Randwick International of Social Sciences (RISS) Journal
Vol. 5, No.3, July 2024 | Page: 484-492
ISSN Online: 2722-5674 - ISSN Print: 2722-5666
https://www.randwickresearch.com/index.php/rissj

Impact of Estrus Response and Pregnancy Rate of Two Cows That are Injected with Prostaglandin F2α Hormone in the System Maintenance is Different to Livestock Farming

DOI: https://doi.org/10.47175/rielsj.v5i3.1034

| Nur Asyiah Siregar[1,*] | Sayed Umar[2] | Ristika Handarini[3] |

[1] Master of Animal Science Study Program, Faculty of Agriculture, Universitas Sumatera Utara, Indonesia

[2] Animal Husbandry Departement, Agricultural Faculty, Universitas Sumatera Utara, Indonesia

[3] Animal Husbandry Study Program, Faculty of Agriculture, Djuanda University Bogor, Indonesia

[*] nurasyiahsiregar4@gmail.com

ABSTRACT

Livestock farming is an effort to breed livestock to obtain benefits or results in the form of products and income. The success of a livestock business depends on three elements commonly referred to as the production triangle, namely seeds, feed, and management. In addition, the techno-socioeconomic characteristics of livestock farmers greatly influence the development of livestock businesses and will later affect the income of livestock farmers. The aim of the research was to examine the injection of the prostaglandin F2α hormone on the estrus response and pregnancy in Ongole crossbreed and Simental crossbreed cows reared using intensive and semi-intensive rearing systems. The data obtained will be analyzed using analysis of variance (ANOVA) and if there is a real effect, continue with further testing with Duncan's Multiple Range Test. The results of research on the percentage of estrus after the first and second injection of the prostaglandin hormone can be seen in the table. The highest percentage of estrus was in the S1P2 treatment with a percentage value of 80% and the lowest percentage value was in the S2P1 and S2P2 treatments with a percentage value of 40%. The percentage of estrus after the second injection, the percentage value for all treatments increased and the percentage of estrus was highest in the S1P2 treatment with a value of 100%. The average value of onset of estrus after the second injection of the PGF2α hormone was lower than the first injection. The longest duration of estrus in the treatment after the first PGF2α hormone injection was in the S1P2 treatment with an average of 24.75 hours, while the longest duration of estrus in the treatment after the second PGF2α hormone injection was in the S2P1 treatment with an average of 25 hours. PO cattle and Simental crossbreeds injected with PGF2α gave no different estrous responses. Intensive and semi-intensive rearing systems provide no different estrous responses. Raising PO cows using a semi-intensive rearing system injected with PGF2α provides an estrous response and high pregnancy rates (60), to be one of techniques to breed cattle of PO cow and have good impact to the success of a livestock business

KEYWORDS

livestock farming; livestcok business, socioeconomic, Prostaglandin F2α hormone; ongole crossbreed cows; simental crossbreed cows; estrus

INTRODUCTION

The cattle farming industry in Indonesia is still relatively slow, even though the demand for domestic cattle is very large. Consumption of beef and cow's milk always increases every

year. Not to mention the recent news about the increase in beef prices on the market which has caused many beef traders to go on strike. So, what causes livestock farming in Indonesia to have difficulty developing.

Livestock farming is an effort to breed livestock to obtain benefits or results in the form of products and income. The success of a livestock business depends on three elements commonly referred to as the production triangle, namely seeds, feed, and management. In addition, the techno-socioeconomic characteristics of livestock farmers greatly influence the development of livestock businesses and will later affect the income of livestock farmers. Beef cattle farming is a business system supported by interrelated components to achieve the main goal of increasing the population of beef cattle and the availability of meat as a source of animal protein from livestock. However, each farmer has his own goal in raising beef cattle, either as a source of income, labor, organic fertilizer producers, or as savings.

