Reduction of aflatoxin M1 in milk of Holstein cows administered a clay adsorbent

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Introduction

Aflatoxins (AF) are secondary metabolites commonly found in dairy feeds that can be transferred into the milk of lactating cows. Because of their negative effects on dairy cows and humans consuming contaminated milk, they are strictly regulated. The objective of the current study was to evaluate the efficacy of an aluminosilicate clay at reducing the transfer of aflatoxin M1 into the milk and its impact on production parameters of lactating dairy cows fed diets contaminated with aflatoxin B1. Additionally, the study aimed to determine the effects of the aluminosilicate clay on body condition, body weight, and respiratory rates of cows consuming aflatoxin B1-contaminated feed.

Materials and Methods

A total of 35 lactating Holstein cows were utilized in a completely randomized design. Cows were stratified by parity, stage of lactation, and previous milk production. Cows were randomly assigned to 1 of 5 dietary treatments, and treatment was administered for 13 days (n = 7): (1) control (CON), basal TMR with no AF or clay; (2) clay control (4C), basal TMR plus 4 oz clay; (3) AF control (AFC), basal TMR plus 113 ppb AF; (4) AF diet with smaller clay dose (4C+AF), basal TMR plus 4 oz clay and 113 ppb AF; (5) AF diet with greater clay dose (8C+AF) basal TMR plus 8 oz clay and 113 ppb AF. Data was analyzed using the GLM procedure of SAS. Treatment and day were considered independent variables, and milk yield, DMI, nutrient intakes, AFM1 variables, and milk composition, body weight and condition, locomotion, and respiratory rate were dependent variables. Previous milk yield and DHIA records taken 3 days prior to the start of the treatment period were used as a covariate for milk yield, fat, protein, solids, and somatic cell count. Means were separated using Fisher's Least Significant Difference, and significance was declared when $P \leq 0.05$. Tendencies were discussed when $0.05 < P \leq 0.10$.

Results

Dry matter intake was greatest in cows consuming 8C+AF compared to CON, AFC, and 4C+AF. Dry matter intake averaged 57.87, 59.51, 57.08, 58.23, 60.84 ± 0.898 lb/d (26.30, 27.05, 25.94, 26.47, 27.65 ± 0.408 kg/d) for CON, 4C, AFC, 4C+AF, and 8C+AF diets, respectively (P = 0.034). Milk yield averaged 62.52, 70.21, 66.03, 65.99, and 69.00 ± 1.762 lb/d (28.42, 31.91, 30.01, 29.99, and 31.36 ± 0.800 kg/d) for CON, 4C, AFC, 4C+AF, and 8C+AF diets, respectively, and was greatest in cows consuming 4C and 8C+AF diets (P = 0.011). Treatment did not affect milk component percent in the milk; however, treatment impacted component yields. Milk fat yield was greatest in AFC cows and least in CON cows (3.09 and 2.49 lb/d (1.40 and 1/13 kg/d), respectively; P < 0.001). Milk protein yield was greatest in 4C cows and least in CON and 4C+AF cows (2.27 v. 2.06 and 2.11 lb/d (1.03 v. 0.93 and 0.96 kg/day), respectively; P = 0.014). Milk solids yield was greatest in 4C cows and least in CON cows (6.18 and 5.62 lb/d (2.81 and 2.55 kg/d), respectively; P = 0.037). Respiratory rate and BCS were similar across treatments. Cows consuming 8C+AF tended to have a greater locomotion score compared to other treatments (P = 0.057). This indicates a tendency for increased lameness in cows fed 8C+AF diets. A dose response was observed for aflatoxin M1 concentration, secretion, and transfer (P < 0.001). Aflatoxin M1 concentration averaged < 0.01, 0.00, 1.64, 1.26, and 0.90 ± 0.383 ppb for CON, 4C, AFC, 4C+AF, and 8C+AF cows, respectively. A reduction of transfer of 21.88 and 40.63% was observed for the addition of 4C+AF and 8C+AF diets, respectively.

Significance

In summary, the addition of aluminosilicate clay to the diets of AF-challenged Holstein cows resulted in reduced aflatoxin M1 transfer to the milk while altering milking performance.