

Progesterone in Blood Plasma of Gilts During Early Pregnancy and During Exposure to Elevated Ambient Temperature

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Story in Brief

The causes of reduced reproductive efficiency in gilts during the summer months must be understood so improvements can be made through management and hormonal therapy. Two experiments were conducted to measure endocrine changes in gilts during early pregnancy and during exposure to elevated ambient temperature.

In the first experiment, indwelling cannulae were placed in the anterior vena cava and blood samples were collected once daily from 13 gilts until 29 days postbreeding. In 10 pregnant gilts, plasma progesterone increased linearly from 0.9 ng/ml on the first day of estrus (day 0) to 42.5 ng/ml on day 12 of pregnancy, then increased gradually to a maximum of 47.7 ng/ml by day 15. Progesterone then decreased sharply to 18.6 ng/ml on day 21 of pregnancy and remained near this level through day 29. Progesterone in the three open gilts increased linearly from 1.2 ng/ml on day 0 to a maximum of 32.9 ng/ml on day 12 post estrus, then decreased to 1.2 ng/ml by day 23 post estrus.

In the second experiment, 18 gilts were cannulated and allotted at random to either hot (95°F) or cool (74°F) environmental chambers for the first eight days following breeding. Blood samples were collected twice daily while gilts were in the chambers. During the eight days of confinement, plasma progesterone in cool gilts increased from 1.0 ng/ml on day 0 to 21.7 ng/ml by day eight. In gilts exposed to elevated ambient temperatures, progesterone increased from 1.4 ng/ml on day 0 to 25.4 ng/ml by day 8, and was consistently higher than in cool gilts. Three of nine gilts in the cool chamber conceived but only one of nine gilts in the hot chamber was pregnant at 30 days after breeding.

Introduction

Farrowing occurs during all months of the year in large-scale swine operations. Lower conception rates and smaller litters frequently occur during the months of high ambient temperature. Previous research at this station has demonstrated that heat stress of gilts during early

pregnancy can cause a reduction in conception rate and in the number of pigs per litter at 30 days of gestation. However, little information is available on plasma hormone changes during early pregnancy or changes in endocrine function which may be caused by heat stress. An understanding of the endocrine alterations caused by heat stress may lead to the development of management or therapeutic methods to increase litter size in gilts.

Two trials were conducted during 1974. The first trial was designed to develop a technique for placing cannulae in the anterior vena cava of gilts to allow collection of blood samples without stress, and to establish normal hormonal changes which occur in gilts during the first 29 days of pregnancy. The objective of the second trial was to quantify endocrine alterations caused by heat stress during the first eight days of pregnancy.

Materials and Methods

In the first trial a technique was developed for cannulating gilts so blood samples could be collected without stress. Gilts were anesthetized with sodium thiopental and a cannula (silastic tubing .085 inches O.D., 48 inches length) was inserted into the anterior vena cava. About 12 inches of cannula were placed in the vein and the remainder was placed under the skin, using a trocar, and was exteriorized at the top of the back. Thirteen Hampshire x Yorkshire gilts were observed through at least one estrous cycle, and were cannulated at six to 12 days prior to the next expected estrus. Cannulated gilts were observed for estrus, using a boar each morning. The boar was allowed to breed gilts on the first day of estrus. Gilts were bled immediately after breeding and were placed in individual confinement stalls to facilitate collection of blood samples. Gilts were artificially inseminated on the second day of estrus and were subsequently bled once daily through day 29 post estrus or until cannulae were no longer functional. During the sampling period the environmental temperature in the barn ranged from 40° to 80° F. At 30 days post breeding, gilts were slaughtered and conception rate, embryo numbers, and corpora lutea numbers were determined.

In the second trial, 18 Hampshire x Yorkshire gilts were cannulated and observed for estrus as in the first trial. Cannulated gilts were bred naturally at 8 am on the first day of estrus and artificially inseminated on the morning of the second day. Gilts were bled immediately after the first breeding and were bled again at 8 pm of the same day. After the second bleeding, gilts were randomly assigned to confinement inside either the hot or cool environmental chamber. Each chamber contained two confinement crates. The hot chamber was maintained at 95° F from

8 am to 8 pm and at 90° F from 8 pm to 8 am. The cool chamber was maintained continuously at 74° F. Relative humidity was constant at 50 percent and all gilts received 12 hours of light (8 am to 8 pm).

During the eight days (days 1-8) of confinement in the environmental chambers, gilts were bled at 8 am and 8 pm each day while consuming feed. Gilts received approximately four pounds of feed per day (the maximum intake of hot gilts), and water was provided at chamber temperature by nipple waterers. Gilts were removed from the chambers after the second bleeding on day eight. Conception rate, embryo numbers, and corpora lutea numbers were obtained at slaughter at approximately day 30 after breeding. Plasma samples were stored at 0° F until progesterone was quantified by radioimmunoassay.

