

ลักษณะการตอบสนองการเป็นสัดในแม่โคที่เหนียวนำ ด้วยพรอสตาแกลนดินที่ลดขนาดโดยการฉีดที่ตำแหน่ง แอ่งโคนหางรอยต่อกระดูกอิเซียมกับเรคตัม

Characteristics of Estrus Response in Dairy Cows Induced by a Reduced Dose of Prostaglandin Injecting at Ischiorectal Fossa

วีระศักดิ์ ปัญญาพรวิทยา¹ พัชรินทร์ ปิ่นทะนา² ชมพร โชคมบุญมงคล²
เอกพจน์ ระบุพิศม³ ศร ธีปฎิมากร³

Veerasak Punyapornwithaya¹ Patcharin Pintana² Chomporn Chokeboonmongkol²
Ekaphot Rangabpit³ Sorn Teepratimakorn³

บทคัดย่อ

การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อทดสอบประสิทธิภาพการใช้สารพรอสตาแกลนดินที่ลดขนาดลงในการเหนียวนำการเป็นสัดในโคนมลูกผสมโฮลสไตน์ฟรีเซียน แม่โคนมที่ไม่ได้ให้น้ำนมจำนวน 30 ตัวที่ถูกเหนียวนำการเป็นสัดโดยการสอดสารโปรเจสเทอโรนชนิดซีไอดีอาร์เป็นเวลา 7 วัน หลังจากตรวจพบการเป็นสัด 8-10 วันต่อมา แม่โคที่มีคอร์ปัส ลูเตียมถูกฉีดด้วยสารไดโนพรอสโตรเมธาามีน (dinoprost tromethamine; Lutalyse[®]) ขนาด 15 มิลลิกรัมซึ่งเทียบได้กับปริมาณ 60% ของขนาดที่ฉีดเข้ากล้ามเนื้อ โดยฉีดเข้าที่ตำแหน่งแอ่งโคนหางรอยต่อกระดูกอิเซียมกับเรคตัม ตรวจการเป็นสัดในช่วง 24-120 ชั่วโมงหลังจากฉีด ทำการตรวจด้วยอุลตราซาวด์ในขณะที่ฉีดสารไดโนพรอสและที่ 72 ชั่วโมงต่อมาเพื่อตรวจลักษณะของฟอลลิเคิลที่ใหญ่ที่สุดและคอร์ปัส ลูเตียม ผลการศึกษาพบว่าเปอร์เซ็นต์แม่โคที่แสดงอาการยืนนิ่งให้ตัวอื่นป้อนแม่โคที่แสดงอาการเป็นสัดรอง (secondary sign) และแม่โคที่มีการบีบตัวของมดลูกและมีสิ่งคัดหลั่งจากปากช่องคลอดเท่ากับ 53.33% (n=16/30) 60.00% (n=18/30) และ 86.66% (n=27/30) ตามลำดับ แม่โคที่เป็นสัดส่วนใหญ่ (81.25%; n=13/16) แสดงอาการเป็นสัดในช่วง 84-96 ชั่วโมงภายหลังฉีด ขนาดและพื้นที่ของคอร์ปัส ลูเตียมในวันแรกของการทดลองมีค่า $1.43\pm 0.34 \times 1.92\pm 0.42$ ซม.

คำสำคัญ: การเป็นสัด แม่โค พรอสตาแกลนดิน ลดขนาดการฉีด

Keywords: estrus, dairy cow, prostaglandin, reduced dose

¹ สาขาวิชาคลินิกสัตว์เคี้ยวเอื้อง คณะสัตวแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ อ.เมือง จ.เชียงใหม่ 50100

Department of Dairy Clinics, Faculty of Veterinary Medicine, ChiangMai University, ChiangMai, 50100

² นักศึกษาสัตวแพทย์ชั้นปีที่ 5 คณะสัตวแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ อ.เมือง จ.เชียงใหม่ 50100

The 5th year veterinary student, Faculty of Veterinary Medicine, ChiangMai University, ChiangMai, 50100

³ ศูนย์วิจัยการผสมเทียมและเทคโนโลยีชีวภาพเชียงใหม่ จ.เชียงใหม่ 50200

ChiangMai Artificial Insemination and Biotechnology Research Center, Muang, ChiangMai 50200

