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Pregnancy rate following artificial insemination or natural service in postpartum estrus synchronized beef cattle

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Abstract: The objective of this study was to investigate the pregnancy rate following artificial insemination (AI) or natural service (NS) in postpartum estrous synchronized beef cattle. A total of 85 Brangus cows, postpartum, were divided into 2 groups. Group 1 consisted of 35 cows and was further subdivided into 7 groups, each consisted of 5 cows that were naturally mated. Group 2 consisted of 40 cows that were artificially inseminated. Estrus synchronization was carried out using a controlled internal drug releasing device (CIDR) containing 1.38 mg of progesterone, for 7 days. Group 1 cows were mixed with bulls at a 1:5 ratio of bull:cows for 7 days and group 2 cows were inseminated 55-58 h after the CIDR removal. Pregnancy was determined using transrectal ultrasonography 32 days after NS and AI. The pregnancy rate was higher in the NS group (28.6%) than in the AI group (18.0%), but the difference was not significant ($P > 0.05$).

Key words: Natural service, artificial insemination, estrus synchronization, conception rate

Introduction

Efficient reproduction is the most important factor for success and profitability for dairy and beef farmers when using artificial insemination (AI) or natural service (NS) (1). In cattle, in order to ensure optimal productivity, many factors influence reproductive efficiency such as calving interval and early return to normal estrous cycle after calving. NS and AI can be used for genetic improvement and to increase the cattle population. However, in tropical regions like Malaysia and Indonesia, NS is still the most frequently used method for breeding in cattle. There are several advantages in using NS, namely, bulls have the capability to identify estrus females prior to breeding (2). Lower cost and better estrus detection are obtained with NS compared with AI (3). AI is an appropriate technology that has been used to increase the cattle population. The pregnancy rate, however, is still relatively low in tropical beef cows.

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In order to achieve a calving interval of 1 year, an optimum postpartum period of 65 days is recommended. This is then followed by conception within 85 to 90 days of the postpartum period (4-6). However, the postpartum stage can be affected by many factors such as prolonged postpartum anestrous period, increase incidence of metabolic diseases, and uterine infections after calving (2,7). Furthermore, Gordon (8) reported that the most significant factors prolonging the interval from calving to conception were breed of cow, body condition, time of year when calving occurred, when suckling was allowed, and the motivation exerted by the calf. Usually, in postpartum beef cattle, recommencement of ovarian cyclicity is reported to be postponed 35-60 days postpartum compared with dairy cows, and the impediment is affected by many factors such as nutrition and cow-calf interaction (9).

Estrus synchronization in a group of female cows allows one to predict the time of estrus with logical accuracy. This reduces the time required for discovery of estrus, or in some cases makes it possible for timed AI without detection of estrus (10). First service conception rate is a very important index that measures the ability of the cow to become pregnant after the first service either by AI or NS. It is extremely important to evaluate the percentage of pregnant females at first service (11). Therefore, the objective of this study was to investigate and compare the rate of pregnancy between NS or AI in postpartum estrus synchronized beef cattle.

A total of 85 Brangus cows (55-60 days postpartum), average weight of 550 kg and aged approximately 4 years, were selected for this study. The cows were divided into 2 groups. Group 1 consisted of 35 cows, which were further subdivided into 7 groups. Each of the 7 groups consisted of 5 cows, which were naturally serviced with 7 Brangus bulls with average body weights of 820 kg and aged approximately 5 years. Group 2 consisted of 50 cows that were artificially inseminated. All of the animals were managed under pasture conditions in separate paddocks planted with *Brachiaria decumbens*, *Digitarria decumbens*, and *Setaria decumbens*, and the bulls were fed 5 kg/head daily and the cows were fed 2 kg/head daily. The research location was situated 50 m above sea level, with average temperature of 30 °C and relative humidity of 87.5%.

Estrus synchronization was carried out using a controlled internal drug releasing device (CIDR) containing 1.38 mg of progesterone (Pharmacia Limited Company, Greenlane, Auckland, New Zealand) (see Figure 1). The device was inserted intravaginally for 8 days. All of the cows were given 2 mg of oestradiol benzoate (Cidorol, Biomac Laboratories Ltd), intramuscularly on the day of the CIDR insertion (day 0). On the day of the CIDR removal, 125 µg of prostaglandin (Estrumate, Schering-Plough Animal Health, Australia) was injected intramuscularly. One day after the CIDR removal, all of the cows were given 1 mg of oestradiol benzoate. Group 1 cows were separated and each group, consisting of 5 cows, was assigned to a bull for 5 days. Cows in both groups were observed visually

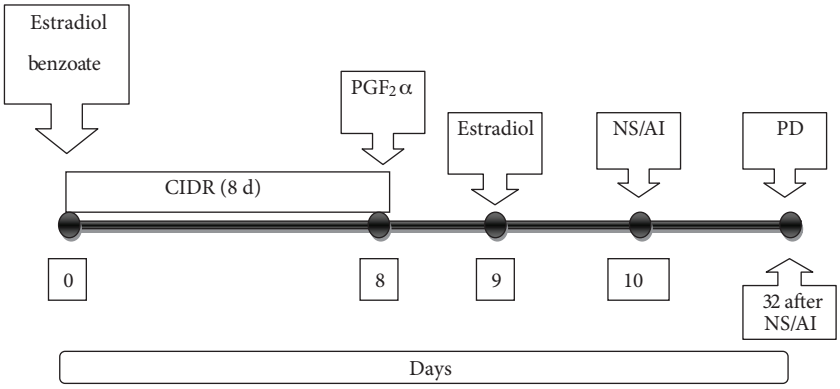

Figure 1. Schematic representation of estrus synchronization procedure using CIDR protocol.

for estrus at 0600-0800, 1200-1400, and 1600-1800, starting on day 10. A cow was identified as in estrus once it had received 1-3 mounts. Group 2 were inseminated 55-58 h after removal of the CIDR.

