Ovozoa 13 No. 2, August 2024 p-ISSN 2302-6464 e-ISSN 2722-967X
Available at https://e-journal.unair.ac.id/OVZ/index

Original article

Effect of PG-600 dose in cows with persistent corpus luteum treated with $PGF_{2\alpha}$ and hCG

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Open access under CC BY – SA license, DOI: 10.20473/ovz.v13i2.2024.90-95
Received February 1 2024, Revised September 1 2024, Accepted September 2 2024
Published online September 2024

ABSTRACT

The purpose of this study was to determine the effect of administering a dose of gonadotropin (PG-600) in cows with persistent corpus luteum (PCL) which were treated with prostaglandin F2 α (PGF2α) and human chorionic gonadotropin (hCG). This study used 20, three-year-old cows diagnosed with PCL, had recently given birth, and were not pregnant. Cows were randomly allocated into groups T0, T1, T2 and T3. Cows in all groups were injected with PGF2α (25 mg/cow). Simultaneously, cows in groups T1, T2 and T3 were also injected with PG-600 at doses of 100, 150 and 200 IU/cow respectively. PGF2α and PG-600 were injected when PCL was identified. After that, cows showing signs of estrus were injected with hCG (100 IU/cow) and artificially inseminated 12-18 hours after the appearance of signs of estrus. AI was conducted using frozen thawed semen. Sixty days following AI, a pregnancy examination was conducted using USG. Estrus was detected in all treated cows, while the pregnancy rates varied. Compared with other groups, the groups given 100 and 150 IU PG-600 produced higher pregnancy rates. It could be concluded that the combination of 25 mg PGF2α, 150 IU PG-600, and 100 IU hCG was the most effective treatment to produce high pregnancy rates in cows with persistent corpus luteum.

Keywords: conception rate, Limousin cows, pregnant mare serum gonadotropin, reproductive disorder, ultrasonography

INTRODUCTION

Reproductive disorders are one of the problems faced by smallholder farmers (Yusuf *et al*., 2019; Tolosa *et al*., 2021). The impact of reproductive disorders could be seen from high services per conception (S/C), long calving interval (CI), and low calving rates which have an impact on decreasing farmer income (Tulu and Negera, 2022).

Prostaglandin F2α (PGF2α) was administered to lyse the corpus luteum (CL) to return the estrous cycle to the follicular phase by stopping progesterone production (Carlos *et al*., 2019). The follicular phase began with the elimination of the negative effects of progesterone so that the GnRH concentration increased and caused an increase in FSH and LH

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production to support follicular growth (Orlowski and Sarao, 2023). Giving PGF2α could help reduce progesterone levels to the lowest level so that it could trigger estrogen secretion from the dominant follicle cells, causing estrus (Madureira *et al*., 2021). The PGF2α could only regress an active CL. Intramuscular injection of 20-25 mg of PGF2α or 5-6 mg intrauterine in cows could on average cause estrus on the third day after injection (Mohammadi *et al*., 2019). Detection of estrus and the correct timing of artificial insemination were important things that could influence the success of pregnancy in livestock to be inseminated. Unsuccessful pregnancy often occured due to incorrect detection of estrus so the timing of artificial insemination (AI) was incorrect (Putri *et al*., 2022).

The role of hCG in livestock, like the LH, included extending the life span of the corpus luteum, increasing progesterone synthesis by the CL, inducing ovulation throughout the estrous cycle, and helping the formation of an accessory CL when given at the beginning of the luteal phase (De Rensis *et al*., 2010). Human Chorionic Gonadotropin could treat domestic animal infertility, resolve cystic ovarian symptoms, induce estrus, eliminate nymphomania, and stimulate ovulation. The LH activity it contained caused hCG to be luteotropic and prolonged the function of the CL for several days, thereby increasing pregnancy rates (Santos-Jimenez *et al*., 2021).

