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Performance, metabolic and hormonal responses on the peripartum of grazing beef cows supplemented during the pre-partum

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SUBJECT AREAS

Small Animal Medicine

KEYWORDS

nutrition, metabolism, parturition, Zebu

Abstract

Background: Strategies for feeding supplements during the pre-partum are usually adopted because nutritional status upon calving is the main factor to affect reproductive performance. Metabolic parameters that relate nutritional status to physiological processes can be used to better understand the effects of supplementation. This study evaluated the effects of 60-day pre-partum energy-protein supplementation on performance, metabolic and hormonal responses during the peripartum of grazing beef cows. Thirty-eight pregnant multiparous Nellore cows were assigned to a completely randomized design with two treatments: control with no supplement and supplementation on the last 60 gestation days (1.5 kg/d).

Results: The supplemented cows had higher ADG during the pre-partum ($P<0.10$), but ADG did not differ between treatments during the postpartum. Nonsupplemented cows' ADG did not change during these periods ($P>0.10$). Supplementation did not affect ($P>0.10$) BCS and calves' BW upon calving on days 45 and 90, milk yield and composition ($P>0.10$). No differences ($P>0.10$) were found for forage intake and neutral detergent fiber digestibility. The intake and digestibility of CP and OM increased ($P<0.10$) with supplementation. An interaction occurred ($P>0.10$) between supplementation and peripartum days for BUN, βHB, T3 and T4. Concentration of others blood parameters significantly changed ($P<0.10$) along peripartum days. There was no difference in pregnancy rates and days from calving to conception among treatments ($P>0.10$).

Conclusions: Providing energy-protein supplement for grazing Nellore cows on the last 60 d of gestation improve energy balance during pre-partum, however, no carryover effects are seen for pre-partum supplementation on post-partum physiological responses. Keywords: nutrition, metabolism, parturition, Zebu

Full-text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Tables

Table 1. Ingredients and composition of supplement provided to cows at 60-days pre-partum

Item[1]	Supplement
Ingredients (%; as-fed basis)	
Corn meal	41.2
Soybean meal	36.0
Wheat meal	20.0
Urea:ammonium sulfate (9:1)	2.80
Chemical composition (g/kg of DM)	
OM	965
CP	320
apNDF	143

[1] OM – organic matter; CP – crude protein; apNDF – neutral detergent fiber corrected for ash and protein residue. Mineral mix - CaHPO4= 50.00%; NaCl= 47.775%; ZnSO4= 1.4%; Cu2SO4= 0.70 %; CoSO4= 0.05%; KIO3= 0.05% and Mr 0.025%.

Table 2. *Uruchloa decumbes* chemical composition

Item	Months			
	August[4]	September	October	November
DM[1]	651.3	762.3	505.8	236.7
OM[2]	931.8	937.6	934.1	910.4
CP[2]	48.8	52.3	58.3	82.1
apNDF[2]	749.3	770.1	731.2	592.5
iNDF[2]	338.7	347.6	362.1	177.8
NDIN[3]	217.1	190.4	259.2	425.6

Dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fibre corrected for ash and protein (apNDF), indigestible neutral detergent fiber (iNDF), insoluble neutral detergent nitrogen (NDIN).
[1]/ g/kg of natural matter
[2]/ g/kg DM
[3]/ g/kg total nitrogen
[4]/ intake and digestibility assay

Table 3. Least square means and P-values for effect of energy-protein supplementation on cows and calves' performance

Item[1]	Treatment		SEM
	No supplementation	Supplementation	
Calving BW (kg)	515.1	536.9	13.86
Calving BCS	5.19	5.53	0.222
BCS 45	5.38	5.11	0.273
CBW (kg)	30.8	32.1	1.14
CBW45 (kg)	70.6	73.0	1.78
CBW90 (kg)	93,2	101.1	6.30
N° days to conception	80	77	11.30
Pregnancy rate (%)	73	68	-

[1]BW- body weight; BCS – Body Condition Score; CBW - Calf Birth Weight; CBW45- Calf Body Weight at 45 days; CBW90- C Weight at 90 days

Table 4. Least square means and P-values for effect of energy-protein supplementation on milk production and composition

Item[1]	Treatment		SEM	P-value
	NS	SS		

Milk 30	7.69	7.84	0.432	0.817
FCM [a] 30	8.68	8.43	0.521	0.742
Fat (%)	5.00	4.90	0.205	0.755
Protein (%)	2.99	3.02	0.054	0.697
Lactose (%)	4.60	4.65	0.066	0.557
Total solids (%)	13.40	13.31	0.285	0.825
Milk 45	7.74	8.15	0.424	0.525
FCM [a] 45	9.17	9.41	0.449	0.717
Fat (%)	5.40	5.17	0.244	0.514
Protein (%)	3.05	3.09	0.057	0.598
Lactose (%)	4.63	4.65	0.047	0.673
Total solids (%)	13.89	14.07	0.221	0.556

