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Short communication

Postparturient Administration of Prostaglandin F2 Alpha Facilitates Weaning-to-service Interval in Primiparous Sows

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Abstract

The present study was conducted to investigate the effect of exogenous prostaglandin F2 alpha ($PGF_{2\alpha}$) administration on weaning-to-service interval (WSI) in primiparous sows. A total of 149 primiparous sows, 74 control and 75 treatment sows, were included in the study. The latter sows were intramuscularly injected with $PGF_{2\alpha}$ approximately at 24-48 h after parturition. Results revealed that those treated with $PGF_{2\alpha}$ returned to be in estrus significantly faster than those in the control group (2.6±1.1 vs 4.5±2.1 days, $p<0.05$), while age at first mating, pregnancy rate, and age at first farrowing were not different from each other. In conclusion, $PGF_{2\alpha}$ could shorten WSI in the primiparous sows as it could induce complete luteolysis and promote uterine involution, resulting in declined non-productive days of the commercial breeding herds.

Keywords: $PGF_{2\alpha}$, primiparous sows, reproduction, weaning-to-service interval

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Introduction

Annually, female pigs are removed from breeding for various reasons around 50%; one-third of the culling reason is reproductive disorders (Engblom et al., 2007). In Thailand, the most outstanding reasons for culling include anestrus (44.0%), abnormal vaginal discharge (20.5%), repeated breeding (15.5%), not being pregnant (10.0%), and miscellaneous causes (10.0%) (Tummaruk et al., 2009). Post-weaning anestrus has been considered one of the most significant problems in breeding herds since it dramatically affects economic status via extending non-productive days (NPD). Basically, sows return to estrus within seven days after weaning. Consequently, the faster the sows start a new estrous cycle, the more the NPD could be diminished. In swine breeding industry, weaning-to-service interval (WSI) is one of the significant reproductive indices to be highlighted since a female which cannot return to estrus within the desired time will result in an economic loss. Currently, a number of hormones have been pervasively used to shorten WSI in female pigs in order to accelerate the initiation of new estrous cycle.

Prior to commencing a new estrous cycle in lactating sows, the uterus must be well-organized by endometrial regeneration and uterine involution which takes approximately 15-21 days (Lopez et al., 2009). Prostaglandin F2 alpha ($PGF_{2\alpha}$) has been introduced since it is mainly responsible for regulating corpora lutea (CL) functions, uterine contractility, ovulation, and embryo attachment (De Rensis et al., 2012). In a field practice, $PGF_{2\alpha}$ was utilized in order to devastate luteal tissue and stimulate uterine involution (Lopez et al., 2009). A recent study demonstrated conflicting clinical results after postpartum administering $PGF_{2\alpha}$; it might be because of different uterine problems and study designs (Lopez et al., 2009). However, the comprehensive field study of $PGF_{2\alpha}$ application in primiparous sows of Thailand has been very scant. The present study was to investigate the effect of administering $PGF_{2\alpha}$ to primiparous sows after farrowing on WSI in a swine breeding herd of Thailand.

Materials and Methods

Animals and management: This study was carried out with 149 replacement gilts in a swine commercial breeding herd in eastern Thailand. All were accommodated in open houses with the same management. Feed was manually given by 3 kg/head/day, meanwhile water were ad libitum provided via water nipples equipped above the crate. Herd health status was routinely monitored by experienced veterinarians. Vaccinations against foot and mouth disease, pseudorabies, classical swine fever, and porcine parvovirus were performed in all gilts. They were inseminated with conventional artificial insemination and were moved to farrowing houses seven days prior to an expected farrowing date. After farrowing, all sows were allowed to have lactation length of 21 days; estrus stimulation and detection, subsequently, were performed.

Backfat thickness measurement: An A-mode ultrasonography (Renco lean meter®, MN, USA) was used to evaluate backfat thickness at P2 position: 6-8 cm off the dorsal midline. An average of the measurements from both sides was used as an individual backfat thickness value (Roongsitthichai and Tummaruk, 2014). The measurement of backfat thickness was performed two times: at farrowing and weaning days.

Estrus stimulation and detection: Back pressure test, as well as exposure to mature boars, was used to stimulate and examine estrus expression in all sows. The test was regularly performed at once by experienced technicians after lactation halted for two times on a daily basis; morning and evening. Those showing standing reflex during such test were considered in estrus. Dates of weaning and the standing reflex were recorded in order to calculate weaning-to-service interval (WSI) of individuals. Nevertheless, those expressing estrus at 21 days onwards after insemination were recorded as non-pregnant sows.

Hormone administration: On the criterion of hormonal use, the sows were classified into two groups: control (n=74) and treatment (n=75) groups. Those in the treatment group were injected with 10 mg $PGF_{2\alpha}$ (Enzaprost®, CEVA Animal Health, Thailand) within 24-48 h after parturition via intramuscular route; whereas the control sows did not receive any treatment.

Statistical analysis: All data were manipulated and statistically analyzed with SAS version 9.3 (SAS Institute Inc., Cary, NC, USA). Descriptive and reproductive data were presented as mean±SD. A comparison between the control and treatment groups was conducted via student *t*-test. Values with $p<0.05$ were statistically significant.

Results and Discussion

Averagely, the primiparous sows were first inseminated at age 254.6±8.7 days and first farrowed 10.5±1.4 piglets at age 369.6±8.7 days. Reproductive data of the primiparous sows classified by postpartum $PGF_{2\alpha}$ are demonstrated in Table 1. Age at first insemination, age at first farrowing, and pregnancy rate of the sows were not different from each other. However, those treated with $PGF_{2\alpha}$ apparently returned to service faster than those in the control group as could be seen from WSI variable (2.6±1.1 vs 4.5±2.1 days, $p<0.05$).

