Theriogenology 93 (2017) 84–92

Contents lists available at ScienceDirect

Theriogenology

journal homepage: www.theriojournal.com

The effect of Presynch-Ovsynch protocol with or without estrus detection on reproductive performance by parity, and the long-term effect of these different management strategies on milk production, reproduction, health and survivability of dairy cows

V.S. Machado [a], R.C. Neves [a], F.S. Lima [b], R.C. Bicalho [a, *]

[a] Department of Population Medicine and Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, NY 14853, USA
[b] Department of Veterinary Clinical Medicine, University of Illinois Urbana-Champaign, Urbana, IL 61802, USA

ARTICLE INFO

Article history:
Received 4 November 2016
Received in revised form
22 January 2017
Accepted 30 January 2017
Available online 1 February 2017

Keywords:
Estrus detection
Timed artificial insemination
Reproduction

ABSTRACT

During the Presynch-Ovsynch protocol, at least half of the cows enrolled display signs of estrus, which can present as an opportunity for cows to be inseminated before the completion of the protocol. The primary objective of this study is to compare two management strategies for first service using the Presynch-Ovsynch protocol: insemination at completion of the Presynch-Ovsynch program (TAIonly) or insemination after estrus detection during the Presynch-Ovsynch protocol, with the remainder of cows being inseminated at timed artificial insemination (ED + TAI). Cows inseminated at completion of the protocol have a longer voluntary waiting period, which could potentially extend their lactation length, allowing them to recover BCS at the end of their lactation and ultimately impacting their subsequent lactation. Therefore, this study has a secondary objective to evaluate the long term impact of these two strategies on reproductive outcomes, culling, milk production and health during the subsequent lactation. A total randomized field trial study design was used, and a total of 3489 cows were randomly enrolled to one of the treatment groups: ED + TAI or TAIonly. Cows enrolled in the TAIonly started the Presynch protocol receiving two injections of PGF2α at 55 ± 3 and 69 ± 3 DIM. They were subsequently submitted to the Ovsynch protocol: GnRH at 81 ± 3 DIM, PGF2α at 88 ± 3 DIM, and GnRH at 90 ± 3 DIM, and then inseminated at fixed time at 91 ± 3 DIM. Cows enrolled in the ED + TAI were submitted to the same synchronization protocol, but they were eligible to be inseminated at any time after the beginning of the synchronization protocol, if detected in estrous. During the experimental lactation, the effect of treatment on first service conception rate (FSCR) was conditional to parity: no difference among primiparous cows, but for multiparous cows, the FSCR was 41.2% and 35.3% for TAIonly and ED + TAI, respectively. Although TAIonly strategy increased the lactation length for primiparous and multiparous, no differences were observed on lactation and reproductive performances. The rate at which cows conceived, and the calving to conception interval during the subsequent lactation was not affected by management strategy. Additionally, no differences were observed in milk production during the experimental and subsequent lactations. The effect of management strategy on survivability was conditional to parity: no differences were observed for multiparous cows, while primiparous ED + TAI cows tended to be less likely to be culled than TAIonly counterparts. Additionally, no differences in health outcomes during the subsequent lactation were observed.

1. Introduction

Besides milk price and production costs, the overall economic outcome of a dairy enterprise is a function of milk production, reproductive efficiency, overall herd health, and longevity of cows. In past decades, genetic selection has focused primarily on

* Corresponding author. Department of Population Medicine and Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, NY 14853-6401, USA.
E-mail address: rcb28@cornell.edu (R.C. Bicalho).

http://dx.doi.org/10.1016/j.theriogenology.2017.01.041
0093-691X/

milk production and components. However, the genetic correlations between milk yield and fertility traits are generally unfavorable [1–3], and this selection for milk production resulted in a decline in reproductive efficiency [4]. To overcome this problem, the majority of dairy herds have adopted management strategies to reduce the calving-to-conception interval, such as ovulation synchronization protocols [5,6]. In a survey, it was reported that 15 out of 16 American herds that demonstrated excellence in reproductive performance implemented the Presynch-Ovsynch protocol for the first service [7]. This extensively used program [6,8] consists of 2 doses of PGF2α administered 14 days apart prior to the beginning of Ovsynch, which allows the cows to start the Ovsynch program during early luteal phase, hence increasing first service conception rate (FSCR) after timed artificial insemination (AI) [9].

During the Presynch-Ovsynch protocol, at least half of the cows display signs of estrus, which can present as an opportunity for cows to be inseminated before the completion of the protocol [10,11]. Inseminating cows in heat prior to the end of the Presynch-Ovsynch protocol is a common practice. Some studies with conflicting results have compared 2 management strategies for first service using the Presynch-Ovsynch protocol: insemination at completion of the Presynch-Ovsynch program (TAIonly) or insemination after estrus detection during the Presynch-Ovsynch protocol with the remainder of cows being inseminated at completion of the program (ED + TAI) [10–13]. While some authors have concluded that ED + TAI was detrimental to FSCR compared to TAIonly [12,13], others reported that there was no difference on FSCR between these two reproductive managements [10,11]. Recently, results from a meta-analysis designed to evaluate which management strategy (TAIonly vs ED + TAI) would achieve the best results on FSCR were reported [14]. Twenty manuscripts including 27 herds and 9813 AI were included in the meta-analysis, and it was concluded that optimal results on FSCR was reached using TAIonly compared to ED + TAI. From the manuscripts included in the meta-analysis, only 4 out of 20 considered parity in their study design, and none of these studies were designed to compare TAIonly and ED + TAI [15–18]. Therefore, the conditional effect of parity on these two different reproductive strategies remains unknown.

