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RESEARCH REPORT

Analysis of platelet activating factor in the gravid reproductive tracts of swine

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Executive Summary

Depressed hog prices in 1998 and 1999 were due to not enough shackle space (kill capacity) and not to a glut of slaughter swine. However, many swine producers were put out of business in California. In 2000, market prices rebounded due to increased shackle space and reduced numbers of slaughter swine available as a result of the sellouts of the previous two years. The economic roller coaster ride emphasized the need for maximizing profit while streamlining operations. Increasing numbers of pigs per litter, and thereby reducing the cost per pig produced, is one aspect of streamlining. A significant step in improved litter efficiency would be to utilize platelet activating factor (PAF) in commercial swine operations. Platelet activating factor is involved in signal transduction within many of the body's physiological systems. Of primary

interest in the reproductive system is PAF's enhancement of embryonic development, placental attachment and sperm functioning. The amount of embryo-derived PAF produced is correlated to pregnancy

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*Student research assistant
Lisa Branstad prepares
swine tissues for freezing.*

potential, since higher PAF levels lead to greater numbers of embryos developing to the blastocyst stage. It is produced by the embryos of various mammalian species, exerts significant effects upon the preimplantation embryo placental attachment, and perhaps maternal recognition of pregnancy and sperm functioning. Presently, only Professor John Diehl of the Animal and Veterinary Science Department at Clemson University, in collaboration with others, has published data to suggest that PAF is found in either male or female swine reproductive tracts. Most notably, PAF was found in the uterine luminal fluid (ULF), the developing filamentous embryo and the endometrium.

Hypothesis

Researchers hypothesized that significant levels of PAF would be found in the reproductive tracts of early pregnant gilts, and that this knowledge will lead to the ability to increase litter numbers. Presently, only Dr. John Diehl at Clemson University in collaboration with others has published data to suggest that PAF is found in either male or female swine reproductive tracts.

If PAF levels were as expected then enhancement of reproduction in swine can be attempted. It is not possible at this time to actively treat the female, so a more appropriate approach would be to pre-treat sperm with PAF prior to artificial insemination or select boars whose sperm produce significant levels of PAF. Pretreatment has resulted in increased numbers of developing embryos (Roudebush, Fukuda and Minhas, 1993). In addition, sperm evaluation for endogenous PAF could be used as part of an overall reproductive soundness exam (Diehl, 1999).



Student research assistants Jenny Hansel (left) and Lisa Branstad process endometrial and embryonic tissues.

Methods and Materials

Fifty-two terminally crossbred (normally would have been harvested as fat hogs) gilts were maintained and bred at the Cal Poly swine unit and utilized in a study to evaluate swine reproductive tracts for the presence of (PAF). Of the 52 gilts, 43 were utilized in the study, 6 had abnormal reproductive tracts upon recovery and 3 were not utilized for health reasons.

Reproductive tracts were removed at harvest, endometrial tissue and embryonic tissue samples were taken and processed, and all tissues quick frozen and then sent to the Animal and Veterinary Science Department laboratory at Clemson University. Student technicians processed the tissues for the presence of PAF, PAF receptors (PAFr) and for DNA coding for PAF and PAFr.

Results

Researchers were successful in confirming that swine do produce and utilize PAF and that PAF plays a significant role in establishing peri-implantation embryonic development and maternal recognition of pregnancy.

Major Accomplishments

- ◆ Collaboration occurred between California Polytechnic State University, San Luis Obispo and Clemson University. Cal Poly has animals that can be used for research but does not have the appropriate labs for classical bench-top research. Clemson has the bench-top labs but does not have animals available for research.
 - ◆ Cal Poly undergraduates and Clemson graduate students were able to perform procedures via a strict protocol applying a scientific approach to data collection and analysis.
 - ◆ Platelet Activating Factor had been identified in other species, but not confirmed in swine until this study.
 - ◆ DNA for the production of PAF and PAFr was identified in both swine endometrial and embryonic tissues.
 - ◆ A significant connection between PAF production and estradiol levels was established and considered as an indication of the mechanism for the maternal recognition of pregnancy in swine.
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Impact Statements

- 1) Having established that swine embryos produce PAF and have PAFr, research can now be pursued to add exogenous PAF to extended boar semen in an attempt to increase the number of pigs/litter.
 - 1a) PAF is routinely added to embryo cultures (particularly with human and other primate embryos) to enhance the viability of embryos when only a few are cultured together.
 - 1b) Semen contains PAF, and decreased levels have been associated with reduced numbers of pigs/litter in swine.
 - 1c) In processed and extended boar semen PAF levels fall to zero by Day 3 post collection.
- 2) Swine now join a long list of mammals in which it has been proven that platelet activating factor is a necessary component of fertilization, embryogenesis and pregnancy.

Acknowledgements

Funding and administrative support for this project was provided by the California State University Agricultural Research Initiative (ARI), administered by the California Agricultural Technology Institute at California State University, Fresno. Additional funding was provided by Fort Dodge Animal Health.

For More Information

This research report contains summarized results of William Plummer's study entitled "Analysis of Platelet Activating Factor in the Gravid Reproductive Tracts of Swine," ARI Project No. 01-3-012 (Research Focus Area: *Production and Cultural Practices*). To view and/or obtain a copy of the complete final report, or to obtain additional information about this or other research projects, visit the ARI website at ari.calstate.edu.

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