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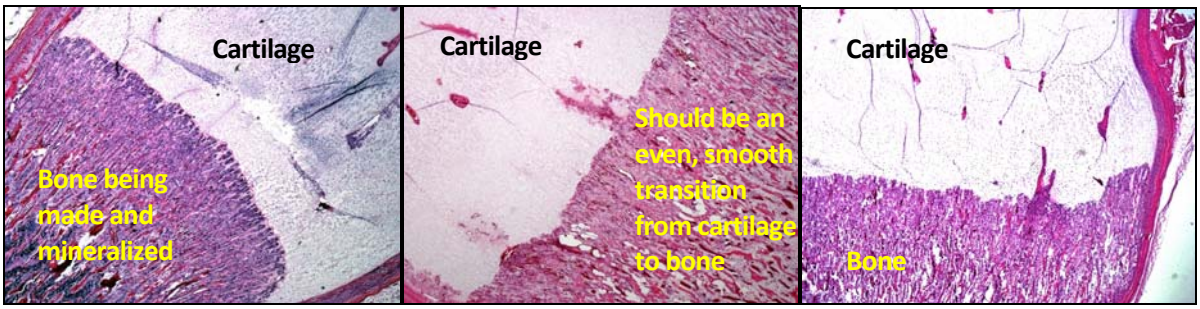
Report on vitamin D proof of concept project[1]

Background:
Necropsies performed on nursery pigs in February 2011 revealed that the pigs had soft, pliable ribs. Serum testing from cohort pigs indicated that their serum 25(OH)D (a vitamin D metabolite which can be measured as an indicator of the vitamin D status of the animal) levels were well below the normal reference ranges for young nursery pigs. At that time, efforts were increased to determine whether the problem was localized to one farm or spanned multiple farms. The immediate basis for concern was that a deficiency of vitamin D can cause enlargement of joints and abnormal bone development, lameness, and can decrease average daily gain. Most vitamin D for a pig pre-weaning is obtained through the colostrum. This level of vitamin D must sustain the pig until solid feed is consumed or supplementation with vitamin D occurs in some other form.

To date, quite a few pigs (approximately 3 wk of age) have been bled across multiple farms. Although some serum 25(OH)D values have been higher than others, we have not been able to locate a pig which has had a level within the laboratory-supplied normal reference range.

In addition, we have submitted ribs for histopathology from many pigs and have had some interesting findings. Though not all ribs submitted have been affected, some of those abnormal findings have included abnormal ossification patterns and micro-fractures.



Rib histopathology: Photographs courtesy of Dr. Jerome Nietfeld

[1] We would like to express our appreciation to Drs. Ron Horst and Jesse Goff for their help with providing supplies and diagnostic testing for this project.

The challenge of a pre-weaning nutritional deficiency is that the solution either needs to be safely administered through the sow (ideal situation) or as a properly timed therapeutic intervention for the pig. Our primary objective for this project was to determine whether we could manipulate the serum levels of 25(OH)D in the pig and determine whether we could raise the weaning (21 d) serum level to the normal reference range values.

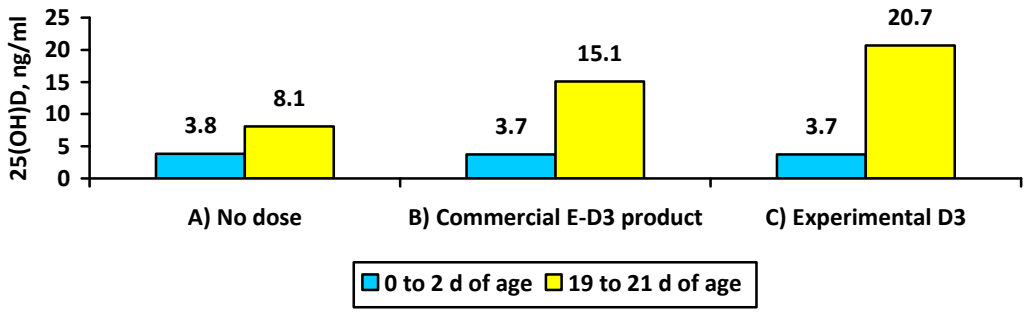
Project procedures:
A total of 54 pigs (initially 0 to 2 d of age) were included in our project from 10 different litters. Either 3 or 6 pigs were selected in each litter. Within each litter, pigs were assigned to each of 3 different treatments (1 or 2 pigs per treatment per litter; 18 pigs per treatment). The 3 treatments were: A) no oral dosing, B) dosing orally with 2 ml of a commercially available product with vitamin D_3 (20,000 IU per ml) and vitamin E (500 IU per ml), or C) dosing orally with 2 ml of an experimental treatment consisting of vitamin D_3 in peanut oil (14,500 IU per ml).

Pigs were first bled on 3/30/11 (d 0) and again on 4/18/11 (d 19). Treatments were administered after blood had been collected on 3/30/11.

Serum was tested for 25(OH)D at Heartland Assays. There were 3 pigs which died prior to 4/18/11 and their records were removed from the data presented below.

Findings:
The results of this project indicate that serum levels of 25(0H)D can be manipulated with oral dosing.

Means[1] for the effect of treatment on 25(0H)D serum levels



[1] The repeated measures model included treatment and time as fixed effects and litter as a random effect.

The normal reference ranges provided from the laboratory from were:

Age	**25(OH)D (ng/ml)**
Neonate ★	**5-15**
10 days	8-23
3-4 weeks ★	**25-30**
Finishing	30-35
Mature	35-70
Parturition	35-100

Based on these reference ranges, with the oral dosing, we were able to increase 25(OH)D in the serum to levels closer to the normal reference ranges.

Additional notes:
As a brief side project, we did try to dose pre-farrow sows with 120,000 IU of the commercial product to see whether there was an obvious difference in the pig serum 25(OH)D levels at weaning. There did not appear to be any obvious difference between the levels in pigs that were farrowed from dosed sows and then given 20,000 IU of vitamin D_3 orally compared with those pigs which were farrowed from non-dosed sows and then given 20,000 IU of vitamin D_3 orally. However, more work needs to be done in this area.

Next steps:
Now that we know that it is possible to manipulate the 25(OH)D levels in commercial pigs today, we need to determine the significance that changing these levels would have on performance and pathology. Weighing pigs and following pigs after dosing will be important to any investigative efforts. Please stay tuned…