SEQUENTIAL FEEDING OF EXTRUDED FLAXSEED (LinPRO-R™) AND HAY INCREASES N-3 PUFA BIOHYDROGENATION INTERMEDIATES IN *LONGISSIMUS THORACIS* OF STEERS

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Abstract – The present study was designed to determine if feeding steers extruded flaxseed and hay (25% and 75%; DM basis) together as a total mixed ration (TMR), or sequentially (non-TMR) would affect fatty acid profiles of *longissimus thoracis* (LT). Twenty four steers were fed per diet for 242 days. Dry matter intake was lower for non-TMR than TMR (P = 0.02), but growth performance did not differ. Overall carcass and meat quality were not affected by diet. Compared to TMR, non-TMR enriched LT α-linolenic acid +14%, vaccenic acid +44%, rumenic acid +40%, and conjugated linolenic acid +58% (P < 0.05). Overall, feeding non-TMR compared to TMR effectively enhanced deposition of healthful fatty acids in beef muscle.

Key Words – beef, CLA, vaccenic acid.

I. INTRODUCTION

Our research group has undertaken a series of trials feeding oilseeds combined with different sources and levels of forage, and we have found highly variable contents of α-linolenic acid (ALA), vaccenic (VA) and rumenic acids (RA) in beef [1-4]. In two studies where similar flaxseed containing red clover silage based diets were fed [2, 3], we found more ALA, VA and RA when sorting of diet components may have occurred [3]. We hypothesized periodic and undiluted intake of ALA-rich supplement may reduce the extent of biohydrogenation. The objective of the present experiment was to determine if feeding extruded flaxseed and ground hay in a total mixed ration (TMR) or sequentially (non-TMR) would affect steer performance, carcass quality and fatty acid profiles of *longissimus thoracis* (LT).

II. MATERIALS AND METHODS

Steers (Angus cross) were cared for according to CCAC guidelines [5]. Three pens of eight steers (325 ± 0.5 kg, 10.4 ± 0.5 months of age) were fed per diet for 242 days. Diets included 25% LinPRO-R™, 74.75% tub ground alfalfa/grass hay, and 0.25% vitamins/minerals (DM basis). The TMR was fed at 8:30, and for the non-TMR, LinPRO-R™ was fed at 8:30 followed by hay at 11:30. At slaughter following carcass splitting, trimmed side weights were measured and 45 min LT pH and temperature were recorded (repeated at 72 h). Carcass sides were chilled for 72 h at 2°C, and weighed to determine cooler loss. *L**, *a**, *b** were measured on LT and hue angle and chroma calculated. Grade data, including estimated yield and subjective estimates of marbling were measured [6]. Following grade assessment, samples of LT were collected for quality and fatty acid analysis. Intramuscular lipids were extracted from LT using chloroform–methanol [7]. Muscle lipids were methylated using acid & base catalysts and analyzed using a 100 m CPsil 88 GC column [8]. Data were analyzed with the mixed models procedure of SAS (SAS Inst. Inc. Cary, NC).

III. RESULTS AND DISCUSSION

Dry matter intake was lower for non-TMR versus TMR steers (10.56 vs. 11.42 kg/d; P = 0.02), but final live weight (610 ± 5.9 kg) and average daily gain (1.18 ± 0.02 kg/d) did not differ. Diet did not affect shrink loss, carcass weight, dressing percentage, grade fat, ribeye area, lean yield or intramuscular fat content. LT pH was increased by 0.1 units (P < 0.05) in non-TMR at 45 min, and at 3 d chroma was 1.4 unit lower, which might

be related to the lower dry matter intakes and lower muscle glycogen levels. Feeding the non-TMR led to greater ALA, VA, RA, *t*11,*c*15-18:2 CLnA and lower n-6/n-3 ratio (Table 1).

Table 1 Feeding extruded flaxseed and ground hay in a total mixed ration (TMR) or sequentially (non-TMR) on *longissimus thoracis* (LT) fatty acid profiles (% of total fatty acids)

	LT		
Variable[4]	TMR	non-TMR	SEM[3]
Σ fatty acids (mg.g^{-1} tissue)	51.70	55.01	3.99
ΣPUFA	4.09	4.15	0.19
18:3n-3 (ALA)	1.13	1.26*	0.04
n-6/n-3	1.54	1.44*	0.03
CLnA	0.16	0.25**	0.01
*t*11,*c*15-18:2	1.58	2.20**	0.05
*c*9,*t*11-18:2 (RA)	0.48	0.64**	0.03
*t*11-18:1 (VA)	4.98	7.43**	0.15

* $P < 0.05$; ** $P < 0.01$.

IV. CONCLUSION

Feeding LinPRO-R™ and ground hay as non-TMR was more effective then feeding a TMR at enhancing deposition of ALA biohydrogenation products in beef muscle without leading to marked changes in performance, carcass or meat quality.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge funding support from the Alberta Meat and Livestock Agency and O&T Farms (Regina, SK, Canada) for donating the LinPRO-R™.

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