

Reaction of Cows Ovaries to GnRH Administration in Different Estrous Stages

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Abstract

Administration of GnRH in the luteal phase of estrous in dairy cows induces an increase of LH levels, with the modification of the growth waves of the ovarian follicles. GnRH induces ovulation or atresia of the dominant follicle and the recruitment of a new wave of follicular growth. The GnRH administration in the luteal phase of the estrous cycle induces growth waves synchronization of ovarian follicles, so that, a new wave of follicles started to grow at 5-6 days after administration. In our experiments, we administered 2ml Ovarelin (100 mcg GnRH), to three groups of cows (116 cows): in early luteal phase of the estrous cycle (days 4-5), in the middle of luteal phase (days 9-12), and late luteal phase (days 15-16). The rates of cows standing heat were 91.66% when GnRH was administered in early luteal phase, 95.22% when was administrated in the middle of luteal phase, and 73.68% in late luteal phase GnRH administration. After artificial insemination, the conception rates were 48.48% in early luteal phase, 52.5% at middle luteal phase and 46.42% in the late luteal phase of the estrous cycle.

Keywords: cow, estrous cycle, GnRH, luteal phase.

1. Introduction

Administration of GnRH induces an increase in LH concentrations and modifying the growth waves of ovarian follicles [1], also modifying the growth model of ovarian follicle [2]. Furthermore, the administration of GnRH induces ovulation or atresia of the dominant follicle [3]. Martinez et al. (1999) have shown that follicles larger than 10 mm in diameter, after administration of GnRH ovulate [4].

In cattle, GnRH administration during the luteal phase of the estrous cycle, determines the change of the distribution of different types of follicles in the ovaries, by increasing the number of medium follicles and reducing the number of large follicles

– due to thereof atresia or luteinization [2, 5]. Wolfenson et al. (1994) studied the dynamic development of ovarian follicles, by ultrasound, after administration of GnRH in the luteal phase of the estrous cycle [1]. They reported that preovulatory follicles were more uniform in size, as part of the same growth wave of ovarian follicles. GnRH induced atresia or ovulation of the dominant follicle, followed by recruitment and growth of a new follicular wave in the next 3-4 days following the hormonal treatment [6]. The administration of GnRH induces a transient increase in FSH secretion, associated with the emergence of a new wave of follicles [7]. The aim of our experiments was to test the reaction of cow ovaries to GnRH administration in different stages of the luteal phase of the estrous cycle.

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2. Materials and methods

The experiments were performed in two dairy cattle farms, from Ghilad–Timis County, in 2014-2016. The biological material for experiment consisted of 116 cows, Romanian Black Pied cattle breed.

In our experiments, we administered 2 ml Ovarelin (100 mcg GnRH), to three experimental cow groups: to 36 cows GnRH was administered in early luteal phase (days 4-5); to 42 cows GnRH was administrated in middle luteal phase (days 9-12); and to 38 cows GnRH was administrated in

late luteal phase (days 15-16). The aim of present experiment was to detect the cows in standing heat in the period of 3-6 days following administration of GnRH. Cows which showed standing heat were artificially inseminated (AI), according to the schedule am/pm. Finally, the experimental data were analyzed by Chi-Square test, using the statistical software–MINITAB 16.

3. Results and discussion

The results of our experiment are shown in Table 1.

Table 1. The reaction of cow ovaries to GnRH administration in different stages of the estrous cycle

Stage of estrous cycle	N	Females who experienced heat		Females artificially inseminated (AI) (n)	Females pregnant after the first artificial insemination (n)	Conception rate (Rc%)
		n	%			
Early luteal phase (days 4-5)	36	33	91.66 ^a	33	16	48.48 ^a
Middle luteal phase (days 9-12)	42	40	95.23 ^{aA}	40	21	52.50 ^a
Late luteal phase (days 15-16)	38	28	73.68 ^{bB}	28	13	46.42 ^a

^{a-a} $p > 0.05$; ^{a-b} $p < 0.01$; ^{A-B} $p < 0.001$.

