THE EFFECT OF PROGESTERONE INTRAVAGINAL DEVICE AND GONADOTROPIN RELEASING HORMONE ON FERTILITY IN POSTPARTUM DAIRY COWS.

PENGARUH IMPLAN PROGESTERON INTRAVAGINA DAN *GONADOTROPIN RELEASING HORMONE* TERHADAP FERTILITAS SAPI PERAH PASCABERANAK.

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ABSTRACT

The study was carried out to determine the effect of progesterone intravaginal devices and gonadotropin releasing hormone on fertility in postpartum dairy cows. Thirty two postpartum dairy cows having body condition score 3 – 4 were used in this study. The cows were devided randomly into 4 groups. Group I (CIDR 9 d), II (CIDR 9 d + GnRH), III (CIDR 15 d), and IV (CIDR 15 d + GnRH). The GnRH was given at the time of insemination. The result of this study showed that the retention of CIDR devices and estrous induction was 100%. Estrous induction recorded on groups I, II, III and IV were 49.50 ± 1.51 ; 49.25 ± 1.67 ; 48.75 ± 1.28 ; 48.25 ± 1.04 hours, respectively. The pregnancy rate on groups I, II, III, and IV were 62.5 % ; 75.0 % ; 50.0 % ; 62.5 % respectively, no significantly different between groups (P>0.05). However, the mean milk progesterone concentration which take on day 7 of group II, had significantly higher (P< 0.05) than the other groups. It can be concluded that progesterone intravaginal devices and administration of GnRH at the time of AI could be used for induction of estrous and ovulation in dairy cows.

Key word: Progesterone, GnRH, Fertility, Postpasrtum Dairy Cows

ABSTRAK

Telah dilakukan penelitian untuk mengetahui pengaruh implan progesteron intravagina dan *gonadotropin releasing hormone* terhadap fertilitas sapi perah pascaberanak. Dalam penelitian ini digunakan 32 ekor sapi perah pascaberanak yang memiliki skor kondisi tubuh 3 – 4. Sapi – sapi tersebut dibagi menjadi 4 kelompok, kelompok I (CIDR 9 hari), II (CIDR 9 hari + GnRH), III (CIDR 15 hari) dan IV (CIDR 15 hari + GnRH). GnRH diberikan pada saat inseminasi. Hasil penelitian menunjukkan bahwa retensi implan CIDR dan angka deteksi estrus 100%. Waktu timbulnya birahi pada kelompok I (49,50 ± 1,51), II (49,25 ± 1,67), III (48,75 ± 1,28) dan IV (48,25 ± 1,04, jam) berbeda tidak nyata (P>0,05). Angka kebuntingan pada kelompok I (62,5 %), II (75,0 %), III (50,0 %) dan IV (62,5 %), berbeda tidak nyata (P>0,05). Namun demikian rata - rata konsentrasi progesteron pada hari ke 7, pada kelompok II nyata lebih tinggi (P< 0,05) dibanding dengan kelompok lain. Dari hasil penelitian dapat disimpulkan bahwa implan progesteron intravagina dan pemberian *gonadotropin releasing hormone* pada saat inseminasi dapat digunakan untuk induksi estrus dan ovulasi pada sapi perah.

Kata Kunci: Progesteron, GnRH, Fertilitas, Sapi Perah Pascaberanak

INTRODUCTION

Reproduction in dairy cattle plays an important role in the economic success of dairy farm. Reproduction not only produces the replacements that are necessary, but also serves to initiate milk flow. For the greatest overall return per cow, along life, regular reproduction and a minimum of low or non – reproductive periods are essential (Wells and Burton, 1999).

For dairy cows, it is important to maintain a calving interval of 364 day. The presence of noncyclic cows at the start of the breeding season can have a significant impact on the reproductive performance of a herd, leading to reduced farm profitability. The prevalence of anovulation in postpartum cows is affected by the interval from calving to start of the breeding season, age, bred, and nutrition. (Coleman, *et al.*, 1990 ; Xu and Burton, 1999).