PG-600 is a single-dose injection product labeled for estrus induction in pigs which contains a combination of pregnant mare serum gonadotropin (PMSG) and human chorionic gonadotropin (hCG) (Habeeb *et al*., 2018). The use of PMSG and hCG (PG-600) could induce follicular growth resulting in 100% estrus (Masruro *et al*., 2020). The PMSG hormone was a complex glycoprotein that had activities like FSH. PMSG worked by inhibiting the follicle regression process. PMSG preparations worked to stimulate follicular growth. The high sialic acid content in the PMSG molecule caused the half-life of the PMSG hormone to be longer, so it was sufficient to give it in a single dose. The PMSG hormone had a direct influence on oocyte maturation by stimulating the development of the oocyte nucleus so that only a small number of oocytes stop developing. The more and faster development of oocytes could affect the number of CL that would form after ovulation (Zolbin *et al*., 2018). The objective of this study was to evaluate the efficacy of different doses of PG-600 in combination with PGF2α and hCG on estrus induction and pregnancy rates in cows with persistent corpus luteum.

MATERIALS AND METHODS

This study was conducted in the Mangaran District Health Center area, Situbondo Regency Animal Husbandry Service which is located at 7° 66' 30" South Latitude and 114° 03' 94" East Longitude. Twenty cows with persistent corpus luteum (PCL), with the criteria of having previously calved, based on medical records showing no signs of estrus for more than one estrous cycle, and having PCL on ultrasound examination, were randomly divided into groups of T0, T1, T2 and T3.

Cows in all groups were injected with PGF2α (Capriglandin, Caprifarmindo Laboratories) at a dose of 25 mg/cow. At the same time, cows in groups T1, T2 and T3 were also injected with PG-600 (Intervet) at doses of 100, 150 and 200 IU/cow respectively. Cows that showed signs of estrus were injected with hCG (Chorulon, MSD) at a dose of 100 IU/cow and artificially inseminated 12-18 hours after the appearance of signs of estrus. All injections were performed intramuscularly. AI was conducted using frozen thawed semen from a Limousin bull (purchased from Center for Artificial Insemination, Singosari), with a dose of 25 million spermatozoa per midi straw (0.5 mL). Implementation of AI by the inseminator according to standard operational procedures. Frozen semen straw was thawed in water at 37-39°C for 15 seconds, then the outside of the straw was cleaned with a sterile tissue. The hawed straw was inserted into the AI gun, and the seal was cut. Plastic sheath was put on and locked and insemination was carried out in the fourth position. Pregnancy examination is carried out 60 days after AI using ultrasound.

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The data obtained was presented in tabular form and then analyzed descriptively.

RESULTS

The hormone therapy applied in this study showed an estrous rate of 100% in all treatment groups. However, mean pregnancy rates varied significantly between groups. The T0 group, which did not receive PG-600, showed the lowest pregnancy rate at 60%, while the T1 group, which received 100 IU of PG-600, had an improved rate of 80%. The T2 and T3 groups, which received higher doses of PG-600 (150 IU and 200 IU, respectively), both achieved 100% pregnancy rates.

Table 1 Estrous and pregnancy rates of cows with persistent corpus luteum treated with PGF2α, hCG, and various doses of PG-600

	treatment			estrous rate (%)	pregnancy rate (%)
	PGF2α	PG-600	hCG		
T0	25 mg	-	100 IU	100	60
T1	25 mg	100 IU	100 IU	100	80
T2	25 mg	150 IU	100 IU	100	100
T3	25 mg	200 IU	100 IU	100	100

PGF2α and PG-600 were injected when CLP was diagnosed; hCG was injected simultaneously with artificial insemination 12-18 hours after the onset of estrus; all injections were performed intramuscularly; pregnancy was diagnosed 60 days after AI by ultrasonography; replicates= 5.