Pregnancy diagnosis was conducted 32 days after NS and AI by transrectal ultrasonography using a 5.0 MHz linear probe attached to an ultrasound scanner (Aloka SSD-500 Echo Camera, Japan). Proportions of cows that showed estrus after the CIDR removal and pregnancy rates after NS and AI were analyzed by chi-square analyses using the PROC FREQ procedure of SAS Ver. 9.0.

Pregnancy rates in the NS group varied between 0% and 60% (average 28.6%) (Figure 2). The pregnancy rate in the AI group was 18.0% (Table). Although the pregnancy rate in the NS group (28.6%) was numerically higher than it was in the AI group (18.0%), the differences were not statistically significant ($P > 0.05$). Figure 3 shows the characteristics of estrus response after the CIDR removal and prostaglandin injection. The result of this study also shows that estrus response was not significantly different ($P > 0.05$) between observation of the NS and AI groups.

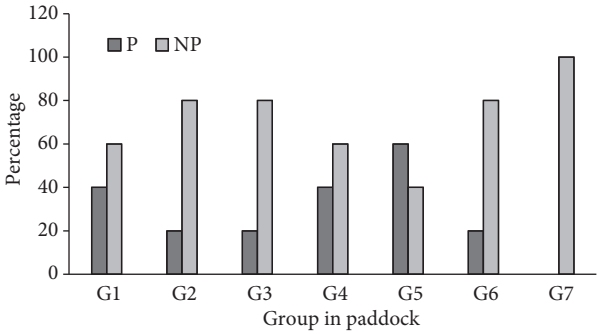

Figure 2. Conception rate in naturally mated estrus synchronized cows.

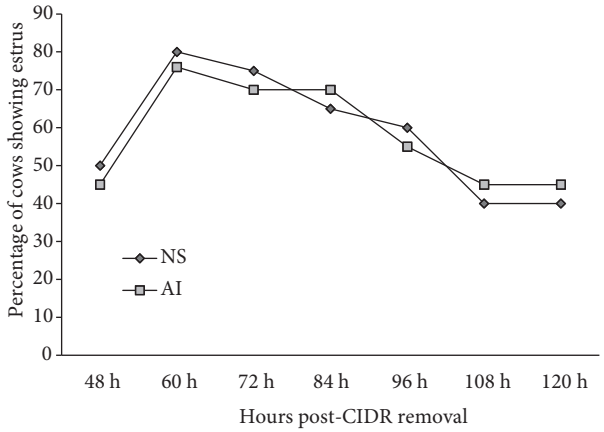

Figure 3. Percentage of estrus synchronized cows showing estrus response in NS and AI groups.

Although higher pregnancy rates were obtained in the NS group compared with the AI group, the difference was not statistically significant. This is in agreement with results reported by Williamson et al. (12) and Niles et al. (13), who obtained similar pregnancy rates from dairy cows bred by NS or AI. Higher pregnancy rates in the NS group compared with the AI group could be due to higher estrus detection by bulls in the NS group. Molina et al. (14) reported that when cows were exposed to bulls the number of females cycling increased, and consequently, the pregnancy rate also increased. The pregnancy rate in the AI group observed in this study was lower than previously reported (15). Additionally, Bartolomo et al. (16) reported that AI after estrus synchronization by a CIDR at 55 days postpartum in dairy cows resulted in a pregnancy rate of 33.2%.

Lower pregnancy rates in the NS and AI groups in this study could be caused by several factors such as suckling, which could be the most important factor. Milk let down involves many hormones, especially

Table. Pregnancy rates of postpartum estrus synchronized beef cattle following natural service and AI.

Breeding method	Number of cows	Number of cows pregnant	Pregnancy rates (%)
Natural service	35	10	28.6
Artificial insemination	50	9	18.0
			Not significant

prolactin (17), which has an effect of maintaining the corpus luteum (CL) in the ovaries. This will hinder the usual process of gonadotropin hormone secretion, which in turn prolongs the estrous cycle (18). Furthermore, Son et al. (19) reported that suckling and poor nutritional administration were the main causes of low reproductive efficiency attributed to long calving, conception interval, and reduced fertility.

Problems associated with parturition can also be a factor affecting the low conception rate in both groups. Infection at the time of parturition could extend the time to postpartum estrus. According to Sheldon et al. (20), the uterus is sterile for the period of pregnancy, but after parturition the uterine lumen is almost always contaminated with a wide range of bacteria. Subsequently, 15%-20% of cows have clinical diseases (postpartum endometritis and subclinical endometritis) that continue for up to 3 weeks. (20-23).

Although all of the cows in both of the groups showed standing heat after estrus synchronization, the variation of pregnancy rates was high. This could also be due to the failure of conception or early embryonic death (10). Other factors such as genetics, ovarian dysfunction, uterine infection, semen quality, nutrition, and environment may also contribute to low pregnancy rates (15). In conclusion, the pregnancy rate in postpartum estrus synchronized beef cows following natural service was better than artificial insemination.

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