Comparative Efficacy of Estrus Synchronisation between Modified Herbs and Control Internal Drug Release (CIDR) in Goats

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Abstract. Estrus synchronisation promises proper breeding management where manipulation of the estrus cycle in animals was achieved at the same time. Control Internal Drug Release (CIDR) is a common practice and commercially used to obtain estrus in the female goats. Conversely, this method is expensive with several limitations. Alternatively, specific herbs were proved to have beneficial effects and therapeutic properties towards animals. Thus, the objective of the present study was to analyse the efficacy of estrus synchronisation using herbs and CIDR in goats. The female goats were divided randomly into two groups, (A) CIDR (n=4) and (B) herbs (n=4). The female goats were inserted with CIDR application devices, feeding with herbs and allowed to respond to estrus naturally for group (A) and (B) respectively. The estrus signs were observed four times daily (0900, 1200, 1500 and 1800 hours, respectively) after CIDR withdrawal (n=14 days) and feeding herbs (n=3 days) respectively. The results indicated that estrus detection was higher in herbs compared to CIDR (80.56% vs 77.78%, respectively) while conception and pregnancy rate was 100%, for both groups. Pregnancy was confirmed with ultrasound scanning at the second trimester of gestation. The onset of estrus was earlier in the females treated with CIDR than those in herbs (22.15h vs 24.4h, respectively). The maximum estrus duration in this study was recorded at 57.5h and 56h for CIDR and herbs, respectively. The estrus response for CIDR and herbs were higher in the morning 100%, for both compared to evening (66.67% vs 83.3%, respectively). In conclusion, the current study suggests that the utilization of herbs for estrus synchronisation is possible because both treatments gave similar result.

1. Introduction
Ruminant industry is inadequate to meet local demand because of the continuous growth of the human population and consumption [1]. Malaysian National Agro-food Policy (NAP, 2011-2020) reported that demand and production for meat are expected to increase from 1.4 million MT in 2010 to 1.8 million MT in 2020 with a growth of 2.4% per annum. Understanding and evaluating the problem is important to provide a more comprehensive step to have an efficiency breeding and management program for ruminant. Anaestrus is currently a major concern confronted by the smallholders. Briefly, few reproductive treatments have been identified to elucidate this constraint.

To date, Controlled Internal Drug Release (CIDR) is the method used to alleviate the anestrus animals. CIDR is an intravaginal progesterone insert which extensively used in beef and dairy cattle, goat and sheep industries. In contrast, CIDR has few drawbacks that include experienced labor which
can lead to high cost. However, studies on alternative method replacing CIDR using local herbs are limited. The herbs are non-hormonal and completely herbal preparation that can help to coordinate the ovarian function. Since ancient times, plants have been used as a model source of medicines because they are reservoir for chemical agents with therapeutic properties [2]. Medicinal plants are the richest bio-resource of drugs and become great interest owing to their versatile applications. Thus, the present study aim to analyse the efficacy of estrus synchronisation using modified herbs and CIDR in goats. The modified herbs are easily found in tropical rainforest and they are formulated with extract of *Piper nigrum* L., *Zingiber officinale*, *Cananga odorata* and *Cinnamomum verum*.

2. Materials And Methods

2.1 Animals and treatment

This study was conducted at the animal farm, Agro-Techno Park, University of Malaysia Kelantan and Kaprima Hulu Seladang Valley Farm. A total of 8 non-pregnant female goats age ranges from two to three years old reared under an intensive management system were selected. The similarities of the nutrition and management system of the goats in both locations were assured to obtain the best result. The female goats were divided randomly into two groups, (A) CIDR group; (B) modified herbs in which (n=4 female goats per group). Group (A) was performed using 14 days CIDR (0.3g of progesterone) protocol. Group (B) was fed orally with modified herbs continuously for three days. Both groups were observed for the behavioral manifestation of estrus signs for 45 minutes four times daily (0900, 1200, 1500 and 1800 hours, respectively). Then, the female goats were artificially inseminated (AI) using frozen semen after 12 hours of standing heat. Pregnancy was confirmed through trans-abdominal ultrasonography at second trimester of gestation [3].

2.2 Estrus synchronisation signs

The estrus signs of the does were observed by visual observation starting from the onset of estrus until the end of the estrus. The estrus sign observed in the experiment was standing heat [4]. Standing heat is the most sexually intensive period of the estrous cycle. Therefore, the secondary estrus signs may vary in severity and period. Such symptoms may occur prior to, during, or after standing heat. Secondary estrus signs observed were tail wagging, redness of vulva, more vocals, excess of mucus and mounting [4]. The beginning of estrus response in this study stated as the onset of estrus (h).

