Key Words: blood physicochemical parameter, hemeprotein, weaned piglet

214 Yeast Cell Wall Mannan Rich Fraction Reduces the Ability of Enterotoxigenic E.coli (ETEC) to Attach to Porcine Intestinal Cells. K. Horgan[1], K. Jacques*[,2], G. Madden[3], [1]*Alltech European Bioscience Centre, Dunboyne, Ireland,* [2]*Alltech, Nicholasville, KY,* [3]*Alltech, Dunboyne, Ireland*

Intestinal infection with enterotoxigenic *Escherichia coli* (ETEC) is an important disease in swine resulting in significant economic losses. The ETEC causing neonatal colibacillosis mostly carry fimbriae and these fimbriae adhere to specific receptors on porcine intestinal brush border epithelial cells starting the process of enteric infection. Mannan rich fractions, extracted from yeast, structurally resemble the receptor sites coating the intestinal epithelium to which intestinal pathogens like ETEC's adhere. These oligosaccharides act as molecular decoys which can competitively inhibit adherence of pathogens to the intestinal epithelium. The objective of this study was to determine if a commercial mannan rich fraction (MRF, Actigen) extracted from the yeast *Saccharomyces cerevisiae* could reduce adherence of a number of ETEC strains to intestinal porcine epithelial cells (IPEC-J2) *in-vitro*.

Briefly, IPEC J2 cells ($2*10^4$ passage 10-18) were cultured on 6 well plates using CO_2 independent medium pH 6.8. The adhesion test consisted of incubation of the MRF (16mg/mL) with the bacteria, this mixture was then added to the IPEC-J2 cell monolayer followed by 30 min incubation (at 37°C and 5% of CO_2) with the cell monolayer. After washing the IPEC-J2 lysates were collected, which consisted of bacteria which adhered to the cells and invaded the cells, and plated on plate count agar, after overnight culturing colonies were counted, the adhesion test was repeated on three different days for each strain of *E.coli*.

Adhesion tests with three different strains of E.coli were performed; *E.coli* 17076, 10674 and 10964 each of which carried fimbrae. MRF shows a clear ability to reduce the number of *E.coli* cells which adhered to the IPEC-J2 cells. In the case of strain 17076 the adherent cells decreased from $1.51x10^6$ CFU in the control untreated IPEC cells to $2.19\ x10^5$ with the Actigen treatment this represents a significant seven fold reduction in attachment $p< 0.05$. In the case of strain 10674 the adherent cells decreased from $1.43\ x10^6$ CFU in the control untreated IPEC cells to $5.28\ x10^4$ with the Actigen treatment this represents a 28 fold reduction in attachment *of E.coli* $P< 0.05$ and for strain 10964 a fivefold reduction in attachment of E.coli to the IPCE cells was noted $P<0.05$.

These results indicate that in this study yeast mannan rich fraction (Actigen) reduced *E.coli* adherence to intestinal cells *in-vitro*. In addition these data suggests that inclusion of MRF in the diets of pigs could potentially support functional activity against *E.coli* infection.

Key Words: ETEC, mannan rich fraction, intestine

215 Effects of antimicrobial or probiotics on growth performance of 6 to 25 kg nursery pigs. D. J. Shawk*[,1], B. J. Feehan[1], O. L. Harrison[1], J. C. Woodworth[1], M. D. Tokach[1], B. D. Goodband[1], S. S. Dritz[1], J. M. DeRouchey[1], N. E. Ward[2], A. B. Lerner[1], [1]*Kansas State University, Manhattan, KS,* [2]*DSM Nutritional Products, Parsippany, NJ*

Two 44-d experiments were conducted to determine the effects of antibiotic or different probiotics on growth performance of 6 to 25 kg pigs. In Exp. 1 and 2, 297 and 315 pigs (21-d of age; DNA Line 241 × 600; initially 5.8 and 6.0 kg BW) were used with 6 and 7 replications/treatment and 5 or 6 pigs/pen. Dietary treatments included a control diet, or the control diet with either carbadox (Mecadox-2.5 Phibro Animal Health, Teaneck, NJ) at 55 mg/kg, 0.05% BioPlus 2B (Chr. Hansen USA, Inc., Milwaukee, WI), or 0.20% of 1 of 6 DSM Probiotics (DSM Nutritional Products, Inc., Parsippany, NJ). For Exp. 1, pigs fed carbadox had increased ($P < 0.05$; SEM = 15.1) ADG (473 g) compared to pigs fed the control (392 g) or DSM Probiotic 1 (391 g), 2 (387 g), 3 (397 g), or 6 (401 g), with pigs fed Bio-Plus 2B (421 g), DSM Probiotic 4 (437 g) and 5 (413 g) intermediate. Pigs fed carbadox had greater ($P < 0.05$; SEM = 23.1) ADFI (708 g) compared to those fed the control (586 g) or DSM Probiotic 1 (586 g), 2 (583 g), or 3 (606 g), with pigs fed DSM Probiotics 4 (656 g), 5 (634 g), and 6 (610 g), and Bio-plus 2B (625 g) intermediate. For Exp. 2, pigs fed carbadox had greater ($P < 0.05$; SEM = 15.3) ADG (542 g) than all other treatments. Pigs fed BioPlus 2B had greater ($P < 0.05$) ADG (463 g) compared to those fed DSM Probiotic 3 (396 g), with the control (412 g) and DSM Probiotic 1 (434 g), 2 (424 g), 4 (441 g), 5 (421 g), and (430 g) intermediate. Pigs fed carbadox had increased ($P < 0.05$; SEM = 22.9) ADFI (802 g) compared to the control (621 g) and DSM Probiotics 1 (665 g), 2 (656 g), 3 (621 g), 4 (686 g), 5 (659 g), and 6 (670 g), with BioPlus 2B (708 g) intermediate. Treatments did not influence G:F in either experiment. In conclusion, pigs fed carbadox consistently had improved ADG and ADFI when

compared to pigs fed the other treatment diets. There was no consistent probiotic response, but pigs fed diets with BioPlus 2B or DSM probiotic 4 elicited the greatest response of the probiotics tested.