The beef cattle farming business is expected to be able to meet the need for beef, due to population growth which increases every year. Consumption of beef and buffalo meat in Indonesia in 2020 is estimated at 717.15 tones. Meat consumption in Indonesia per capita in 2020 was 2.66 kg/capita/year (Central Statistics Agency, 2020). The government has done various thing efforts to meet the need for meat starting from early 2000 with the Beef Self-Sufficiency Program. The breeds of beef cattle that are in demand and are widely kept by people in Pancur Batu District people's farms are Ongole crossbreed cattle (PO) and Simental cattle. PO cattle are tropical cattle which have the advantage of high adaptability to tropical climates, heat resistance, resistance to parasitic disturbances such as mosquito and tick bites, besides that they also show good tolerance to feed containing high crude fiber (Astuti, 2004). Meanwhile, Simental cattle are suitable for keeping in places with a temperate climate. Genetically, Simental cattle are beef cattle that come from cold climates. Adult Simental bulls can reach a body weight of 1150 kg while adult Simental cows reach 800 kg (Sujarwo, 2012).

One of the hormones used to synchronize estrus is prostaglandin (PGF2α). This hormone is a luteolytic agent that causes the corpus luteum to regress and is used to induce estrus in cows. The onset of estrus due to PGF2α induction is caused by lysis of the CL by the vasoconstrictive action of PGF2α so that blood flow to the CL decreases drastically followed by a decrease in progesterone levels. Factors that influence reproductive success include management, including the cow rearing system. The cattle rearing system will influence the fulfillment of food needs, breed of feed and feeding patterns. The livestock rearing system is divided into three (3) rearing systems, namely: intensive, semi-intensive and extensive.

One way to increase the success of artificial insemination is to synchronize estrus by injecting the hormone prostaglandin. Efforts to synchronize estrus by injecting prostaglandin hormones are expected to increase the percentage of estrus and pregnancy in cows, which is expected to shorten the calving interval in cows. From the description above, the author is interested in conducting research on the response of two breeds of mother cows, namely Ongole crossbreed cows and Simental cows which are injected with prostaglandin hormones with different rearing systems which can increase the percentage of estrus and pregnancy rates of cows.

RESEARCH METHODS

The research was carried out in Pancur Batu District, Deli Serdang Regency. This research lasted for 5 months starting from November 2021 to March 2022.

Materials used in this research: 10 Ongole (PO) crossbreed cows and 10 Simental crossbreed cows that have given birth at least once or with an age range of > 3 years, prostaglandin hormone (PGF2α), frozen semen/straw, soap, tissue, and water.

The tools used according to the stages in this research are divided into two, namely the implementation of synchronization using tools: a prostaglandin hormone preparation applicator, a 5 ml syringe with a syringe for injecting PGF2α, a cow pen with an area of 1.5 x 2 meters, rope and gloves. Meanwhile, tools for carrying out artificial insemination (AI): AI gun, IB plastic sheet, liquid N2 container, frozen semen and straw scissors.

Research procedure

This research will be divided into 3 stages, namely stage I: Selection of mother cows and grouping of rearing systems, stage II: Injection of prostaglandin hormonesF2α and stage III: Artificial Insemination and Pregnancy Check (PKB).

Observed Variables

a) Onset of estrus
   Estrus onset is the interval (distance) from the last injection of the PGF2α hormone until the first symptoms of estrus appear (Balumbi, 2019). To obtain the results of the onset of estrus, observations were made according to the time specified in the research procedure.
b) Estrus percentage
   The percentage of estrus after the first and second PGF2α injection was obtained from the comparison between the cows in heat and the total number of cows that received the PGF2α injection treatment and then multiplied by 100%.
c) Duration of estrus
   The duration of estrus is the distance from the first appearance of estrus symptoms until the disappearance of estrus symptoms (Handarini et al, 2017). To obtain results of estrus duration, observations were made according to the time specified in the research procedure.
d) Pregnancy rate
   The pregnancy rate or Pregnancy Rate (PR) is the number of pregnant female cows divided by the total number of cows times 100%. The diagnosis of pregnancy in this study was based on the results of a rectal examination. Pregnancy age is expressed in months (Pian et al, 2020).

