

INFLUENCE OF ESSENTIAL OILS ON ANIMAL PERFORMANCE, CARCASS TRAITS AND TEMPERAMENT OF HEIFERS FINISHED IN FEEDLOT

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Abstract – Essential oils (EO) are natural products extracted from plants by steam distillation, which are known for its antimicrobial effects, as potential alternative to growth promoters in animal production. Three levels of essential oils were evaluated for 90 days on performance and carcass characteristics of crossbred heifers (F1 – ½ Nellore vs. ½ Angus) finished in feedlot. Forty-two 12-month-old heifers, with initial average body weight of 219±27 kg, were kept in individual pens (10 m²). Diets consisted of 10% roughage and 90% concentrate, with expected 1.50 kg/day weight gain. The experimental design was completely randomized, with three diets and fourteen replications. Shrink body weight (BW), average daily gain and carcass characteristics were determined. Different levels of essential oils did not affect final body weight, average daily gain, carcass characteristics and temperament score.

Key Words – Cattle, Meat quality, Plant extract

I. INTRODUCTION

The new beef production system is rounded up with cattle finished in feedlot [1]. Feeding cost in feedlot represents 70-80% of animal production; therefore is important to improve the performance and thus ensure the profitability of production and meat quality. Additives are added in the diets to improve feed efficiency. Thus, ionophores have been extensively used in ruminants as growth promoters [2]. However, no animal-based food products containing these substances has entered or been produced in Europe since January 2006, according to the European Union legislation published in the Official Journal of the European Union (Regulation 1831/2003/EC).

Thus, it is necessary to research natural alternatives to replace ionophores additives in the diets of ruminants. In recent years, plant extracts such as essential oils (EO) have received increased attention as potential alternatives to growth promoters for animal production. They have been shown to exhibit selective antibacterial activity, and may inhibit degradation of protein in the rumen, thereby potentially increasing the intestinal supply of amino acids (AA) to the animal host. These substances have also been proposed, at low dosages, to be modifiers of rumen fermentation [3]. In Europe, use of plant extracts in livestock production has expanded [4] Essential oils (EO), which are natural products are extracted from plants by steam distillation, are known to have antimicrobial effects due to their ability to modify cell permeability in microbes [5]. Consumers are concerned on product quality that is consumed. Beef quality is determined by several factors, in particular, nutrition and genetic groups [6]. This study was carried out to evaluate performance, carcass characteristics and temperament from heifers fed with different levels of essential oils mix.

II. MATERIALS AND METHODS

Forty-two 12 month-old crossbred heifers (F1 – ½ Nellore vs. ½ Angus), average body weight of 219 ± 27 kg were used in the current study. Heifers 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. Heifers were vaccinated, dewormed and distributed in a completely randomized design.

Feed formulation and quantity given daily to the animals followed NRC [7] recommendations for a 1.50 kg/day 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 7.5g /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 (10% roughage and 90% concentrate) were used (Table 1).

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

Item	F00 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

¹Without essential oils; ²3.5 g essential oils/animal/day; ³7.0 g essential oils/animal/day; ⁴Dry matter; ⁶Organic matter; ⁷Crude Protein; ⁸Ether extract; ⁹Total digestive nutrients; ¹⁰Fiber carbohydrates; ¹¹Neutral detergent fiber; ¹²Acid detergent fiber; ¹³Calcium; ¹⁵Potassium

Average daily gain was evaluated when beef heifers were weighted after a 16-h fast (solid food) at the start of the experiment (d 0) and then at every 28 days. Final body weight was determined on the 90th day (345 kg). Average daily gain was calculated by the difference between the initial body weight and the final live weight, divided by the number of days of feedlot (90). At the end of the experiment, crossbreeds 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 the hot carcass. Hot carcass dressing

was determined by the ratio between the weight of the hot carcass and final body weight multiplied by 100. Carcass physical factors, such as carcass length, leg length, cushion thickness and pH were evaluated after the chilling period (24 h). Backfat thickness, *Longissimus* and ratio muscle area, were determined on *Longissimus* muscle.

