



Control of Estrus and Ovulation in Peri-Pubertal Gilts with Allyltrenbolone or a Combination of Natural Gonadotropins

Technical Report No. 6

Introduction

One-hundred-and-twenty large, white X landrace gilts were allocated at random to one of three treatment groups. Treatment A gilts were given an orally active progestogen, allyltrenbolone (Regumate; Hoechst UK) once daily for 18 days from 185 days of age. Treatment B gilts were given a subcutaneous injection of gonadotropins (400 IU Pregnant Mare's Serum Gonadotropin, 200 IU Human Chorionic Gonadotropin, P.G. 600®; Intervet Laboratories) at 203 days of age. Treatment C gilts received no exogenous hormones.

All the gilts were housed in groups of 10 from 153 days of age and up to 203 days of age, were isolated from boars. From 203 days each group of 10 gilts was subdivided into two groups of five, a boar was accommodated in a pen adjacent to each group of five and daily contact with it was allowed for one hour.

Eight gilts in treatment A, five gilts in treatment B and seven gilts in treatment C failed to exhibit estrus before 233 days of age ($P > 0.05$). The intervals from exposure to the boar to the onset of estrus for treatments A, B and C were 8.5, 5.5 and 11.0 days respectively ($P < 0.001$).

Gonadotropin treatment significantly reduced the time taken by gilts to show estrus and the variability within the group was significantly less

than that in the other two groups. There were no significant differences between the groups in the mean size of their litters.

In commercial pig production, the programmed replacement of culled sows by pregnant gilts is a major problem. The main difficulty is the often sporadic and unpredictable onset of puberty within groups of peri-pubertal gilts. Estrus detection and service are therefore difficult to manage successfully.

Techniques for the synchronization of estrus in groups of gilts have been investigated by a number of workers and have been reviewed by Varley (1983b). One promising method involves the use of combinations of gonadotropins, Pregnant Mare's Serum Gonadotropin (PMSG) and Human Chorionic Gonadotropin (HCG), to induce ovulation and estrous cycles. A second approach has involved the use of progestogens such as allyltrenbolone to suppress estrus and ovulation, and this method has been the subject of a number of recent studies (Kraeling and others 1979, Pursel and others 1981, Stevenson and Davis 1981, Varley 1983a).

This paper describes the results of a trial carried out on a commercial farm to compare allyltrenbolone and gonadotropins as agents for estrus synchronization in gilts.

Materials and Methods: Animals and Treatments

One-hundred-and-twenty large white X landrace gilts were allocated at random to one of three treatment groups. Treatment A gilts were given the orally-active progestogen allyltrenbolone (Regumate; Hoechst) once daily for 18 days from 185 days of age. The progestogen was dispersed in an oil base (4 mg allyltrenbolone/ml) and the solution was contained in a pressurized container which allowed 5 ml to be dispensed every time a valve on the top of the container was depressed and released. Each gilt

received one dose per day which was dispensed on top of its daily feed allowance. The daily dose of allyltrenbolone was therefore 20 mg.

Treatment B gilts were given a subcutaneous injection of a combination of gonadotropins containing 400 IU Pregnant Mare's Serum Gonadotropin (PMSG) and 200 IU of Human Chorionic Gonadotropin (HCG) (P.G. 600®; Intervet Laboratories) at 203 days of age. The control gilts (treatment C) were not given exogenous hormones.

Animal Management

The experiment was carried out on a large commercial pig farm in Aberdeenshire, Scotland (J.A. Simmers and Sons, Old Meldrum, Aberdeen). All gilts were initially selected for breeding at 90 days of age, when they weighed approximately 30 kg and were transferred from a minimal disease unit to the gilt rearing accommodation. Here they were fed 1.6 kg/day of a diet containing 160 g crude protein and 12.5 MJ digestible energy/kg dry matter. The gilts were housed in groups of 10 up to 153 days of age and in groups of five thereafter. Throughout the experiment they were fed in their respective groups and individual feeders were not used.

Any animals not served by 235 days of age were slaughtered and their reproductive tracts were recovered for examination. A blood sample was taken for progesterone assay immediately before slaughter.

Blood samples were also collected at 195, 199 and 203 days of age from treatment B and C gilts and at 177, 181 and 185 days of age from treatment A gilts. These blood samples were assayed for progesterone to determine which of the gilts had cycled before treatment.

Before 203 days of age, the gilts were housed in isolation from boars, but at 203 days of age they were transferred in the same groups of five gilts to accommodation where a working boar was housed adjacent to each group. The boar was allowed into each pen of gilts for one hour each day to facilitate the detection of estrus, and at the appearance of estrus the gilts were mated twice on consecutive days.

