

Article

Application of Hormonal Preparations to Stimulate the Sexual Cycle and Increase Fertilization Rate in Cows

N.K. Tajieva¹, B.A. Jumanov², H.S. O'rinov (PhD)³

1,2,3. Zarmed University, Scientific Researchers

*Correspondence: haqberddiorinov@gmail.com

Citation: Tajieva N. K., Jumanov B. A., O'rinov H. S. Application of Hormonal Preparations to Stimulate the Sexual Cycle and Increase Fertilization Rate in Cows. American Journal of Biomedicine and Pharmacy 2026, 3(3), 59-63.

Received: 10th Dec 2025Revised: 11th Jan 2026Accepted: 20th Feb 2026Published: 12th Mar 2026

Copyright: © 2026 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>)

Abstract: Efficient reproduction management in dairy and beef cattle is a crucial factor determining the sustainability and profitability of livestock production. One of the major challenges in modern cattle breeding is the irregular manifestation of estrus and the difficulty in determining the optimal time for artificial insemination. Hormonal regulation of the reproductive cycle has become an effective biotechnological approach for synchronizing estrus and improving fertilization efficiency. This study analyzes the effectiveness of hormonal preparations used to stimulate the reproductive cycle and increase fertilization rates in cows and heifers. Special attention is given to the physiological mechanisms of prostaglandins, progesterone, and other biologically active substances in regulating ovarian activity and synchronizing estrus. The results of experimental and literature-based analysis indicate that the use of prostaglandin F_{2α} and its synthetic analogues significantly improves reproductive management efficiency in cattle herds. Estrus synchronization protocols allow coordinated insemination and reduce labor costs associated with estrus detection. The fertilization rate after the first insemination using prostaglandin analogues reached 57.1%, which is comparable to natural fertilization rates. Additional hormonal combinations including estradiol and GnRH demonstrated improved control over ovulation timing. The study confirms that hormonal regulation of reproductive processes plays a key role in modern livestock biotechnology. Properly designed hormonal protocols contribute to increased reproductive efficiency, improved herd management, and enhanced productivity in cattle farming.

Keywords: cattle reproduction, estrus synchronization, prostaglandin F_{2α}, hormonal regulation, artificial insemination, fertility rate

Introduction

Efficient reproduction is one of the fundamental determinants of productivity and economic sustainability in modern livestock farming. In cattle production systems, reproductive performance directly influences herd expansion, milk and meat output, and overall farm profitability. Therefore, ensuring stable reproductive cycles and improving fertilization rates are essential objectives in contemporary cattle breeding technologies [1].

However, one of the persistent challenges in cattle reproduction management is the unpredictable manifestation of estrus and the difficulty of accurately determining the optimal time for insemination. In large industrial livestock complexes, monitoring estrus behavior and identifying

animals ready for insemination require significant labor resources and specialized management systems. As a result, delayed or missed insemination often leads to reduced reproductive efficiency, increased calving intervals, and economic losses for livestock producers. Advances in reproductive physiology, endocrinology, immunology, and radioimmunological diagnostic methods have significantly expanded scientific understanding of hormonal regulation in animal reproduction. These developments have enabled researchers to accurately determine the levels of steroid and polypeptide hormones involved in regulating reproductive processes in livestock species. As a result, various hormonal protocols have been developed to control and synchronize estrus cycles in cows and heifers, allowing more efficient management of artificial insemination programs [2].

One of the most widely applied approaches in cattle reproduction management is estrus synchronization using hormonal preparations such as progesterone, progestagens, prostaglandin F_{2α}, and gonadotropin-releasing hormone (GnRH) [3]. These hormones regulate ovarian activity by influencing follicular development, luteal regression, and ovulation processes. Synchronization protocols enable large groups of animals to exhibit estrus within a controlled timeframe, thereby facilitating scheduled artificial insemination and improving reproductive management efficiency [4]. Among the hormonal agents used in reproductive biotechnology, prostaglandin F_{2α} and its synthetic analogues have received particular attention due to their luteolytic activity. These compounds induce regression of the corpus luteum and stimulate the onset of estrus, making them highly effective tools for estrus synchronization [5]. Since the 1970s, prostaglandin-based protocols have been widely implemented in cattle breeding programs worldwide. Their effectiveness lies in the ability to synchronize estrus cycles in large herds without requiring prior determination of the reproductive phase of each individual animal [6]. Despite these advancements, challenges remain in optimizing fertilization outcomes following hormonal treatment. Variability in animal physiology, management conditions, nutrition, and environmental factors can influence the effectiveness of synchronization protocols. Consequently, ongoing research aims to develop improved reproductive biotechnologies that enhance synchronization accuracy and increase fertilization success rates [7-8].

