Application of Artificial Insemination (AI) Tool Based on Oestrus Automatic Detection to Improve Goat Pregnancy in Yogyakarta

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ABSTRACT

This study aims to determine the level of pregnancy in goats and sheep in Indonesia, especially in the Yogyakarta area, by comparing the use of conventional AI devices with AI devices equipped with endoscopes. Many factors, including livestock, breeders, officers, spermatozoa, and environmental factors, strongly influence reproductive performance. The process of pregnancy in goats and sheep begins with the process of estrus, mating, pregnancy, birth, and postpartum estrus as the beginning of a continuous cycle. The problem found that the pregnancy rate in goats and sheep is relatively low. The low genetic quality of goats and sheep causes population growth in Yogyakarta to run slowly. This research was conducted by direct observation of the animal's condition, then observation using an AI smart endoscope. AI Smart endoscopy was used to observe estrus time and followed up with AI in goats that had shown AI time. Observation of pregnancy was carried out two months after AI. The results showed that AI using smart endoscopy AI Gun on 20 goats resulted in 55% pregnancy. This is higher than conventional AI, which is 35%. The success of AI using the estrus synchronization method is 65%. The benefit of this research is the achievement of increasing pregnancy and improving the genetic quality of goats and sheep by using an AI device equipped with an endoscope. The target of veterinarians and field paramedics is more accustomed to using modified AI devices to make it easier to detect estrus. This program is expected to increase both the number of fetuses from an average of only 1-2 to 2-3 births and the success rate of AI increases.

Keywords: Artificial Insemination, Endoscopy, Goats, Sheep, Ultrasound.

1 Introduction

Goats and sheep are classified as one of the most widely developed ruminants. The business potential in Indonesia is relatively high. This can be seen from the availability of abundant feed ingredients and the high reproducibility of goats. However, the quality and productivity of the goats are still deficient, mainly due to poor maintenance systems and uncontrolled mating systems. Maintenance management is still very simple. Technological innovations in feed and reproductive management have not been implemented, impacting the low productivity level. Limited knowledge and resources hinder the development of a goat business [1]. The low productivity of goats occurs as livestock in Indonesia are conventional farms. The quality of goat and sheep breeds, the use of technology, and the skills of breeders are still relatively low.

According to information from members of the livestock group and the local office, the average birth rate for goats and sheep is 1-2 fetuses, while the normal birth rate for goats and sheep is around 3-4. Mating failure is an essential factor in pregnancy. Thus, appropriate technological methods to overcome these problems are needed. Artificial insemination is a reproductive technology that has long been used in large ruminants but has not been widely used in goats [2]. The low reproductive efficiency of goats in the tropics

is caused by low fertility and uncontrolled estrus time, so the mating time cannot be determined. One of the alternatives for increasing the reproductive efficiency of goats is the application of artificial insemination (AI) technology. AI technology has been used for a long time and has proven to improve the quality of livestock breeds and accelerate the spread of livestock breeds.

The problem with AI in goats in Indonesia is that it is challenging to recognize estrus symptoms because goats often show silent estrus (silent heat), and inaccurate estrus detection results in inaccurate insemination time. Smart endoscopy AI is an appropriate technology developed to mitigate this issue. The AI is a modified tool with a device that can be inserted into the reproductive cavity of goats and sheep connected to a monitor screen so that veterinarians or inseminators can observe the state of vaginal change and discharge. Cervical conditions and can decide the status of estrus for continued AI. Activities in livestock groups aim to increase productivity levels and the number of young goats and sheep. The combination of Smart Endoscopy AI tools can be used as a reference to determine when the right time is for artificial insemination to minimize AI failure. In addition, this new technology-based application can reduce the value of conventional AI costs.

2   Research Methodology

This research has been carried out at the Yogyakarta Goat and Sheep Farmer Association group, Sleman, Yogyakarta Special Region Province. Interpretation and discussion were held at the Department of Reproduction and Obstetrics, Faculty of Veterinary Medicine, Yogyakarta. This research was conducted from April 2022 – September 2022. The sample used was 60 goats. The study began with anamnesis to determine the health condition of the goats and to analyze the condition of the goats that were showing signs of normal oestrous.

