3° CONGRESSO MULTISALA

Relais Convento, Persico Dosimo (Cremona)

ATTI CONGRESSUALI

7 Pre-Congress

8 - 9 MAGGIO 2025

Estrous Cycle Control in Sheep and Goats

Jeferson Ferreira da Fonseca[1]; Juliana Nascimento Duarte Rodrigues[2]
[1] Embrapa Caprinos e Ovinos, Estrada Sobral/Groaíras, km 04, CP 145, CEP 62010-970, Sobral, CE, Brazil.
[2] Universidade Federal Rural da Amazônia, Campus Paragominas, Rodovia PA-256, s/n, CEP 68627-451, Paragominas, PA, Brazil.

Abstract

Estrous cycle control is a foundational tool in the reproductive management of sheep and goats, facilitating the strategic use of assisted reproductive technologies such as fixed-time artificial insemination, superovulation, and embryo transfer. Its success depends on a comprehensive understanding of follicular dynamics, reproductive seasonality, and hormonal responsiveness. This review discusses the physiological basis and practical application of estrus synchronization and induction protocols, highlighting the role of intravaginal progesterone devices, prostaglandins, and equine chorionic gonadotropin (eCG). Key protocol variables, including hormone type, dosage (e.g., 330 mg progesterone in CIDR, 60 mg medroxyprogesterone acetate in sponges, 37.5 µg cloprostenol, and 200-300 IU eCG), and timing of administration, are presented. The use of low-cost alternatives such as progesterone-soaked tampons and reusable devices is also reviewed. The analysis emphasizes that optimal outcomes require careful female selection, minimal hormonal intervention, and timing precision. Estrous control protocols, when properly designed and implemented, enhance reproductive efficiency while aligning with sustainability and animal welfare standards.

Introduction

Estrous cycle control is the basis of reproductive biotechnologies applied in small ruminants and is fundamental to the success of techniques such as fixed-time artificial insemination (FTAI), superovulation, embryo transfer, and lactation induction. The main objective is to synchronize or induce estrus and ovulation in groups of females, allowing for rational scheduling of reproductive management and the formation of homogeneous groups of pregnant animals. Moreover, when used rationally and with a solid physiological basis, hormonal protocols can optimize outcomes while minimizing impacts on animal welfare, public health, and production system sustainability.
Physiologically, the estrous cycle of ewes and does consists of luteal and follicular phases, typically lasting between 17 and 21 days. The follicular phase begins with luteolysis and culminates in ovulation, characterized by the growth of dominant follicles stimulated by FSH and LH. As demonstrated by Ginther et al. and De Castro et al. , follicular development occurs in waves, and the timing of the dominant wave emergence directly influences synchronization success. Understanding this follicular dynamic is essential to determine the ideal moment for hormone application.
One of the most influential factors in the efficiency of hormonal protocols is the body condition score (BCS) of the female. Fonseca and Alvim (2018) recommend that at least 80% of females should have a BCS between 2.75 and 3.5 on a scale from 1 to 5, which is considered optimal for hormonal responsiveness. Animals outside this range are more likely to present reproductive failures, such as anestrus, silent ovulation, or persistent follicles. Furthermore, uterine diseases, metabolic disorders, and poor nutritional management are limiting factors that must be

corrected prior to protocol implementation.

The most widely used method for estrus synchronization involves the use of intravaginal devices impregnated with progesterone or synthetic progestogens, such as CIDRs (Controlled Internal Drug Release) containing 330 mg of natural progesterone, or vaginal sponges with 60 mg of medroxyprogesterone acetate (MAP). These devices are usually kept in place for 6 to 14 days and are followed by an injection of prostaglandin F2α (PGF2α) or analogues, such as 37.5 µg of sodium cloprostenol intramuscularly, to induce luteolysis and stimulate synchronized estrus return. In many protocols, eCG (equine chorionic gonadotropin) at a dose of 200 to 300 IU is also administered 24 h before or at the time of device removal to stimulate follicular growth and ovulation.

showed that in sheep treated with two doses of PGF2α seven days apart, estrus response exceeded 90%, with ovulation occurring between 42 and 60 hours after the second dose. In goats, the administration of two doses of 37.5 µg cloprostenol with a 10 to 11-day interval has been successfully applied, provided the second dose is administered at least 3.5 days after previous estrus to ensure most animals are in a functional luteal phase.

