

Effects of antibiotics on growth performance, diarrhea, and bacterial translocation in weanling pigs experimentally infected with a pathogenic *E. coli*

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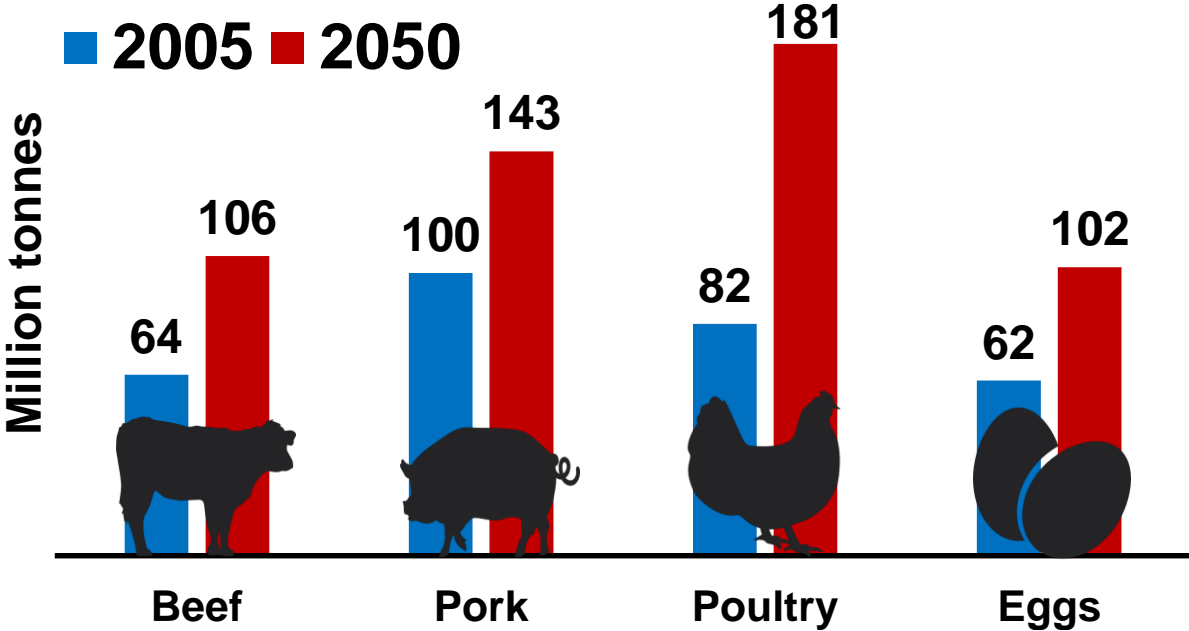
Presentation
#91



Outline

- **Challenges in pig industry**
- **Antibiotic growth promoter & side effects**
- **Hypothesis & Objective**
- **Results and conclusions**

Growth in global protein demand



Source: Food and Agriculture Organization of the United Nations, ESA Working Paper No. 12-03, p. 131

Weaning stress

- Environmental changes
- Transportation stress
- Abrupt transition of diet
- Increased exposure to pathogens



Post weaning diarrhea in pigs

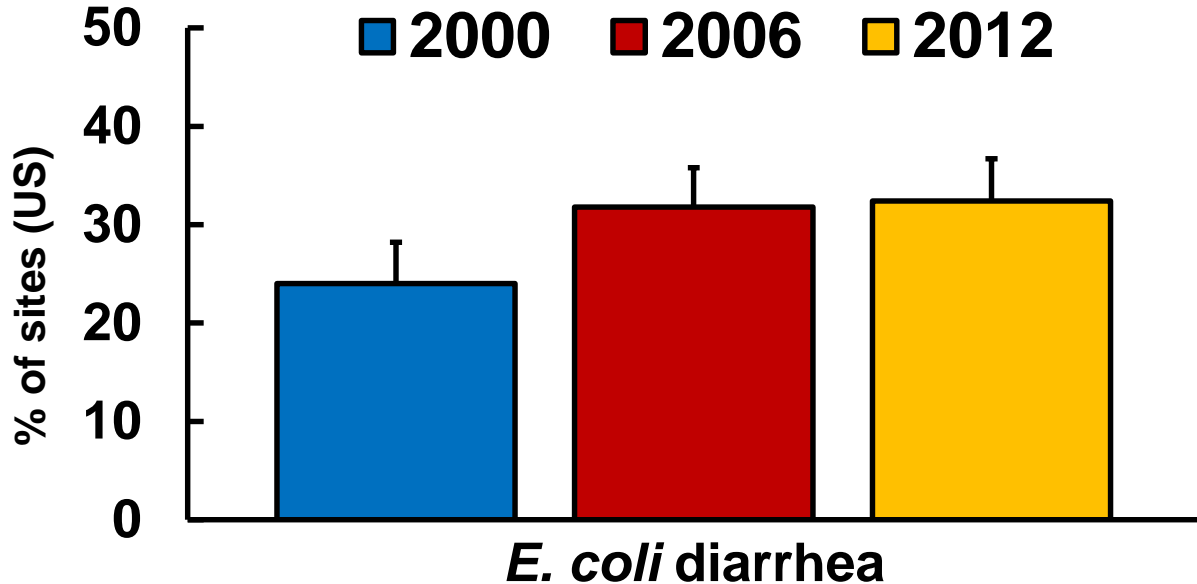
- One of the most serious threats for the swine industry
- Usually associated with proliferation of enterotoxigenic

