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Author(s)	Ninpetch, Nattapong
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氏名：ニンペット ナタポン

Name : NINPETCH Nattapong

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Role of metabolic and endocrine factors in an alteration of the endometrial epidermal growth factor concentration in repeat breeder dairy cows

(乳用リピートブリーダー牛の子宮内膜上皮成長因子濃度異常における代謝および内分泌因子の役割)

Repeat breeder cows are defined as apparently normal cows but failed to conceive after several times of artificial insemination (AI) and have become a major cause of economic loss in the dairy and beef cattle industries. Epidermal growth factor (EGF) is one of the important regulatory components of uterine function and exhibits peak concentrations twice on days 2 to 4 and days 13 to 14 of the estrous cycle of fertile cows. An abnormality of the EGF profile contributed to reduced fertility and was found in about 70% and 40% of repeat breeder and high-yielding cows, respectively. However, the etiology of this abnormality has not been well understood. Therefore, this study was conducted to describe the recovery process of cyclic change and the factors that affect the recovery of the endometrial EGF cycle in lactating dairy cows during the postpartum period.

In chapter 1, the recovery of the EGF cycle in postpartum cows showing a normal estrous cycle was examined. Firstly, EGF concentrations were determined in every estrous cycle from calving to 90 days postpartum (dpp) or until the cows showed normal EGF profiles for 2 consecutive estrous cycles (recovery of EGF cycle). About 75% (338 out of 452) and 90% (401 out of 452) of cows showed the first normal EGF profile by 60 and 90 dpp, respectively. In contrast, about 40% (192 out of 452 cows) recovered the EGF cycle. More than 90% of cows showed the first normal EGF profile within 70 dpp conceived by 150 dpp and less than 10% remained open by 180 dpp. While about 30% of cows failed to show the normal EGF profile at all and remained open. The risk factors analysis found that parity, body condition score at calving, day of the first ovulation, milk yield at peak level, and peak period were associated with delayed recovery of the EGF cycle.

In chapter 2, the involvement of the leptin system, a potential linkage of metabolic status to reproduction in repeat breeder cows, was studied. The leptin system and the endometrial EGF profile were examined in repeat breeder cows before and after SP treatment. Heifers and fertile cows were given PBS and used as controls. Plasma leptin concentrations

were similar in all cattle groups and did not correlate with endometrial EGF concentrations. The EGF concentrations and expression of leptin receptor (Ob-R) in the endometrium were examined in all cattle groups. The Ob-R level was lower in heifers than in the cows. The Ob-R level in repeat breeder cows showing the normalized EGF concentration after SP treatment was at intermediate levels between heifers and repeat breeder cows with unnormalized EGF profiles.

In this study, I have confirmed the association of the recovery of the EGF cycle with fertility, and determined risk factors for delaying the EGF cycle recovery. The coincidence of declining Ob-R and normalization of the EGF cycle may give a clue to improving measures against the abnormality of the EGF profile in repeat breeder cows in dairy herds.