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Effects of Resynchronization with Progesterone and Prostaglandin $F_2\alpha$ on Estrus Response and Pregnancy Rate in Beef Cattle

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Abstract: This experiment was designed to compare the estrus response and pregnancy rate of cows first synchronized using CIDR with cows that were resynchronized after failing to display estrus. Estrus response and pregnancy rate were also compared between cows resynchronized with either CIDR or prostaglandin $F_2\alpha$ ($PGF_2\alpha$). Initially, 140 Brangus cows were synchronized with CIDR. About 30 days after Artificial Insemination (AI), cows were checked for pregnancy using ultrasound and those that remain open were divided into two groups and resynchronized with either CIDR or two injections of $PGF_2\alpha$ at 11 days interval. All cows were observed visually for estrus response for a period of 2 h at 12 h interval, starting immediately after CIDR removal or after the second injection of $PGF_2\alpha$. Cows were in estrus when they mounted if at least 3 times during the period of observation. Following removal of CIDR and second injection of $PGF_2\alpha$, cows were inseminated 60 and 70 h later, respectively. There were no significant differences ($p>0.05$) in estrus response and pregnancy rate between cows initial synchronization and resynchronization with CIDR protocol. Although, statistically not significant there was relatively higher percentage of estrus response (81.6 vs. 70%) and pregnancy rate (30.6 vs. 28.0%) in cows resynchronized with CIDR than cows resynchronized with $PGF_2\alpha$.

Key words: Beef cattle, resynchronization, CIDR, $PGF_2\alpha$, estrus response, pregnancy rate

INTRODUCTION

A good indicator to determine the reproductive performance of a cow is the Calving Interval (CI). A cow with good performance is expected to calf down every year. To attain a year round calving interval, management of estrous cycle in a herd of cows is very critical and this can be achieved by estrus synchronization (Cavalieri *et al*., 2008). However, resynchronization of estrus and insemination in open cows after a first unsuccessful synchronization are utilized to reduce variations in inter-estrus interval. This procedure have been reported to improve and maintain reproductive efficiency (Eagles *et al*., 2001; Stevenson *et al*., 2003; McDougall and Loeffler, 2004). Furthermore, following the first synchronized estrus and Artificial Insemination (AI), cows can also be resynchronized for the subsequent second and third estrous cycles (Cavalieri *et al*., 2000; Cavalieri and Macmillan, 2002). Several studies have reported that resynchronization treatments have helped to improve the reproductive performance of cows (Cavalieri and Macmillan, 2002; Cavalieri *et al*., 2004, 2008). A resynchronization protocol which involves placing a Progesterone Releasing Intra vaginal Device (PRID) 12-15 days after the first insemination for 7-8 days, combined with an i.m. injection of 0.5-1.0 mg Oestradiol Benzoate (OB) at the time of PRID insertion and another injection of equal dose within 24-48 h after PRID removal was previously reported to enhance pregnancy rate (Cavalieri *et al*., 2000, 2004, 2008). These treatments consistently increased the synchrony of return to estrus in non-pregnant cattle (Van Cleeff *et al*., 1996; Stevenson *et al*., 2003). However in CIDR-treated cattle, the initial pregnancy rate (Chenault *et al*., 2003) or the pregnancy rate after resynchronization (Stevenson *et al*., 2003) was reduced.

Prostaglandin $F_2\alpha$ ($PGF_2\alpha$) and its synthetic analogues have been used to control the estrous cycle in cattle (Wright and Malmo, 1992). Nevertheless, the effectiveness of $PGF_2\alpha$ to synchronize estrus is dependent upon the presence of a responsive Corpus Luteum (CL). Calving interval of 13.7 and 13.5 months

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have been reported in the Canada (Lucy, 2001) and the Netherlands (Fatehi and Schaeffer, 2003), respectively. Slow resumption of reproductive cycle during the postpartum period remains a problem in cattle raised in tropical countries like Indonesia and Malaysia with the period to first postpartum estrus reported to be about 4.5 months (Yimer *et al*., 2010). Synchronization program has been used to facilitate estrus detection rate but with varying degrees of success (Galina and Arthur, 1990; Bo *et al*., 2003). Therefore, the present study was conducted to depict estrus response and pregnancy rate of cows after synchronization and resynchronization with CIDR protocol as well as between groups of cows resynchronized with CIDR and $PGF_2\alpha$ protocols.

