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CONSTRUINDO SABERES, FORMANDO PESSOAS E TRANSFORMANDO A PRODUÇÃO ANIMAL

EFFECT OF DURATION OF LIMIT-FEEDING ON BLOOD CONCENTRATIONS OF METABOLITES IN HOLSTEIN × ZEBU FINISHING STEERS

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Resumo: Objetivou-se avaliar o efeito de diferentes durações de restrição alimentar sobre as concentrações sanguíneas de metabólitos de machos Holandês × Zebu castrados em terminação. Vinte machos Holandês × Zebu castrados (peso médio inicial = 319 ± 16,2 kg; idade = 19 ± 1 mo) foram aleatoriamente designados a um dos tratamentos: alimentação ad libitum por 84 dias (**AL84**); alimentação restrita durante os primeiros 28 dias (**R28**); alimentação restrita durante os primeiros 42 dias (**R42**); ou alimentação restrita por 84 dias (**R84**). Animais dos tratamentos R28, R42, e R84 receberam alimentação restrita a 85% do consumo ad libitum de materia seca. Amostras de sangue foram coletadas nos dias 0, 21, 42, 63, e 84. Não houve interação tratamento × dia para nenhum dos metabolitos avaliados (P>0,10). Não foram observados efeitos de tratamento ou dia (P≥0,24) para concentrações de creatinina, triglicerídeos, ou proteina total. Observou-se efeito de tratamento para as concentrações de ureia e albumina (P<0,05). Independente da duração da restrição, não foram observadas adaptações fisiológicas durante a restrição alimentar para nenhum dos metabólitos analisados em machos Holandês × Zebu castrados em terminação.

Palavras-chave: blood parameters, compensatory growth, growth physiology

Introduction

Limit-feeding is defined as providing feed in amounts less than the predicted ad libitum intake. In most cases, limit-fed cattle experience compensatory growth (**CG**) when subsequently returned to ad libitum feed, due to the early metabolic adaptation to feed restriction (Hornick et al., 2000). However, the magnitude and persistence of the metabolic adaptation after ad libitum access to feed are variable and depend on the degree and duration of feed restriction (Hornick et al., 2000).

Thus, the exact mechanisms by which CG occurs are still not fully understood. Therefore, our objective was to evaluate the effect of duration of limit-feeding on response of key metabolites associated with growth metabolism of Holstein × Zebu finishing steers limit-fed to 85% of ad libitum dry matter intake (**DMI**).

Materials and Methods

The institutional animal care and use committee approved all procedures involving animals (process 12/2016). Twenty Holstein × Zebu steers (average age = 19 ± 1 mo; average initial body weight = 319 ± 16.2 kg) were used in this study. The experiment was a completely randomized design and lasted 112 d, with 28 d for the steers to adapt to the location and diets and 84 d of data collection. At the end of the adaptation period, steers were randomly assigned to 1 of 4 treatments: ad libitum-fed for 84 d (**AL84**); limit-fed for first 28 d (**R28**); limit-fed for first 42 d (**R42**); or limit-fed for 84 d (**R84**). During the limit-feeding periods, steers fed R28, R42, and R84 were limit-fed to 85% of ad libitum, based on AL84 steers DMI. All steers were fed a diet of 40% corn silage and 60% concentrate (dry matter basis) for 84 d.

Blood samples were collected from individual steers on d 0, 21, 42, 63, and 84 at 0700, before feeding. Plasma or serum concentrations of albumin, creatinine, urea, total protein, glucose, and triglycerides were measured using kits from Bioclin Diagnostics (Bioclin® Quibasa Química Básica Ltda, Belo Horizonte, Brazil), and analyzed in accordance with manufacturer's instructions in an automatic

biochemistry analyzer (Mindray BS200E, Shenzhen Mindray Bio-Medical Electronics Co. Ltd., Shenzhen, China).

Data were analyzed as a completely randomized design by PROC MIXED procedures in SAS (version 9.4, SAS Institute Inc., Cary, NC, USA). Sampling day was included as a repeated measure. Concentrations of the respective metabolites on d 0 were used as covariates, except for urea concentrations because urea concentrations did not differ on d 0. Means were compared using the Fisher test. For all tests, 0.05 was adopted as the critical level of probability for a type-I error.

Results and Discussion

There was no treatment × day interaction for any metabolites evaluated therefore, the main effects of treatment and day are discussed separately. Urea and albumin concentrations were affected ($P \leq 0.03$) by treatment (Table 1). Overall urea concentrations were greatest ($P<0.05$) in steers fed AL84 and least in steers fed R28; steers fed R42 and R84 were intermediate and not different ($P>0.05$) from one another. The lower urea concentrations may be indicative of the efficient use of nutrients (Ellenberger et al., 1989).

