

# Nature Inspires Estrus Synchronization in Murciano-Granadina Goats under Extremely Hot Climate - 1-4

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**Abstract:** Despite the seasonal nature of reproduction in goats, creating a capacity that enables getting goats pregnant throughout the year is of economical importance in commercial settings. The objective was to compare natural and artificial (hormonal) methods of estrus synchronization on pregnancy rate of Murciano-Granadina goats under extremely hot climate of southern Iran. To synchronize estrus, experimental goats received one of three treatments. The first group (n = 123) was treated with CIDR (intravaginal progesterone release) on day-0 and which was later removed on day-19 plus eCG injection followed by introduction to bucks on day-21. The second group (n = 157) was treated with CIDR on day-0 and with eCG injection on day-17, then CIDR removed on day-19 followed by introduction to bucks on day-21. The third group (n = 257) did not receive any hormonal treatments and were only synchronized naturally via introduction to bucks (natural mating). Findings revealed that natural synchronization (male effect) resulted in significantly greater pregnancy rates compared to the second group (69 vs. 53%, P < 0.05). The first group tended to have greater pregnancy than did the first group (63 vs. 53%, P < 0.10). Improved reproductive performance of dairy goats under hot stressful climate signifies the economical importance and practicality of natural mating as an effective method of estrus synchronization in commercial goat production.

**Keywords:** Estrus synchronization, Murciano-Granadina Goat, Pregnancy, Hot climate.

## IMPLICATIONS

Nature does best in synchronizing estrus in goats under extremely hot climate. Thus, there are no needs for hormonal therapy and investing much time and money. Such a natural inspiration of goat reproduction requires consideration in breeding management programs of goats kept under intensified environments.

## INTRODUCTION

Future commercial goat production economy will depend on the degree of reproductive success. Efforts have recently focused on improving goat reproduction efficiency [1]. Reproduction in mammals is a result of interactions among different internal (e.g., endocrine) and environmental factors [2]. Reproduction can be induced by external hormonal treatments or by manipulating the animal environment [3,4]. Goats are usually seasonal breeders [5,6]. As a result, kidding occurs during certain times of the year and milk production fluctuates accordingly [7,8]. From an economical perspective, this is not desirable because a more consistent production of milk throughout the year would be more favorable. As such, goat producers aim

to get their animals pregnant all the time using artificial or hormonal treatments. However, the efficacy of such hormonal products and treatments under abnormal environmental conditions (e.g., extremely hot climates) is not well characterized [3]. Practically, natural mating is preferably used over hormonal treatments to synchronize estrus in first-kid goats, when compared to multiparous goats [9]. We hypothesized that the efficiency of external hormonal treatments would be depressed under extremely hot animal environments, and thus, natural mating would be a superior method to synchronize estrus and obtain successful pregnancy in commercial dairy goats. This hypothesis was fuelled by the contemplation that livestock management strategies are to be inspired by the nature of animal and environment. Information is lacking on the potential comparative effects of hormonal treatments versus natural mating (i.e., male effect) for estrus synchronization and reproductive success in Murciano-Granadina goats. The objective was, therefore, to determine pregnancy rates following natural mating versus external hormonal treatments for estrus synchronization in Murciano-Granadina goats under extremely hot climate of southern Iran (Kerman province).

## MATERIALS AND METHODS

This experiments was conducted on 537 Murciano-Granadina dairy goats (body weight = 30 ± 2 kg) in

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Ghale-Ganj region of Kerman province. The study started late July 2017. The ambient temperature during the experiment varied between 38 to 55°C over the 24-h period. To note, ruminants are exposed to heat stress when ambient temperature exceeds 25°C. All goats were kept under the same housing and environmental conditions according to the guidelines of the Iranian Council on Animal Care [10]. The experimental goats were housed in 3 separate groups. The group 1 (n = 123) received an intravaginal progesterone insert or CIDR (Controlled Internal Drug Release) on d-0 which was removed on d-19 combined with eCG injection, followed by introduction to bucks on d-21. The group 2 (n = 157) received CIDR on d-0 and eCG on d-17 with CIDR removed on d-19 when introduction to bucks occurred. Treatments in groups 1 and 2 were designed to test separate and combined effects of CIDR and PMSG on estrus synchronization [16,17]. The group 3 (n = 257) was synchronized only using the male effect by natural mating without any external CIDR or hormonal treatments. This group had no contacts with bucks for at least 40 days before the commencement of the study to ensure that the optimum male effect for successful estrus synchronizing occurred. In all three groups, female to male ratio was 10 to 1. All does were tested for pregnancy using ultrasound 30 days after separating bucks (Portable Ultrasound Scanner Veterinary Pregnancy V16 with 7.5 MHz Rectal Probe). Pregnancy rates were calculated by dividing the number of does pregnant to the total number of does in each group. Data were statistically analyzed within the SPSS software (ver. 25) using Chi-Square test and Mean Comparison Methods. Differences were declared significant when  $P < 0.05$ . Tendencies were discussed at  $P < 0.10$ .

