Effect of eCG on fertility to GnRH-based TAI protocols in beef cows (*Bos Taurus*)

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17TH INTERNATIONAL CONGRESS ON ANIMAL REPRODUCTION

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ICAR 2012 Vancouver, British Columbia, Canada

Available online at www.sciencedirect.com
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Theriogenology 71 (2009) 698–706
www.theriojournal.com

Effects of progesterone presynchronization and eCG on pregnancy rates to GnRH-based, timed-AI in beef cattle☆

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Received 9 February 2008; received in revised form 12 June 2008; accepted 12 September 2008

Abstract

Three experiments were conducted to determine the effects of low-dose progesterone presynchronization and eCG on pregnancy rates to GnRH-based, timed-AI (TAI) in beef cattle (GnRH on Day 0, $PGF_{2\alpha}$ on Day 7, with GnRH and TAI on Day 9, 54–56 h after $PGF_{2\alpha}$). Experiments 1 and 2 were 2 × 2 factorials with presynchronization (with or without a once-used CIDR; Days −15 to 0 in Experiment 1 and Days −7 to 0, with $PGF_{2\alpha}$ at insertion, in Experiment 2), and with or without 400 IU eCG on Day 7 in suckled cows. In Experiment 3, suckled cows and nulliparous heifers were either presynchronized with a twice-used CIDR (Days −5 to 0) and $PGF_{2\alpha}$ at insertion, or no treatment prior to insertion of a new CIDR (Days 0–7). Presynchronization increased ($P < 0.05$) ovulation rate to GnRH on Day 0 (75.0% vs 48.7%, 76.7% vs 55.0%, and 60.0% vs 36.1% for Experiments 1, 2, and 3, respectively), increased the diameter of the preovulatory follicle in Experiments 1 and 2, and increased the response to $PGF_{2\alpha}$ (regardless of parity) in Experiment 1 ($P < 0.01$), and in primiparous cows in Experiment 2 ($P < 0.01$). Effects of presynchronization on pregnancy rates (53.4% vs 54.1%, 57.7% vs 45.3%, and 54.3% vs 44.4% for Experiments 1, 2, and 3, respectively) were influenced by parity and eCG ($P < 0.05$). Treatment with eCG had no effect ($P > 0.05$) on the diameter of the preovulatory follicle (Experiment 1), or the response to $PGF_{2\alpha}$ (Experiments 1 and 2), but tended ($P = 0.08$) to improve pregnancy rates, especially in primiparous cows that were not presynchronized ($P < 0.01$). However, the effects of eCG and presynchronization were not additive.

Keywords: Estrus synchronization; Timed-AI; Presynchronization; Ovarian follicular development; Cattle

1. Introduction

The basic GnRH-based protocol for timed-AI (TAI) of cattle consists of an initial treatment with GnRH, $PGF_{2\alpha}$ 7 d later, and a second GnRH treatment 48 h later, either 16–18 h before (Ovsynch) or concurrent with (CO-Synch) TAI [1,2]. Pregnancy rates were low when ovulation did not occur in response to the first GnRH and estrus was premature, [3,4], or the second GnRH induced ovulation of small (<12 mm) preovulatory follicles [5]. Conversely, pregnancy rates in

☆ Portions of these data were presented at the Annual Meetings of the International Embryo Transfer Society, Copenhagen, Denmark January 2005 and Orlando, FL, USA, January 2006.

