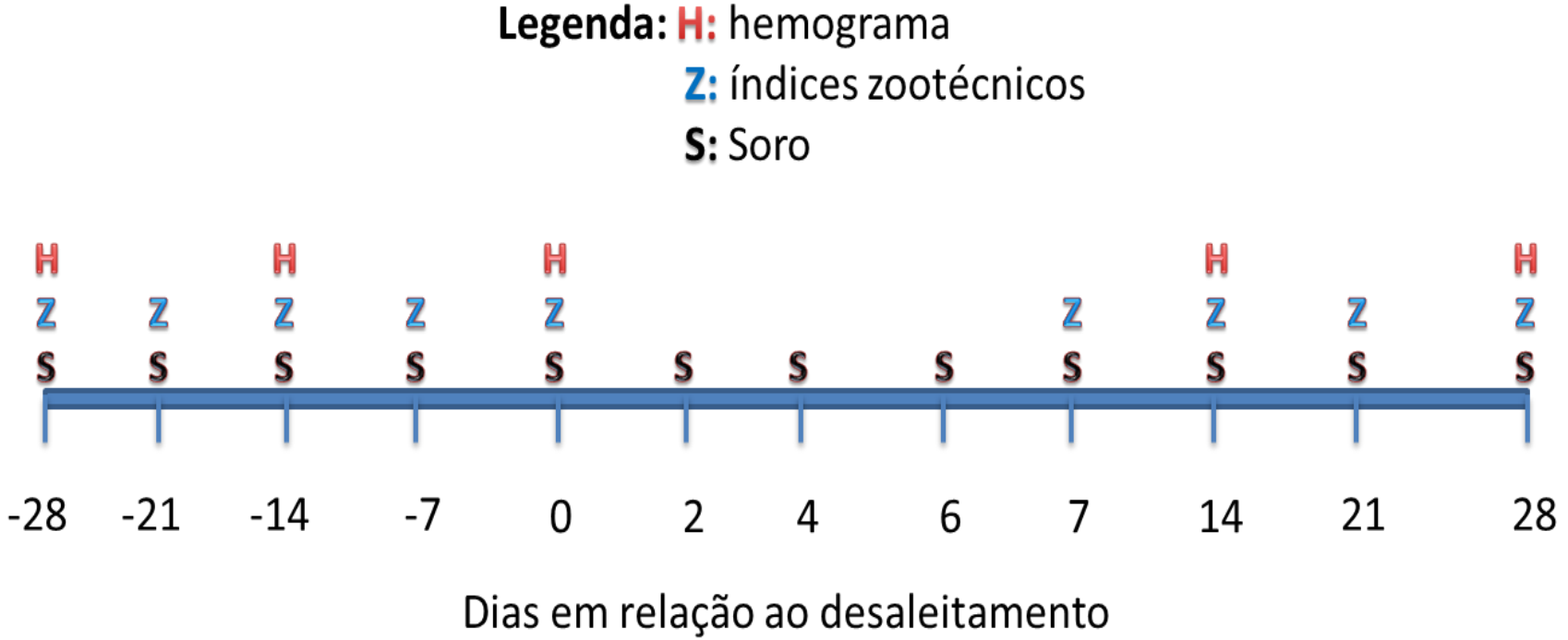


Figura 1: Esquema de coleta de amostras de sangue das bezerras para obtenção sangue total para hemograma, soro para a realização das avaliações metabólicas e parâmetros zootécnicos.