E. coli (ETEC)

- F4 (K88) or F18

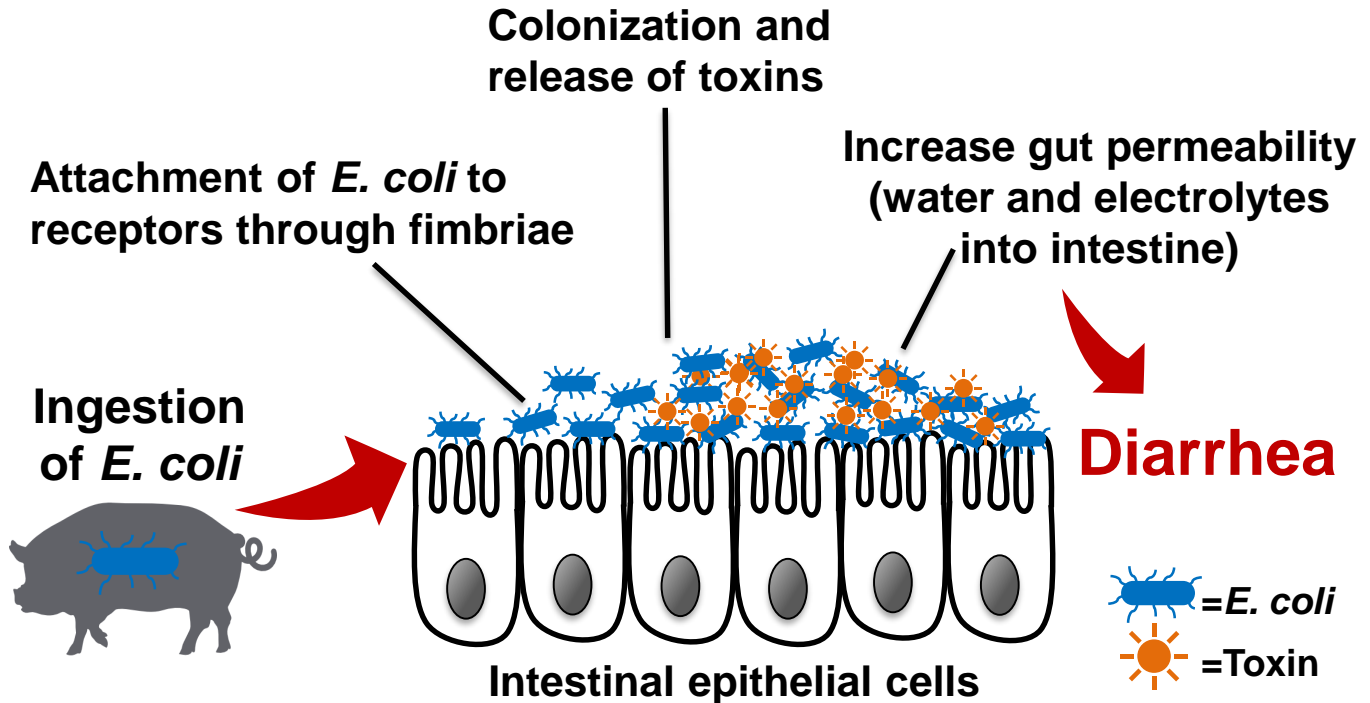


Post-weaning *E. coli* diarrhea morbidity



USDA, Swine 2012 Part III: Changes in the U.S. Swine Industry, 1995–2012

Post-weaning *E. coli* diarrhea



Antibiotic growth promoters (AGPs) in diets

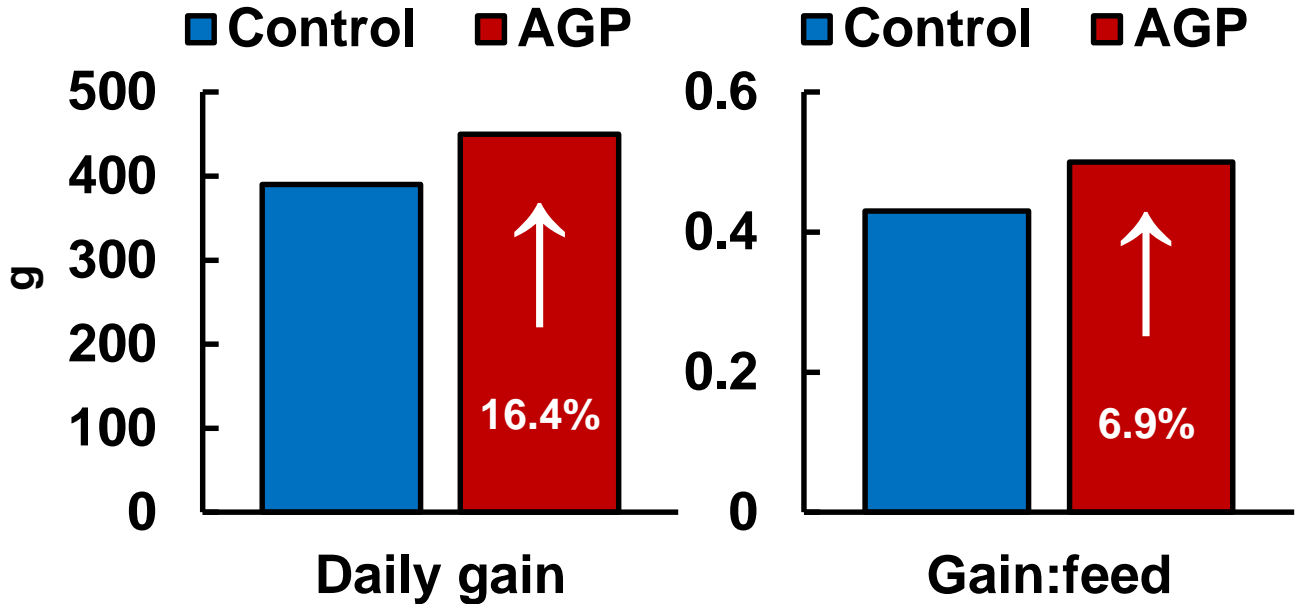
➤ **A medicine that inhibits the growth of or destroys microorganisms**

