ESSENTIAL OILS IN THE DIET OF CROSSBRED YOUNG BULLS FINISHED IN FEEDLOT: INFLUENCE ON ANIMAL PERFORMANCE, CARCASS TRAITS AND TEMPERAMENT

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Abstract – Three essential oils levels (1=without essential oils; 2= 3.5 g essential oils/animal/day; 4= 7.0 g essential oils/animal/day) were evaluated for 120 days on animal performance carcass traits, and temperament score of crossbred young bulls (F1 – ½ Nellore *vs.* ½ Angus) finished in feedlot. Twenty seven 12-month-old young bulls, with initial average weight of 243.21 ± 35.29 kg were kept in individual pens (10 m^2). Diets consisted of 10% roughage and 90% concentrate, with 1.50 kg/d expected. Shrunk body weight (BW) and temperament score were recorded at feedlot entry (d 0), on d 30, 60, 90, and 120 of feedlot. Average daily gain and carcass traits were determined. The experimental design was completely randomized, with three diets and nine replications. Different levels of essential oils did not affect final body weight, average daily gain, carcass characteristics and temperament.

Key Words – Cattle, Meat quality, Plant extract.

I. INTRODUCTION

Brazil is increasingly stands out in the world beef market, having the largest commercial cattle herd and is the largest exporter of beef in the world. Brazil has climate characteristics favorable for cattle. In the summer has forage supply, but has a dry winter where there is a shortage. However, the feedlot system enters as a key tool in this process, especially for finishing beef cattle, which reduces the time of slaughter and improve meat quality. Consumers are increasingly demanding for quality products, in the specific case of meat, the requirements are flavor, tenderness and amount fat. To improve performance and feed efficiency are some additives used in cattle feed. The additives in general interact with the membrane of Gram positive bacteria inhibiting their growth, and consequently selecting the Gram negative. However, in 2006 the European Union, banned the use of ionophores due to possible risk of toxicity and the emergence of resistant bacteria, considered a risk to human health. As a result, there is a huge search for natural alternatives to replace these products that improve animal production, such as performance, feed efficiency and meat quality. Some research shows positive effects of essential oils on animal performance. Essential oils are natural plant extracts that contain a wide variety of compounds with antimicrobial and antioxidant activities. Essential oils have characterized a direct effect on the rumen fermentation microorganisms responsible for acting to control pathogens by antimicrobial activity, since the essential oils act on the bacterial cell wall structure, denaturing and coagulating the proteins. More specifically, act by altering the permeability of the cytoplasmic membrane, resulting in loss of chemiosmotic control of the affected cell and therefore bacterial killing [1]. In addition to their antimicrobial activity, they posses biological activities such as that of antioxidants and as hypocholesterolemics, and stimulate effect on animal digestive systems. This study was carried out to evaluate performance and carcass characteristics of bulls fed with different levels of essential oils mix.

II. MATERIALS AND METHODS

Twenty seven12 month-old crossbred young bulls (F1 – ½ Nellore *vs.* ½ Angus), average weight of 243.21 ± 35.29 kg were used in this assay. Bulls were randomly kept in individual pens (10 m²), partially covered with concrete floor, furnished with 250 L drinking troughs and concrete 2 × 0.4 × 0.5-m feeding troughs. Young bulls were vaccinated, dewormed and distributed in a completely randomized design. Feed formulation

and quantity given daily to the animals followed NRC [2] recommendations for a 1.50 kg/day weight gain. The experiment comprised three diets: without mix essential oil (E00), with 3.5 g/animal/day of the essential oil (E3.5) and with 7.0 g/animal/day of the essential oil (E7.0). The essential oils mix consist in seven plants extracts: oregano (*Origanum vulgare*), garlic (*Allium sativum*), lemon (*Citrus limonium*), rosemary (*Rosmarinus officinalis*), thyme (*Thymus vulgaris*), eucalyptus (*Eucalyptus saligna*) and sweet orange (*Citrus aurantium*). Full iso-energetic and iso-nitrogenous diets, comprising 10% roughage and 90% concentrate (Table 1) were used.