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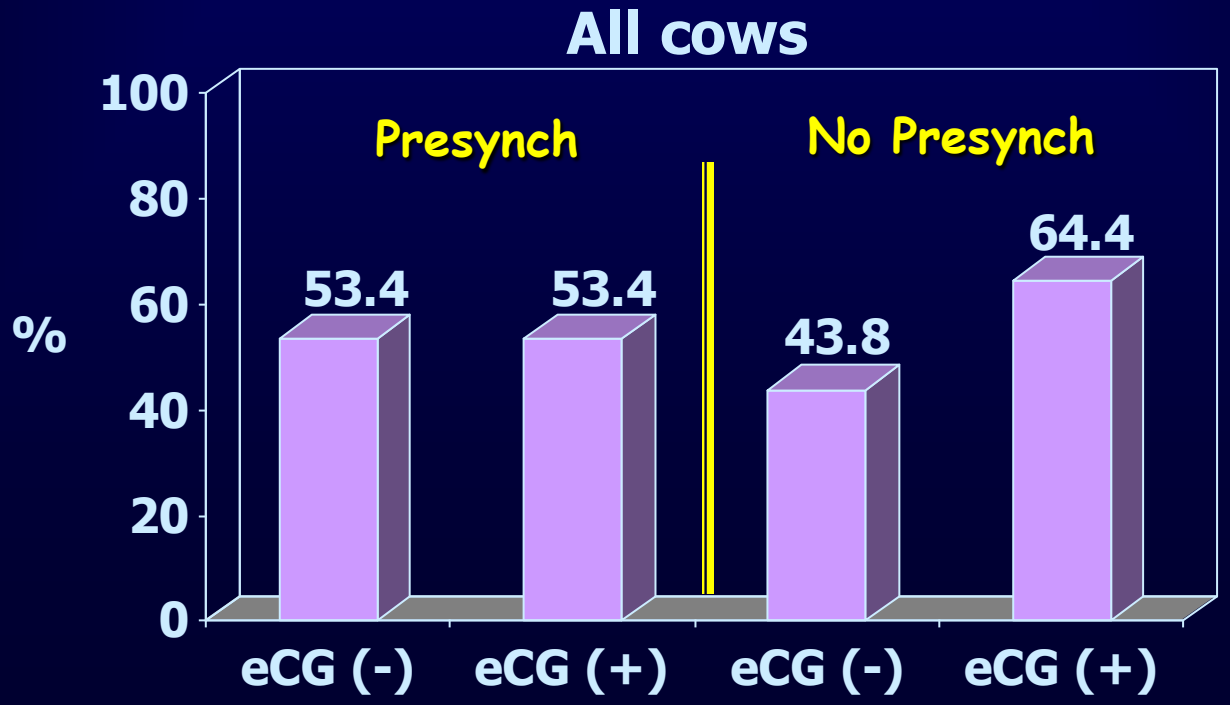
0093-691X/$ – see front matter © 2009 Published by Elsevier Inc.
doi:10.1016/j.theriogenology.2008.09.045

Cow's study (Experiment 1)

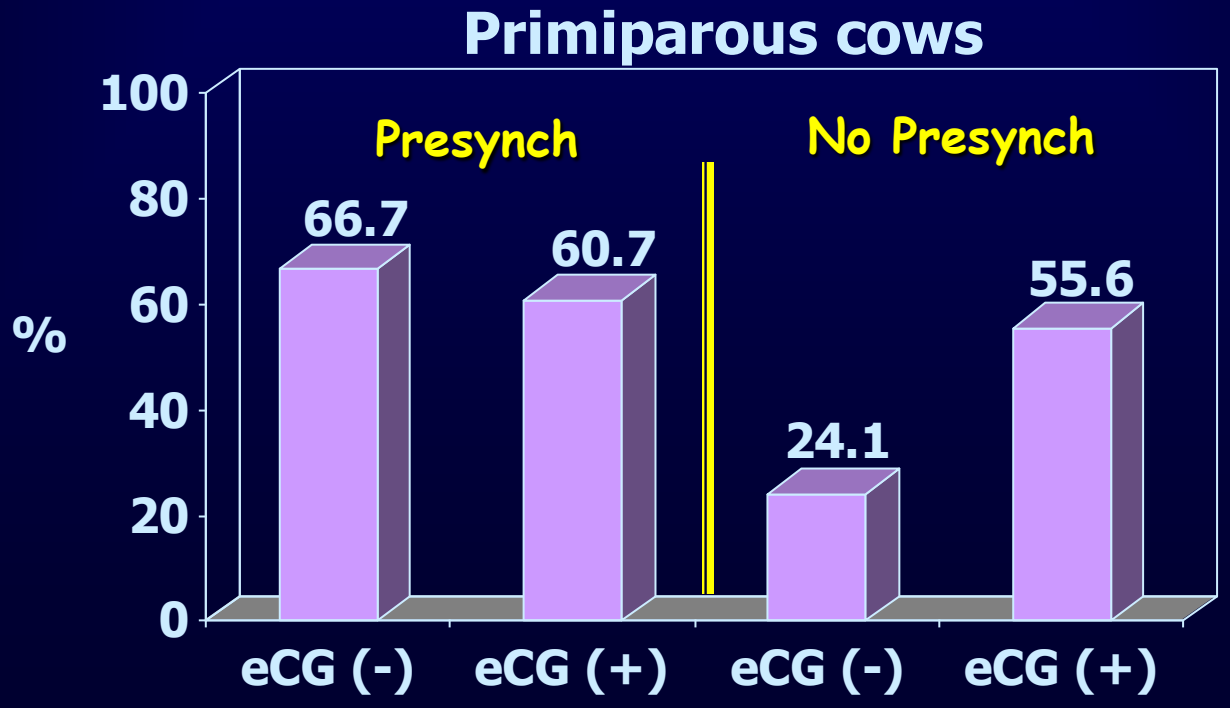
- ✓ Suckled crossbred beef cows (n=292)
- ✓2X2 factorial; presynchronization (used CIDR for 15 d) and eCG treatment (400 IU)