The interval between device removal and ovulation is typically 60 to 72 hours, which should guide insemination timing .

For estrus induction in acyclic females, a common condition during seasonal anestrus or in prepubertal animals, progesterone treatments must be combined with eCG and, occasionally, GnRH. For instance, Carvalho de Paula et al. reported conception rates above 60% in acyclic goats treated with vaginal sponges containing 60 mg MAP for 6 days, plus 200 IU eCG and cloprostenol 24 h before sponge removal. This protocol promotes the development of new antral follicles and ensures ovulation even in the absence of a functional corpus luteum. In sheep, Fonseca et al. achieved similar results using 37.5 µg of cloprostenol 24 hours before device withdrawal combined with 200 IU eCG at removal.

Due to the high cost and limited availability of commercial devices, affordable alternatives have been investigated. Prates et al. tested the use of human vaginal tampons (OB® type) soaked in micronized progesterone in 96% ethanol at concentrations of 200 mg and 400 mg. These tampons were inserted for six days in Santa Inês ewes, and plasma progesterone levels reached thresholds compatible with functional luteal phase (>1 ng/mL). Ovulation and conception rates were comparable to the CIDR group, but with significantly lower cost, approximately $1.50 per 400 mg tampon versus $7.84 per CIDR.

Cervical mucus evaluation during estrus is also a useful tool for determining the optimal insemination window. Fonseca et al. (2017) and documented the evolution of cervical mucus types in hormonally induced goats and sheep, showing that crystalline mucus (transparent and elastic) is associated with the estrogen peak and precedes ovulation by 12 to 24 hours. Conversely, thick or cloudy mucus suggests that the female is not yet receptive or is not cycling. Hence, mucus scoring can guide insemination timing, especially when using frozen semen, which requires more precise synchronization with ovulation.

Reusing hormonal devices has been explored to reduce operational costs. reported that vaginal sponges reused for up to three cycles maintained high estrus response rates (100%), with no significant loss in ovulation or conception. In goats treated with intravaginal reused devices for six and twelve cycles, pregnancy rates were 58% and 67%, respectively, compared to 60% in the control group . The estrus-to-ovulation interval was around 29 hours in reused groups versus 40 hours in the control, which necessitates slight adjustments to insemination timing.

The rational use of hormones should also consider biosafety and sustainability. Selecting molecules with rapid metabolism and structural similarity to natural hormones reduces residue risks and aligns with international standards for animal product safety. Minimizing hormonal doses, observing withdrawal times, and respecting ethical standards are essential principles for maintaining consumer confidence and environmental responsibility. In this context, the use of photoperiod manipulation followed by estrus synchronization could be an alternative for obtaining synchronous estrus induction in acyclic goats (Netto et al., 2020).

It is concluded that estrous cycle control in sheep and goats is a strategic tool for improving reproductive performance and herd productivity, provided it is based on sound physiological knowledge, adapted to the herd's conditions, and executed with technical precision. Appropriate female selection, cautious hormone use, and team training are the pillars for implementing effective and sustainable protocols. The development of low-cost alternatives, such as progesterone-infused tampons and reusable sponges, and the refinement of hormonal protocols with dose optimization expand access to reproductive biotechnologies and improve the performance of small ruminant systems in Brazil and worldwide.