Indonesian traditional dairy cows usually have low reproductive performance and low productivity. It is show from calving interval 30 month and conception rate 32 %. The longer calving interval cause from post-partum anestrus 62 %, it is consist subestrus, interference functional on ovary and uterus was 26 % and the cause postpartum anestrus was hipofunction ovarian, sista luteal and cista corpus luteum (Putro, 1987). Therefore, development of treatment program that can effectively induce estrus and ovulation in dairy cows have a major effect on herd reproductive performance.

Several program have been used for induction estrus and ovulation in dairy cows. Program involving progesterone and prostaglandin $F_2\alpha$ treatment. The development of long – term progesterone intrauterine devices for estrus synchronization in cattle in simpler, cheaper and more efficient ways. Progesterone intravagina device had been demonstrated to be effective in overcoming postpartum anestrus with inactive ovaries (Putro, 2000). However, lowered fertility was often experienced at first synchronized estrus with progesterone, especially after treatment for more than 10 days. Thus, treatment program for cows need to be developed that will improve conception rate in induced estrus.

In several studies, gonadotropin releasing hormone (GnRH) group near the time of insemination has increased fertilization rate, reduced the embryonic death rate (Tanabe, *et al.*, 1994). Administration of GnRH at the time insemination may modify the function of pre or postovulatory ovarian follicles or characteristics and secretory capacity of the developing corpus luteum (Mee, *et al.*, 1993). The study was conducted to determine the effect of progesterone intravagina devices and gonadotropin releasing hormone on fertility dairy cows.

MATERIAL AND METHODS

Animal and Treatment. Thirty two lactating Friesian cows between 2 and 4 years old, having body condition score 3 – 4, and in the luteal phase of normal estrous cycle were used in this study. At the beginning of this study all the animal were divided randomly into four treated groups. In the group I, a CIDR (controlled internal drug release) intravaginal implant (EAZI – BRED CIDR InterAg, Hamilton, New Zealand), a progesterone vaginal device contain 1, 33 gram progesterone, was inserted aseptically into the vagina for 9 days. Group II, a CIDR were inserted into vagina and injection intramuscular 250 µg GnRH (Gonadorelin, Fertagyl™ Intervetat, International B. V. Boxmeer Holland) at the time of insemination. Group III, a CIDR were inserted into vagina for 15 days, and in group IV, a CIDR were inserted into vagina as group III and then injected GnRH at the time of insemination.

The artificial insemination was done by fixed time at 58 an 72 hours after CIDR device removal with frozen semen. Pregnancy diagnosis by palpation per-rectum at 90 days after the AI. Throughout the study, milk samples were taken at day 0, 5 and 9/15 at the devices inserted, at the AI, day 7, 11 and 18 after AI. Milk samples were assayed for progesterone with a commercial ELISA kit (Ridgeway Science, UK). The intra – assay and intra assays coefficients of variation of the assays were less than 10 per cent.

Estrus detection rate was defined as the percentage of animals show estrous and were analyzed descriptively. The pregnancy rate was defined as the percentage of insemination cattle that were pregnant from insemination and were analyzed by a chi - square. Daily concentration of progesterone in milk were analyzed by ANOVA factorial 2 x 2.

RESULTS AND DISCUSSION

No heifers lost their CIDR devices during the synchronization period. It is show that CIDR devices effective for synchronization estrus postpartum dairy cows.

Estrous Induction (EI)

The result of this study show that all treated cows were estrous (100%). It was show that CIDR devices were effective for induction estrus. Progesterone group were effective in induced ovulation and estrous in heifer and cows (Smith *et al.*, 1987; Anderson *et al.*, 1982). Additionally, group of cows with progesterone or norgestomet in combination with GnRH or hCG during postpartum period induced ovulation and formation of corpus luteum with typical life spans (Smith *et al.*, 1987). The group with CIDR 9 days and 15 days can induce estrous in postpartum dairy cows. The result of this study was higher to the previous study reported by Clark *et al.*, (1999) 93.3 %, Ryan *et al.*, (1999) 98.7 %, Xu, *et al.*, (1997) 93.3 % and Xu and Burton, (2000) 92.8 %.