[a]FMC=4% fat-corrected milk yield (30 and 45 days)

Table 5. Least square means and P-values for effect of energy-protein supplementation on cow's intake during pre-calvir

Item	Treatments		SEM	*P*-v
	No supplementation	Supplementation		
	kg/d			
DM	7.82	8.88	0.317	0.
DMF	7.82	7.54	0.317	0.
OM	7.29	8.29	0.291	0.
CP	0.38	0.80	0.015	<0
apNDF	5.96	5.86	0.237	0.
iNDF	2.66	2.57	0.105	0.
dOM	2.93	3.91	0.227	0.
dNDF	3.02	2.94	0.171	0.
	g/kg BW			
DM	15.33	17.24	0.742	0.
DMF	15.33	14.63	0.718	0.
OM	14.31	16.09	0.684	0.
apNDF	11.68	11.39	0.539	0.
iNDF	5.22	4.99	0.236	0.

Total dry matter intake (DM), dry matter of forage intake (DMF), organic matter (OM), crude protein (CP), neutral de corrected for ash and protein (apNDF), indigestible NDF (iNDF), digested organic matter (dOM), disgested NDF (dNDF).

Table 6. Least square means and P-values for effect of energey-protein supplementation on apparent digestibility and synthesis of nitrogen compounds during pre-calving

Item	Treatments		SEM	*P*-value
	No supplementation	Supplementation		Sup
OM	39.86	47.32	1.522	0.013
CP	2.77	50.65	1.623	<0.001
apNDF	50.67	50.21	0.014	0.832
Nmic	89.24	92.69	66.535	0.370
Emic	190.06	148.16	12.666	0.036

Organic matter (OM, %), crude protein (CP, %), neutral detergent fiber corrected for ash and protein (apNDF, %), digested organic matter (dOM, g/kg DM), ruminal synthesis of microbial nitrogen (NMic, g/d), efficiency for synthesis of microbial pr (Emic, g microbial CP synthesis kg dOM intake).

Table 7. Least square means and P-values for effect of supplementation on serum metabolites and hormones during pre

Item	Treatments		SEM
	No supplementation	Supplementation	
Glucose, mg/dL	62.97	63.70	1.895
Triglycerides, mg/dL	26.74	27.07	1.085
Total cholesterol, mg/dL	132.04	142.47	5.385
VLDL mg/ dL,	5.34	5.41	5.385
LDL mg/ dL,	56.21	66.15	5.054
HDL mg/ dL,	69.45	70.58	3.339
Creatinine, mg/dL	1.40	1.39	0.054
BUN, mg/dL	14.46	15.18	0.836
Total Proteins, g/dL	7.39	7.43	0.124
Albumin, g/dL	3.26	3.24	0.042
Globulins, g/dL	4.15	4.19	0.149
NEFA, mmol/L[1]	0.33	0.27	0.042
βHB, mmol/L[1]	0.47	0.45	0.021
IGF-1, ng/dL	184.64	196.54	16.670
Insulin, µIU/mL	2.99	2.83	0.324
T3, ng/mL	0.637	0.823	0.1305
T4, µg/dL	4.66	5.81	0.689
Progesterone, ng/mL,	0.87	1.02	0.2461

[1]/Non-esterified fatty acids (NEFA); β-hydroxybutyrate (βHB)
[2]/ Supplementation (Sup)
[3]/ Day relative to calving (Day)

Figures

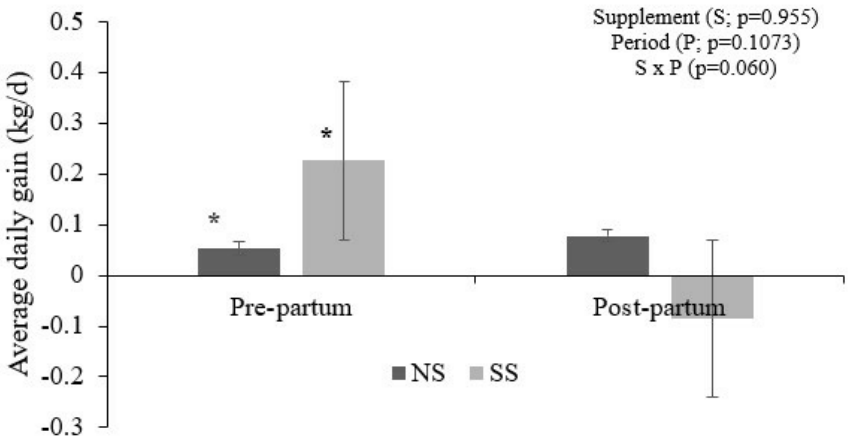


Figure 1

Average daily gain during pre- and post-partum period. Asterisks (*) indicate significant differences between treatments (P<0.10). NS: Nonsupplemented cows, SS: Supplemented cows.