Females who experienced heat and were artificially inseminated		
	Early luteal phase (days 4-5)	Middle luteal phase (days 9-12)
Middle luteal phase (days 9-12)	0.521 <i>is</i>	-
Late luteal phase (days 15-16)	0.042*	0.007**

Females pregnant after the first insemination		
	Early luteal phase (days 4-5)	Middle luteal phase (days 9-12)
Middle luteal phase (days 9-12)	0.733 <i>is</i>	-
Late luteal phase (days 15-16)	0.873 <i>is</i>	0.622 <i>is</i>

* $p < 0.05$; ** $p < 0.01$; *is*-insignificant differences between groups

The table data show that from the 36 cows to which were administered 100 mcg GnRH in early luteal phase (days 4-5), 33 cows (91.66%) showed standing heat 5-6 days after administration. Also, from the 42 cows at which were administered 100 mcg GnRH in middle luteal phase (days 9-12), 40 females (95.23%) experimented heat. From the 38 cows to which were administered GnRH (100 mcg) in late luteal phase (days 15-16), 28 cows showed standing heat, 5-6 days after administration. After data processing and statistical interpretation the results presents no significant differences ($p > 0.05$) between the group of cows that received GnRH in the early luteal

phase (days 4-5) and the group of cows that received GnRH in the middle luteal phase (days 9-12). But, there are significant differences ($p < 0.01$) between the cow groups with GnRH administration in the early luteal phase (days 4-5) and the group of cows to which GnRH was administered at the end of the luteal phase (days 15-16). Among the group of cows that received GnRH in middle luteal phase (days 9-12) and group of cows that received GnRH in the late luteal phase of the estrous cycle (days 15-16) there are very significant differences ($p < 0.001$). Cows that showed standing heat were artificially inseminated, after the program am/pm. In case of

GnRH administration in early luteal phase, from 33 cows which experimented heat, 16 cows become pregnant after the first insemination, which represents a conception rate of 48.48%. Also, from 40 cows experimented heat after GnRH administration at middle luteal phase, 21 cows remained pregnant after the first artificial insemination, which represents a conception rate of 52.50%. Referring to the cows which got GnRH in late luteal phase, from the 28 cows which showed heat, 13 cows remained pregnant after the first artificial insemination that represents a conception rate of 46.42%. After statistical data processing, there were no significant differences ($p>0.05$) between the three experimental groups of cows.

From the obtained data, it appears that the best results are achieved when GnRH is administered in middle luteal phase of the estrous cycle (days 9-12) when the percent of females standing heat is 95.23%, and the conception rate is 52.5%. Vasconcelos et al. (1999) [9] considers that these results are due to the fact that after administration of GnRH, the largest follicle of the first follicular growth wave loses its dominance. Ginther et al. (1996) [8] stated that after the disappearance of the dominant follicle from the first follicle growth wave, an increase in serum FSH is observed, followed by recruitment of a new growth wave of ovarian follicles [8]. Referring to not very positively results obtained in case of GnRH administration in late luteal phase (days 15-16), are caused by estrous cycles with three growth waves of ovarian follicle—73.68% rate of standing heat at 5-6 days after GnRH administration and 46.42% conception rate [9].

4. Conclusions

In dairy cows, after the administration of 100 mcg GnRH in the luteal phase of the estrous cycle, the females showed grouped standing heat, at 5-6 days after administration.

Cows receiving GnRH in the early luteal phase of estrous cycle (days 4-5) showed heat in a rate of 91.66%; those with GnRH administration in middle luteal phase (days 9-12) showed heat in a rate of 95.23%, and those receiving GnRH in late luteal phase (days 15-16) showed a heat rate of 73.68%; There are no significant differences ($p>0.05$) between the groups of cows stimulated in the early luteal phase and those stimulated in

middle luteal phase; Also, there are significant differences ($p<0.01$) between the group of cows stimulated in early luteal phase (days 4-5) and the group of cows stimulated in the late luteal phase (days 15-16). There are very significant differences ($p<0.001$) between the group of cows stimulated in the middle luteal phase (days 9-12) and the group of cows stimulated in the late luteal phase (days 15-16).

Conception rate after artificial insemination was 48.48% in early luteal phase, 52.5% in middle luteal phase and 46.42% in the late luteal phase of estrous cycle, but the differences are not significant ($p>0.05$).

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