MATERIALS AND METHODS

The study was conducted in a herd of 140 cows over a period of 16 months at a commercial Brangus cattle farm in Johor, Malaysia (Lat: 2°6'N and long: 103°24' 34E). These cows were approximately 4 years old and have an average weight of 510 kg with body condition score of 5-6 (scale of 1-9) (Houghton *et al*., 1990). They were lactating with calves and between 50 and 55 days postpartum (Beal, 1983). All the animals were raised in pasture paddock with stocking rate of 50 cows/paddock. Each paddock is approximately 4 ha. The cows were fed with concentrates at 2 kg/head/day.

Synchronization of estrus: All of the 140 cows were initially synchronized with CIDR containing 1.38 g of progesterone (Pfizer Animal Health, New Zealand Ltd.) followed by AI. The 1st day of CIDR insertion was considered as day 0 of the estrous cycle and the cows were also given 2 mg of oestradiol benzoate (Cidirol, Biomac Laboratories Ltd.) intramuscularly. On the day of removal of the CIDR insert (day 8), cows were given 125 μg of $PGF_2\alpha$ followed by administration of 1 mL of OB the next day. Artificial Insemination (AI) using frozen semen thawed was performed 60 h after removal of CIDR.

Resynchronization of estrus: Pregnancy diagnosis was conducted 30 days after the first insemination by transrectal ultrasonography using an ultrasound scanner (Aloka SSD-500 Echo Camera, Japan) attached to a 5.0 MHz linear probe (Pierson and Ginther, 1984; Kastelic *et al*., 1988). Out of the total 140 cows inseminated following initial synchronization, 41 were confirmed to be pregnant and did used following program. Cows that did not conceive (n = 99) were randomly divided into two groups for resynchronization. The first group (n = 49) were resynchronized following the same method used in the first synchronization. The second group (n = 50) however were resynchronized with 125 μg $PGF_2\alpha$ (Estrumate, Schering-Plough Animal Health, Australia), injected at 11 days apart. Cows were inseminated using frozen thawed semen at 60 and 70 h after the removal of CIDR for the first group and after second the $PGF_2\alpha$ injection for the second group, respectively (Fig. 1).

Estrus observation: The cows were observed continuously in the paddocks for onset, duration and behavioral patterns of estrus for 120 h following CIDR removal and second injection of $PGF_2\alpha$. All cows were observed visually for mounting, standing to be mounted and number of mounts performed for a period of 2 h, immediately 0 h after removal of CIDR and second

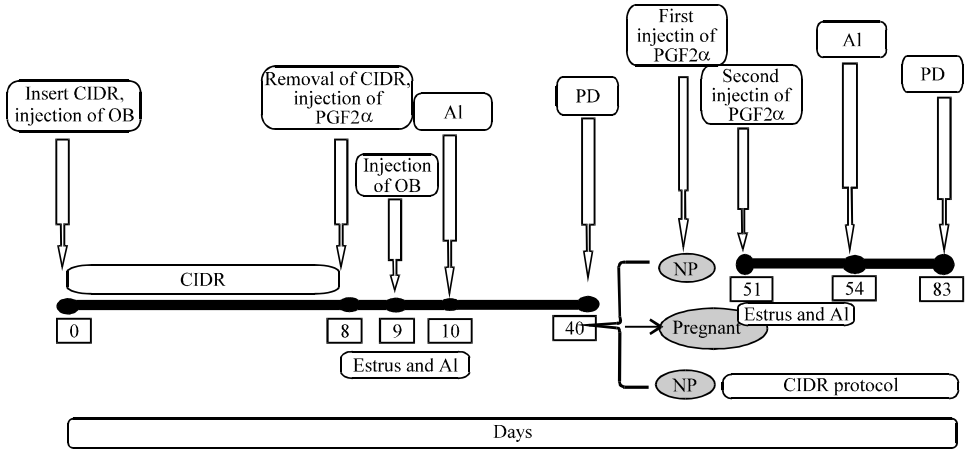

Fig. 1: Synchronization and resynchronization protocol with CIDR and $PGF_2\alpha$ administration in beef cattle