The sows treated with $PGF_{2\alpha}$ postpartum, in the current study, possessed obviously shorter WSI than those in the control group. This implied that the corpora lutea of these sows were completely regressed faster than of those of the control group. Naturally, luteolysis in gestating sows takes place before parturition via $PGF_{2\alpha}$ from the endometrium (Evans and O'Doherty, 2001). Normally, progesterone declines rapidly after parturition to <1.0 ng/ml (Baldwin and Stabenfeldt, 1975; Tarrier et al., 1989). Nevertheless, a preceding study in the Netherlands

revealed that approximately 8% of weaned sows possessed persistent corpora lutea on the ovaries, maintaining high concentration of blood progesterone (>3.0 ng/ml) (Elbers et al., 1994). Moreover, Lewis (2004) stated that progesterone tenanted a suppressive effect on immunity mechanism of the endometrium. It might lead to an inappropriate environment of the endometrium, impairing the readiness for initiating standing estrus after delivery. However, $PGF_{2\alpha}$ has an immunostimulatory effect on the endometrium; it has been thought that $PGF_{2\alpha}$ administration enhances immunocyte response from the endometrium (Lopez et al., 2009). As a result, the postpartum application of $PGF_{2\alpha}$ facilitated the luteolysis and the preparation of suitable uterine environment for the next estrous cycle of the sows.

Not only luteolytic effect, $PGF_{2\alpha}$ also stimulates uterine involution which is majorly driven by muscle contraction of the uterus (Dial, 1984). An *in vitro* study found that $PGF_{2\alpha}$ injection resulted in a strong contractility of uterine muscular layers, especially longitudinal muscle (Cao et al., 2002). In addition, a former study demonstrated that exogenous $PGF_{2\alpha}$ administration to farrowed sows with and without reproductive problems contributed to increased uterine contraction and debris removal from the uterus (Koketsu and Dial, 2002).

Table 1 Reproductive data (mean±SD) of 149 primiparous sows in control and treatment groups

Variables	Control (n=74)	Treatment (n=75)
Age at first mating (day)	254.4±8.6[a]	254.9±8.8[a]
Pregnancy rate (%)	80.0[a]	90.0[a]
Age at first farrowing (day)	369.4±8.7[a]	369.9±8.8[a]
First litter size (piglet)	10.6±1.2[a]	10.5±1.5[a]
Weaning-to-service interval (day)	4.5±2.1[a]	2.6±1.1[b]

[a,b] Different superscripts demonstrate statistical difference (p<0.05).

In summary, the administration of $PGF_{2\alpha}$ to the postparturient primiparous sows could help lessen WSI since the exogenous $PGF_{2\alpha}$ administration could induce luteolysis, together with regress persistent corpora lutea, and promote uterine involution. This made uterine environment ready for the next estrous cycle. Therefore, the primiparous sows treated with $PGF_{2\alpha}$ showed standing reflex after weaning faster than those not receiving any treatment. The administration of $PGF_{2\alpha}$ will be beneficial to commercial breeding herds since it can help reduce the non-productive days.

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บทคัดย่อ

การฉีดโพรสตาแกลนดิน เอฟทูอัลฟ่าช่วยลดระยะหย่านมถึงผสมพันธุ์ในแม่สุกรท้องแรก

อตถพร รุ่งสิทธิชัย[1] เผด็จ ธรรมรักษ์[2] นัทธี อ่ำอินทร์[2]*

การทดลองนี้มีวัตถุประสงค์เพื่อศึกษาผลของการฉีดโพรสตาแกลนดิน เอฟทูอัลฟ่าต่อระยะหย่านมถึงผสมพันธุ์ในแม่สุกรสาวท้องแรก สุกรที่ใช้ศึกษามีทั้งหมด 149 ตัว แบ่งเป็นกลุ่มควบคุม 74 ตัว และกลุ่มทดลอง 75 ตัว ทำการฉีดโพรสตาแกลนดิน เอฟทูอัลฟ่าให้กับสุกรในกลุ่มทดลองหลังคลอดประมาณ 24-48 ชั่วโมง และไม่มีการฉีดฮอร์โมนใดให้กับสุกรในกลุ่มควบคุม จากการศึกษาพบว่าแม่สุกรในกลุ่มทดลองสามารถกลับมาแสดงอาการเป็นสัดได้เร็วกว่าแม่สุกรในกลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ (2.6±1.1 และ 4.5±2.1 วัน, $p<0.05$) ในขณะที่อายุที่ได้รับการผสมพันธุ์ครั้งแรก อัตราการตั้งท้อง และอายุที่เข้าคลอดครั้งแรกไม่มีความแตกต่างกัน โดยสรุป ฮอร์โมนโพรสตาแกลนดิน เอฟทูอัลฟ่าสามารถช่วยลดระยะหย่านมถึงผสมพันธุ์ในแม่สุกรท้องแรกได้ เนื่องจากมีความสามารถในการสลายเนื้อเยื่อก้อนเหลืองและกระตุ้นให้มดลูกเข้าอู่เร็วขึ้น จึงส่งผลให้จำนวนวันที่ไม่ให้ผลผลิตของฟาร์มลดลงอีกด้วย

คำสำคัญ: โพรสตาแกลนดิน เอฟทูอัลฟ่า แม่สุกรท้องแรก ระบบสืบพันธุ์ ระยะหย่านมถึงผสมพันธุ์

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