

Optimizing production potential in bovines by managing ovarian rebound

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Dairy farming focuses on successful cattle reproduction, with the postpartum period playing a crucial role in achieving normal fertility and calving intervals. The ovarian activity in postpartum cows is dependent on a functional hypothalamic-pituitary interaction. Pregnancy restricts follicular development in cows immediately after calving. Since ovarian alterations occur every 4 days in dairy cows, it is imperative that restoration of postpartum ovarian cyclicity (ovarian rebound) is achieved as quickly as possible for optimum breeding efficiency. Ovarian rebound is a crucial physiological process, and it plays an important role in recovery of cyclicity in cows. There are several managemental and clinical approaches to address the several facets of postpartum complications that may affect the process of resumption of ovarian activity. The proper knowledge and their application may be helpful for the farmers to enhance their profitability.

Keywords: Calving interval, Fertility, Follicular development, Postpartum, Ovarian activity

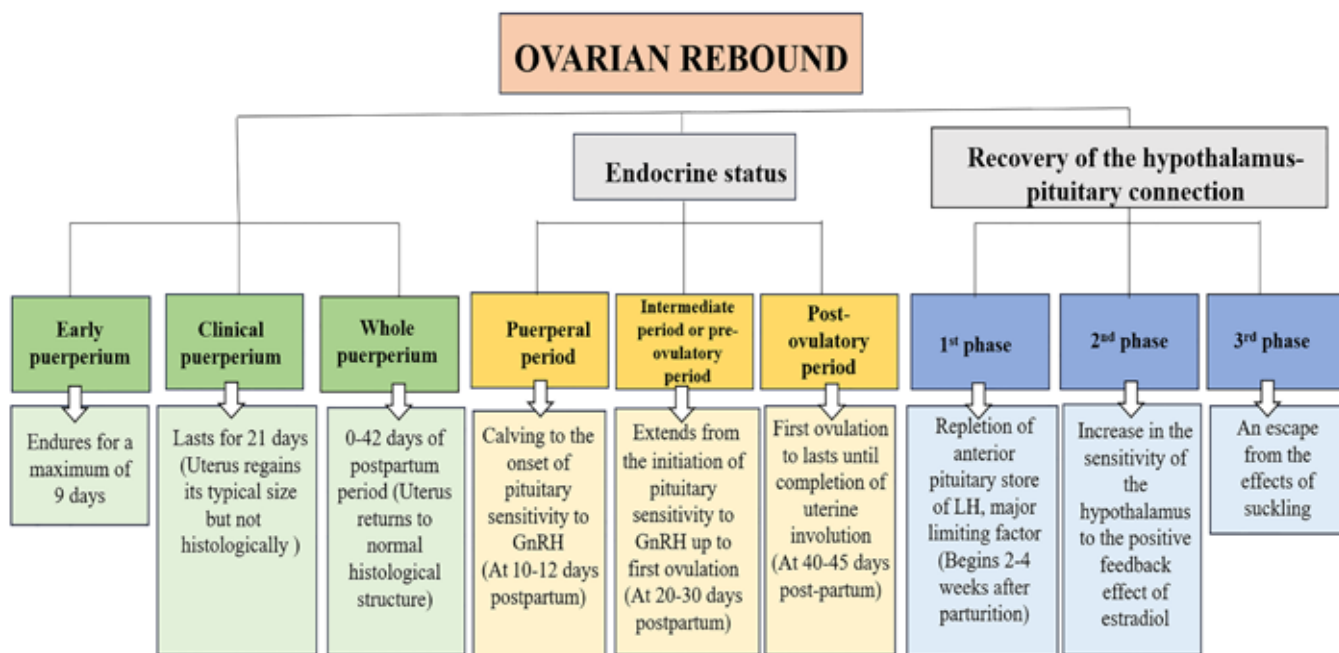
Reproductive efficiency is an assessment of a cow's ability to become pregnant. Because of huge influence on subsequent fertility, the postpartum period is a crucial stage in the reproductive lives of dairy cows. It is a period of transition during which the reproductive axis repairs from parturition and gradually attains the anatomical and functional status necessary to initiate a subsequent pregnancy. As a result, the next pregnancy is contingent on the completion of uterine involution and the cyclic function of the ovaries. In order to achieve normal fertility and an adequate calving interval, postpartum ovarian activity must be resumed as soon as possible. The sequence of events that leads to estrus and ovulation in postpartum cows is identical to that of regular cycle cows and is heavily reliant on a completely functional hypothalamic-pituitary interaction. Because of the release of enormous amounts of placental hormones exerting a constant negative feedback effect (progesterone) and depletion of pituitary store