The method used in this study is an experimental method with a randomized block design. Sixty goats were divided into several groups. Group I: 20 goats were artificially inseminated conventionally (control), group II: 20 goats were observed for their estrus time using a smart endoscope and continued with AI, and group III: 20 goats were synchronized using 0.5 ml PGF2α intramuscularly and then artificially inseminated. Forty-five days after insemination, pregnancy was observed using ultrasound. Pregnancy rate data were obtained by comparing the three sample groups reported descriptively.

3   Theory and Calculation

The estrus cycle occurs in adult females, and each cycle will end with ovulation (the release of eggs to be fertilized). Mating occurs in female goats in a state of heat. Estrus is a condition when female cattle are ready to mate. The estrus cycle depends on the type and age of the animal [3]. The average length of estrus in goats is around 24-48 hours, and the optimal mating time is around 24-36 hours from the start of estrus [4]. Good mating by an adult female does not cause death to the offspring or the mother during childbirth. Males should be more than one year old. The reproductive organs of goats or sheep aged 8 to 12 months are still in the growth stage, so they do not function optimally. The level of libido in males is affected by age, where at 33 to 48 months, males quickly respond to riding a female in heat [5].

Artificial insemination (AI) is the placement of semen in the reproductive tract artificially. The cement placed can be either frozen cement or fresh cement. Semen placement can be intravaginal, intracervical or intrauterine. Each method has different techniques and difficulties. In general, intravaginal and intracervical techniques are more accessible to perform than intrauterine ones requiring special skills and equipment. AI in goats and sheep aims to continue offspring that are better than expected, both in quantity and quality.

AI tools that have been used are inseminators in the field. This tool is equipped with an IB gun and uses a speculum to open the vaginal cavity of goats and sheep. The initial preparation for insemination was restraining the ewe. Then, the insemination pipette is filled with the liquid semen needed, or if with an IB

gun, the straw is inserted into the IB gun, and the tip is cut, then the gun is wrapped in a plastic seat. The speculum is lubricated with lubricant and carefully inserted into the vagina with a flashlight. An insemination pipette is inserted into the cervix, and semen is sprayed slowly into the cervix.

Artificial Insemination (AI) in cattle has been carried out massively for decades. However, AI in goats still faces several obstacles, one of which is the problem of low success. This is due to the AI tool does not match the physiology of the goat's reproductive organs. The speculum functions to assist the process of the completion of sperm by the inseminator with a tool called a gun. AI's low success in goats is because the speculum is not entirely acceptable and reaches the goat's cervix. In addition, the speculum on the market today only functions to open the vulva so that the insemination tool can only enter the vagina. For this reason, a tool is needed to help the insemination gun enter the front of the cervix.

Modify the speculum based on the size and material that is more suitable. The AI gun innovation uses a modified tool like a camera sensor. The speculum is equipped with a camera that captures images of the cervix and then interprets them on the monitor screen. Inseminators can determine the status of the lust picture in goats and sheep to determine the right time to carry out AI. The application of AI technology must be carried out in an integrated manner with several activities directly related to the success of the AI program [6].

4 Results and Discussion

A comparison of estrus quality in each group shows the effectiveness of estrus in each experimental animal. Evaluation of pregnancy in each treatment is presented in Table 1. Statistical calculations show no significant difference in pregnancy rates in each treatment (P>0.05). A comparison of the three groups showed that group III had the highest percentage of pregnancy, which was 65% (Figure 1).

