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Short communication

Effects of supplementation with plant extract product containing carvacrol, cinnamaldehyde and capsaicin on serum metabolites and enzymes during the finishing phase of feedlot-fed bull calves

Cristina Castillo[a,*], José Luís Benedito[a], Patricia Vázquez[a,d], Víctor Pereira[a], Jesús Méndez[b], Juan Sotillo[c], Joaquín Hernández[a,1]

[a] Departamento de Patología Animal, Facultad de Veterinaria, Universidad de Santiago de Compostela, Campus Universitario s/n, 27002 Lugo, Spain
[b] Departamento Técnico de COREN, SCL. c/Juan XXIII 33, Ourense, Spain
[c] Departamento de Medicina y Cirugía Animal, Facultad de Veterinaria, Universidad de Murcia, Spain
[d] IMASDE-Agroalimentaria, Madrid, Spain

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ABSTRACT

This study investigated the *in vivo* effects of a commercial blend of plant extracts (carvacrol, cinnamaldehyde and capsaicin) on serum metabolic parameters closely connected with energy and protein metabolism (glucose; L-lactate; non-esterified fatty acids, NEFA; urea nitrogen, SUN; creatinine; total protein, TSP) and enzymes associated with hepatic function (aspartate-aminotransferase, AST and gamma-glutamyl transferase, GGT) in finishing-stage Belgian Blue bull calves maintained in a commercial feedlot. Monitoring was performed over 86 days in 24 animals randomly allotted to two groups: (1) a control group (CTR, no supplementation; $n = 10$), and (2) a group receiving dietary supplementation with a commercial blend of plant extracts (PEX, 100 mg/kg DM of concentrate; $n = 14$). Under the conditions of our study, supplementation with the commercial blend did not give detrimental effects, but the opposite: the decrease in serum L-lactate, NEFA and creatinine levels and the increase in SUN concentrations; suggests an improvement in the energy status and protein turnover of the supplemented animals.

1. Introduction

Many of the actions attributed to plant extracts derived from effects found in humans or monogastric animals, but it is no fair to suggest that this same effect will occur in ruminants, particularly in calves. The *in vitro* effects of several plant extracts and their constituents on ruminal fermentation have been well documented by Cardozo et al. (2004, 2005) and Busquet et al. (2005a,b, 2006), suggesting dietary supplementation with carefully selected and combined natural plant extracts as a possible means of modifying ruminal fermentation patterns in beef production systems.

Abbreviations: ADFom, acid detergent fibre expressed exclusive of residual ash; AST, aspartate-aminotransferase; BW, body weight; CP, crude protein; CTR, control diet (non-supplemented); DM, dry matter; DOT, days on trial; EDTA, ethylene-diamine-tetra-acetic acid; EE, ether extracts; GGT, gamma glutamyl-transferase; aNDFom, neutral detergent fibre expressed exclusive of residual ash; NEFA, non-esterified fatty acids; PEX, supplemented diet with a commercial blend of plant extracts (carvacrol cinnamaldehyde and capsaicin); SUN, serum urea nitrogen; TSP, total serum proteins.

* Corresponding author. Fax: +34 982 28 59 40.
E-mail address: cristina.castillo@usc.es (C. Castillo).

[1] ECBHM Diplomate.

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Table 1
Ingredients and chemical composition of the concentrates supplied in the present study.

	Growing	Finishing
Ingredient (g/kg of DM)		
Barley	326	305
Rye	50	60
Wheat	100	100
Corn	100	100
Molasses	25	25
Palm oil (980 g/kg bypass)	18	20
Palm kernel oil	–	40
Soybean meal, 440 g/kg CP	151	96
DDGS[a]	70	80
Corn gluten feed	100	100
Wheat bran	–	42
Soybean hulls	32	11
Vitamin/mineral premix[a]	28	21
Chemical composition (as feed basis)		
DM	895	881
CP	166	155
ADF	66	72
NDF	190	216
EE[b]	41	47
NFC[c]	545	531
Starch	350	350
Ash	58	51

[a] Vitamin and mineral premix contained per kg DM premix: 10,000 IU vitamin A, 2000 IU vitamin D, 10 IU vitamin E, 0.4 mg Co, 16 mg Cu, 25 mg Fe, 2 mg I, 110 mg Mn, 0.3 mg Se, and 120 mg Zn.
[b] EE: ether extract content.
[c] NFC: non-fibre carbohydrates calculated as 100 − (CP + ash + NDF + EE).

In addition, a little *in vivo* research (Cardozo et al., 2006; Chaves et al., 2008) on the effects of plant extracts has been performed, although under highly controlled conditions that do not closely reflect the management and nutritional protocols used on commercial feedlot farms. In a previous research performed by our group (Hernández et al., 2009) we found that supplementation with the same commercial blend of plant extracts (carvacrol, cinnamaldehyde and capsaicin) had beneficial effects on performance in comparison with controls, and only in the finishing period: although animals were supplemented in the beginning of the growing phase, the positive effects were observed after 8 weeks of supplementation (on 56 days on trial, DOT). Recent *in vivo* study in feedlot cattle (Yang et al., 2010) has shown that supplementation with cinnamaldehyde had no effect on final body weight or feed efficiency although metabolic parameters (glucose and NEFA) reflected improved energy status of the animals.

On the other hand, the clinical chemistry profile is a valuable diagnostic tool that can be useful for planning nutritional options and monitoring the response to it, indicating changes in the metabolic status of beef cattle. The study of animal health taking into account not only productive parameters but also health biomarkers is acquiring increasingly importance. In line with the scarcity of results on this field, the present study follows to last article of Hernández et al. (2009), now focusing on the stage were relevant effects were recorded, and evaluates short- and long-term effects of dietary supplementation with a commercial blend of three active compounds (carvacrol, cinnamaldehyde and capsaicin) on serum parameters closely connected with energy and protein metabolism (glucose; L-lactate; non-esterified fatty acids, NEFA; urea nitrogen, SUN; creatinine; total protein, TSP) and enzymes that associated with function (aspartate-aminotransferase, AST and gamma-glutamyl transferase, GGT) in finishing-stage Belgian Blue bull calves maintained in a commercial feedlot.

The objectives of the present study were therefore to evaluate the effects of a commercial blend of plant extracts containing carvacrol, cinnamaldehyde and capsaicin on serum metabolites in feedlot. As far as we know no studies of such metabolic variables have been carried out in which diet, as the independent variable, has been manipulated taking into account the nutritional protocols used in commercial feedlot farms.

2. Materials and methods

2.1. Animals and experimental design

This study was part of a larger research program concerning the employment of plant extracts as growth promotants in feedlot (Hernández et al., 2009). Twenty-four double-muscled Belgian Blue bull calves (131 ± 3.5 kg) were purchased and transported to the commercial study farm (Coren SCL, Ourense, NW Spain) at an age of 3–5 weeks. Adaptation to high-grain diets was carried out using milk replacer (1 L/20 kg body weight, BW) combined with a solid starter containing maize, wheat, barley, soybean meal, and vitamin-mineral premix (see footnote to Table 1); water and straw were available *ad libitum*. The compositions of the diets provided during the growing and finishing periods (14–22 and 23–35 weeks of age) are listed