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Reproductive parameters in Holstein dairy cows treated with three resynchronization methods

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Abstract: *The objective of the present study was to determine the reproductive parameters in Holstein cows treated by different hormonal protocols during insemination and postpartum periods. The 114 dairy cows (multiparous) with BCS between 2.75 and 3 were divided into 3 groups in a completely randomized design. 38 cows were treated by Heatsynch method + eCG (M_1), 38 cows received Ovsynch + CIDR (M_2) and 38 cows were subjected to the Heatsynch method (M_3). Blood samples were taken to determine progesterone plasma contents in 14, 21 and 24 days after first insemination. Results showed that treatment with M_2 protocol significantly decreased days to first service and conception rate in the cows ($P < 0.05$). First service conception rate in cows treated with M_1 protocol was higher ($P < 0.05$) compared to M_2 and M3 protocol. Pregnancy rate in $M_1$was significantly higher than that of the other groups ($P \leq 0.05$). This difference could be due to equine chorionic gonadotrophin (eCG) which could have an effective function on ovulation, fertilization and embryo's vitality. Plasma progesterone levels of pregnant cows were higher than that of nonpregnants cows regardless the type of resynchronization protocols ($P \leq 0.05$). However, activation of ovaries, reinitiate estrous cycle and accordance between estrous and ovulation were increased when dairy cows subjected to the Heatsynch + eCG method (M_1). Thus, M_2 protocol is recommended for primiparous but not for multiparous cows, and T_3 protocol is not recommended for synchronization.*

Key words : *Progesterone, Reproductive indices, CIDR, Dairy cattle, eCG*

I.Introduction

Lactating dairy cows with high genetic merit and outstanding milk production are likely to be more vulnerable to fertility problems, such as lower AI conception rates, weaker expression of estrus, and greater embryonic loss after insemination than lower producing cows [18]. Reproductive efficiency in dairy herds increases by inseminating all the cows shortly after the end of the voluntary waiting period, obtaining high pregnancy rate to first service, enhancing embryonic and fetal survival, and detecting and re-inseminating non-pregnant cows. Ultrasonography enables early pregnancy diagnosis and detection of non-pregnant cows, which can be subjected to resynchronization of ovulation and timed AI (TAI) to minimize the problem of low estrus detection [24]. When estrus was synchronized and AI was scheduled after detected estrus in earlier studies, fertility was greater than when AI was made at fixed times after synchronization without regard to detected estrus [4, 19, 16]. Poorer fertility after timed AI (TAI) often was attributed to insufficient synchrony of estrus and ovulation to allow appropriate timing of AI relative to ovulation [8]. Deficiencies in luteal function [6], either before or after insemination, are associated with reduced fertility in beef [21] and dairy cattle [10]. In addition, concentrations of progesterone (P4) in blood 34 to 48 h before the preovulatory surge of LH were greater in cows that conceived compared with those that failed to conceive [7]. Thus, the magnitude of P4 concentrations before estrus may be associated with factors that increase the probability of conception. Blood concentrations of P4 during the luteal phase before insemination are associated positively with conception rate [9, 7, 12, 10, 26, 27]. Increased pregnancy rate was reported after intra vaginal inserts containing P4 were applied to cows that were synchronized with $PGF_{2\alpha}$ [33]. Therefore, reproductive performance of cows receiving the Ovsynch protocol may be improved if P_4 is administered during the 7 d between the first GnRH and the only $PGF_{2\alpha}$ injections. Progesterone should prevent premature estrus and ovulation during the period in which spontaneous luteolysis may occur in small percentages of cows whose dominant follicles are not responsive to the first GnRH injection [30, 25, 28, 31, 32]. Protocols for synchronization of ovulation and TAI, such as Ovsynch (GnRH on day 0, PGF 2a on day 7, GnRH on day 9 and TAI 16 h later; [25, 1997] and Heatsynch (GnRH on day 0, PGF 2a on day 7, ECP on day 8, and TAI on day 10; [22], insure that all cows are inseminated and generate acceptable pregnancy rates in lactating dairy cows. Since the stage of the estrous cycle is known to affect the response to these protocols [31, 20], a presynch program was developed that allows initiation of Ovsynch in the early- to mid- luteal phase of the estrous cycle, improving pregnancy rate to first service in cyclic cows [20]. Protocols for resynchronization of estrus that considered the stage of the estrous cycle have been applied after detection of non-pregnant cows by per rectum palpation of the uterus and assignment of protocols based on the presence or absence of a CL [1]. Another approach for resynchronization after non-pregnancy diagnosis by ultrasonography was either to initiate the Ovsynch protocol 7 days before ultrasonography or to take advantage of a natural resynchronization after previous service with application of shortened protocols that used PGF_{2a} to induce luteolysis and then GnRH [29] or ECP [3] to induce ovulation. An alternative is to consider the stage of the estrous cycle at the time of initiation of the resynchronization protocol by evaluating ovarian structures and uterine characteristics at the time of a non-pregnancy diagnosis. Determination of the stage of the estrous cycle can be done using per rectum examination and ultrasonography [24] of the genital tract. The objective of this study was to effects of different resynchronization methods on reproductive indices in lactating dairy cows.

