

Effects of oligosaccharide-based polymer on growth performance, diarrhea, and fecal β -hemolytic coliforms in weanling pigs experimentally infected with a pathogenic *E. coli*

Kwangwook Kim¹, Yijie He¹, Cynthia Jinno¹, Seijoo Yang¹,
Xunde Li¹, David Bravo², Eric Cox³, and Yanhong Liu¹

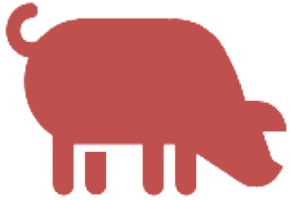
¹University of California, Davis, CA,

²Pancosma|ADM, Rolle, Switzerland,

³Ghent University, Ghent, Belgium



Outline



**Challenges in
pig industry**



**In-feed
antibiotics and
potential
alternatives**



**Research
objective &
methods**



**Results &
conclusions**

Weaning stress

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

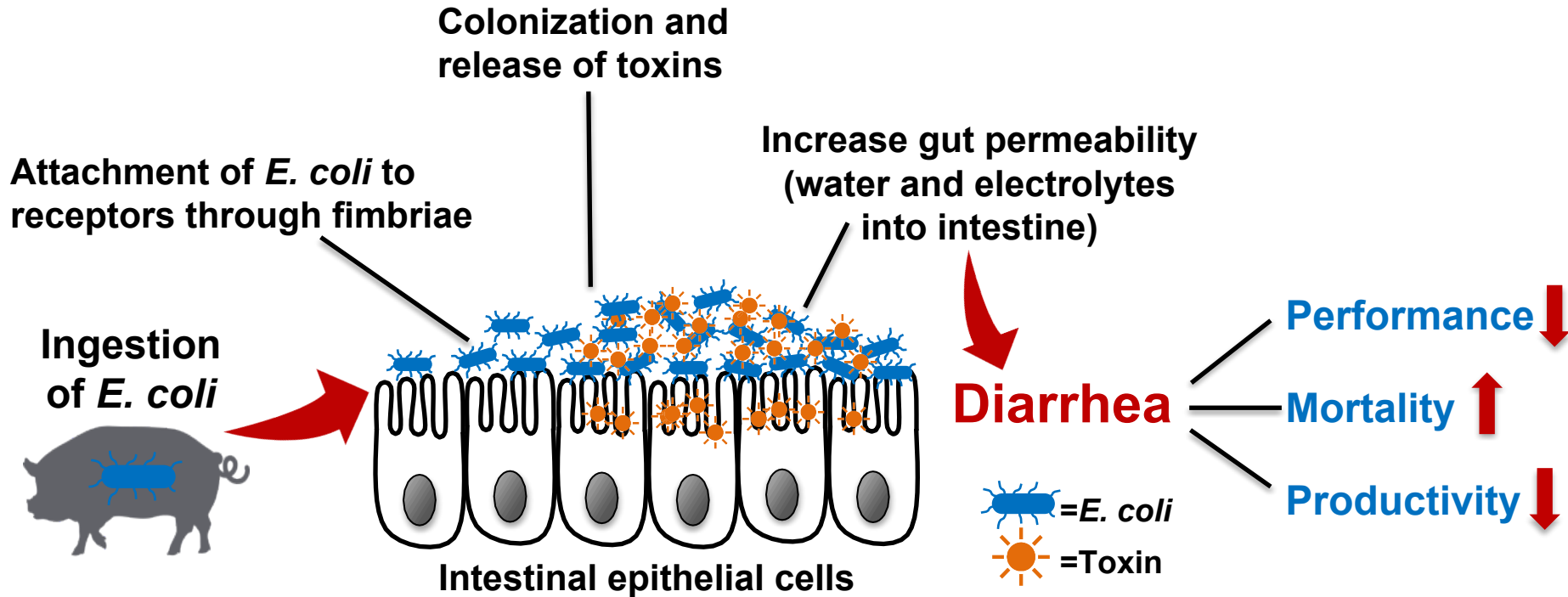


Post weaning diarrhea in pigs

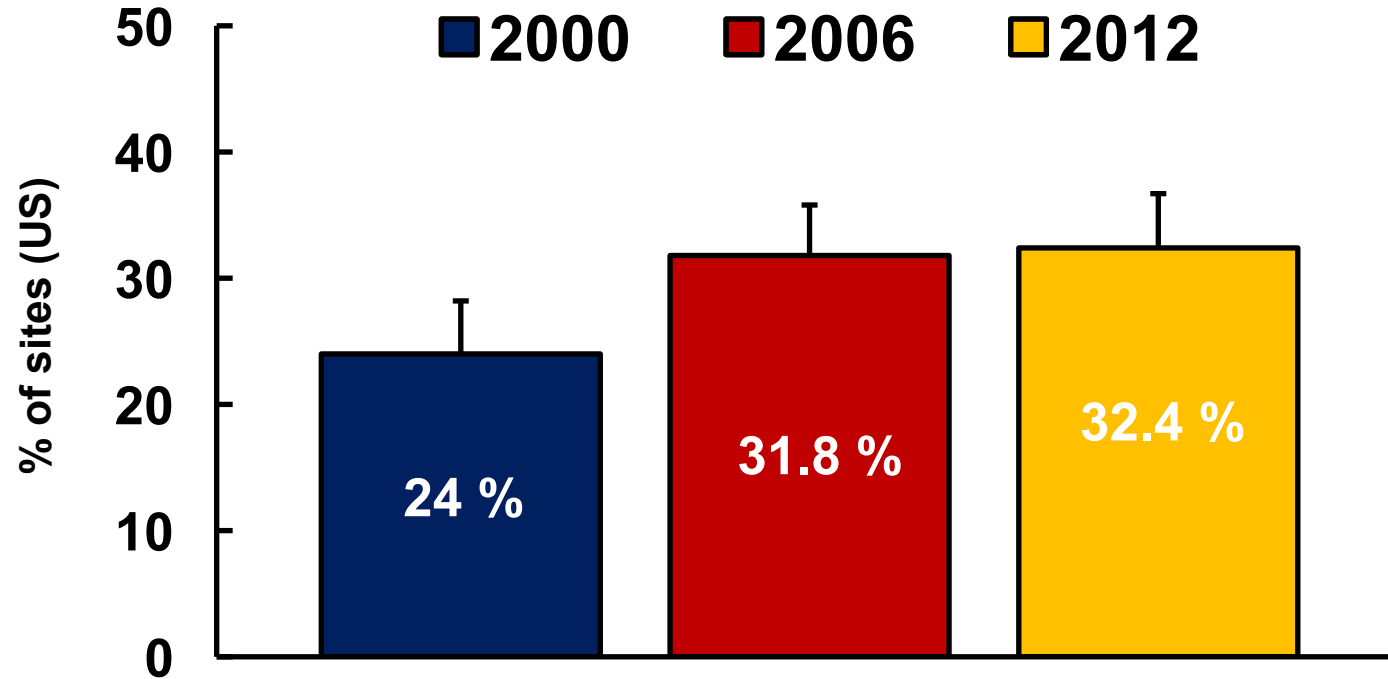
- One of the most serious threats for the swine industry
- Usually associated with proliferation of enterotoxigenic *E. coli* (ETEC)
 - ✓ F4 (K88)
 - ✓ F18



Post-weaning *E. coli* diarrhea



Post-weaning *E. coli* diarrhea morbidity



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

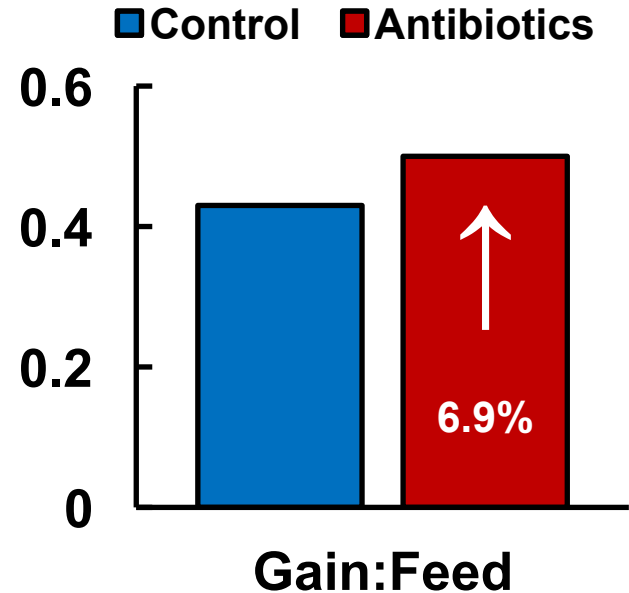
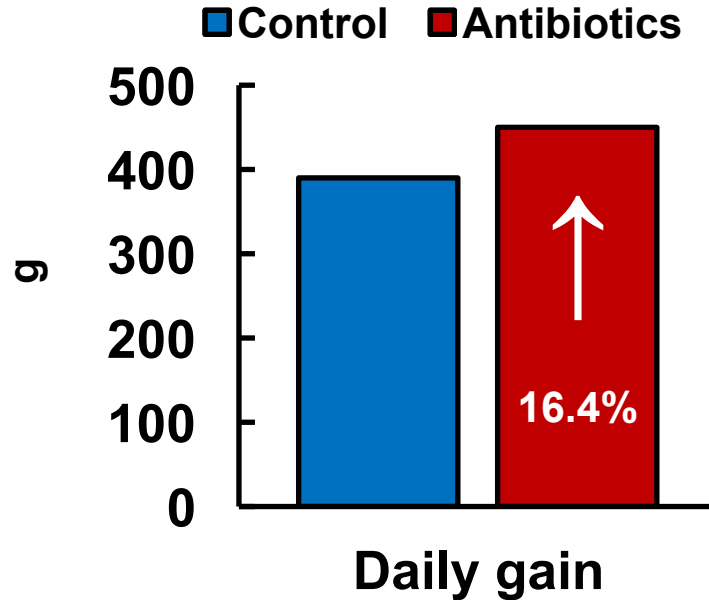
In-feed antibiotics