Overall albumin concentrations were greatest ($P<0.05$) in steers fed R42 and R84, and least in steers fed AL84; steers fed R28 were intermediate and not different ($P>0.05$) from the other treatments. While there was no main effect of treatment ($P=0.14$) on glucose concentrations, there was an effect of day ($P<0.01$) for concentrations of glucose. Glucose concentrations were lower ($P<0.05$) on days 0, 21, and 42, and subsequently increased ($P<0.05$) on days 63 and 84.

Metabolite concentrations have been used as indicators of animal growth status (Ellenberger et al., 1989; Keogh et al., 2015). In most cases, changes in metabolite concentrations are observed during limit-feeding period in ruminants, as a response to reduced feed intake and an attempt to maintain homeostasis (Hornick et al., 2000).

Table 1 - Effect of duration of limit-feeding period on blood parameters concentrations of Holstein × Zebu finishing steers[a]

Item	Treatment[b]				SEM	P-value	Days on feed					SEM	P-value
	AL84	R28	R42	R84			0	21	42	63	84		
No. animals	5	5	5	5	-	-	5	5	5	5	5	-	-
Glucose (mg/dL)	76.6	79.7	80.5	78.8	1.18	0.14	78.5b	78.4b	76.6b	79.2ab	81.8a	1.07	< 0.01
Triglycerides (mg/dL)	17.6	17.6	19.2	19.4	0.8	0.24	19.4	18.5	19.1	17.4	18.0	0.83	0.46
Urea (mg/dL)	20.5a	16.6c	17.5bc	18.6b	0.67	<0.01	18.5	18.0	19.5	18.8	16.7	0.90	0.26
Creatinine (mg/dL)	1.39	1.31	1.36	1.36	0.028	0.26	1.36	1.37	1.37	1.36	1.34	0.028	0.91
Albumin (g/dL)	3.15b	3.31ab	3.43a	3.42a	0.046	0.03	3.33	3.27	3.29	3.35	3.40	0.056	0.45
Total protein (g/dL)	7.06	6.9	6.8	6.88	0.122	0.48	6.86	7.00	6.99	6.93	6.77	0.100	0.38

a–cMeans with different letters within a row are significantly different (P < 0.05).
[a]Treatment × day interaction was not significant.
[b]AL84 = Steers fed for ad libitum-intake for 84 d; R28 = Steers limit-fed (intake restricted to 85% of ad libitum dry matter intake (DMI), based on AL84 steers intake of the last 3 d) for 28 d then fed for ad libitum-intakes for 56 d; R42 = Steers limit-fed (intake restricted to 85% of ad libitum DMI, based on AL84 steers intake of the last 3 d) for 42 d then fed for ad libitum-intakes for 42 d; R84 = Steers limit-fed (intake restricted to 85% of ad libitum DMI, based on AL84 steers intake of the last 3 d) for 84 d.

Generally, feed restriction decreases concentrations of urea, glucose, albumin, and total protein; and, this effect is reversed within days after the return to ad libitum feeding, depending on the duration and severity of restriction (Ellenberger et al., 1989; Keogh et al., 2015). However, our results did not follow the same pattern. There was no treatment × day interaction for any of the metabolites evaluated. This suggests that, regardless timing of restriction, no physiological adaptation occurred during the

limit-feeding period for any metabolite evaluated. In addition, no treatment or day effect were observed for concentrations of creatinine, triglycerides, or total protein (P≥0.24). Thus, it seems that 15% of DMI restriction, up to 84 d, was not severe enough cause typical physiological responses to limit-feeding in finishing feedlot Holstein x Zebu steers.

Conclusion

Regardless timing of restriction in the current study, no physiological adaptation occurred during the limit-feeding period for any metabolites evaluated in Holstein × Zebu finishing steers.

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Referências

ELLENBERGER, M.A.; JOHNSON, D.E.; CARSTENS, G.E.; HOSSNER, K.L.; HOLLAND, M.D.; NETT, T.M.; NOCKELS, C.F. Endocrine and metabolic changes during altered growth rates in beef cattle. **Journal of Animal Science**, v.67, p.1446-1454, 1989.

HORNICK, J.L.; VAN EENAEME, C.; GÉRARD, O.; DUFRASNE, I.; ISTASSE, L. Mechanisms of reduced and compensatory growth. **Domestic Animal Endocrinology**, v.19, p.121-132, 2000.

KEOGH, K.; WATERS, S.M.; KELLY, A.K.; WYLIE, A.R.G.; SAUERWEIN, H.; SWEENEY T.; KENNY, D.A. Feed restriction and realimentation in Holstein-Friesian bulls: II. Effect on blood pressure and systemic concentrations of metabolites and metabolic hormones. **Journal of Animal Science**, v.93, p.3590-3601, 2015. doi:10.2527/jas.2014-8471.