Oral and Injectable Iron for Nursing Pigs

by: Gary L. Cromwell
Professor, Swine Nutrition

Giving injectable iron to newborn pigs is a procedure with which every swine producer is well acquainted. Iron administration within a few (1-3) days after birth is absolutely essential -- otherwise newborn pigs will quickly become iron deficient (anemic). Anemia is a condition in which animals do not have sufficient hemoglobin in their blood to transport oxygen from the lungs to the body tissues, and to carry carbon dioxide from the body tissues to the lungs for exhalation.

Symptoms of iron deficiency anemia include pale coloring around the eyes, nose and mouth. The greater the anemic condition, the paler the tissues. Normal tissues should be pink in color. Also, as anemia progresses, pigs may experience spasmodic breathing, a condition commonly referred to as "thumps". Growth rate may not be affected, but anemic pigs are more susceptible to scours and other health disorders. Often, the largest, fastest growing pigs in the litter are the ones that become the most anemic if sufficient iron is not given.

Anemia can be verified by measuring the concentration of hemoglobin in the blood. Another way is to determine the blood hematocrit (percent red blood cells in the blood). At birth, the pig has about 10 to 12 grams (g) of hemoglobin per 100 milliliters (ml) of blood. Within a few days after birth, the hemoglobin will drop to 7-8 g/100 ml or less, depending how rapidly the pig grows and expands its body weight and blood volume. Once the hemoglobin level drops below 7, the pig is considered anemic. Severe anemia occurs when hemoglobin falls to 4 or less.

Why are newborn pigs so vulnerable to iron deficiency while most other animals are not? There are four basic reasons:

- First, the newborn pig is born with only moderate stores of iron, most of which are in the liver. At birth, the pig has enough iron to sustain its hemoglobin for about 3-4 days. After that, they will become anemic if additional iron is not supplied.

- Second, newborn pigs grow at an extremely fast rate in comparison with most other animals. By the time a 3-lb pig is 3-4 weeks old, it has quadrupled its body weight. It takes much longer for a newborn calf, lamb, horse, or human baby to even double its weight, let alone quadruple it. This extremely fast growth rate means that muscle mass and blood volume are increasing rapidly, and the hemoglobin quickly becomes diluted out in the blood.

- Third, milk is the only food consumed by pigs, and milk is an extremely poor source of iron. A quart of milk contains only about 1 milligram (mg) of iron, and pigs require about 7 to 8 times that much iron every day. This means that a pig would have to drink 2 gallons of milk every day (can you imagine a 3 pound pig drinking 16 pounds of milk a day?) just to obtain sufficient iron. Even at 3 weeks of age, pigs consume only about ½gallon of milk per day. Milk from cows, mares, ewes, and other animals also is low in iron, but young calves, foals, and lambs also nibble on solid feed (which contains iron) shortly after birth -- and pigs don't. They essentially consume only milk during the first few weeks of life.

- Finally, pigs are raised in an environment where they cannot get iron from other sources. Before the move to confinement, iron deficiency was not a problem because the pigs picked up iron from nuzzling in the soil or from consuming soil from the sow's udder. Today, this is not possible because sows and pigs are on concrete, steel, rubber, or plastic slats.

A few years ago, there was a shortage of injectable iron and many swine producers were unable to get it. The shortage was because the major U.S. companies that made iron dextran closed for about a year to upgrade their facilities. Lots of questions arose on what to do. At that time, we conducted some research to evaluate oral iron alternatives that producers could use during the interim period when they were not able to get injectable iron.

We tried several approaches. They included providing (1) a high-iron feed containing 10,000 ppm of iron as iron sulfate placed in the pen daily, (2) an oral iron product (Acido-Iron , Alltech, Inc.) mixed with water (700 ppm iron) and placed in a watering device for the pigs, (3) this same product mixed with water (6,000 ppm iron) and sprayed on the sow's udder once or twice daily, and (4) a high iron product (Acido-Iron Bioplex , Alltech, Inc.) orally dosed (60 mg iron/pig) 3 to 12 hours after birth. These oral iron treatments were compared with a single 100 mg injection of iron (1 cc of iron dextran) given at day 1 of age, and with control pigs that received no iron.

Average pig weights at 4 weeks and percent survival were similar for the various iron treatments, even though hemoglobin levels were quite different. At 3 weeks, the control pigs were anemic, averaging 5.5 g of hemoglobin/100 ml of blood. Pigs injected with iron had hemoglobins of 9.0. Hemoglobins of the pigs treated with iron in the water and where iron was sprayed on the sows' udder were higher (13.0 and 10.9) than the iron-injected pigs; but hemoglobins of pigs treated with iron in the feed or where iron was dosed at birth were lower (8.0 and 7.8 g/100 ml) as compared with the iron-injected pigs.

In these experiments, the 100 mg injection of iron (or 1 cc of iron dextran) resulted in adequate hemoglobins at 10 days, but the hemoglobins appeared to be decreasing by 3 weeks. To offset this decrease, we tried three other options which included a single 150 mg injection of iron (1½cc of iron dextran) at day 1, (2) a single 200 mg injection of iron (2 cc of iron dextran) at day 1, and (3) a 100 mg injection at day 1 followed by a second 100 mg injection of iron at 2 weeks of age.

Hemoglobins were increased by injectable iron compared with non-treated controls (Table 1). The blood values were slightly better in pigs given the higher doses of iron than in those given the single 100 mg dose, especially at day 24. Pig growth rates were not affected by iron treatment, but survival to weaning (28 days) was improved by the iron treatments.

Based on this study and on others conducted elsewhere, we feel that there is a benefit in hemoglobin status by giving at least 150 mg of iron (1½cc of iron dextran) at 1-2 days of age. Our results also indicate that there is an advantage in blood hemoglobin status by giving a second 100 mg injection at 2 weeks following a 100 mg injection of iron at 1 day. However, if 150 or 200 mg of iron is given on day 1, there is no need for a second iron injection at 2 weeks.

It is important that no more than 200 mg of iron (2 cc of iron dextran) be given to pigs. Higher levels of iron encourage systemic bacterial growth and can lead to diarrhea and possible toxicity.

Table 1. Injectable iron for nursing pigs[a]

Item	Injectable iron, mg[b]				
	0	100	150	200	100/100
Hemoglobin, g/100 ml[c]					
at 12 days	6.3	10.3	11.2	11.2	10.4
at 24 days	6.0	9.8	11.6	11.9	11.0
28-day weaning wt, lb	13.6	13.4	12.1	12.8	14.7
Survival to weaning, %	75	91	89	100	89

[a]University of Kentucky, four litters/treatment. Sows were in crates on rubberized expanded metal floors.

[b]Iron injections given on day 1 only, except for the 100/100 treatment, where 100 mg of iron was given on day 1 and then again on day 14. A 1 cc injection of iron dextran provides 100 mg of iron.

[c]Initial hemoglobin was 10.7 g/100 ml.