

# Reproduction Performance of Etawah Cross Bred Goats in Estrus Synchronization by *Controlled Internal Drug Release* Implant and Pgf2 $\alpha$ Continued by Artificial Insemination

Diah Tri Widayati<sup>1)</sup>, Aris Junaidi<sup>2)</sup>, Kresno Suharto<sup>3)</sup>, Amelia Oktaviani<sup>1)</sup>, Wahyuningsih<sup>1)</sup>

**Abstract**—The estrus female Etawah cross bred goats were synchronized estrus by controlled internal drug release (CIDR) implants for 10 days combined with PGF2 $\alpha$  injection, and continued by artificial insemination (AI) within the hours of 24 period. Vaginal epithelium was taken to determine estrus cycle of the goats without estrus synchronization. The estrus responds (the puffy of vulva and vaginal pH) and percentage of pregnancy were investigated. The data were analyzed descriptively and Independent Sample T-Test. The results showed that the puffy of vulva and vaginal pH were significantly different in synchronized estrus goats and control goats (2.18  $\pm$  0.33 cm vs. 1.20  $\pm$  0.16 cm and 8.55  $\pm$  0.63 vs. 8.22  $\pm$  0.22). Percentage of pregnancy was higher in synchronized estrus goats (73.33%) than in control (53.3%). Estrus synchronization by using CIDR implants and PGF2, continued by AI was effective to improve reproduction performance of Etawah cross bred goats.

**Keywords**—Artificial insemination, Estrus synchronization, Etawah cross bred goat, Reproduction performance.

## I. INTRODUCTION

IN Indonesia, goats are kept as an important component of farming activities, particularly by smallholders. Production of these animals plays an important role as an income generating activity, and a source of animal protein to support the national program on meat self-sufficient. Etawah crossbred goat is one of potential livestock to be developed. However, difficulties on estrus detection, insignificant estrus sign, and unknown time of ovulation cause low reproduction performance of these animals. Application of reproductive technologies is possible to improve their reproduction performance. High reproduction performances are essential for profit in meat goat production [1], and are determined by the number of progeny delivered in a given period of time.

A progesterone-releasing controlled internal drug release

(CIDR-B for cattle and CIDR-G for sheep and goats) treatment has been found to be effective in controlling the estrus cycle in domestic ruminant species. A routine synchronization treatment using intravaginal CIDR device for 10 days, together with a prostaglandin injection, 2 days before CIDR removal, efficiently induces and synchronizes estrus and ovulation during the breeding as well as during the non-breeding seasons in goats [2]. In the present study, The estrus of Etawah cross bred goats were synchronized using CIDR implants for 10 days combined with PGF2 $\alpha$  injection, and continued by artificial insemination (AI) in the 24 hours period. Their estrus responds and percentage of pregnancy post AI were examined.

## II. MATERIAL AND METHODS

### *Animals and location of research.*

Thirty Etawah cross bred does of 2 - 3 years old, weighting 27 - 35 kg, clinically health, at least have shown twice normal estrus cycle (19 until 21 days), and have at least once birth were used in this studies. Those animals had body condition scores of (BCS) 2 - 3 [3]. These animals were randomly into two groups: estrus synchronized group and control (without estrus synchronization).

Before conducting the study, each doe was dewormed and submitted to a general physical examination and vaginal inspection. They were individually fed with fresh grass cubes twice daily. The concentrate consumed per doe per day varied between 500 and 800 g. Drinking water was available ad libitum.

The studies were carried out at Balai Pembibitan Ternak dan Hijauan makanan Ternak (BPT-HMT) Singosari Malang, East Java and Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta.

### *Estrus synchronization*

Estrus synchronization was conducted by implanting intravaginal CIDR (CIDR-SHEEP and Goat Device, 0.3 g progesterone, Pharmacia & Upjohn Pty Limited, Rydalmere NSW) during 10 days. Intramuscularly injection of 125 g (0.5 cc) dose PGF2  $\alpha$  (Juramet®, Jurox, Australian) was given on day 8. On day 10 the CIDR was removed.

### *Estrus detection*

The estrus responds of were detected every 4 hours for 60 hours since CIDR removal. Vaginal epithelium smears were

<sup>1)</sup>Diah Tri Widayati. Faculty of Animal Science, Gadjah Mada University, Yogyakarta, Indonesia, Jl. Fauna, no. 3, Bulaksumur, Yogyakarta 55281, phone: +620274513363, e-mail: widayati@ugm.ac.id

<sup>2)</sup>Aris Junaidi. Faculty of Veterinary Medicine Science, Gadjah Mada University, Yogyakarta, Indonesia, Jl. Fauna, no. 3, Bulaksumur, Yogyakarta 55281, phone: +620274560862, e-mail: arjuna05@ugm.ac.id