injection of $PGF_2\alpha$. Cows receptive to at least 3 mounts were considered to be in estrus (Acevedo *et al*., 2007; Busch *et al*., 2008). The percentage of estrus response was calculated by dividing the number of cows that manifested estrus signs with the total number of cows synchronized. Pregnancy diagnosis was conducted using transrectal ultrasonography as described previously 30 days after insemination.

Statistical analyses: Data on estrus response and pregnancy rate of cows after CIDR removal and second injection of $PGF_2\alpha$ (resynchronization) were computed by Chi-square analyses using the PROC FREQ of the SAS system (SAS Inst. Inc., Cary, NC, USA).

RESULTS AND DISCUSSION

The percentage of estrus response following initial synchronization with CIDR was 67.1% which is relatively lower than the estrus response observed after resynchronization (81.6%) using the same method (Table 1 and Fig. 2). However, the difference was not statistically significant ($p>0.05$). The percentage of estrus response of cows resynchronized with CIDR and $PGF_2\alpha$ are shown in Table 1 and Fig. 3. There was no significant difference ($p>0.05$) between the CIDR protocol and $PGF_2\alpha$ administration in terms of estrus response observed from 24-120 h after removal of CIDR and second $PGF_2\alpha$ injection. The pregnancy rate of postpartum cows were synchronized using CIDR protocol (29.2%) was lower than cows resynchronized with the same protocol (30.6%) but higher than cows resynchronized with $PGF_2\alpha$ injection (28.0%) (Table 1). Similarly, the differences among the three groups for pregnancy rates were not statistically significant ($p>0.05$).

One of the main determinants for successful pregnancy in cows is estrus detection. Accurate detection of estrus is essential in cows using AI. Inaccuracy in estrus detection results in insemination of cows that are not in estrus thus decreasing the herd conception rate (Jainudeen and Hafez, 2000). In the field, estrus detection after estrus synchronization is a prerequisite for better pregnancy rates. In the present study, comparison on estrus response between postpartum cows initially synchronized with CIDR and cows that were resynchronized using the same CIDR protocol after they failed to conceive from the first synchronization showed that estrus response in cows after first synchronization (68.0%) was lower than after resynchronization (80.0%). According to Rasby *et al*. (1998) a similar percentage of estrus response (80.0%) was reported in beef cows treated with CIDR for 7 days and estrus was observed about 1-3 days after CIDR removal. Two different resynchronization protocols in cows for estrus response and pregnancy rate were also compared in the present study. The proportion of estrus response manifested by

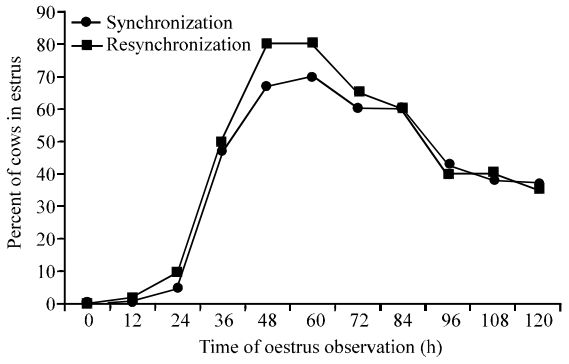

Fig. 2: Percentage distribution of estrus response in synchronized and resynchronized cows using CIDR observed at 12 h intervals

