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Abstract
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Keywords
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MATURATION OF THE GILT'S UTERUS BEFORE PUBERTY: RESPONSE TO PROGESTERONE AT DIFFERENT AGES

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Summary

We determined the age at which progesterone induced certain responses in the gilt's uterus. The prepubertal maturation permitting each response is being studied currently with the intent of using the information to develop methods to improve litter size in pigs, perhaps by identifying markers for uterine function that could be used before gilts enter the breeding herd.

(Key Words: Gilt, Uterus, Progesterone.)

Introduction

Considerable information has been developed on the physiology of reproduction at the time of and after puberty. In contrast, relatively little is known about the reproductive development of young pigs. For example, at birth, the gilt possesses a uterus that resembles the adult uterus only in its general characteristics. The lining of the uterus, the endometrium, is only a poorly defined tissue. During the first few weeks of extrauterine life, the uterine glands develop, and the uterus assumes the general architecture of the adult organ. However, development is far from complete, and it is not until approximately 100 days of age that the gilt might initiate pregnancy if she were induced to ovulate by injecting gonadotropins. Still her uterus is far from completely developed, and the pregnancy is likely to be lost. Although the gilt is only 3 to 4 months older before she would enter the gilt pool on a swine farm, her reproductive system has undergone a considerable amount of maturing towards the adult phenotype. The physiology to this stage and during the remainder of the prepubertal period is responsible for producing a fertile female. We believe it is important to understand the changes occurring between birth and puberty to determine the processes that may affect fertility. That is, it may be possible to either modify prepubertal development to improve fertility or to develop tests that identify the most fertile females before they reach puberty.

In the present work, we studied the ability of the gilt's uterus to respond to progesterone and secrete the components of the uterine milk that nourish and support pig embryos both before and after they attach to the uterus.

Procedures

Prepubertal gilts were assigned to begin receiving treatment at 6, 46, 76, 106, or 136 days of age. Daily treatment was either progesterone (1 mg/lb) dissolved in corn oil and injected subcutaneously or only the corn oil (controls). Treatments were administered for 14 consecutive days, and then the gilts were hysterectomized, the uterus trimmed and weighed, and .85% saline was flushed through one uterine horn to obtain a sample of the uterine secretions. The flushings were evaluated for the presence of uteroferrin and retinol binding protein, two proteins present in the uterine milk during early pregnancy, as well as prostaglandin E2 and the total secretory protein. These are components of the uterine milk known to be induced by progesterone during early pregnancy. The presence of the two specific proteins were evaluated using western blots, prostaglandin E2 by radioimmunoassay, and total protein by the Lowry procedure.

Results and Discussion

The uteri of gilts beginning treatment at 6 days of age were unresponsive to progesterone; however, responses in all the characteristics studied were detected among comparative older gilts. Data are presented as the increases induced by progesterone over control gilts of the same age (Figure 1). Four distinct patterns of response were detected among the characteristics studied. Only uterine weight was increased by progesterone in gilts receiving it from 46 to 59 days of age. The increases over controls were similar for all but the youngest age group and ranged from 3.8- to 4.8-fold. The amount of protein recovered in the uterine flushings increased only marginally after progesterone treatment beginning at 46 days of age or younger but was increased 4.4- to 6.9-fold for older gilts. The presence of uteroferrin and retinol binding protein was first detected in the uterine flushings of gilts that began their progesterone treatment at 76 days of age, and the response to progesterone appeared to increase in magnitude for later age groups.

Our results indicate that the prepubertal gilts uterus develops responsiveness to progesterone in stages over the prepubertal period. The earliest progesterone-induced response was an increase in uterine weight. The mechanism for this response is not known and is the subject of our continued investigations. The induction of uteroferrin and retinol binding protein can be considered to indicate the secretion of components important for the maintenance of pregnancy. The appearance of these proteins occurs in the uterus of progesterone-treated gilts as they reach the age when pregnancy can first be established. Therefore, their appearance is consistent with their presumed necessity for the establishment and maintenance of pregnancy. In other studies, we quantified uteroferrin and retinol binding protein and found a graded response with increased amounts of these proteins in the uterus of older gilts treated with progesterone. This could be interpreted to indicate that the uterus of prepubertal gilts matures quantitatively and does not reach full function until at or after puberty.

Progesterone-induced responses in prostaglandin E were strikingly different from the other responses measured. Levels were as much as 150-fold higher than those of controls (Figure 1). Perhaps prostaglandin E is associated with proliferation of cells in the endometrium or with cellular remodelling. These possibilities will require further evaluation. The increase in luminal protein induced by progesterone in gilts treated from 46 to 59 days indicated increased secretory response of the endometrium at this age.

