



2024 BIF Symposium

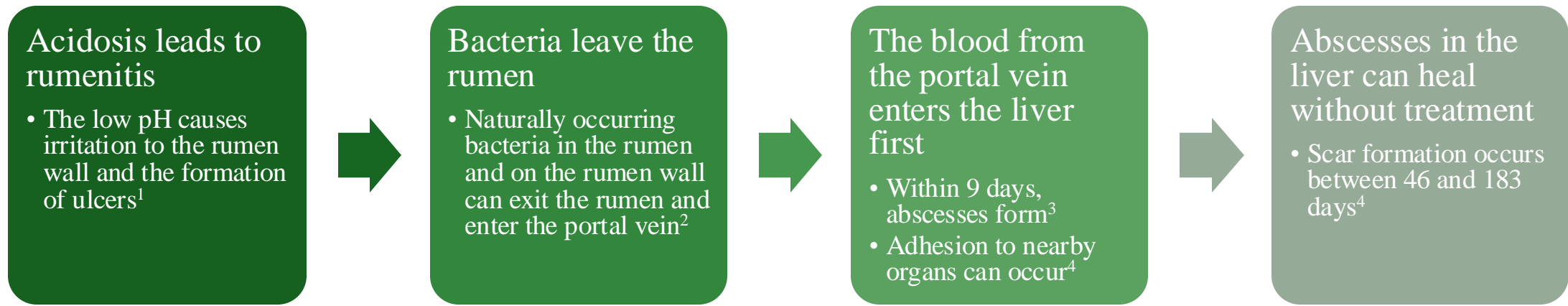
Preliminary heritability estimate for liver abscess incidence in beef on dairy heifers

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What are liver abscesses?

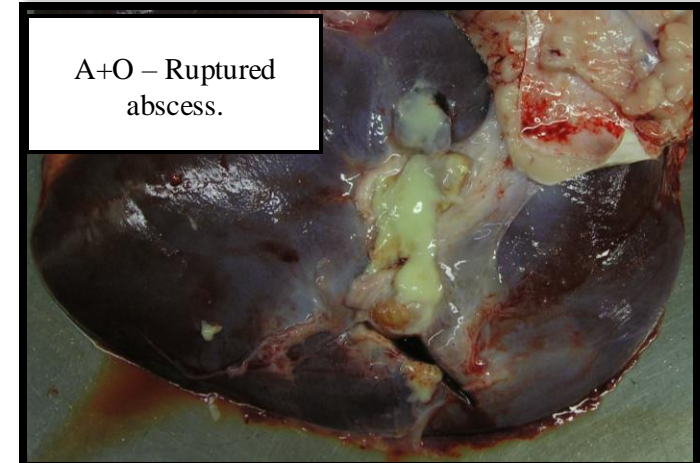
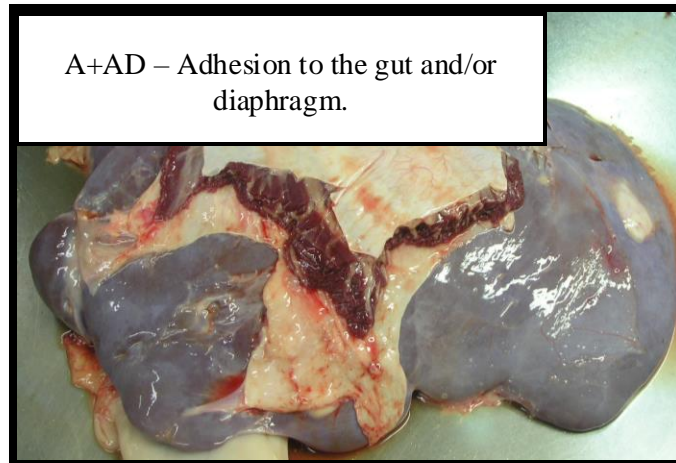
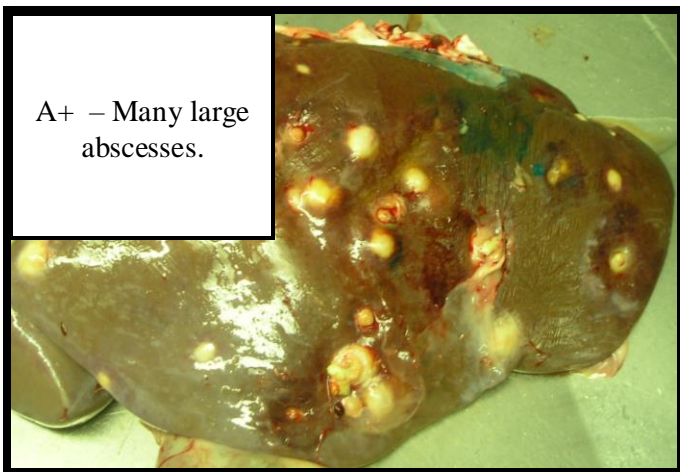
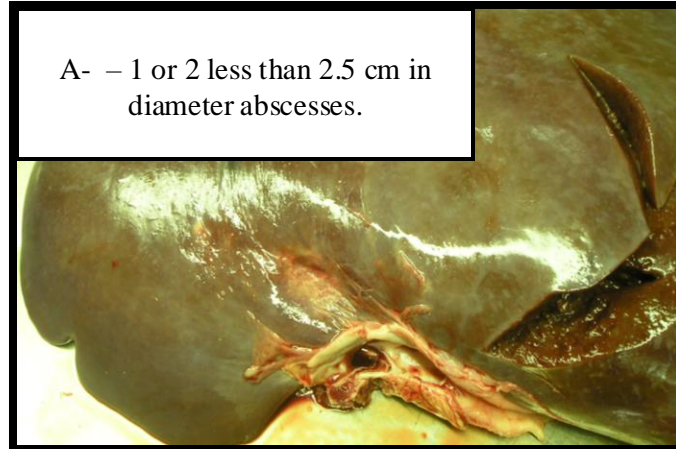
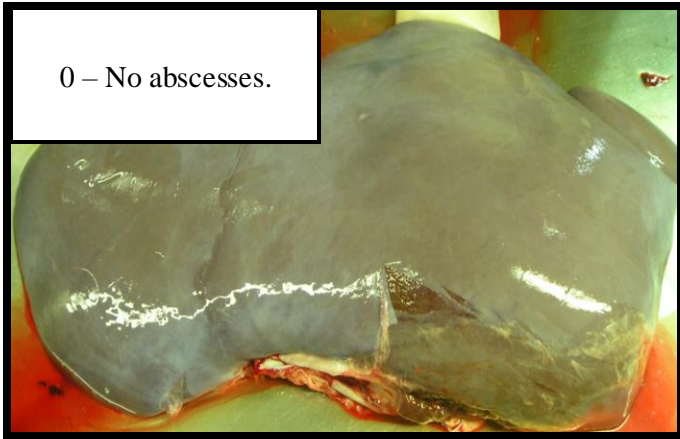
- Liver abscesses are encased pockets of pus formed in the liver
- Pathogenesis:



- The bacteria commonly isolated from liver abscesses are⁵:
 - *Fusobacterium necrophorum*
 - Subsp. *necrophorum* and *funduliforme*
 - *Trueperella pyogenes*
 - *Clostridium perfringens*
 - *Salmonella enterica*

Liver abscess scoring system

- A liver with a score of 0 is edible, but a liver with any abscess (a non-zero score) is condemned at slaughter
- Visual representation of liver abscess scores⁶:



Why care about liver abscesses?

Difficulty with antemortem diagnosis

Live cattle do not show clinical signs
Most diagnosed at slaughter⁷

Possible diagnostic tools, such as ultrasound, are occasionally successful but can be costly⁸

New diagnostic tools are being investigated

Prevention methods are not always effective or sustainable for long-term use

Antimicrobial feed additives^{9, 10, 11}

Nutritional management to decrease ruminal acidosis incidence¹²

Vaccination is available, but varied success¹³

Condemned livers have large annual economic impact on beef producers

In 2009, annual economic loss due to liver condemnation for abscesses was over **\$15.8 million**¹⁴

In 2009, additional annual economic loss due to condemnation of entire gut was over **\$7 million**¹⁴

In 2015-2016, the economic loss due to liver abscesses in fed cattle was **\$1.46/animal**⁵

Background and Objective

- Due to the difficulty with current prevention methods for liver abscesses in cattle, there may be the potential of genetic selection as a prevention tool
 - In the literature, one study has investigated the genetic components of liver abscess incidence in cattle, finding 35 SNP associations and genetic variation that indicate genetic selection may be possible for decreasing liver abscess incidence ¹⁵
 - The animals in the study were beef cattle slaughtered at a commercial beef processing plant

The objective of this study was to utilize quantitative genetics to produce a preliminary heritability estimate of liver abscess incidence in fed, beef on dairy heifers.