- **Growth promotion**
- **Disease prevention**
- **Disease treatment**



Source: <http://mbioblog.asm.org>

Efficacy of antibiotics as growth promoters for weaned pigs (7-25 kg)



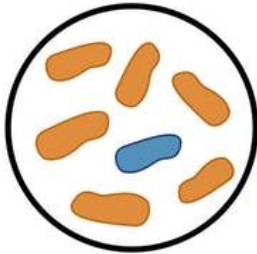
Zimmerman, 1986

Side effects of antibiotics

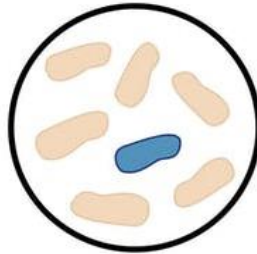
- **Development of resistant strains of pathogenic organisms**
- **Adverse or toxic reactions**
- **Increased susceptibility to infections**

Neu, 1992, Cunha, 2001, Davies, 2010

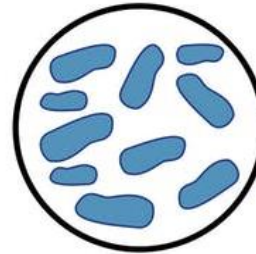
How does antibiotic resistance occur?



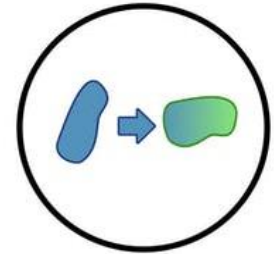
Lots of germs and some are drug resistant



Antibiotics kill the bacteria causing the illness as well as the good bacteria protecting the body from infection



The drug resistant bacteria is now able to grow and take over



Some bacteria give their drug resistance to other bacteria



- Normal bacterium



- Resistant bacterium



- Dead bacterium

<https://ducu59us/Shutterstock.com>

Adverse effects by low-dose AGP

Subinhibitory antibiotics concentration



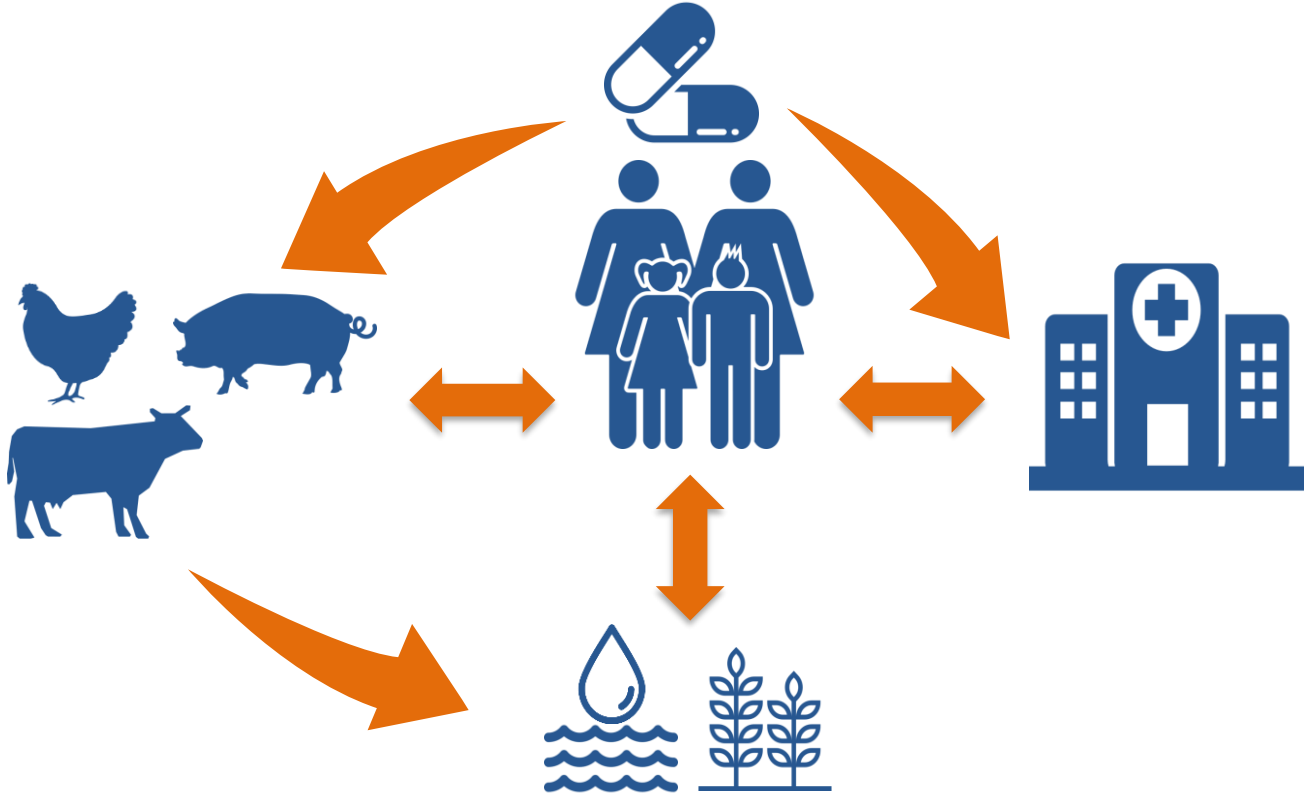
Enhancing bacterial selection for antibiotic resistance genes



