# Effects of very low-dose antibiotics on gene expression profiles in ileal mucosa of weaned pigs infected with a pathogenic *E. coli*

Kwangwook Kim[1], Sungbong Jang[2], and Yanhong Liu[1]
[1]University of California, Davis, CA, [2]University of Georgia, Athens, GA

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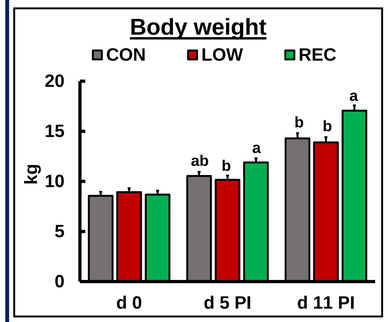
Comparative Animal Nutrition & Physiology Laboratory

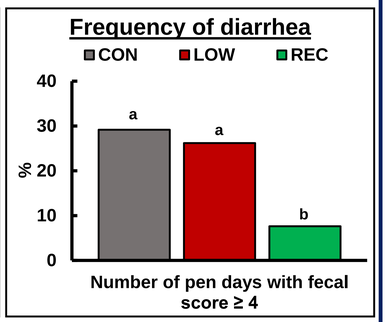
## Background

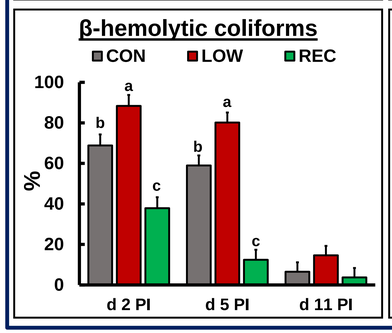
- Antibiotics have been widely used as growth promoters and to treat the diarrheal disease caused by enterotoxigenic *Escherichia coli (E. coli)* in livestock production
- As one of the biggest public health concerns, antibiotic resistance leads to tremendous economical loses and increased mortality of both humans and livestock
- Potential antibiotic residue in food supply chain causes the selection of resistance genes in bacteria, which may lead to the failure of medical treatment in animal production (Bengtsson and Greko 2014)

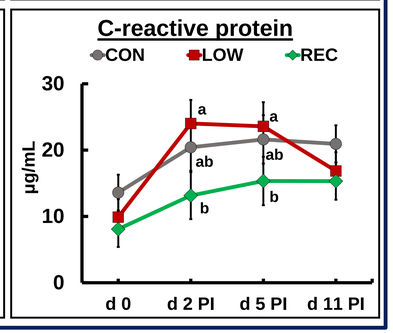
## Preliminary data

Supplementation of very low-dose antibiotics exacerbated growth performance and systemic inflammation of weaned pigs infected with a pathogenic *E. coli* (Kim et al., 2019a,b)



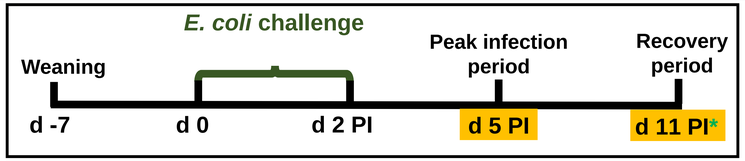




## Objective

**To investigate the effect of very low-dose antibiotics on gene expression profile in ileal mucosa of weaned pigs experimentally infected with F18 *E. coli***

## Materials and methods




*PI= post-inoculation

- Experimental design: RCBD (Blocks: BW x Sex)
- 34 weanling pigs (6.88 ± 1.03 kg, 21 d old)
- Treatments: 3 dietary treatments (11-12 pigs/treatment)

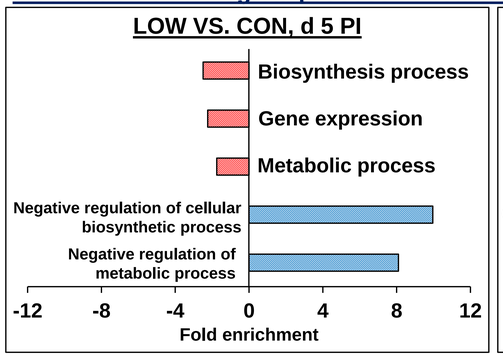
| | |
|---|---|
| Nursery basal diet as control (CON) | *E. coli* challenge |
| CON + 0.5 mg/kg of antibiotics (Very low-dose; LOW) | |
| CON + 50 mg/kg of antibiotics (Recommended-dose; REC) | |