(ความสูงxความยาว) และ 2.24 ± 0.97 ตารางเซนติเมตรตามลำดับ ขนาดและพื้นที่ของฟอลลิเคิลที่ใหญ่ที่สุดในวันที่ 3 ของการทดลองมีค่า $0.95\pm 0.22\times 1.27\pm 0.37$ ซม. และ 1.01 ± 0.48 ตารางเซนติเมตร ตามลำดับ การศึกษาในครั้งนี้แสดงให้เห็นว่าการฉีดสารพรอสตาแกลนดินที่ลดขนาดลงที่ตำแหน่งแอ่งโคนหางรอยต่อกระดูกก็เชื่อมกับเรคตัมน่าจะเป็นทางเลือกในการเหนี่ยวนำการเป็นสัดในโคนม

Abstract

The objective of this study was to test the efficiency of reduced dose of prostaglandin on the characteristic of estrus response in Holstein crossbred dairy cows. Thirty non-lactating Holstein crossbred cows were induced into estrus by progesterone (CIDR) inserted for 7 days. Eight to ten days after estrus cows with corpus luteum were injected with 15 mg of dinoprost tromethamine (Lutalyse®) which was equal to 60% of intramuscular dose at ischiorectal fossa (IRF). Estrus detection was done between 24-120 hours after injection. Ultrasonographic examination was done at time of dinoprost injection (Day 0) and 72 h later (Day3) to monitor the morphology of largest follicle and the corpus luteum. The result showed that percent of cow standing heat, cows showed secondary sign and cows presented uterine tone and vaginal discharge were 53.33% (n=16/30) 60.00% (n=18/30) and 86.66% (n=27/30), respectively. Most of estrus cows (81.25%; n=13/16) expressed the onset sign of standing heat between 84-96 hours after injection. The average size and area of corpus luteum on Day0 were $1.43\pm 0.34\times 1.92\pm 0.42$ cm (in height and width) and 2.24 ± 0.97 cm², respectively. The average size of largest follicle on Day3 was $0.95\pm 0.22\times 1.27\pm 0.37$ ซม. และ 1.01 ± 0.48 cm², respectively. This study demonstrated that the using of reduced dose PG by injection at IRF might be the alternative way in estrus synchronization in dairy cows.

Introduction

Prostaglandin F_{2α} (PGF_{2α}) and its analogues have been used to manipulate the bovine estrus cycle through its luteolytic effects (De Rensis and Peters, 1999). Normally, the site of PGF_{2α} administration is intramuscular (IM). Because of economic aspect, numerous attempts have been made to reduce the cost of using PGF_{2α}, therefore; there were reports that investigated in using reduced dose of prostaglandin. It has been administered to subcutaneous (Brogliatti et al., 2000) or intravulvosubmucosal (IVSM) (Horta et al., 1986) at lower dose.

In Thailand, the cost of PGF_{2α} hormone is considered as an influential expense. Numerous studies reported that the decreasing dose of PGF_{2α} was as effective as full dose when administrated by injection at IVSM or infusing to uterine lumen (Butcharoen et al., 2001). However, these approaches are difficult for use under field conditions when compared with IM injection.

Recently, there were some studies presented that the dose of PGF_{2α} can be reduced by 60% when injection at ischiorectal fossa (IRF), the depression located lateral to the tailhead and medial to the tuber ischii, in beef cattle (Colazo et al., 2002a; Colazo et al., 2002b) or by 40% in dairy cows (Brinkerhoff et al., 2004). However, there were no reports of ischiorectal fossa route for administration of prostaglandin in Holstein crossbred cows in Thailand.

The objective of this study was to determine the efficiency of reduced dose of prostaglandin on the characteristic of estrus response in Holstein crossbred dairy cows which administration on ischiorectal fossa route.

Material and Methods

Animals

This study was carried out in experimental dairy farms in ChiangMai and Lumphoon provinces. Farm size, general management and reproductive management at two farms were similar. Thirty non-lactating Holstein crossbred dairy cows with body condition score more than 2.5 (5-scales; Edmonson et al., 1989) and on day 8 to day 10 were used. Cows were housed in free - stall barns and were free for grazing in grazing area near their barns. All cows were good condition and have no abnormality of reproductive tract when examined by ultrasound. The study was conducted from October to November 2004 which an average temperature and humidity was 25.5°C, 80.9% and 24.2°C, 78.2%, respectively.

Estrus induction

Cows were induced in to estrus by CIDR (EAZI-BREED; CIDRTM, New Zealand) inserted for 7 days at any stage of estrus cycle. Additionally, only cow with mature corpus luteum on the day of insertion CIDR[®] was injected IM with 25 mg dinoprost tromethamine (Lutalyse[®]). Eight to ten days after showing sign of estrus cows were scanned by ultrasound to detect corpus luteum. Cows with mature corpus luteum were injected at ischiorectal fossa with 15 mg of dinoprost tromethamine which is equal to 60% of IM dose with a 18 - gauge, 1.5-inch needle.