Table 1: *Pregnancy rate of the treatment group.*

Treatment	Pregnancy Status		Amount
	Not Pregnant	**Pregnant**	
Conventional AI	65% (13/20)	35% (7/20)	100%
AI - Smart *Endoscopy AI Gun*	45% (9/20)	55% (11/20)	100%
AI with Synchronization	35% (7/20)	65% (13/20)	100%
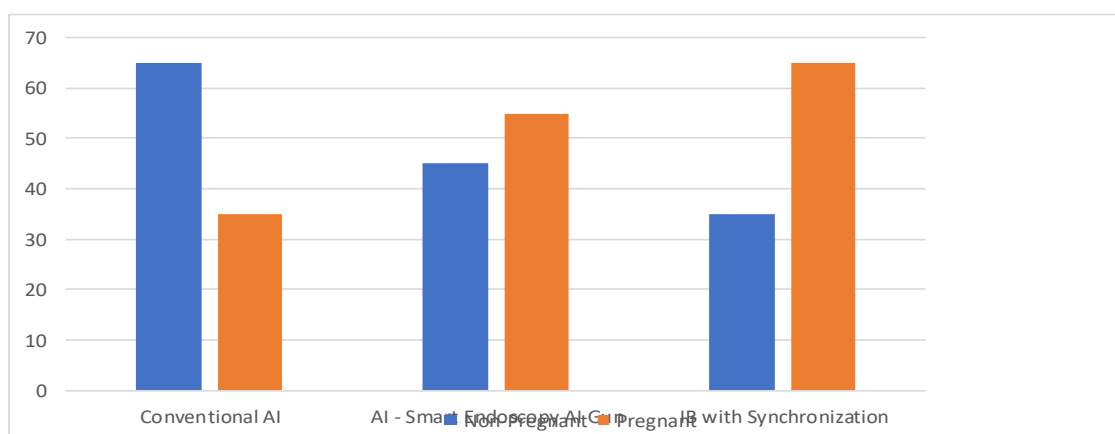
Figure 1: *Comparison of pregnancy status in each treatment*

Artificial insemination with the new method of smart endoscopy AI Gun (55%) could approach AI results with estrus synchronization (65%). This shows that the AI with the Smart Endoscopy AI Gun can be a

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practical, effective, inexpensive, and affordable solution for rural farming communities. Conventional AI shows a pregnancy rate of 35%. This indicates that the effect of estrus detection greatly determines the pregnancy success rate in goats and sheep. The use of this new technological method still requires other research to improve the accuracy of the tool (Figure 2). So far, the application of artificial insemination to goats in Indonesia is still experimental, with pregnancy rates varying between 0%-69.64% [7].

The pregnancy rate on the AI Gun AI smart endoscopy method shows results close to the research of [8], which is 54.55%. Through this AI technology and the selection of seeds from superior males, it is possible to increase the spread of the genetic quality of goats and sheep. In addition, the number of sheep births will increase, and the sheep population with good genetic quality will be spread among livestock groups.

Figure 2: *Usage of smart endoscopy AI and the cervical interpretation (oestrus).*

This tool can be used in rural areas because it is easy and effective. This can be seen from the results of using this tool as effectively as the synchronization method. This appropriate technology can become a breakthrough in helping the detection of estrus in goats and sheep. This tool is easy to use, practical, effective, affordable, and has high accuracy in estrus detection, so that it can reduce costs compared to estrus synchronization. The fertility of the female livestock influences the pregnancy rate, the skill of the inseminator, the timing of AI, and the quality of the sperm used. In small ruminants, the success of insemination is still low. This is due to the relatively small size of the female reproductive organs, including the size of the cervix [9]. With this low-cost method with high effectiveness, animal welfare is hoped to be optimal. This method can increase pregnancy, accelerate the spread of goat and sheep populations, improve the genetic quality of goats and sheep, and promote modern AI technology to livestock farmers to improve community welfare.

5   Conclusions

The use of smart endoscopy AI Gun can be used as an alternative solution to increasing pregnancy in goats and sheep. Veterinarians or inseminators can use devices modified with camera sensors to detect estrus. Correct estrus detection will increase pregnancy. This tool can reduce costs. This tool optimizes animal welfare and is practical, inexpensive, and effective compared to synchronization and conventional AI. The results of this evaluation can be used as input in the implementation of AI goats and sheep to produce good genetic quality so that the population of goats and sheep increases. Therefore, further studies must be carried out to accelerate the production rate and increase the goat and sheep population.

6   Declarations

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6.3 Publisher's Note

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How to Cite

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