References

Bonato, G.C., Maia, A.L.R.S., Côrtes, L.R., Oliveira, T.A., Arrais, A.M., Figueira, L.M., Oliveira, M.E.F., Souza-Fabjan, J.M.G., Fonseca, J.F., 2019. Effects of d-cloprostenol administrations with 7.5 and 11.5-day intervals between administrations on pregnancy rates after artificial insemination in estrous cyclic dairy goats. Anim Reprod Sci 209, 106172. https://doi.org/10.1016/j.anireprosci.2019.106172

Carvalho-de-Paula, C.J., Souza-Fabjan, J.M.G., Gonçalves, J.D., Dias, J.H., de Souza, G.N., Oliveira, M.E.F., Fonseca, J.F., 2020. Effect of a 12-h increment in the short-term treatment regimen on ovarian status, estrus synchrony, and pregnancy rate in artificially inseminated dairy goats. Anim Reprod Sci 221, 106571. https://doi.org/10.1016/j.anireprosci.2020.106571

De Castro, T., Rubianes, E., Menchaca, A., Rivero, A., 1999. Ovarian dynamics, serum estradiol and progesterone concentrations during the interovulatory interval in goats. Theriogenology 52, 399-411. https://doi.org/10.1016/S0093-691X(99)00138-7

Fonseca, J.F., Souza-Fabjan, J.M.G., Oliveira, M.E.F., Cruz, R.C., Esteves, L. V., Matos de Paiva, M.P.S.L., Brandão, F.Z., Mancio, A.B., 2017. Evaluation of cervical mucus and reproductive efficiency of seasonally anovular dairy goats after short-term progestagen-based estrous induction protocols with different gonadotropins. Reprod Biol 17, 363-369. https://doi.org/10.1016/j.repbio.2017.10.002

Ginther, O.J., Beg, M.A., Bergfelt, D.R., Donadeu, F.X., Kot, K., 2001. Follicle Selection in Monovular Species. Biol Reprod 65, 638-647. https://doi.org/10.1095/BIOLREPROD65.3.638

Maia, A.L.R.S., Brandão, F.Z., Souza-Fabjan, J.M.G., Balaro, M.F.A., Oliveira, M.E.F., Facó, O., Fonseca, J.F., 2017. Reproductive parameters of dairy goats after receiving two doses of d-cloprostenol at different intervals. Anim Reprod Sci 181, 16-23. https://doi.org/10.1016/j.anireprosci.2017.02.013

Menchaca, A., Miller, V., Gil, J., Pinczak, A., Laca, M., Rubianes, E., 2004. Prostaglandin F2α Treatment Associated with Timed Artificial Insemination in Ewes. Reproduction in Domestic Animals 39, 352-355. https://doi.org/10.1111/J.1439-0531.2004.00527.X

Pinna, A.E., Brandão, F.Z., Cavalcanti, A.S., Borges, A.M., Souza, J.M.G., Fonseca, J.F., 2012. Reproductive parameters of Santa Inês ewes submitted to short-term treatment with re-used progesterone devices. Arq Bras Med Vet Zootec 64, 333-340. https://doi.org/10.1590/S0102-09352012000200012

Prates, J.F., Brair, V.L., Maia, A.L.R.S., Souza-Fabjan, J.M.G., Brandão, F.Z., Bonato, G.C., Fonseca, J.F., 2019. Use of human intravaginal tampon embedded with natural progesterone induces synchronous estrus in Santa Inês ewes. Arq Bras Med Vet Zootec 71, 345-348. https://doi.org/10.1590/1678-4162-10241

Souza, J.M.G., Torres, C.A.A., Maia, A.L.R.S., Brandão, F.Z., Bruschi, J.H., Viana, J.H.M., Oba, E., Fonseca, J.F., 2011. Autoclaved, previously used intravaginal progesterone devices induces estrus and ovulation in anestrous Toggenburg goats. Anim Reprod Sci 129, 50-55. https://doi.org/10.1016/J.ANIREPROSCI.2011.09.012

Souza-Fabjan, J.M.G., Brair, V.L., dos Santos Silva, D., Schmidt, A.P.P., Figueira, L.M., Rangel, P.S.C., Vergani, G.B., de Oliveira Machado, V., Oliveira, M.E.F., da Fonseca, J.F., 2021. Vaginal cytology and cervical mucus as tools to predict ovulation time in small ruminants. Trop Anim Health Prod 53, 223. https://doi.org/10.1007/s11250-021-02667-6