➤ Antimicrobial substances active against bacteria

- Growth promotion
- Disease prevention
- Disease treatment



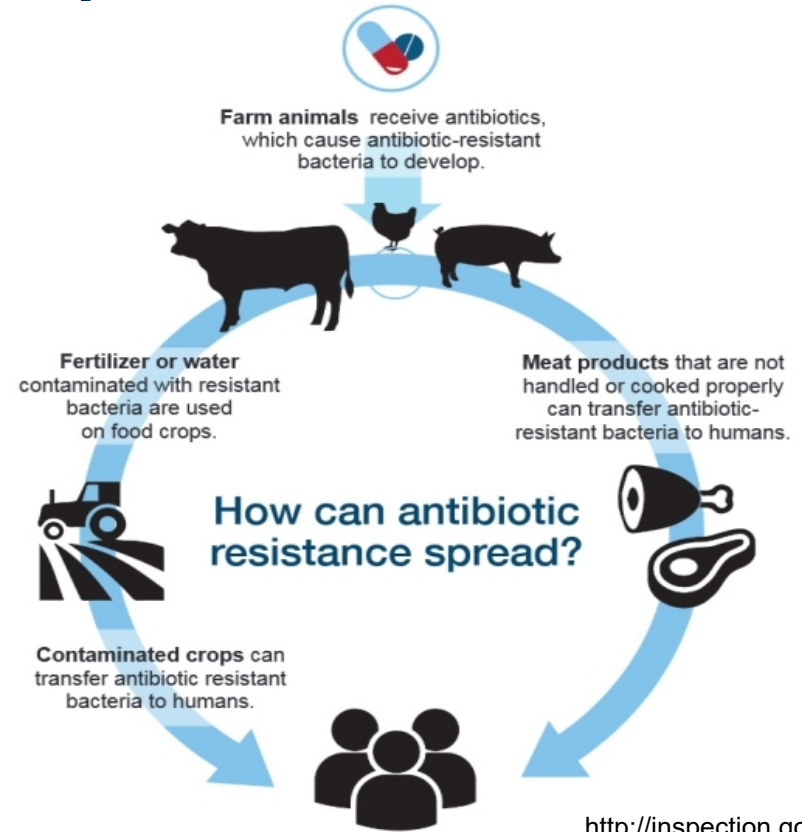
Efficacy of antibiotics as growth promoters for weaned pigs (7-25 kg)



Zimmerman, 1986

Antibiotic resistance as a major public health concern

- **Banned antibiotics as growth promoter in the E.U and U.S since 2006, and 2017, respectively**
- **Alternatives to antibiotic are highly demanded**



<http://inspection.gc.ca>

Blood group A antigen oligosaccharides

- High correlation between blood group A antigen and F18 ETEC adherence on the small intestine of young pigs (Coddens et al., 2009; Patent US8703722B2)
- Blood group A antigen might disturb the toxin activity by interfering with ETEC binding to the receptors in the small intestine of pigs (Barra et al., 1992)

