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*Original article*

# Effect of single treatment with cloprostenol or dinoprost on estrus and reproductive performance in anestrous dairy cows after service

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## Abstract

Previous studies have compared the effectiveness of dinoprost and cloprostenol in cows yielding conflicting results. The aim of our study was to evaluate the efficacy of single treatment with cloprostenol or dinoprost on estrus and reproductive performance in cows with unobserved estrus after service. The study was conducted over four years in two dairy herds of Polish Holstein Frisian cows under a herd health program with an average milk yield per cow over 9000 L. Cows (n=523) diagnosed ultrasonographically as non-pregnant and with a corpus luteum were randomly assigned to be treated with either cloprostenol (n=261) or dinoprost (n=262). The estrus detection rates after administration of cloprostenol or dinoprost were 59.4%, and 57.6%, respectively. The difference between both groups was not statistically significant (p>0.05). Distribution of observed estrus did not differ between cloprostenol and dinoprost. There were no differences (p>0.05) between cloprostenol and dinoprost in conception rate (65.2% vs. 66.2%, respectively) and pregnancy rate (57.5% vs. 54.9%, respectively). Mean days open were similar in cows of both treatments (177.5 ± 74.6 days vs. 175.8 ± 62.6 days, respectively; p>0.05). In conclusion, data from this study showed no significant differences in estrus detection rates and fertility between cows with unobserved estrus after service treated with cloprostenol or dinoprost. Both products are equally useful for the treatment of non-pregnant dairy cows with anestrus after service within a reproductive herd health program.

**Key words:** prostaglandin $F_2\alpha$, silent heat after artificial insemination, fertility, cow

## Introduction

One of the major factors contributing to extended interval from calving to conception is anestrus after service. Conception rates after first service of between 40-50% have been reported for high yielding cows (Lucy 2001, Dobson et al. 2008, Barański et al. 2008, Walsh et al. 2011). Thus, there are many cows which must be re-inseminated because they are not pregnant. However, only less than half of the cows that fail to conceive (non-pregnant) after service can be detected in estrus according to the expected time following insemination (Bartlett et al. 1987, Nation et al. 2001, Cavalieri et al. 2003, Chenault et al. 2003). Bartlett et al. (1987)

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reported that 80% of cows with anestrus following an unsuccessful insemination showed evidence of cyclic activity, whereas the remaining 20% of those cows had pyometra, cystic follicles or ovarian afunction. Australian researchers (Nation et al. 2001, Cavalieri et al. 2003) described non-return, non-pregnant cows as "phantom cows" (appearing to be pregnant but in reality are not). They reported that the major cause of the phantom cow syndrome is the failure to detect a return to estrus.

Silent heat or subestrus is defined as a condition in which the behavioral signs of heat are not observed at the expected time although the cows are cycling regularly (Seguin et al. 1985, Opsomer et al. 1996, Mwaanga and Janowski 2000). Estrus signs are weakly expressed in high-producing dairy cows (Lucy, 2001). With increasing milk yield the percentage of cows in estrus that stand-to-be-mounted has declined from 80% to 50% and the duration of detected estrus was reduced from 15 h to 5 h over the past 50 years (Dobson et al. 2008). Furthermore, in modern dairy herds, the efficiency of estrus detection can be poor (Rorie et al. 2002, Roelofs et al. 2005).

Prostaglandin $F_2\alpha$ ($PGF_2\alpha$) treatment is one of the practicable methods of estrus induction in cows with silent heat (Plunkett et al. 1984, Seguin et al. 1985, Kudláč 1993, Stevenson and Pursley 1994, Mwaanga et al. 1999, Mateus et al. 2002). A functionally mature corpus luteum (CL) is the basis for efficient use of prostaglandins, since early CL (first 5 days) is not sensitive to $PGF_2\alpha$ (Lauderdale 1975, Watts and Fuquay 1985, Wiltbank et al. 1995). The interval from an injection of prostaglandin $F_2\alpha$ to estrus depends on the stage of follicle development. When $PGF_2\alpha$ was administered to cows with a mature corpus luteum, about 70% of cows detected in heat showed signs of estrus on days 3 or 4 after treatment (Plunkett et al. 1984, Seguin et al. 1985).

There are a few forms of prostaglandins, but commonly two of them are used: dinoprost (a thromethamine salt of the natural $PGF_2\alpha$), which has a short half-life due to fast inactivation by oxidation after one passage through the lungs (Kindahl 1980) and cloprostenol (a synthetic analogue) with a longer biological half-life and greater luteolytic strength (Bourne 1981).

Some practitioners and dairy farmers believe that cloprostenol induces estrus in a higher percentage of cows and sooner after treatment, than dinoprost. Studies comparing the effectiveness of dinoprost and cloprostenol in cows yielded conflicting results. They demonstrated an increase in estrus expression (Sudweeks et al. 1983, Pursley et al. 2012) and conception rates (Martineau 2003, Pursley et al. 2012) in cows treated with cloprostenol compared to dinoprost or no differences between the two products (Seguin et al. 1985, Turner et al. 1987, Salverson et al. 2002, Stevenson and Pathak 2010, Perez-Marin et al. 2015).

