

Effectiveness of PGF2 α Hormone Dosage Using the IM Method to Synchronize Estrus in Peanut Goats

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Abstract

The purpose of this study is to assess the effectiveness of administering doses of PGF2 α hormone in regulating estrus synchronization in Kacang goats. The research was conducted in Sohuwe Village with variables including the time of onset of estrus, percentage of estrus, symptoms of estrus, and duration of estrus. In the study, it was found that administering doses of PGF2 α hormone at 0.4 ml, 0.6 ml, and 0.8 ml to bean goats resulted in significant differences in the onset and duration of estrus. This indicates different variations in estrus response between the different doses. Estrus symptoms observed in all animals included restlessness, mounting and standing still when mounted, decreased appetite, swelling and redness of the vulva, and the discharge of transparent mucus from the vulva. The estrus percentage reached 100% in all animals. It can be concluded that the doses of PGF2 α hormone used are still effective for estrus synchronization in Kacang goats. However, the results indicate that the 0.8 ml dose (P3) had a better influence on the onset and duration of estrus compared to the 0.4 ml (P1) and 0.6 ml (P2) doses. This indicates that the 0.8 ml dose had the most significant effect in regulating estrus in bean goats in the study.

Keywords: PGF2 α , Estrus Synchronization, Bean Goats



INTRODUCTION

The Peanut goats native to Indonesia and has a small to medium-sized body, with a light head, short ears, and is widespread in rural areas. Indonesia. Peanut goats have a high level of adaptation to various natural conditions and good breeding efficiency, often kept as a source of protein and additional income by local farmers. Many farmers choose to breed Peanut goats because they are considered to be easy animals to raise. They are able to convert poor quality feed, have a relatively short reproductive maturity and gestation period, and can be used as savings to meet urgent needs. In addition, Peanut goats also have a moderate reproductive rate, providing a good opportunity for farmers to develop their farming business (Tulle *et al.*, 2021; Harmoko *et al.*, 2020).

Capital investment in goat farming enterprises is relatively low compared to cattle farming enterprises. Goats are believed to mature physically and sexually faster. In addition, goats have more than one kid in one birth, short birth spacing, and a relatively faster gestation period resulting in faster capital turnover compared to other ruminant livestock businesses. This is also justified by Mutaqqin *et al.* (2017) who stated that local goats mature faster sexually crossbreeding with other goat breeds is easy to do, and can survive with low quality feed. However, the quality and productivity of local goats are still considered very low, mainly due to poor management systems and uncontrolled mating systems. According to Dwatmadji *et al.* (2017), the reproductive performance of goats is influenced by the lack of reproductive management efforts made by farmers. Therefore, increasing the number of livestock needs to be supported by farmers' awareness of the importance of reproductive management. In the livestock industry, one strategy that can be used to improve reproductive efficiency is through the application of hormone technology.

Various techniques are used to regulate the estrous cycle in ruminants, including the administration of progesterone and estrogen. However, currently, prostaglandin F₂-alpha (PGF₂α) is the most commonly used preparation (Fauzi *et al.*, 2017). The hormone often chosen to induce estrus is prostaglandin F₂α (PGF₂α), such as Lutaprost which contains cloprostenol sodium. Cloprostenol sodium is an analogue of prostaglandin F₂α (PGF₂α), which is the main luteolytic agent that induces luteinization. Decreased levels of the hormone progesterone stimulate follicular growth through the production of FSH, which in turn increases ovarian follicle growth and estrogen hormone production, which triggers estrus (Agnieszka *et al.*, 2019).



