

Effects of Tasco-14 Supplementation on Growth and Fertility Traits in Young Male Boer Goats Experiencing Heat Stress

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ABSTRACT

The current study examined effects of supplementation of Tasco-14 (seaweed, kelp extract) on growth and fertility in young male goats experiencing heat stress. Twenty young Boer males (27.8 ± 1.5 kg) were grouped randomly into 1 of 4 dry-lot pens and maintained on a free choice high-energy diet. Goats received either supplementation of Tasco-14 (35 g/week, oral) or no supplementation (control) for an 84-day period, during which weekly average high temperatures ranged from 32.1-38.2 °C. Data were collected for scrotal growth, average daily gain (ADG), final live-animal ribeye area (REA), bi-weekly rectal temperature, final sperm cell concentration, and final sperm motility score. No differences ($P > 0.05$) were observed between supplemented and control males for scrotal circumference growth, REA, or ADG. Rectal temperature was greater ($P = 0.010$) in males receiving Tasco-14 than in controls. Although no difference ($P = 0.232$) was observed between treatments for sperm motility score, sperm cell concentration was greater ($P = 0.036$) in supplemented males than in controls. Thus, sperm cell motility was unaffected and sperm cell concentration was improved by supplementation of Tasco-14 in growing males experiencing heat stress, despite marginally increased body temperature.

KEY WORDS: heat stress, kelp extract, seaweed extract, tasco-14

INTRODUCTION

Heat stress is a major limiting factor of goat production in Texas. Increased ambient temperature adversely impacts both physical performance (McDaniel and Parker, 2004) and reproductive capacity (Rockett et al., 2001). Increased respiratory frequency (Allen et al., 2001) and metabolism (Valko et al., 2004) that often characterize heat stress

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can increase levels of free radical compounds, resulting in decreased sperm quality and production (Volger et al., 1991). Supplementation of products rich in antioxidants during periods of heat stress has been shown to improve fertility (Breezezinska-Slebodzinska et al., 1995; Leonard et al., 2001; Evans et al., 2002). One such product is kelp extract (Galipalli et al., 2004a) which contains two important antioxidants: α -tocopherol and glutathione. The objective of this study was to determine effects of Tasco-14 (a kelp extract) on growth and fertility traits of young Boer males experiencing heat stress.

MATERIALS AND METHODS

Experimental Procedure. Twenty young male Boer goats (27.7 ± 1.5 kg, approximately 100 days of age and 21 days after weaning) produced at Angelo State University were used in the present study. Goats were stratified by size and confined in one of four dry-lot pens at the Angelo State University Management, Instruction, and Research Center on May 26. After an 11-day adjustment period, all goats were fed a free access high-energy diet (Table 1) for 84 days. Ten randomly selected goats were supplemented with Tasco-14 (Acadian Agritech, Dartmouth, Nova Scotia; Table 2) seaweed (kelp) extract (35 g/week, oral) for the duration of the 84-day feeding period. Each week, ten-gram doses of extract were administered on Monday and Wednesday, and 15-g doses were given on Friday. Extract was administered orally from a 100-g squeeze-tube to the back of the tongue. Body weights were recorded on days 0, 28, 56, and 84, rectal temperature was measured on days 8, 22, 36, and 50, and scrotal circumference was measured on days 0 and 84. Final ribeye area measurements were conducted on the live animal using an ALOKA 500 (ALOKA, Inc., Wallingford, CT) ultrasound machine. On day 84, a sperm sample was collected from each goat via electroejaculation and sperm motility score (1 = extreme movement; 7 = no movement) was assigned and sperm cell concentration was determined via hemacytometer. Maximum ambient temperature (Figure 1) for the region averaged 35.9, 36.1, and 36.2 °C for June, July, and August, respectively.

Statistical Analysis. Weight and rectal temperature were analyzed as a split plot using the mixed procedure of SAS (SAS Institute, Inc., Cary, NC) with repeated measures function. Treatment was in the main plot and the sub plot included day of measurement and treatment by day interaction. Scrotal circumference growth, REA, sperm motility score, and sperm cell concentration were analyzed as completely randomized designs. Due to variance, a Wilcoxon rank test was performed using the nonparametric one-way procedure of SAS. Goat was the experimental unit.

