Induction and Synchronization of Estrus in Prepuberal Gilts and Anestrous Sows by a PMSG/HCG-Compound

Technical Report No. 9

Summary

This paper deals with the influence of a PMSG/HCG-compound (400 I.U. PMSG and 200 I.U. HCG in one dose) on the estrus onset in prepuberal gilts and in anestrous sows and gilts. The results of five different experiments are reported.

Introduction

For economic pig production maximum reproductive efficiency is a basic postulate. It can be achieved through early breeding of gilts, high conception rates, large litter size, low post-natal losses, short lactation periods, high conception rates after early weaning and low frequency of anestrous animals. Higher profits can be expected when estrus, insemination and farrowing are synchronized in larger groups of animals. Synchronization of estrus in pigs seems to be achieved with the application of a compound consisting of small amounts of PMSG and HCG (400 I.U.: 200 I.U.) as demonstrated by Schilling, Cerne and Minar (1971), Schilling and Minar (1971), Cerne and Schilling (1972). This new compound can replace Methallibure which is no longer available (Polge, 1971). Progestogens failed to synchronize estrus in pigs (Ulberg, Grummer and Casida, 1951; Winzenried, 1969). Relatively high doses of gonadotropins have been used for induction of estrus in gilts—500 to 2,000 I.U. of PMSG and 500 to 750 I.U. of HCG -(Dziuk, 1965; Dziuk and Polge, 1965). For treatment of anestrus, the androgen-estrogen combination suitest (Jochle, et al., 1967) and the gonadotropin-estrogen compound Prolan-O1 "S" (Cerne, 1966; Doplihar, 1966) or PMSG and HCG (Peters, et al., 1965) have been used with different degrees of success.

Materials and Methods

Five experiments were carried out: experiments A, C and E at one Yugoslavian industrial pig farm with more than 2,500 Swedish Landrace breeding sows. All breeding animals were carefully selected, and in the process of continuous pig production, they were kept in large groups. The lactation period lasted four weeks. In experiment B, unselected German Landrace gilts were used and it may be noted that in previous experiments (Schilling and Minar, 1971) only five to ten percent of the gilts of this breed had reached puberty before 6.5 months of age. Experiment D included 28 anestrous sows of the same breed. All experimental animals were treated s/c with one dose of PMSG/HCG-compound (5 ml: 400 I.U. PMSG + 200 I.U. HCG).

Estrus was detected with teaser boars and with the "Detest"-equipment (Cerne, 1968). Inseminations were carried out with fresh diluted semen on the first and second days of estrus.

Results

Induction of Estrus, and Conception Rates in Prepuberal Gilts

Experiment A

One hundred and twenty prepuberal Swedish Landrace gilts classified into four groups by age (5 to 6.5 months) were injected with one dose of the PMSG/HCG-compound. Onset of estrus and conception rates (C.R.) were compared with those of the same number of gilts in four control groups (Table 1). Ninety-three to 100% of the treated animals came into estrus 3 to 7 days post-injection; 90, 93 and 100 percent of the non-inseminated gilts (Groups A, B, D) came into estrus again—well synchronized—after 21 days (± 2 days), 86% at the third cycle (Group A).

In the control animals estrus was not observed before 6 months of age; 33% showed estrous symptoms between 6 and 6.5 months (Group C). The conception rate of the experimental animals was high: more than 80% of the inseminated gilts conceived at the first induced cycle (82.1%, Group C). Of all treated animals, 76.7% farrowed after treatment at 6 months (first cycle, Group C) and 80% after injections at 5.5 months (second cycle, Group B) compared with 23.3 and 40% of the corresponding control animals. Breeding and farrowing were 6 to 8 weeks earlier. Litter size was normal, though in the treated groups it was always higher than in the controls.

Experiment B

Thirty-five unselected prepuberal German Landrace gilts, 5.5 to 6 months old, were injected with the hormonal compound. All were inseminated on the fourth and fifth day after treatment regardless of estrous symptoms, and slaughtered 30 days later.