of LH (estradiol) towards the end of pregnancy, pregnancy disrupts the cyclic interplay between the hypothalamus, adenohypophysis, and gonads.

It is important to understand physiological alterations which include ovarian rebound, uterine and cervical involution, return to cyclicity, and disappearance of bacterial infection that develops in the calving process to optimize the breeding efficiency of cows.

Farmers diligently observe various indicators during the initial 10 days following calving in dairy cattle to assess the health and recovery of the cow. One crucial aspect they monitor is the progression of lochial discharge, which typically shifts from reddish-brown to whitish-transparent as the healing process progresses after calving. Any excessive or foul-smelling discharge during this period could signal underlying issues such as pyometra, metritis, or endometritis, prompting the need for veterinary attention.

Additionally, farmers take note of the reduction in vestibular swelling and the repositioning of the sacro-sciatic ligament within 3-5 days, indicating positive postpartum recovery. A healthy postpartum cow will exhibit interest in food and resume normal eating habits, while deviations in appetite or abnormal behaviours such as restlessness, aggression, or lethargy may indicate health problems. Around 25–30 days postpartum, cows may exhibit signs of estrus, marking their return to reproductive function, as the first ovulation occurs on the 12th day of postpartum (silent estrus). Following a voluntary waiting period of 60 days, the optimal timing for artificial insemination is between 60 and 90 days after parturition. Although farmers may not always adhere to the recommended rectal examination between 1-2 months, they often proceed directly to insemination based on their observations. After two months of insemination, it is advisable for farmers to bring their animals to a nearby hospital or veterinary



Classification of ovarian rebound

clinic for pregnancy diagnosis. Furthermore, cows that experienced weight loss during pregnancy and calving may gradually regain body condition during the puerperium period, particularly with adequate nutrition. This vigilant monitoring enables farmers to ensure the health and productivity of their dairy cattle during the critical postpartum phase.

Events occurring during the early post-partum period

Uterine and cervical involution: Uterine involution is the process by which the uterus reverts to its typical, non-pregnant size and function following parturition. It should happen on average 25 days after parturition in both multiparous and primiparous dairy cows. The rate of myometrial contractions, elimination of bacterial infection, and regeneration of endometrium are the factors that determine when the uterus returns to its typical size. Smooth muscles are primarily responsible for the evacuation of the uterine contents and the reduction in uterine size. The cervical and uterine diameters decrease as a result of the contraction of the uterus. By day seven postpartum, the cervix shrinks from about 30 cm at the time of delivery to about 2 cm and the pattern of structural remodeling

begins at the cranial end of the cervix moves to caudally. However, the farmers must know that the process can be enhanced with application of proper management practices. The management practices which a farmer can adopt to enhance the process are detailed in this article.

Regeneration of the endometrium

During parturition, the endometrial epithelium is frequently damaged, the caruncular tissue is shed as part of the puerperium's physiological influence, and there is noticeable tissue recasting at that time. It is believed that the endometrium's tissue architecture takes three to four weeks to completely rebuild, which is significant for future conception.