## RESULTS AND DISCUSSION

The pregnancy rates for the two hormonal groups were 63 and 53%, while that of the natural mating group was 69% (Tables 1 and 2). Overall, the natural mating resulted in significantly greater pregnancy rates, when compared with the external hormonal treatments. This study is the first to report a superior pregnancy rate by natural compared to hormonal estrus synchronization in Murciano-Granadina goats. The pregnancy rate tended to be greater for the group 1 than for the group 2 (63% vs. 53%,  $P=0.07$ ). This suggests that hormonal therapy for the first group was more stable and successful in synchronizing estrus. It is likely that CIDR and PMSG could more effectively

act to synchronize estrus when given at different times. However, the superior effect of natural mating on pregnancy rate was significant only when compared with group 2 and not group 1. This finding is of practical importance, as it shows that natural mating works well under stressful climatic conditions in getting goats pregnant. External hormonal treatments impose significant costs to the small ruminant industry. Thus, if under certain circumstances, natural mating would result in better or even equal reproductive performance, drug and treatment costs will be dramatically reduced. This will benefit the farm economy and environmental sustainability. The ranges of pregnancies obtained in the current study read well with the literature values [11-15].

It is possible that the extremely hot climate of the region reduced the efficiency of CIDR and PMSG utilized in the current study. A premise considered in designing the current study was that reproductive techniques utilized in commercial goat production systems ought to be inspired by the nature of the animal and its environment. This would imply that when the climate is highly stressful and goats partition more nutrients towards sustaining immunity, external hormonal therapies may not lead to maximal performance. Under such stressed conditions, goats may respond well to their natural drivers of reproduction behavior and fertility. Accordingly, they would exhibit improved estrus synchronization and pregnancy success in response to natural mating without the additional stress and biochemical interference of hormone therapy, signifying the importance of male effect in enhancing goat fertility. The sufficiently high number of goats (large sample size) of the present study highlights the practicality of the outcomes and their application to farm scenarios. Future studies monitoring production performance and persistence as well as health and immune status under different reproductive protocols are warranted.

**Table 1: Pregnancy Rates (Averages and Standard Errors) in Treatment Groups**

Treatment/Group	Pregnancy rate	Standard error
1	0.63 (78/123)	0.043
2	0.53 (83/157)	0.040
3	0.69 (177/257)	0.029

Treatment 1 = CIDR inserted at d-0 and removed at d-19, eCG injection at d-19, and introduction to bucks at d-21.

Treatment 2 = CIDR inserted at d-0 and removed at d-19, eCG injection at d-17 and introduction to bucks at d-19.

Treatment 3 = natural mating with no hormonal treatments.

Table 2: Treatment Means Comparisons (Pregnancy Rates)

Treatment/Group	Comparing group	Means difference	Standard error	Significance level
1	2	0.10	0.059	0.073
	3	0.06	0.052	0.295
2	1	0.10	0.059	0.073
	3	0.16	0.049	0.010
3	1	0.06	0.052	0.295
	2	0.16	0.049	0.010

Treatment 1 = CIDR inserted at d-0 and removed at d-19, eCG injection at d-19, and introduction to bucks at d-21.

Treatment 2 = CIDR inserted at d-0 and removed at d-19, eCG injection at d-17 and introduction to bucks at d-19.

Treatment 3 = natural mating with no hormonal treatments.

## CONCLUSIONS

Under the extremely hot climate of the southern Iran, natural mating of Murciano-Granadina goats (i.e., sole male effect) without any hormonal treatments resulted in superior pregnancy rates than did external hormonal treatments (CIDR + eCG). Therefore, natural mating proved successful in synchronizing estrus in Murciano-Granadina goats under stressful environmental conditions.

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## DECLARATIONS OF INTEREST

None.