As shown in Table 2, in 80% of the gilts sexual maturity was induced by hormonal treatment. Eighty-two percent of the mature animals, or 66% of all treated animals were pregnant. In 14% of the nonpregnant animals the time of insemination probably did not correspond to the time of ovulation. The number of corpora lutea (average 11.6) was as high as in gilts at the onset of puberty (Schilling and Minar, 1971). Embryonic mortality and loss of eggs at Day 30 of pregnancy was 30% of which 3 to 4 can be assumed to be lost before implantation.

Table 2.

Ovulation and Conception Rate in Prepuberal Gilts
(30 days after insemination)

Treated animals:	35
infantile ovaries	7 (20 percent)
mature but non-prregnant	5 (14 percent)
pregnant	23 (66 percent)
In pregnant animal:	
corporea lutea	11.6/animal
living embryos	8.5/animal
embryonic mortality	30 percent (3/4 before implantation)

Table 1.

Estrus, and Average Total Litter Size in Prepuberal Gilts Following Treatment

Experimental groups	Age at treatment (months)	Percent of gilts in estrus 1st	2nd cycle	3rd	Gilts inseminated No.	cycle	age	Animals farrowed No.	percent of gilts insemin.	percent of all gilts	Average total litter (size range)
Group A	5-5.5	100	100	86	26	3	200-210 days	26	100	86.7	10.1(7-14)
Control	–	–	–	–	30	–	from day 210	22	73.3	73.3	9.8(2-12)
Group B	5.5	100	90	–	27	2	about day 190	24	88.8	80.0	9.9(2-13)
Control	–	–	–	–	15	1	from day 190	12	80.0	40.0	9.3(4-11)
Group C	6	93	–	–	28	1	about day 180	23	82.1	76.7	9.8(5-13)
Control	–	–	–	–	10	1	from day 180	7	70.0	23.3	8.7(2-11)
Group D	6.5	100	93	–	28	2	about day 220	26	92.8	86.7	10.4(8-14)
Control	–	–	–	–	30	–	from day 220	24	80.0	80.0	9.7(4-13)

30 animals in each group.

Table 3.

Induction of Estrus and Conception Rates in Anestrous Sows Treated at 11th or 12th Day after Weaning

Group	No.	Anestrous No.	In estrus and inseminated No.	percent	Farrowed No.	percent	Average total litter size	Normal estrus before next breeding No.	percent
Treated	22	363	318	87.6	244	77.2 (67.2)*	10.5	212	87.0
Controls	11	118	85	72.0	71	83.0 (60.0)*	10.4	45	63.3

*of all animals

Table 4.

Percentage of Anestrous Sows Showing Estrus after Treatment on 11th or 12th Day after Weaning

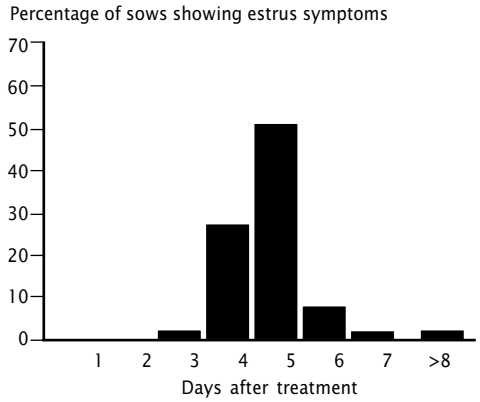
Group		Total	In estrus	11.15	16.20	21.25	26.30	31.35	36.40
Treated	No.	363	318	102	210	3	–	3	–
	percent	100.0	87.6	32.0	66.0	1.0	–	1.0	–
Controls	No.	118	85	11	8	15	37	8	5
	percent	100.0	72.0	13.0	9.5	17.5	43.5	9.5	6.0

Induction and Synchronization of Estrus, and Conception Rates in Anestrous Sows and Gilts

Experiment C

More than 1,000 sows were divided, after four weeks lactation, into 33 groups having 30 to 40 animals in each. In these groups, 8 to 40% of the animals did not come into estrus during the first 10 days after weaning; 363 anestrous sows from 22 groups were injected with the PMSG/HCG-compound on the 11th or 12th day; 118 anestrous sows in 11 groups remained untreated as controls (Table 3).

Figure 1. Distribution of induced estrus of 318 anestrous sows treated at the 11th and 12th day after weaning.