Table 1. Analysis (as fed) of ad libitum experimental diet (as fed)

Ingredient	Amount
Crude protein, %	16.00
Crude fat, %	2.50
Crude fiber, %	17.00
Ca, %	1.00
P, %	0.30
K, %	1.00
NaCl, %	1.25
Cu, ppm	25.00
Se, ppm	0.30
Vitamin A, IU/kg	4545.45
Vitamin E, IU/kg	9.09
Monensin, IU/kg	4.55

Table 2. Nutrient analysis (as fed) of Tasco-14 supplemented to young male Boer goats experiencing heat stress

Nutrient	Amount	Nutrient	Amount
Dry Matter, %	88	Chloride, % (max)	3.5
Crude Protein, % (min)	4	Magnesium, % (min)	0.6
Crude Fiber, %	6	Phosphorus, % (min)	0.1
Crude Fat, % (min)	2.5	Potassium, % (min)	1.5
Carbohydrates, %	52	Sodium, % (max)	3.5
Ash, % (max)	23	Sulfur, % (min)	1.8
Aluminum, ppm (max)	120	Chromium, ppm	1
Barium, ppm (max)	15	Cobalt, ppm	< 1.0
Beryllium, ppm	< 1.0	Copper, ppm (max)	2
Boron, ppm (min)	80	Iodine, ppm (min)	650
Cadmium, ppm (min)	< 1.0	Manganese, ppm (min)	25
Lead, ppm	< 1.0	Selenium, ppm	< 1.0
Mercury, ppm	< 1.0	Zinc, ppm (min)	20
Molybdenum, ppm	< 1.0	Vitamin A, IU/kg ¹	259
Vanadium, ppm (max)	5	Vitamin D3, IU/kg ¹	1,404.00
Calcium, % (min)	1.2	Vitamin E, IU/kg ¹	3.6

¹ As determined by SDK Laboratories, Hutchinson, KS.