Estrus detection

Estrus detection was done every day in the morning (6.00–6.30 am.) and evening (18.00–18.30 pm.) for 4 days (Day 2–Day5) after PGF_{2α} injection. Standing heat was defined as a primary sign and the present of vagina discharge, mounting and riding other cows were defined as a secondary sign. Uterine tone and present of vaginal discharge were added to the estrus sign when cows were palpation on Day 3 by rectal palpation.

Ultrasonography

Ultrasonographic examination was done at time of dinoprost injection (Day0) and 72 h later (Day3) (Brinkerhoff et al., 2004). Either morphology of corpus luteum on Day0 and on Day3 or the largest follicle on Day3 was monitored with a 5.0 MHz linear array transducer ultrasound (Aloka Model SD500). Each ovary was scanned in lateromedial and dorsoventral planes to determine the position, the diameters (height and width) and the area of the CL and the largest follicle.

Statistical analysis

Estrus response and other correlated parameters were defined : % standing heat = (no.of cows showed sing of standing heat / total cows) x 100, % cows showed secondary sing of estrus = (no.of cows showed secondary sing of estrus/ total cows)x100 and % cows showed only uterine tone& vaginal discharge = (no.of cows showed only uterine tone& vaginal discharge/ total cows)x100. Size of follicle and corpus luteum were showed by mean and standard deviation analyzed by PROC UNIVARIATE (SAS, 1990).

Result

The characteristics of estrus response were showed in table 1. Most of estrus cows (81.25%; n=13/16) expressed the onset sign of standing heat between 84–96 hours after injection. The size and area of largest follicle and corpus luteum were presented in table 2. When examining the size of corpus luteum on Day3 compared to Day0, the area of corpus luteum of was dramatically decreased in most cows (data not shown).

Table 1 The estrus response of cows injected with prostaglandin at IRF.

Parameter	Value (no./total)
% standing heat	53.33% (n=16/30)
% cows showed secondary sign of estrus	60.00% (n=18/30)
% cows showed only uterine tone& vaginal discharge	86.66%(n=26/30)

Table 2 The size and area of follicle and corpus luteum on D0 and D3 after injection prostaglandin at IRF.

Structure	Day0	Day3
Total number of cows, n	30	30
Size of follicle (cm)* (Mean±SD); Area of follicle (cm ²)	nd**	h=0.95±0.22, w=1.27±0.37; 1.01±0.48
Size of corpus luteum (cm)*; Area of corpus luteum (cm ²)	h=1.43±0.34, w=1.92±0.42; 2.24±0.97	na***

* presented as height (h) and width (w), ** nd:not determine,***na:not available

Discussion

Estrus synchronization is a useful method for reproductive management in dairy cows. Many studies have shown that use of PGF_{2α}, can improve estrus detection efficiency (Odde, 1990). Cow with functional corpus luteum expressed sign of estrus over a 7 day period after treatment with PGF_{2α}, depending on the stage of follicular growth at the time of luteal regression (De Rensis and Peters, 1999).

Estrus synchronization by using prostaglandin with full dose or reduced dose was reported in many studies in Thailand. One and two IM injection program induced heifers into estrus 53% and 68% respectively (Aiumlamai et al., 1995). With economic aspects, the study of using decreasing dose PGF_{2α}, was investigated. When injection at IVSM and infusion in uterine, dose of PGF_{2α}, can be reduced to 1/6-1/8 of IM dose (Butcharoen et al., 2001). However, the administration of prostaglandin by intra -uterine require more equipments and experience of technicians while the injection at IVSM need more practically than IM and IRF. Thus, the IRF might be an alternative route.

The characteristics of estrus response might be classed into three groups as shown in table 1. Percent cow showed standing heat was not high. It was suggested that estrus detection two times per day was probably not sufficient or cows did not actually show behavior of standing heat. Nevertheless, percent of standing heat was similar to the previous report (Aiumlamai et al., 1995) but higher than the report investigated that overall estrus detection rate for all cows given $\text{PGF}_{2\alpha}$, was 48% in IM and 38% in IRF group (Brinkerhoff et al., 2004). Normally, it has been known that the disadvantage point of using is that $\text{PGF}_{2\alpha}$ was not synchronized cow in estrus precisely. Several studies have reported that animals were detected in estrus in over 5 days. Therefore, estrus synchronized by $\text{PGF}_{2\alpha}$, was depended on estrus detection (Pursley et al., 1997).

