

Pilot study to investigate the impacts of cannabinoids from industrial hemp and repeated transportation events on cattle health and immune status

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Introduction

The segmentation of the cattle industries necessitates regular transportation. Transport alters immune and stress biomarkers in cattle. The passage of the 2018 Farm Bill excluded industrial hemp (IH; *Cannabis sativa*, $\leq 0.3\%$ tetrahydrocannabinol) from the USDA marijuana definition and DEA Schedule I status, enabling USDA-authorized IH research to determine the sustainability of IH cultivation. Data on the utility of IH for cattle transport has not been described. The object of the current study was to evaluate the effects of oral IH on immune and stress biomarkers in cattle being transported considerable distances.

Materials and methods

Holstein steers ($n = 12$), average body weight 948 ± 86 lb (430 ± 39 kg), were blocked by weight and randomly assigned to treatment groups in a 4×4 Latin Square study design so that each animal received every treatment combination. Treatments included transport (transport [T] or control [C]) and drug administration (IH [H] or placebo [P]). Oral IH boluses were formulated to achieve 2.49 mg/lb (5.5 mg/kg) cannabidiolic acid. Cattle in transport treatments were hauled 623 mi (1017 km), or approximately 8 h, to simulate a stressful travel distance. Biomarkers were evaluated at 24 h prior to transport and at 8 , 24 , 32 and 48 h after transport and included change in bodyweight (Δ BW), accelerometry, complete blood count, serum chemistry and blood cortisol analysis. Accelerometers were placed on the LH limbs. A 10 d washout period was observed after the conclusion of each replicate of the study. Additional plasma analytes and kinetic gait analysis data are being analyzed. Responses were analyzed using repeated measures with steer nested in treatment as a random effect, and drug, transport, time, drug by transport, drug by time, transport by time, drug by transport by time, and replicate as fixed effects.

Results

Not all results are presented. Results with significant drug or transport effects are presented as least squares means \pm SE. Drug had an effect on Δ BW and blood glucose (BG). Transport had an effect on Δ BW, accelerometer outcomes, segmented

neutrophil count (SEG), total protein (TP), BG, and cortisol. Time had an effect on Δ BW, SEG, TP, and BG, and cortisol. There was a transport by time interaction for Δ BW, SEG, TP, and BG. A smaller Δ BW was observed in steers in the H vs. P treatments (-6.89 ± 0.72 vs -9.06 ± 0.72 kg, $P = 0.04$) and a larger Δ BW was observed in steers in the T vs C treatments (-13.00 ± 0.72 vs. -2.94 ± 0.72 kg, $P < 0.0001$). Loss in BW was greatest at 8 h ($P < 0.0001$). The greatest Δ BW was observed in transported steers at 8 h ($P < 0.0001$). Steers in the C vs T treatments had lower motion indices (841 ± 48.43 vs 1204 ± 48.71), took fewer steps (188 ± 10.42 vs 271 ± 10.48 steps), had more lying bouts per hour (0.58 ± 0.04 vs 0.21 ± 0.05), and spent a greater proportion of time lying (0.55 ± 0.01 vs 0.43 ± 0.01) ($P < 0.0001$). Steers in the C vs T treatment had lower SEG (2.47 ± 0.16 vs 3.75 ± 0.15 K/ μ L), $P < 0.0001$. The highest SEG values were observed at 8 h ($P < 0.0001$); steers in the T group had higher SEG values at 8 h than all other steers ($P < 0.0001$). Lower TP was observed in steers in the C vs T treatment (6.30 ± 0.04 vs 6.45 ± 0.03 mg/dL, $P = 0.0054$) and was highest at 8 h ($P = 0.0002$) and in steers in the T group at 8 h compared to all other steers ($P < 0.0001$). Lower BG was observed in steers in the H vs P and C vs T treatments (H vs. P: 88.27 ± 0.81 vs 91.03 ± 0.86 mg/dL, C vs T: 87.24 ± 0.87 vs 92.07 ± 0.79 mg/dL; $P = 0.0234$ and 0.0001 , respectively). The highest BG values were observed at 8 h, with transported steers at 8 h having higher BG than all other steers ($P < 0.0001$). Blood cortisol levels were higher in T vs C steers (3.30 ± 0.25 μ g/dL vs 2.15 ± 0.28 μ g/dL, $P = 0.0008$). Peak cortisol levels were observed at 8 h ($P < 0.0001$).

Significance

These data support previous literature on shrink, dehydration, stress leukograms and blood cortisol in transported cattle. Cattle treated with IH may have reduced shrink and stress-induced hyperglycemia. Discomfort, stress or hunger due to transport may cause transported cattle to lay down less than non-transported cattle. Further research is needed to confirm the effects of IH observed in this study.