The effect of cloprostenol or dinoprost on estrus rate and fertility performance was investigated mainly in various synchronization protocols before first insemination such as Cosynch, Ovsynch-Resynch (Stevenson and Phatak 2010), G6G/Ovsynch (Martins et al. 2011), or two injections of $PGF_2\alpha$ 14 days apart (Pursley et al. 2012). However, in many dairy herds the single injection of prostaglandin in cows with unobserved estrus is still used. To our knowledge there is only one previous study comparing cloprostenol and dinoprost for estrus induction in cows with unobserved estrus after service (Seguin et al. 1985), but that study was performed many years ago using cows fed in different way comparing nowadays and with lower milk yield.

Thus, the aim of our study was to evaluate the efficacy of a single treatment with cloprostenol or dinoprost on estrus and reproductive performance in cows with unobserved estrus after service.

## Material and Methods

This clinical trial was carried out from January 2012 to December 2014 in two dairy herds under a herd health program (Barański et al. 2005). Both herds were located in North-East Poland and comprised 300 Polish Holstein Frisian cows with an average milk yield of 9000 L per cow. The cows were housed in free stall barns with a total mixed ration (TMR) feeding system. The TMR was based on corn and grass silage, concentrate, and vitamin and mineral supplements. The animals had free access to water and were milked twice daily. Estrus was observed three times a day for twenty - thirty minutes by the herdsmen during the day and at night by night shift caretakers. Cows detected in estrus were inseminated by AI technicians. The animals were inseminated at the first estrus occurring 60 days post-partum. Pregnancy was diagnosed by transrectal ultrasound at days 30-37 after AI using a 5 MHz linear transducer (Honda HS-V 1500). Cows diagnosed as pregnant were re-examined on day 200 after AI using transrectal palpation.

Cows (n=523) diagnosed ultrasonographically as non-pregnant and with corpus luteum (> 15mm of diameter) were randomly assigned to be treated with either cloprostenol (n=261) or dinoprost (n=262). Cows received intramuscularly 0.5 mg of cloprostenol (Oestrophan, Bioveta, Czech Republic) or 25 mg of dinoprost (Dinolytic, Pfizer, Poland).

Time of occurrence of estrus after treatment was recorded. Conception and pregnancy rates and days

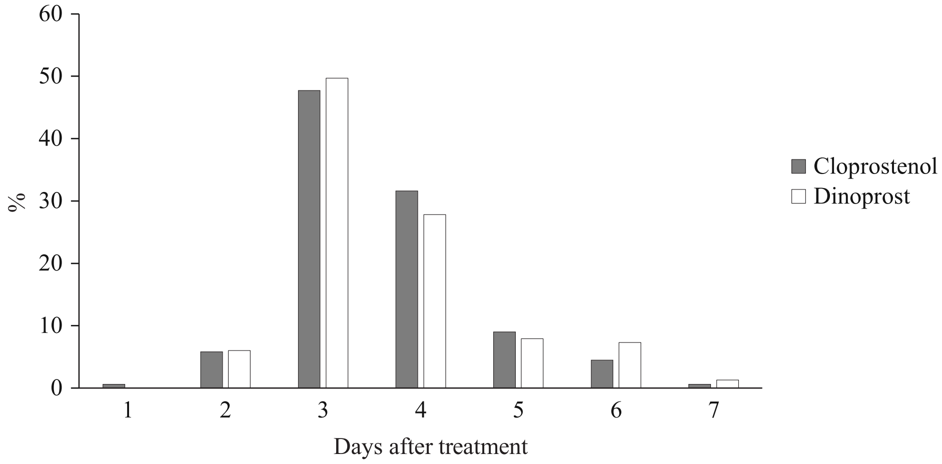


Fig. 1. Distribution of cows in estrus (%) within 7 days after treatment with cloprostenol or dinoprost.

Table 1. Estrus detection rate and fertility performance in cows with silent heat after service treated with cloprostenol or dinoprost.

| Treatment | Cows n | Interval from calving to treatment days (mean ± SD) | Estrus detection rate % (n/n) | Conception rate % (n/n) | Pregnancy rate % (n/n) | Days open (mean ± SD) |
|---|---|---|---|---|---|---|
| Cloprostenol | 261 | 148.0 ± 56.8 | 59.4 (155/261) | 65.2 (101/155) | 57.5 (89/155) | 177.5 ± 74.6 |
| Dinoprost | 262 | 143.2 ± 49.6 | 57.6 (151/262) | 66.2 (100/151) | 54.9 (78/151) | 175.8 ± 62.6 |

open were calculated. Conception rate was defined as the percentage of cows that were inseminated following a single treatment with $PGF_2\alpha$ and diagnosed pregnant at pregnancy diagnosis. Pregnancy rate was defined as the percentage of inseminated cows pregnant at day 260 after AI. Days open describe the interval from parturition to conception.

### Statistical analyses

Differences in mean estrus rate, conception and pregnancy rates and days open between cows treated with cloprostenol or dinoprost were analyzed using the Mann-Whitney test and the t-test using GraphPad Prism version 6.00 (GraphPad Software, San Diego, CA, USA). The level of significance was considered as $p<0.05$.