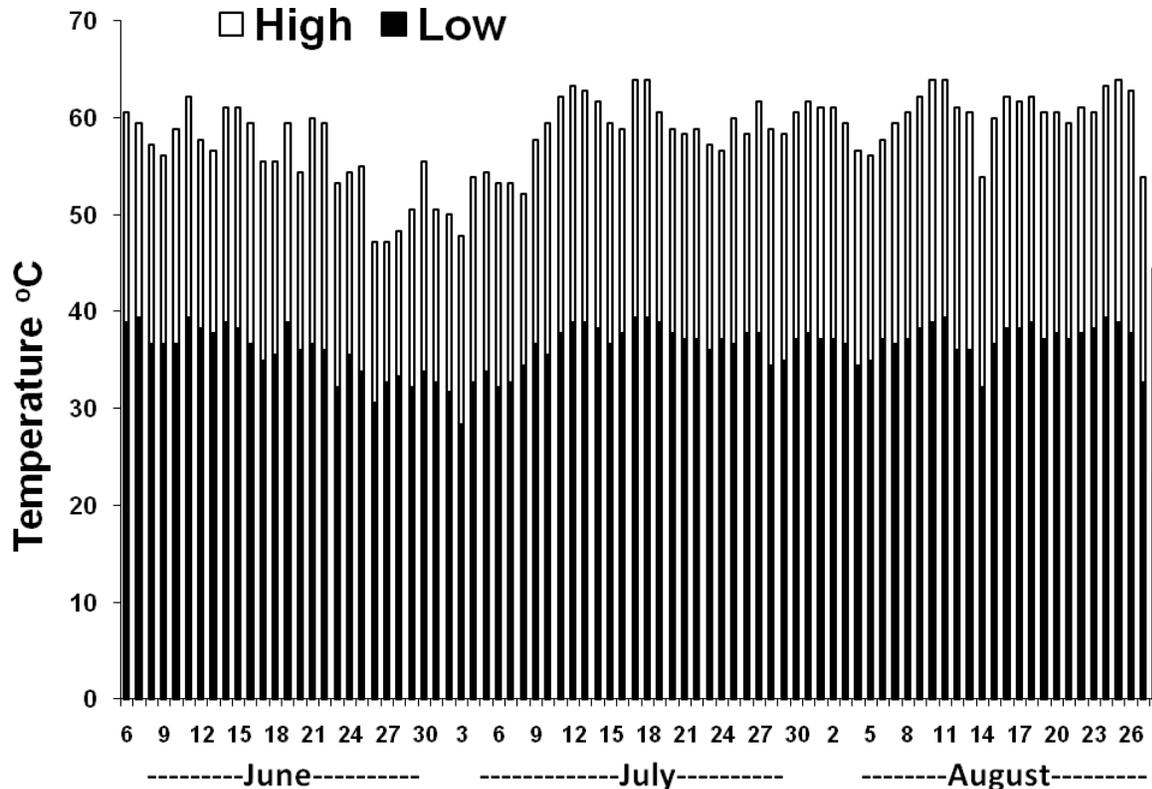


Figure 1. Daily maximum and minimum ambient temperatures (°C) for San Angelo, TX over the 84-day feeding period

RESULTS AND DISCUSSION

No treatment by day interaction was observed ($P = 0.742$) for body weight over the 84-day experimental period. Body weight (Figure 3) did not differ ($P = 0.964$) between goats receiving Tasco-14 supplementation and controls, but did increase ($P < 0.001$) with day, as expected, suggesting that supplementation of Tasco-14 to goats under the current conditions does not alter weight gain. These data contradict previous findings by Leupp et al., (2005), in which Tasco-14 increased digestibility of poor quality roughage and allowed supplemented animals to more efficiently use available forage and, consequently, exhibit greater rates of gain. This effect may not have been observed in the present study due to the use of a high energy diet.

Ribeye area (Table 3) measured at the conclusion of the 84-day experimental period did not differ ($P = 0.515$) between supplemented and control groups. Although Ventura and Castañón (1997) found that protein availability was improved by supplementing seaweed extract, goats in the current study received adequate amounts of dietary protein. Scrotal circumference growth was not different ($P = 0.111$) among

treated goats and control counterparts. However, variance between animals within treatment groups was large, and greater replication may have been warranted.

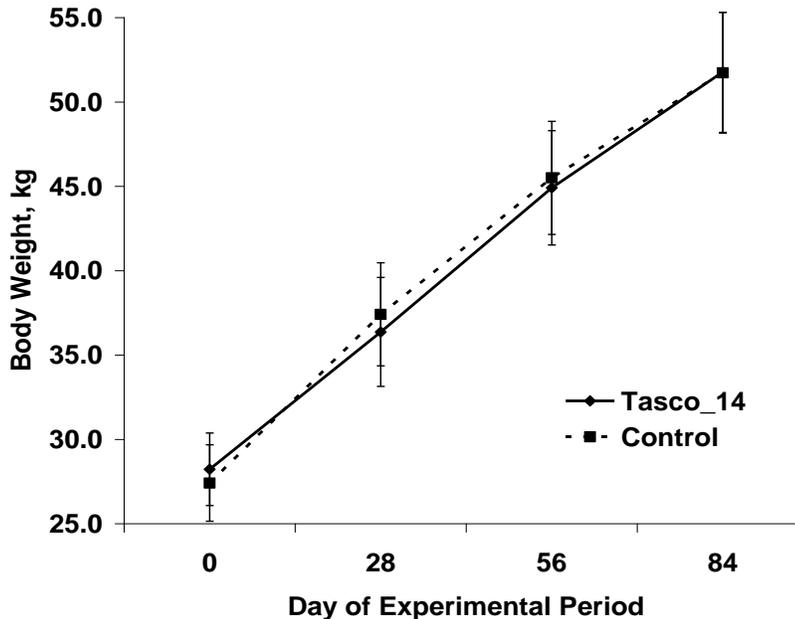


Figure 3. Average body weight (kg) of young male Boer goats supplemented with Tasco -14 (35 g/week) for 84 days while experiencing heat stress. No treatment by day interaction was found ($P = 0.742$). Overall treatment means did not differ ($P = 0.964$)