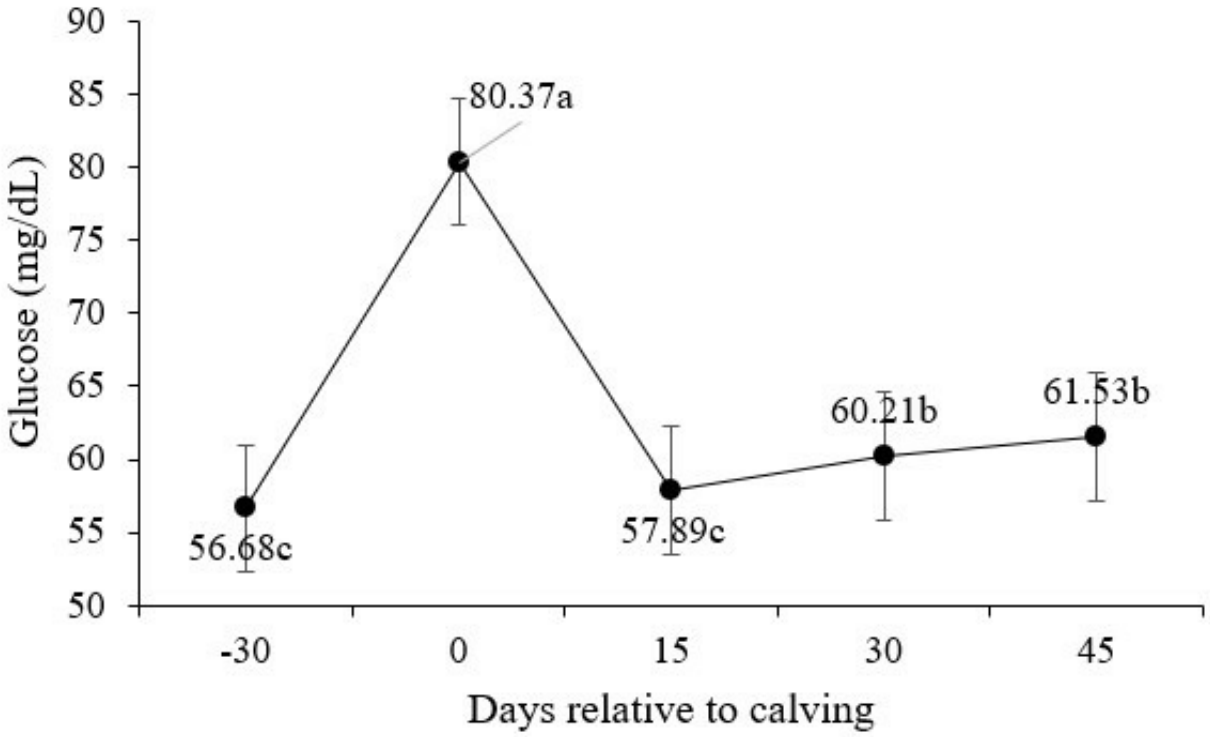


Figure 2

Glucose plasma concentrations during pre- and post-calving. Different letters indicate significant differences between days (P<0.10).