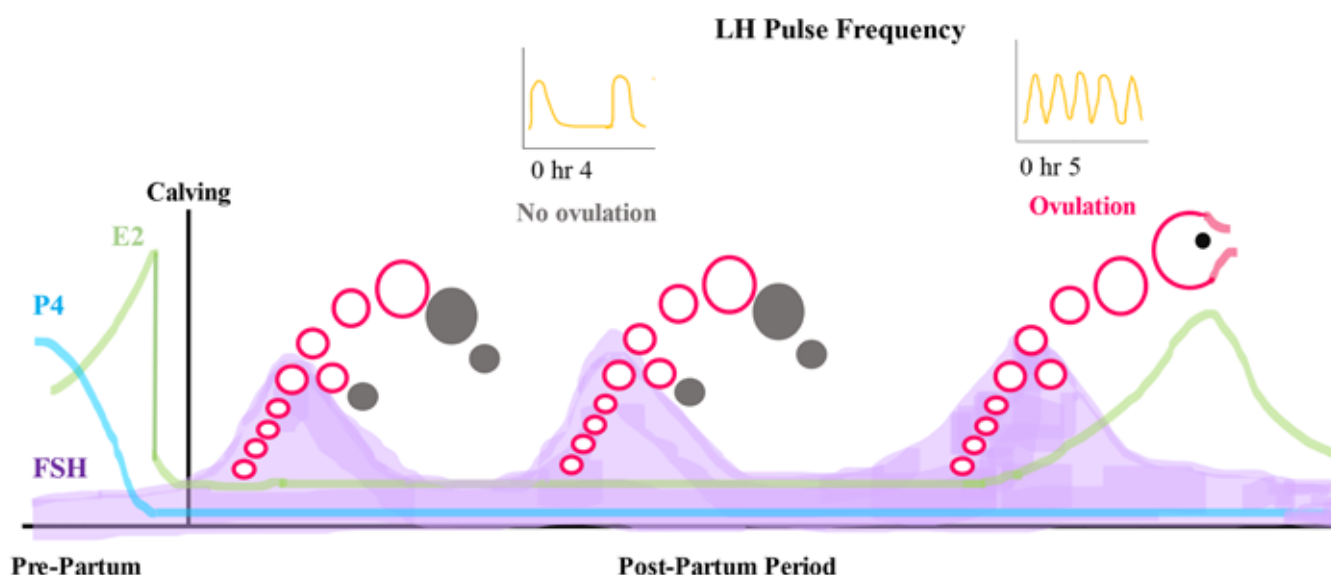
Post-partum ovarian activity (ovarian rebound)

During the last 4-6 weeks of pregnancy in cows, high levels of serum progesterone are maintained, although oestradiol and oestrone sulphate levels rise 10-15 times higher than pro-oestrous level. The combined negative feedback impact of these steroids on the hypothalamic-pituitary axis causes low LH concentrations, while the inhibition of transitory recurring rises in FSH suppresses follicular

waves in the late pre-partum phase. Such changes combined with first postpartum 2-3 days transient rise in FSH causes the emergence of the first postpartum follicular wave within 10-14 days following calving, whereas a decrease leads to the selection of a dominant follicle (DF). Dairy cows often have a silent first ovulation of the DF, followed by a brief estrous cycle with only one follicular wave (>70%). Second ovulation is typically associated with estrus behaviour, followed by a normal luteal phase with normal progesterone levels. Post-partum uterine infection has an effect on ovarian activity. Uterine illness reduces hypothalamic gonadotropin-releasing hormone (GnRH) and pituitary luteinizing hormone (LH) output, with little effects on ovarian function. High levels of PGF2 α , due to subclinical infection during the first 3 weeks post-partum, act as a uterine signal and prevent premature onset of ovarian cyclicity once the puerperal infection is mostly gone.

