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Effect of ionophores and selenium supplementation on the composition of long-chain fatty acid in carcass fat of steers

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Introduction

Ionophores are used in the livestock and feedlot industry, and have many advantageous effects, including increased growth, coccidiostat activity and decreased rumen methane production. This investigation formed part of a histopathological evaluation of cattle that received different ionophore treatments combined with a high level of selenium (Se). The effect of ionophores on the composition of fatty acids in muscle, subcutaneous and perirenal fat of steers was researched because of the reported shift in the volatile fatty acid composition in the rumen caused by ionophores (Schelling, 1984; Fellner *et al.*, 1997; Lana & Russel, 1997). This is mainly due to increased propionate production. A shift in the composition of fatty acids in the rumen can alter the fatty acid composition of body fats (Gilka *et al.* 1989; Casey & Webb, 1995). Resent research suggests that the inclusion of ionophores influence the composition of animal fats (Duckett *et al.*, 1993; Uriyapongson *et al.*, 1994; Duckett and Wagner, 1997). The inclusion of Se has a protective effect against ionophore toxicity in pigs (Van Vleet *et al.*, 1983) and chickens (Vanderkop & MacNeil, 1989). Se acts as an antioxidant in cells and protects them against harmful free radicals, which can cause tissue damage.

Materials and Methods

Eighty weaners (ca. 8 months old) were allocated at random to four ionophore treatment groups (C = Control, M = Monensin, S = Salinomycin and L = Lasalocid). A standard diet without mineral and vitamin supplements was fed to the animals. Approximately 1 mg Se/kg feed was included in the rations of half of the steers in each group. The mineral/vitamin mixes plus the relevant ionophore and tylosin were mixed into the diet for the respective treatments. The steers were placed in steer finishing pens equipped with automated individual feeding troughs. The animals were slaughtered at the A2 carcass grading stage. Fat samples (approximately 5 g subcutaneously and perirenal), as well as samples from the *M. longissimus dorsi* were collected for determination of the fatty acid composition (Casey & Webb, 1995). Fat thickness was measured on the left and right sides of the cold carcass. Lipid was extracted with chloroform:methanol (2:1 v/v; Folch *et al*., 1957; Ways & Hanahan, 1964) and butylated hydroxytoluene (BHT) was included as antioxidant. Fatty acids were measured by gas chromatography and expressed as a proportion of total fatty acids (w/w %) (Webb and Casey, 1995a & b). Data was analysed by multifactor analysis of variance (ANOVA) and Scheffe's test for variance using the GLM procedure of SAS (1992).

Results and Discussion

Steers were slaughtered at an average live weight of 356 kg. Fat thickness measured on the left side (5.401 ∀ 2.197mm) and the right side (5.240 ± 2.009mm) of each carcass did not differ ($P > 0.05$). Neither treatment with ionophores nor supplementation of the diet with Se significantly influenced ($P > 0.05$) the composition of long-chain fatty acids in the different fat depots sampled. Since Se does not affect fatty acid metabolism (Koenig *et al.*, 1997), no effects on fatty acids were expected due to the addition of Se to the diet. The proportions of long-chain fatty acids present in the subcutaneous fat and *M. longissimus dorsi* differ from that reported by Enser *et al*. (1996) for British retail beef and Webb and Casey (1995a) for animals treated with a growth promotants (Table 1). Webb and Casey (1995a) reported the subcutaneous fat of South African beef treated with growth promotants to be more saturated (SFA = 44.54%) than the ionophore treated animals (SFA = 42.96%), with C16:0, C18:0, C18:2 and C18:3 slightly higher and the monounsaturated fatty acids C16:1 and C18:1 slightly lower than that observed in the present study. Subcutaneous fat of British retail beef (Enser *et al.*, 1996) contain higher proportions of C16:0 than South African beef and lower proportions of C14:0, C18:0, C18:1, C18:2 and C18:3. In muscle, lower proportions of C16:1, C18:0, C18:1 and C18:3 were reported for British retail beef than found in the present study.

Table 1 Fatty acid composition of ionophore and Se treated steers, British meat and steers treated with growth promotants (mean ± s.d.; w/w %).

	Subcutaneous fat				*M. longissimus dorsi*		Perirenal fat
	Ionophore and Se	Growth promotant[ave]*	Growth promotants[c]*	British meat**	Ionophore and Se	British meat**	Ionophore and Se
C14:0	4.97±1.32	4.01±0.68	3.98±0.89	3.72±0.62	4.71±0.80	2.66±0.54	3.91±0.92
C15:0	1.22±0.32	0.47±0.20	0.42±0.19	n.d.	0.82±0.29	n.d.	0.34±0.18
C15:1	0.14±0.02	n.d.	n.d.	n.d.	n.d.	n.d.	0.15±0.02
C16:0	23.27±1.45	24.24±1.67	25.21±2.08	26.1±1.81	23.76±1.36	25.0±1.77	20.87±1.41
C16:1	6.22±0.72	4.17±0.71	4.50±0.84	6.22±1.13	5.91±0.64	4.54±0.81	2.31±0.62
C18:0	13.50±2.22	14.75±2.23	13.67±2.66	12.2±2.34	14.56±2.33	13.4±1.84	30.22±3.05
C18:1	44.07±2.38	42.98±2.54	42.93±2.01	40.21	45.47±2.32	41.18	34.51±2.63
C18:2	5.20±1.07	6.29±1.63	6.57±1.43	1.10±0.28	4.23±0.70	2.42±0.63	5.22±0.64
C18:3	1.50±0.27	2.03±1.36	1.69±0.71	0.48±0.12	0.82±0.23	0.70±0.18	1.11±0.23
SFA	42.96±2.55	44.54±2.79	44.21±3.71	n.d.	43.65±2.54	n.d.	56.53±3.22

* Webb & Casey, 1995a; ** Enser *et al*., 1996; ave =average for all treatments; c =control group; n.d.= no data

Conclusion

It was concluded that the different ionophores used do not influence the composition of long-chain fatty acids in body fat of steers at the present level of inclusion. Se may be included into the diet of steers fed ionophores for its intended beneficial effect without any influence on the long-chain fatty acid composition of depot fat of steers.

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