The effects of short- and long-term exposure to endophyte-infected tall fescue seed on serum, fecal and urine concentrations of ergovaline and lysergic acid in mature gelding horses

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Introduction Approximately 33 million acres of tall fescue, a cool-season grass commonly used for forage and turf purposes (Sleeper and Buckner, 1995), are grown in the United States. Despite its good nutritive value, consumption by livestock results in a decrease in both reproductive and growth performance due to ergot alkaloids produced by an endophytic fungus (Cross et al., 1995; Porter and Thompson, 1992). Little research has investigated the metabolic fate of ergot alkaloids and/or their metabolites in grazing horses. Thus, the objectives of this experiment were: a.) to determine concentrations of ergovaline (EV) and lysergic acid (LA) in the feces and urine of geldings exposed to endophyte-infected tall fescue seed over a time course experiment and b.) to measure the effects of alkaloid-containing tall fescue on nutrient digestibility and serum clinical enzyme profiles.

Materials and Methods Mature geldings (394.2 ± 7.1 kg; n = 10) of mixed breeding were randomly assigned to one of two treatments: 1) control diet with endophyte-free tall fescue seed (EF) or 2) a diet containing endophyte-infected (EI) tall fescue seed at 0.5 mg ergovaline/kg of total diet. Lysergic acid in the EI diet was 0.84 mg/kg diet and 0.0 mg/kg in the control diet. The seed was premixed with a commercial sweet feed and molasses. Three distinct phases were established: no exposure (Control phase-ContP; 14 d); short-term exposure (Acute phase – AcuteP; 4 d), and longer-term exposure to ergovaline (Sub-acute phase –SAP; 21 d). Total fecal and urine collections were performed for a total of 4 d within each phase for the quantification of ergovaline and lysergic acid. Blood and rectal temperatures were collected daily during each phase. Serum was analyzed for prolactin, creatine kinase (CK), alkaline phosphatase (AP) and aspartate aminotransferase (SGOT).

Results Differences due to treatment were undetected for body weight and rectal temperature (P = 0.97). Digestibility of DM, CP, and NDF were similar (P > 0.30) between the treatment groups. Prolactin concentrations decreased (P = 0.01) throughout the trial but did not differ between the EI and EF treatments (P = 0.96). Serum AP and CK were similar between treatment groups (Table 1). Serum aspartate aminotransferase was greater for the EF treated group than those in the EI group during the AcuteP (P = 0.09; 402.6 vs. 269.6 U/L). Within the EI treatment group, SGOT was greater during the SAP than the ContP (P = 0.03). Geldings consuming the EI diet had fecal ergovaline concentrations of 0.0, 0.3, and 0.4 mg/kg for the ContP, AcuteP, and SAF, respectively. Within the EI group, ergovaline concentrations differed between the phases (P < 0.01) with the greatest amount excreted during the SAP. While in the AcuteP, 60% of ergovaline consumed by EI animals was found in the feces, and 80% of that consumed by the same animals was found in the feces during the SAP. Lysergic acid in the feces was similar between the AcuteP and SAP for the EI group; however, urinary LA output was higher during the AcuteP than the SAP (P > 0.01). Fecal lysergic acid was 25.0 and 27.0% of total LA intake (0.84mg/kg diet) for the AcuteP and SAP, respectively, while 84.5 and 58.3% of dietary LA was found in the urine of EI-fed geldings for the AcuteP and SAP, respectively.

Table 1 Rectal temperature (RT), serum enzyme, and ergovaline data for geldings fed an endophyte-free (EF) and endophyte-infected diet (EI).

	Phase					
	Control		Acute		Subacute	
Treatment	EF	EI	EF	EI	EF	EI
RT, °C[a]	38.5	38.6	38.6	38.7[b]	38.4	38.3[c]
SGOT, U/L[a]	329.8	228.9	402.6[d]	269.6[b, e]	407.9	326.6[c]
CK, U/L	239.2	228.2	311.9	231.8	293.9	231.3
AP, U/L[a]	222.1	213.6	247.2	233.4	207.4	210.4

[a] Phase effect (P < 0.10)
[b, c] Within treatment, means differed (P < 0.03)
[d, e] Treatments differed between EF and EI groups (P = 0.09)

Table 2. Fecal (mg/kg) and urinary (mg/L) levels of ergovaline (EV) and lysergic acid (LA) for geldings fed and endophyte-free (EF) and endophyte-infected diet (EI).

	Phase					
	Control		Acute		Subacute	
Treatment	EF	EI	EF	EI	EF	EI
Fecal EV	0.00	0.00	0.00	0.32	0.00	0.40
Urinary EV	0.00	0.00	0.00	0.00	0.00	0.00
Fecal LA	0.00	0.00	0.00	0.21	0.00	0.23
Urinary LA	0.00	0.00	0.00	0.71[a]	0.00	0.49[b]

[a, b] Within treatment, means differed (P > 0.01)

Conclusions Concentrations of 0.5 mg ergovaline per kg diet or less had little effect on serum prolactin, AP, CK, and SGOT, body weight, rectal temperature, or nutrient digestibility. A majority of the ergovaline consumed by geldings was excreted in the feces. Because no obvious signs of decreased animal performance were observed, results suggest geldings grazing endophyte-infected tall fescue containing less than 0.5 mg ergovaline/kg DM for a 21 d period may not experience fescue toxicosis.

References

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