

Oxidative stability of chevon as influenced by dietary Tasco supplementation in Boer goat bucks

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Abstract

Tasco seaweed (*Ascophyllum nodosum*) extract has been reported to improve vitamin E status and carcass characteristics in meat animals, but its effects have not been studied in goats. This study was conducted to determine the effects of Tasco feed supplementation on colour and oxidative stability of goat meat (chevon). Mature intact Boer goats were fed a lucerne pellet diet and a Tasco supplement either with (Treatment) or without (Control) seaweed extract (2% of daily intake) for 8 weeks (n = 16/treatment group). The animals were transported 6 h to the slaughter facility on two different days, held in pens without feed, and slaughtered. Colour values (CIE L*, a*, b*), visual scores, percent metmyoglobin (metMb) and thiobarbituric acid reactive substance (TBARS) of loin/rib chops (2.5 cm thick) were recorded on 1, 3, 5 and 7 days of display. The L* values increased significantly from d-1 to d-3, but did not change thereafter. Both a* and b* values decreased gradually until five days of display. However, after five days, the a* value remained unchanged, while the b* value increased significantly. Percent metMb and TBARS increased over display time. Metmyoglobin formation was significantly less in the treated group than in the control group. TBARS increased rapidly during the first three days of display, but did not change significantly thereafter. Visual scores decreased significantly over display time, and were negatively correlated with percent metMb (r = -0.62) and TBARS values (r = -0.40). Seaweed extract supplementation increased colour stability of loin/rib chops, although there was no effect on lipid oxidation.

Keywords: Goats, Chevon colour, TBARS

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Introduction

Tasco livestock feed supplement, which contains an extract from brown seaweed (*Ascophyllum nodosum*), is known to have positive effects on vitamin E status and meat quality characteristics of cattle (Montgomery *et al.*, 2001). The mode of action has not been elucidated, although it is known that the brown seaweed contains some of the natural antioxidants such as substituted phenols, poly phenolic compounds, and vitamin precursors such as α -tocopherol (Le Tutor, 1990).

Goat meat (chevon) may be prone to rapid lipid and pigment oxidation on refrigerated display (Kannan *et al.*, 2001) because of its higher unsaturated fatty acid content (Park & Washington, 1993) compared to other types of red meat. Montgomery *et al.* (2001) reported that Tasco increased the shelf life of beef by preventing or delaying muscle pigment and lipid oxidation. The effect of Tasco on the shelf life of chevon has not been investigated so far. Thus, this experiment measured the effects of Tasco feed supplementation on the colour and oxidative stability of chevon.

Materials and Methods

Thirty two mature intact Boer goats were housed in pens (4 bucks/pen) and fed a pelleted lucerne diet supplemented with Tasco either with (Treatment, 4 pens) or without (Control, 4 pens) seaweed extract for eight weeks. Goats were randomly allocated to the treatment groups. The diet contained 60% lucerne pellets and 40% Tasco feed, so that the treated group received seaweed extract at 2% of daily intake. At the end of the feeding trial the goats were transported 6 h and slaughtered on two different days. Goats were held in pens overnight without feed, but with access to water prior to slaughter and processing. Animals were stunned using a captive-bolt pistol prior to exsanguinations.

Carcasses were not subjected to electrical stimulation and were chilled for 24 h before fabrication. Loin/rib chops (2.5 cm thick) for determination of L* (lightness), a* (redness), b* (yellowness) values (CIE, 1976) were placed on styrofoam trays and wrapped with polyvinyl chloride film (oxygen transmission rate = 3000 cc/m²/24 h at 5 °C). Trays were placed in a display case (2 °C) to simulate retail conditions. Colour measurements were made on the cut surface using a Hunter Lab chroma meter (MiniscanTM XE plus, Model D/8-S) at 1, 3, 5 and 7 days (d-1, d-3, d-5, & d-7) of display. Three chops were used to measure colour at each time period. The chops were also evaluated visually at each time period by eight trained persons. Visual colour values were determined based on colour intensity (redness) and homogeneity using a scale from 1 to 10, with higher scores representing a more attractive and homogeneous red colour. After colour analysis, the chops were used for analysis of percent metmyoglobin (metMb) and thiobarbituric acid reactive substances (TBARS) according to the procedures described by Krzywicki (1982) and Buege & Aust (1978), respectively.

