RELATIONSHIPS BETWEEN OVULATION RATE AND LITTER SIZE FOR FLUSHED AND NONFLUSHED GILTS[1]

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Summary

We examined the effects of flushing (3.4 lb additional ground milo for approximately 2 wk before insemination) and pubertal status (inseminated at puberty or postpuberty) on ovulation rate and litter traits in gilts. Flushing resulted in 1.1 more eggs released at ovulation and 1.3 more pigs/litter. The response in litter size occurred primarily among gilts inseminated at their pubertal estrus. Neither flushing nor pubertal status affected prenatal survival. Data for 58 gilts were used to evaluate the relationship between ovulation rate and litter size. Litter size increased linearly with increased ovulation rate to a maximum of 13 pigs when 19 eggs were released at ovulation. We conclude that ovulation rate limits litter size for gilts inseminated at puberty, because their unstimulated ovulation rate does not fully utilize the reproductive potential of their uterus. It appears that litters of 12 to 13 pigs are possible, but we have not been successful in increasing the average litter size in postpubertal gilts beyond 10 to 11 pigs, because our flushing treatment produced only a modest increase in ovulation rate of postpubertal gilts.

(Key Words: Ovulation Rate, Litter Size, Prenatal Survival, Flushing.)

Introduction

The number of eggs released at ovulation (ovulation rate) establishes the upper limit for litter size. In theory, ovulation rate should be positively correlated with litter size. However, fertilization, embryo survival, and fetal survival rates also impose limits on litter size. Available information indicates that about 14 in. of uterus is required for each fetus. When the uterine capacity is reached, additional increases in ovulation rate will not increase litter size. We have reported previously that flushing (additional feed for 2 wk before breeding) increased litter size for gilts bred at puberty, but not for postpubertal gilts (1984 and 1987 Swine Day Rep. of Prog. 461 and 528). As a part of those studies, we also evaluated the effect of flushing on ovulation rate and the relationship between ovulation rate and litter size.

[1]We appreciate the generous donation of altrenogest by Rousel-Uclaf, Paris, France. Altrenogest is a synthetic hormone and is not approved for use in swine by the FDA at the present time.

Experimental Procedures

The gilts providing data for this experiment are a subset of those included in a previous report (1987 Swine Day Rep. of Prog. 528, pp 27-30) for which ovulation rate was determined. Gilts either received a flush treatment (3.4 lb ground milo) in addition to their standard diet (4 lb/d) or did not receive the flush (controls) for at least 10 d before breeding. Flushing was discontinued when gilts were detected in estrus. In addition, one-half of the gilts on each treatment were estrous synchronized by feeding altrenogest for 14 d. Altrenogest is not considered in this report. Approximately 15 d after estrus, gilts were anesthetized, and their ovaries were examined surgically to determine the number of corpora lutea (CL) or ovulation rate. Those data and litter data collected at farrowing were used to evaluate the response to flushing and the relationship between ovulation rate and litter size.

Two blood samples were collected 10 d apart from each gilt before breeding and evaluated for progesterone. Progesterone concentrations exceeding 2 ng/ml were evidence for ovulation, and such gilts were classified as postpubertal. Otherwise, gilts were classified as pubertal if they were detected in estrus. Gilts were observed for estrus twice daily for 10 d. Estrous gilts were inseminated twice with semen from at least two boars.

Results and Discussion

Ovulation and litter traits are reported in Table 1. Flushing increased ($P<.05$) ovulation rate by 1.1 CL and litter size by 1.3 pigs. Gilts inseminated at puberty also responded to flushing with an increase ($P=.10$) of 1.1 CL, but postpubertal gilts exhibited only a numerical trend of .8 CL for increased ovulation rate in response to flushing.

The relationship between ovulation rate and litter size is depicted in Figure 1. Only two gilts produced more than 19 eggs, and they were excluded from that data. Litter size increased ($P<.001$) linearly with increased ovulation rate over the range from 8 to 19 CL. There were no effects of flushing or pubertal status on this relationship nor did flushing or pubertal status affect embryo survival. Therefore, it appears that increases in litter size for flushed gilts are solely dependent on increased ovulation rate.

Our results have consistently shown a response to flushing in litter size for gilts inseminated at puberty, but not for gilts inseminated at a postpubertal estrus. The present study provides a partial explanation for that observation. Nonflushed gilts inseminated at puberty had an average ovulation rate of 13.3 and farrowed 8.3 pigs (Table 1). Ovulation rate appears to have limited their litter size. Postpubertal gilts had an average of 13.9 CL corresponding to a litter size of 10 pigs, but data in Figure 1 indicate that increases in litter size should occur at least up to ovulation rates of 19, corresponding to a litter size of 13.1. The data in Table 1 indicate a very modest increase of .8 CL attributable to flushing in postpubertal gilts. One previous report compares ovulation rates in pubertal and postpubertal gilts after flushing. That work also showed the largest response in pubertal gilts. Therefore, our flushing treatment may not be adequate for increasing ovulation rate in postpubertal gilts.