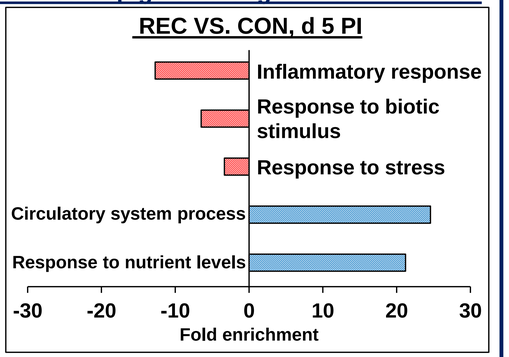
- Ileal mucosa samples were collected on d 5 and 11 PI
- Total RNA was extracted and analyzed for gene expression profiles by Batch-Tag-Seq
- Modulated differential gene expression were defined by 1.5-fold difference and a cutoff of $P < 0.05$ using limma-voom package
- Statistical overrepresentation test was performed using PANTHER classification system (http://www.pantherdb.org/)
  - Identified differentially expressed genes
    - ✓ LOW vs. CON : 51 (d 5); 57 (d 11)
    - ✓ REC vs. CON : 63 (d 5); 125 (d 11)
  - Gene ontology: Biological process
  - Test type & correction: Binomial & Bonferroni correction for multiple testing
  - Reference gene list: *Sus scrofa* (pig)

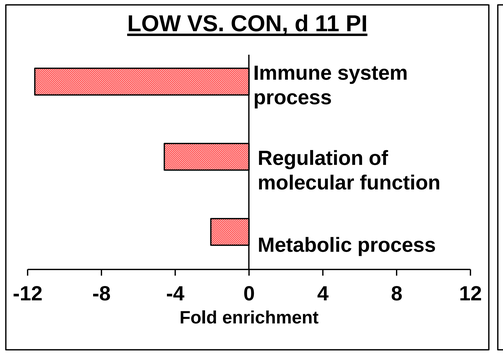
Research project No. W4002

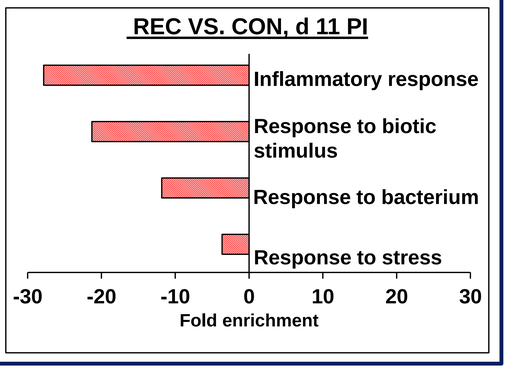
## Results

Modulation of biological process in ileal mucosa of pigs challenged with F18 *E. coli*




## Conclusions

- Recommended-dose antibiotics enhanced disease resistance of pigs, as indicated by down-regulated the expression of genes involved in inflammatory response and response to stress
- Very low-dose antibiotics adversely altered the expression of genes that are related to metabolic processes and immune responses
- These observations support the adverse effects of very low-dose antibiotics on performance and overall health of weaned pigs infected with F18 *E. coli*

## References


- Bengtsson B, Greko C. 2014. Antibiotic resistance-consequences for animal health, welfare, and food production. Ups. J. Med. Sci. 119:96–102.
- Kim, K., Y. He, C. Jinno, S. Yang, M. Song, P. Ji, and Y. Liu. 2019a. Effects of antibiotics on growth performance, diarrhea, and bacterial translocation in weanling pigs experimentally infected with a pathogenic *E. coli*. J. Anim. Sci. 97(Suppl_2):53.
- Kim, K., Y. He, C. Jinno, S. Yang, M. Song, P. Ji, and Y. Liu. 2019b. Effects of antibiotics on blood profiles in weanling pigs experimentally infected with a pathogenic *E. coli*. J. Anim. Sci. 97(Suppl_2):78.