Table 1 Chemical composition of the basal diets (% DM)

Item	E00[1]	E3.5[2]	E7.0[3]
DM[4]	88.14	88.14	88.14
OM[6]	96.58	96.58	96.58
CP[7]	12.51	12.51	12.51
EE[8]	3.15	3.15	3.15
TDN[9]	81.43	81.43	81.43
CF[10]	6.37	6.37	6.37
NDF[11]	21.02	21.02	21.02
ADF[12]	10.62	10.62	10.62
Ca[13]	0.36	0.36	0.36
P[14]	0.47	0.47	0.47
Essential oil	0.00	3.50	7.00

[1]Without essential oils; [2]3.5 g essential oils/animal/day; [3]7.0 g essential oils/animal/day, [4]Dry matter; [6]Organic matter; [7]Crude Protein; [8]Ether extract; [9]Total digestive nutrients, [10]Fiber carbohydrates; [11]Neutral detergent fiber; [12]Acid detergent fiber; [13]Calcium, [15] Potassium

Average daily weight gain was evaluated when bulls were weighted after a 16-h fast (solid food) at the start of the experiment and then at every 28 days. Bulls' final weight was determined on the 120th day (440.30 kg). Average daily gain was calculated by the difference between the initial live weight and the final live weight, divided by the number of days (120). At the end of the experiment, bulls were slaughtered at a commercial abattoir 20 km from feedlot (Maringá, PR) after a solid feed fast according to cattle finishing routine in Brazil. After slaughter, carcasses were divided medially through the sternum and vertebral column. The two similar halves were weighed to determine the weight of the hot carcass. Hot carcass dressing was determined by the ratio between the weight of the hot carcass and final live weight multiplied by 100. Carcasses were then identified and conditioned in freezers at a temperature below 4ºC, and kept for 24 h. Carcass length, leg length, cushion thickness and pH were evaluated after the chilling period. Cover fat thickness, *Longissimus* muscle area and ratio were determined on *Longissimus* muscle.

Carcass length is the distance between the pubis bone edge and the medial cranial edge of the first rib, and was calculated by tape measure. Leg length, the distance (cm) between the edge of the pubis bone and a mid-point of the tarsus articulation bones was measured by a wooden compass. The distance was then measured by tape. Using the above-mentioned compass, cushion thickness was calculated by tape-measuring the distance between the lateral and medial section of the cushion upper part. Backfat thickness was estimated on left side of the carcass by exposing the *Longissimus* muscle at the region between the 12th and 13th rib, through the mean of three equidistant points, by a precision caliper. The *Longissimus* muscle area was retrieved from the *Longissimus* muscle between the 12th and 13th ribs. The muscle was traced on vegetal paper and the area was measured using a planimeter.

Temperament was evaluated calculating chute score and exit score. Chute score was assessed based on a 5-point scale where: 1=calm with no movement; 2=restless movements; 3=frequent movement with vocalization; 4=constant movement, vocalization, shaking of the chute; and, 5=violent and continuous struggling [3]. Exit velocity was assessed by determining the speed of the steer exiting the squeeze chute by measuring rate of travel over a 2.0-m distance with an infrared sensor (FarmTek Inc., North Wylie, TX). Further, young bulls were divided in quintiles according to their exit velocity, and assigned a score from 1 to 5 (exit score; 1=slowest young bulls; 5= fastest young bulls). Individual temperament scores were calculated by averaging steer chute score and exit score [4]. The experiment comprised three diets and nine replications. The results were analyzed by variance analysis with SAS statistical package (Statistical Analysis System, version 8.1). Temperament data were assessed using PROC MIXED procedure of SAS and Satterthwaite

approximation. The model statement used for temperament score obtained during feedlot finishing 120 days contained the effects of diet, day and the resultant interaction and values obtained on d -10 as covariate. Data were analyzed using animal(diet) as the random variable. The specified term for repeated statements was day and animal(diet) as subject for temperament score, and the covariance structure utilized was based on the Akaike information criterion. Results are reported as least square means, separated using LSD and reported according to treatment effects (diet). Significance was set at $P \leq 0.05$.