Estrous synchronization is a strategy to trigger estrus in a group of healthy female animals by regulating hormonal mechanisms. The goal is for estrus and ovulation to occur simultaneously or within a very close time span after administration of the hormone PGF2 α , allowing simultaneous mating. Bahari *et al.* (2023) explained that estrus synchronization is one of the important methods in regulating reproduction of farm animals. The advantages of estrus synchronization include the ease of detecting lambing because animals show symptoms at the same time, which makes it easier to determine the timing of mating, as well as the birth of offspring at the same time, which ultimately increases the efficiency of livestock maintenance and sales management (Zaenuri & Rodiah, 2016). Estrus synchronization can be done using prostaglandins or progesterone hormones. Anisa *et al.* (2023) reported that the use of prostaglandins for estrus synchronization gave similar estrus response, estrus onset, and estrus intensity in goats. The process of estrus induction using PGF2 α is usually divided into two stages. The initial stage tends to be successful in balancing the estrous cycle with a functional *corpus luteum* (CL) (Nascimento *et al.*, 2014). The second stage is performed during the luteal phase (Labetubun *et al.*, 2020).

Hormones given in very small amounts can stimulate certain cells to function, but how much hormone dose is still effective to be given to pea goats by IM method is not yet known. Therefore, a hormone dose of 0.4 ml was given to test whether the dose was still effective for estrus synchronization. Furthermore, the hormone dose of 0.6 ml is the dose recommended by the lutaprost prostaglandin hormone company. The results of research by Labetubun *et al.* (2020), showed that injecting PGF2 α intramuscularly at a dose of 1.5 ml in the P3 treatment had a faster onset of estrus, which was only 5.31 hours on average, compared to the results of Gea *et al.* (2023), which has a longer onset of estrus, namely 2 days with a dose of 0.5 ml, then a dose of 0.8 ml of hormone is given to test how long the onset of estrus or the time of onset of estrus after giving this dose. Intra Muscular (IM) injection is the injection of hormones into the muscle. There are various injection methods for estrus synchronization in goats.

However, the IM method of PGF2 α injection is the most effective method for estrus synchronization in Peanut goats. This study aims to determine the effectiveness of the dose of PGF2 α hormone using the IM method for estrus synchronization in Peanut goats.

RESEARCH METHODS

The study was conducted for two months from September to November 2023 in Sohuwe Village, East Taniwel Sub-district, West Seram Regency (SBB). Tools used included syringes, clocks,



cameras, and numbering tools for cattle. PGF2 α hormone (Lutaprost), nine female and two male goats were prepared as research materials. The method applied was an experiment involving three treatment doses of Lutaprost-type PGF2 α hormone, namely 0.4 ml (P1), 0.6 ml (P2), and 0.8 ml (P3) given to nine goats, each repeated three times. The goats used ranged in age from 3 to 4 years old, not yet pregnant, but had given birth. To determine pregnancy status, a test using *Pregna Drop* was conducted. Observation of estrus was done the day after intramuscular injection of PGF2 α .

The research stages can be described as follows:

1. Preparatory stage: consists of collection of female goats based on predetermined criteria, preparation of group pens, preparation of feed, conducting physiological adaptation with goats. All activities in the study aim to ensure the health of goats is guaranteed during the implementation of the study. Preparation is also done on the tools and materials needed for research, as well as other important things, to ensure the smoothness and success of the research. Also, a pregnancy test using *Pregna Drop* was conducted to determine whether or not the female animals that were the subject of the study were pregnant.
2. The treatment stages in this study involved 3 different treatments, namely the use of PGF2 α with P1 (0.4 ml), P2 (0.6 ml) and P3 (0.8 ml) in a total of 9 goats. Each treatment was done as many as 3 replicates. The distance between the first injection and the second injection was 11 days.
3. The observation stage or estrus detection was carried out after the second PGF2 α injection. Observations were made 3 times a day at 07.00 to 09.00 WIT, 12.00 WIT, and 12.00 WIT to 14.00 WIT and 16.00 to 18.00 WIT. observations were conducted visually and using male goats to detect estrus.

The variables observed in this study include: time of onset of estrus, percentage of estrus, signs of estrus, and duration of estrus. Data analysis in this study using a complete randomized design (CRD) unidirectional pattern was used to analyze data on the time of onset of estrus and duration of estrus. While descriptive analysis to analyze the variable percentage of estrus and signs of estrus.