Development of ovarian follicles after calving/ Progression of ovarian rebound

Pregnancy continues to restrict follicular development in cows after calving because of corpus luteum of pregnancy. The first ovarian follicle emerges on the 5th day



Hormonal and follicular changes in the early postpartum period

following parturition in dairy cows. During the post-partum period, the ovary on the same side as the previously pregnant uterine horn has fewer active follicles compared to the ovary on the opposite side. Ovarian alterations occur every 4 days in dairy cows throughout the postpartum period, and the mean delay from parturition to the emergence of ovarian follicles (0.5 to 1.0 cm in diameter) in normal cows is 15.0 ± 0.2 days. After day 12 postpartum, the first DF with a diameter more than 9 mm emerges under normal condition. Ovulation often happens after the second or third wave, when follicles are dominant. The fate of dominant follicles after partum is directly related to an animal's metabolic status, such as pre-partum nutrition, post-partum energy balance, and parity. In anoestrous cows, the dominant

follicle's inability to produce high levels of oestradiol is linked to Net energy balance (NEB) in the early postpartum period.

A considerable number of cattle are often sensitive to aberrant luteal function, with the corpus luteum (CL) lasting less than 10 days after the first ovulation postpartum, known as the short estrous cycle. A typical luteal phase lasts 14-18 days, with a normal 21-day estrous cycle. In most cows, the initial postpartum ovulation occurs without visible indications of estrus and is followed by a short estrous cycle lasting 8 to 12 days. Premature production of PGF2 α from the uterus on day 5 of a short estrous cycle may cause subnormal luteal activity in cattle. Reduced LH and IGF-I levels can also increase the incidence of inactive ovaries, ovarian cysts, and non-functional

corpora lutea in post-partum cows, resulting in a longer interval to first ovulation after calving and delayed post-partum resumption.

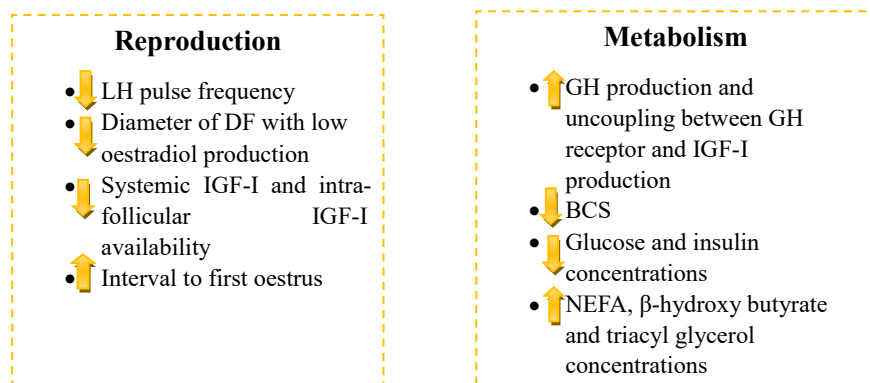
Factors influencing postpartum ovarian activity and parturition

Nutrition

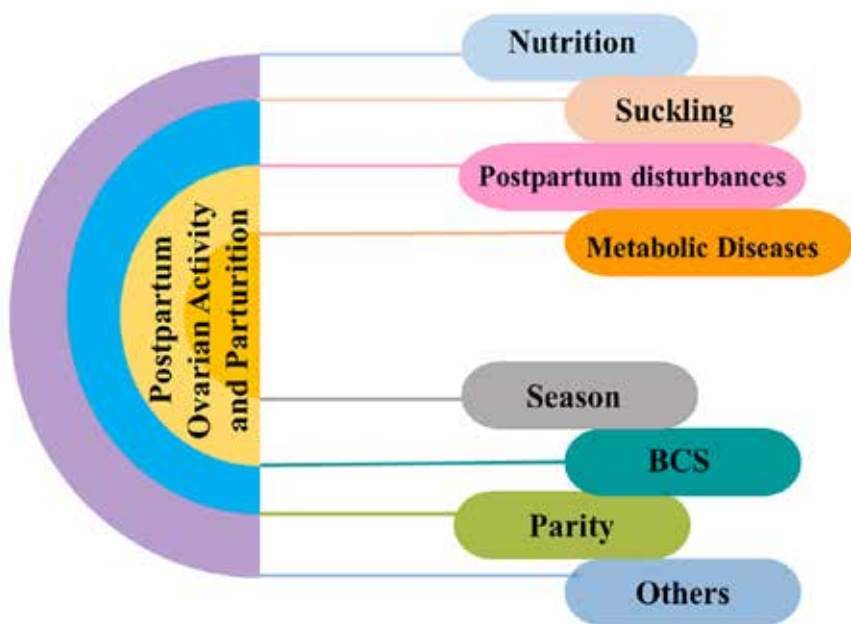
Dairy cow owners must ensure proper nutrition during the postpartum period to prevent delayed ovarian rebound and increased embryonic mortality. Adequate nutrition is especially important for primiparous cows due to growth and suckling requirements. High calcium and vitamin D diets lead to faster uterine involution and fewer open days. According to various experts, inadequacy of vitamin A can cause silent heat, delayed ovulation, and fetal death.

