

PROGESTERONE - A KEY PLAYER IN REPRODUCTION

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Introduction

Progesterone is an important hormone that plays a crucial role in the vital activities of animals. Progesterone is secreted by the luteal cells of corpus luteum, the placenta and the adrenal glands. The main source of progesterone is luteal cells of corpus luteum. As it plays key roles in metabolic and reproductive activities, its assay helps in better fertility management of the herd. The objective of this article is to highlight the importance of progesterone in fertility management of cattle.

Role of Progesterone in healthy animals

The most common progestin is progesterone which is the hormone mainly responsible for nidation and maintenance of pregnancy. An optimum ratio of estrogen to progesterone in blood is a prerequisite for successful fertilization and subsequent conception (Gupta et al., 1998). The granulosa cells of follicle secrete progesterone even before ovulation. After ovulation the luteal tissue proliferates to fill the cavity with functional luteal tissue that begins to produce progesterone at an increased rate.

The effects of progesterone are seen only after the target tissue has been subjected to a period of estrogen stimulation. The priming by estrogen leads to a synergistic effect. Progesterone acts on the uterus to cause secretion of uterine milk by the endometrial glands.

In bovines showing regular heat cycles, progesterone is the regulator of length of diestrus, because as soon as the corpus luteum fails to secrete progesterone a burst of FSH (Follicle Stimulating Hormone) follows, which causes development of the follicles and proestrus is set in. If progesterone from a previous corpus luteum is lacking the first ovulation will be usually characterised by a silent heat in the postpartum period in the cow.

Progesterone in low doses favours ovulation in cattle, probably through its indirect effect on LH (Luteal Hormone) release. Synthetic progestogens are commercially available to synchronize estrous cycle of cows. The conception rate will be higher in animals treated with progesterone within three

weeks after artificial insemination (Srivastava and Kharche, 2001). Supplementation with progesterone just on the day of embryo transfer might improve pregnancy rate in recipients (Balakrishnan et al., 1994). Progesterone in high doses has the ability to prevent development of follicles thereby blocking ovulation. Progesterone blocks GnRH output and pituitary gonadotropin release, thereby rendering the ovary inactive.

Role of Progesterone in Pregnancy

The most dramatic role of progesterone occurs during pregnancy. The early rise in progesterone following development of the corpus luteum prepares the uterus for pregnancy. Progesterone acts on the endometrium, inhibits myometrial activity and causes preparation for nidation regardless of whether or not a zygote is present. The physiologic half life of progesterone is only 22-36 minutes in the cow. So the constant secretion is essential to maintain the circulating level required during pregnancy. As the placenta develops during pregnancy increasing amount of progesterone are elaborated by placenta. Progesterone causes the development of the alveolar system of the udder.

Progesterone favours an economy of body metabolism and during pregnancy animal experiences a period of increased efficiency of nutrient utilization; appetite increases during the pregnancy due to the influence of progesterone and normally there will be tendency for less physical activity during pregnancy; these effects favours weight gain in the pregnant animal (Booth and Mc Donald, 1982).

Pregnancy diagnosis by progesterone assay

Pregnancy diagnosis can be done by the determination of the progesterone concentration in the plasma of cows. In pregnant animals, at about 21 days after the previous estrous, progesterone levels remain elevated (6ng/ml). If the cow is not pregnant and is close to or at estrous, the progesterone level will be low.

Progesterone crosses mammary gland and appears in milk. Progesterone is easily soluble in

milk fat, and there will be higher concentration per unit volume in milk than in the blood or plasma (Arthur et al., 1989). Concentration in the milk can be assayed using the radio immunoassay and enzyme linked immunosorbent assay. The optimum time for collecting the milk sample is 24 days after insemination. The level of progesterone will be higher in the afternoon than in the morning milk, and higher in strippings than in bulk milk or foremilk. The accuracy of the method in the diagnosis of pregnancy is between 80 and 88%. Cows which are found to be pregnant at 24 days by progesterone assay should be checked at a later date by rectal palpation. The early pregnancy diagnosis in cattle can be made by progesterone determination of 18-24 days after insemination, when pregnant and non-pregnant animals exhibit marked difference in their blood progesterone levels (Shemesh et al., 1983).

Dipstick enzyme immunoassay using lyophilized substrate was demonstrated in detection of pregnant cows with 92% precision and non-pregnant cows with 100% precision (Lakhchaura et al., 2003). Progesterone can be given to prevent abortion in females prone to abortion as a result of insufficient secretion of endogenous progesterone; it is also used to promote conception in the first 20 days after insemination (Roberts, 1986).

Applications of progesterone assay in fertility management

1. To confirm postpartum anoestrus: A high progesterone concentration in the milk ten days before or after the palpation of ovaries without a corpus luteum is indicative of a non-observed estrous and a low concentration is indicative of anestrus (Arthur et al., 1989).

2. To ensure that a cow is close to, or is in estrous on the day of insemination: Milk progesterone concentration should be low on the day of insemination

3. To anticipate the return to estrous in the absence of pregnancy: If the milk progesterone concentration is low on day 19 after insemination, then the cow can be assumed to be non-pregnant, and its return to estrous can be anticipated.

4. To confirm ovarian structures identified at rectal palpation: Confirmation of the presence of a corpus luteum or luteal cyst can be made by the presence of concurrently high milk progesterone concentration.

5. To assess the response of cows to therapy: The assay of progesterone concentration in milk at varying intervals can be used to assess the luteolytic response after prostaglandin treatment or the luteotrophic response after GnRH or hCG therapy.

Serum progesterone assay is being done free of cost, at Cattle Sterility Office, Aluva. ELISA kit for assay of progesterone is commercially available at a price range of Rs.9000 to 15000 for 90 tests. Private laboratories charge Rs.300 to Rs.400 per progesterone assay.

Conclusion

Progesterone is a hormone that plays key role in animal reproduction. Progesterone assay in combination with rectal palpation provides better assessment of reproductive status of a cow.

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