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New Tool Predicts Piglet's Nursing Ability

A sow nursing her litter of piglets.

Unlike humans, when pigs are born, they enter the world without any immunity against foreign elements like disease-causing pathogens. Their chance for survival relies heavily on getting enough colostrom—a milk-like substance produced by mammals after giving birth.

Newborns that fail to nurse and receive colostrum from the sow within the first 24 hours usually die. That's because piglets are born with limited energy stores, and colostrum also provides the energy they need to stay alive.

For the swine industry, preweaning mortality has long been a major problem, costing an estimated $1.6 billion each year. Now, a new tool may help give these at-risk animals a second chance.

To improve neonatal piglet survival, Agricultural Research Service physiologists Jeffrey Vallet, Jeremy Miles, and Lea Rempel at the U.S. Meat Animal Research Center (USMARC) in Clay Center, Nebraska, have developed a measuring technique referred to as the "immunocrit" that can determine whether neonatal piglets have received adequate colostrum from the sow.

Colostrum contains immunoglobulins, which are antibodies made by the sow's immune system to protect against bacteria, viruses, and other foreign substances. Humans receive these antibodies in their mother's womb, but pigs and other livestock rely on passive transfer through nursing after birth, says Vallet, research leader of USMARC's Reproduction Unit. Thus, piglets are born with no immunoglobulin, and piglet serum immunoglobulin reflects their colostrum intake.

"Colostrum gives piglets their first antibodies so that they can have some immunological protection during the first couple of days of life," Miles says. "If they don't suckle, they don't have any immunoglobulins."

The Immunocrit at Work

The immunocrit, which measures newborn piglet serum immunoglobulin, is simple, inexpensive, rapid, and accurate. It is similar to the hematocrit, used for years by doctors to measure the volume of blood cells and determine whether a patient is anemic, Vallet says.

Blood samples are taken from piglets on day one after birth, mixed with ammonia sulfate to precipitate immunoglobulin, put into a microcapillary tube, and spun so the precipitated immunoglobulin settles to the bottom. The volume of the precipitated immunoglobulin is then measured and divided by the total volume in the tube.

PEGGY GREB (D2658-1)

Physiologist Jeffrey Vallet collects a blood sample from a 1-day-old piglet. The sample will be used to run a new immunoglobulin immunocrit technique that will tell whether the piglet received sufficient colostrum from its mother.

"We can go through a litter of piglets and take blood samples quickly and eas-

PEGGY GREB (D2660-1)

Technician Mike Judy loads immunoglobulin immunocrit tubes into a centrifuge. After centrifugation, the immunocrit measurement is easily made with a metric ruler.

ily, and the assay itself is very simple to use," Vallet says.

Scientists have demonstrated that immunocrit measurements are predictive of piglets' mortality and nursing ability and that the average immunocrit of piglets in a litter reflects the sow's colostrum production capability. Because the test is so rapid, it is possible to identify compromised piglets and take steps to rescue them, Vallet says.

Help for the Smallest

The immunocrit is good at identifying piglets within a litter that haven't eaten at all or haven't had the opportunity to nurse, Miles says. In one experiment, scientists used the immunocrit to assess colostrum intake in a group of piglets—the smallest from each litter—and then measured the contents of each piglet's stomach. They found that some piglets' stomachs were nearly empty. Those same piglets had an immunocrit measurement of nearly zero, validating that the immunocrit accurately detects piglets that receive no colostrum within a 24-hour period.

Immunocrit results correlated well with results from a more complicated and expensive traditional method—protein A sepharose combined with electrophoresis—in detecting piglets that had not nursed at all.

In another study, using more than 2,000 piglets, researchers found that the immunocrit could predict preweaning survival. They also noted a connection between immunocrit measurements and piglet weight: Heavier piglets were more likely to survive the challenge of not getting colostrum within the critical time frame.

Enhancing Management Practices

The immunocrit can be used to test management practices, such as split suckling, and other strategies used by swine producers to help prevent colostrum deficiency, Vallet says.

Split suckling is a labor-intensive method that involves marking the first-born group of piglets, putting them aside, and then allowing the last piglets born uninhibited access to the sow. The practice is designed to improve access to colostrum for later-born piglets, because studies have shown that there is some influence of birth order on colostrum intake.

"The immunocrit can be performed 24 hours after the split suckling procedure to find out if progress is being made in improving colostrum in different piglets," Vallet says. "Producers can also use the immunocrit as a monitoring device for day-one piglet care. For example, they can randomly select piglets and benchmark how those piglets are doing."

The new technique isn't just for pigs. It could also fit well into management practices of cattle producers. The immunocrit was successfully used to monitor colostrum intake of 96 calves 24 hours after birth.

Taking a Genetic Approach

"Another strategy is to use genomics to modify the colostrum-piglet-mother interaction during that first 24-hour window," Vallet says. "We should be able to use the immunocrit to get some idea of the sow's ability to produce colostrum and then genetically select for colostrum production."

Preliminary research conducted by Gary Rohrer, a geneticist at USMARC, suggests that individual immunocrit values are heritable, presumably because nursing ability is heritable. From analyses of piglets and their mothers, Rohrer found the most significant portion of the variation—50 percent—is accounted for by the piglet's genetics. The mother is responsible for 20 percent of the variation.

Immunocrit data collected from 500 litters—about 5,000 piglets—provide a valid sample for genomic research, Vallet says. Data from each individual piglet is an indicator of its nursing ability, but the average across all piglets gives some indication of the sow's colostrum-production ability.

"When it comes to genetic associations, the more numbers, the better," Rohrer says. "Not only do we have a much higher heritability for the actual piglet's ability or potential, we also have a lot more records."

Rohrer plans to group DNA from piglets with very high immunocrit values and compare it with DNA collected from piglets with very low values.

"We can efficiently genotype those pools of DNA, estimate frequencies, and hopefully identify regions of the genome that are affecting the pig's ability to acquire and absorb colostrum," he says.

If successful, researchers would be able to recommend genetic markers that allow pork producers to identify and breed sows that ably produce colostrum and piglets with improved neonatal nursing abilities—an outcome that would help reduce the odds of preweaning mortality.—By **Sandra Avant,** ARS.

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