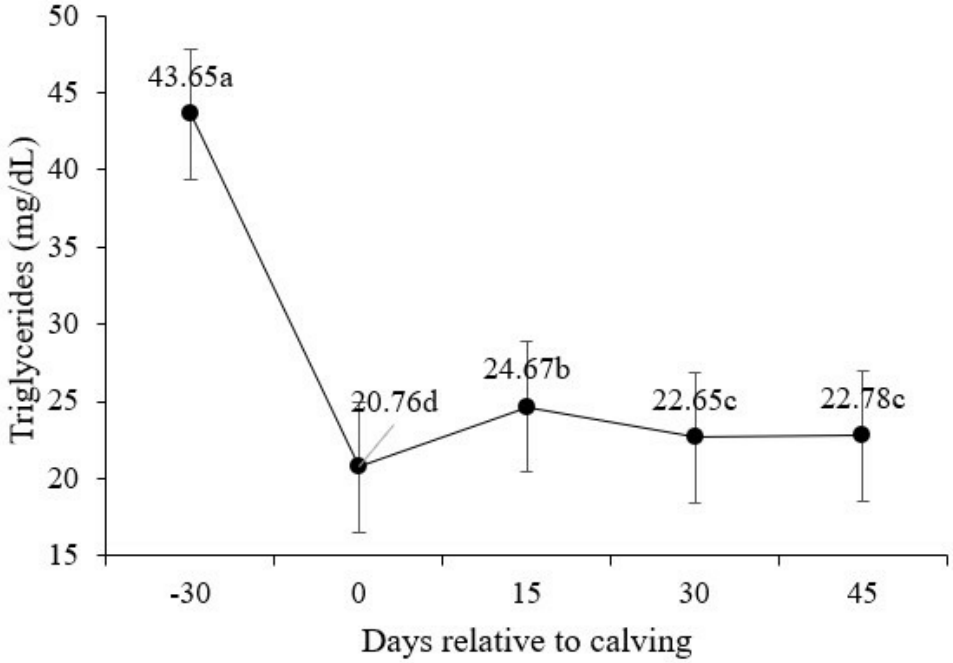


Figure 3

Triglycerides serum concentrations during pre- and post-calving. Different letters indicate significant differences between days (P<0.10).

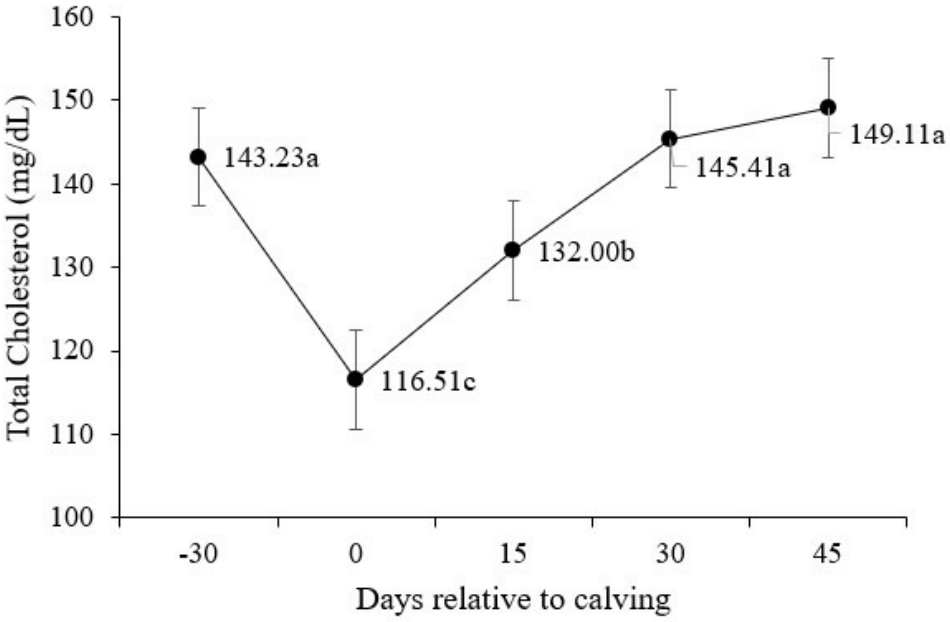


Figure 4

Total cholesterol serum concentrations during pre- and post-calving. Different letters indicate significant differences between days (P<0.10).