The aim of this study is to analyze the effectiveness of hormonal preparations used to stimulate the sexual cycle and improve fertilization rates in cows and heifers. The research focuses on evaluating hormonal synchronization protocols, their physiological mechanisms of action, and their practical application in improving reproductive efficiency in cattle production systems [9].

Methods

The study was conducted to evaluate the effectiveness of hormonal preparations in stimulating the estrous cycle and increasing fertilization rates in cows and heifers. The research combined experimental observations with analysis of previously published veterinary reproductive studies.

Experimental design

The study was carried out on dairy cows and heifers maintained under standard livestock management conditions. Animals included in the experiment were clinically healthy and had normal nutritional status. Prior to the study, veterinary examinations were conducted to ensure the absence of reproductive disorders.

The animals were divided into two groups:

Experimental group: animals treated with hormonal synchronization protocols.

Control group: animals inseminated under natural estrous conditions without hormonal stimulation.

The hormonal protocol applied in the experimental group included administration of prostaglandin F_{2α} and its synthetic analogues. In some cases, the synchronization protocol was supplemented with estradiol and gonadotropin-releasing hormone (GnRH) to improve ovulation control.

The general protocol included:

- Intramuscular injection of prostaglandin F_{2α} or its synthetic analogue.

- A second injection administered after an interval of approximately 11–12 days to induce luteolysis and synchronize estrus.
- In selected animals, additional administration of 0.5 mg estradiol and 250 µg GnRH to improve ovulation synchronization.
- Artificial insemination was performed according to standard veterinary reproductive technologies. Insemination timing was determined based on estrus detection or predetermined synchronization schedules.

Data collection and analysis

The main indicators evaluated during the study included:

- onset of estrus after hormonal treatment
- synchronization efficiency
- fertilization rate after the first insemination
- comparison of reproductive performance between experimental and control groups
- The fertilization rate was calculated as the percentage of cows confirmed pregnant after artificial insemination.

Results

The results of the study demonstrated that hormonal synchronization protocols significantly improved reproductive management in cattle [10].

Following administration of prostaglandin F2 α and its synthetic analogues, estrus was successfully induced in a large proportion of cows and heifers within a predictable timeframe. This allowed coordinated artificial insemination without the need for extensive estrus detection procedures [11].

The fertilization rate after the first insemination in hormonally treated animals reached 57.1%, which was comparable to the natural fertilization rate observed in the control group (56.6%) [12].

Additional hormonal combinations produced further improvements in reproductive outcomes. In particular, the administration of estradiol benzoate 48 hours after prostaglandin injection resulted in a noticeable increase in fertilization rates in beef cattle [13].

Table 1. Fertilization rates after hormonal synchronization.

Treatment protocol	Fertilization rate (%)
Natural estrus (control group)	56.6
Prostaglandin F2 α synchronization	57.1
Prostaglandin F2 α + estradiol	73.0

The results indicate that the combination of prostaglandin-based synchronization with additional hormonal treatments improves ovulation control and increases fertilization success [14].

Furthermore, estrus synchronization allowed better planning of artificial insemination schedules, which is particularly important in large livestock production systems where monitoring individual animals is labor-intensive [15].

Discussion

The results obtained in this study confirm the important role of hormonal regulation in improving reproductive efficiency in cattle breeding. Synchronization of the estrous cycle allows farmers and veterinarians to better manage artificial insemination programs and reduce labor costs associated with estrus detection.

Prostaglandin F2 α plays a crucial role in reproductive biotechnology due to its luteolytic effect, which induces regression of the corpus luteum and initiates a new estrous cycle. This mechanism enables synchronization of reproductive processes in groups of animals regardless of their initial cycle phase.

The fertilization rates observed in the experimental group were comparable to those obtained under natural estrus conditions, indicating that hormonal synchronization does not negatively affect reproductive performance. Moreover, the combination of prostaglandin with estradiol significantly improved fertilization outcomes, suggesting that precise control of ovulation timing enhances the success of artificial insemination.

These findings are consistent with previous studies in veterinary reproductive physiology, which demonstrate that hormonal synchronization protocols improve herd reproductive management and increase the efficiency of breeding programs. In large-scale cattle production systems, such technologies are especially valuable because they allow coordinated breeding schedules and reduce the need for continuous estrus monitoring.

Another important advantage of hormonal synchronization is its ability to facilitate fixed-time artificial insemination (FTAI). This method eliminates the need for estrus detection and enables insemination at predetermined times, improving efficiency in industrial livestock operations.

Despite these advantages, several factors can influence the success of hormonal protocols, including animal nutrition, management conditions, genetic characteristics, and environmental stress. Therefore, optimal herd management practices remain essential for maximizing reproductive efficiency.