Average of estrous induction at group I (CIDR 9 day), II (CIDR 9 + GnRH), III (CIDR 15 day), and IV (CIDR 15 + GnRH) was 49.50 ± 1,51 ; 49,25 ± 1,6 ; 48,75 ± 1,28 ; 48,25 ± 1,04 hours respectively. It was likely that these cows were at a mid stage of follicular wave at the time of CIDR removal. Xu and Burton, (2000) found that interval from CIDR removal to onset estrous was 24 – 48 hours (55,7%) and 48 hour (27, 8 %).

In herd with low estrous detection rate, the use of estrous synchronization and fixed time insemination could improve herd reproduction performance by improving the efficiency and accuracy of estrous detection (Nebel and Jobst, 1998).

Pregnancy Rate

The pregnancy rate of synchronized cows to fixed time AI on group I, II, III and IV were 62. 5 % ; 75.0 % ; 50.0 % ; 62.5 % respectively, those data were not significantly difference (P>0.05). Group with CIDR + GnRH had higher pregnancy rate (75.0% ; 62,5%) than group by CIDR both 9 day and 15 day. (62.5% ; 50.0%), but there was no significant difference between CIDR and CIDR + GnRH (P>0.05).

The higher of pregnancy rate in the present study related to some factors as estrous expression, good insemination technique, timing of insemination and quality of semen, as well as the choice of animal that have 3 – 4 body condition score (BCS) (McDonald, 1971 ; Matsuda, 1997). Failure one of the factors can effect pregnancy rate result, although the other factor can also effect to pregnancy rate failure, such as early embryonic death (Salisbury and VanDemark, 1961). Hafez (1993) explained that the animal were not showing repeat breeding syndrome will result high pregnancy rate and vice versa, repeat breeding cows will result low pregnancy rate.

Tabel 1. Reproductive performance of dairy cows in the treatment with CIDR 9 , 15 day and addition GnRH at the time insemination

	CIDR		CIDR + GnRH	
	9 day	15 day	9 day	15 day
Estrous Induction (Hour)	49.50	49.25	48.75	48.25
Pregnancy Rate (%)	62.5[a]	75.0[a]	50.0[a]	62.5[a]

[a] They are no significant differences between groups (P>0.05)

The reduction in pregnancy rate of treatment CIDR 15 days could be due to the prolonged maintenance of dominant follicle by subluteal concentration of progesterone release from the CIDR device in the absence of corpus luteum, it was leading to decreased fertilization rate and increased embryonic death within a few days (Xu and Burton, 1999 ; Stevenson *et al.*,1990).

Twagiramungu *et al.*, (1995) and Xu and Burton, (2000) stated that GnRH could causes ovulation of the healthy dominant follicle on ovarian at the treatment by progesterone devices and corpus luteum could increase progesterone concentration in cows treated with CIDR. The pregnancy rate was not maximal due to the failure of fertilization or early embryonic death. Early embryonic death was occured after 30 day in heifer were 24,5 % and in cows were 32,5 % (Hunter, 1991).

Lee *et al* (1985) observed that dairy cows that become pregnant at their first postpartum service after injection of GnRH at the time of insemination has higher concentration of milk progesterone. Mee, *et al*, (1993) suggest that GnRH may have acted to enhance or alter theca – lutein or granulose – lutein differentiation in pre or postovulatory follicle or developing CL and (or) may have acted on developing CL to promote the conversion of small luteal cells to large cells, thereby increasing progesterone secretion.

Concentration of Milk Progesterone

Milk progesterone concentration were measured in milk samples taken throughout the study and the mean data for the four treated group are presented in Table 2.

Table 2. The mean ± SE milk progesterone concentration of treated groups.

