GENETIC GROUP AND DIETARY POLYUNSATURATED FATTY ACID LEVEL ON SHELF LIFE OF BEEF

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Abstract – This study aimed to evaluate the effects of genetic group and dietary polyunsaturated fatty acid (PUFA) on shelf life traits of beef. Thirty Nellore and thirty crossbred Angus x Nellore males were feedlot and fed diets containing low (LPF) or high (HPF) PUFA levels. Soybean oil (3.5%) was added in HPF diet. After 133 days of feeding, animals were harvested and *Longissimus* muscle samples were taken for shelf life (0, 3 and 5 days) evaluations. No genetic group vs diet interaction was observed. Purebred animals showed higher values of thiobarbituric acid reacting substances (TBARS), L* and b* than crossbred animals. The HPF diet presented higher TBARS values than LPF. All treatments are unlikely to affect consumer acceptance of meat.

Key Words – crossbred, Nellore, soybean oil, TBARS

I. INTRODUCTION

Fatty acids (FA) profile of beef meat can be affected by factors like genetics and nutrition. Beef cattle with high content of intramuscular fat shows a more saturated FA profile because most of fat comes from lipid drop (triglycerides), which is rich in saturated FA, whereas animals with low content of intramuscular fat have a more unsaturated FA profile because fat comes mainly from cell wall (phospholipids) [1]. Several studies have shown that meat FA profile can be changed by feeding diets with high levels of polyunsaturated FA [2]. However, FA profile of meat affects oxidative stability of meat, decreasing shelf life, because polyunsaturated FA are more susceptible to oxidation than saturated FA [3]. Because distinct genetic groups have different potentials for depositing intramuscular fat, feeding high levels of polyunsaturated FA can also affect differently the FA profile and therefore the shelf life of meat. Therefore, this study was carried out to evaluate the effects of the dietary PUFA levels in different genetic groups, on shelf life properties of meat.

II. MATERIALS AND METHODS

Thirty Nellore and 30 crossbred Angus x Nellore (368 ± 28 kg bodyweight; 24 mo old) were feedlot and fed diets containing low (LPF) or high (HPF) levels of polyunsaturated FA. The control diets contained corn silage (10%), sugarcane bagasse (5%), corn grain (58%), citrus pulp (16%), soybean meal (9%), urea (1.2%), and mineral salt (0.8%). For the HPF diet, soybean oil (3.5%) was added in replacing of corn grain. After 133 days on feed, animals were harvested and samples of *Longissimus* muscle (12^{th} rib level) were taken, vacuum packed and aged for 7 days. After that, samples were removed from vacuum package and placed on Poyfoam trays, overwrapped with an oxygen-permeable polyvinylchloride film and stored for 0, 3 or 5 days under simulated retail display conditions of illumination (Halogen light; 2000 lx) and temperature (4 °C). Luminosity (L*), intensity of red (a*) and yellow (b*), evaporative loss, and thiobarbituric acid reacting substances (TBARS) were measured. Means were analyzed as repeated measurements over time and were compared by Student's t test. Differences were considered statistically significant when $P \leq 0.05$.

III. RESULTS AND DISCUSSION

There was no interaction among genetic groups, diets, and time for any traits evaluated.
Genetic group. Purebred animals had a higher values of L*, b*, and TBARS than crossbred animals (Table 1). On the contrary, a negative correlation between TBARS and L* have been reported by Wood et al. [3].

Diet. Animals fed HPF diet had a higher evaporative loss and TBARS concentration than those fed LPF. Nevertheless, concentrations of malonaldehyde (MDA) were lower than the threshold (2.0 mg/MDA.kg muscle tissue) recommended for the consumer acceptance of meat [4].
Time. Values of L*, a*, and b* decreased quadratically over time on the display ($P = 0.0012$; $P = 0.0014$; $P < 0.0001$), whereas evaporative loss and TBARS increased linearly over time (both $P < 0.0001$). These results are in agreement with Rodas-Gonzalez et al. [5] statement that the exposure of meat to the oxygen catalyzed lipid oxidation over time.

Table 1 Means, standard errors (SEM) and probabilities (*P*-value) of the shelf life and lipid oxidation of meat according to the genetic group and diets.

Traits[2]	Genetic group (GG)		Diet (DT)[1]		SEM	*P*-value		
	B. indicus	Crossbred	LPF	HPF		GG	DT	GG x DT
L*	38.4	36.6	37.5	37.4	0.48	0.0003	0.7844	0.5441
a*	18.4	17.6	17.9	18.1	0.61	0.1790	0.7040	0.4767
b*	15.1	13.7	14.3	14.5	0.33	0.0023	0.7753	0.1978
Evaporative loss, %	6.0	5.7	5.3	6.5	0.36	0.4974	0.0065	0.2221
TBARS, mg MDA/kg	0.21	0.16	0.16	0.21	0.02	0.0249	0.0023	0.5750

[1]LPF = low polyunsaturated fatty acid level. HPF = high polyunsaturated fatty acid level.
[2]TBARS = thiobarbituric acid reacting substances; MDA = malonaldehyde

Table 2 Means, standard errors (SEM) and probabilities (*P*-value) of the shelf life and lipid oxidation of meat according to the time under simulated retail display conditions.

Traits[1]	Time, days			SEM	*P*-value
	0	3	5		
L*	38.3	38.5	35.6	0.53	<0.0001
a*	19.8	19.8	14.3	0.67	<0.0001
b*	15.4	15.6	12.2	0.39	<0.0001
Evaporative loss, %	-	5.1	6.7	0.36	0.0007
TBARS, mg MDA/kg	0.14	0.16	0.26	0.02	<0.0001

[1]TBARS = thiobarbituric acid reacting substances; MDA = malonaldehyde

IV. CONCLUSION

Meat from purebred animals had higher oxidative potential as well as diets with HPF levels. However, in spite of these changes, all treatments are unlikely to affect consumer acceptance of meat.

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REFERENCES

1. De Smet, S., Raes, K., & Demeyer, D. (2004). Meat fatty acid composition as affected by fatness and genetic factors: a review. Animal Research 53(2): 81-98.
2. Bressan, M. C., Rodrigues, E. C., De, M. L., Ramos, E. M., Silva, J. S., Bessa, R. B., & Gama, L. T. (2016). Differences in intramuscular fatty acid profiles among Bos indicus and crossbred Bos taurus × Bos indicus bulls finished on pasture or with concentrate feed in Brazil. Italian Journal of Animal Science 15(1): 10-21.
3. Wood, J. D., Enser, M., Fisher, A. V., Nute, G. R., Sheard, P. R., Richardson, R. I., Hughes, S. I., & Whittington, F. M. (2008). Fat deposition, fatty acid composition and meat quality: A review. Meat Science 78(4): 343-358
4. Campo, M. M., G. R. Nute, S. I. Hughes, M. Enser, J. D. Wood, & R. I. Richardson. (2006). Flavour perception of oxidation in beef. Meat Science 72:303-311.
5. Rodas-Gonzalez, A., C. Narvaez-Bravo, M. M. Brashears, J. L. Tedford, G. O. Clark, J. C. Brooks, B. J. Johnson, R. J. Rathmann, & M. F. Miller. (2011). Evaluation of the storage life of vacuum packaged Australian beef. Meat Science 88:128-138.