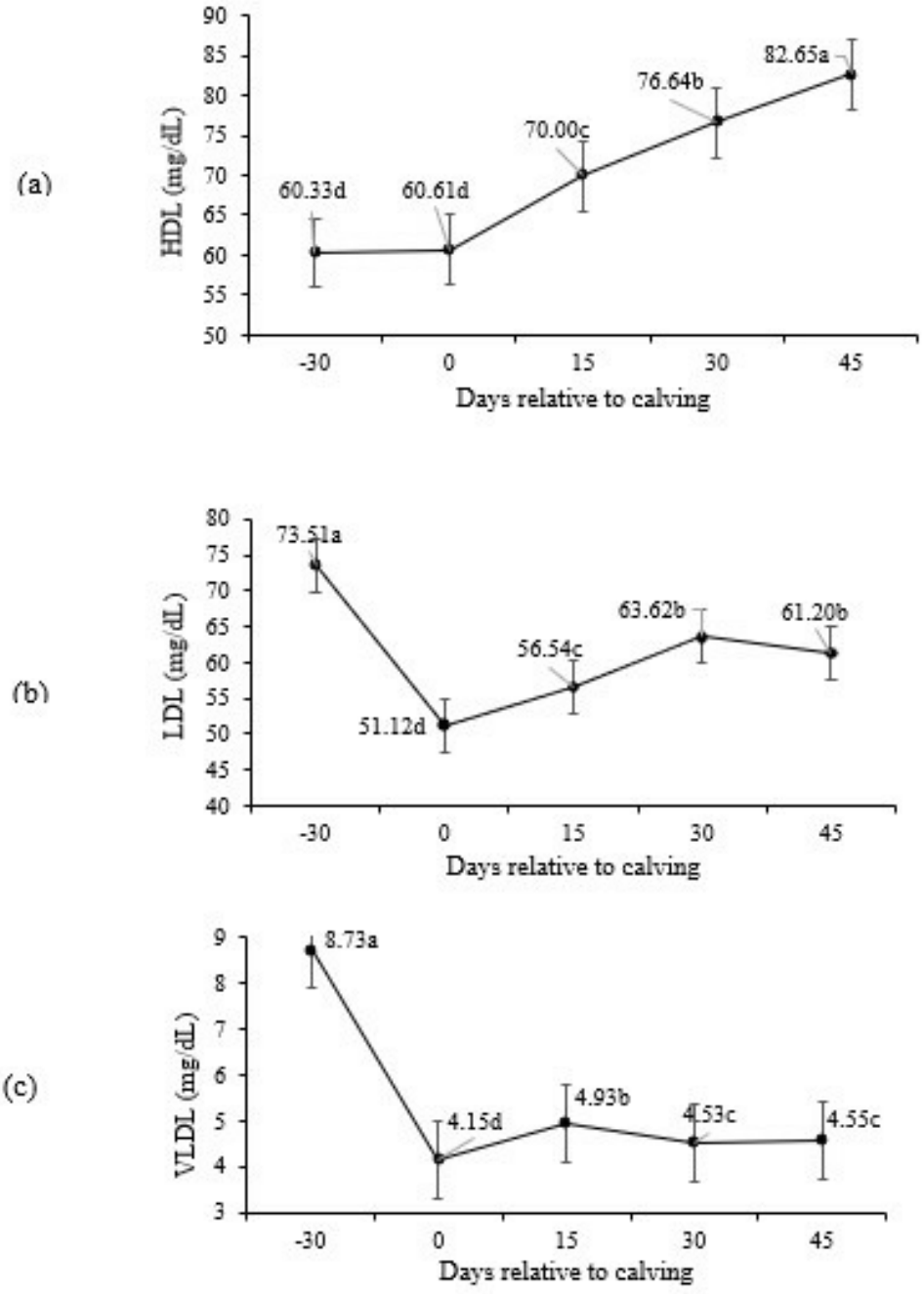


Figure 5

HDL (a), LDL (b) and VLDL (c) serum concentrations during pre- and post-calving. Different letters indicate significant differences between days ($P<0.10$).