Another reproductive management strategy widely used by dairy producers is the voluntary waiting period (VWP), which is the period after parturition when cows are not eligible to be inseminated. The ideal VWP is not outright, as there is a variety of factors that should be taken into consideration when implementing a given VWP in a herd. In general, the value of a new pregnancy increases with DIM early in lactation, but it decreases with time later in lactation, and the value of a new pregnancy peaks later in the lactation for high producing and primiparous cows [19]. Voluntary waiting period can be extended by only inseminating cows at completion of synchronization protocols [11]. The economic consequences of strategically extending the lactation of high-producing cows have been evaluated previously, with greater advantages for primiparous cows, due to their higher lactation persistency [20]. Hence, to evaluate the long term effect of different reproductive managements that impact the VWP in a herd is warranted.

Therefore, the primary objective of this study was to evaluate the effect of two different reproductive strategies (TAIonly vs ED + TAI) on reproductive outcomes in the experimental lactation (FSCR, pregnancy loss, and calving to conception interval). The secondary objective was to evaluate the long term impact of these two strategies on reproductive outcomes, culling, milk production and health during the subsequent lactation.

2. Material and methods

2.1. Farm management and study design

This study was conducted in a dairy farm located near Ithaca, New York. The farm milked 3300 Holstein cows three times daily in a double 52-stall parallel milking parlor. The cows were housed in freestall barns, with concrete stalls covered with mattresses and bedded with manure solids. All cows were offered a TMR consisting of approximately 55% forage (corn silage, haylage, and wheat straw) and 45% concentrate (corn meal, soybean meal, canola, cottonseed, and citrus pulp) on a dry matter basis of the diet. The diet was formulated to meet or exceed the NRC nutrient requirements for lactating Holstein cows weighing 650 kg and producing 45 kg of 3.5% fat corrected milk.

A total of 3489 cows were enrolled in the study. Regardless of their health status, all cows that calved from September 1st of 2011 until October 22nd of 2012 were eligible to be enrolled in the study. Cows were enrolled at calving, and there was no exclusion criteria. Data was collected until March 27th of 2015. A total randomized field trial study design was used; cows were randomly assigned to one of the treatment groups: TAIonly and ED + TAI. Randomization was completed in Excel (Microsoft, Redmond, WA) using the random number function and imported into the farm's Dairy Comp 305® software (Valley Agricultural Software, Tulare, CA). Cows enrolled in the TAIonly started the Presynch [9] protocol receiving two injections of $PGF_{2\alpha}$ at 55 ± 3 and 69 ± 3 DIM (25 mg of dinoprost tromethamine; Lutalyse, Zoetis Animal Health, NJ). They were subsequently submitted to the Ovsynch protocol [21]: GnRH (100 μg of gonadorelin diacetate tetrahydrate, Cystorelin, Merial Ltd, NJ) at 81 ± 3 DIM, $PGF_{2\alpha}$ at 88 ± 3 DIM, and GnRH at 90 ± 3 DIM, and then inseminated at fixed time at 91 ± 3 DIM. Cows enrolled in the ED + TAI were submitted to the same synchronization protocol, but they were eligible to be inseminated at any time after the beginning of the synchronization protocol, if detected in estrous. Therefore, the VWP was 55 ± 3 and 91 ± 3 DIM for ED + TAI and TAIonly cows, respectively. Estrus was detected solely by activity monitors (Alpro, DeLaval, MO). Cows were classified as having an activity level of 0, 1, 2, or 3, and the activity level threshold for triggering AI was ≥2. After the first service, all cows were submitted to the Resynch protocol [22], and were eligible to be inseminated on estrus detection, regardless of treatment groups.

During the subsequent lactation, cows from both treatment groups were submitted to the same synchronization protocol described above, and were eligible to be inseminated at any time after 69 ± 3 DIM if detected in estrus before the end of synchronization protocol.

2.2. Case definition

Dystocia, retained placenta (**RP**), metritis, mastitis, displaced abomasum (**DA**), ketosis, and lameness were diagnosed and treated by trained farm personnel who followed a specific diagnostic protocol designed by veterinarians from the Ambulatory and Production Medicine Clinic, Cornell University. Farm personnel were masked to the treatments. Dystocia was defined as calving requiring assistance. Retained placenta was defined as a condition which cows failed to release their fetal membranes within 24 h of calving. Metritis was defined as the presence of fetid, watery, red-brown uterine discharge and rectal temperature >39 °C. Ketosis was defined as high concentrations of ketone bodies (≥1470 μmol/L) in urine reagent strips. Displaced abomasum diagnosis made by the farm personnel was confirmed and treated by veterinarians. Mastitis was defined as abnormal changes in the udder and milk, such as watery appearance, flakes and clots. Lame cows were