Carcass length (the distance between the pubis bone edge and the medial cranial edge of the first rib) was calculated by tape measure. Leg length (the distance, in 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 obtained by tape measure; 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 on *Longissimus* muscle between the 12th and 13th ribs. The muscle was traced on vegetal paper and the area was measured by a planimeter. Individual temperament scores were calculated by averaging steer chute score [8] and exit score by measuring rate of travel over a 2.0-m distance with an infrared sensor (FarmTek Inc., North Wylie, TX). The experiment comprised three diets and fourteen replications. The results were analyzed by variance analysis with SAS statistical package. 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

The initial body weight was similar for heifers from three diets (Table 2). The different levels of essential oil did not affect the average daily gain ($P > 0.05$). There is a great variation among the results of various plant extracts inclusion in the diets for ruminants and the number of the studies on essential oils effect on animal performance and meat quality on cattle finished in feedlot is very small. The diets did not change hot and cold weight and carcass dressing. Hot

carcass dressing was 52.6%. In Brazil, crossbred bulls (*Bos taurus* vs. *Bos indicus*) fed high energy density and finished in feedlot presents hot carcass dressing between 52 and 56% [9]. Carcass characteristics including carcass weight, dressing percentage, backfat thickness, LM area, carcass and leg length, and cushion thickness were not affected by different essential oils levels. Lack of effects of essential oil on carcass traits is consistent with the absence of the effects on daily gain in the present study. However Chaves et al. [10] reported that supplementation of lamb diets with 0.2 g/kg of carvacrol or cinnamaldehyde (essential oil of cinnamon) tended to increase liver weight but did not affect carcass weight.

Table 2 Carcass characteristics and meat quality of heifers (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	219.26	220.28	219.78	4.29	0.99
FBW ⁶ , kg	341.06	347.71	347.57	4.84	0.81
ADG ⁷ , kg	1.33	1.39	1.40	0.02	0.59
HCW ⁸ , kg	180.71	180.70	184.12	2.81	0.85
HCD ⁹ , %	52.97	51.93	52.97	0.28	0.23
CCW ¹⁰ , kg	176.51	176.05	179.81	2.72	0.83
CCD ¹¹ , %	51.74	50.61	51.73	0.28	0.18
BT ¹² , mm	6.49	6.28	7.33	0.42	0.58
LMR ¹³ , cm ²	0.53	0.55	0.51	0.01	0.47
LMA ¹⁴ , cm ²	57.40	58.45	61.66	1.67	0.59
CL ¹⁵ , cm	116.52	115.21	117.93	0.54	0.13
LL ¹⁶ , cm	74.38	74.52	73.64	0.47	0.72
CT ¹⁷ , cm	21.63	22.16	22.22	0.15	0.24

¹Without essential oils; ²3.5 g essential oils/animal/day; ³7.0 g essential oils/animal/day; ⁴Standart error of means; ⁵Initial body weight; ⁶Final body weight; ⁷Average daily gain; ⁸Hot carcass weight; ⁹Hot carcass dressing; ¹⁰Cold carcass weight; ¹¹Cold carcass dressing; ¹²Backfat thickness; ¹³Longissimus muscle Ratio; ¹⁴Longissimus Muscle area; ¹⁵Carcass length; ¹⁶Leg length; ¹⁷Cushion thickness; Significant if $P \leq 0.05$.

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

Table 3 Temperament score of heifers (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		
Heifers	2.12	2.10	2.11	0.11	0.99

¹Without essential oils; ²3.5g essential oils/animal/day; ³7.0g essential oils/animal/day; ⁴Standart 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).

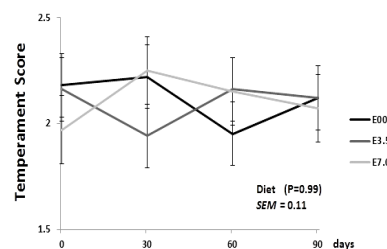


Figure 1. Temperament score during feedlot finishing (90 days) of heifers (1/2 Nellore vs. 1/2 Aberdeen Angus) fed on diets containing different essential oils levels (E00=Without essential oils; E3.5= 3.5g essential oils/animal/day; E7.0=7.0g essential oils/animal/day).

IV. CONCLUSION

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

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