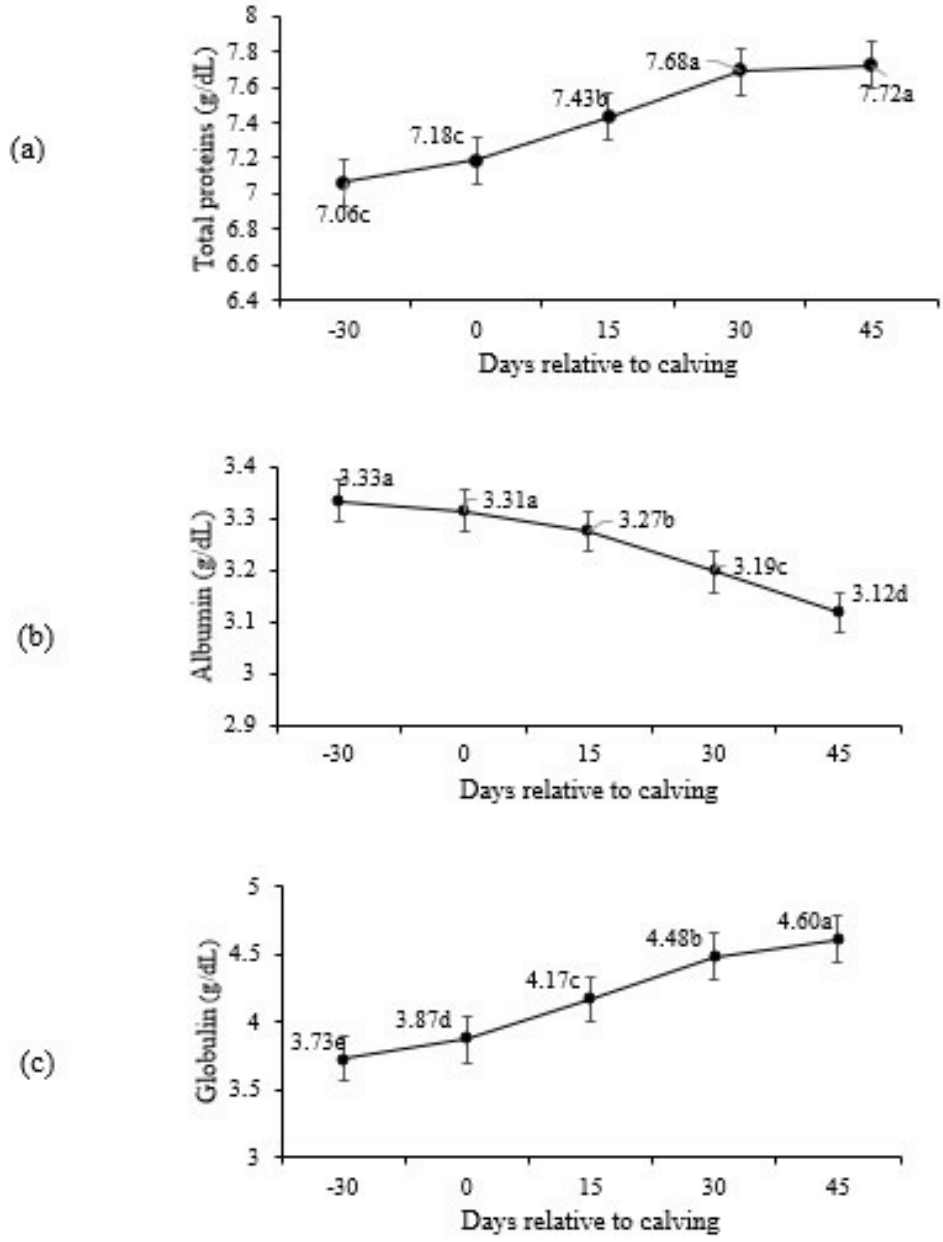


Figure 6

Total protein (a), albumin (b) and globulin (c) serum concentrations during pre- and post-calving. Different letters indicate significant differences between days ($P<0.10$).

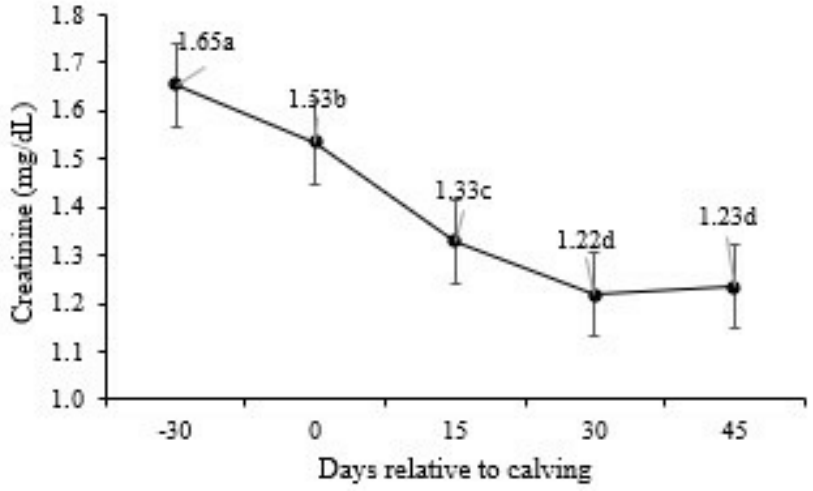


Figure 7

Creatinine serum concentrations during pre- and post-calving. Different letters indicate significant differences between days (P<0.10).

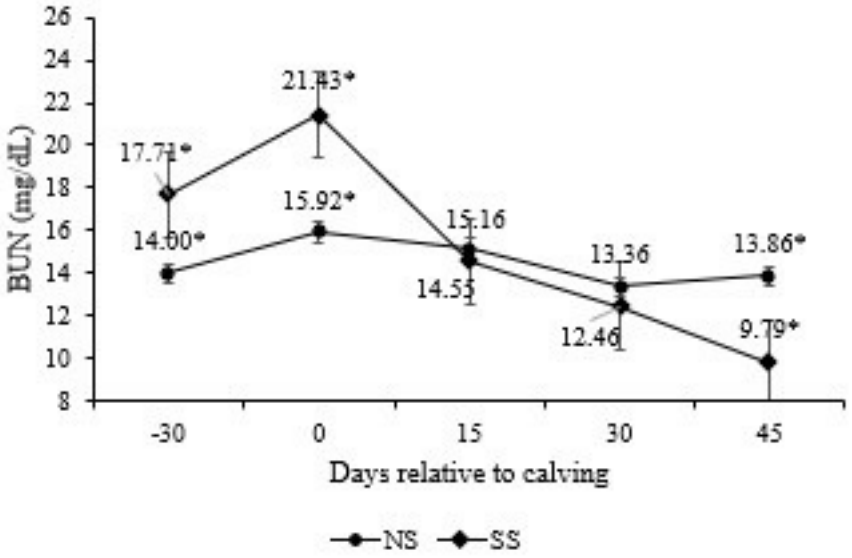


Figure 8

Blood urea nitrogen (BUN) concentrations during pre- and post-calving. Numbers followed by asterisks (*) are significantly different between treatments (P<0.10).