Increasing antibiotic resistance

Barbosa and Levy, 2000; Smith et al., 2002; Barlow, 2009; Brewer et al., 2013, Looft et al., 2014

How antibiotic resistance can spread?



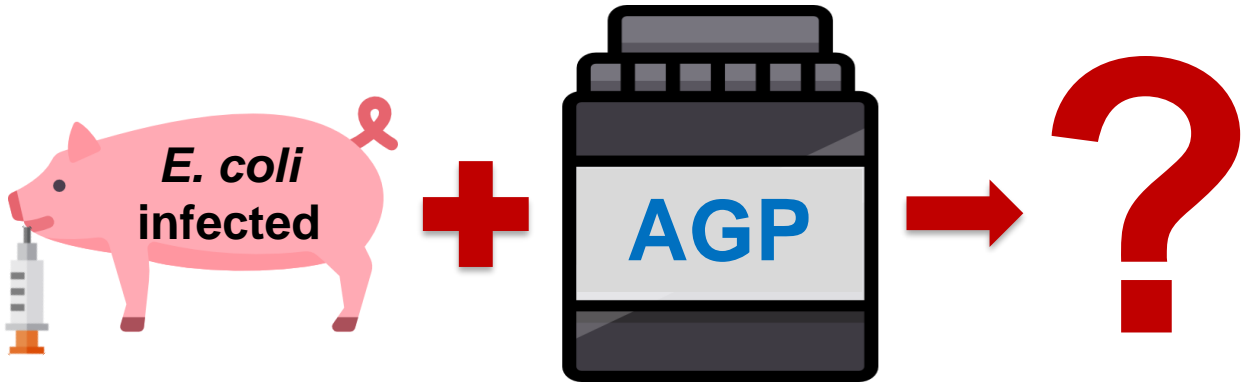
Hypothesis



Exposure to potential antibiotic resistance determinants or antibiotic residues exacerbates the infection of pigs.

<https://www.foodsafetynews.com/international-targets-recommended-for-reducing-animal-antibiotic-use>