After mating, the gilts remained in their experimental groups until pregnancy was diagnosed with an ultrasound device (Medata Systems). They were then moved to commercial farrowing units where they were used as replacement females.

The gilts within a pen received the same treatment and replicate blocks of three pens including treatments A, B and C were accommodated concurrently.

Service dates, conception failures, returns to service and litter sizes were recorded for all the gilts, but litter sizes were included in the analysis only when they were conceived to the first service.

Statistical Analysis

Differences between treatment groups in the proportion of gilts becoming anestrous or failing to conceive were examined by χ^2 analysis. Differences in the intervals from 203 days of age to estrus, and in litter size, were analyzed as a completely randomized design without blocking.

Table 1.

	Treatment		
	A	B	C
Number of gilts	40	40	40
Number of gilts ovulating before treatment started	0	4	3

Results

Table 1 shows the numbers of animals in each treatment group which had increased (>1 nmol/litre) concentrations of plasma progesterone before treatment. None of the treatment A gilts ovulated before Regumate treatment and only a small proportion of the other two groups showed signs of ovulation. Considering all the gilts, 94.2 percent of them were pre-pubertal before treatment.

Table 2 gives the overall reproductive performance of the three treatment groups. Of the 40 gilts allocated to each treatment, eight in treatment A, five in treatment B and seven in treatment C did not exhibit estrus during the experiment. These differences were not significant. For treatments A, B and C, of the gilts which were served, none, two and two gilts respectively returned to service three weeks after service.

The reproductive tracts of all the gilts culled from the experiment owing to infertility were examined, and one gilt from treatment B was found to have cystic follicles on both ovaries. One gilt from treatment A which was culled because it did not show estrus was found to have cycled before slaughter, as indicated by the presence of normal corpora lutea. None of the control gilts had abnormal ovarian structures.

There were highly significant differences ($P < 0.001$) between all three treatment groups in the standard deviation of the interval between exposure to the boar at 203 days of age and the appearance of estrus. Group B gilts showed estrus sooner after exposure to the boar than the other two groups and their response was less variable. Fig. 1 illustrates the time at which estrus was first observed in the three groups of gilts.

The standard error of the interval from exposure to the boar to estrus was calculated for each replicate block of five gilts. These standard errors were then subjected to analysis of variance and the mean values for each treatment groups are presented in Table 2. There was a significant difference in this respect between treatment B and treatment C but not between treatment A and treatment C.

Gonadotropin treatment therefore significantly reduced the time taken by gilts to show estrus after exposure to the boar and the variability of the time of estrus onset within replicate groups of gilts treated with gonadotropins was also significantly less than that in the control groups of gilts.

There were no significant differences between treatment groups in either the total number of piglets born per litter or in the number of piglets born alive per litter.

Figure 1.

Interval from Boar Exposure to Estrus (days)

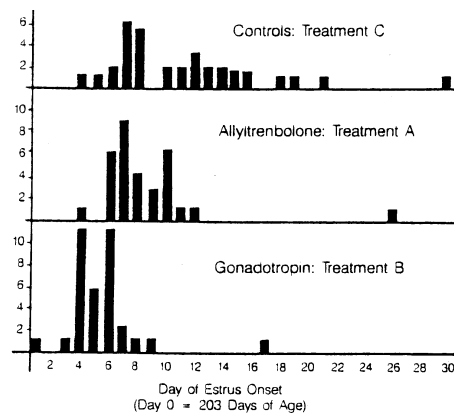


Table 2.

	Treatment			Level of Significance
	A	B	C	
Number of gilts allocated	40	40	40	–
Number of gilts anestrous	8	5	7	NS
Number of gilts served	32	35	33	–
Number of served gilts which returned estrus	0	2†	2†	NS
(1) Interval from boar exposure to the onset of estrus (days)	8.5 ± 0.6 a	5.5 ± 0.4 b	11.0 ± 0.9 c	$P < 0.01$
*Standard error within replicate blocks of (1)	2.5 ± 0.3 ab	1.6 ± 0.3 a	5.1 ± 0.6 b	$P < 0.01$
Litter size (total)	7.7 ± 0.5	7.5 ± 0.6	8.3 ± 0.6	NS
Litter size (born alive)	7.4 ± 0.5	7.1 ± 0.6	8.0 ± 0.6	N S

*Means on a line with different subscripts are significantly different

† These litters are not included in farrowing performance

NS Not significant

Discussion

In this experiment, the use of either allyltrenbolone or gonadotropin injections was effective in the control of estrus and ovulation in groups of prepubertal gilts. Gonadotropin injections were superior to treatment and allyltrenbolone and the mean time to the onset of behavioral estrus was significantly less for the gilts treated with gonadotropins.

