South African Journal of Animal Science 2004, 34 (Supplement 1)

Peer-reviewed paper: 8th International Conference on Goats

Physiological responses to preslaughter transportation stress in Tasco-supplemented Boer goats

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Abstract

Tasco seaweed (*Ascophyllum nodosum*) supplementation is known to increase antioxidant activity and immune response in farm animals, but its effects have not been adequately studied in goats. This study was conducted to determine the effects of Tasco feed supplementation on stress responses in transported goats. Mature uncastrated 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 eight weeks (n = 16/treatment group). The animals were transported 6 h to impose stress, held in pens overnight without feed and slaughtered on two different days. Blood samples were collected via jugular venipuncture, before (0 h) and after transportation (6 h) and after overnight holding (24 h) to assess stress responses. Dietary treatment did not influence plasma cortisol, glucose concentrations and creatine kinase (CK) activity. Plasma cortisol and glucose increased due to transportation, but decreased significantly after holding. Plasma CK activities increased during transportation and holding, and peaked significantly at 24-h sampling. Transportation increased neutrophil counts and decreased lymphocyte counts significantly, but did not affect eosinophil and monocyte counts. Tasco feed supplementation did not have any effect on the physiological responses to transportation stress in goats. Transportation stress may have negative effects on immune function in goats.

Keywords: Goats, stress, transportation
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Introduction

Tasco feed supplement, which contains an extract from brown seaweed (*Ascophyllum nodosum*), is known to positively influence antioxidant activity and immune response in farm animals, particularly during stressful situations. Saker *et al*. (2001) reported that the antioxidant activity of Tasco lowers oxidative stress in cattle. Meat goats are frequently transported long distances to slaughter facilities before being harvested (Kannan *et al*., 2000). Overnight feed withdrawal prior to harvesting is a common commercial practice, primarily to reduce carcass contamination with gut contents during slaughter. However, transportation and prolonged feed deprivation may increase stress responses and live weight losses (Kannan *et al*., 2000; 2002). The antioxidant nature of Tasco could increase stress tolerance by reducing the effect of toxic oxygen radicals produced during stress.

The effect of Tasco feed supplement on meat goats has not been adequately documented. The objective of this experiment was to determine the effects of Tasco feed supplementation on certain physiological indicators of stress in goats subjected to pre-slaughter transportation.

Materials and Methods

A feeding trial was conducted using 32 uncastrated male Boer goats. Goats were housed in pens (4 bucks/pen) and fed a lucerne pellet diet supplemented with Tasco either with (Treatment, 4 pens) or without (Control, 4 pens) seaweed extract for eight weeks. The daily ration contained 40% Tasco supplement and 60% of lucerne pellets. For the treated group, 2% of daily intake was seaweed extract.

At the end of the feeding trial, the goats were subjected to transportation stress on two different days (one week apart) and then slaughtered. Each day, goats from 2 control pens and 2 treatment pens (16 goats) were subjected to a 6 h transportation to impose stress. Goats were held thereafter in pens overnight without feed, but with *ad libitum* access to water. Blood samples were collected by jugular venipuncture before (0 h) and after transportation (6 h) and after overnight holding (24 h) to assess stress responses (Time). Blood tubes were placed on ice immediately after collection until plasma was separated. Blood smears were

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prepared and counted for differential leukocyte profiles as described by Kannan *et al*. (2000). Plasma cortisol concentrations were determined as described by Kannan *et al*. (2000). Blood glucose and creatine kinase (CK) were analyzed using commercially available kits as described by Kannan *et al*. (2002). The data were analyzed as a Randomized Complete Block Design (RCBD) using GLM procedures (Repeated Measures Analysis) in SAS (SAS, 1995).