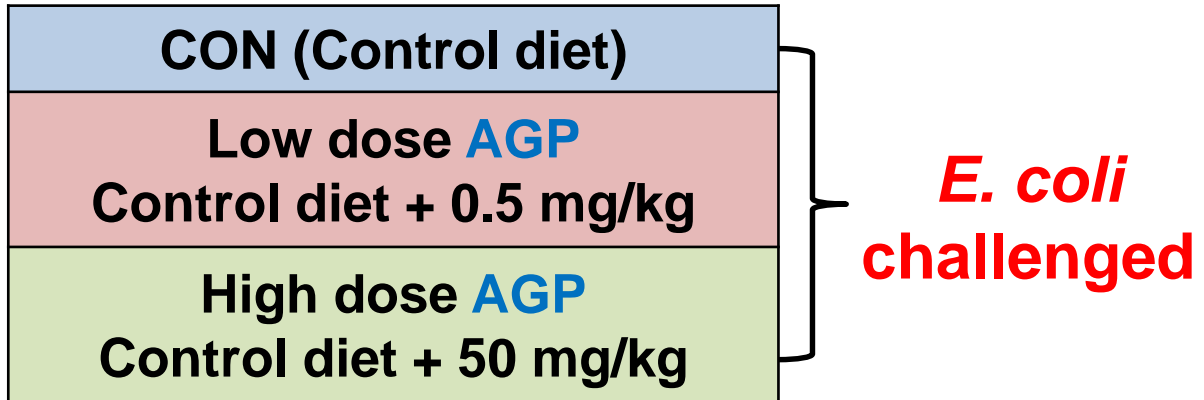
Objective



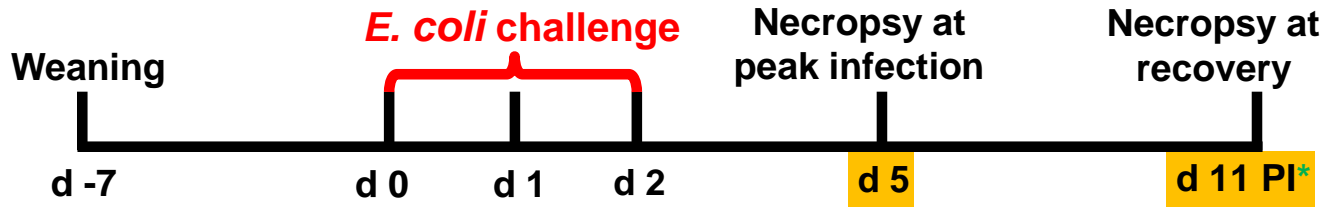
Investigate the effects of very low-dose antibiotics on growth performance, diarrhea, fecal β -hemolytic coliforms, and bacterial translocation of weaned pigs experimentally infected with F18 *E. coli*.

Experimental design & treatments

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



Experimental timeline & data collection



➤ **Pathogenic F18 *E. coli* challenge (LT, STb, SLT-2); oral inoculation, 10^{10} cfu/dose with 3 doses**

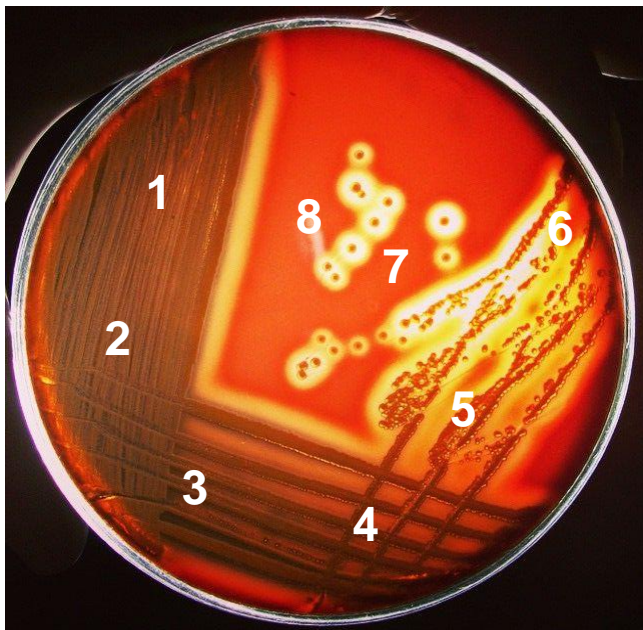
➤ **Growth performance**

➤ **Daily diarrhea score**

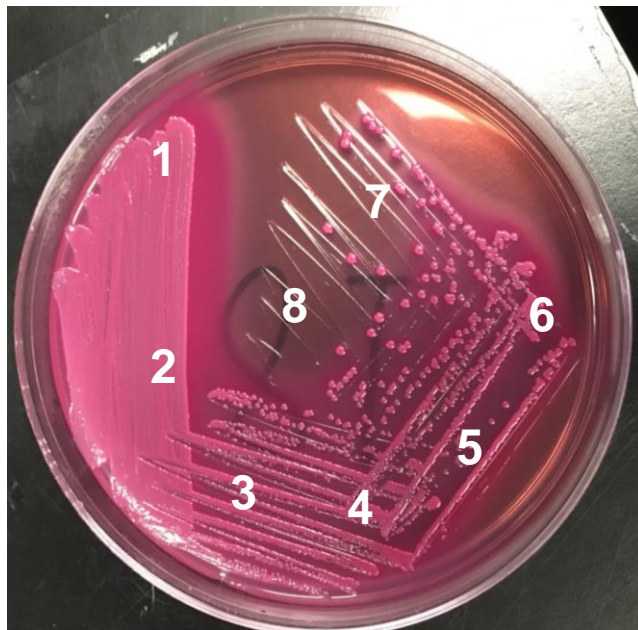
➤ **β -hemolytic coliforms in feces**

***PI=post-inoculation**

β -hemolytic coliforms & *E. coli* in feces



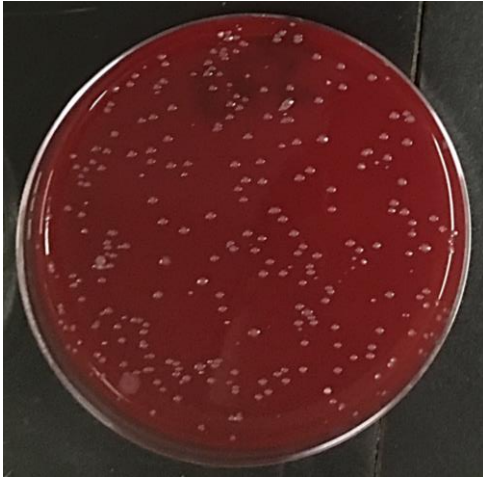
Blood agar



MacConkey agar

Data collection cont.

