PERFORMANCE AND MEAT QUALITY OF BEEF FATTENING CATTLE OFFERED TWO CONTRASTING PRESERVED GRASS SILAGES

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Introduction

In many countries ensiled forages are highly valued as animal feed. It is essential to have a good microbial fermentation process to produce high quality silage. In Lithuania, weather conditions do not always permit sufficient wilting of crop. The formic acid based additives, as fermentation inhibitors, could in theory be used to ensure good fermentation of wet crops (McDonald, 1991). Furthermore, it is known that the use of biological additives can improve the fermentation characteristics and quality of silages (Muck et al., 2005). Additional benefits by using silage additives may arise from nutrient conservation due to improved DM recovery and aerobic stability and due improved performance of the cattle. Meat quality is a complex trait, referring to the compositional, visual and sensory traits of a carcass, or its retail cuts and describes the attractiveness of meat to consumers. Silage feeding has been reported to affect several meat quality characteristics of beef, in particular colour, flavour and fatty acid composition and silage fermentation can also impact on meat quality (O'Sullivan et al., 2004). Ensiling of forages results in fatty acid losses and various silage additives and consequently fermentation can effect on levels and proportions of fatty acids in forages and herewith in muscle (Dewhurst and King, 1998). The objective of the current study was to evaluate the effects of two contrasting preserved silages on performance and meat quality of fattening cattle.

Materials and Methods

Roundbale silage of a second cut red clover-dominated sward was produced. Unwilted herbage was baled at 180 g DM/kg fresh matter. Every third bale was left untreated (C), treated with inoculant (2 *Pediococcus acidilacticci* and *2 Lactobacillus plantarum* and *Cellulase,* application rate - 10^5cfu/g fresh herbage) (I) or treated with a formic acid-based silage additive (52.3% formic acid, 26.1% ammonium tetraformiate, 5.4% propionic acid, 1.1% ethyl-benzoate, application rate - 6 l/t fresh herbage) (A). Fifteen Lithuanian Black-and-White bulls on average 312 (±13) kg initial weight were used in factorial designed production experiment with 3 silages and 3 blocks in 126 days experimental period. Silages were offered *ad libitum* in two daily feeds on an individual bull basis. All animals received some quality of concentrate feed (2.24 kg $^{d-1}$) offered 2 times a day.

At the end of the trial 3 animals from each group were slaughtered by captive bolt stunning followed by exsanguinations in the abattoir. Afterwards, hot carcass weight was determined. The slaughter and dressing procedures were in accordance with EU specifications. During the slaughter, fat found in the abdominal cavity (from kidneys, stomach and intestines) was collected and weighed. The dressing percentage was calculated by dividing the hot carcass weight by the finish weight. In 24 hours after chilling the carcass at 0-4°C, was weighed and dressed by separating bones, tendons and meat. The morphological composition of carcass was calculated by weighing bones, tendons and meat separately, and by dividing these weights by the chilled carcass weight. A sample *of M. longissimus thoracis* (11-13^{th} thoracic vertebrae) was collected from the left side of each carcass for meat quality analysis. The meat from the left side of each carcass was ground, and the average sample of 400 g ground meat was taken for analysis. Meat samples from each carcass were put into polyethylene bags with the plastic tags inside. Meat samples were analysed at the Chemical Laboratory of the Lithuanian Institute of Animal Science. The data were analysed by one-way ANOVA, and a mean comparison by Fisher'PLSD.

Results and Discussion

In C, I and A silages content of the total fermentation acids, lactic acid, acetic acid and butyric acid were 60.6; 72.74 ($P<0.01$) and 56.37 ($P<0.01$), 31.50; 62.84 ($P<0.01$) and 43.20 ($P<0.01$) , 25.45; 8.56($P<0.01$) and 12.68 ($P<0.01$) and 2.85; 0.26($P<0.01$) and 0.14($P<0.01$) g/kg DM, respectively. Silage treated with inoculant had significantly lower content of ammonia N then untreated or treated wit acid-based additive that indicating reducing proteolysis. The growth rate of bulls in all three groups was high. The average daily gain was from 1.120 to 1.214 kgd^{-1}. However, the body weightgain of bulls fed inoculated and chemical treated silage was, respectively, by 8.36 and 7.64% higher than C group.