## REFERENCES

- Nunes JF, Salgueiro CCM. Strategies to improve the reproductive efficiency of goats in Brazil. *Small Rum Res* 2011; 98: 176-184. <https://doi.org/10.1016/j.smallrumres.2011.03.036>
- Arrebola FA, Pardo B, Sanches M, Lopez MD, Perez-Marín CC. Factor influencing the success of an artificial insemination programme in Florida goats. *Spanish J Agric Res* 2012; 10(2): 338-344. <https://doi.org/10.5424/sjar/2012102-223-11>
- Stanimir A, Yotov Desislava V, Velislavova L, Dimova R. Pregnancy rate in Bulgarian White milk goats with natural and synchronized estrus after artificial insemination by frozen semen during breeding season. *Asian Pac J Reprod* 2016; 5(2): 144-147. <https://doi.org/10.1016/j.apjr.2016.01.011>
- Sohnrey B, Holtz W. Technical note: transcervical deep coital insemination of goats. *J Anim Sci* 2005; 83: 1543-1548. <https://doi.org/10.2527/2005.8371543x>
- Chemineau P, Martin GB, Saumande J. Seasonal and hormonal control of pulsatile LH secretion in the dairy goat (*Capra hircus*). *J Reprod Fertil* 1988; 83: 91-98. <https://doi.org/10.1530/jrf.0.0830091>
- Malpoux B, Thiéry JC, Chemineau P. Melatonin and the seasonal control of reproduction. *Reprod Nutr Dev* 1999; 39(3): 355-366. <https://doi.org/10.1051/rnd:19990308>
- Meza CA, Ross TT. Factors affecting fertility and prolificacy of dairy goats inseminated with frozen-thawed semen. In: Dubeuf JP, editor. *Proceedings of the 7th International Conference on goats*. Inesc-Id: Lisbon 2000; pp. 476-478.
- Mellado M, Valdez JE, Garcia JE, Lopez R, Rodriguez A. Factors affecting the reproductive performance of goats under intensive conditions in a hot arid environment. *Small Rum Res* 2006; 6: 110-118. <https://doi.org/10.1016/j.smallrumres.2005.02.016>
- Kulaksiz R, Daskin A. Reproductive performance of primiparous and multiparous Saanen goats after laparoscopic intrauterine insemination: a field study. *Turk J Vet Anim Sci* 2012; 36(2): 201-204.
- Iranian Council of Animal Care. *Guide to the Care and Use of Experimental Animals*. Isfahan University of Technology, Isfahan, Iran 1995; volume 1.
- Bonev G, Kostov L, Georgiev St. Laparoscopic insemination of sheep with deep frozen semen. In: *Proc. International Conference for advancement of sheep and goat production*. Veter Inst Ohrid 1991; 23: 131-134.
- Ciptadi G, Budiarto A, Ihsan MN, Wisaptiningsih U, Wahyuningsih S. Reproductive performance and success of artificial insemination in Indonesian crossbred goats in research versus small holder arm. *American-Eurasian J Sust Agri* 2014; 8(7): 35-38.
- Leethongdee S, Lieangcharoen N, Thuangsanthia A. The fertility rate following the superficial cervical artificial insemination with fixed time system after the induction of oestrus and vulval in mixed bred goats. *Reprod Domest Anim* 2013; 48: 112.
- Ritar AJ, Ball PD, O'May PJ. Artificial insemination of Cashmere goats: effects on fertility and fecundity of intravaginal treatment, method and time of insemination, semen freezing process, number of motile spermatozoa and age of females. *Reprod Fert Dev* 1990; 2(4): 377-384. <https://doi.org/10.1071/RD9900377>

- [15] Simões J. Recent advances on synchronization of ovulation in goats, out of season, for a more sustainable production. *Asian Pac J Reprod* 2015; 4(2): 157-165.  
[https://doi.org/10.1016/S2305-0500\(15\)30014-2](https://doi.org/10.1016/S2305-0500(15)30014-2)
- [16] Leboeuf B, Delgadillo JA, Manfredi E, Piace`re A, Clément V, Martin P. Management of goat reproduction and insemination for genetic improvement in France. *Reprod Dom Anim* 2008; 43(Suppl. 2): 379-385.
- [17] Holtz W, Sohnrey B, Gerland M, Driancourt MA. Ovsynch synchronization and fixed-time insemination in goats. *Theriogenology* 2008; 69: 785-792.  
<https://doi.org/10.1016/j.theriogenology.2007.10.004>

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