EFFECT OF DURATION OF LINSEED SUPPLEMENTATION ON NUTRITIONAL PROPERTIES OF BEEF

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Abstract – This study was conducted to assess the effect of linseed supplementation and the duration of feeding on nutritional properties of beef. Fatty acids, and bioactive compounds were determined on steaks from Friesian steers. Animals were divided into six experimental treatments consisting in 2 finishing diets: control diet *vs* linseed diet containing 10% whole linseed and 3 time of feeding: 40, 75, or 120 days before slaughter. Meat from steers fed linseed supplementation showed an increased percentage of n-3 PUFA from 40 to 75 days of feeding, while, CLA increased from 40 and 75, but declined at 120 days. Duration of feeding significantly affected creatine concentrations with an increase in LS group from 40 to 75 days of feeding.

Key Words – bioactive compounds, fatty acids profile, duration of feeding

I. INTRODUCTION

Many studies have been conducted on diet supplementation with oilseeds to produce beef with enhanced levels of components with potential health benefits such as *n*-3 PUFA and CLA [1]. However, little information regarding the changes of meat fatty acids composition in response to the duration of oilseed inclusions in the diet of ruminants are available. Few studies on pig [2] have been carried out to investigate the time required for the incorporation of significant quantity of PUFA into meat. Therefore, the aim of this study was to assess how the duration of linseed feeding may affect the incorporation of *n*-3 PUFA in beef in order to determine the optimal supplementation strategy. The dietary effects of linseed on fatty acids profile, and bioactive compounds were also studied.

II. MATERIALS AND METHODS

Fifty-four Friesian steers were randomly allocated during finishing period into six experimental treatments following a 2 x 3 factorial arrangement. The 6 treatments consisted of 2 diets, control (CO) *vs* linseed diet (LS) containing 10% whole linseed and 3 different time of administration of the diet: 40, 75, or 120 days before slaughter. At the end of each feeding period, steers were slaughtered and after 8 days of aging longissimus thoracis muscle was removed from each half carcass and cut into steaks for nutritional determination.

FAME were extracted according to O'Fallon et al. [3] and quantified using a gas-cromatograph equipped with HP-88 fused-silica capillary column (length 100 m, internal diameter 0.25 mm, film thickness 0.25μm). Individual FAMEs peaks were identified by comparing their retention times with those of standards. (Matreya). Creatine, creatinine, carnosine and anserine were extracted from raw meat and analyzed by HPLC according to Mateescu et al. [4]. The chromatographic separation was performed using an Infinity 1260 HPLC equipped with Kinetex HILIC Silica column (4.6 × 75 mm, 2.6 μm) and a DAD detector. Data were subjected to an analysis of variance, using the GLM procedure of the SAS statistical software [5]. The mathematical model included fixed effect due to diet, duration of feeding, interaction of diet x duration and random residual error. All effects were tested for statistical significance (to $P < 0.05$) and significant effects were reported in table.

III. RESULTS AND DISCUSSION

The effect of linseed supplementation and duration of feeding on nutritional properties of beef is shown in Table 1. Linseed supplementation increased significantly the percentage of total monounsaturated fatty acid (MUFA),

polyunsaturated fatty acids (PUFA), total CLA and *n*-3 polyunsaturated fatty acids, while reduced saturated fatty acid (SFA) and *n*-6 polyunsaturated fatty acids. Regarding to the effect of duration of feeding a decline of total PUFA and *n*-6 PUFA was observed in control diet and in linseed diet, respectively. In addition, meat from steers fed with linseed supplementation showed an increased percentage of *n*-3, linolenic and EPA fatty acids passing from 40 to 75 days of administration remaining constant thereafter, while, vaccenic acid, CLA 9*c*,11*t*, total CLA increased (P<0.001) between 40 and 75, but declined at 120 days. Differences between the content of *n*-3 and *n*-6 fatty acids are related with the amount of linseed in the diet and the ratio of 18:3 *n*-3 to 18:2 *n*-6. In particular, these fatty acids compete for the same enzymes responsible for desaturation and elongantion and for their incorporation into lipid tissues. Diet supplemented with linseed increased the availability of linolenic acid into the rumen resulting in enhanced synthesis of its elongation and desaturation products such as EPA, DPA and DHA.

Table 1. Effect of linseed inclusion (CO *vs* LS) and feeding duration (40, 75 and 120 days) on fatty acid composition (%) and bioactive compounds (mg/g meat) of meat from *longissimus thoracis* muscle (means ± SEM).

	CO			LS				Effects, P		
	40	75	120	40	75	120	SEM	Diet	Duration	Diet x Duration
SFA	47.12	47.39	48.14	43.86	43.77	43.96	0.68	**	NS	NS
MUFA	40.85	40.28	40.15	42.64	42.84	42.79	0.61	*	NS	NS
PUFA	12.47^{a}	12.52^{a}	11.64^{b}	13.24	13.49	12.82	0.27	*	**	*
n-6	11.24	11.4	10.79	10.88^{a}	10.56^{ab}	10.06^{b}	0.21	*	*	*
n-3	1.23	1.13	0.85	2.36^{b}	2.93^{a}	2.76^{a}	0.13	**	*	NS
Total CLA	0.32	0.44	0.34	0.56^{b}	0.76^{a}	0.61^{b}	0.05	*	*	*
Creatine	2.61	2.72	2.83	2.88^{b}	3.15^{b}	3.28^{a}	0.08	*	*	*
Carnosine	2.12	2.38	2.3	3.45	3.68	3.77	0.12	***	NS	NS
Anserine	0.65	0.8	0.74	1.11	1.15	1.03	0.05	***	NS	NS

NS = not significant; * = P< 0.05; **= P<0.01; ***= P<0.001.

Diet significantly affected the profile of bioactive substances, in particular, meat from linseed group showed the greater concentration of creatine, carnosine and anserine than control meat. Duration of feeding significantly affected creatine concentration, while no differences were found in carnosine, creatinine and anserine concentrations.The high contents of bioactive compounds found in LS group could be linked to the amino acids composition of linseed. Although the interaction with other linseed components such as *n*-3 polyunsaturated fatty acids could have contributed to the great content of these compounds. This hypothesis could be confirmed by the highest content of creatine in meat from linseed group after 75 days.

IV. CONCLUSION

The present result suggested that supplying 10% linseed for 75 days before slaughter is a sufficient feed duration to reach the saturation plateau for the synthesis of the PUFA *n*-3 metabolites and for enrich meat of bioactive compounds. Short-term diet administration can be of interest for meat industry with an economic sustainability of linseed feeding.

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