Effect of aspirin to intentionally induce leaky gut on performance, blood markers of stress, and carcass characteristics of feedlot cattle

PURDUE UNIVERSITY® ANIMAL SCIENCES

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Introduction

- Stress from weaning, feed restriction, transportation, and acidosis can negatively impact gastrointestinal tract (GIT) barrier function (Wan et al., 2014; Zhang et al., 2013).
- GIT dysfunction (leaky gut) can cause inflammation and activate the immune system leading to decreased growth, increased morbidity and mortality, and thus negatively impacts producer profitability.
- The exact repercussions of long-term leaky gut and maintenance of an activated immune system on beef cattle performance are currently unknown.
- Aspirin (acetylsalicylic acid) is known to cause mucosal injury leading to increased gut permeability and tight junction damage (Oshima et al., 2008).
  - Dietary administration of 50 to 100 mg/kg BW aspirin is a safe and effective method to intentionally induce leaky gut in cattle (Briggs et al., 2019).
  - The maximum recommended dosage of aspirin is 100 mg/kg every 12 h (Gingerich et al., 1975) with a 24 h meat and milk withdrawal period (Smith et al., 2008).

Hypothesis

Long-term administration of 50 mg/kg BW aspirin will compromise GIT barrier function, leading to inflammation and immune system activation that will negatively impact animal performance and carcass characteristics.

Objective

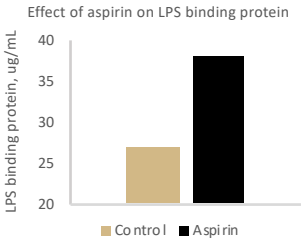
Determine the impact of leaky gut on animal physiology, growth, and production.

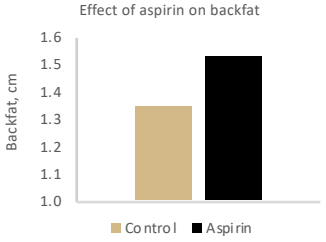
Results

Table 1. Effect of aspirin on on performance

	Treatment			
Item	Control	Aspirin	SEM	*P* value
Weight, kg	621.3	612.6	4.88	0.21
Average daily gain, kg/d	1.69	1.61	0.035	0.10
Dry matter intake, kg/d	9.8	9.8	0.18	0.84
Gain:feed	0.173	0.164	0.0038	0.15
Days on feed	158	161	4.49	0.59

Results





- Steers fed aspirin had greater backfat (*P* = 0.02) and tended to have greater serum concentrations of LPS binding protein (*P* = 0.07), a marker of LPS appearance in circulation.

Table 3. Effect of aspirin on on carcass characteristics

	Treatment			
Item	Control	Aspirin	SEM	*P* value
Hot carcass weight, kg	389.0	382.7	2.11	0.05
Fat thickness, cm	1.35	1.53	0.049	0.02
Rib-eye area, cm	88.4	84.7	0.91	0.01
Yield grade	3.11	3.43	0.080	0.01
Marbling score	418.5	448.6	5.76	< 0.01
Liver abscess, %	18.8	16.8	5.62	0.80

Conclusion

Leaky gut has a negative impact on feedlot cattle performance and carcass composition. Long-term use of aspirin can be used as a model to study the effects of leaky gut in feedlot cattle on growth and carcass characteristics. Strategies that decrease leaky gut may be able to improve feedlot cattle performance.

Materials and Methods

- Ninety-six Angus x Simmental steers (355.0 ± 14.8 kg) were allotted to 16 pens (8 pens/treatment; 6 animals/pen; 48 animals/treatment) based on breed and body weight.
- Pens (6.1 x 3.7 m) were located in a slatted floor, curtain-sided finishing barn.
- Control diets contained 50% corn, 24% dried distiller's grains with solubles (DDGS), 20% corn silage, and 6% vitamin/mineral supplement (DM basis). Aspirin was delivered to steers in a corn/DDGS premix that replaced a portion of DDGS and corn in the diet.
- Steers were vaccinated and implanted with Synovex-ONE (200 mg of trenbolone acetate and 28 mg of estradiol benzoate; Zoetis Animal Health, Kalamazoo, MI) at feedlot entry.
- Steers were fed 300 mg of Optaflexx (ractopamine hydrochloride; Elanco, Greenfield, IN) daily during the last 42 d before slaughter.
- Steers were transported 400 km to a USDA inspected commercial abattoir (Tyson Foods Inc., Joslin, IL) and slaughtered at 3 different time points (147, 161 and 175 d) according to when 42 d of Optaflexx feeding was achieved (average pen BW of 617 ± 35.2 kg).
- Serum was collected at slaughter for analysis of lipopolysaccharide binding protein (LBP; LSBio, LS-F7412, Seattle, WA), interleukin-6 (IL-6; abcam, ab205280, Cambridge, UK), haptoglobin (ICL, E-10HPT, Inc., Portland, OR), serum amyloid A (SAA; Tridelta Development Ltd., TP 802, Maynooth, County Kildare, IE), and aspartate aminotransferase (AST; Sigma-Aldrich, MAK055, St. Louis, MO) using commercially available kits. Concentrations were determined at 450 nm on a Spark 10M plate reader (Tecan Life Sciences, Männedorf , Zürich, Switzerland).
- Data were analyzed as a completely randomized design using the MIXED procedure of SAS with pen considered the experimental unit. Performance and serum data were analyzed as repeated measures over time. The model included the random effect of pen and the fixed effect of treatment, time, and the interaction of treatment and time.

Results

Table 2. Effect of aspirin on on serum markers of inflammation

	Treatment			
	Control	Aspirin	SEM	P-value
LPS binding protein, ug/mL	31.1	41.1	3.69	0.07
Interleukin-6, pg/mL	45.7	39.4	8.04	0.58
Haptoglobin, ug/mL	2.98	2.47	0.522	0.50
Serum amyloid A, ug/mL	46.8	37.9	6.02	0.30
Aspartate aminotransferase, mU/mL	33.7	34.4	1.07	0.68