Livestock Science 163 (2014) 172–180

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Effect of estrus expression prior to ovulation synchronization protocols on reproductive efficiency of lactating dairy cow

Mufeed A. Alnimer [a,*], Mohammed M. Ababneh [b]

[a] Department of Animal Production, Faculty of Agriculture, University of Jordan, Amman 11942, Jordan
[b] Department of Veterinary Clinical Sciences, Faculty of Veterinary Medicine, Jordan University of Science and Technology, Irbid 22110, Jordan

ARTICLE INFO

Article history:
Received 20 December 2012
Received in revised form
16 February 2014
Accepted 19 February 2014

Keywords:
Dairy cows
Estrous
Cosynch
Presynch
Fertility
TAI

ABSTRACT

Cosynch-72 (CO-72) is one of the most widely known timed AI (TAI) protocols in cattle. The protocol involves giving GnRH on d-7, $PGF_{2\alpha}$ on day 0, and the second GnRH on day 3 concurrent with AI. CO-72 has been adapted as the standard reproductive management protocol in postpartum (pp) dairy cows in several large dairy farms in Jordan. This research was conducted to study the effect of estrus detection and presynchronization strategy prior to Cosynch protocol on reproductive efficiency of lactating dairy cows in Jordan. Cows ($n=1220$) were injected with $PGF_{2\alpha}$ on day 30 ± 3 pp and observed for signs of estrus over the experiment. Cows detected in estrus before ($n=21$) or after ($n=409$) $PGF_{2\alpha}$ injection underwent to CO-72 protocol starting with GnRH 12 days after heat (control group; HCO-72). In contrast, cows that were not detected in estrus were randomly assigned into two treatments (NHCO-72; NHOV-CO-72): cows in the NHCO-72 treatment underwent a CO-72 protocol on day 44 ± 3 pp; while cows in the NHOV-CO-72 treatment underwent a first CO-72 protocol without AI starting on day 44 ± 3 followed by another CO-72 protocol with AI seven days after the last GnRH injection (day 61 ± 3). Cows showed premature estrus (≤ 48 h post-$PGF_{2\alpha}$) ($n=184$) were excluded from the study. Cows in NHOV-CO-72 treatment had higher ($P<0.05$) pregnancies per AI (P/AI) and reduced pregnancy losses (PL) (42.8, 14.5%) than those in HCO-72 (27.1, 43.0%) and NHCO-72 (26.8, 42.5%) treatments, respectively. Pregnancies per AI and PL were significantly ($P<0.05$) affected by parity and season. Primiparous had higher P/AI and reduced PL (35.4, 21.4%) than multiparous cows (28.7, 41.7%; respectively). Cows inseminated in cold months had higher P/AI and reduced PL (35.9, 17.9%) than cows inseminated in hot months (24.8, 52.9%; respectively). In conclusion, presynchronization in the NHOV-CO-72 treatment increased P/AI and reduced PL when compared to the other two treatments. Detection of estrus before the beginning of Cosynch did not affect fertility and cows exhibiting heat at any time during the synchronization protocol should be inseminated to maximize P/AI. Improvement in the NHOV-CO-72 in this study was probably due to later insemination and not for induction of cyclicity as there were no differences between HCO-72 and NHCO-72.

1. Introduction

Poor reproductive efficiency is a worldwide problem affecting the dairy industry. Recent studies have shown that, under modern management and housing systems,

* Corresponding author. Tel.: +962 6 5355000x22400; fax: +962 6 5355577.
E-mail address: amufeed@ju.edu.jo (M.A. Alnimer).

http://dx.doi.org/10.1016/j.livsci.2014.02.017
1871-1413

delay in the onset of postpartum (pp) ovarian activity, inaccurate detection of estrus and early embryonic mortality are the major reproductive problems. Expression of estrus during the first month pp and early resumption of pp ovulation have been reported to improve reproductive efficiency in dairy cows (Thatcher and Wilcox, 1973; Walsh et al., 2011). In high-producing dairy cows, 6–59% of the pp Holstein cows do not resume cyclicity by 60 day or before the first service artificial insemination (AI) (Santos et al., 2009). These cows experience reduced Pregnancies per AI (P/AI) and increased pregnancy losses (PL) following the first AI (Chebel et al., 2006; Santos et al., 2004, 2009).