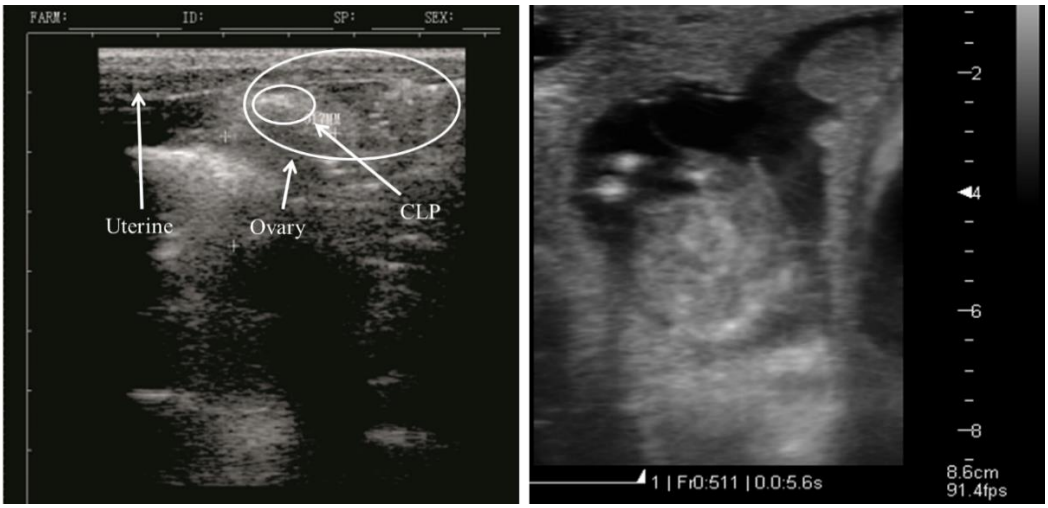

Figure 1 Diagnosis of persistent corpus luteum in cows using ultrasonography (left) and pregnancy examination on day 60 after artificial insemination (right).

DISCUSSION

In this study, cows experiencing PCL were treated with a combination of PG-600, PGF2α, and hCG. Persistent corpus luteum is a condition where the CL did not regress, remaining in the ovary for an extended period and often leading to anestrus (Azwani *et al*., 2021). The clinical management of PCL typically involved induction of luteolysis, which could be achieved through rectal palpation, intrauterine iodine administration, or PGF2α therapy (Azwani *et al*., 2021).

PGF2α, a potent luteolytic agent, was administered intramuscularly at a dose of 25 mg per cow to induce CL regression and synchronize estrus. PGF2α naturally functioned by inducing luteolysis during the luteal phase of the estrous cycle in non-pregnant cows, typically between days 16 to 18, which facilitated the return to the

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follicular phase and the onset of estrus (Carlos *et al*., 2019). Previous studies had demonstrated variable estrous rates following PGF2α administration, ranging from 72.32% to 100% (Bihon and Assefa, 2021).

Simultaneously with PGF2α, PG-600 was administered intramuscularly at varying doses of 100, 150, and 200 IU per cow. PG-600 is a hormone preparation containing a combination of PMSG and hCG, which were analogous to follicle stimulating hormone (FSH) and luteinizing hormone (LH) (Kumari *et al*., 2015). These hormones played a critical role in stimulating follicular growth, leading to estrus and subsequent ovulation (Nedresky and Singh, 2021). In this study, all treatment groups exhibited a 100% estrous rate, indicating the effectiveness of PG-600 in inducing estrus.

However, the pregnancy rates varied significantly between the groups. The groups given higher doses of PG-600 (150 IU and 200 IU), achieved a 100% pregnancy rate, while the group given a lower dose (100 IU), had a pregnancy rate of 80%. The control group, which did not receive PG-600, exhibited the lowest pregnancy rate at 60%. This suggests that the higher doses of PG-600 were more effective in supporting follicular maturation and subsequent ovulation, leading to improved conception rates. These findings are consistent with previous research, which reported that higher doses of PG-600 combined with hCG could significantly enhance both estrous and pregnancy rates in cows with reproductive disorders (Masruro *et al*., 2020; Azwani *et al*., 2021). Specifically, the study by Azwani *et al*. (2021) found that a combination of 7.5 mg PGF2α, 300 IU PG-600, and 300 IU hCG resulted in a 100% estrous and pregnancy rate in dairy cows with CLP.

The administration of hCG, which was carried out simultaneously with AI, was known to elevate plasma progesterone levels, supporting the maintenance of the CL and preventing early embryonic loss (Pandey *et al*., 2016). By increasing progesterone production, hCG helped sustain pregnancy by ensuring the continued development of the CL, which was crucial for maintaining pregnancy and preventing embryonic abortion (Cunha and Martins, 2022). In addition, post-AI hCG injection could promote the formation of an accessory CL, which had been associated with a lower incidence of early embryonic death (Chen *et al*., 2023). The results of this study are consistent with these findings, with ultrasonography revealing continued CL growth following hCG administration, thus ensuring maintenance of pregnancy.