Day of Taken Sample	N	Mean milk progesterone (ng/ml) (X ± SEM)			
		Group I	Group II	Group III	Group IV
0	2	5.00 ± 1.4	5.24 ± 1.19	4.65 ± 0.78	5.98 ± 0.68
5	2	7.89 ± 0.93	7.25 ± 0.83	5.58 ± 2.89	6.18 ± 0.73
9/15	2	15.99 ± 2.20	15.08 ± 1.91	14.73 ± 1.90	15.73 ± 1.78
IB	2	1.72 ± 0.49	1.42 ± 0.60	1.48 ± 0.60	1.53 ± 0.47
7 post IB	2	8.72 ± 2.47 [b]	13.16 ± 3.43 [c]	6.18 ± 0.77 [a]	9.68 ± 0.37 [b]
11 post IB	2	15.30 ± 1.19 [a]	14.58 ± 1.75 [a]	11.68 ± 3.55 [b]	11.56 ± 3.05 [b]
18 post IB	2	16.44 ± 1.23 [a]	17.89 ± 2.36 [b]	16.70 ± 4.02 [a b]	17.20 ± 4.02 [a b]

[a, b] Different superscript in the same row indicate significantly different (P<0.05).

The milk concentration of progesterone in the four treated groups were quite similar in pattern. They increased rapidly following CIDR insertion, reached maximum at day 9 of insertion for group I and II, at day 15 of insertion for group III and IV (15.99 ± 2.20 ; 15.08 ± 1.91 ng/ml and 14.73 ± 1.90 ; 15.73 ± 1.78 ng/ml, respectively, P>0.05). Five days after the CIDR insertion, milk concentration of progesterone increased rapidly in the group I, II, III and IV (7.89 ± 0.93 ; 7.25 ± 0.83 ; 5.58 ± 2.89 ; 6.18 ± 0.73 ng/ml) respectively, and reached to basal levels when cows were showing estrous behavior (1.72 ± 0.49 ; 1.42 ± 0.60 ; 1.48 ± 0.60 ; 1.53 ± 0.47 ng/ml, respectively, P>0.05).

The result analysis of milk progesterone show that concentration of progesterone in day 7 post artificial insemination increase significantly. The result of Duncan test show that group II significantly higher (P<0.05) than group I, III and IV (13,16 ± 3,43 ng/ml vs 8.72 ± 2,47 ; 6,18 ± 0,77 ; 9,68 ± 0,37 ng/ml, respectively). The analysis Duncan test concentration of progesterone day 11 show that group I and group II significantly higher than Group III and group IV (15,30 ± 1,19 and 14,58 ± 1,75 ng/ml vs 11,68 ± 3,55 and 11,56 ± 3,05 ng/ml). Whereas the concentration of progesterone day 18 after insemination show that group I significantly lower than group II.

The present study indicated that the CIDR is an effective device for continuous delivery of progesterone to enable synchronization of estrous in lactating dairy cows, as reported by Ryan *et al.*, (1999) Mberato *et al.*, (2001). The mean milk progesterone concentration increased significantly after CIDR insertion and reached a maximum mean concentration day 9 for group I and II and day 15 for group II and IV. Progesterone is know to suppress the pulsa concentration of LH, and thus indirectly suppress ovarian follicular maturation. After the CIDR removal, due the sudden decline in milk progesterone, the ovulatory follicle developed rapidly and animal exhibited estrous behavior. The low mean milk concentration of progesterone within two days after CIDR removal in present study agrees accordingly with a report that the follicular phase of estrous cycle is characterized by low secretion, and elevated estrogen, LH and FSH. The follicular phase of estrous cycles is completed by effect of the preovulatory surge of LH. After LH surge, production estrogen by the largest follicle is reduced and production of progesterone is increased

as the largest follicle become atretict as observed by Tribulo *et al.*, (1997).

The result show that given of GnRH at the time insemination show significantly effect to concentration of progesterone, because the GnRH although cause the ovulation also formed the new corpus luteum of more healthy so result of increase concentration of progesterone. Smith, *et al.*, (1987) state that the used progesterone intravagina device and addition GnRH cause the luteal function become normal, increase amount receptor progesterone in the uterus to control of released PGF_2 alfa. Treatment with GnRH at the time of insemination enhanced the lifespan of induction CL by increasing the frequency of LH (7,6 ± 0.9 ng/ml) during progesterone group (Mee, *et al.*, 1990).

It was concluded that the used of progesterone intravaginal device (CIDR) and GnRH at the time of insemination could be used for induction estrous and ovulation in dairy cows. The addition of GnRH at the time insemination may increase the pregnancy rate.

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