NUTRITION NOTES
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DIETARY VITAMIN C HELPS HEALTH-CHALLENGED PIGS

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Increasing serum vitamin D levels with the use of a stabilized form of vitamin C is an important finding to help the pork industry make progress towards addressing many issues that may be associated with vitamin D status

Swine producers are continually faced with the challenges of getting weaned pigs off to a good start. In addition to the normal stresses associated with weaning, pigs may be exposed to conditions and pathogens that may further compromise their health, feed intake and growth. After weaning, it is extremely important for pigs to begin eating quickly and have access to a diet that provides energy and essential nutrients for optimum health and growth performance. Therefore, we elected to evaluate supplementing starter diets with a stable form of vitamin C (Rovimix® Stay-C® 35). Vitamin C has multiple functions in the body, such as helping with enzyme systems that synthesize collagen, assisting with the absorption of dietary minerals, sparing vitamin E, as an antioxidant in helping to maintain the immune system, wound healing, and in helping convert 25-hydroxyvitamin D3 (the storage form of vitamin D3) to 1,25-dihydroxyvitamin D3 (the active form of vitamin D3). The need for dietary vitamin C in mammals is usually limited to humans, non-human primates, guinea pigs and fruit-eating bats. Most mammalian species, including swine under normal conditions, can synthesize their own vitamin C. However, there are data suggesting that weanling pigs experiencing increased levels of stress can benefit from added vitamin C in their diets. Factors that may result in a conditional dietary requirement for vitamin C to optimize health and performance are younger weaning ages, genetics, decreased feed intake, diet changes, new environment, poor bio-security, new pathogens, comingling, vaccinations, and poor housing conditions. In addition, with the vitamin D issues plaguing the entire feed industry in the last four years, we believed it was important to not only look at performance, but to evaluate the blood status of vitamin D3 metabolites in pigs to determine if vitamin C supplementation could be beneficial. The objective of this study was to evaluate the effect of a stabilized vitamin C on the performance and serum vitamin D3 concentrations in health-challenged pigs.

In Table 1 are the growth and economic data. In this test, we had 244 pigs and 28 pens per treatment with an average initial weight of 13.51 pounds. The pigs were fed grind-and-mix diets following Kent NexGen starter programs. In all weigh periods, the addition of the stable form of vitamin C to the diets resulted in significant improvements in growth and economic performance. For example, there was a 21% response in gain after 10 days on test with an overall response in gain of 9% for the 34-day feeding period. Feed conversions were also improved with the added vitamin C, which resulted in lower costs per pound of gain as well as a greater net return (value of gain minus feed cost) per pig of $0.27 at Day 10 and $0.73 at Day 34.

continued

Table 1. Vitamin C in Health-Challenged Pigs (Trial 1)

Days 0-10	Without Vitamin C	With Vitamin C	Advantages to Vitamin C
Avg. Daily Gain[1], lb	.19	.23	+ 21%
Avg. Daily Feed[2], lb	.30	.33	+ 10%
Feed/Gain[2]	1.83	1.53	- 16%
Cost/lb Gain[2], cents	66.82	56.71	-10.11 cents
Net Return[1], $/Pig@80 cents/lb live weight	.38	.65	+ $0.27
Days 0-20			
Avg. Daily Gain[1], lb	.42	.47	+ 12%
Avg. Daily Feed[1], lb	.59	.63	+ 7%
Feed/Gain[1]	1.41	1.34	- 5%
Cost/lb Gain[2], cents	36.42	34.99	-1.43 cents
Net Return[1], $/Pig@80 cents/lb live weight	1.98	2.36	+ $0.38
Days 0-34			
Avg. Daily Gain[1], lb	.65	.71	+ 9%
Avg. Daily Feed[2], lb	1.01	1.06	+ 5%
Feed/Gain[1]	1.57	1.51	- 4%
Cost/lb Gain[2], cents	35.68	34.71	- 0.97 cents
Net Return[1], $/Pig@60 cents/lb live weight	5.38	6.11	+ $0.73

KNG; 244 pigs/trt; 28 reps; Init. Wt., 13.51 lb; [1] Vitamin C effect (P ≤ .05); [2] Vitamin C effect (P ≤ .10)