Data analysis

The data obtained will be analyzed using analysis of variance (ANOVA) and if there is a real effect, continue with further testing with Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Estrus Percentage of Two Breeds of Cows

The percentage of estrus after the first and second injection of the PGF2α hormone was obtained from the comparison between the cows in heat and the total number of cows that received the PGF2α injection treatment and then multiplied by 100%. A cow is declared in heat if it shows signs of lust such as a swollen, reddish vulva and transparent mucus coming out and the cow is in a position ready to mate or standing heat (Sudarmaji et al., 2012). The results of observations obtained regarding the percentage of estrus of two breeds of cattle in different rearing systems can be seen in the following table:

Table 1. Estrus Percentage of Two Breeds of Cows in Different Rearing Systems

Treatment	Number of Cows	Injecting Estrus Cows 1	Injecting Estrus Cows 2	Estrus Percentage (%) 1	Estrus Percentage (%) 2
S1P1	5	3	3	60	60
S1P2	5	4	5	80	100
S2P1	5	2	3	40	60
S2P2	5	2	4	40	80

The percentage of estrus from the observations after the first and second prostaglandin hormone injection can be seen in table 1. The lowest percentage value is in the Cow treatment.Simental crossbreeds with an intensive rearing system (S2P1) and Simental crossbreed cattle with a semi-intensive rearing system (S2P2) with the same estrus percentage value, namely 40%, while the highest percentage was in PO cows treated with a semi-intensive rearing system (S1P2) with an estrus percentage value 80%. Different rearing systems have no effect on the percentage of estrus in Simental breed (S2) cows, but have an effect on PO cows (S1) in the semi-intensive rearing system, the percentage of estrus in cows is higher. The high percentage of cow estrus in the S1P2 treatment is influenced by various factors, namely in the semi-intensive rearing system the need for animal feed comes from grazing areas where cattle are grazed during the day until evening so that instinctively cattle will eat various kinds of grass according to their needs without any limit on quantity. forage.

The low estrus percentage can be caused by the timing of the hormone injectionPGF2α is in the follicular phase so that PGF2α injection is not effective and estrus does not occur, because the most effective phase for injecting the PGF2α hormone is in the luteal phase where the corpus luteum is still active (Sudarmaji., et al 2012). This is in accordance with the opinion of Taga (2020) who states that the PGF2α hormone works by regressing the corpus luteum, resulting in a decrease in progesterone hormone levels. Decreasing progesterone levels will have an impact on the FSH hormone increasing, thereby stimulating the development of follicles to maturity, which ultimately causes symptoms of lust in cows.

NThe lowest estrus percentage value after the second prostaglandin hormone injection was PO cows with an intensive rearing system (S1P1) and Simental crossbreed cattle treated with an intensive rearing system (S2P1) with a percentage value of 60% and the highest percentage of estrus was treated with PO cows with a semi-intensive rearing system (S1P2) with a percentage value of 100%. The low percentage of estrus in the two breeds of cattle kept using an intensive rearing system is due to the fact that the feed is provided to meet the needs of a limited number of livestock, when compared to the semi-intensive feed rearing system in grazing areas without restrictions. The increase in the percentage of estrus after the second injection is because after repeating the hormone injection, it is hoped that the entire treatment will be in the luteal phase. In accordance with the opinion of Sudarmaji et al. (2012) stated that after the first injection of the PGF2α hormone, the percentage of lust was 57.97%, where at the first injection follicle development was occurring, followed by an increase in the estrogen hormone so that PGF2α did not work effectively, this is called the follicular phase. After the second PGF2α injection, all cows (100%) showed symptoms of estrus because all cows were in the luteal phase, which is the phase when the corpus luteum functions. The results of research on the percentage of estrus after the second injection of PGF2α in two breeds of cattle with different rearing systems were lower compared to previous research which reported the results of research on the percentage of estrus after the second injection. According to Balumbi et al. (2017) who reported the results of research on estrus synchronization with a single injection only resulted in 70% of treated cows showing

symptoms of estrus. Meanwhile, treatment with multiple injections resulted in an estrus response that reached 90%.