Suckling

Suckling is an exteroceptive stimulation which regulates reproductive cycles in female mammals. Thus, in dairy cows, initial ovulation and first estrus occur early in suckler cows. High-yielding cows have a longer cyclic period or may cease cycling spontaneously. It is imperative to note that the time taken for energy balance during early lactation and first ovulation have a strong association.



Impact of NEB on reproduction and metabolism



Post ovarian activity factors

Postpartum disturbances

Studies have shown that a wide spectrum of periparturient complications may slow ovarian rebound. Farmers sometimes get overly concerned about retained fetal membranes in their animals. However, apart from causing delayed uterine recovery, significant purulent vaginal discharge, and endometritis (in cases left unattended), these retained membranes do not seem to directly affect the early onset of ovarian activity. This could be due to a higher level of stress, exacerbated by physical interference and assisted placental removal. Moreover, cows with incidence of dystocia, still-birth and vaginal prolapse also had an increase in open days, the number of inseminations required per conception, and the calving interval, resulting in significant economic losses.

Metabolic diseases

In terms of metabolic illnesses, milk fever increases the uterine involution period and the number of services per conception.

Season

Seasonal differences in conception rate and a lengthier gap between parturition and initial estrus (service period) were found to exist in cows. Generally, spring-calving dairy

cows have a longer interval between calving and first ovulation than autumn-calving cows.

Body condition score (BCS)

A low BCS during calving may cause a delay in first estrus and a calving to conception lag after calving, for its association with Negative Energy Balance (NEB). NEB also reduces the number and size of big ovarian follicles and lowers plasma progesterone and estradiol-17 concentrations.

Parity

Pluriparous cows have a quicker ovarian rebound as compared to primiparous cows due to the second pattern of follicular development in pluriparous cows. Despite the rapid uterine involution in primiparous cows, postpartum reproductive indices improve as parity increases. Parity and return of ovarian activity are inversely associated. Following their fourth calving, both heifers and cows experience a rise in acyclic time following calving. The anestrus period of primiparous cows is shorter than

that of pluriparous cows. The time from calving to ovulation (first and second), number of follicular waves, calving to insemination and calving to conception (days open), is shorter in pluriparous cows.

Protocols to induce early ovarian rebound

Hormonal intervention

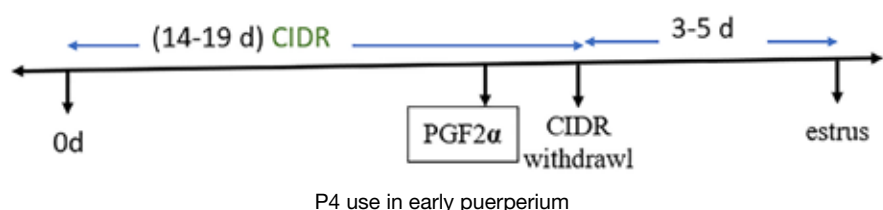
Hormonal techniques to promote ovulation should be combined with corrective management strategies. Lipid supplementation such as increased feeding of oil cakes can enhance the generation of oestradiol in dominant follicles and increases the size of the pre-ovulatory follicle. Due to a shorter duration of dominance for the first dominant follicle and an earlier occurrence of the mid-luteal phase FSH rise, treatment with bST (bovine somatotropin) caused the second wave of follicles to appear two days sooner. Therefore, even in the case of exogenous hormonal therapy, monitoring feed intake as well as the length and scope of the NEB period are essential management aspects needed for thereafter high reproductive efficiency.