Our Study

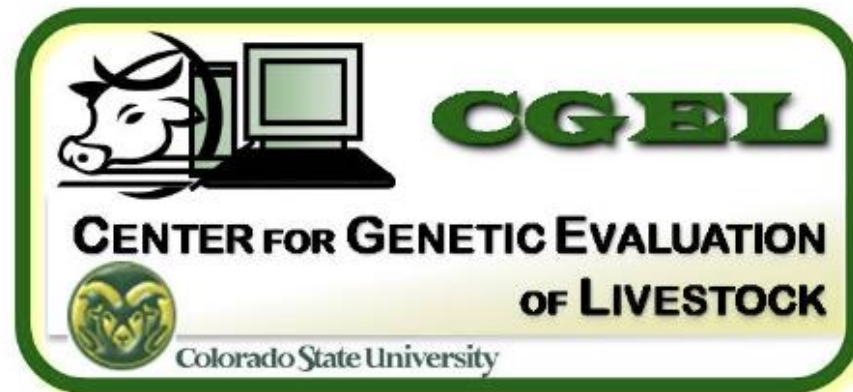
- 1,492 beef on dairy heifers harvested in Dodge City, Kansas
- All had liver abscess scores assigned at harvest
 - Used Elanco scoring system of 0, A-, A, A+, A+AD, and A+O
- At the feedlot prior to harvest, animals were split by kill lot and within each kill lot they had a treatment assigned
 - Treatments are for a different study and are not of direct interest in this study
- Pedigree had sire information on all heifers, but no dam information
 - Utilized a 3-generation sire pedigree
 - There were 19 unique sires across all heifers



Photo Credit: Hy-Plains Feedyard, LLC

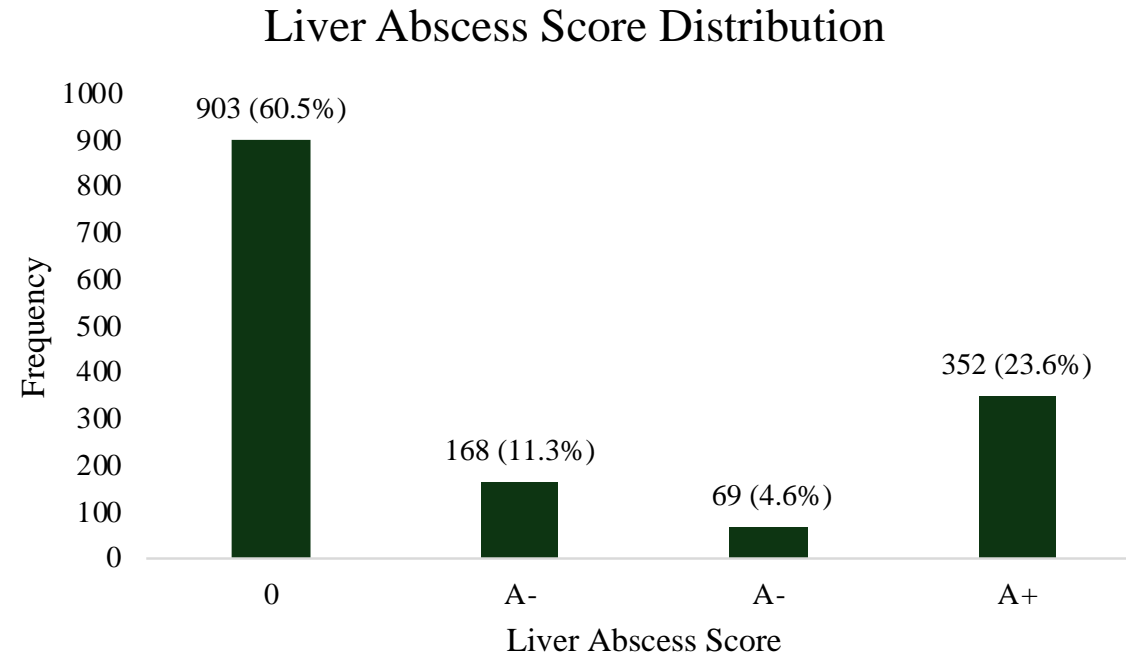
Statistical Analysis

- Scores of 0, A-, A, and A+ were renumbered to 0, 1, 2, and 3, respectively
 - Scores of A+AD and A+O were accounted for as A+
- Evaluated the effects of contemporary group (CG), number of BRD treatments, and age in days
 - A mixed effect sire model was used to estimate heritability
- Due to the animals being in a second study that included treatment, contemporary group was a combination of kill lot and treatment



