

The effects of fish oil inclusion in the concentrate and method of silage preservation on the colour and sensory characteristics of beef

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Introduction

Manipulation of ruminant ration composition has been employed to enhance the concentration of conjugated linoleic acid (CLA) in milk and meat. Noci et al. (2004) reported that inclusion of fish oil in the concentrate supplement to grass silage-fed steers or wilting of grass prior to ensiling increased CLA concentration in tissue. Strategies that improve the fatty acid composition must not impair other quality characteristics of beef. The objective of this experiment was to determine the effect of the dietary modifications of Noci et al. (2004) on the appearance and eating quality of beef.

Materials and Methods

Eighty Friesian steers (liveweight = 565 kg) were blocked on bodyweight and within block, randomly assigned to either unwilted or wilted grass silage (S) and one of four concentrate rations: 0g fish oil (F)/kg (F0), 10g F/kg (F10), 20g F/kg (F20) or 40g F/kg (F40) in a 2x4 factorial arrangement. All rations were enriched with 80g sunflower oil/kg. Growth was monitored at three-week intervals to achieve similar carcass weights at the end of a 108-day experiment. At 48h after slaughter, *m. longissimus dorsi* pH, drip loss and colour characteristics (lightness, redness and yellowness) were measured. A sample of longissimus muscle was aged for 14 days and stored frozen prior to colour (redness) stability and lipid oxidation analysis (Tarladgis et al., 1960). A sample from the 10th rib area was aged for 14 days and stored frozen for sensory analysis by a 10 member trained taste panel. Panelists rated cooked steak using 0-100 line scales where low values are low ratings and high values higher ratings for a particular trait. A sample was also aged for 7 days and stored frozen pending measurement of shear force (Shackelford et al., 1991). Data were analysed according to a randomised block design. The effect of increasing concentration of

F in the concentrate was tested using orthogonal polynomials.

Results

Data on beef quality characteristics are summarized in Table 1 and Table 2. Shear force was decreased by inclusion of F in the ration. The high level of F inclusion decreased toughness and increased overall liking of beef from cattle fed unwilted silage. In addition there were no treatment effects on redness or lipid stability or on the sensory panel assessment of "beef, abnormal, greasy, bloody, livery, metallic, bitter, sweet, rancid, fishy, acidic, cardboard, vegetable/grassy or dairy" flavours.

Table 2. The eating quality of grilled loin steaks.

	Fish oil concentration (g/kg)				SED	P
	0	10	20	40		
<i>Unwilted silage</i>						
Toughness	44.4 ^b	45.8 ^b	48.9 ^b	39.0 ^a	2.33	***
Juiciness	35.9	33.6	35.1	38.8	1.94	NS
Overall liking	23.5 ^{ab}	25.0 ^{bc}	21.2 ^a	27.3 ^c	1.66	*
<i>Wilted silage</i>						
Toughness	36.8 ^a	41.7 ^b	42.7 ^b	35.2 ^a	2.31	**
Juiciness	43.2 ^b	39.8 ^{ab}	36.7 ^a	43.3 ^b	1.90	***
Overall liking	27.5	25.3	22.6	24.9	2.22	NS

High values indicate high or extreme panel ratings. ^{ab}Figures with the same superscript do not differ significantly.

Conclusions

Neither fish oil supplementation nor wilting of grass prior to ensiling negatively affected the flavour, appearance and lipid or colour stability of beef. Wilting of grass prior to ensiling and the highest level of fishoil supplementation increased beef tenderness.

References

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Table 1. pH, colour and shear force (N) of *m. longissimus dorsi*

Silage (S)	Unwilted				Wilted				SED	S	F ¹	S*F
	0	10	20	40	0	10	20	40				
Fish oil(F) (g/kg)												
pH	5.51	5.58	5.59	5.57	5.58	5.54	5.58	5.55	0.027	NS	NS	NS
Lightness	33.8	33.7	33.0	34.5	33.1	33.9	34.3	33.7	0.71	NS	NS	NS
Redness	14.4	13.4	13.2	13.7	13.1	13.6	13.2	12.9	0.64	NS	NS	NS
Yellowness	7.9	7.5	7.1	7.8	7.1	7.5	7.3	7.4	0.37	NS	NS	NS
Drip loss (%)	0.78	1.41	0.69	0.43	0.71	0.82	0.73	0.68	0.238	NS	L,C	NS
Shear force	40.7	40.2	40.1	35.3	36.1	39.8	38.4	31.5	3.59	NS	L	NS

¹L and C are linear and cubic effects of fishoil concentration in the concentrate, respectively