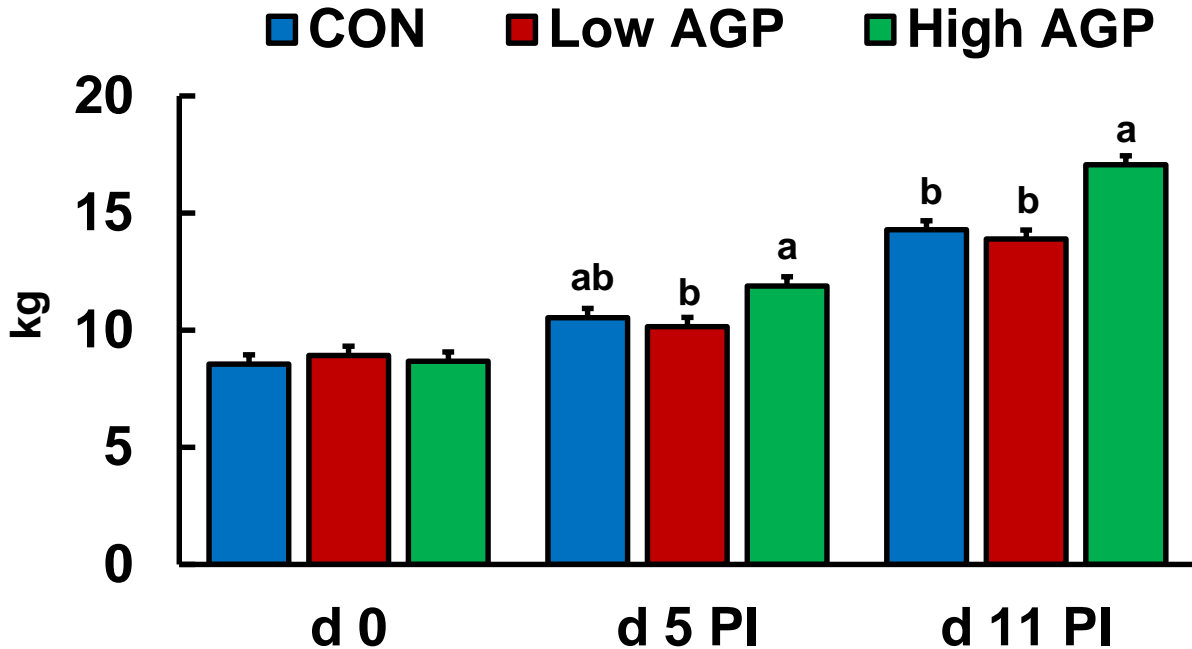
- **Bacterial translocation in mesenteric lymph nodes**



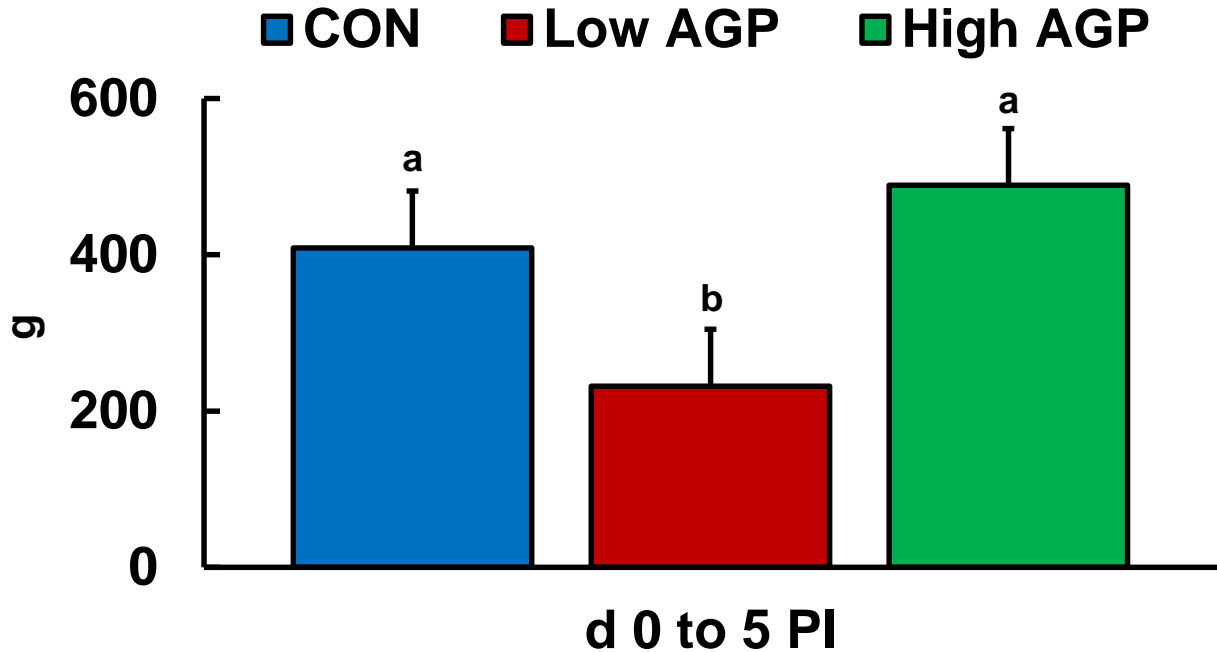
← **Plate homogenized
lymph nodes to blood agar**