RESULTS AND DISCUSSION

Estrus Emergence Time

The time of onset of estrus is calculated from the last or second hormone injection to the appearance of estrus symptoms in goats. The estrus process is influenced by various hormones, including gonadotropins from the anterior pituitary gland and ovarian hormones such as FSH and estrogen (Nurfitrani *et al.*, 2015). The duration of estrus in female goats ranges from 12-48 hours and can vary greatly between individuals. Previous research by Adam *et al.* (2018) showed that ovulation always occurs after the end of estrus in goats. The P3 treatment showed a faster onset of estrus compared to P2 and P1, as indicated by the results of statistical analysis that showed a significant difference ($P < 0.05$) between the two treatments.

Table 1: Time to estrus after PGF2 α hormone administration

Repeat	Estrus onset time (hours)		
	0.4 ml (P1)	0.6 ml (P2)	0.8 ml (P3)
1	66,05	41,00	28,54
2	66,20	39,53	29,37
3	69,00	39,50	29,26
Average	66.09 ^c $\pm$ 0.10	40.01 ^b $\pm$ 0.86	29.06 ^a $\pm$ 0.45

^{abc}Observed superscript differences indicate significant differences ($P < 0.05$).

Data analysis showed variation in the time of onset of estrus in all goats injected with PGF2 α intramuscularly (IM). Treatment P3, P3 treatment showed the fastest onset of estrus compared to P2 and P1 treatments, while P2 treatment was faster than P1 (Table 1). In other words, when given PGF2 α IM, the P3 treatment produced a faster estrus response, with an average onset in only 29.06 hours. This time difference was 10.95 hours faster than P2 and 37.03 hours faster than P1. In addition, there was a significant difference of 26.08 hours between P2 and P1.

These results confirm that the dose of PGF2 α given directly affects the decrease in the corpus luteum of Peanut goats. The higher the dose of hormones given, the faster the goats will enter estrus. Previous studies by Labetubun *et al.*, (2020) on Peanut goats found that IM administration of PGF2 α at a dose of 1.5 ml on the 10th day after the second injection resulted I



an average onset of estrus within 5.31 hours.

Estrus Percentage

Estrus, also known as lambing, is an important phase in the reproductive cycle of a female animal where her body is ready for mating. At this stage, there is an increased production of the hormone estrogen, which results in the growth of ovarian follicles reaching their peak. The duration of estrus, or the length of the period of willingness to mate, is influenced by the amount of estrogen hormone produced by the ovarian follicles during this phase (Handayani *et al.*, 2014).

Table 2: Percentage of estrus after PGF2 α hormone administration

PGF2 α Dose Treatment	Number of Livestock (tail)	Estrus Percentage (100%)
0.4 ml (P1)	3	100
0.6 ml (P2)	3	100
0.8 ml (P3)	3	100
Total	9	100

The results showed that all goats studied, whether treated with P1, P2, or P3 harmonized with the use of PGF2 α hormone, showed positive estrus symptoms with an overall rate of 100% (Table 2). This may be influenced by the correct timing of treatment, especially during the luteal phase (CL), which makes PGF2 α work effectively. This result is in accordance with the findings reported previously by Gea *et al.* (2023) who also found that all goats showed 100% estrus symptoms after using PGF2 α .

The results of this study are in line with research conducted by Labetubun *et al.*, (2020) and Puturuhi's research (2018), which showed that intramuscular administration of PGF2 α (IM) in Peanut goats can achieve an estrus rate of 100%. This finding confirms that the intramuscular (IM) injection method of PGF2 α is an effective method to synchronize estrus in Bean goats. It also reinforces the reliability and effectiveness of using the MI method in inducing estrus in Peanut goats for reproductive management purposes.

Symptoms of Estrus

Estrous symptoms are a series of functional changes in the body of livestock that indicate readiness for mating. This is reflected in behavioral changes in female cattle, such as restlessness, swelling of the vulva, changes in the color and consistency of vulval mucus, and other signs such



as reddening of the vulva. These changes indicate an active estrus phase in the reproductive cycle of the female livestock.