RESULTADOS E DISCUSSÕES

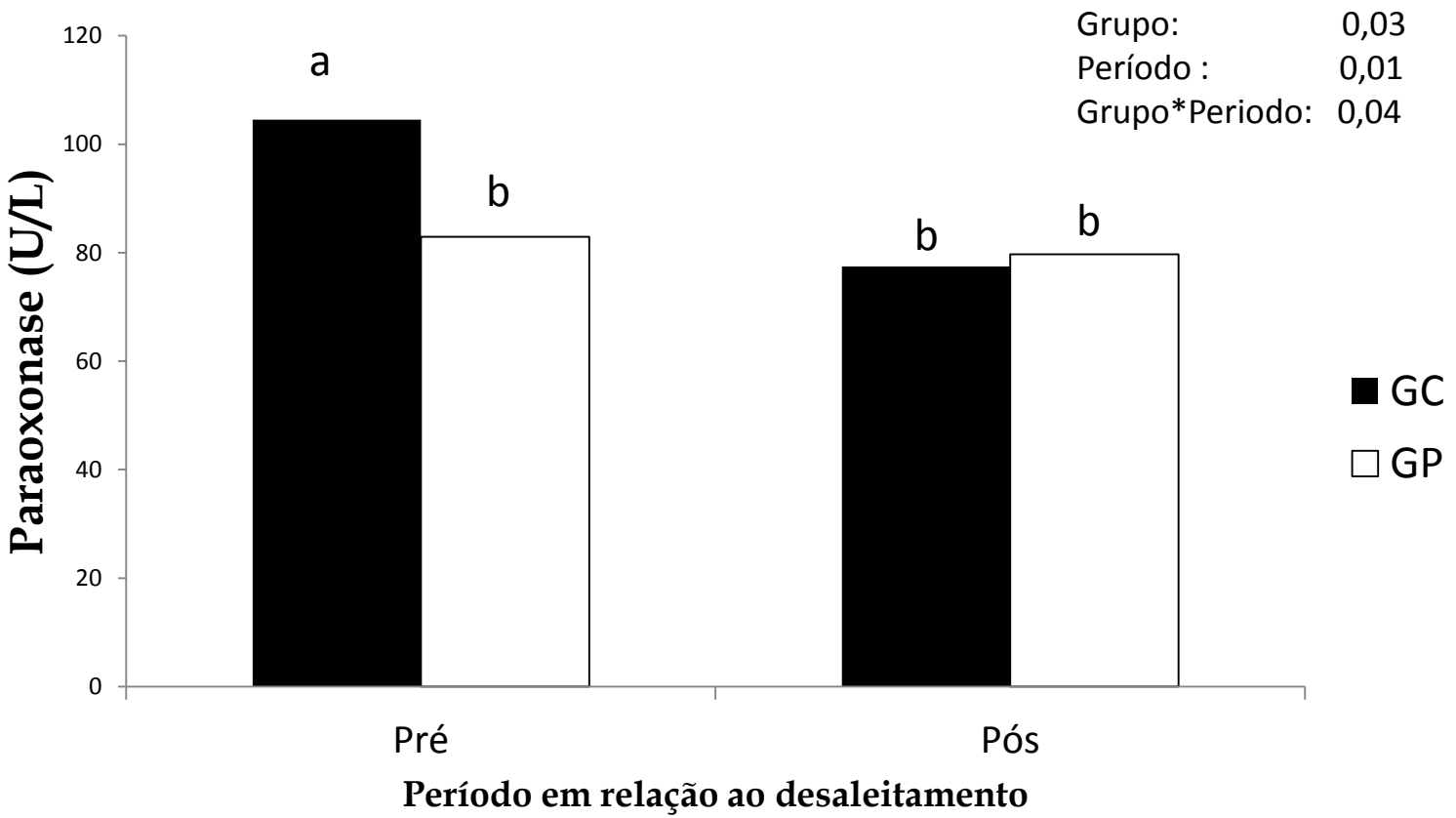


Figura 3: Valores médios das concentrações plasmáticas de paraoxonase (UI/L) na transição do desaleitamento em bezerras suplementadas com PUFA (n=3) e sem PUFA (n=3). Letras distintas foram consideradas diferentes quando p<0, 0,05.