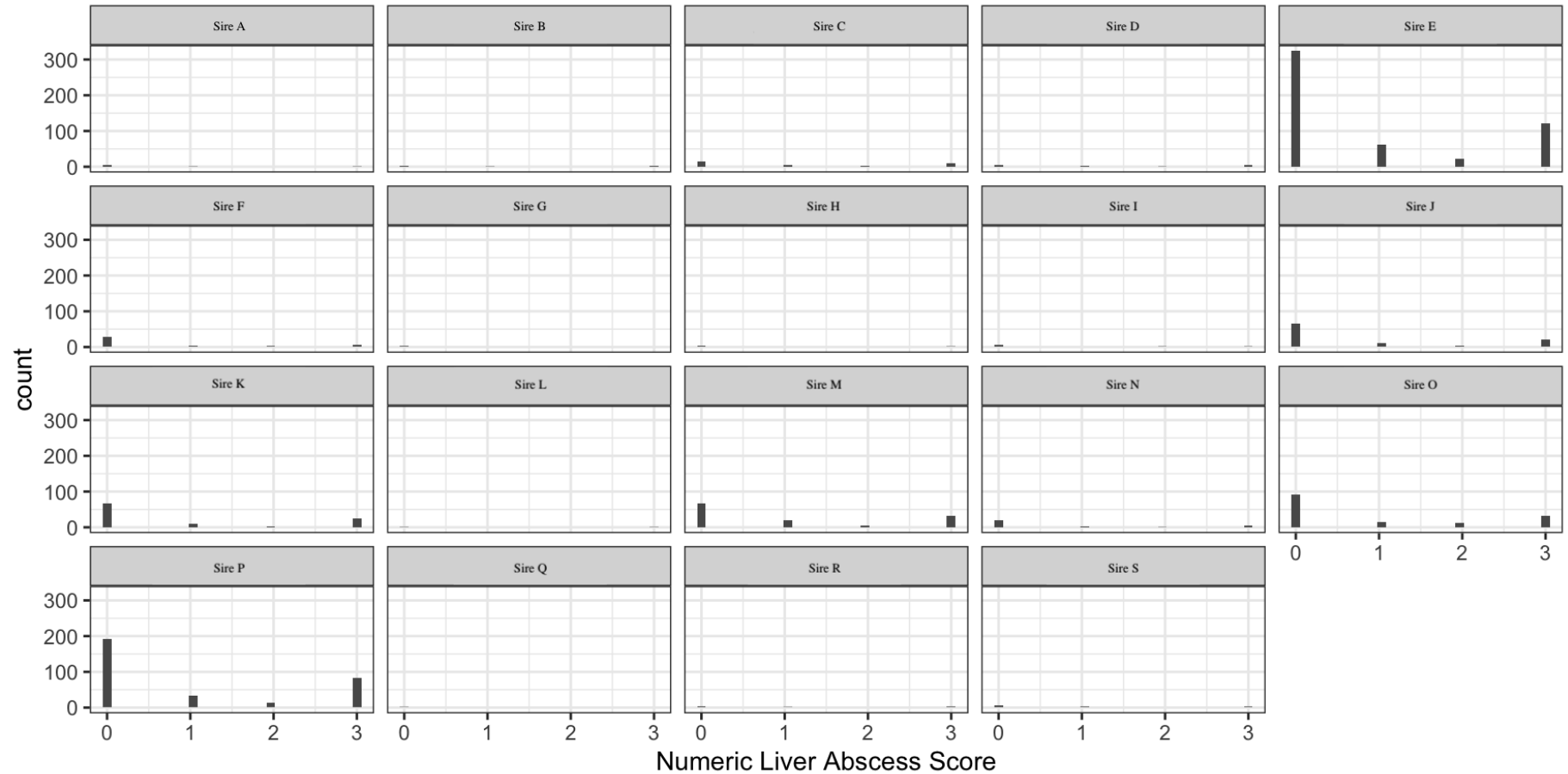
Descriptive Summaries

- The incidence rate of liver abscesses in this data set was 39.5%
- In the A+ category, 232 were A+AD, 14 were A+O, and 106 were A+



Descriptive Summaries

- Liver abscess distributions per sire
- Sires are renamed from A to S to remain confidential
- Counts per sire vary drastically, with Sire E having 530 progeny in the data set, but nine sires having less than 10 progeny in the data set



Results

- Genetic variance (σ_{BV}^2) estimated from this data set was $2.70 \times 10^{-7} \pm 9.99 \times 10^{-9}$
- Phenotypic variance (σ_P^2) estimated from this data set was $1.58 \pm 5.86 \times 10^{-2}$

$$h^2 = \frac{\sigma_{BV}^2}{\sigma_P^2} = \frac{2.70 \times 10^{-7}}{1.58} \approx 0$$

- The heritability (h^2) estimated from this data set was 0.

The heritability estimate from this preliminary study is **0**.

Discussion

- The preliminary heritability estimate for liver abscess incidence was 0
 - In this data set, liver abscesses are not heritable
- The results from this study did not find indications of liver abscesses having a genetic component, like the Keele et al. (2016) study found¹⁵
- The lack of variation in sires may contribute to the inability to identify a non-zero genetic variance
 - Current efforts are being done to obtain dam information for the heifers
 - Future estimates will have increased accuracy as more pedigree information is collected
- Based on the results of this study, genetic selection tool development is still to be determined
 - More experimentation may be needed on environmental factors affecting liver abscesses

Acknowledgements

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Thank you!
Questions?

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