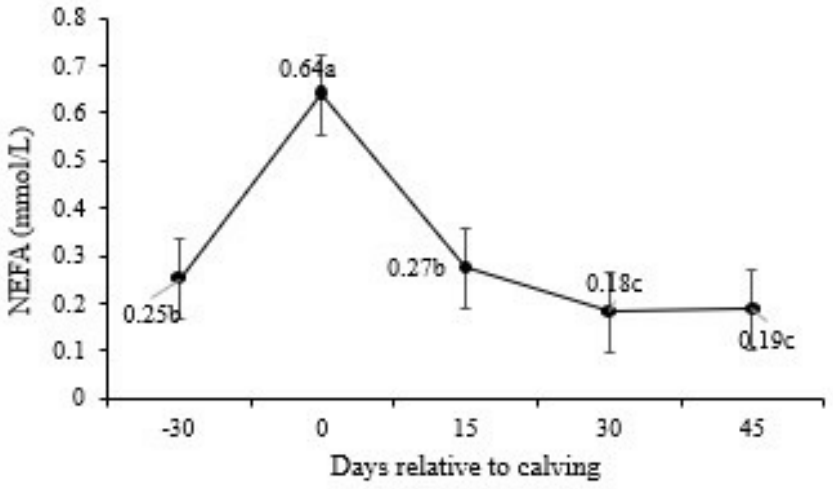


Figure 9

Non-esterified fatty acids (NEFA) serum concentrations during pre- and post-calving.

Different letters indicate significant differences between days (P<0.10).

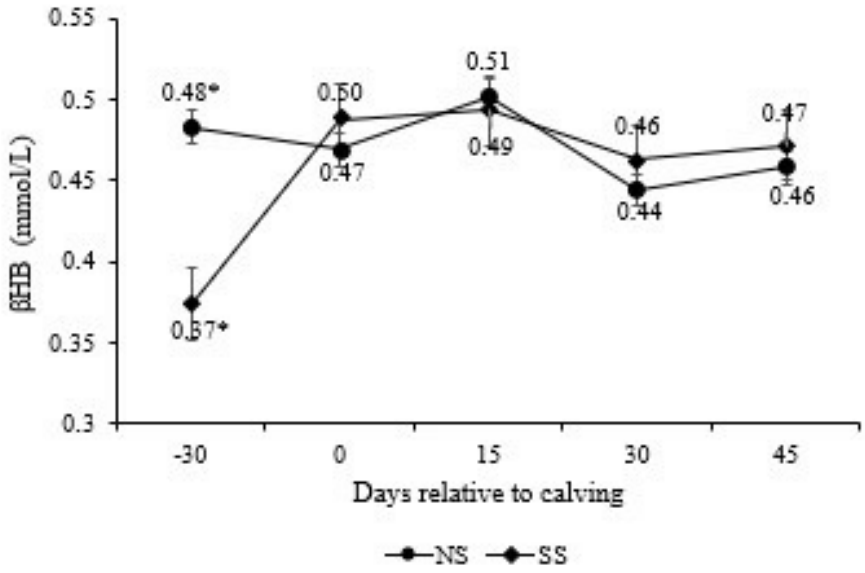


Figure 10

β-hydroxybutyrate (BHB) serum concentrations during pre- and post-calving. Numbers followed by asterisks (*) are significantly different between treatments (P<0.10).