The I and A bulls tended to have higher carcass yield compared with C group. The analysis of the morphological composition of carcass showed that the meat: bone ratio in I and A groups was insignificantly higher, therefore, the muscling score in these groups was, respectively, by 0.29 and 0.18 unit higher than that in the C group.

The chemical composition of ground meat and *M. longissimus thoracis* showed differences between the groups. There was a significantly (P<0.01) higher content of dry matter, protein, fat and ash in the *M. longissimus thoracis* in I and A groups in comparison with the C group and lower content of this nutritive matter in the ground meat. In I and A groups, the pH values of the *M. longissimus thoracis* was 0.41 ($P < 0.01$) and 0.31 ($P < 0.01$) unit lower, water binding capacity 0.05 and 0.09% higher, cooking losses 1.57 (P<0.05) and 0.07% lower and protein value index 0.19 ($P < 0.05$) and 0.1 ($P < 0.05$) unit higher in comparison with the C group (Figure 1). There were few significant differences between the groups for the concentration of fatty acids in the *M. longissimus thoracis.* Grass silage contain a high proportion of linolenic acid (C18:3ω3), typically 50 - 75 %, in the lipids. Feeding of I and A forages resulted in significant increase of polyunsaturated fatty acids 18:2ω6 and 18:3ω3 in the fat of the bulls compared with untreated silage (Table 1). Ensiling of forages results in fatty acid losses and various silage additives and consequently fermentation can effect on levels and proportions of fatty acids in forages and herewith in muscle (Dewhurst and King, 1998). Acid 18:2 is part of the group of omega 6 acids (Wood, 1997), which restrict the risk of coronary heart disease with increasing mean serum LDL-cholesterol levels (Aro, 2002).

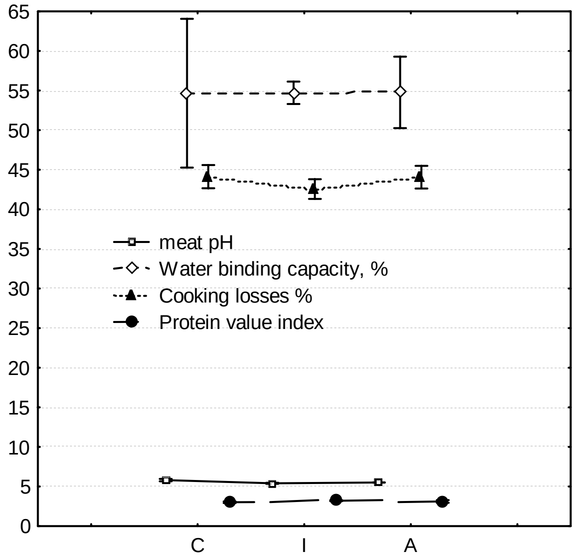

Figure 1. Physicochemical indicators of *M. longissimus thoracis*

Table 1. High molecular weight fatty acid composition in *Musculus longissimus thoracis* fat, % of total fatty acids

	C	**I**	**A**	$LSD_{0.05}$
14:0	1.06	1.06	0.77	0.572
i16:0	0.11	0.20	0.30	0.208
16:0	44.38	42.41	36.40*	4.301
i18:0	0.13	0.20	0.27	0.150
18:0	8.10	12.87*	13.01*	3.257
S_1 saturated	53.75	56.74	50.33	4.916
14:1	0.12	0.02*	0.08	0.063
16:1	2.12	1.29	1.99	1.743
18:1ω9	43.44	40.39	45.59	3.084
S_2 unsaturated	45.69	42.01	47.67	4.623
16:2	0.09	0.12	0.22	0.162
18:2ω6	0.37	0.95*	1.38*	0.483
18:3ω3	0.11	0.17**	0.19**	0.039
S_3polyunsaturated	0.57	1.25**	1.80**	0.455
$S_4 = S_2 + S_3$	46.25	43.26	49.46	4.978

* and ** denotes significant at level 0.05 and 0.01 respectively.

Conclusions

Inoculated or acid treated silages supported higher level of growth by cattle compared to ordinary made silage. The results of this study demonstrated, that different fermented silages affect the carcass and meat quality of fattening bulls. Beef produced by inoculated or acid treated silages feeding present meat with enhanced nutritional quality for the consumer resulted from a high accumulation of beneficial fatty acids 18:2ω6 and 18:3ω3 and lower concentration of saturated fatty acids and compared with beef meat from a ordinary made silage feeding.

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