P4 uses in early puerperium

Progesterone exposure beforehand can counteract effects, allowing most cows to exhibit oestrous behaviour. To help the DF present at the end of therapy ovulate, progesterone priming will enhance the incidence of oestrus at initial ovulation, decrease short cycles, and increase the frequency of LH pulses.

Prostaglandin F_2 administration during the early puerperium

The length of elevated PGF_2 production in the postpartum period was adversely associated to the number of days required to complete uterine involution and the time between parturition and the return to normal ovarian activity.

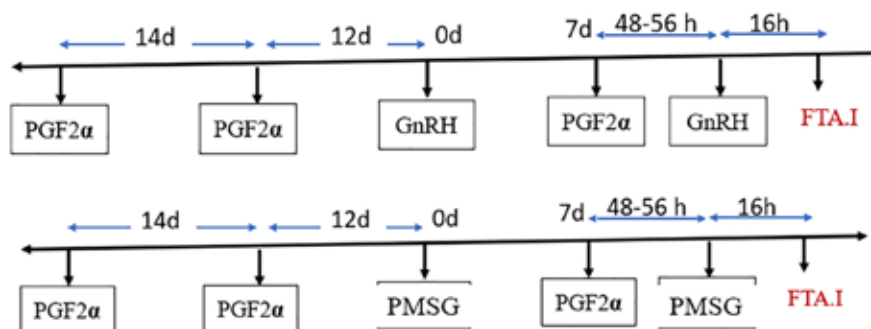


P4 use in early puerperium

PGF2 α	25mg	I/M	Immediately after parturition
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Combination with prostaglandin F₂

PGF2 α + Oxytocin	25 mg + 50 unit	I/M	Immediately after parturition
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Presynch and modified Presynch protocols

Uses of GnRH plus PGF2 α during early puerperium

The Presynch and modified Presynch strategies, which successfully ovulate for post-partum animals, have been universally adopted by the dairy industry, whose pregnancy and conception rates are 83–84% and 44–57%, respectively.

Management strategies for farmers

If the placenta remains after calving for more than 12 hours, seek veterinary assistance. Provide lukewarm water until evacuation. After expulsion, prevent the cow from ingesting the placenta and dispose it properly. Clean the cow with warm, antiseptic water. Offer moistened bran with crude sugar/molasses and milk three times each

day until the udder inflammation resolves. To avoid milk fever, ensure appropriate calcium and phosphorus intake and avoid overmilking. Wheat bran, oats, and linseed oil seeds are among the feed ingredients, with DCP/TDN levels of 16–18% and 70%, respectively. Over the course of three weeks, gradually raise the concentrations. All this will help to reduce the time taken for ovarian rebound.

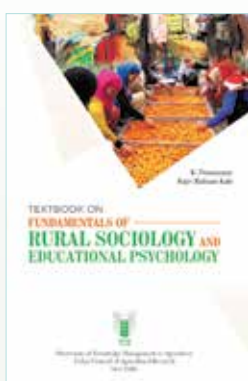
CONCLUSION

Delivering two PGF2 α injections before Ovsynch, either utilizing GnRH or PMSG procedures, increased the reproductive performance of dairy cows. Also,

animals given PMSG had a better conception rate than cows given GnRH. Dietary management, particularly high DMI during periparturient and early postpartum periods, significantly influences anoestrus occurrence. To achieve high reproductive performance, prevent metabolic diseases, feed dry matter after calving, ensure uterine involution within 6 weeks, and achieve high oestrous detection and conception rates through artificial insemination.

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Textbook on Fundamentals of Rural Sociology and Educational Psychology



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TECHNICAL SPECIFICATIONS

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