Key Words: antibiotic, nursery pig, probiotic

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216 The Effect of Administration of a Nutrient Dense Liquid at Weaning on Growth Performance and Morbidity and Mortality of Pigs during the Nursery Period Under Commercial Conditions.

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There is increased interest in providing nutritional supplementation via the water supply to minimize dehydration as well as to compensate for reduced feed intake in newly weaned pigs. Blue2® is a nutrient dense liquid that supplies electrolytes through the water in addition to providing the pig with a readily-available source of energy immediately post-weaning. A RCBD was used to compare two treatments; Control (no water enrichment) and Blue 2 (Blue2® delivered in the drinking water for 2 days immediately post-weaning at a dilution ratio of 1:128). A total of 9,215 pigs housed in single-sex groups of 72 (64 replicates), at a floor space of 0.30 m^2/pig, were used in the study. Day of start on test was used as the blocking factor. The study was carried out from weaning (approximately 21 d of age and 5.9 ± 0.24 kg) to 7 weeks post weaning. The same standard commercial nursery dietary program consisting of 4 phases was fed to pigs in both treatments. Within each phase, diets were formulated to meet or exceed nutrient requirements as recommended by NRC (2012). Pigs had *ad libitum* access to feed and water throughout the study. Pen weights and pen feed intakes were collected every 2 weeks, and used to calculate ADG, ADFI and G:F. The pen of pigs was the experimental unit; data were analyzed using the PROC MIXED procedure of SAS (v. 9.2; SAS Inst. Inc., Cary, NC) with the model accounting for the fixed effects of treatment, and the random effect of block and replicate. There was no effect of administering Blue2® on overall ADG, ADFI, or G:F compared to the Control. Morbidity and mortality were reduced for pigs on the Blue 2 treatment compared to the Control treatment (4.29 vs 3.35%; $P = 0.02$). The results of this study suggest that morbidity and mortality can be reduced by supplementing pigs with Blue2® in the water supply for 2 days immediately post-weaning.

Key Words: Blue2, mortality, nursery pigs

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217 Effects of Dietary Vitamin E and Selenium on Growth Performance and Immune Response of Nursery Pigs Following an Immune Challenge.

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Antioxidants, such as Se and vitamin E, have been reported, in some instances, to improve growth performance in nursery pigs, but reports on the effect of these nutrients on immune response are limited. To study the effects of Se and vitamin E on growth performance and immune response, 280 crossbred pigs (5.8 kg BW) were used in a 36-d experiment. From d 0-7, all pigs were fed a common diet (0.15 mg/kg Se, 16 IU/kg vitamin E). On d 7, pens (10 pigs/pen) were randomly allotted to 1 of 4 dietary treatments arranged in a 2 x 2 factorial (7 reps/trt) consisting of the combination of two concentrations of Se (0.15 vs. 0.30 mg/kg) and vitamin E (16 vs 32 IU/kg). Diets were based on corn and soybean meal and the diets were mixed by adding Se (Sel-Plex® 600, Alltech, Inc) and/or vitamin E (Lutavit® E 50, BASF) to a basal diet. Pigs and feeders were weighed weekly to determine ADG, ADFI and G:F. On d 21, 4 pigs from each pen were challenged with LPS *E.coli* O111:B4 (25 μg of LPS/kg BW). Body wt, rectal temperature (RT) and blood was collected for determination of cytokines at h 0, and 3 and 6 h post-injection. Data were analyzed as completely randomized design with the main effects of Se, vitamin E, and their interaction tested. There were no ($P > 0.10$) Se by vitamin E interactions for any response criteria. There were no differences ($P > 0.10$) in growth performance for d 7-21. However, for d 21-36, ADG and G:F were improved ($P < 0.02$) for pigs fed increasing Se. For the entire period (d 7-36), increasing Se improved ($P < 0.04$) G:F, but did not affect ($P > 0.10$) ADG or ADFI. Following LPS challenge, RT, TNF-α, and IL-1 were increased ($P < 0.05$) at 3 h post-injection, but no differences ($P > 0.10$) among treatments were noted. However, growth performance (ADG, G:F) was increased ($P < 0.05$) and TNF-α concentrations were reduced ($P < 0.10$) when pigs were fed the combination of high Se (0.30 mg/kg)/ vitamin E (32 IU/kg) compared to those fed the low concentrations (0.15 mg/kg; 16 IU/kg). These data suggest that increasing Se (up to 0.30 mg/kg) increased growth performance in nursery pigs, but increasing vitamin E had little effect. Furthermore, increasing Se or vitamin E had little effect on pro-inflammatory cytokine production.