- **All data were analyzed by ANOVA using the
PROC MIXED of SAS**

Body weight

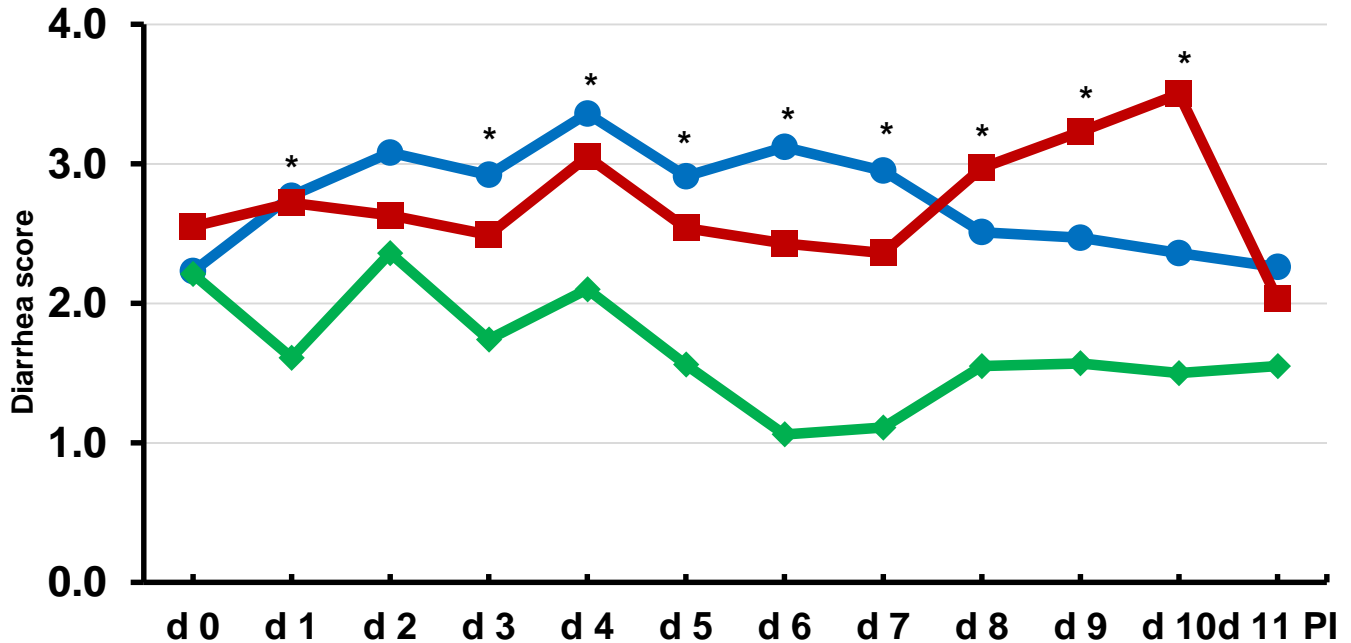


Average daily gain

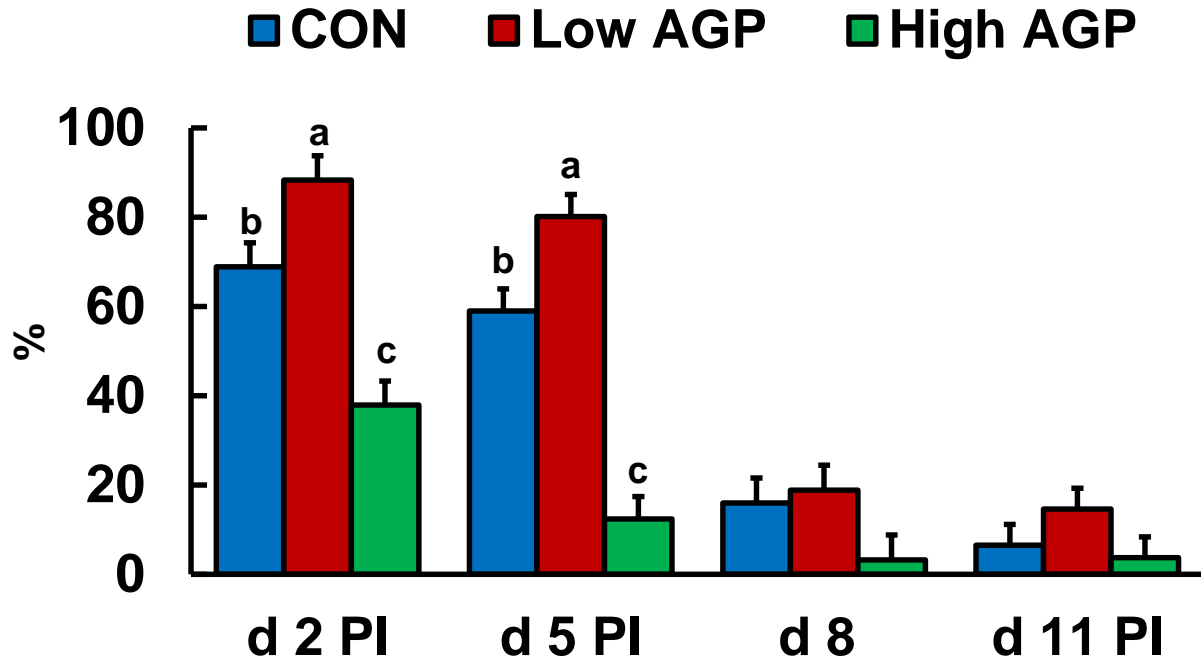


Diarrhea score

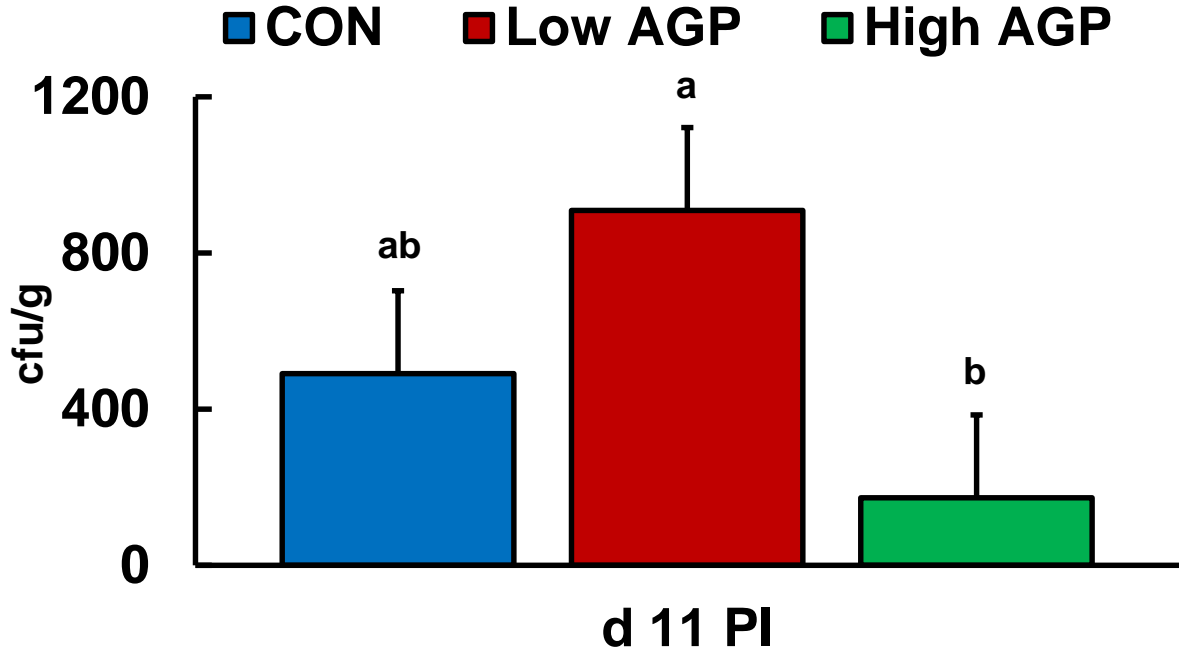
● CON ■ Low AGP ◆ High AGP



β -hemolytic coliforms in feces



Bacterial translocation in mesenteric lymph node



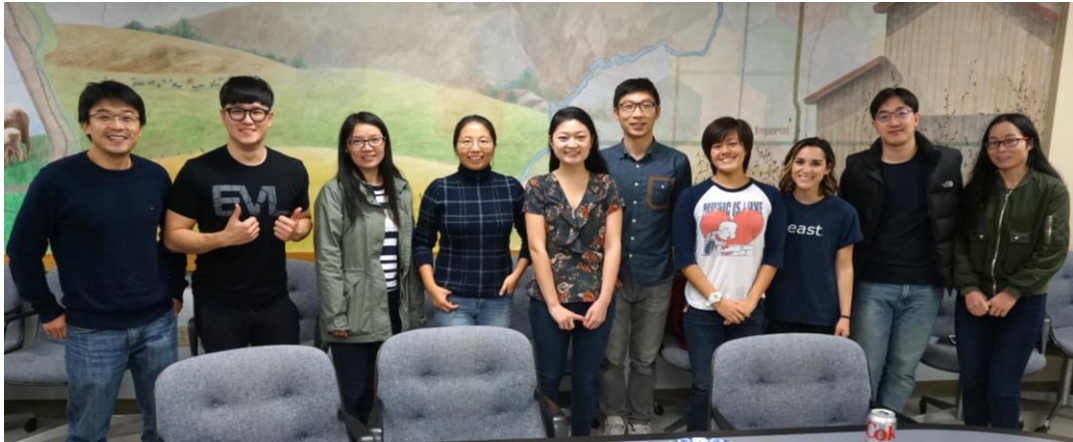
Conclusions

Very low-dose antibiotic growth promoter supplementation

- ✓ **Exacerbated growth performance**
- ✓ **Exacerbated diarrhea**
- ✓ **Delayed reduction of β -hemolytic coliforms**
- ✓ **Increased bacterial translocation**

of weaned pigs experimentally infected with F18 *E. coli*.

Acknowledgements



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University of California, Davis**



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Thank you for your attention!

