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Applying variations of the Ovsynch protocol at the middle of the estrus cycle on reproductive performance of lactating dairy cows during summer and winter

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Abstract

Two modifications of the Ovsynch protocol, GnRH + TAI after $PGF_{2\alpha}$ 48 h (CO-48) or 72 h (CO-72), were compared with the original protocol (OVS: GnRH–7 d–$PGF_{2\alpha}$–2 d–GnRH–16 h–TAI) to study their effects on reproductive performance in 785 lactating dairy cows (Holstein Friesian, Bos Taurus). Results showed that more cows ($P < 0.001$) returned to estrus within a week after TAI with CO-48 treatment compared with that in OVS and CO-72 treatments. Pregnancy rates were greater ($P < 0.001$) for the CO-72 cows than those for both OVS and CO-48 treatments and for primiparous cows compared with multiparous cows. Moreover, pregnancy rates were lower in summer compared with those in winter. Pregnancy losses for cows in both CO-48 and CO-72 were greater ($P < 0.05$) than that for cows in OVS treatment. Pregnancy losses were greater in summer ($P < 0.001$) than in winter and for multiparous cows ($P < 0.001$) than for primiparous cows. In conclusion, primiparous and winter-bred cows had greater pregnancy rates and fewer pregnancy losses than those of multiparous cows and summer-bred cows, respectively. Because of the presence of significant treatment, parity, and season interactions, TAI with ovulation synchronization protocols should be tailored according to the season and parity. CO-72 is recommended for primiparous cows but not for multiparous cows, and CO-48 is not recommended for synchronization. Furthermore, cows that exhibited estrus at any time were inseminated to improve pregnancy rates in ovulation synchronization protocols.

Keywords: Cosynch; Dairy cow; Ovsynch; Pregnancy rate; Season

1. Introduction

Fertility in dairy cows is defined as the ability of the animal to conceive and maintain pregnancy if inseminated at the appropriate time relative to ovulation [1]. Poor reproductive performance is an emerging trend in dairy cattle farms. Failure of estrus detection and embryonic or fetal losses are among the leading causes behind this poor performance [2]. Detection of estrus is an essential component of postpartum breeding programs that depend on overt signs of estrus for optimal timing of insemination. About 50% of standing heats are undetected during the postpartum period [3,4]. This inefficiency in estrus detection can increase the average interval between successive inseminations to about 40 to 50 days [5] and limits both reproductive efficiency and profitability. Timed artificial insemination (TAI) has been advised to overcome the problem of inefficient estrus detection.

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Programmed breeding systems are beneficial to the management of reproduction of dairy cows because it is a method to schedule and control the insemination program of lactating dairy cows. Therefore, estrus-synchronization programs should aim to synchronize follicular wave development as well as the onset of estrus and ovulation. The Ovsynch protocol (GnRH–7 d–$PGF_{2\alpha}$–2 d–GnRH–16 h–TAI) is an effective planned breeding program that allows insemination of cows artificially without estrus detection [6,7]. Conception rates after this program vary in the literature. Numerous factors have been identified to influence the rate of conception such as body condition score [8], stage of estrus cycle at the initiation of the protocol [9,10], parity [11–13], and heat stress [14–16]. Various times have been recommended for the intervals between $PGF_{2\alpha}$ and second GnRH and TAI in the Ovsynch protocol. Pursley et al. [17] administered GnRH 48 h after $PGF_{2\alpha}$ to cows in the Ovsynch protocol and used various intervals between GnRH and TAI breeding from 0 to 32 h at 8-h increments. Pregnancy outcomes in their study resulted in a quadratic response curve, indicating that there may be an optimal time of AI around 16 h after the second GnRH with flexibility in the time of AI in relation to ovulation.

A Cosynch protocol has been used as a specific modification of Ovsynch in which cows receive TAI immediately after the second GnRH administration [18]. This procedure allows dairy managers to restrain cows for treatment purposes one time less compared with the original Ovsynch protocol but more importantly allows for handling all cows at the same time each day, thereby potentially decreasing labor cost and stress. Pregnancy rates using the Cosynch protocol were similar [19] or lower [20] than those obtained after using the Ovsynch protocol when cows were inseminated 24 h after the second GnRH administration. Further modification in Ovsynch and Cosynch protocols led to the development of Cosynch-72 in which GnRH administration and TAI were scheduled 72 h after $PGF_{2\alpha}$ administration. Portaluppi and Stevenson [21] reported that pregnancy rates were greater for G72+TAI72 than for G48+TAI48 and G72+TAI72 protocols. They suggested that delaying the time of the second GnRH and AI might improve Ovsynch results, at least during the first AI after presynchronization. In our study, we started Ovsynch protocol in cows 10 days after they were observed in heat (middle of the estrus cycle), which has been shown to be a more optimal time to initiate Ovsynch protocol compared with the early or late estrus cycle [9] with different intervals between $PGF_{2\alpha}$ and GnRH in TAI. We hypothesized that administration of GnRH and TAI at 72 h after $PGF_{2\alpha}$ (CO-72) could improve pregnancy rate compared with administration of GnRH and TAI at 48 h after $PGF_{2\alpha}$ (CO-48) or Ovsynch (GnRH + $PGF_{2\alpha}$ + GnRH) with TAI 16 h after the second GnRH (OVS) because a large number of cows come to heat around 72 h after $PGF_{2\alpha}$ administration. Pregnancy rates are usually low in summer months compared with those in winter months [13,14]. Therefore, the objective of this research was to study the effect of various modifications of the Ovsynch protocol during summer and winter on reproductive performance of lactating dairy cows.

2. Materials and methods

2.1. Cows, housing, feeding

This study was performed at a private dairy farm housing approximately 2700 Holstein Friesian milking cows located in the Alkhaldia area of the northern part of Jordan at 32°33′ N, 35°51′ E during the period between June 2005 and January 2006. Environmental data for mean maximum temperature (31.1 ± 1 °C and 16.9 ± 1.1 °C), minimum temperature (15.9 ± 1.1 °C and 5.8 ± 2.1 °C), and relative humidity (51.9 ± 1.2% and 61.1 ± 1.2%) during the experimental period for summer (June to September) and winter (October to January) months, respectively, were obtained from the Official National Station in the Alkhaldia area. Cows were housed in free-stall barns provided with shade and were milked three times daily at 8-h intervals. The rolling average milk yield for the herd was 8500 kg per lactation. Cows were fed total mixed ration (TMR) of 40% forage (corn silage and alfalfa hay) and 60% concentrate (corn, barley, wheat bran, soybean meal, and commercial concentrate for lactation with trace minerals and vitamins) containing 1.80 Mcal net energy of lactation (NE_L)/kg and 19% crude protein (CP) (dry matter (DM) bases) according to National Research Council (NRC) recommendations [22]. Cows had free access to fresh water.

2.2. Experimental design

A total of 850 lactating Holstein Friesian dairy cows (Bos Taurus) (primiparous, n = 370; and multiparous, 3.5 to 7 yr old, n = 480) were subjected to an estrus detection program between Days 25 to 30 postpartum. The program included an ALPRO system with an activity meter (Delaval International AB, Tumba, Sweden) fitted to the neck of every cow to detect and record the activities exhibited by the cow when she approaches heat and transmits data every hour to the computer. In addition, standing heat was confirmed by visual observation. If