P=0.08

Cow's study (Experiment 2)

- ✓ Suckled crossbred beef cows (n=411)
- ✓2X2 factorial; presynchronization (used CIDR for 7d plus PG) and eCG treatment (400 IU)



P<0.01

Effects of presynchronization and eCG on pregnancy rates to GnRH-based, fixed-time artificial insemination in beef heifers

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[1]*Agriculture and Agri-Food Canada, Brandon, Manitoba, Canada R7A 5Y3;* [2]*Alberta Agriculture and Rural Development, Edmonton, Alberta, Canada T6H 5T6;* [3]*Agriculture and Agri-Food Canada, Lethbridge, Alberta, Canada T1J 4B1; and* [4]*Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatoon, Canada S7N 5B4.* *Received 8 July 2009, accepted 22 October 2009.*

Small, J. A., Colazo, M. G., Kastelic, J. P., Erickson, N. E. and Mapletoft, R. J. 2010. **Effects of presynchronization and eCG on pregnancy rates to GnRH-based, fixed-time artificial insemination in beef heifers**. Can. J. Anim. Sci. **90**: 23–34. Three experiments were conducted to determine the effects of presynchronization and treatment with equine chorionic gonadotropin (eCG) on corpus luteum (CL) and ovarian follicular development, plasma progesterone concentrations, and pregnancy rates in beef heifers subjected to a gonadotropin releasing hormone (GnRH)-based, fixed-timed AI (TAI) protocol. All heifers were given GnRH on day 0, prostaglandin $F_{2\alpha}$ (PGF) on day 7, and a second GnRH on day 9 concurrent with TAI (54 h after PGF). In exp. 1 ($N=148$), presynchronization with PGF (days −22 and −11) decreased the percentage of heifers with non-luteal plasma progesterone concentrations on day 0 (5.4 vs 29.7%) and day 7 (0 vs 11.6%; $P<0.05$), but not on day 9 (74.3 vs. 66.2%; $P>0.20$), and reduced the number of heifers in estrus and bred before TAI ($P<0.05$). Although presynchronization reduced preovulatory follicle diameter (12.9 ± 0.3 vs. 14.9 ± 0.3 mm; mean ± SEM; $P<0.01$), it did not affect TAI pregnancy rates (36.5 vs. 29.7%; $P>0.20$). In exp. 2, heifers ($N=128$) were presynchronized with melengestrol acetate (MGA) (days −27 to −12), and received a controlled internal drug release (CIDR) on day 0; on day 7, half were given 300 IU of eCG at CIDR removal. Treatment with eCG tended to increase preovulatory follicle diameter in heifers that did not ovulate to GnRH on day 0 ($P=0.06$), but did not affect the percentage of heifers with non-luteal plasma progesterone concentrations on day 9 (57.8 vs. 57.8%) or TAI pregnancy rates (48.4 vs. 53.1%; $P>0.20$). Experiment 3 was a 2 × 2 factorial arrangement of presynchronization (PGF concurrent with a CIDR on day −7) and eCG treatments (on day 7) applied to heifers in three herds (A, $N=150$, B, $N=260$ and C, $N=40$). All heifers had a once-used CIDR from days 0 to 7. Presynchronization increased the percentage of heifers (Herd A) with low-luteal plasma progesterone concentrations on day 0 (70.7 vs. 22.7%) and day 7 (90.7 vs. 53.3%; $P<0.01$), but did not affect the percentage of heifers with non-luteal concentrations of progesterone on day 9 (97.3 vs. 93.3%; $P>0.20$). Combined for all herds, presynchronization reduced the prevalence of a CL on day 0 (23.5 vs. 73.7%; $P<0.01$), and increased the prevalence of follicles ≥10 mm on day 7 (96.8 vs. 86.7%; $P<0.01$); however, TAI pregnancy rates (195/439 = 44.4%) were not improved by either presynchronization or eCG treatment ($P>0.20$).