Pregnancy diagnosis was confirmed using rectal palpation and ultrasonography. Ultrasonography, widely used in reproductive research, allows for the observation of follicles and the CL without impacting the physiological state of the cow's ovaries (Torres-Lechuga and González-Maldonado, 2022). It is effective for early pregnancy detection, typically recommended from 30 days post-AI, though it can identify pregnancies as early as 25 days (Bagley *et al*., 2023).

CONCLUSION

This study concludes that while PG-600 has been widely used by veterinarians to treat persistent corpus luteum (PCL) cases, the commonly applied dose of 300 IU per cow may not be the most cost-effective option for farmers. The findings of this research indicate that a reduced dose of 150 IU of PG-600 is equally effective in enhancing conception rates in cows with PCL. This suggests that veterinarians could optimize treatment protocols by using a lower, yet effective, dose of PG-600, thereby providing a more economical solution without compromising reproductive outcomes.

ACKNOWLEDGEMENT

Thank you to Sri Chusniati, drh., M.Kes. for expertise support, Prima Aldino for technical support.

AUTHOR'S CONTRIBUTIONS

Sofia Brenieta Brilianti (SBB), Wurlina Wurlina (WW), Sri Mulyati (SM), Budi Utomo (BU).

SBB: conceived the idea, designed the mainframe of this manuscript, acquisition data,

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WW and SM: analysis and interpretation of data, SBB and SM: manuscript drafting. BU, WW and OSW: critically read and revised the manuscript for intellectual content. All authors read and approved the final manuscript.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

FUNDING INFORMATION

This study funded by the authors.

REFERENCES

Almeida FB, Faria OAC, Silva BDM. 2018. Prostaglandin F2α as an inducer of ovulation in Fixed Timed Artificial Insemiantion in Zebu cows. Anim Reprod. 15 (Suppl.1): 1104.

Aréchiga-Flores C, Cortés-Vidauri Z, Hernández-Briano P, Flores-Flores G, Rochín-Berumen F, Ruiz-Fernández E. 2019. Review: Function and regression of the corpus luteum during the estrous cycle. Abanico Vet. 9: 1-21.

Azwani N, Suprihati E, Madyawati SP, Srianto P, Sardjito T. 2021. Angka kebuntingan sapi perah dengan korpus luteum persisten setelah pemberian kombinasi Prostaglandin F2α dan Gonadotropin. Ovozoa : J Anim Reprod. 10: 59-64.

Bagley JE, Richter MP, Lane TJ. 2023. The role of transrectal sonography in pregnancy diagnosis in cattle. J Diagn Med Sonogr. 39: 50-60.

Bihon A, Assefa A. 2021. Prostaglandin based estrous synchronization in cattle: A review. Cogent Food Agric. 7: 1932051.

Chen F, Hou Y, Zhu X, Mei C, Guo R, Shi Z. 2023. Impact of accessory corpus luteum induced by gonadotropin-releasing hormone or human chorionic gonadotropin on pregnancy rates of dairy cattle following embryo transfer: A meta-analysis. Vet Sci.10: 309.

Cunha TO, Martins JPN. 2022. Graduate Student Literature Review: Effects of human chorionic gonadotropin on follicular and luteal dynamics and fertility in cattle. J Dairy Sci. 105: 8401-10.

De Rensis F, López-Gatius F, García-Ispierto I, Techakumpu M. 2010. Clinical use of human chorionic gonadotropin in dairy cows: An update. Theriogenology 73: 1001-8.

González EU, Pérez LAV, Garza A, Mapes G, Gutiérrez CG, Hernández-Cerón J. 2017. Pregnancy rate in dairy cows treated with human chorionic gonadotropin five days after insemination. Austral J Vet Sci. 49: 119-22.

Habeeb HMH, Hazzard TM, Stormshak F, Kutzler MA. 2018. Effect of different dosages of PG-600 on ovulation and pregnancy rates in ewes during the breeding season. Transl Anim Sci. 3: 429-32.