<sup>3)</sup>Kresno Suharto. National Animal Husbandry Training Centre, Malang, Indonesia, phone: +620341591302, e-mail: kres\_oktavia@yahoo.co.id

<sup>4)</sup>Amel Oktaviani. Faculty of Animal Science, Gadjah Mada University, Yogyakarta, Indonesia, e-mail: ameliaaokta@gmail.com

<sup>5)</sup>Wahyuningsih. Faculty of Animal Science, Gadjah Mada University, Yogyakarta, Indonesia, e-mail: wahyunin07@yahoo.com

taken to determine estrus cycle on Etawah crossbred goats without estrus synchronization (control group). Does were checked visually and were considered to be in estrus when they showed outward signs including vigorous tail-swishing, reddening of the vulva, vaginal discharge of mucus, and homosexual behavior. Does were also exposed individually to the vasectomized buck, and were considered to be in estrus when allowing to be mounted by the buck. The duration of estrus was recorded at the time from when the doe showed a sign of estrus to the time when the doe rejected mounting of the buck.

#### Artificial insemination

Artificial insemination (AI) was done at 24 hours since the onset of estrus. All does were intravaginal inseminated with frozen semen using a speculum with an attached light source and a goat artificial insemination catheter (IMV Technologies, France). Thawed semen was deposited in the genital tract as deep as possible without harming the tissue. All straws used in the experiment were prepared from one buck (BIB, Singosari, Malang, Indonesia). Each straws contained 39 millions of total spermatozoa. Post-thawing motility was 41 %.

#### Statistical analysis

The post AI estrus responds and percentage of pregnancy were investigated. Data of visual sign of estrus were analyzed descriptively. The puffy of the vulva, vaginal pH, percentage of pregnancy post AI, pregnancy period and kidding rate were analyzed by using the T-Test.

### III. RESULTS

The estrus respond of synchronized does was 100 %. No pessaries were lost during this research. None of the does showed estrus while the pessaries were in place. Initiation of estrus following CIDR removal was  $26.59 \pm 0.98$  hours. The duration of estrus was  $35.6 \pm 2.6$  hours. In control does, estrus cycle was determined by vaginal smear, and showed that the duration of estrus was  $36.61 \pm 2.5$ .

TABEL I ESTRUS RESPOND AND REPRODUCTION PERFORMANCE OF ETAWAH CROSSBRED DOES

Parameter	Synchronized does	Control does
Puffy of vulva (cm)	$2.18 \pm 0.33^a$	$1.20 \pm 0.16^b$
Vaginal pH	$8.55 \pm 0.63^a$	$8.20 \pm 0.24^b$
Pregnancy rate (%)	73,33 (11/15) <sup>a</sup>	53.33 (8/15) <sup>b</sup>
Pregnancy (days)	$153 \pm 1.7$	$152 \pm 1.9$
Kidding rate (%)	90.90 (10/11)	87.50 (7/8)

Superscript letters, a and b exhibit significant difference ( $P < 0.05$ ) from estrus synchronized does and control does

Tables 1 summarized the result of estrus responds and pregnancy rate of this study. The result showed that the puffy of vulva was significantly different in synchronized estrus does ( $2.18 \pm 0.33$  cm) and control does ( $1.20 \pm 0.16$  cm). The peak of puffy of vulva occurred at hour 30 and 48 post CIDR removal in estrus synchronized does and control does, respectively (figure 1).

The vaginal pH of estrus synchronized does and control does was  $8.55 \pm 0.63$  and  $8.22 \pm 0.22$ , respectively. These data showed significantly different between synchronized does and control. Increasing of vaginal pH occurred at 6–36 hours post CIDR removal in synchronized does and at 6–42 hours post CIDR removal in control. The highest vaginal pH of both groups was  $9.33 \pm 0.58$  and  $8.67 \pm 0.58$  occurred at 36 and 42 in synchronized does and control, respectively (fig. 2).

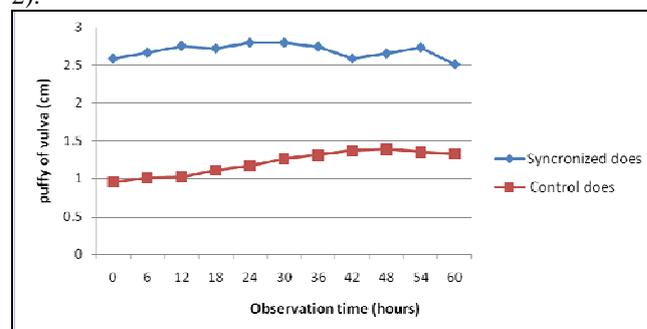


Fig. 1. Puffy of vulva (cm) of estrus synchronized does and control does at hour 0–60 post CIDR removal