2.3 Reproductive parameters

The identified reproductive parameters of female goats were estrus response, time to onset of estrus (h), duration of estrus (h), heat detection rate, conception rate and pregnancy rate (second trimester of gestation). All the equations were explained below:

a) Determination of female exhibit estrus response [5]:

\[
\text{Number of females in estrus} \times 100 \quad \text{Number of total females}
\]

b) Determination of estrus detection rate:

\[
\text{Number of does inseminated over 21 days} \times 100 \quad \text{Number of does eligible to be breed 21 days}
\]

c) Determination of conception rate [6]:

\[
\text{Total number of does detected pregnant} \times 100 \quad \text{Total number of does tested for pregnancy}
\]
d) Determination of pregnancy rate [5]

\[
\text{Number of pregnant females} \times 100
\]
\[\frac{\text{Number of mated females}}{}\]

2.4 Outcome measure and analysis

The reproductive performances (estrus response between groups, onset of estrus, duration of estrus, heat detection rate, conception rate and pregnancy rate) were compared using two-tailed student t-test at p<0.05. Additionally, the estrus response was compared between three days using one-way analysis of variance (ANOVA) at p<0.05. All the data were analysed using Statistical Package for the Social Sciences (SPSS) version 25.

3. Results And Discussion

The result of the current study found that, there were no significantly different (p>0.05) in estrus response for both group, respectively. However, the highest estrus response was shown in modified herbs at 80.56% followed by CIDR at 77.78%. The estrus response in modified herbs and CIDR were not significant may attributed to the breed variability, season and type of progesterone device [7]. Recently, the finding on estrus response has indicate that the percentage of ewes exhibited estrus response after CIDR withdrawal ranged between 84% and 90% [8]. Numerous studies have attempted to explain most of the estrus signs are specific depending on species [9, 10]. Table 1 shows a comparison of the estrus response between the treatment of CIDR and modified herbs within three days.

\[\text{Table 1. Mean and standard error of mean (SEM) of estrus response after treatment of CIDR and modified herbs}\]

| Days  | CIDR (%) | Modified herbs (%) | P-value |
|-------|----------|--------------------|---------|
| Day 1 | 66.67±10.54 | 75.00±15.81       | 0.47    |
| Day 2 | 83.33±12.36 | 83.33±16.67       | 1.00    |
| Day 3 | 83.33±12.36 | 83.33±16.67       | 1.00    |
| Overall| 77.78±6.67   | 80.56±8.94        | 0.68    |

%-percentage

Figure 1 shows comparison of the percentage of the means and standard error of the means (SEM) of estrus response between treatment CIDR and modified herbs. The figure indicates the differences of estrus response in modified herbs and CIDR treatment.
Figure 1. The percentage of Mean ± SEM of comparative efficacy of estrus synchronisation

There were significantly different (p<0.05) between the onset of estrus in CIDR and modified herbs (22.15h vs 24.4h, respectively). These results are consistent with other findings stated that an interval onset of estrus was 21.7 ± 0.4h [11]. Plus, there were significantly different (p<0.05) between the estrus duration in CIDR and modified herbs (57.5h vs 56h, respectively). Few numbers of studies have found that the estrus duration in Nubian, Boer and Damascus goats were 21.7h±0.7, 20.7h±0.7 and 21.2h±1.5 respectively but can range from 18 hours to 4 days [12, 13, 14]. Table 2 shows a comparison of onset of estrus and estrus duration for treatment of CIDR and modified herbs. Among the groups, CIDR shows faster onset of estrus compared to modified herbs (22.15 h vs 24.4 h) and longer estrus duration (57.5 h vs 56 h) compared to modified herbs respectively.

Table 2. Mean and standard error of mean (SEM) of onset of estrus and estrus duration (h)

| Treatment Groups (n=4) | CIDR (hour ± SE) | Modified herbs (hour ± SE) | P-value |
|-----------------------|------------------|-----------------------------|---------|
| Onset of estrus       | 22.15±0.03       | 24.40±0.05                  | 0.013   |
| Estrus duration       | 57.50±0.03       | 56.00±0.01                  | 0.001   |

%-percentage, SE-standard error, n-number of sample

The overall heat detection, conception and pregnancy rate in both groups are shown in table 3. There were no significantly different (P>0.05) in the means between all the reproductive parameters in CIDR and modified herbs. These differences could be exploited by various factors related to lactation status, postpartum period, and herd nutrition and management that may result in lower conception rate [15]. As stated, pregnancy rate in female goats treated with CIDR and modified herbs were 100% in both prior to AI and natural mating (see Table 3). However, this finding differs from other research reported that after insertion CIDR for 14 days, the goats obtained 60% of kidding rate [16]. A further study confirm that lower pregnancy rate have been reported when AI is performed in synchronised...
estrus goats than with natural estrus and also during the non-breeding with concerning to the breeding season [17].