Since the initial 1 to 2 weeks represent a key period in which we need to improve the nutritional status and performance of pigs post-weaning, we chose to collect blood samples from 8 pigs per treatment on Day 11 post-weaning and determine if dietary vitamin C would affect their vitamin C and vitamin D status. On Day 11, plasma vitamin C levels were 52.6% greater (1.16 vs. 0.76 mg/dL) for pigs fed the diet supplemented with vitamin C. Also on Day 11, serum levels of 25-hydroxyvitamin D3 had increased 38.4% (10.02 vs. 7.24 ng/mL) for pigs fed vitamin C post-weaning. Table 3 shows the serum measurements of 1,25-dihydroxyvitamin D3 on Day 11. This vitamin D metabolite is the active form of vitamin D3. Pigs supplemented with vitamin C had a 14% increase in the serum levels of this key metabolite. Furthermore, in Table 4 are the data for 24,25-dihydroxyvitamin D3, which is another important vitamin D3 metabolite produced from 25-hydroxyvitamin D3 in the kidney. Note that supplemental vitamin C resulted in a 46% increase ($P < .09$) in 24,25-dihydroxyvitamin D3. Because vitamin D is important for facilitating the absorption of calcium, phosphorus and magnesium, having adequate levels of these metabolites is important for the optimum growth and development of tissues, particularly that of bones.

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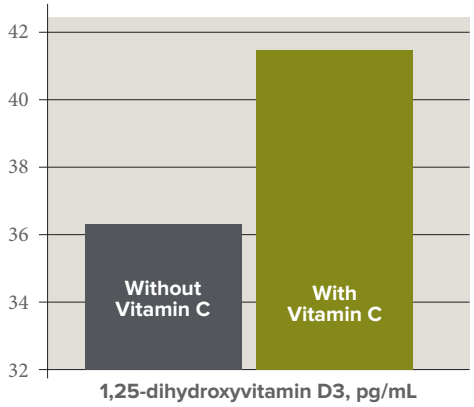
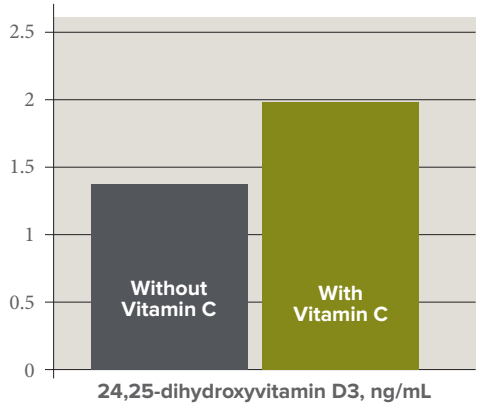
Table 3. Effect of Vitamin C on 1,25-dihydroxyvitamin D3 (Trial 2)



KNG; Trial 2; 8 pigs/trt; 8 reps; littermate gilts utilized across treatments

Table 4. Effect of Vitamin C[1] on 24,25-dihydroxyvitamin D3 (Trial 2)



KNG; Trial 2; 8 pigs/trt; 8 reps; littermate gilts utilized across treatments; [1]Vitamin C effect (P < 0.09)

DISCUSSION:

The data from this trial clearly shows that supplemented vitamin C was very important for health-challenged pigs as it significantly improved gain, feed intake, feed efficiency, and economics. Moreover, supplemental vitamin C resulted in a 14% increase in 1, 25-dihydroxyvitamin D3 and a 46% increase in 24, 25-dihydroxyvitamin D3, which are key metabolites made in the kidney from 25-hydroxyvitamin D3. The last four years have been extremely difficult in the swine industry with regard to soft bones and other various issues thought to be related to the vitamin D status of pigs. We believe that these data are important in helping address this key area in swine production. Based on the above research, Kent Nutrition Group has introduced a new line of NexGen® pig starters with NutriVantage® technology which contains a stable form of vitamin C (Rovimix® Stay-C® 35).

BOTTOM LINE:

Increasing the post-weaning serum vitamin D levels with the use of a stabilized form of vitamin C is an important finding to help the pork industry make progress towards addressing the plethora of issues that may have been associated with vitamin D nutrition in post-weaning pigs during the last 4 years. In addition, marked improvements in gain, feed efficiency, and economics from supplementation with vitamin C demonstrates that providing a dietary 'margin of safety' for this vitamin may be important for ensuring that health-challenged pigs have a better start during the post-weaning period. The Kent Nutrition Group, Inc. will continue to conduct cutting-edge research to improve nutrition, health, and efficiencies in the pork industry to help feed a growing population.

Based on this important research, the following Kent NexGen products now contain additional vitamin C:

- NexGen 5-10 Complete (2025)
- NexGen 8-13 Complete (2030)
- NexGen 12-17 Complete (2040)
- NexGen 17-25 Complete (2050)
- NexGen 12-17 Mixer (2047)

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