food animal agriculture. The current study investigated the efficacy of a dairy-origin probiotic bacterium, *Propionibacterium freudenreichii* strain N3523 (PF) against *S.* Heidelberg using *in vitro* and *in vivo* experiments. The *in vitro* experiments included motility-, multiplication-, adhesion- and invasion assays in modified motility medium, cecal contents, and avian epithelial cell lines, respectively. In addition, probiotic qualities of PF were tested by exposing it to low pH, and bile salts, and conducting hemolysis-, antibiotic susceptibility-, antimicrobial activity-, and adhesion and invasion- assays. Follow up *in vivo* experiments were conducted in 2-week, 7-week, and 12-week old commercial turkeys to determine the efficacy of PF against *S*. Heidelberg colonization. For all *in vitro* assays, the treatments were duplicated and the experiments were repeated at least 3 times. For *in vivo* studies, each treatment group had at least 12 birds, and the experiments were repeated. Data were analyzed using the PROC-MIXED procedure of SAS, with a $P<0.05$ determining statistical significance. The *in vitro* results revealed that PF was effective in reducing *S*. Heidelberg motility, multiplication, adhesion, and invasion to avian epithelial cells ($P<0.05$). PF possessed high survival rate in low pH and in the presence of bile salts. PF did not possess hemolytic activity and showed susceptibility to the common antibiotics, ensuring the safety for use in turkeys. Additionally, the cell-free extracts of PF possessed antimicrobial activity against pathogens, including *S*. Heidelberg ($P<0.05$). In the *in vivo* experiments, the reduction in the *S*. Heidelberg populations ranged from 1.0- to 2.7- $\log_{10}$ CFU/g of the cecum in different age groups ($P<0.05$). In addition, PF supplementation significantly reduced *S*. Heidelberg invasion of liver and spleen of turkeys ($P<0.05$). PF colonized in high numbers (~5.0 $\log_{10}$ CFU/g) in the cecum, indicating its high adherence potential. In conclusion, PF could be used as an effective probiotic in turkeys to prevent *S*. Heidelberg colonization and dissemination to internal organs. The research was financially supported by the Minnesota AES Project (State Special).

Key Words: Propionibacterium freudenreichii, Salmonella Heidelberg, Turkeys

351 Effects of Tylosin Administration Route on the Development of Antimicrobial Resistance in Fecal Enterococci of Finishing Swine. F. Wu*, M. D. Tokach, J. M. DeRouchey, S. S. Dritz, J. C. Woodworth, R. D. Goodband, K. Capps, S. Remfry, K. Chitakasempornkul, N. M. Bello, T. G. Nagaraja, R. G. Amachawadi, *Kansas State University, Manhattan, KS*

Antibiotics can be administered via various routes in swine production, which may influence antimicrobial resistance development. A total of 40 barrows and 40 gilts (initially 93.9 ± 3.57 kg BW) were used in a 35-d study to determine the effects of tylosin administration route on growth performance and antimicrobial resistance in fecal enterococcus isolates. Pigs (1 pig/pen, 20 pigs/treatment) were blocked by initial BW and gender. Within blocks, combinations of 2 pens (1 barrow pen and 1 gilt pen) were assigned randomly to 1 of 4 treatments. The antibiotic treatments followed US label directions and were: 1) no antibiotic (CON), 2) 110 mg tylosin per kg feed for 21 d (FEED), 3) 8.82 mg tylosin per kg BW through intramuscular injection twice daily for the first 3 d of each wk during the 3-wk treatment period (IM), and 4) 66 mg tylosin per liter of drinking water for the first 3 d of each wk during treatment period (WATER). Antibiotics were administered during d 0 to 21 and all pigs were then fed a common diet with no antibiotic treatment from d 21 to 35. Among the medicated pigs, total tylosin dose administrated was 18.0g via IM, 8.6g in FEED, and 3.7g with WATER. Fecal samples were collected on d 0, 21, and 35. Antimicrobial susceptibility was determined according to minimal inhibitory concentration breakpoints. No evidence for route×gender interactions ($P>0.55$) were observed for growth performance. From d 0 to 21, pigs receiving CON and FEED had greater ($P<0.05$) ADG than those receiving IM, with the WATER group intermediate (1.26, 1.26, 1.15, 1.22 kg/d, respectively). There was no evidence for different ADFI among treatments. Pigs receiving IM (0.324) or WATER (0.322) had poorer ($P<0.05$) G:F than CON (0.347), but were not different from pigs receiving FEED (0.339). No evidence for route×day interactions ($P>0.23$) were observed for enterococci resistance to any antibiotic. Overall, enterococcal isolates collected from pigs receiving FEED or IM were more resistant ($P<0.05$) to erythromycin and tylosin than CON and WATER groups. Resistance prevalence to these 2 antibiotics was greater on d 21 and 35 than d 0. In summary, tylosin injection decreased ADG and G:F of finishing pigs, likely due to the stress reaction to handling and injection. Tylosin administration through injection and feed resulted in greater probability of enterococcal resistance to erythromycin and tylosin compared with in-water treatment, which is likely a combined effect of administration route and dosage.

Key Words: administration route, antimicrobial resistance, fecal enterococci

352 Modeling Dietary Net Energy for Maximum Profitability in Growing-Finishing Pigs. J. A. Soto*[,1], M. D. Tokach[1], S. S. Dritz[1], M. A. D. Goncalves[2], J. C. Woodworth[1],