II. Materials and methods

This study was performed at a private dairy farm housing consisting 300 Holstein Friesian milking cows with cooperation Rezvan Agriculture junior college located in Kerman province (latitude 25^0 55 $^/$ N, longitude 53^0 $26^/$ E , altitude 1755m) in Iran. Cows were housed in free stall barns and dry lots and fed a total mixed ration (TMR) thrice daily to meet or exceed requirements for lactating cows. Cows with reproductive abnormalities (i.e., metritis, pyometra, uterine or ovarian adhesions) were not included in the study. The 114 dairy cows (second lactation) with BCS between 2.75 and 3 were divided into 3 groups in a completely randomized design. 38 cows were treated by Heatsynch method + eCG (T1), 38 cows received Ovsynch + CIDR (T2) and 38 cows were subjected to the Heatsynch method (T3). **Group M_1 (n= 38):** Cows in the Heatsynch+ eCG group received 100 mg im of GnRH and 200 (IU) eCG on day 0, 25 mg im of PGF2α on day 7, 1 mg im of ECP(0.5 mL of ECP1 sterile solution; Pfizer Animal Health) on day 8, and TAI 48 h later (day10).

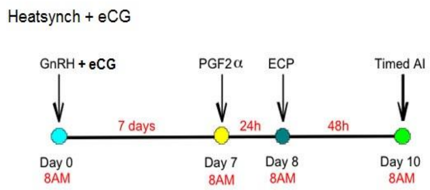

Fig. 1. Heatsynch + eCG protocol.

Group M_2 (n= 38): Cows in the Ovsynch + CIDR group received 100 mg im of GnRH (2 mL of Cystorelin1; Merial Ltd., Iselin, NJ, USA) on day 0, 25 mg im of PGF2α (5 mL of Lutalyse1 sterile solution; Pfizer Animal Health, New York, USA) on day 7, 100 mg im of GnRH on day 9, and TAI 16 h later (day 10).

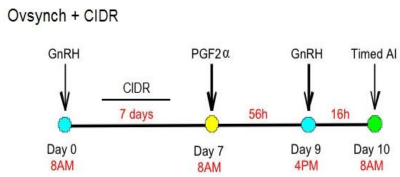

Fig. 2. Ovsynch + CIDR protocol.

Group M_3 (n= 38): Cows in the Heatsynch group received 100 mg im of GnRH on day 0, 25 mg im of PGF 2a on day 7, 1 mg im of ECP(0.5 mL of ECP1 sterile solution; Pfizer Animal Health) on day 8, and TAI 48 h later (day10).

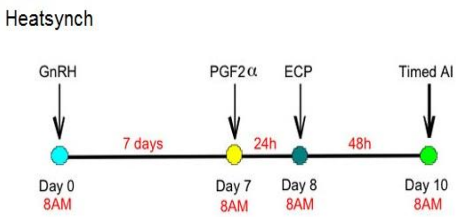

Fig. 3. Heatsynch protocol.

In days 14, 21 and 24 after insemination, blood samples were taken from jugular vein in 10-ml vacuum tubes (venoject) for pregnancy diagnosis. Serum was recovered by centrifugation (10 minutes at 3000 rpm) and stored at -20ºC until assayed for Serum progesterone concentrations using commercially available ELISA kit (Demeditec Diagnostics GmbH, Kiel, Germany). The reproductive parameters recorded. Data was analysed using the General Linear Model (GLM) procedures of statistical analysis system (SAS) by compeletly randomize design and the means were compared using Duncan´s multiple range test.

III.Results and Discussion

The results of reproductive parameters are summarized in (Table 1). The number of S/C for pregnant cows was lower for cows treated with M_2 protocol compared to M_1 and M_3 protocols respectively; $P < 0.01$). No difference ($P > 0.05$) was observed for Service/Conception (S/C) between the cows with $M_{1,}$ M2 and M_3 protocols. First service conception rate on Day 30 for cows in the M_1 protocol tended to be higher than those for cows in the M_2 and M_3 protocols. However, there was a significantly difference (P< 0.05) for FSCR amongst M_1 with M_2 and M_3 protocols.

Table 1. The effect of three resynchronization methods on reproductive parameters of dairy cows.