Results and Discussion

Conception Rate, Corpora Lutea and Embryo Numbers

In the first trial 77 percent of the gilts conceived, indicating that cannulation and confinement to the individual crates had no major effect upon conception (table 1). Average number of corpora lutea and embryos after day 30 were 13.2 and 13.0 respectively. Conception rates for gilts confined to the environmental chambers were 33 percent for cool gilts and 11 percent for hot gilts, indicating that some factor such as chamber noise or twice daily bleeding may have affected conception rate in both groups. However, three of nine cool gilts conceived while only one of nine hot gilts was pregnant at 30 days after breeding. Average numbers of corpora lutea and embryos were 13.7 and 11.3 respectively for the cool gilts, while corpora lutea number and embryo number for the one pregnant hot gilt was 13.0 and 8.0 respectively. Although conception rate was low in both groups, this data agrees with

Table 1. Conception rate, corpora lutea numbers and embryo numbers in cannulated gilts¹

Treatment	Gilts	Pregnant	Corpora Lutea	Embryos
<i>Experiment 1</i>	(no.)	(no.)	(no.)	(no.)
Confined at swine barn (40-80° F)	13	10	13.2	13.0
<i>Experiment 2</i>				
Cool Environmental chamber (74° F)	9	3	13.7	11.3
Hot Environmental chamber (90-95° F)	9	1	13.0	8.0

¹ Cannulae were placed in the anterior vena cava six to 12 days before estrus and blood plasma was collected daily (Experiment 1) or twice daily (Experiment 2).

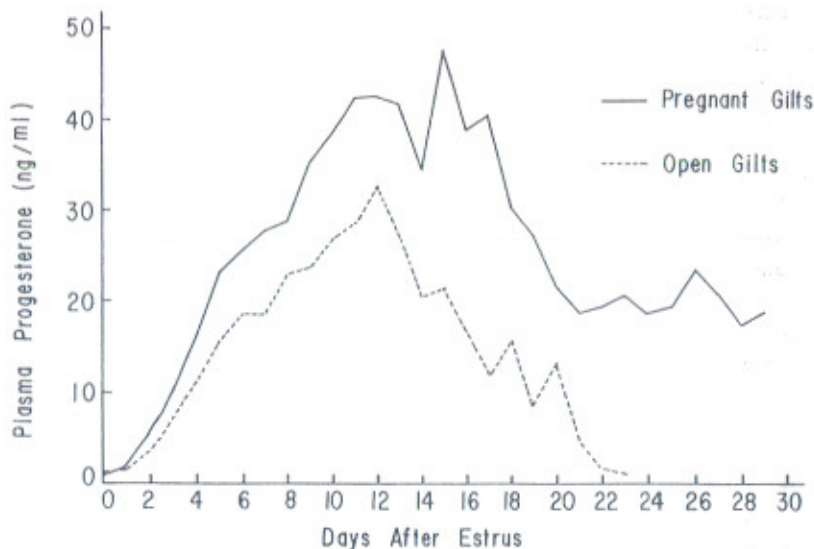


Figure 1. Plasma progesterone in pregnant (n=10) and open (n=3) gilts.

previous studies which demonstrated that conception rate and number of embryos at 30 days was higher in cool gilts than in hot gilts.

Plasma Progesterone

Plasma progesterone in the 10 pregnant gilts in trial 1 increased from 0.9 ng/ml on the first day of estrus to 42.5 ng/ml on day 12, and reached a maximum of 47.7 ng/ml on day 15. Progesterone then decreased sharply to 18.6 ng/ml on day 21 and remained near this level through day 29 of pregnancy. This reduction in plasma progesterone during early pregnancy is not observed in cattle. Plasma progesterone in cows during the early months of pregnancy is similar to the maximum observed during the luteal phase of the estrous cycle. In three open gilts, progesterone increased from 1.2 ng/ml on day 0 to 32.9 ng/ml on day 12, then decreased sharply to 1.2 ng/ml by day 23 post estrus.

Plasma progesterone was altered when gilts were exposed to elevated ambient temperature (figure 2). Progesterone in gilts placed in the hot chamber rose from 1.4 ng/ml on day 0 to 25.4 ng/ml on the second bleeding of day 8 post estrus. Similarly, progesterone levels in cool chamber gilts increased from 0.95 ng/ml on day 0 to 21.72 ng/ml on the second bleeding of day 8 post estrus. However, progesterone in hot

gilts was consistently higher than in cool gilts, suggesting that high environmental temperature alters endocrine function in gilts. This alteration in endocrine function could be related to the reduced reproductive efficiency observed when gilts are exposed to elevated ambient temperatures during early pregnancy.

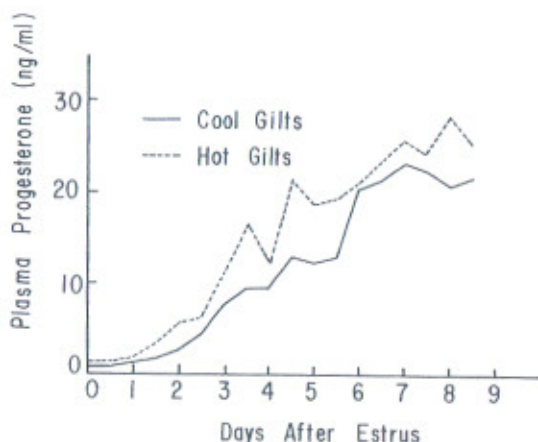


Figure 2. Plasma progesterone in gilts exposed to cool (74° F) or hot (95° F) environments after breeding.

Induction of Constant Estrus in Ovariectomized Sows

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Story in Brief

Seven ovariectomized sows were treated with 12, 20 or 40 mg. of estradiol benzoate or 36 mg. of diethylstilbesterol to induce constant estrus. Within three days after treatment all sows were in standing estrus, and sows remained in estrus for 13 to 21 days after treatment.