Sperm motility score did not differ ($P = 0.399$) among goats administered Tasco-14 and controls. However, the supplemented group appeared to exhibit more consistency, with 80 % of the animals scoring in the top quarter of the scale, compared to 50 % of controls. This study does not support previous research that found high levels of antioxidants in seaweed extract reduce damage to sperm cells and increase sperm motility (Brezezinska-Slebodzinska et al., 1995; Galipalli et al., 2004a; Galipalli et al., 2004b). Sperm cell concentration was greater ($P = 0.036$) in goats supplemented with Tasco-14 compared to controls. Average concentration for both groups were above the 2 to 3 billion cells/mL average reported by Coffey et al., (2004), although some control animals fell well below this average value. These data indicate supplementation of kelp extract increases sperm cell concentration in goats experiencing heat stress.

Data indicate supplementation of Tasco-14 improves sperm cell concentration in young Boer goats experiencing heat stress. Although rectal temperature (Figure 2) was increased by Tasco-14 supplementation, this phenomenon did not appear to adversely affect growth traits. Supplementation of seaweed extract during periods of elevated ambient temperature may provide improved breeding opportunities. However, more research is needed to clarify effects of Tasco-14 on scrotal circumference and growth traits.

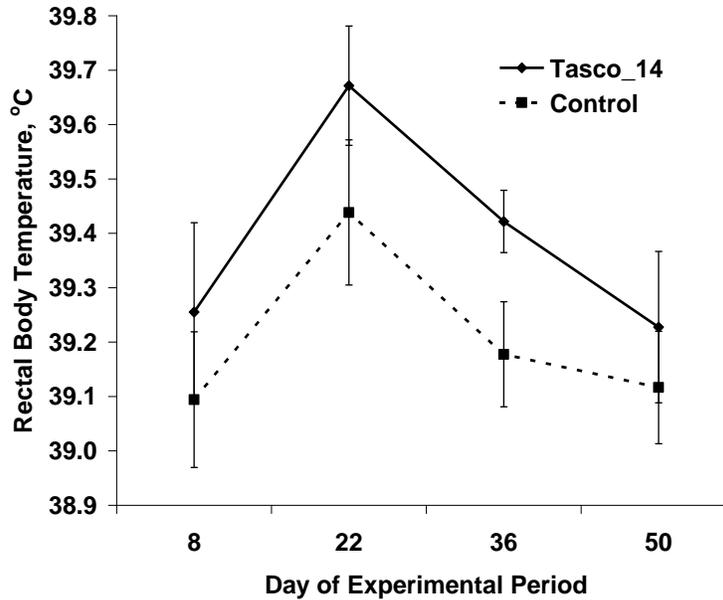


Figure 2. Average rectal temperature (°C) of young male Boer goats supplemented with Tasco -14 (35 g/week) for and 84-day period while experiencing heat stress. No treatment by day interaction was found ($P = 0.947$). Overall treatment means differ ($P = 0.010$)

Table 3. Ribeye area, scrotal circumference growth, sperm motility score, and sperm cell concentration in young male Boer goats supplemented with Tasco -14 (35 g/week) for and 84-day period while experiencing heat stress

Item	Treatment		SE ¹	P-value
	Control	Tasco-14		
Ribeye area, cm ²	5.0	5.1	0.1	0.515
Scrotal circumference growth, cm	7.6	9.9	1.3	0.111
Sperm motility score ²	2.7	1.8	0.6	0.399
Sperm cell concentration, x 10 ⁹ /mL	3.0	4.2	0.5	0.036

¹Standard error (n = 10).

²1 = extreme movement; 7 = no movement.

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