Onset of Estrus in Two Breeds of Cows

Estrus onset is the interval (distance) from the last injection of the PGF2α hormone until the first symptoms of estrus appear (Balumbi, 2019). Observations of the onset of estrus in the treatment of two breeds of PO cows and simental crossbreed cows injected with prostaglandin hormones with different rearing systems were calculated in hours. The results of observations obtained regarding the onset of estrus of two breeds of cows in different rearing systems can be seen in the following table:

Table 2. Estrus Onset of Two Breeds of Cows in Different Rearing Systems

Treatment	Number of Cows	Onset of Estrus hour of first injection	Estrus onset hour 2nd injection
		O'clock	O'clock
S1P1	5	70.67	70.33
S1P2	5	71.00	62.60
S2P1	5	69.50	63.33
S2P2	5	79.50	69.25

Note: The effect is not significantly different (P>0.05)

The results of research on the onset of estrus in two cattle breeds, the fastest are simental cows with an intensive rearing system (S2P1) with an average value of 69.5 hours, while the longest onset of estrus is simental cows with a semi-intensive rearing system (S2P2) with an average value of 79.5 hours. In the S2P2 treatment, there was a significant effect when compared to other treatments because the onset of estrus occurred more than 72 hours (3 days). The onset of estrus at the first injection gives a different response in simental crossbreed cows kept under different rearing systems, namely intensive and semi-intensive.

Different rearing systems cause different estrus onset responses in the same breed of cattle, this is because the feed given is different in terms of quality and quantity of feed. In the intensive rearing system, the feed given is 2 kg of forage and concentrate per day per head. Meanwhile, in the semi-intensive rearing system, the need for cattle feed comes from the grazing area where cattle are grazed during the day until evening so that instinctively the cattle will eat grass according to their needs. Different feeds affect the physiological condition of livestock so that the onset of estrus in the same breed of cattle with different rearing systems will respond differently to the onset of estrus.

Several factors that influence the speed with which signs of lust appear include genetic factors, age, livestock physiology and environmental conditions (Fauzi et al., 2017). The research results of Fauzi et al. (2017) stated that the earliest signs of lust after PGF2α injection occurred at the 27th hour and the slowest appearance occurred at the 69th hour, the appearance of signs of lust after the PGF2α injection occurred most often at the 30th - 40th hour with a total of 21. tails from 40 individuals with a percentage of 52.50% of the population.

The onset of estrus in two breeds of cows with different rearing systems after the second injection was faster than after the first injection. Irmaylin et al. (2012) stated that the speed of onset of estrus in PO cows after two injections of PGF2α was caused by the mechanism of action of PGF2α preparations which were effective in lysing CL in various parities of PO cows using the method of two PGF2α injections with a distance of 11 days between injections 1 and 2, where the cows were in the phase of the estrus cycle which is simultaneously the same as the second hormone injection (luteal phase). The results of

research on the onset of estrus in two breeds of cows after the second prostaglandin hormone injection with the fastest distance, namely in PO cows treated with a semi-intensive rearing system (S1P2) with an average value of 62.60 hours and the longest distance between estrus onset after the second prostaglandin hormone injection, namely in treated cows. PO with an intensive maintenance system (S1P1) with an average value of 70.33 hours.

In the second PGF2α injection, it was also seen that the effect of different rearing systems in the same cow breed had an effect on the onset of estrus. The onset of estrus for PO cows with a semi-intensive rearing system is faster compared to PO cows reared with an intensive rearing system, this is because PO cows reared semi-intensively have their feed needs met more in the pasture while PO cows reared intensively have less feed requirements. fulfilled by the limited feed provided by breeders.