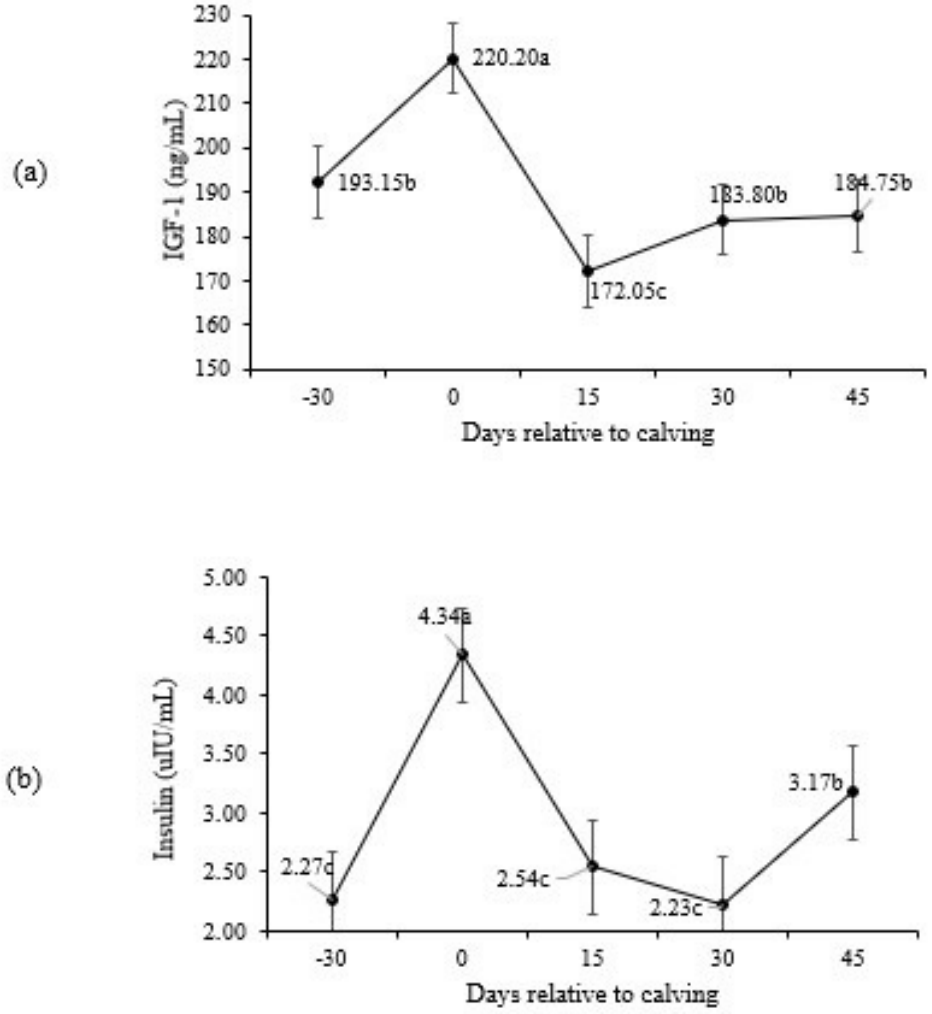
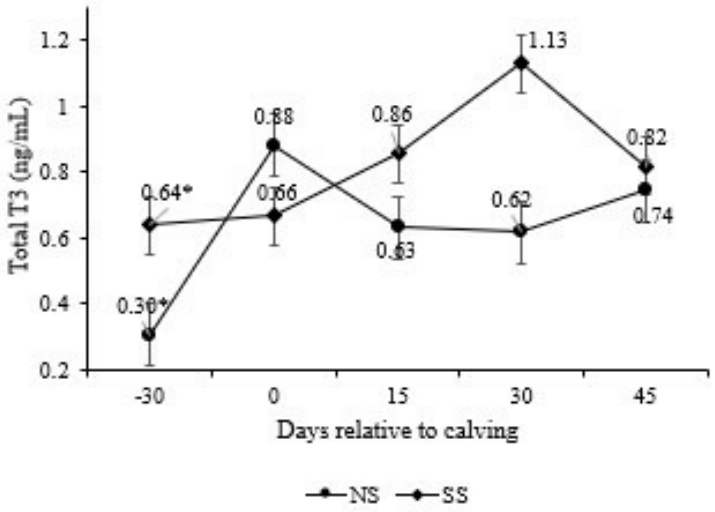


Figure 11

IGF-1 (a) e Insulin (b) serum concentrations during pre- and post-calving. Different letters indicate significant differences between days ($P<0.10$).

(a)



(b)

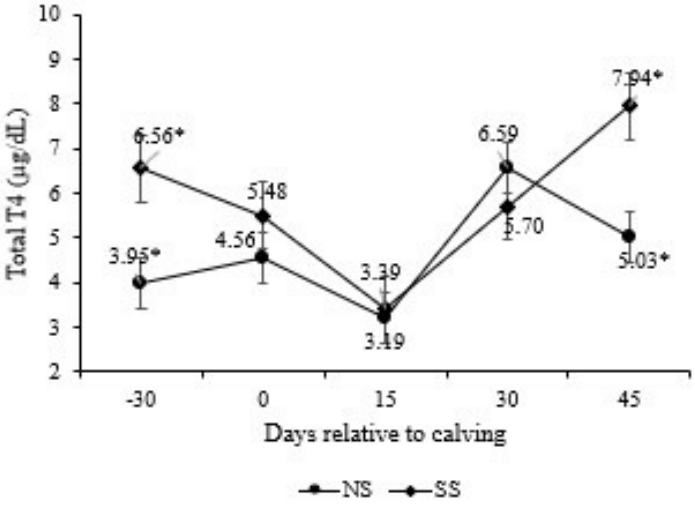


Figure 12

Total T3 (a) and T4 (b) serum concentrations during pre- and post-calving. Numbers followed by asterisks (*) are significantly different between treatments ($P<0.10$).