Key words: Presynchronization, equine chorionic gonadotropin, GnRH, fixed-time artificial insemination, progesterone

Small, J. A., Colazo, M. G., Kastelic, J. P., Erickson, N. E. et Mapletoft, R. J. 2010. **Effets de la pré-synchronisation et de l'administration de gonadotrophine chorionique équine (eCG) sur le taux de conception des génisses de boucherie inséminées artificiellement à période fixe par administration de GnRH**. Can. J. Anim. Sci. **90**: 23–34. Les auteurs ont procédé à trois expériences pour vérifier les effets de la pré-synchronisation et de l'administration d'eCG sur le développement du corps jaune et des follicules ovariens, sur la concentration plasmatique de progestérone et sur le taux de conception des génisses de boucherie inséminées artificiellement à période fixe (IAPF) après administration de GnRH. Les sujets ont reçu de la GnRH le jour 0, de la PGF le jour 7 et une deuxième dose de GnRH le jour 9, parallèlement à l'IAPF (54 h après la PGF). Dans la première expérience (N = 148), la pré-synchronisation avec la PGF (jours −22 et −11) diminue la proportion de génisses présentant de la progestérone lutéale dans le plasma le jour 0 (5,4 c. 29,7 %) et le jour 7 (0 c. 11,6 %; P < 0.05),

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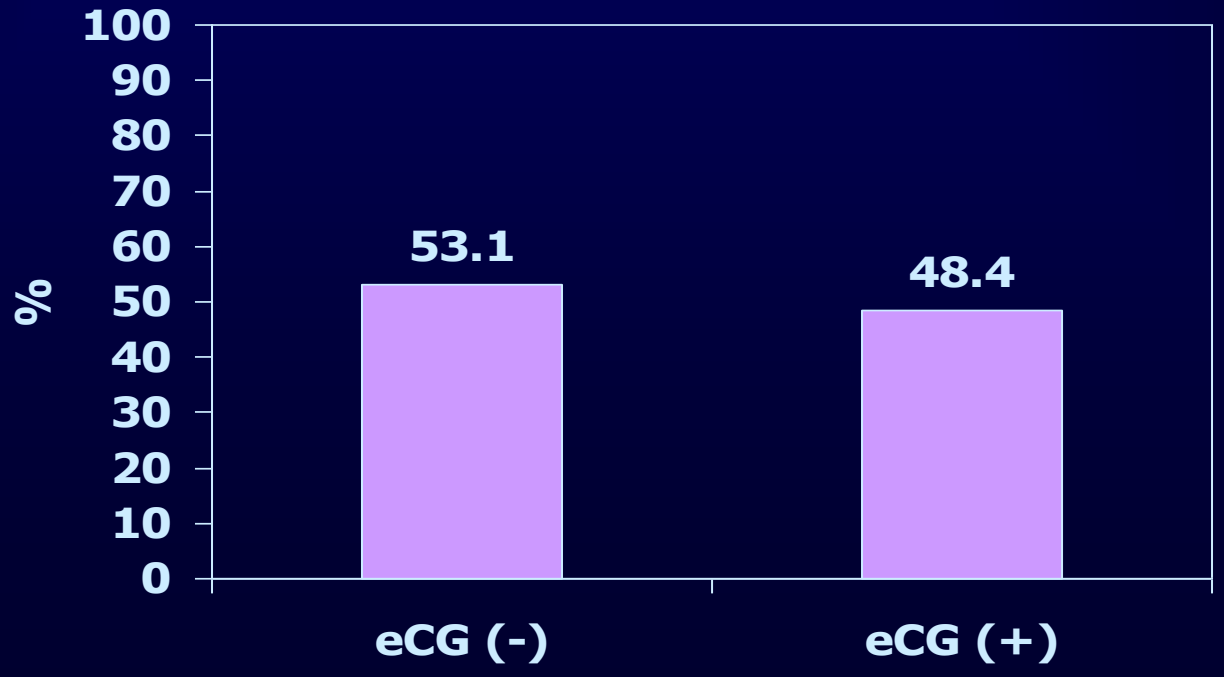
Portions of these data were presented at the Annual Meetings of the International Embryo Transfer Society, Portland, OR, USA (January 2004), Copenhagen, Denmark (January 2005), and Orlando, FL, USA (January 2006).