The level of infertility was unaffected by treatment and the overall farrowing rate to the first service was 80 percent.

Of the selected gilts, 16.6 percent were culled because they were anestrus, a higher proportion than that reported by Cronin and others (1983) and by Ehnvall and others (1981), although in their studies no method of estrus synchronization was used.

Working with allyltrenbolone-treated gilts, Varley (1983a) reported that none of 40 treated gilts became anestrus, one mated gilt returned to service three weeks after mating and four were found to be not pregnant at full term. However, the gilts were mated at around 220 days of age and were therefore significantly older when allyltrenbolone was first administered than the gilts in the present work.

Paterson and others (1984) have reported that 100 percent of gilts treated with P.G. 600® at 174 days of age ovulated but only 45 percent showed signs of estrus. In contrast, Blichfeldt (1983) applied the same treatment to gilts which had not previously shown estrus at 240 days of age; 97 percent ovulated and 89 percent showed estrus.

For all the gilts in treatment A showing estrus, the average interval from withdrawal of allyltrenbolone to the onset of estrus was 8.5 days. This compares well with the data of Varley (1983a) who reported an interval of 8.4 days for gilts given 20 mg/day of allyltrenbolone. Varley (1983b) has reviewed the literature on the use of allyltrenbolone in peripubertal gilts, and in nine separate studies the interval from withdrawal of the progestogen to the onset of estrus ranged from 4.9 to 8.4 days, and the standard errors associated with these mean values ranged from 0.05 days to 1.1 days. This variance was probably largely due to differences in the dose rate used (12.5 mg/day to 40 mg/day) and to the gilts being fed either in groups or individually. In the work reported here, treatment A gilts were housed in groups of five and were group-fed, in contrast to the earlier work of Varley (1983a) in which the gilts were fed individually. Another difference between the two experiments was that in the earlier work the allyltrenbolone was given as a powder in a premix meal, whereas in the present work an oil-based preparation of allyltrenbolone was used; this presentation did not result in any deterioration in the performance of the gilts.

The use of the PMSG/HCG treatment resulted in a significantly shorter and less variable interval to the onset of estrus than that observed for the other two treatment groups. Walker and Burnett (1984) observed that prepubertal gilts injected with PMSG/HCG at 173 days of age showed estrus on an average at 10.6 days after injection and 90 percent of these gilts showed estrus within five days of the treatment.

The gilts in treatment B were 30 days older at injection than those in the study of Walker and Burnett (1984) and this difference probably accounted for the lower mean interval (5.5 days) to estrus in the present study.

The level of prolificacy was unaffected by treatment. Varley (1983a) reported a significant ($P < 0.05$) increase in prolificacy (11.2 vs. 9.3 piglets per litter born alive) when allyltrenbolone was used as an agent for heat synchronization. Other workers have also reported increases in litter size after the use of allyltrenbolone (Webel and Day 1981, Varley 1983b) although there are also studies showing no effect (Britt 1980, Pursel and others 1981).

The mean litter size for the three treatment groups combined was 7.5 piglets born alive, a lower level of performance than in other studies. Varley (1983a) observed that for gilts mated at 224 days of age the mean litter size was 9.9 and in the study of Walker and Burnett (1984) gilts mated at 173 days of age farrowed 9.1 piglets per litter.

Either allyltrenbolone or PMSG/HCG treatment gave significantly improved synchronization of estrus in peri-pubertal gilts. The PMSG/HCG gave a better response than allyltrenbolone and, in view of the simplicity of giving a single injection, PMSG/HCG treatment would probably be the preferred on-farm method. However, Paterson (1982) discussed the wide variations that are apparent between experiments with PMSG/HCG treatment and reported that the percentage of gilts becoming anestrus after PMSG/HCG treatment ranged up to 57 percent.

Another possibility for the control of reproduction in gilts is to use a combined progestogen / gonadotropin treatment. Polge (1980) has described a method using allyltrenbolone treatment followed by a PMSG injection one to two days after withdrawal of the progestogen. This treatment caused a high incidence of anestrus in treated gilts. More recently at the Rowett Institute the authors have used allyltrenbolone in conjunction with PMSG/HCG injections one day after progestogen withdrawal. In this work the 18 gilts allocated to a once-bred gilt experiment (Fowler and Varley 1985) were given allyltrenbolone initially at 155 days of age. They all exhibited estrus, were mated and 16 of them farrowed. The interval from the withdrawal of allyltrenbolone to estrus was 5.8 ± 0.18 days and the subsequent litter size was 10.7 ± 0.9 piglets born alive. These preliminary data suggest that the combination of a progestogen followed by gonadotropin might offer greater precision and control of first estrus and ovulation in gilts than that offered by either treatment alone.

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