From ultrasonography, the area of corpus luteum in most cows was dramatically decreased or absent on Day3 but we not measured. Also, they presented the uterine tone and vaginal discharge on Day3. It has been suggested that percent of corpus luteum regressed after $\text{PGF}_{2\alpha}$ injection was approximately 90%. It means that $\text{PGF}_{2\alpha}$ had a high efficiency in luteolysis. However, we did not have the profile of progesterone to confirm or support our finding and this study had not the real control group in which the animal should be administered with normal dose and route. Subsequently, it was impossible to compare with the normal procedure.

The success of injection $\text{PGF}_{2\alpha}$ at IRF site was discussed by Colazo et al. (2002a). IRF apparently contains considerable fat.. The injection of prostaglandin into a fat depot may slow its absorption and prolong the time that the CL is exposed to it. The number of $\text{PGF}_{2\alpha}$ signals from that mechanism was effective for luteolysis.

This study demonstrated that the using of reduced dose $\text{PGF}_{2\alpha}$ by injection at IRF might be the alternative route for administration of prostaglandin to induce estrus in dairy cows.

Conclusion

This study investigated that dose of prostaglandin $\text{F}_{2\alpha}$ can be reduced by 60% of intramuscular dose when injection at ischiorectal fossa site. Thus, IRF might be the alternative route of injection of prostaglandin $\text{F}_{2\alpha}$ to induce estrus in dairy cows.

References

- Aiumlamai, S., Chaimongkol, C., Nithichai, K., Thommalee, T. and Kindahl, H. 1995. A clinical and endocrine study on heat synchronization in cattle using prostaglandin $F_{2\alpha}$. The 1st D.P.O. Annual Conference : The Dairy Technology Application. 22-28 August 1995. Nakornratchasima. pp. 68-76.
- Brinkerhoff, J., Silcox, R., Donley, J. and Kubo, C. 2004. The luteolytic potential of reduced doses of prostaglandin. *J Dairy Sci.* 87(Suppl.) 1: 469.
- Brogliatti, G.M., Martinez, M.F., Vietri, B., Basualdo, M., Feula, P. and Colazo, M.G. 2000. Subcutaneous injection of reduced dosages of cloprostenol to induce luteal regression in beef cattle. *Theriogenology.* 53: 197(abstract).
- Butcharoen, S., Virakul, P. and Suwimonteerabutr, J. 2001. Estrus synchronization in postpartum dairy cows by intrauterine infusion of prostaglandin $F_{2\alpha}$. Proceeding of the 4th dairy and dairy product conference. 13-14 December 2001. Sol. Twin Tower Hotel. Bangkok. pp. 33-34 (abrt.).
- Colazo, M.G., Martinez, M.F., Kastelic, J.P., Mapletoft, R.J. and Carruthers, T.D. 2002a. The ischiorectal fossa : an alternate route for the administration of prostaglandin in cattle. *Can. Vet. J.* 43(7): 535-541.
- Colazo, M.G., Martinez, M.F., Kastelic, J.P. and Mapletoft, R.J. 2002b. Effects of dose and route of administration of cloprostenol on luteolysis, estrus and ovulation in beef heifers. *Anim Reprod. Sci.* 72: 47-62.
- De Rensis, F. and Peters, A.R. 1999. The control of follicular dynamics by $PGF_{2\alpha}$, GnRH, hCG and oestrus synchronization in cattle. *Reprod. Dom. Anim.* 34: 49-59.
- Edmonson, A.J., Lean, I.J., Weaver, L.D., Faver, T., and Webster, G. 1989. A body condition scoring chart of Holstein dairy cows. *J. Dairy Sci.* 72: 68-78.
- Horta, A.E.M., Costa, C.M.S.G., Robalo Silva J. and Rios Vasquez, M.L. 1986. Possibility of reducing the luteolytic dose of cloprostenol in cycling dairy cows. *Theriogenology.* 25: 291-301.
- Odde, K.G. 1990. A review of synchronization of estrus in postpartum cattle. *J Anim Sci.* 68: 817-830.
- Pursley, J.R., Michael, R. KOSOROK. and Milo C. Wiltbank. 1997. Reproductive Management of Lactating Dairy Cows Using Synchronization of Ovulation. *J. Dairy Sci.* 80: 301-306.
- SAS. 1990. SAS Procedures Guide. SAS institute Inc, Lavy, NC, USA.