Table 3. Symptoms of estrus after PGF2 α hormone treatment

Treatment	Estrus Symptoms
P1	In the P1 treatment, cattle showed signs of estrus such as restlessness, emitting characteristic sounds, lack of appetite, raised tail and faster movements, frequent bleating, red and swollen vulva, mucus coming out of the vulva, mating behavior with the same sex, and being peaceful when ridden by male cattle.
P2	Cattle show signs of estrus with restlessness, producing characteristic sounds, decreased appetite, raised tail and faster movements, frequent bleating, red and swollen vulva with a warm sensation to the touch, mucus discharge from the vulva, mating behavior with conspecifics, and calming down when ridden by males.
P3	Show symptoms of overheating due to restlessness, produce distinctive sounds, have decreased appetite, raised tail and faster movements, often clipped, red and swollen vulva with a warm sensation to the touch, mucus discharge from the vulva, often paired with males and calm when ridden by male cattle

The results from Table 3 show that estrus symptoms in all treatments P1, P2, and P3 showed a good response. Although there was no significant difference in estrus symptoms between the three treatments, all treatments showed similar characteristics in goats during estrus. Symptoms observed included restlessness, distinctive sounds, decreased appetite, tail lift and more active movements, reddened and swollen vulva with a warm sensation to the touch, mucus discharge from the vulva, increased social behavior with conspecifics, and restlessness when in close proximity to bulls. These results are in line with previous studies conducted by Gea *et al.* (2023), Budiyanto *et al.* (2020), and Fattah (2015), who also noted that goats show symptoms of estrus with similar characteristics, such as restlessness, raised tail, frequent bleating, swollen and red vulva, warm to the touch, mucus discharge from the vulva, and behavior that approaches the male and shows readiness to mate.



Length of Estrus Time

Differences in follicular maturation in the follicular phase can cause the speed of onset of estrus to vary significantly between individuals, where estrus duration is the time span from the appearance of estrus symptoms to the end of those symptoms.

Table 4. Length of estrus time after PGF2 α hormone treatment

Estrus Time (Hour)			
Repeat	0.4 ml (P1)	0.6 ml (P2)	0.8 ml (P3)
1	27,05	30,44	37,09
2	28,11	30,01	35,47
3	27,13	29,37	35,58
Average	27.43 ^a $\pm$ 0.59	29.94 ^b $\pm$ 0.54	36.05 ^c $\pm$ 0.91

^{abc}Observed superscript differences indicate significant differences ($P < 0.05$).

Table 4 shows that the length of estrus varies among goats receiving PGF2 α injections IM. The P3 treatment showed a longer estrus duration compared to P2 and P1, while P2 had a longer estrus duration than P1. This suggests that the dose of PGF2 α effect on estrus duration in goats, where higher doses tend to produce longer estrus duration.

The P3 treatment, with a dose of 0.8 ml, showed a longer response to estrus duration, averaging 36.05 hours, compared to P2 and P1. This may be due to the greater amount of hormone in the P3 dose, which is still circulating in the blood circulation and exerts a greater physiological influence on estrogen production by ovarian follicles. Higher concentration of estrogen in the blood may affect the length of estrus in goats.

The results of this study, from the length of estrus observed in the treatment groups P1, P2, and P3 are still within the normal range for goats, which is 24-48 hours. These findings are in line with the results of research conducted by Sinda *et al.* (2017), which recorded variations in estrus duration between 32.67 to 45.50 hours for Peanut goats that received treatment using unequal doses of PGF2 α hormone.

CONCLUSIONS

PGF2 α hormone at a dose of 0.8 ml (P3) showed a more effective impact on the variable time of onset of estrus and duration of estrus in pea goats when compared to treatments P2 (0.6



ml) and P1 (0.4 ml). There was a significant difference in the time of onset of estrus and duration of estrus between these treatments. The percentage of estrus in peanut goats injected with PGF2 α hormone reached 100%, indicating that PGF2 α hormone is very effective in synchronizing estrus in peanut goats. In addition, the symptoms of estrus observed in all animals were consistent, indicating that PGF2 α hormone provides a uniform response in inducing estrus in Peanut goats.

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