Abbreviations: **CIDR**, controlled internal drug release (1.9 g progesterone); **CL**, corpus luteum; **eCG**, equine chorionic gonadotropin; **GnRH**, gonadotropin releasing hormone; **LH**, lutenizing hormone; **MGA**, melengestrol acetate; **PGF**, prostaglandin $F_{2\alpha}$; **TAI**, fixed-time artificial insemination

Heifer's study (Experiment 1)

- ✓ Crossbred beef heifers (n=128)
- ✓ presynchronization with MGA for 15 d
- ✓ eCG treatment (300 IU)



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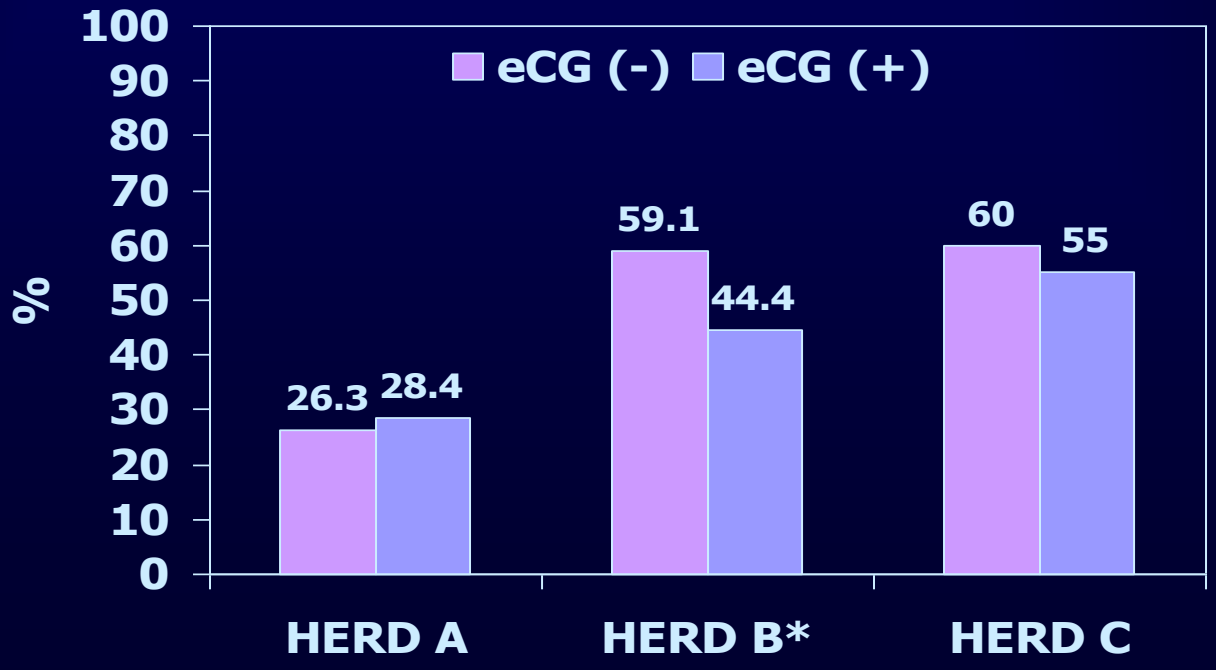
Heifer's study (Experiment 2)

- ✓ Crossbred beef heifers (n=450)
- ✓ presynchronization with a CIDR
- ✓ eCG treatment (300 IU)



* P<0.05

Take home message

- ✓ Treatment with eCG improved pregnancy rate to TAI, especially in primiparous beef cows that are not presynchronized.
- ✓ Treatment with eCG did not improve prenancy rate in heifers.