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Department of
Agriculture

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Research, Education,
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National Research Initiative (NRI)

Modified Diet May Increase Swine Birthrate

by Stacy Kish, CSREES

For more than 20 years, intensive genetic selection has led to an increase in both litter size and birth weight in swine. However, prenatal death and fetal growth restriction remain important factors that limit maximum reproductive performance in swine. New research, funded by USDA's Cooperative State Research, Education, and Extension Service (CSREES), shows this problem may be alleviated by dietary adjustments that can enhance placental growth, thereby promoting an optimal intrauterine environment throughout pregnancy. >>

Naturally occurring limitations in the placenta's ability to supply an adequate amount of nutrients to the fetus can result in prenatal death and fetal growth restriction. Increased death and reduced growth of fetuses are further exacerbated by the widespread practice of restricted feeding programs to prevent excessive weight gain of sows during pregnancy. Although this feeding regimen can ameliorate farrowing difficulties and appetite reduction during lactation, research from a team of scientists at Texas A&M University and Texas Tech University indicate that sows may not receive sufficient amounts of certain nutrients during mid- to late-gestation to support rapid absolute growth of their fetuses and mammary tissues. Specifically, these nutrients include arginine, one of the amino acids that are the building blocks for tissue proteins.

With grant support from the CSREES National Research Initiative (NRI), Guoyao Wu, Sung Woo Kim and colleagues discovered that prenatal death in swine could be greatly reduced by supplementing standard corn and soybean-based maternal diets with an additional 0.83 percent arginine between days 30 and 114 of gestation.

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Right: A sow and her progeny at Texas Tech University Swine Research Farm.
Credit: Dr. Sung Woo Kim

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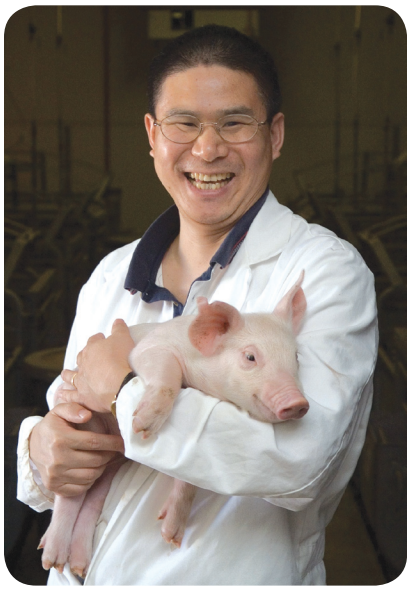
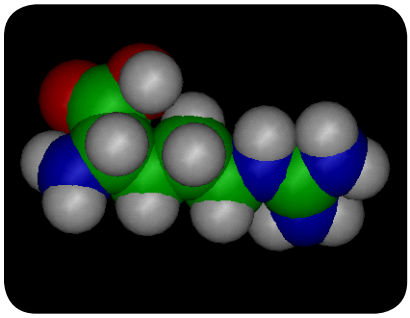


Above: Dr. Guoyao Wu holding a piglet.
Credit: Jerrold Summerlin, Texas A&M Agriculture



Above: The 3-dimentional structure of arginine.
Credit: www.worldofmolecules.com

Compared to the control sows that received no additional arginine, the additional supplementation increased the number and total litter weight of piglets born alive by two per litter and 24 percent, respectively. The study shows that a specific dietary intervention can enhance reproductive performance in pigs.

This recent discovery may result in a significant economic return to pork producers. An increase in the number of live-born pigs will markedly reduce the production costs associated with sow reproduction and lactation. An increase in the vitality of newborn pigs will increase their rate of survival to weaning.

This use of dietary arginine supplementation was based on the findings of basic research on arginine biochemistry and nutrition that was supported by the USDA-NRI since 1992. Arginine plays multiple roles in animal metabolism by serving as a substrate for the synthesis of various important molecules that enhance placental growth (including placental vascular growth). Ultimately, this can result in increased utero-placental blood flow and, therefore, improved transfer of nutrients from mother to fetus.

Arginine can be synthesized by sows, and its concentration is relatively high in corn- and soybean meal-based diets. Thus, it was traditionally considered that arginine was a non-essential amino acid for pregnant pigs and that the amount consumed from a conventional diet was sufficient for optimal reproductive performance. However, recent biochemical studies revealed that arginine serves key regulatory functions in nutrient metabolism and fetal growth in pigs. Thus, there has been a paradigm shift in our understanding of the beneficial roles for arginine in swine nutrition and production.

The USDA's Cooperative State Research, Education, and Extension Service (CSREES) funded this research project through the NRI Animal Reproduction Program. CSREES advances knowledge for agriculture, the environment, human health and well-being, and communities by supporting research, education and extension programs in the Land-Grant University System and other partner organizations. For more information, visit www.csrees.usda.gov. ■

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