Research has been conducted to control the estrous cycle of the cow with the administration of hormones. Timed AI (TAI) programs rely on control of the estrous cycle by synchronizing follicular development, CL regression, and, ultimately, ovulation to allow for TAI with adequate P/AI (Thatcher et al., 2001). One of the most accepted TAI protocols in dairy herds is the Ovsynch protocol (Pursley et al., 1997). This protocol consists of an injection of GnRH, followed 7 days later by a luteolytic dose of $PGF_{2\alpha}$, a second GnRH injection is given at 48 h after $PGF_{2\alpha}$, and fixed-time AI is performed 16–24 h later. Several modifications of this protocol have been developed with the intention to improve P/AI. Improved P/AI using the protocol known as Presynch Ovsynch in cycling cows (El-Zarkouny and Stevenson, 2004; Moreira et al., 2001; Navanukraw et al., 2004), but not anovular cows have been reported (Moreira et al., 2001). Anovular cows have reduced fertility to TAI following Ovsynch (Chebel et al., 2006; Gümen et al., 2003). On average 20 to 30% of cows are anovular at the time of first service TAI (Gümen et al., 2003; Lopez et al., 2005; Moreira et al., 2001). A variant of Ovsynch program known as Cosynch-72 proved superior to other programs (Alnimer et al., 2009; Portaluppi and Stevenson, 2005). In this program the second GnRH and TAI is performed at 72 h after $PGF_{2\alpha}$. Induced cyclicity using progestins with or before application of synchronization protocols was shown to improve P/AI compared with cows that were not cycling. Souza et al. (2008) developed a new program (Double-Ovsynch) for ovulation synchronization. This new protocol involved two sequential Ovsynch protocols with the second protocols starting 7 days after the last GnRH of the first Ovsynch. Due to its length, this protocol is recommended to breed cows in their first AI pp. Souza et al. (2008) found that P/AI were greater in the Double Ovsynch than in the Presynch–Ovsynch protocol (49.7% vs. 41.7%, respectively). This improvement was apparent in primiparous cows (65.2% vs. 45.2%) with no difference between treatments observed in multiparous cows (37.5% vs. 39.3%). They explained that the improved response of cows to the new protocol was due to induced cyclicity and increased stage synchronization of the cycle at Ovsynch initiation in primiparous cows.

Under farm conditions, determination of cow cyclicity is dependent on heat detection and rectal palpation findings. Errors in rectal palpation especially with the increase in numbers of farmers and AI technicians performing the exam make heat detection the only practical mean to determine cyclicity. Furthermore, estrous detection aids improved estrous detection efficiency and accuracy. These aids vary from mount detection devices, activity meters, cameras and hormone analysis. Therefore, the objectives of this study were to test if detection of estrus after $PGF_{2\alpha}$ injection on day 30 pp by means of visual observation and activity meters can affect the response to Cosynch-72 and to determine if induction of cyclicity in cows that were not detected in estrus after $PGF_{2\alpha}$ injection on day 30 pp by application of Ovsynch–Cosynch can improve reproductive response in comparison with Cosynch-72 alone in those cows that were not detected in estrus.

2. Materials and methods

2.1. Cows, housing, and management

Holstein Friesian lactating dairy cows were housed in free-stall barns provided with shades on a commercial dairy farm located in Alkhaldia area of the northern part of Jordan at 32°33′N, 35°51′E during the period between January 2008 and December 2009. Cows were milked three times daily at 8 h intervals with an average milk yield of around 8000 kg per lactation (305 days). Cows were fed a 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 1.75 Mcal net energy of lactation (NE_L)/kg, 17% crude protein (CP) at dry matter (DM) basis according to National Research Council (NRC) recommendations (2001). Cows had free access to fresh water.

Meteorological data consisted of daily maximum and minimum temperatures and relative humidities were obtained from the Official National Station at Dulail area 2 km away from the farm. Mean maximum temperature (35.5 °C and 22.0 °C), minimum temperature (22.0 °C and 6.6 °C), and relative humidity (55.5% and 58.1%) were recorded during the hot and cold months of the years, respectively. This information was used to calculate the temperature humidity index (THI) for each day, using the following equation:

$THI = Temperature - (0.8 \times temperature) + (RH/100) \times (Temperature - 14.4) + 46.4$ (McDowell et al., 1979; highest daily temperature in Celsius degrees; RH refers to maximum relative humidity). Therefore, THI ranged between 75.5 and 64.2 during the experimental period for hot (June to September) and cold (October to May) months, respectively.

2.2. Experimental design

A total of 1270 lactating Holstein Friesian dairy cows (*Bos taurus*) were subjected to an estrus detection program starting on day 25 pp until the end of experiment. 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. Although there is currently a consensus that routine postpartum $PGF_{2\alpha}$ injections do not show any significant improvement of the reproductive performance, reproductive management program of this dairy farm utilizes the strategic injection of $PGF_{2\alpha}$ during the 4 week PP. Fifty cows were excluded from the study due to different reasons