**Table 3.** Mean and standard error of mean (SEM) reproductive parameters of CIDR and modified herbs

| Reproductive parameters | CIDR    | Modified herbs | P-value |
|-------------------------|---------|----------------|---------|
| Estrus detection rate (%) | 100.00  | 100.00         |         |
| Conception rate (%)     | 100.00  | 100.00         | 1.00    |
| Pregnancy rate (%)      | 100.00  | 100.00         |         |

% - percentage

4. Conclusion

In conclusion, the outcome of the present study indicate that onset of estrus and estrus duration in both groups were significantly different (p<0.05). However, the estrus response, estrus detection, conception and pregnancy rate in both groups were not significantly different (p>0.05). The findings in comparing between treatments were varied. This might due to limited number of sample, physiological status and breed of the goats. Modified herb were suggested to show similar result as CIDR, thus further study on the utilization of modified herb is promising. Hormone assay on female goats before and after utilization of modified herb will assure the efficacy of herb in estrus synchronisation.

References

[1] Khandoker M, Afini N and Azwan A 2018 Productive and reproductive performance of Saanen goat at AZ-Zahra farm of Sandakan in Malaysia *Bangladesh Journal of Animal Science* 47(1) 1-12.
[2] Ganesh P, Kumar R S and Saranraj P 2014 Phytochemical analysis and antibacterial activity of Pepper (Piper nigrum L.) against some human pathogens *Central European Journal of Experimental* 3(2) 36-41.
[3] Reichle J and Haibel G 1991 Ultrasonic biparietal diameter of second trimester Pygmy goat fetuses *Theriogenology* 35(4) 689-694.
[4] Welch S 2018 How to determine when a cow is in heat *Recognizing Signs of Heat* 1.
[5] Akar Y, Yüksel M and Ograk Y 2014 Oestrus synchronization and reproductive performance under different protocols in anoestrous dairy goats *Research Opinions in Animal & Veterinary services* 4(8) 432-436.
[6] Qureshi M A, Javed K, Jarral Z A and Khan S A 2008 Environmental factors affecting performance traits of crossbred and locals dairy cows at Mirpur Azad Jamu and Kashmir *Pak. J. Agri. Sci.* 45(2) 362-371.
[7] Santos G, Silva-Santos K, Melo-Sterza F, Mizubuti I, Moreira F and Seneda M 2011 Reproductive performance of ewes treated with an estrus induction/synchronization protocol during the spring season *Anim. Reprod.* 8 3-8.
[8] Paula M R and Antonio G B 2019 Efficiency of CIDR-based protocols including GnRH instead of eCG for Estrus Synchronization in Sheep *Animals (Basel)* 9(4)146.
[9] Battaglia R A 2001 Handbook of Livestock Management 3rd Edition New Prentice Hall Inc.
[10] Koyuncu M and Altmecik S 2013 Importance of body condition score in dairy goats Macedonian Journal of Animal Science 3(2) 167-171.
[11] Bitaraf A, Zamiri M, Kafi M and Izadifard J 2008 Efficacy of CIDR, fluogestone acetate sponges and cloprostenol for estrous synchronization of Nadooshani goats during the breeding season Iranian Journal of Veterinary Research 8(3) 218-224.
[12] Thompson F N, Abrams E and Miller D M 1983 Reproductive traits in Nubian dairy goats Animal Reproduction Science 6 59-65.
[13] Greyling J P 200 Reproduction traits in Boer goat doe Small Rumin. Res. 36(2) 171-177.
[14] Zarkawi M and Soukouti A 2001 Serum progesterone levels using radioimmunoaassay during oestrous cycle of indigenous Damascus does New Zealand J. Agric. Res. 44(2-3) 165-169.
[15] Son D, Choe C, Cho S, Choi S, Kim H, Hur T et al. 2007 A CIDR Based timed embryo transfer protocol increases the pregnancy rate of lactating repeat breeder dairy cows J. Reprod. Dev. 53(6) 1313-1318.
[16] Kor N, Ziae N and Pour E 2011 Comparison of reproductive performance in Raieni Goats following different estrous synchronization methods and subsequent eCG treatment during the natural breeding season Global veterinaria 7(6) 618-624.
[17] Karatzas G, Karagiannidis A and Varsakel A A 1997 Fertility of Fresh and frozen- thawed goats semen during the non- breeding season Theriogenology 48 1049-1059.