Kumari N, Arora T, Modakand SB, Muralidhar K. 2015. A critical review of gonadotropic activity of Pregnant Mare Serum Gonadotropin. Asian J Sci Technol. 06: 1933-40.

Madureira AML, Burnett TA, Borchardt S, Heuwieser W, Baes CF, Vasconcelos JLM, Cerri RLA. 2021. Plasma concentrations of progesterone in the preceding estrous cycle are associated with the intensity of estrous and fertility of Holstein cows. PLoS One. 16: e0248453.

Manta MW, da Silva EP, Feltrin SR, Prante AL, Aires KV, de Andrade LG, da Silva AP, Amaral CDS, Wink LM, Portela VM, Antoniazzi AQ. 2024. Human Chorionic Gonadotrophin (hCG) induces changes in IFN-pathway and Interferon-Stimulated Genes (ISGs) on the bovine endometrium at day 18 of pregnancy. Anim Reprod. 21: e20230130.

Masruro NA, Mulyati S, Harijani N, Madyawati SP, Samik A, Ratnani H. 2020. Application of Gonadotropin combination for ovarian hypofunction therapy in dairy cows. Ovozoa : J Anim Reprod. 9: 23-7.

Mohammadi A, Seifi HA, Farzaneh N. 2019. Effect of prostaglandin F2α and GnRH administration at the time of artificial insemination on reproductive performance of dairy cows. Vet Res Forum 10: 153-8.

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Nedresky D, Singh G. Physiology, Luteinizing Hormone. [Updated 2022 Sep 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. https://www.ncbi.nlm.nih.gov/books/NBK539692/

Orlowski M, Sarao MS. 2024. Physiology, Follicle Stimulating Hormone. [Updated 2023 May 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. https://www.ncbi.nlm.nih.gov/books/NBK535442/

Pandey AK, Ghuman SP, Dhaliwal GS, A. Kumar A, Agarwal SK. 2016. Impact of buserelin acetate or hCG administration on day 12 post-ovulation on subsequent luteal profile and conception rate in buffalo. J Anim Reprod Sci. 136: 260-7.

Santos-Jimenez Z, Meza-Herrera CA, Calderon-Leyva G, Martinez-Ros P, Guillen-Muñoz JM, Gonzalez-Bulnes A. 2021. Efficiency of hCG for inducing resumption of ovarian cyclicity and synchronized ovulations during the seasonal anestrous in sheep. Animals 11: 3159.

Socha BM, Łada P, Jończyk AW, Korzekwa AJ, Skarżyński DJ. 2022. The role of peroxisome proliferator-activated receptors in $PGF_{2\alpha}$-induced luteolysis in the bovine corpus luteum. Animals (Basel) 12: 1542.

Tolosa F, Netsere M, Habtamu Y.2021. Assessment of major reproductive disorders in dairy cattle in and around Bale Robe, Oromia regional state, Ethiopia. Vet Med Int. 2021: 8855718.

Torres-Lechuga ME, González-Maldonadob J. 2022. Ultrasonography and physiological description of essential events for reproductive management in dairy cattle. Rev Mex Cienc Pecuarias 13: 452-472.

Tulu D, Negera C. 2022. Reproductive disorders of cattle in the Tole district of Southwest Ethiopia and their prevalence and associated risk factors, Adv Agric. 2022: 4806982.

Utami P, Hanif MZ, Yekti APA, Prafitri R, Huda AN, Kuswati K, Kusmartono K, Susilawati1 T. 2022. Evaluation the success of artificial insemination using frozen sexed semen based on different estrous characters. J Agripet 22: 190-6.

Yusuf M, Toleng AL, Rahardja DP, Sahiruddin S, Long ST. 2019. The incidence of reproductive disorders in dairy cows under smallholder farms. Hasanuddin J Anim Sci. 1: 22-7.

Zolbin MJ, Nematian S, Daghigh F, Namdar F, Zaree ST, Madadian M, Abbasi M, Mogahi SMHN, Takzareea N. 2018. PMSG and hCG hormones effect on the development and growth of ovarian follicles. J Contemp Med Sci. 4: 51-4.

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