The results of the second PGF2α injection on the onset of estrus were longer compared to the results reported by Balumbi (2017) stating that the onset of estrus in double injections was relatively shorter because the distance between the last injection and the time of onset of estrus was shorter, this shows a high estrus response in double injections compared to single injection (47.55 hours and 53.28 hours).

Estrus Duration of Two Breeds of Cows

The duration of estrus or the length of estrus is calculated starting from the first time the cow shows symptoms of estrus after hormone injectionPGF2α until the end of estrus symptoms (Handarini et al., 2017). The results of observations obtained regarding the duration of estrus of two breeds of cows in different rearing systems can be seen in the following table:

Table 3. Estrus Duration of Two Breeds of Cows in Different Rearing Systems

Treatment	Number of Cows	Estrus duration hour to first injection	Estrus duration hour to second injection
		O'clock	O'clock
S1P1	5	24.33	24.00
S1P2	5	24.75	24.60
S2P1	5	24.00	25.00
S2P2	5	23.50	24.00

Note: The effect is not significantly different (P>0.05)

Results of research on the duration of estrus in two breeds of cows after injectionThe first PGF2α hormone has the shortest average duration of estrus, namely in the treatment of Simental crossbreed cows with a semi-intensive rearing system (S2P2), the average value is 23.50 hours and the average time of estrus duration is longer, namely in the treatment of PO cows with a semi-intensive rearing system (S1P2), the average value 24.75 hours. The difference in estrus duration in two breeds of cattle, namely PO cows and Simental crossbreeds with the same rearing system, namely semi-intensive rearing, has an effect because the breeds of cows are different. The duration of estrus as a result of this study is shorter than the results of research by Balumbi (2017) who reported that the estimated duration of estrus for simultaneous use of a single injection was (24.85 hours) while the double injection treatment group was around 23.55 hours shorter than a single injection.

The results of the observations regarding the estimated duration of estrus after the second hormone injection were that the average estrus duration was the shortest, namely for PO cows treated with an intensive rearing system (S1P1) and simental breed cows with a semi-intensive rearing system (S2P2) with an average value of 24 hours. The longest duration of estrus with an average value of 25 hours was in the S2P1 treatment. In this study, in the S2P1 treatment, the duration of the first and second estrus was longer compared to the results

reported by Roceyana (2011) which stated that the duration of estrus for intensively reared simental cows was 20 hours.

From the average value of estrus duration after the first and second hormone injection, it can be seen that the maintenance system influences the length of estrus duration. The influence of the rearing system is closely related to the feed given to cattle. Feeding livestock with an intensive rearing system in the form of forage and concentrate per day is 2 kg per head. The feed requirement for an intensive rearing system depends and is limited so that the amount of feed given by the farmer is very influential. Meanwhile, in the semi-intensive rearing system, the cow's feed needs come from the areagrazing where cattle are grazed from midday to evening so that instinctively the cattle will eat grass according to their needs.

The duration of estrus after the first and second injection was lower compared to the results of Handarini's research *et al*. (2017) reported that when injecting the hormone prostaglandin F2α the duration of estrus for 72 hours was 80% due to the mechanism of the hormone's function being quite long, namely lysing the CL first and then stimulating the secretion of gonadotropin hormones for the folliculogenesis process and also due to the CL development of each individual different (Handarini et al., 2017).

Irmaylin et al. (2012) stated that the duration of estrus is the time interval from the onset of estrus symptoms until the disappearance of estrus symptoms in livestock. The length of estrus is influenced by age, body condition, and the type of hormone used for synchronization influences the length of estrus.