## Results

Intervals from calving to treatment were similar for cows treated with cloprostenol or dinoprost (148.0±56.8 days vs. 143.2±49.6 days, respectively). The estrus detection rates after administration of cloprostenol or dinoprost were 59.4%, and 57.6% respectively (Table 1). The difference between both groups was not statistically significant ($p>0.05$).

The distribution of estrus within 7 days after treatment did not differ between both products ($p>0.05$). Approximately 75% of cows in estrus after treatment with cloprostenol or dinoprost were detected on day 3 and 4 (Fig. 1).

There were no differences ($p>0.05$) between cloprostenol and dinoprost in conception rate (65.2% vs. 66.2%) and pregnancy rate (57.5% vs. 54.9%, respectively). Mean days open were similar in cows of both treatments (177.5±74.6 days vs. 175.8±62.6 days, respectively; $p>0.05$) (Table 1).

## Discussion

It has been reported (Sudweeks et al. 1983, Pursley et al. 2012) that cloprostenol compared to dinoprost increased the estrus detection rate, probably because of a faster decrease in progesterone during the first 12 hours after injection and greater increase in estradiol concentrations (Martins et al. 2011). In the present study there were no effects of treatment with cloprostenol or dinoprost on estrus detection. Several previous studies which compared cloprostenol and dinoprost also demonstrated no differences in estrus expression (Seguin et al. 1985, Turner et al. 1987, Salverson et al. 2002, Martineau 2003, Perez-Marin et al. 2015). In our study the estrus detection rate was about 60%; our data are similar to those of Plunkett et al. (1984) and Seguin et al. (1985) for dairy cows with unobserved estrus. A study by Pursley et al. (2012) demonstrated an estrus detection rate of 46.7% in cows treated with cloprostenol or dinoprost 14 days apart.

In this study we were not able to differentiate cows with silent heat and those with a prolonged luteal phase. Earlier studies showed that the main cause of anestrus after service in non-pregnant cows was failure of estrus detection (Bartlett et al. 1987, Nation et al. 2001, Cavalieri et al. 2003). Successful treatment is dependent on accurate diagnosis of a functional corpus luteum. In our study the presence of a corpus luteum was diagnosed by ultrasonography. The predictive values of ultrasonography for the presence or absence of a matured corpus luteum were 87% and 92%, respectively (Hanzen et al. 2000). Based on progesterone concentration, the accuracy of the ultrasonography in the diagnosis of silent heat in cows was 89.0 % (Zduńczyk et al. 2009). The incidence rate of estrus after administration of $PGF_2\alpha$ may also be related to estrus detection deficiency, non-responsiveness of some CLs even in the appropriate phase of cycle, or injection of the prostaglandin into fat or ligamentous tissue (Watts and Fuquay 1985, Wiltbank et al. 1995, Répási et al. 2005).

Our data indicate that there were no differences in distribution of observed estrus for cloprostenol versus dinoprost. Most cows were detected in estrus on days 3 and 4 after administration of both products. This result is in accordance with other studies (Seguin et al. 1985, Stevenson and Pathak 2010). However, Pursley et al. (2012) reported that a significantly greater percentage of first lactation cows treated with cloprostenol compared to dinoprost was detected in estrus on days 3 or 4 following the treatment. They supposed that the reason for this increase was enhanced circulating estradiol concentration due to accelerated decrease in progesterone concentration in cows treated with cloprostenol, as demonstrated by Martins et al. (2011).

In the present study conception rate and pregnancy rate did not differ between the cloprostenol and dinoprost groups. These results are consistent with earlier studies which compared both types of prostaglandin. Seguin et al. (1985) demonstrated no differences between these two products in conception and pregnancy rates in dairy cows with unobserved estrus. Salverson et al. (2002) reported identical pregnancy rates for beef heifers treated with either dinoprost or cloprostenol. Stevenson and Pathak (2010) demonstrated similar conceptions rates in dairy cows treated with cloprostenol or dinoprost during Presynch or Resynch programs. In contrast, Sudweeks et al. (1983) and Martineau (2003) reported higher conception and pregnancy rates for dairy heifers and cows treated with cloprostenol than dinoprost. In the study by Martins et al. (2011) cloprostenol tended to improve the conception rate in dairy cows compared with dinoprost when used within an Ovsynch program. Pursley et al. (2012) found an increase in conception and pregnancy rates in first parity dairy cows treated with cloprostenol.

The reason for the differences in estrus expression and conception rates between cloprostenol and dinoprost reported by some researches is not clear. Such differences could result from various stages of luteal phase and varying status of the follicular wave at the time of treatment (Watts and Fuquay 1985, Lucy et al. 1992).

In the present study mean days open did not differ between treatments. There is no previous study on the effect of treatment with cloprostenol or dinoprost on days open in cows with unobserved estrus after service.

In conclusion, data presented in this study showed no significant differences in estrus detection rates and fertility between cows with unobserved estrus after service treated with cloprostenol or dinoprost. Both products are equally useful for the treatment of non-pregnant cows with anestrus after service within reproductive herd health programs.

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