Parameter(s)	Heatsynch + eCG		Ovsynch + CIDR		Heatsynch	
	[5]RS	[6]OS	RS	OS	RS	OS
[1]FSCR (%)	%45	%55*	%57	%43	%67	%33
[2]SSCR (%)	%35	%65	32%	68%	%50	%50
[3]TSCR(%)	%30	%70	%27	%73*	%44	%56
[4]S/C	2/06 ± 0.24		1/98 ± 0.19		2/33 ± 0.25	
Open days	104		96		121	

[1]First service conception rate, [2]Second service conception rate, [3]Third service conception rate, [4]Service/Conception,[5]Return Scale, [6]Obtaion Scale

Synchronization of oestrus using prostaglandin programs in lactating cows is an established technique for reducing the post partum interval to first insemination [15, 23]. The results from this study showed that treatment with $PGF_{2\alpha}$ on Day 15 post partum has the potential to reduce days to conception and number of S/C only in cows that were treated with M_2 protocol (Table 1). These results are consistent with observations reported by Benmrad & Stevenson, [2] and Young et al. [34], who indicated that a single intramuscular injection of $PGF_{2\alpha}$ in the early post partum period reduced the post partum interval to conception. However, our results are in contrast with the results of López-Gatius and Camón-Urgel, [17], who reported that interval from calving to conception, number of services per conception and percentage of cows pregnant to first service were not influenced by treatment of $PGF_{2\alpha}$ on Day 14 post partum. Our results showed that treatment with $PGF_{2\alpha}$ on Day 15 post partum significantly improved FSCR only in cows were treated with M_1 protocol (Table 1). Results of this experiment revealed that Plasma progesterone in first group was significantly different than that of the other groups (Fig. 4).

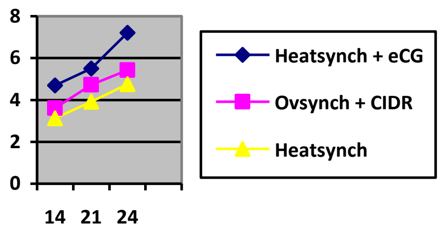

Fig.4. Mean blood progesterone concentration in days after AI.

Our results are in agreement with those of Young et al., [34] who reported that cows treated with $PGF_{2\alpha}$ between 4 and 28 days post partum, irrespective of post partum disease and/or abnormal calving, had a 25% higher first service conception rate than controls. Kasimanickam et al. [14] evaluated the effect of a single treatment with $PGF_{2\alpha}$ on fertility and reported an overall increase in pregnancy to first AI. DeJarnette and Marshall [5] found that two $PGF_{2\alpha}$ treatments can be advantageous for secondiparous. In an attempt to hasten uterine involution and thus shorten the interval from parturition to estrus, exogenous $PGF_{2\alpha}$ or its synthetic analogs have been administered early post partum (usually as a single dose, i.m.) in both dairy and beef cows with variable results [17]. However, there are conflicting reports on the effectiveness of exogenous $PGF_{2\alpha}$ to increase the rate of uterine involution, cause evacuation of bacterial contamination from the uterus, and subsequently improve conception rate [14]. These reports examined the use of $PGF_{2\alpha}$ on either one or two occasions between 12 and 40 days post partum, without regard to the presence of a functional corpus luteum. It has been shown that treatment with $PGF_{2\alpha}$ can increase uterine $PGF_{2\alpha}$ and luteal leukotriene B4 (LT_{B4}) secretion, and that LT_{B4} can enhance chemotaxis, random migration and antibody-independent cell-mediated cytotoxicity [11]. In the present study, administration of GnRH on Day 23 post-AI increased the days to conception and the number of S/C and decreased FSCR in cows treated with M_1 compared to M_2 protocol (Table 1). Several studies have investigated the effect of treatment with GnRH or equine chorionic gonadotropin (eCG) after insemination to improve fertility by inducing ovulation and forming an accessory corpus luteum [13]. Corpus luteum development results in secretion of P4, which influences embryo development, interferon-τ production, and inhibition of the luteolytic cascade. Administration of GnRH on days 22–23 after a previous AI should induce ovulation in the majority of cows and result in formation of a CL and synchronization of an ovarian follicular wave. Observations reported by Chebel et al. [3], indicated that the administration of GnRH on Day 21 after AI to lactating dairy cows of unknown pregnancy status, did not affect pre-enrollment pregnancy rates determined on Days 28 and 42 after insemination.

IV. Conclusion

It was concluded from the findings that treatment with $PGF_{2\alpha}$ on Day 15 post partum had a beneficial effect on the reproductive performance in cows were treated with M_1 and M2 protocol. Furthermore, administration of a GnRH agonist on Day 23 after AI did not improve reproductive performance for cows receiving first post partum TAI after Heatsynch protocol.

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