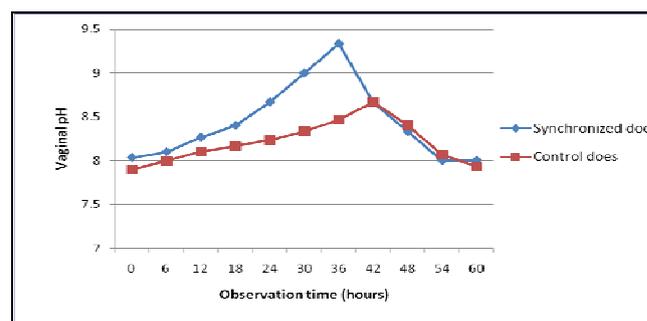


Fig. 2. Vaginal pH of estrus synchronized does and control does at hour 0–60 post CIDR removal

Percentage of pregnancy was higher in estrus synchronized goats (73.3%) than in control (53.33%). However, pregnancy period and kidding rate of both groups were similar ( $153 \pm 1.7$  vs.  $152 \pm 1.9$  days and 90.90 and 87.50 %).

### IV. DISCUSSION

In the present study, CIDR treatment combined with PGF2 $\alpha$  was able to induce estrus behavior in all synchronized does. This finding was similar to the previous work [4]. The intravaginal sponges did not fall off. None of does exhibited estrus while being treated with progestagen, indicating that the 0.3 g intravaginal CIDR was adequate to suppress estrus activity and confirming that progestagen has the ability to inhibit estrus in goats [5]. In the present study, the estrus duration of both groups ( $35.6 \pm 2.6$  hours and  $36.61 \pm 2.5$ ) along with preceding study [6].

The puffy of vulva was significantly different in synchronized estrus does ( $2.18 \pm 0.33$  cm) and control does ( $1.20 \pm 0.16$  cm). The peaks were  $2.8 \pm 0.17$  and  $1.39 \pm 0.01$ , occurred at hours 30 and 48 post CIDR removal in estrus

synchronized does and control does, respectively. Besides, aggressive behavior of doe, they also exhibited visual changes in outer genital organ during estrus, such as colour change of vulva, swollen vulva and mucous discharge. Vasculature increased on reproduction tract during estrus caused puffiness of vulva or swollen vulva and vagina [7], and reddish the vestibulum [8].

Cervical mucus produced in both of does groups were thin and clear during estrus. These evidences correlated with the increasing of Estradiol -17 $\beta$  at hour 24- 48 after CIDR removal [9]. Moreover, cervical mucus was produced under the influence of estrogen and was maximal at the time of ovulation when it was thin, clear, acellular and conducive to sperm penetration.

The vaginal pH was higher in estrus synchronized does than in control does ( $8.55 \pm 0.63$  and  $8.22 \pm 0.22$ , respectively). The highest vaginal pH of both groups was  $9.33 \pm 0.58$  and  $8.67 \pm 0.58$ , respectively, and occurred during estrus. Does of synchronized groups of vaginal pH during estrus was higher than diestrus, and the pH was between 6 - 7 during outside of the estrus stage [10]. The other researcher reported that goat vaginal pH was affected by interaction between hormone, microorganism and unknown factor, and discharge of mucus caused by base of vaginal pH [11].

Percentage of pregnancy was higher in estrus synchronized does (73.3%) than in control (53.30%). This finding exhibited that estrus synchronization using intravaginal CIDR device for 10 days combined with prostaglandin injections could improve pregnancy rate. In agreement with previous study [12], interval from CIDR removal to estrus was found to be the most critical and, hence, the factor predicting the occurrence of the LH surge and ovulation. CIDR removal and treatment with PGF $_{2\alpha}$  indirectly initiated the endogenous GnRH peak which resulted in the LH surge. These results indicated that the estrus synchronization protocols might be useful when the precise timing of ovulation is required. By improving the synchrony both of the LH surge and ovulation, it would facilitate the implementation of fixed-time breeding and AI in Etawah crossbred goats.

Three does of control with recurrent estrus post AI were ovariectomized, and then were processed for histological observations. Histological observation showed follicular development in these animal, and vestige of corpus luteum regression. This finding proved no ovulation occurred, therefore, the animals failed to pregnant eventhough the AI was conducted at hour 24 post onset of estrus. In the control does, although they exhibited estrus characteristics, ovulation did not occur. Ovulation was preceded by evidence of LH surge, and LH surge rarely occurred in estrus synchronized does with BCS < 3 [13].

Pregnancy period and kidding rate of both groups were similar ( $153 \pm 1.7$  vs.  $152 \pm 1.9$  days and 90.90 and 88.89 %). The gestation length of does ranged from 150 - 155 days. This length was within the range of 146-155 days as reported in the previous work.

Finally, estrus synchronization using intravagina CIDR implant during 10 days combined with PGF $_{2\alpha}$  on day 8 was effective for the estrus synchronization and improved reproduction performance of Etawah cross bred goats.

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