Pregnancy Rates for Two Breeds of Cows

Pregnancy is a period of development in the uterus that is related to nutrition from fetal development and maternal (parent) adaptations directed at fetal development (Arman, 2014). The success of pregnancy is also determined by semen and the placement of semen during insemination. The pregnancy rate or Conception Rate (CR) is the percentage of pregnant female cows from the first insemination. The pregnancy rate is determined based on the results of pregnancy diagnosis within 40-60 days after insemination (Saputra et al., 2021). The results of observations obtained regarding the pregnancy rates of two breeds of cattle in different rearing systems can be seen in the following table:

Table 4. Pregnancy Rates of Two Breeds of Cows in Different Raising Systems

Treatment	Number of Cows	Pregnant Cow	Pregnancy Rate (%)
S1P1	5	0	0
S1P2	5	3	60
S2P1	5	2	40
S2P1	5	2	40
Total	20	7	35

The results of the research showed that the highest pregnancy rate was in the S2P1 treatment with a pregnancy percentage of 60% from the number of 3 pregnant cows out of 5 cows in the S1P2 treatment, while the pregnancy rate in the S1P1 treatment of all treatments had no pregnant cows. The low pregnancy rate in the treatment was influenced by various factors, the factors that influenced the pregnancy rate were breed of cow, rearing system and timing of artificial insemination. Zulfahmi (2014) reported the conception rate of simental cattle inseminated at different times with the best percentage being 62.5% in the afternoon.

The percentage of pregnancy rates in the same breed of cattle, namely PO cows with different rearing systems, has an effect on the percentage of pregnancy rates if seen in the table in treatment S1P1, none of the treatments were pregnant so the percentage value was 0%, the low percentage of pregnancy in the treatments was caused by limited feed. given by the breeder.

The need for feed in an intensive rearing system is dependent and limited so that the amount of feed given by breeders greatly influences the pregnancy rate of livestock. Meanwhile, in the semi-intensive rearing system, the need for cattle feed comes from the grazing area where cattle are grazed during the day until evening so that instinctively the cattle will eat grass according to their needs.

According to Bernardi *et al*. (2015) stated that the low success of pregnancy resulting from AI straw BB occurs due to several factors including the skill of the inseminator in determining the time and carrying out the AI procedure, animal physiology, semen quality and environmental factors.

Impact of PGF2α Injection to PO cow to livestock farming

PO cattle are not pure Indonesian cattle but rather a cross between Sumba Ongole (SO) cattle and local cattle (Sudarmaji et al., 2012), so that the adaptability to the tropical environment of Indonesia is lower than Bali cattle. However, with a semi-intensive maintenance system injected with PGF2α, it provides a high estrus response and pregnancy rate reaching 60% in PO cattle. This will indirectly become a solution for livestock businesses and have a good impact on meeting the need for cattle stock.

CONCLUSIONS

Based on the results of the research that has been carried out, it can be concluded that:

1. PO cattle and Simental crossbreeds injected with PGF2α gave no different estrous responses.
2. Intensive and semi-intensive rearing systems provide no different estrus responses.
3. Rearing PO cows using a semi-intensive rearing system injected with PGF2α provides an estrous response and high pregnancy rates (60) give good impact for developing livestock farming and livestock business.

Suggestion

It is recommended that to increase the estrus response and pregnancy rate, PO cows should be kept using a semi-intensive rearing system.

Acknowledgment

The author would like to thank Prof. Dr. Ir. Sayed Umar, Ms and Dr. Ir. Ristika Handarini, MP as the chairman and members of the supervisory committee who have helped the author in providing ideas, suggestions, instructions and guidance so that this research can be completed.

The author would like to thank Dr. Ir. Ma'ruf Tafsin, M.Si and Dr. Ir. Simon Elieser Sinulingga, M.Sc as the examiners, also Dr. Nevy Diana Hanafi, S. Pt, M. Si as the Head of the Animal Husbandry Masters Study Program who have provided input for this research

The author would also like to thank Labuhan Siregar, S.Pt and his family who have helped in the implementation of the research.

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