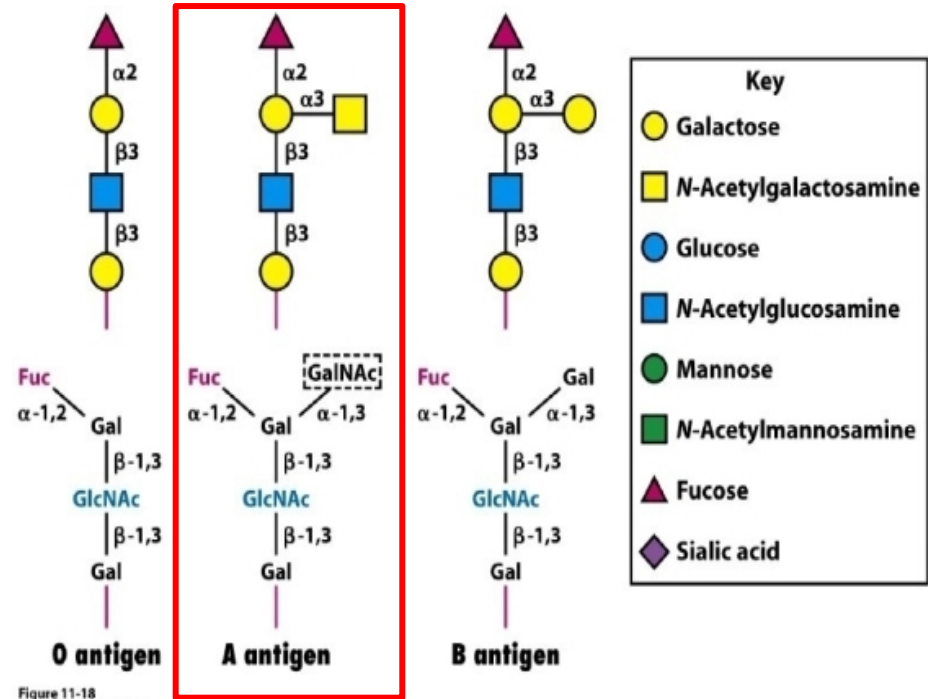


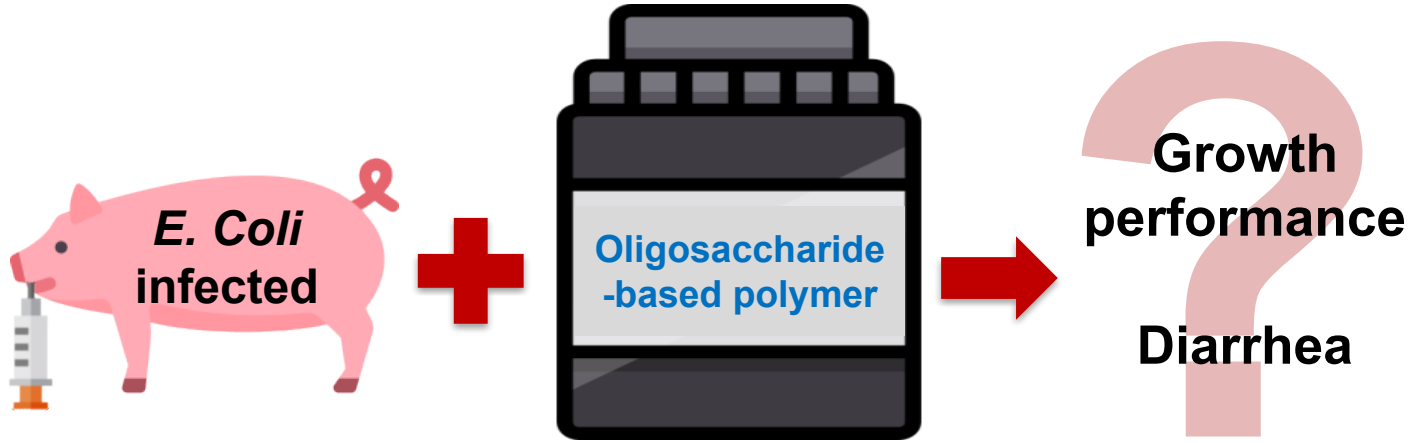
Figure 11-18
Biochemistry, Sixth Edition
© 2007 W. H. Freeman and Company

Hypothesis



The combination of blood group A antigen oligosaccharides and carrier may enhance disease resistance of pigs against F18 *E. coli* infection by inhibiting bacterial attachment

Research objective



To investigate dietary supplementation of oligosaccharide-based polymer on growth performance, diarrhea, and fecal β -hemolytic coliforms of weaned pigs experimentally infected with a pathogenic F18 *E. coli*.

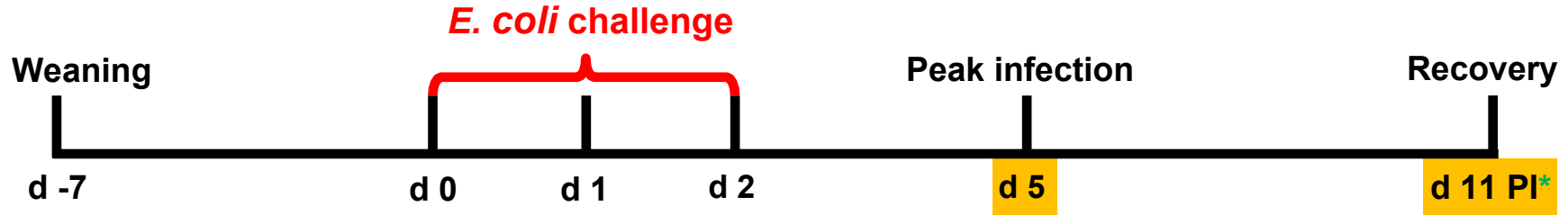
Experimental design & treatments

- Experimental design: RCBD (Blocks: BW x Sex)
- 48 weaning pigs (7.23 \pm 1.11 kg BW, 21 d old)
- Treatment: 4 treatments (12 pigs/treatment)

