Study upon the Moment of Ovulation in Sows to Establish the Optimum Moment for Semen Inoculation

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Abstract
Efficiency of artificial insemination depends equaly by semen quality and time of inoculation. The optimal time for inoculation was calculated usually from the moment of detection of heat, for double insemination, so that one of the two inoculations to approach the time of ovulation. To increase the efficiency of boars exploitation is necesary to change the method to a single insemination.
To ensure normal fertility parameters with only one inoculation it is necessary to chose with great precision the moment of insemination ,in order to ensure the time for sperm capacitation and penetration of viable oocytes. Starting from the fact that major events such as forrowing and death occur, according to the circadian rhythm, in the second half of the night, this study aims to detect from this point of view the moment of ovulation, to find a more reliable calculation for the time of semen inoculation.
The experiments were conducted on puberal gilts, which were not treated for induction of ovulation; the control for detecting the follicular dehiscence was done only on physiological oestrus. Females having symptoms at heat control were subject to series of laparatomias, complete with collection and examination of oocytes.

Keywords: artificial insemination, oestrus, oocytes, time of ovulation.

1. Introduction

The success of artificial insemination is provided mainly by two basic factors: the quality of semen and the timing for semen inoculation [1-3]. Regarding semen quality there are now sufficient objective methods of assessment, but the best time of inoculation was calculated from certain physiological parameters, plus a correction to have a safety margin. So many recommendations were calculated from the moment of detection, but these require double insemination, so that one of the two inoculations to approach the time of ovulation [4, 5].

Aiming to increase efficiency of boars exploitation it would be necessary to make only one insemination, but this technique it would theoretically reduce to half the chances of succes. To ensure normal fertility parameters using this single inoculation, it must be chose with great precision the insemination moment in order to ensure time for sperm capacitation and penetration of viable oocytes [5, 6].
Starting from the fact that most biological phenomena are governed by certain biorhythms and major events such as forrowing and death occur, according to the circadian rhythms, in the second half of the night, we decided to study, from this point of view, the moment of ovulation, to find a more secure method for timing sperm inoculation.

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2. Materials and methods

The experiments were conducted on a total of 29 gilts after puberty that has not received any hormonal treatment, the control for follicular dehiscence being made only for physiological oestrus. The gilts were checked daily, at $09.^{00}$ hr., for boar immobility syndrome as a sign of the onset of heat. Females found in heat were subject to series of control laparatomias, completed with collection and examination of oocytes. All gilts that presented hemorrhagical corpora lutea and stigma still bloody, and oocytes without cumullus proliger or corona radiata, were considered having completed the ovulation.

Females that in addition with hemorrhagic corpora lutea on the ovaries had other mature follicles still unopened, or the oocytes were still embedded in the mass of cumullus proliger, were appreciated that the ovulation process is ongoing.

It was assumed that ovulation has not yet started to gilts that had not a single mature follicle opened [7, 8].

3. Results and discussion

Results are presented in Tables 1, 2 and 3. As shown in Table. 1and 2, 22 gilts were operated in the second half of the night (from $00.^{00}$ hr. to $07.^{00}$ hr) and other 7 in the first part of the morning (from $7.^{00}$ hr to $9.^{00}$hr). From the first group of 22 gilts, 13 females (59%) were found at the right moment of ovulation, 4 (18%) gilts having completed the ovulation and 5 gilts (23%) in which follicular dehiscence not yet begun. From the second group of 7 gilts, 6 (85.7%) having completed ovulation and only 1 (14.3%) was without follicular dehiscence.

The 4 gilts examined within 24-48 hours after heat control were found with the ovulation process completed and even having 2-4 cell stage embryos

Similar dynamics are observed in the table. 3 where from the 25 gilts examined until 24 hours after discovery the heat syndrome, 13 (52%) were at the moment of ovulation, 6 (24%) had finished ovulation process and the other 6 (24%) not yet in ovulation process.

These results demonstrate that a percentage of 70-75% of females are in the process of ovulation or even completed within 15-22 hours after detection of heat, that is corresponding to $00.^{00}$ - $07.^{00}$ hr. meaning the second half of the night after the day detection of heat. This range corresponds to the circadian rhythm that occurs for the main biological events.

Table 1. The phenomenon of ovulation in gilts with physiological oestrous according to circadian rhythms (response of animals)

The time of laparatomias	Interval between oestrus control - laparatomy	Gilts examined	Phase of laparatomy					
			Ovulation completed		Current		No ovulation	
	hours	No.	No.	%	No	%	No.	%
0^{00}-3^{00}	15-18	8	0	0	6	75	2	25
3^{00}-5^{00}	18-20	7	2	28.6	5	71.4	0	0
5^{00}-7^{00}	20-22	7	2	28.6	2	28.6	3	42.8
7^{00}-9^{00}	22-24	3	2	66.6	0	0	1	33.3
9^{00}-9^{00}	24-48	4	4	100	0	0	0	0

Table 2. The phenomenon of ovulation in gilts with physiological oestrous according to circadian rhythms (examination of ovaries and collected material)

The time of laparatomias	Interval checking - laparatomy	Gilts examined	Follicles			Eggs collected		Embryos
			Total from which	Ovulated	Unovulated	With cumullus proliger	Without cumullus	
	Hours	No.	No.	No.	No.	No.	No.	No.
0^{00}-3^{00}	15-18	8	81	56	25	38	18	0
3^{00}-5^{00}	18-20	7	101	101	0	60	38	0
5^{00}-7^{00}	20-22	7	73	43	30	8	32	1
7^{00}-9^{00}	22-24	3	33	20	13	0	13	7
9^{00}-9^{00}	24-48	4	50	50	0	0	19	31

Table 3. The phenomenon of ovulation within 24 hours from the detection of heat

Sows examined	Ovualtion completed		Ovuation in process		Without ovulation	
No.	No.	%	No.	%	No.	%
25	6	24.0	13	52.0	6	24.0

4. Conclusions

1. Ovulation process in females from pig species is governed by circadian rhythms, like other biological phenomena.
2. Most females ovulate in the second half of the night to morning, in the period from $00.^{00}$ till $07.^{00}$ hr.
3. Starting from this moment of ovulation and calculating the time for semen capacitation, it is clearly that insemination must be made at around $22.^{00}$ hr, to ensure a larger group of fertilized ova.
4. It is necessary for the future, to check in a field trial this method of single inoculation of semen, in order to increase the efficiency of artificial insemination in pigs.

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