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# Recruitment and selection of ovarian follicles for determination of ovulation rate in the pig

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**Abstract**

Gonadotropins determine the follicle selection and ovulation rate. Follicle growth is independent of gonadotropins until antrum formation, at which time recruitment occurs. Once recruited, follicles will continue to grow or degenerate. In gilts, visible surface follicles are classified as small (<3 mm), medium (3–6.9 mm) and large (≥7.0 mm). At estrus (day 0), there are ∼15 small and medium follicles, and ∼15 large follicles. By day 3, there may be ∼30 small, 5 medium and no large follicles. During the remainder of the luteal phase, the pool of follicles increases and peaks at day 11–13 with ∼50 small, and 30 medium, but with no large follicles observed. By the start of the follicular phase at day 15, numbers of small and medium follicles rapidly decline, while a pool of medium follicles is selected for the ovulation. The size of large follicles at estrus is heterogeneous (6.5–10.0 mm) but their number is reflective of the subsequent number of corpora lutea found following the ovulation. However, the time of medium follicle selection for ovulation is variable during the late luteal and early follicular phases. Suppression of FSH before and at the time of luteolysis reduces medium and large follicles but does not reduce the ovulation rate. In contrast, suppression of FSH for 3 days or unilateral ovariectomy after 3 days of the follicular phase prevents full ovulatory compensation. Therefore, FSH appears to be involved in the maintenance of a pool of medium follicles that can be selected by LH to mature and ovulate.


*Keywords:* Follicles; Pig; Ovulation rate; Recruitment; Gonadotropins

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## 1. Importance of ovulation rate in the pig

Ovulation rate (OR) determines the potential number of eggs, embryos, or piglets that can be produced from any single estrous event. Ovulation rate has been estimated by numbers of large follicles at estrus and by corpora lutea (CL) counts following the ovulation. It is not clear whether these measures truly reflect healthy eggs or even total eggs ovulated, since 5–15% of the ova are not recovered based on CL counts [1,2], and further embryo losses of 5–25% occur until day 30. These data indicate that the conditions that control follicle development and selection for ovulation may control not only the OR but the quality of the ova that are released and the embryo's potential to develop into a live born fetus.

Despite the possible inaccuracy of OR based on CL counts, it has generally been assumed that this was a measure for the upper limits to litter size in swine [3]. In some cases of poor fertility, low OR has been associated with certain genetics, reproductive age, and even season of the year. In each of these situations, litter size may be limited by reduced numbers of healthy follicles at estrus. Yet in most cases, OR is not limiting, and once 16–18 ova are produced, litter size is limited by fertilization failure [4], embryonic loss [2], fetal loss due to uterine space limitations [5], or fetal losses as a result of disease [6]. Today, however, OR may have an even broader implication since it may determine the limits for oocyte and embryo production for use in assisted reproductive technologies such as IVF–IVM, embryo transfer, and embryo cryopreservation. Ovulation rate may also be important from the standpoint that adequate numbers of large follicles are needed for the production of threshold estrogen concentrations, which initiates the estrus expression and induction of the LH surge.

## 2. Follicle classification and recruitment in the pig

Atresia and ovulation are the only fates for a follicle, once it has entered the growing pool. From the hundreds of follicles that begin growth, only 10–20 are selected to release an egg. Prior to puberty and well into more advanced reproductive age, most of the follicles are primordial [7], where they remain dormant in the resting pool until some unknown number of follicles receive a stimulus to grow each day. Thereafter, at any subsequent time, these follicles may either continue on their path for development, or they may become atretic. The primordial follicle contains an immature-sized oocyte, surrounded by one to two layers of flattened cells. With growth, they reach the primary follicle stage ($\sim$0.12 mm), containing a full-size oocyte and one to three layers of granulosa cells. The follicle then enters the secondary stage with 3–20 layers of granulosa cells [8] with a diameter of 0.14–0.40 mm [9]. Further, growth past the 0.4 mm stage allows the formation of an antrum, and begins to depend upon gonadotropins. The time interval from when a follicle leaves the resting pool until antrum formation is estimated to require 83 days [9,10]. In the antral class, most follicles range in size from 0.4 to >1.5 mm, with thecal cell layers, and 10–30 layers of granulosa cells. The time from antrum formation until the follicle reaches 1 mm in size may take 3–4 weeks, and from 1 to 7 mm in size, another 2–3 weeks. It is clear from these observations, that growth rate increases with follicle size [9].