Nursery basal diet as control (CON)	} <i>E. coli</i> challenged
CON + 10 mg/kg of oligosaccharide-based polymer* (LOW)	
CON + 20 mg/kg of oligosaccharide-based polymer* (HIGH)	
CON + 50 mg/kg of antibiotics (Carbadox; AGP)	

*Glycoconjugate composed of blood group A antigen oligosaccharides grafted on carrier and was designed and synthesized by Elicityl (France) in cooperation with Dr. Eric Cox (Ghent Univ., Belgium) and provided by Pancosma (Geneva, Switzerland)

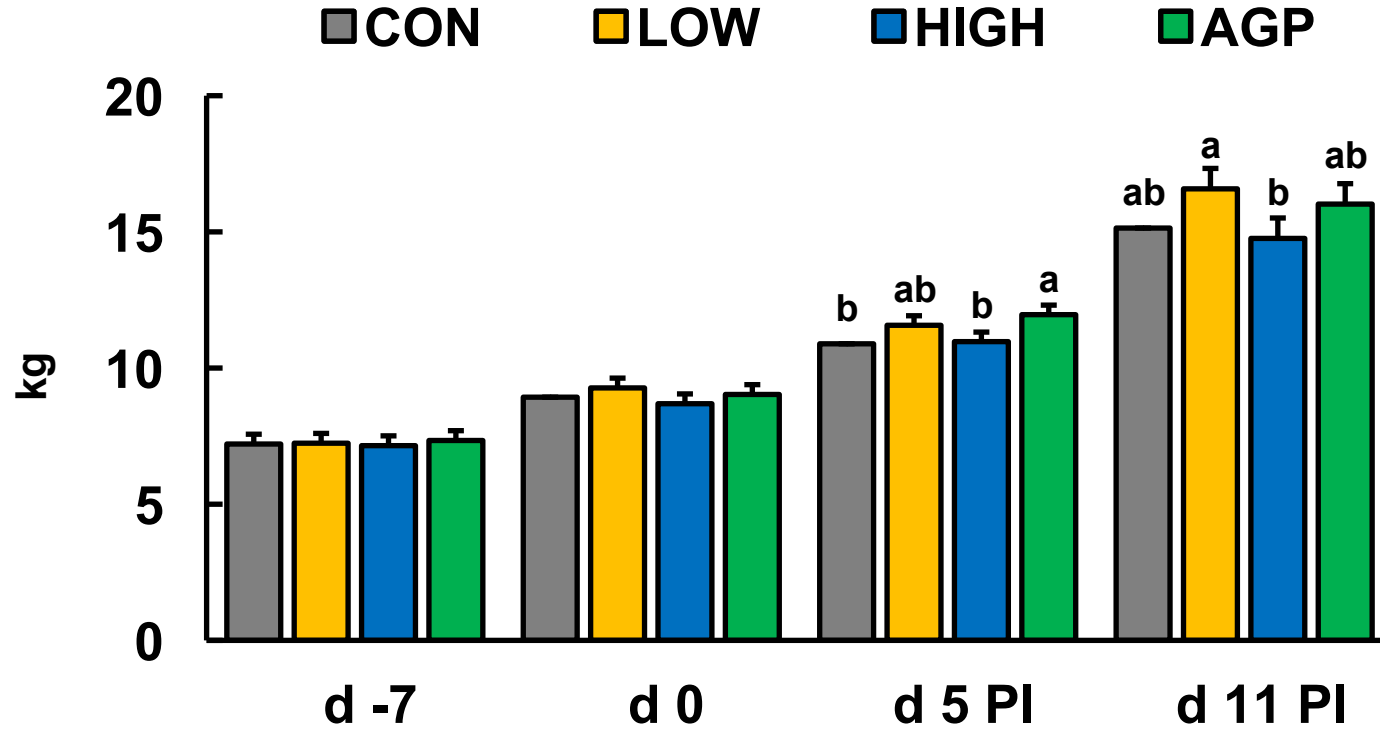
Experimental timeline & data collection



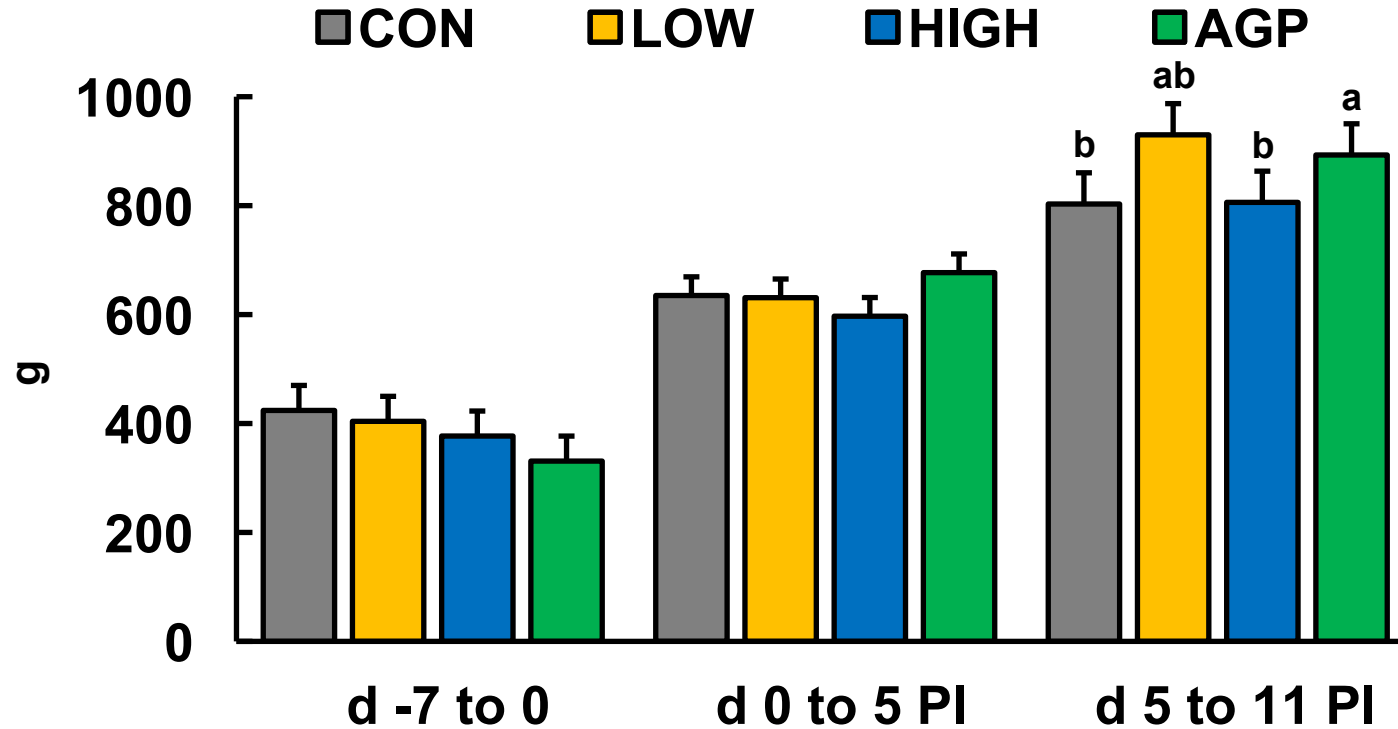
➤ **Pathogenic F18 *E. coli* challenge (LT, STb, Stx2e);** oral inoculation, 10^{10} cfu/dose with 3 doses *PI=post-inoculation

- **Growth performance**
 - ✓ Body weight
 - ✓ Average daily gain
 - ✓ Average daily feed intake
 - ✓ Gain:Feed
- **Diarrhea severity**
 - ✓ Daily diarrhea score
 - ✓ Frequency of diarrhea
- **All data were analyzed by ANOVA using the PROC MIXED of SAS**

