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Study of Postpartum Ovulation and Postpartum Estrus in Rodents with Special Reference to *Mus Musculus*

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ABSTRACT:

The present investigation continues for descriptive review analysis of postpartum estrus in rodents. A number of mammal species go through postpartum ovulation (PPO), in which they reproduce within 24 hours of giving birth. The PPO maximizes reproductive efficiency in mice by reducing the time between litters, which is predominantly regulated by endogenous steroid hormones. For this review study, information related to PPO were gathering from different journals, papers, thesis and web blog and the final result was concluded.

Keywords: Postpartum ovulation, Rodents, Ovulation, Estrus

INTRODUCTION

Postpartum ovulation (PPO) occurs in several species of mammals when they ovulate and copulate within 24 hours of giving birth (Carrillo-Martínez, 2011). The PPO maximizes reproductive efficiency in rodents by reducing the time between litters, which is primarily regulated by endogenous steroid hormones. Ovulation occurs spontaneously in menstrual species in response to an increase in estradiol and luteinizing hormone (LH) (Blaustein, 2008).

In order to prepare for embryo implantation, endometrial stromal cells undergo terminal differentiation after ovulation as a result of the development of the corpus luteum (CL) and enhanced progesterone secretion (spontaneous decidualization; SD) (Bellofiore, 2018). Ovulation, SD, and embryo implantation have not been observed in any menstruating species postpartum, despite the fact that these events happen naturally during the primate menstrual cycle. This is because lactational amenorrhea impairs ovarian function (Rolland, 1975).

In addition, Gray, et al. showed that non-breastfeeding women experienced anovulation for 45 days on average postpartum, as opposed to 189 days on average for those who continuously nursed. (Gilbert, 1984). The only rodent with a menstrual period similar to a primate, the Egyptian spiny mouse (*Acomys cahirinus),* also has a PPO. (Bellofiore, 2017).

PPO has been considered to occur 24 hours following litter delivery in light of the highly reliable 40-day inter-birth gap, and the sequence has been utilized to calculate gestational and foetal ages in recent research. because there is no visible vaginal plug after mating.

Furthermore, given that spiny mice actively nurse their young from birth (based on observations from our colony) and presuming that spiny mice have an endocrine system that controls ovulation similarly to that of humans, dams should continue to be anovulatory while nursing.

The aim of the present study is to review the different studies about the PPO in rodents

MATERIALS AND METHODS

We built a protocol for a systematic review of the PPO related publications. The databases of ScienceDirect, Cochrane, SCOPUS, and CINAHL were all thoroughly searched. Paper on Postpartum ovulation and postpartum estrus were chosen for this analysis. To gather information, the following terms and keywords were used: Postpartum Ovulation, rodents and Postpartum Estrus.

STUDY

This review is a continuation of a series of studies of postpartum ovulation and estrus in rodents-related papers, thesis, journal, etc. The PPO in rodents is predominantly regulated by endogenous steroid hormones, and it maximizes reproductive efficiency by reducing the time between litters. Connar and Devis, 1980 designed the experiment to study the postpartum estrus in Norway rat physiology. Females were sacrificed by decapitation at 3 h intervals following delivery of the first pup. Plasma levels of estradiol-1713 and progesterone were analyzed throughout the 24 h postpartum estrus period. Estradiol levels ranged from 130.35 pg/ml at 3 h to a low of 5.35 pg/ml at 24 h. Progesterone exhibited a peak level of 37.04 ng/ml at 12 h, and the intermediate levels ranged from 6.51 ng/ml to 23.01 ng/ml. Attempts were made to correlate the plasma steroid levels with vaginal cytology. Ovulation was noted as early as 3 h postpartum with 100% ovulation occurring by 18 h. Females exhibited a "diestrous" smear throughout the 24 h period.

Bingel & Schwartz (1969) during their study, 'Timing of LH release and ovulation in the postpartum mouse" found that postpartum ovulation in the mouse, like cyclic ovulation, tends to occur during the late part of the dark period or early part of the light period. Most of the mice giving birth between 21.00 and 01.00 hours ovulated approximately 26 hr after delivery, LH presumably having been released about 14 hr after delivery. Runner & Ladman, 1950 state postpartum ovulation occurred approximately 12 to 18 hr after delivery, the exact delivery-to-ovulation interval depending on the time of delivery. Pituitary assay findings from the same animals were interpreted by Ladman, Palm, and Runner (1953) to show that pituitary gonadotrophin levels sufficient to induce ovulation were released 3 hours after parturition.

Rebar et al., 1969; Ying et al., 1973; Mon et al., 1974 suggested rat has a preovulatory surge of gonadotropin secretion within 24 h following parturition. Although The stimuli which initiate this postpartum gonadotropin surge have not been identified. Fox and smith 1984 worked on the topic "postpartum preovulatory surge of gonadotropin secretion in the Rat May Be Initiated by the Labor Process" and suggested that the process of parturition actively contributes to the stimulation of the postpartum gonadotropin surge. They also explain why gonadotropin surges do not occur at the end of pregnancy even though the steroid hormone milieu is apparently appropriate for the occurrence of gonadotropin surges. It is possible that prior to parturition the estrogen-stimulated signal for a gonadotropin surge is actively inhibited, and that this inhibition is overridden by the cervical stimulation which eventuates during the labor process. The stimuli arising during parturition, therefore, appear to enable the time of day signal for the postpartum gonadotropin surge to be expressed.

Long and Evans, 1922; Kirkham and Burr, 1913; King, 1913 state Even the earliest investigators interested in the reproductive physiology of rats were aware that ovulation occurs not only in cycling females but also soon after parturition. Hashizume et al. (1973) studied ovulation with respect to the end of delivery. They reported that a majority of the females had ovulated by 14 h postpartum. Hoffman and Schwartz (1965) investigated postpartum ovulation in relation to the ambient photoperiod. They found that 63% of the females had ovulated by 24 h postpartum.

CONCLUSION

From the study, we can conclude that the postpartum ovulation postpartum gonadotropin secretion occurs in rodents like Mice, rats, etc. However further study is needed in this field to know the exact cause and mechanism of PPO in animals like Rodent.

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