

Effects of bypass fat supplementation on the oestrous cycle duration of early lactating cows

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Summary

Diets containing supplemental fat often stimulate increased milk production because of increased energy intake, improved efficiency of utilization of energy, or both. However, dietary fat may influence synthesis of reproductive hormones. We examined the effects of bypass fat supplementation on the oestrous cycle duration (days) of twenty-four early lactating Friesian/Holstein cows. Oestrus was observed (oestrus = d 0), and cows were randomly assigned to either be fed control diet (n = 12) or diet supplemented with 3% bypass fat (n = 12) treatment. In cows fed bypass fat, there was a significant increase in the duration of the oestrous cycle. The increase was associated with increased serum progesterone from mid to late luteal phase. Therefore, the dietary supplementation of bypass fat can influence the oestrous cycle duration in early lactating cows.

Keywords: bypass fat, oestrous cycle, early lactating cow

Introduction

Fats are often included in cattle diets to increase the energy supplied. Previous studies on cattle have shown a number of influences of dietary fat supplementation on reproductive function (for a review, see Staples et al., 1998). Although it has been suggested that diets containing supplemental fat often stimulate increased milk production (Sklan et al., 1994) and enhance ovarian activity (Lammoglia et al., 1997), however, the mechanism of action is not clear because supplementation can also affect cattle fertility by reducing the total synthesis of prostaglandins (PG) by affecting the activity of PG synthase (Thatcher et al., 1995). It is therefore important to understand how changing the composition of dairy cow diets to increase milk production may affect cattle fertility. This study examined for the first time in Thailand the effects of dietary supplementation of bypass fat on some of reproductive parameters in early lactating cows.

Materials and Methods

Animals and diets

Twenty-four multiparous Friesian/Holstein cows in early lactation were assigned randomly to one of two treatment groups: (i) control (n = 12; SUT021, Suranaree University of Technology, Thailand) and (ii) bypass fat (n = 12). The treatment diet contained 3% bypass fat (a palm oil product from Berg + Schmidt Malaysia, Kuala Lumpur). The diets were offered twice each day. Cows were housed throughout the trial with water, roughage, and mineral licks freely available, and were milked twice each day and observed for oestrous behaviour at least twice each day. The experiments were performed at SUT Farm, Suranaree University of Technology, Thailand.

Experimental design

Starting from the oestrus immediately after standing heat (d 0), cows were fed a control or bypass fat diet. The duration of oestrous cycles 1 and 2 was measured for each cow as the interval between consecutive oestrous periods. Blood was collected by jugular venipuncture

for measurement of serum concentration of progesterone on d 0, d 15, d 17, d 19, and d 23. Samples were centrifuged, and the serum was decanted and frozen.

Plasma hormone

The jugular serum samples were analyzed for concentration of progesterone by a competitive immunoassay using direct chemiluminescent technology (Bayer HealthCare).

Statistical analysis

The data were analyzed using Origin 6.1 (Origin Lab, Northampton, Massachusetts, USA) and statistical significance was tested with ANOVA. A *P* value of < 0.05 was taken to indicate statistical significance. Results are quoted as the mean \pm SEM.

Results and Discussion

The duration (days) of oestrous cycles was obtained from twelve cows per group for one oestrous cycle each. There was a significant difference in the duration of the oestrous cycle between control cows and cows fed a diet supplemented with bypass fat ($P < 0.05$). The days of the oestrous cycles were as follows: control: 21 ± 1.04 and bypass fat supplementation: 25.8 ± 1.46 . These results are consistent with the serum concentration of progesterone. On d 15 to 19, progesterone was significantly higher in cows fed a diet supplemented with bypass fat in comparison with control cows ($P < 0.05$). On d 23, plasma progesterone concentrations (ng/ml) were reduced to near basal levels measured on d 0 (control; 0.8 ± 0.05 ; treatment; 1.5 ± 0.15) in control cows but not cows fed bypass fat. The concentrations of progesterone on d 23 were as follows: control: 0.7 ± 0.12 and bypass fat supplementation: 8.1 ± 0.30 ($P < 0.05$). The present study has confirmed previous findings that dietary fat intake can alter reproductive function, particularly in the late luteal phase. The mechanism of this process is unknown, although one possibility should be considered is that the fat may alter luteal prostaglandin synthesis.

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