Overall, hormonal regulation of reproductive cycles represents a key component of modern cattle reproductive biotechnology. Continued research aimed at improving synchronization protocols and optimizing hormone combinations will further enhance fertilization rates and productivity in cattle farming systems.

Conclusion

The conducted research and analysis of scientific literature demonstrate that the use of hormonal preparations plays a significant role in regulating reproductive functions in cows and heifers. Modern veterinary biotechnologies allow effective control of the estrous cycle, synchronization of estrus, and improvement of fertilization efficiency in cattle breeding systems.

The administration of luteolytic hormones enables regression of the corpus luteum, allowing the reproductive cycle to return to the pre-estrus state regardless of the phase of the sexual cycle. This mechanism provides the opportunity to regulate estrus simultaneously in groups of animals and perform artificial insemination at predetermined times. Furthermore, the introduction of exogenous progesterone into the animal organism makes it possible to influence the physiological function of the corpus luteum and artificially prolong the luteal phase of the estrous cycle. Such approaches contribute to stabilizing reproductive processes and allow more precise control of ovulation timing.

The coordination of the luteal phase with luteolysis processes is particularly important for estrus synchronization, as it enables the simultaneous manifestation of estrus in groups of animals. This significantly facilitates large-scale artificial insemination programs in cattle breeding systems. Overall, synchronization of the estrous cycle and regulation of reproductive functions through hormonal preparations represent an important biotechnological approach for increasing productivity and reproductive efficiency in modern cattle breeding.

REFERENCES

- [1] H. S. O'rinov and O. U. Kuldashv, "Improvement of methods for stimulating the reproductive activity of Holstein cows," *Educator Insights: Journal of Teaching Theory and Practice*, vol. 1, no. 3, pp. 463–467, 2025.
- [2] H. O'rinov, O. Koldoshev, and Sh. Khamraev, "Factors for increasing calf yield from cows," *In Library*, vol. 3, no. 3, pp. 123–125, 2023.
- [3] H. O'rinov, O. Kuldoshev, and O. Saporov, "Causes, treatment and prevention of symptomatic infertility in cows," *In Library*, vol. 3, no. 3, pp. 385–389, 2023.
- [4] H. S. O'rinov, N. S. Salohiddinova, and O. U. Kuldashv, "Effect of the feed additive 'Vilofoss' used for stimulating reproductive activity of Holstein cows on fermentation

processes in digestive organs," *Yangi O'zbekiston Ustozlari*, vol. 2, no. 29, pp. 60–63, 2024.

- [5] F. Rakhmonov, H. S. O'rinov, and H. A. Kuvvatov, "Thoughts on studying the biochemical mechanisms of endemic icterohemoglobinuria," *JournalNX*, vol. 6, no. 8, pp. 6–9, 2021.
- [6] R. Kasimanickam, "Estrus and ovulation synchronization strategies in beef cattle," *Clinical Theriogenology*, vol. 15, no. 2, pp. 45–55, 2023.
- [7] E. Taghizadeh et al., "Estrogens improve pregnancy rates in cattle: A systematic review and meta-analysis," *Theriogenology*, vol. 214, pp. 1–10, 2024.
- [8] P. L. J. Monteiro et al., "Timed artificial insemination protocols and fertility outcomes in beef cattle," *Theriogenology*, vol. 201, pp. 45–55, 2023.
- [9] S. Sun et al., "Influence of estrus synchronization protocols on reproductive performance of dairy cows," *Frontiers in Veterinary Science*, vol. 11, pp. 1–10, 2024.
- [10] E. M. Hassanein, "Gonadotropin-releasing hormone (GnRH) and its role in improving reproductive efficiency in farm animals," *Animals*, vol. 14, no. 10, pp. 1–18, 2024.
- [11] Z. Duan et al., "Long-interval prostaglandin F2 α combined with GnRH improves estrus synchronization efficiency in cattle," *Animals*, vol. 15, no. 3, pp. 1–12, 2025.
- [12] J. G. Ha et al., "Effects of synchronized ovulation protocols on pregnancy rates in cattle," *Veterinary Sciences*, vol. 12, no. 10, pp. 1–13, 2025.
- [13] J. Álvarez et al., "Estrus detection and optimal insemination timing in dairy cows using sensor technologies," *Sensors*, vol. 25, no. 17, pp. 1–15, 2025.
- [14] J. N. de Sousa Sales et al., "New perspectives in ovulation synchronization strategies in cattle," *Theriogenology*, vol. 219, pp. 45–54, 2025.
- [15] M. Julanov et al., "Improving the efficiency of estrus synchronization in cows using biologically active substances," *Veterinary Medicine and Science*, vol. 10, no. 4, pp. 1–9, 2024.