RESULTADOS E DISCUSSÕES

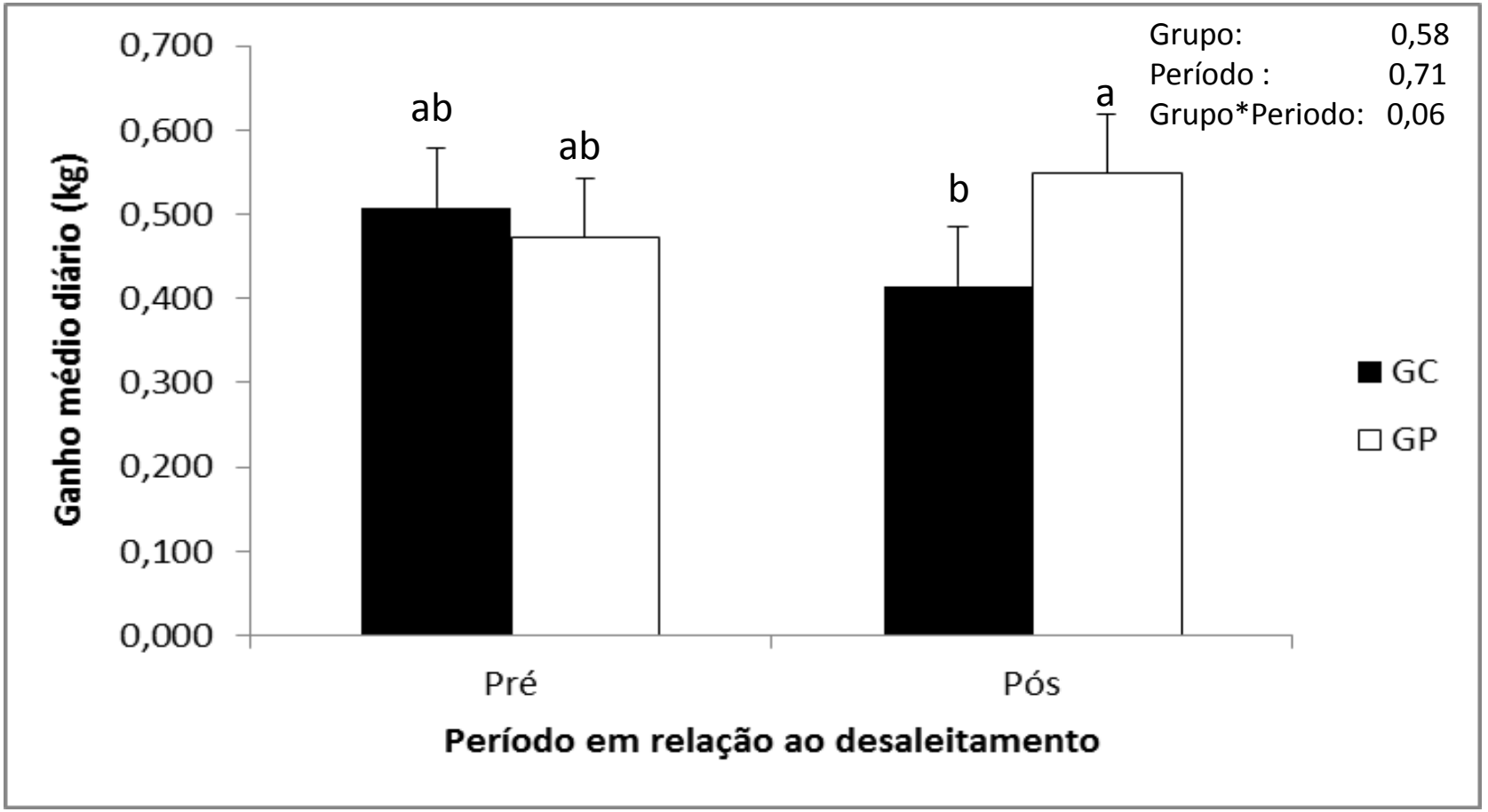


Figura 2: Ganho de peso médio diário (g/dia), na transição do desaleitamento em bezerras suplementadas com PUFA (n=3) e sem PUFA (n=3). Letras distintas foram consideradas tendência a serem diferentes quando p<0, 10.

RESULTADOS E DISCUSSÕES

Tabela 3: Valores médios de altura de cernelha (cm) e perímetro torácico (cm) dos animais alimentados com, ou sem suplementação de PUFA.

Variáveis	GC[1]		GP[2]		Valor de P		
Zootécnicas	Média	EPM	Média	EPM	Grupo	Período	Grup*Per[3]
Perímetro Torácico	88,080	0,69	88,275	0,64	0,83	<0,05	0,30
Altura de cernelha	80,184	1,31	83,417	1,29	0,15	<0,05	0,96

[1]GC = grupo controle. [2]GP = grupo PUFA. [3]Grup*Per = Interação entre grupo e período. Variáveis consideradas diferentes quando p<0,05 e tendendo a ser diferentes quando p <0,10.