Body weight

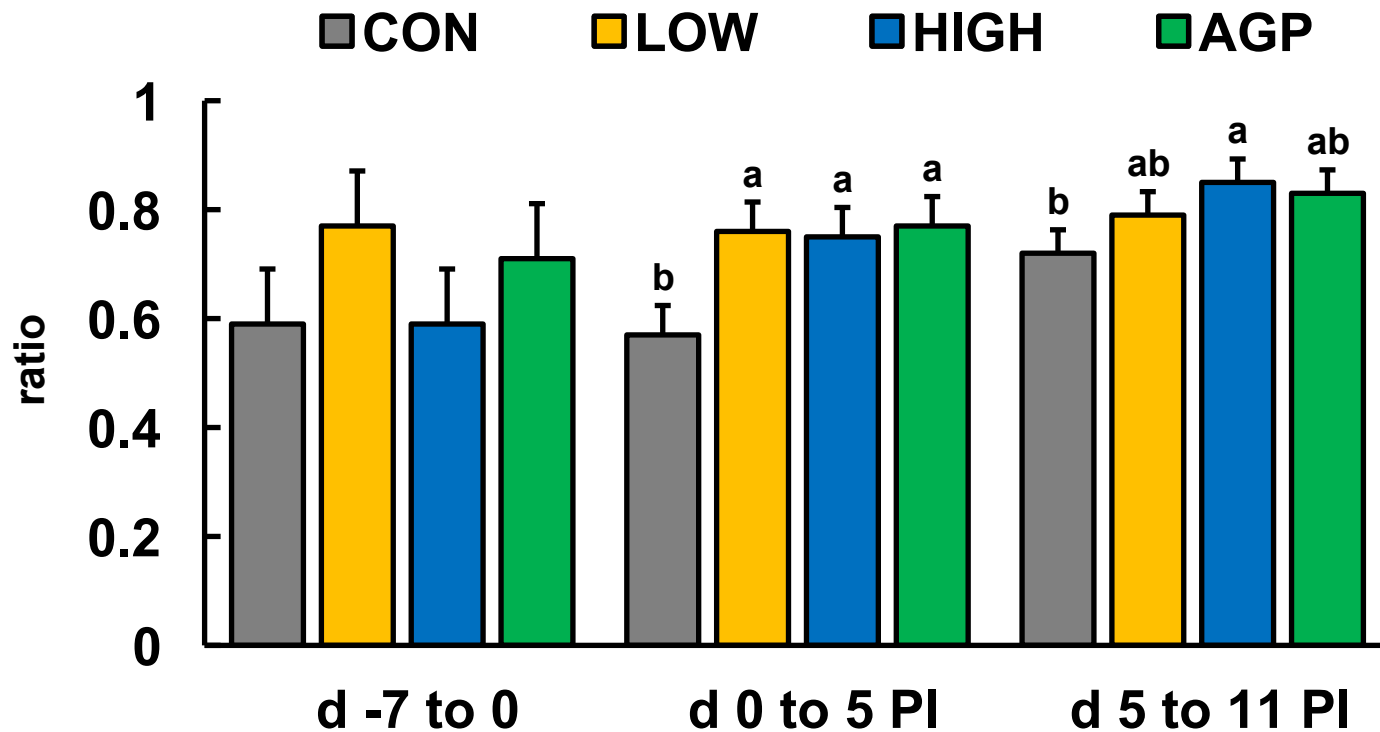


Average daily feed intake

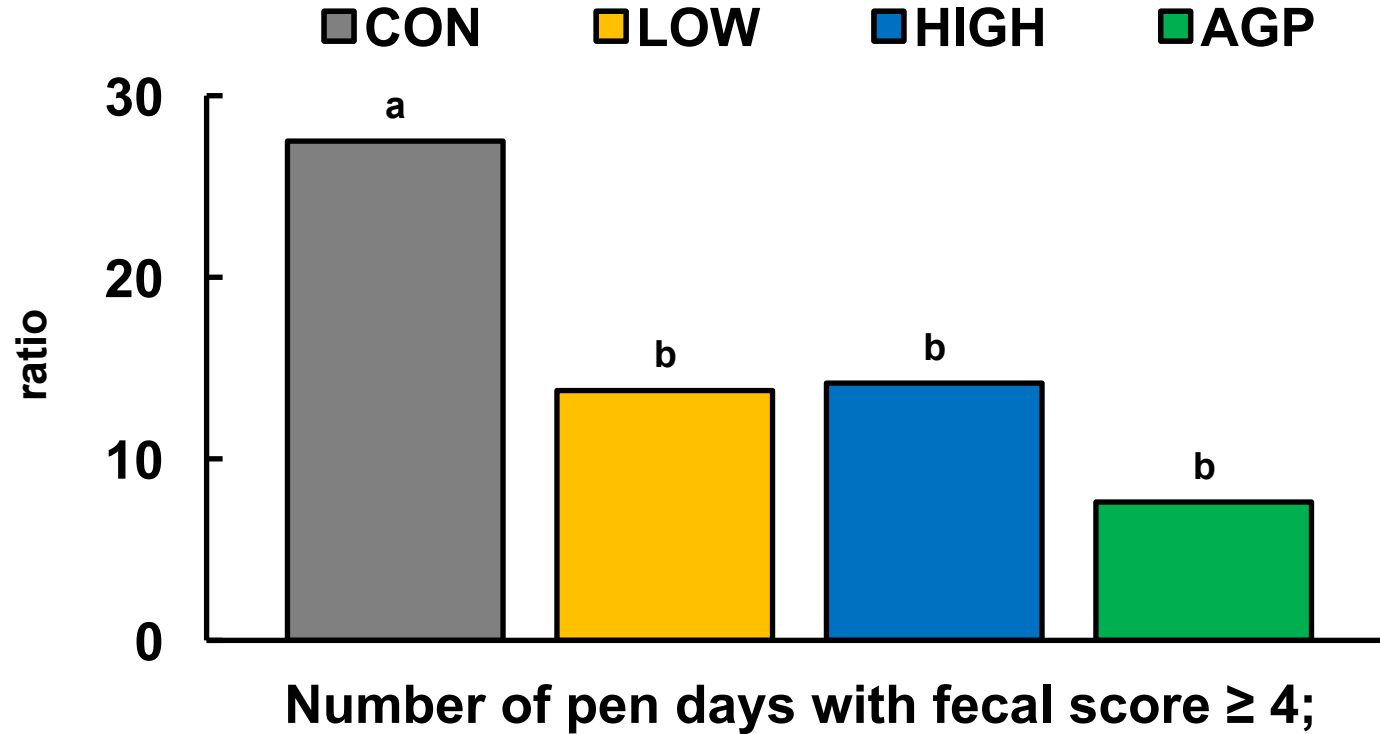


No differences in average daily gain among the treatments throughout the experiment

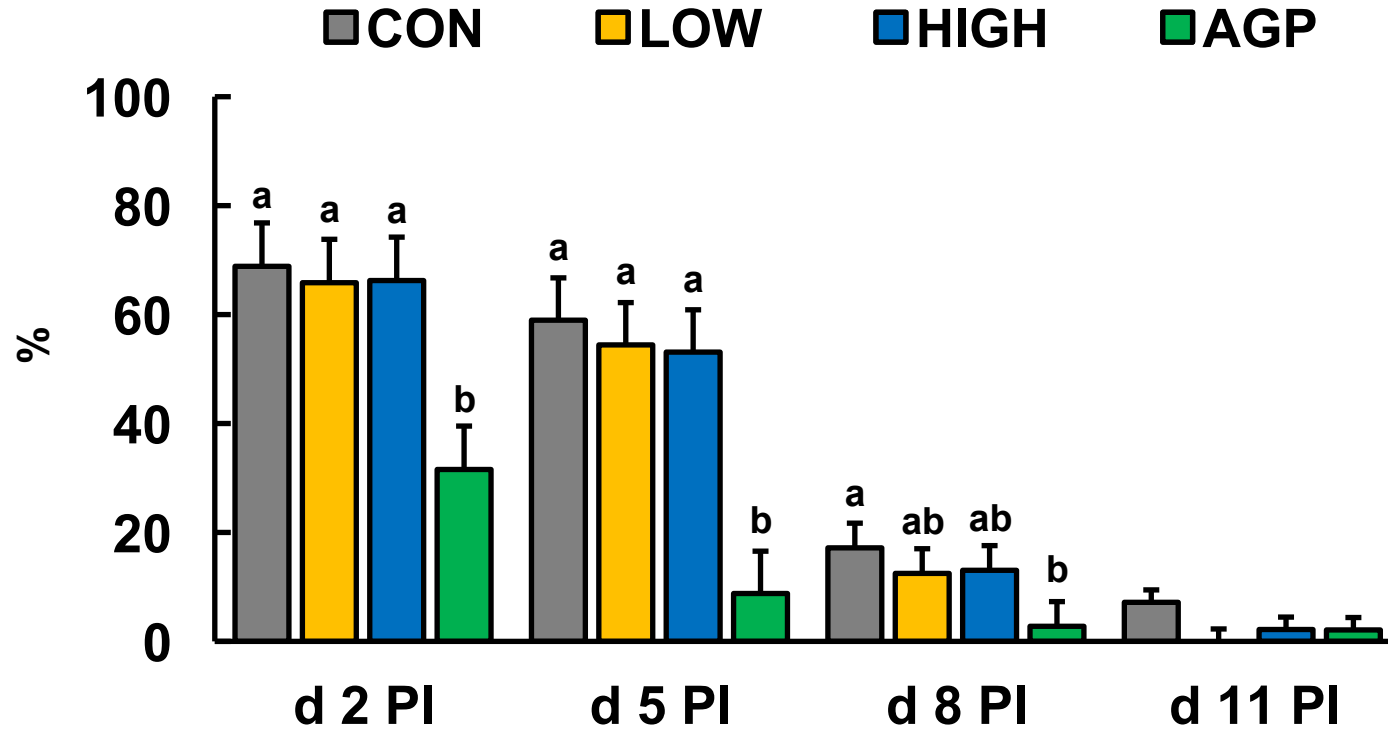
Gain:Feed



Frequency of diarrhea



β -hemolytic coliforms in feces



Conclusions

	Oligosaccharide -based polymer	Antibiotics
Feed efficiency	Enhanced	Enhanced
Diarrhea	Reduced	Reduced
β -hemolytic coliforms	Relatively high percentage	Relatively low percentage

Oligosaccharide-based polymer and antibiotics may have used different mechanisms to reduce diarrhea in weaned pigs infected with a pathogenic *E. coli*

Acknowledgement



Comparative Animal Nutrition & Physiology Laboratory
University of California, Davis



Thank you for your attention!