III. RESULTS AND DISCUSSION

There was no difference in initial and final weight according the diets (P>0.05, Table 2). The different essential oils levels did not affect the average daily gain. Benchaar *et al.* [4] demonstrated no change in gain average dairy of beef cattle fed a silage-based diet supplemented with 2 or 4 g/day of a essential oil mixture consisting of thymol, eugenol, vanillin and limonene. Carcass weight, dressing percentage, fat thickness, LM area, carcass and leg length and cushion thickness were not affected by different essential oils levels.

Table 2 Carcass characteristics and meat quality of young bulls (1/2 Nellore *vs.* 1/2 Aberdeen Angus) fed on diets containing different essential oils levels

Items	Treatments, g/day			SEM[4]	P-*value*
	E00[1]	E3.5[2]	E7.0[3]		
IBW[5], kg	244.66	245.33	240.22	6.79	0.94
FBW[6], kg	444.77	431.22	444.88	10.03	0.82
ADG[7], kg	1.64	1.52	1.67	0.04	0.37
HCW[8], kg	243.16	239.76	245.68	6.35	0.93
HCD[9], %	54.60	55.48	55.14	0.34	0.58
CCW[10], kg	238.40	235.06	240.86	6.22	0.93
CCD[11], %	53.53	54.40	54.06	0.33	0.58
BT[12], mm	6.66	6.98	6.39	0.40	0.84
LMR[13], cm²	0,51	0.52	0,54	0.01	0.54
LMA[14], cm²	71.11	71.66	74.22	1.77	0.76
CL[15], cm	123.16	124.27	123.66	0.78	0.85
LL[16], cm	79.94	78.88	78.72	0.97	0.86
CT[17], cm	24.72	25	25.44	0.39	0.76

[1]Without essential oils; [2]3.5 g essential oils/animal/day; [3]7.0 g essential oils/animal/day, [4]Standart error of means; [5]Initial body weight; [6]Final body weight; [7]Average daily gain; [8]Hot carcass weight; [9]Hot carcass dressing; [10]Cold carcass weight; [11]Cold carcass dressing; [12]Backfat thickness; 13Longissimus muscle Ratio; [14]Longissimus Muscle area; [15]Carcass length; [16]Leg length; [17]Cushion thickness; Significant if $P \leq 0.05$.

Lack of effects of essential oil on carcass traits is consistent with the absence of the effects on gain diary in the present study. However Chaves *et al.* [5] reported that supplementation of lamb diets with 0.2 g/kg of carvacrol or cinnamaldehyde (essential oil) tended to increase liver weight but did not affect carcass weight. Bampidis *et al.* [6] observed that carcass characteristics were not changed in cattle fed with fed 0, 102, or 213 mg/d of oregano essential oils.

The temperament score was not affected by different levels of essential oil (Table 3).

Table 3 Temperament score of young bulls (1/2 Nellore *vs.* 1/2 Aberdeen Angus) fed on diets containing different essential oils levels

Items	Treatments, g/day			SEM[4]	P-*value*
	E00[1]	E3.5[2]	E7.0[3]		
Young bulls	2.31	2.21	2.27	0.14	0.88

[1]Without essential oils; [2]3.5g essential oils/animal/day; [3]7.0g essential oils/animal/day; [4]Standart error of means; Significant if $P \leq 0.05$.

Temperament score was not affected by essential oils inclusion in the diet during feedlot finishing (Fig. 1).

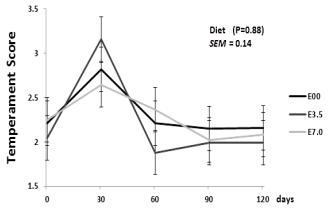

Figure 1. Temperament score during feedlot finishing (120 days) of young bulls (1/2 Nellore *vs.* 1/2 Aberdeen Angus) fed on diets containing different essential oils levels (E00=Without essential oils; E3.5= 3.5g essential oils/animal/day; E7.0=7.0g essential oils/animal/day).

IV. CONCLUSION

The different levels of essential oils not affect the animal performance, carcass traits, and temperament score of young bulls finished in feedlot. It is necessary more study for prove the effects of essential oils in beef cattle productions.

ACKNOWLEDGEMENTS

Appreciation is expressed to São Paulo Research Foundation – FAPESP (process 2012/18873-8 research support and 2012/11918-6, master scholarship).

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