The data were analyzed as Randomized Complete Block Design with split-plot arrangement using GLM procedures in SAS (SAS, 1995). When treatment was significant in ANOVA ($P < 0.05$), the means were separated using the LSD test. Pearson correlation analysis was used to determine the relationships among visual scores, percent metMb, TBARS, and a* values.

Results and Discussion

Meat surface discoloration is mainly associated with the oxidation of myoglobin to metMb (Faustman & Cassens, 1990). In this study, display time altered the colour values (L*, a*, b*) and visual scores of chevon loin/rib cuts, probably due to metMb accumulation (Table 1). However, the colour values and visual scores were not influenced by dietary supplementation of Tasco seaweed extract. The L* value did not change significantly after an initial increase from d-1 to d-3 of display. Both a* and b* values decreased gradually during the first five days of display, thereafter, a* values remained unchanged. Visual scores for red colour intensity and homogeneity decreased with increasing display time.

Table 1 Colour values (CIE L*, a*, b*), visual score (VS), metmyoglobin (metMb, %) and thiobarbituric acid reactive substances (TBARS, mg MDA/kg meat) as influenced by Tasco feed supplementation in Boer bucks

Variable	Treatment (Trt)	Display time (Time)				s.e.m.	P-value		
		d-1	d-3	d-5	d-7		Trt	Time	Trt x Time
L*	Tasco	39.9	44.7	41.9	43.9	0.87	0.66	0.01	0.87
	Control	39.4	44.7	40.5	43.6	0.85			
a*	Tasco	12.0	11.6	9.1	9.2	0.33	0.69	0.01	0.48
	Control	11.8	11.4	9.3	9.8	0.32			
b*	Tasco	15.5	10.3	9.1	10.7	0.49	0.89	0.01	0.58
	Control	14.8	10.4	8.6	11.3	0.48			
VS	Tasco	10.0	5.8	5.0	3.2	0.29	0.67	0.01	0.99
	Control	10.0	5.6	4.9	3.1	0.28			
MetMb	Tasco	18.7	20.8	22.3	24.7	0.47	0.01	0.01	0.68
	Control	21.6	24.3	25.8	27.3	0.46			
TBARS	Tasco	2.2	3.4	3.3	4.6	0.49	0.17	0.01	0.42
	Control	1.8	3.6	3.7	3.5	0.47			

L* = Lightness, a* = redness, b* = yellowness

Metmyoglobin accumulation increased from d-1 to d-7 of refrigerated display of chops in both control and treated groups. The lower metMb levels at 24 h postmortem (d-1 sampling) in the treated group may be due to the antioxidant effect of the Tasco seaweed extract. After 24 h postmortem, the rate of oxidation was

the same in both treated and control groups. Montgomery *et al.* (2001) reported that improvement in colour stability of meat resulting from Tasco supplementation may be related to elevated antioxidant activity in the steers.

The TBARS values were not affected by Tasco seaweed extract supplementation in this study (Table 1). Goats tend to have lower intramuscular and subcutaneous fat compared to other species. This may have prevented the accumulation, and thereby the influence, of fat-soluble antioxidants in the muscles. TBARS increased rapidly during the first three days of display, and thereafter the changes were not significant. Kannan *et al.* (2001) reported that lipid oxidation increased with increasing refrigerated display time in case-ready chevon cuts from Spanish goat carcasses.

Visual scores were negatively correlated with metMb % ($r = -0.62$; $P < 0.01$) and TBARS values ($r = -0.40$; $P < 0.01$), and positively correlated with a^* values ($r = 0.47$; $P < 0.01$). The a^* values were negatively correlated with metMb percent ($r = -0.41$; $P < 0.01$) and TBARS values ($r = -0.30$, $P < 0.01$). This relationship indicates that redness decreased with increasing metMb accumulation and lipid peroxidation. Percent metMb was not significantly correlated with TBARS ($P = 0.08$) in the present study, although Kannan *et al.* (2001) reported a positive correlation between lipid and pigment oxidation in chevon cuts. The relationships observed among TBARS, percent metMb and visual scores suggest that perceivable redness decreased with increasing metMb formation and lipid oxidation in chevon.

Conclusions

Tasco supplementation minimized metMb formation during the first 24 h postmortem. The positive effect may be related to the antioxidant properties of the Tasco seaweed extract. However, Tasco supplementation did not influence lipid oxidation, probably due to the lower intramuscular fat in goats. Further studies are required to evaluate the effects of different levels and durations of seaweed extract supplementation on lipid oxidation in chevon.

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