Results and Discussion

Treatment or Treatment × Time interaction effects were not significant for any of the blood hormone and metabolite responses (Table 1). Cortisol concentrations peaked after the 6-h transportation and decreased after overnight holding (24 h sampling). The concentrations at 24 h sampling were greater than those at 0 h. This suggests that stress increased due to transport and decreased during holding. However, it is not known whether cortisol concentrations at 6 h were declining after being elevated during transportation, since blood sampling was not done during this 6 h non-stop journey. Cortisol concentrations in cattle decrease as a result of habituation during prolonged or repeated exposure to transportation (Lay *et al*., 1996).

Table 1 Plasma cortisol and glucose levels and creatine kinase (CK) activities as influenced by Tasco feed supplementation and transportation stress in Boer bucks

		Blood, sampling time			P - value	
Variable	Treatment	0 h	6 h	24 h	Treatment	Time
Cortisol (ng/mL)	Tasco	7.6 ± 1.18	31.9 ± 4.30	11.3 ± 2.52	0.98	0.01
	Control	9.5 ± 1.62	27.1 ± 5.93	14.1 ± 3.48		
Glucose (mg/dL)	Tasco	60.1 ± 1.89	163.5 ± 17.27	48.2 ± 8.37	0.57	0.01
	Control	58.3 ± 2.60	168.9 ± 23.79	63.2 ± 11.53		
CK (IU)	Tasco	139 ± 20.1	392 ± 91.2	583 ± 93.5	0.54	0.01
	Control	130 ± 27.7	307 ± 125.6	307 ± 125.6		

Plasma glucose concentrations increased when measured 6 h after transportation and decreased thereafter. Catecholamines secreted from the sympathetic nerve endings and adrenal medulla induce glycogenolysis in liver and muscle (Nwe *et al*., 1996). Plasma CK activity increased at 6 h, and further increased after overnight holding. Elevation of CK levels at 6 h may be due to muscular activities and injuries during loading and transportation, and that at 24 h may be due to agonistic activities during feed deprivation. Feed deprivation tends to increase agonistic encounters, resulting in bruises and muscle damage in goats (Kannan *et al*., 2002).

Table 2 Neutrophil (N) and lymphocyte (L) percentages as influenced by Tasco feed supplementation and transportation stress in Boer bucks

		Blood, sampling time			P - value	
Variable	Treatment	0 h	6 h	24 h	Treatment	Time
N (%)	Tasco	56.1 ± 0.60	41.5 ± 0.65	45.1 ± 0.59	0.79	0.01
	Control	56.3 ± 0.83	43.1 ± 0.89	43.9 ± 0.82		
L (%)	Tasco	41.7 ± 0.76	57.4 ± 0.59	53.3 ± 0.61	0.69	0.01
	Control	41.4 ± 1.05	55.9 ± 0.82	53.9 ± 0.83		

Stress affects the immune system of farm animals since both cortisol and catecholamines reduce immunity in animals. In this study Tasco feed supplementation as well as transportation for 6 h decreased

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lymphocyte counts and increased neutrophil counts but did not influence the differential leukocyte counts. The same trends continued during overnight holding (Table 2). However, transportation did not affect eosinophil and monocyte counts (not shown).

These results are in agreement with our previous observations (Kannan *et al*., 2000) that transportation and feed deprivation for 18 h decreased the lymphocyte counts and increased neutrophil counts and N:L ratio in goats. Tasco feed supplementation has been reported to increase immune function in cattle (Saker *et al*., 2001). In this study the effect of Tasco was not significant enough to cause changes in the leukocyte profiles of uncastrated Boer goats.

Conclusions

Transportation increased physiological stress responses in goats. Overnight holding without feed decreased stress, but increased muscle damage and/or activity as indicated by elevated CK activity. Tasco supplementation did not influence any of the stress responses, including leukocyte profiles. However, transportation stress may have negative effects on immune function as shown by decreased lymphocyte counts. Goats may become susceptible to infections after experiencing an intense transportation stress.

Acknowledgements

This research was supported by the Agricultural Research Station at FVSU. The authors would like to thank Nealie Moye and Shirley Wang for technical assistance.

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