After treatment, 87.6% of the animals showed estrous symptoms and were inseminated at the first and second day of estrus: 77.2% of the inseminated sows (67.2% of all those treated) farrowed. Of the 118 control animals, only 72% came into estrus and were inseminated; 83% of them (60% of all controls) farrowed. The hormone-induced estrus was easy to detect and well synchronized. Within 3 to 8 days after injection, estrus was detected in 98% of the sows Table 4 and Fig. 1). Most of the control sows came into estrus between 20 to 30 days after weaning, and only 22.5% during the period from 11 to 20 days. After the end of the next lactation period, 87% of those previously treated with the hormonal compound came into estrus within 10 days after weaning without treatment, compared with 63.3% of the controls (Table 3).

Experiment D

Twenty-eight anestrous sows received the hormonal compound between 20 and 100 days after weaning. The lactation period of these sows was 6 weeks. As shown in Table 5, 89% of the treated animals came into estrus mainly between the third and seventh days after injection; 92% of the inseminated sows (82.1% of all animals) farrowed, on average, 10.6 piglets per litter. In 15 anestrous gilts which showed no estrous symptoms until 9 months of age. estrus was induced in 87% with one injection, appearing between the third and seventh days. Of the inseminated gilts, 84.6% (73.3% of all animals) farrowed with an average of 9.3 piglets per litter.

Table 5.

Induction of Estrus and Conception Rates in Anestrous Sows and Gilts Treated with PMSG/HCG-Compound

Group	No.	In estrus No./Percent		Farrowed No./Percent		Litter size
Sows	28	25	89.0	23	92.0 (82.1)*	10.6
Gilts	15	13	87.0	11	84.6 (73.3)*	9.3

*of all animals

Increase of Litter Size in Sub-Fertile Sows

Experiment E

Thirty-seven sows which had below average litter sizes (4.3 ±. 1.3 piglets per litter) with no more than 6 piglets per litter at their second to fourth farrowing, received one injection of the PMSG/HCG-compound on the first day after weaning. All animals came into estrus within 3 to 7 days after treatment, and the average litter size at farrowing of 9.7 ± 1.9 piglets was significantly higher ($p < 1\%$) than in previous litters. At the following pregnancy the same sows, with no hormonal treatment, gave a total average litter size of 5.2 ± 1.7. This indicates that the increase in litter size was due to the treatment.

Discussion

It has been demonstrated that a PMSG/HCG-compound induced follicular development and ovulation in the inactive ovaries of prepuberal gilts as well as in anestrous sows. Most of the treated animals responded with good synchronization of estrus and ovulations, and the induced estrus was highly fertile.

The response to the low dosage (only 400 I.U. PMSG and 200 I.U. HCG) was remarkable. Perhaps this combination is particularly favorable and explains the stimulating effect.

The number of growing follicles was normal. All Grafian follicles ovulated and no cysts were observed (see Schilling and Minar. 1971).

These studies indicate the PMSG/HCG-compound could be used to achieve the synchronization of estrous cycles necessary for planned breeding programs in pigs. A single treatment of a group of prepuberal gilts resulted in synchronized estrus (3 to 5 days later), synchronized inseminations and synchronized farrowing.

Those sows which normally do not come into estrus within 10 days after weaning could also be treated with this hormone combination, and a high percentage of them could be bred 4 to 6 days later.

In some cases, it may be useful to employ this substance as a “cycle starter” immediately after weaning.

In comparison with other compounds tested, treatment with PMSG/HCG-compound is very cheap and application is simple. Only one injection is necessary. The conception rate is reasonably high and the estrous symptoms are very distinct, which is helpful for diagnosis of estrus where no teaser boar is available.

These investigations may provide some information regarding hereditary factors influencing fecundity. Near doubling of average total litter size in subfertile sows after treatment, and the decrease in average litter size in subsequent farrowings when no hormonal treatment was given, may indicate a hereditary disposition for small litter size. Improvement of litter size seems to be only a temporary “environmental” effect. This compound, therefore, should be used with due caution when selection of breeding animals is being made. It could, however, be advantageous for the induction of synchronized estrus in prepuberal gilts, in anestrous sows, and as a cycle starter after weaning.

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