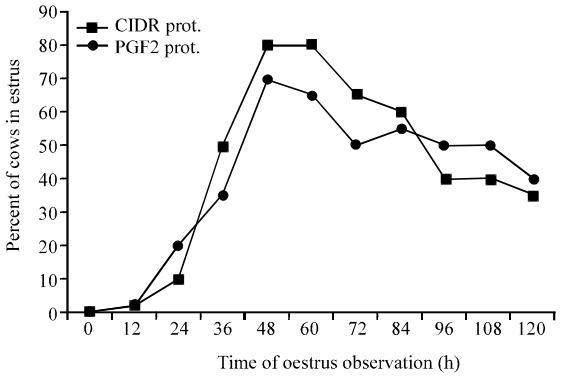

Fig. 3: Percentage distribution of estrus response in CIDR and $PGF_2\alpha$ resynchronized cows observed at 12 h intervals

Table 1: Percentage of estrus response and pregnancy initial synchronization after resynchronization using CIDR and $PGF_2\alpha$ administration

				Pregnancy (%) based on	
Items	Total population	No. of cows mounting (%)	Cows of pregnant	Estrus response	Total sample
Initial (synchronization)	140	94/140 (67.1)	41	39/94 (41.4)	29.2
Resynchronization (CIDR)	49	40/49 (81.6)	15	15/40 (37.5)	30.6
Resynchronization ($PGF_2\alpha$)	50	35/50 (70.0)	14	11/35 (31.5)	28.0

Non significant between resynchronization using CIDR and $PGF_2\alpha$ methods

cows resynchronized with CIDR protocol (81.6%) was higher than those resynchronized with $PGF_2\alpha$ (70.0%) (Table 1). The higher proportion of cows exhibiting estrus following CIDR may be due to enhanced ovarian activity induced by the combined treatment of progesterone, $PGF_2\alpha$ and oestradiol benzoate on day 9th in the CIDR protocol. The result of resynchronization with $PGF_2\alpha$ in the present study were comparable with those reported previously in Brahman (58.0%) and Holstein cows (71.0%) (Voh *et al*., 1987; Krininger *et al*., 2003).

The pregnancy rate observed in cows initially synchronized with CIDR in the present study was only 29.2% which was lower but not significant than those cows resynchronized with the same protocol (30.6%).

These results are in agreement with a previous study by Bartolome *et al*. (2005) that recorded a pregnancy rate of 28.4 and 28.6% following initial synchronization and after resynchronization using CIDR protocol, respectively. The low pregnancy rate after initial synchronization in the current study may be associated with lactation influence. Lactational anestrus and an erratic reactivation of ovarian activity during the postpartum period have been reported to adversely influence pregnancy rate in cows (Molina *et al*., 2003). Despite the high percentage of cows that showed standing heat observed in the group resynchronized with CIDR (81.6%), the pregnancy rate was low (37.5%). This might be due to failure of conception and early embryonic death (Jainudeen and Hafez, 2000). Sheldon *et al*. (2006) reported that the uterus is sterile during pregnancy but after parturition, the uterine lumen is almost always contaminated with a wide range of bacteria. According to Thatcher *et al*. (2006), the majority of postpartum cows failed to commence ovarian cyclicity in time and this limits successful reproductive management.

Estrus synchronization at 50 days postpartum is ideal for first AI. Cows that failed to conceive could still be resynchronized for second insemination. This protocol could reduce the long postpartum anoestrus and thus shortens the calving interval. Toelihere *et al*. (1980) reported that the ideal calving interval as 12 months; 9 months for pregnancy and 3 months for suckling and post partum periods during which the cow return to estrus. According to Cavalieri *et al*. (2008), postpartum estrus synchronization and resynchronization significantly improved the reproductive performance of cows enrolled in such programs.

CONCLUSION

In the study, the present study has revealed a similar effect of both initial synchronization and re-synchronization with CIDR protocol on Brangus cows in terms of the proportion of cows that exhibit estrus. Furthermore, both CIDR and $PGF_2\alpha$ protocols for estrus resynchronization in postpartum Brangus cows have indicated a similar proportion estrus response and pregnancy rates.

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