We conclude that litter size for pubertal gilts can be increased by flushing. Because a significant proportion of gilts are expected to be pubertal at mating, it is likely that flushing would increase litter size on most swine farms. These data also provide a possible explanation for the inability of flushing to increase litter size in postpubertal gilts. In this experiment, the explanation may be the relatively modest increase of .8 CL attributable to flushing in postpubertal gilts. Perhaps greater levels of feed intake are required to maximize ovulation rate in postpubertal gilts.

Table 1. Ovulation and Litter Traits as Affected by Pubertal Status and Flushing

Item	Flush: No	Flush: Yes
All gilts		
CL[ac]	13.4 ± .4 (39)[b]	14.5 ± .4 (42)
Pigs/litter[c]	9.0 ± .5 (30)	10.3 ± .6 (30)
Pigs/CL	.66 ± .03	.70 ± .04
Pubertal gilts		
CL[d]	13.3 ± .5 (19)	14.4 ± .5 (12)
Pigs/litter	8.3 ± 1.0 (15)	9.4 ± 1.0 (9)
Pigs/CL	.63 ± .06	.64 ± .06
Postpubertal gilts		
CL	13.9 ± .6 (20)	14.7 ± .5 (30)
Pigs/litter	10.0 ± .9 (15)	10.3 ± .7 (21)
Pigs/CL	.71 ± .06	.70 ± .05

[a]Corpora lutea. [b]No. of gilts. [c]Flushing effect ($P<.05$). [d]Flushing effect ($P=.10$).

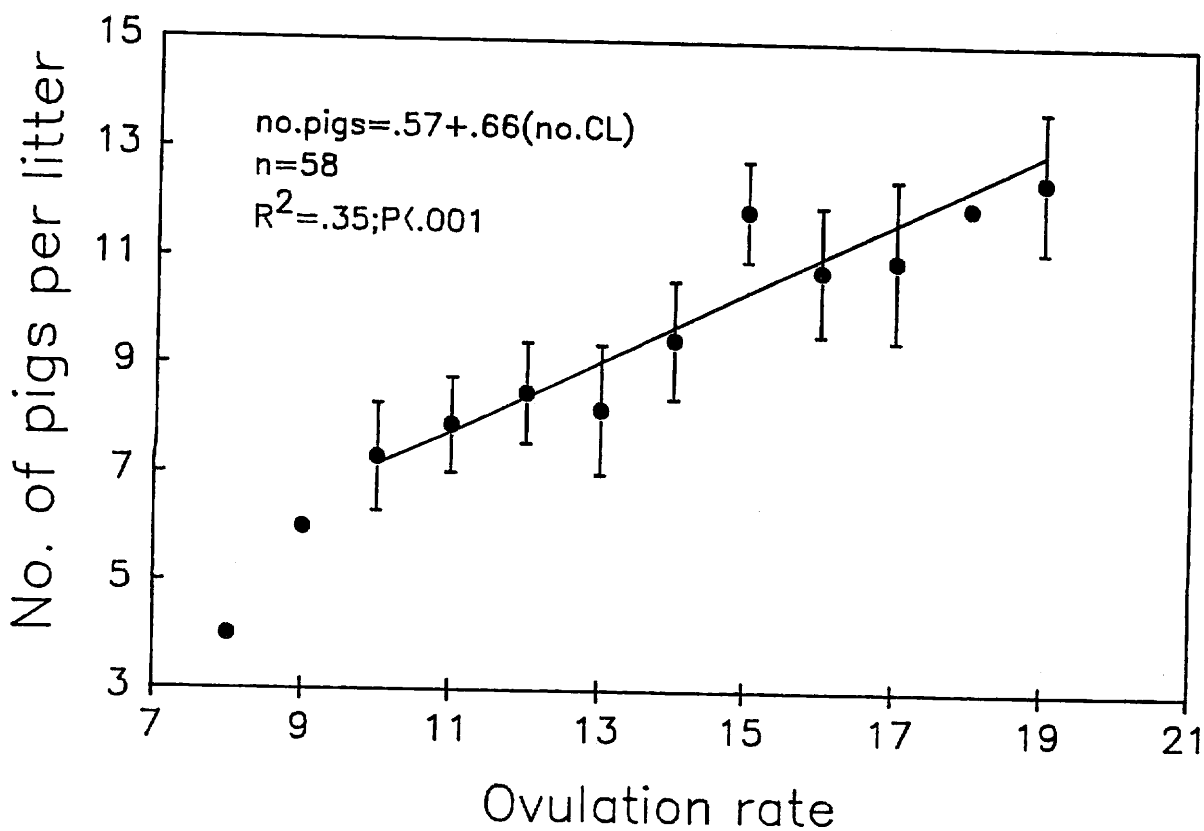

Figure 1. Relationship between ovulation rate and litter size.

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