An understanding of each of the responses observed in this study may lead to ways to improve uterine function and fertility. For example, an understanding of the ability of progesterone to increase uterine weight may reveal previously unknown mechanisms controlling uterine growth and lead to treatments that increase uterine capacity in postpubertal gilts. Further, an understanding of the physiology leading to enhanced secretion of progesterone-induced uterine secretions may lead to approaches to enhance the uterine environment during pregnancy.

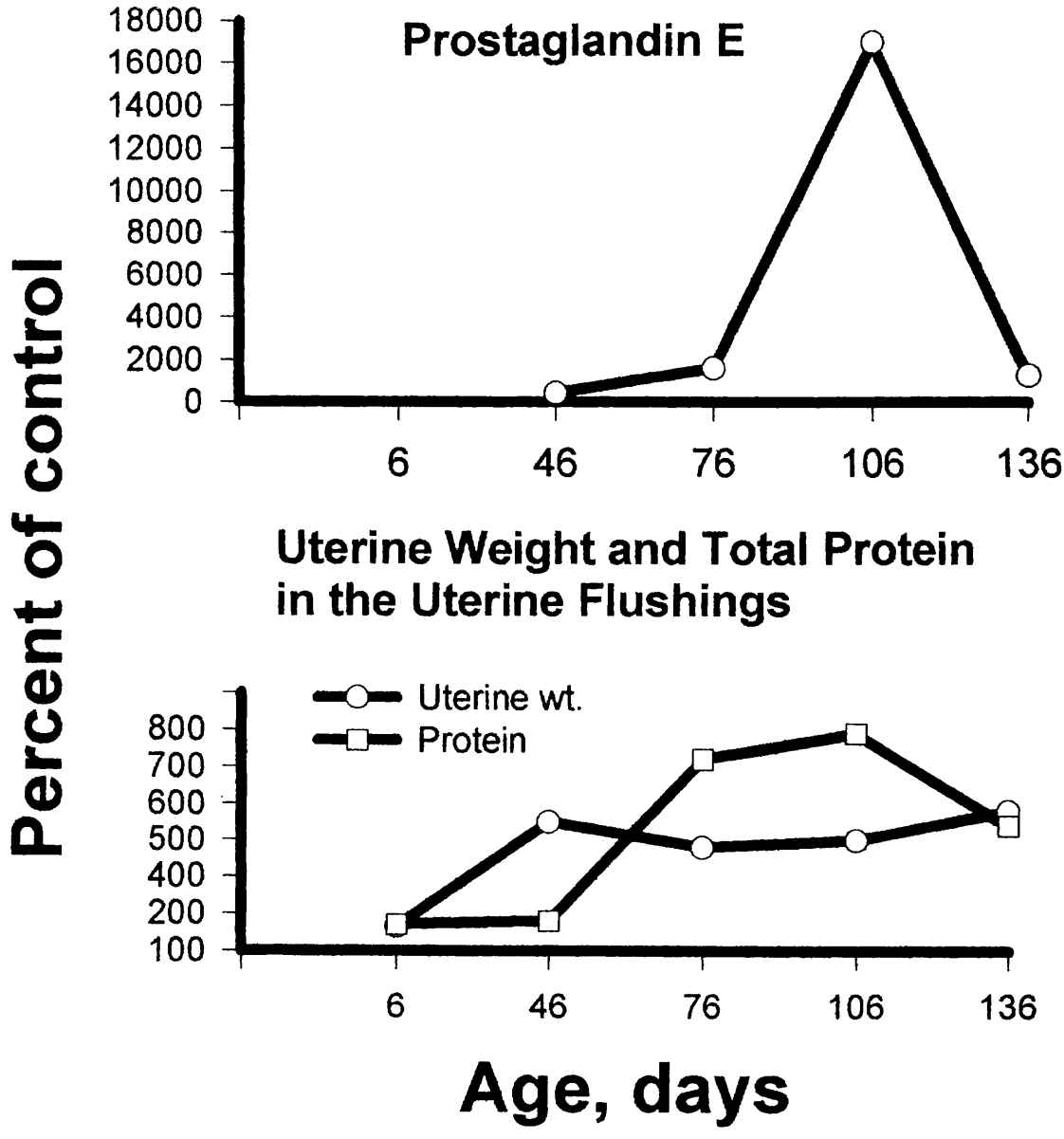

Figure 1. Progesterone-Induced Increase in Certain Uterine Traits.