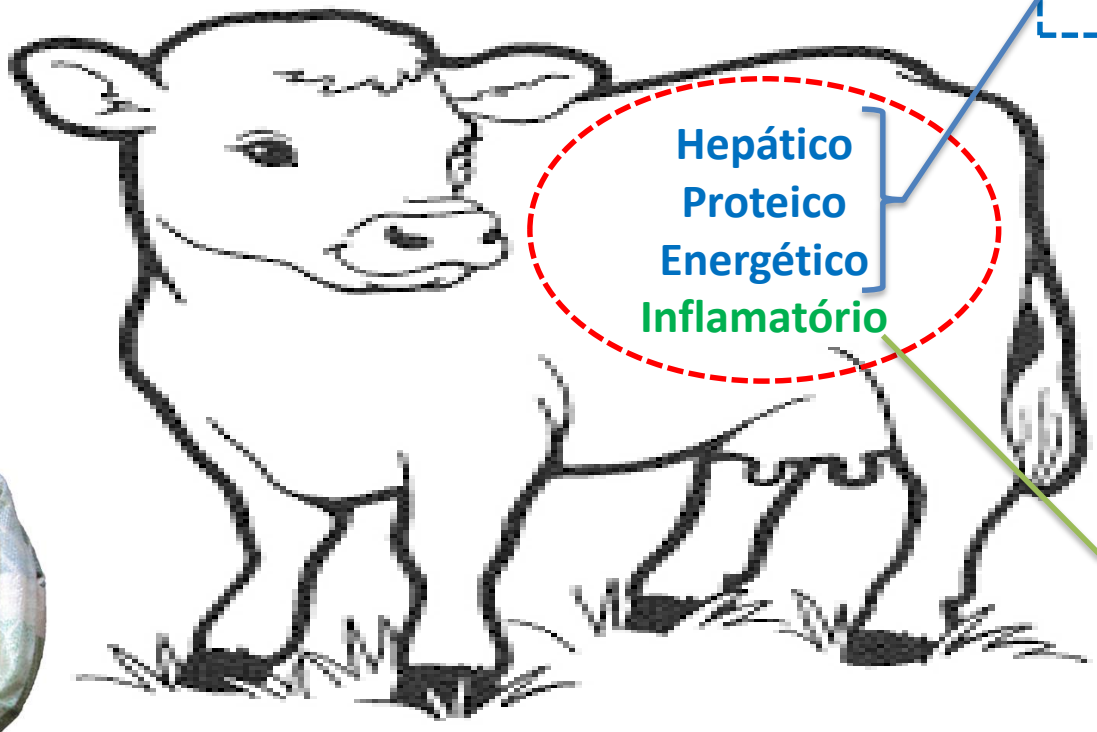
RESULTADOS E DISCUSSÕES

Tabela 4: Valores médios das concentrações plasmáticas de albumina, glicose (mg/dL), colesterol total (mg/dL), ureia (mg/dL), triacilglicerol (mg/dL), GGT (UI/L), AST (UI/L), proteínas totais (mg/dL) em bezerras na transição do desaleitamento, sem e com suplementação de PUFA, e sua interação entre os grupos e períodos.

Variáveis	Grupo				Valor de P		
	GC[1]		GP[2]				
	Média	(±EPM)[3]	Média	(±EPM)[3]	Grupo	Período	Gru*Per[4]
Albumina	3,003	0,065	3,157	0,065	0,154	0,240	0,220
Glicose	76,129	5,736	79,614	5,705	0,682	<0,001	0,811
Colesterol	118,43	8,208	122,30	8,202	0,755	<0,001	0,651
Ureia	31,208	1,968	34,715	1,960	0,266	<0,001	0,866
Proteínas totais	6.299	0,132	6,399	0,131	0,623	0,005	0,902
Triacilglicerol	24,519	3,330	26,578	3,326	0,685	0,011	0,206
GGT[5]	17,143	1,108	20,883	1,106	0,067	0,677	0,095
AST[6]	59,183	4,165	59,808	4,126	0,921	0,070	0,896

[1] GC: grupo controle; [2] GP: grupo PUFA. Ácidos graxos poli-insaturados; [3] (±EPM) = Erro padrão da média; [4] Gup*Per= Interação entre os grupos e períodos; [5] GGT = gama-glutamil transferase; [6] AST = aspartato amino transferase. Variáveis consideradas diferentes quando p<0,05 e tendendo a ser diferentes quando p <0,10.

RESULTADOS E DISCUSSÕES



Hepático
Proteico
Energético
Inflamatório

Segurança

Modulação

Ganho de peso

Efeito da utilização de ácidos graxos poli-insaturados sobre o metabolismo, reprodução, produção e composição do leite de ruminantes

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