EFFECTS OF PROTECTED FAT ON PLASMA CONCENTRATIONS OF CHOLESTEROL AND PROGESTERONE IN LACTATING DAIRY COWS

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Story in Brief

Concentrations of total cholesterol and progesterone were measured in early lactating dairy cows fed either a control diet or a diet containing a protected fat (1.8% on a DM basis) between weeks 4 and 12 post partum. All cows were fed the control diet from parturition to week 4 post partum. Plasma samples were collected twice weekly. Plasma total cholesterol and progesterone were greater in cows fed protected fat than in cows fed the control diet.

(Key Words: Total Cholesterol, Progesterone, Protected Fat.)

Introduction

Reproductive performance of lactating dairy cows tends to decrease as milk production increases. During early lactation, many high producing cows are unable to consume enough feed to meet their energy demands, resulting in a state of negative energy balance. Energy balance (EB), quantified using measures of milk production (quantity and composition), dietary intake (quantity and composition) and body weight, may be associated with reproductive efficiency (Butler and Smith, 1989). Although studies implicate EB as a regulator of ovarian function (Butler and Smith, 1989; Spicer et al., 1990), the hormone(s) or metabolite(s) mediating the effects of EB on ovarian function is(are) unknown. Increasing the energy content of the diet with fat that bypasses the rumen may increase blood progesterone and have positive effects on reproductive function (Sklan et al., 1991). The objective of this study was to determine if addition of protected fat to diets of lactating dairy cows alters plasma total cholesterol and(or) progesterone concentrations.

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Materials and Methods

From parturition to week 12 post partum, 14 pluriparous Holstein cows were individually fed a total mixed ration of sorghum silage, alfalfa hay, whole cottonseed and concentrate (20.3, 19, 8.5 and 52.2%, respectively on DM basis) ad libitum. Cows were milked twice daily (3:00 AM and 3:00 PM) and milk samples were collected weekly during consecutive afternoon and morning milkings for analysis of fat and solids-not-fat content. Body weights (BW) were recorded weekly.

Energy balance was calculated weekly for each cow (NE_l intake - NE required for maintenance - energy secreted in milk + energy in BW loss; Staples et al., 1990), and expressed as megacalories of NE per day. At 4 weeks post partum cows were randomly divided into two diet groups: one which received the total mixed ration previously described (control) throughout the study, and another group which was fed the control diet plus protected fat (Megalac, Church & Dwight Co., Inc.) at 1.8% of diet DM (fat), beginning 4 weeks post partum. Net energy for lactation was .79 Mcal/lb DM for the control diet and was increased to .81 Mcal/lb DM in the fat diet.

Blood samples were collected twice weekly for quantification of plasma total cholesterol and progesterone concentrations. Plasma total cholesterol and progesterone data were analyzed as a split-plot design with diet group as main plot and week post partum as a subplot.

Results and Discussion

Diet had no effect ($P>.10$) on EB or milk production; average daily EB and milk production between week 5 and 12 post partum was 8.1 ± 7 Mcal/d and 80.3 ± 4.6 lb./d, respectively.

Cows fed protected fat had greater ($P<.05$) plasma total cholesterol concentrations during weeks 5 to 12 than did control cows (Figure 1). Previous studies have shown that plasma total cholesterol increases in cattle fed protected fat (Carroll et al., 1990; Sklan et al., 1991). Week post partum also affected ($P<.01$) plasma total cholesterol concentrations (Figure 1); in control and fat-fed cows, plasma total cholesterol increased ($P<.05$) approximately 50% between week 1 and 4 post partum. Similarly, others (Carroll et al., 1990; Sklan et al., 1991) observed that serum total cholesterol increased with week post partum in lactating dairy cows.

Average weekly concentrations of progesterone in plasma during wk 5 to 12 were greater ($P<.05$) in cows fed the fat diet than the control diet (data not shown). In addition, progesterone concentrations during the first postpartum estrous cycle increased above controls in fat-fed cows within the first 10 to 11 days of the first cycle (Figure 2). Previous studies (Carroll et al., 1990; Sklan

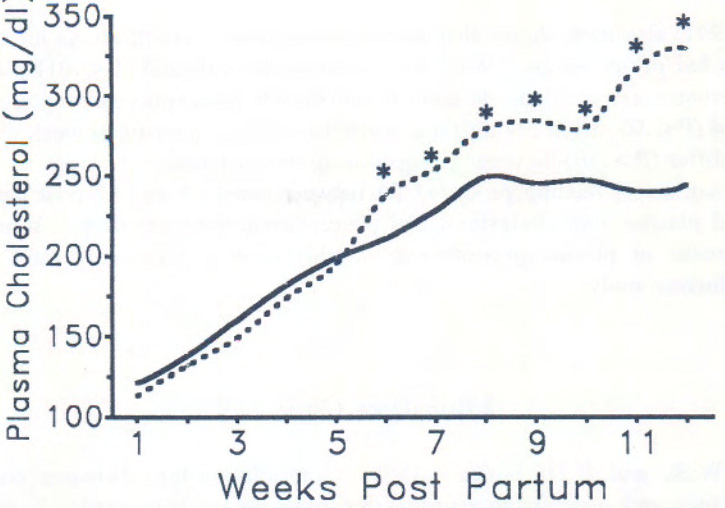

Figure 1. Concentrations of total cholesterol in plasma of cows fed a control (——) or protected fat diet (····) during early lactation. *, Mean differs ($P<.05$) from respective control mean. Pooled SE=9.4 mg/dl.

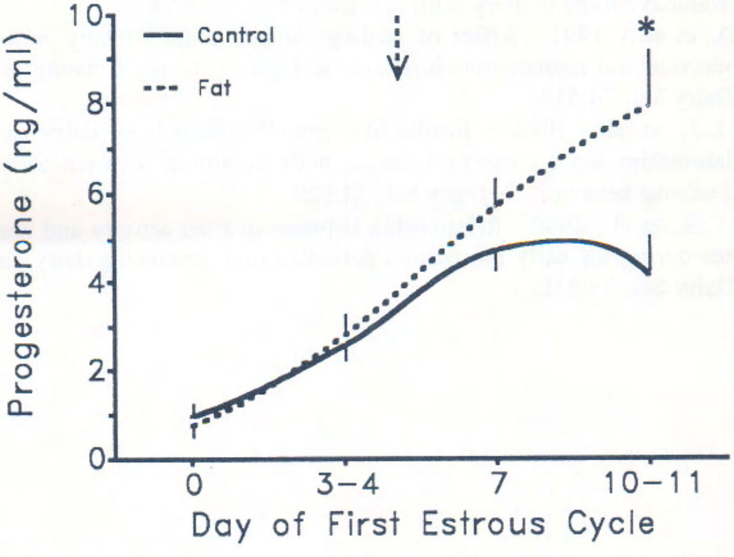

Figure 2. Concentrations of progesterone during the first 10 to 11 days of the first postpartum estrous cycle in plasma of cows fed a control (——) or protected fat (····) diet. Data from two of seven fat-fed cows were deleted because fat was introduced to their diets after day 10 of their first estrous cycle. Arrow indicates average day of the first estrous cycle that fat was introduced to the diet of fat-fed cows (mean = 4.6 days). *, Mean differs ($P<.05$) from respective control mean. Pooled SE=.5 ng/ml.

et al., 1991) also have shown that blood progesterone concentrations increases in cattle fed protected fat. Week post partum also affected ($P<.01$) plasma progesterone concentrations; in control and fat-fed cows, plasma progesterone increased ($P<.05$) from .94 ng/ml at week 1 to $3.2 \pm .8$ ng/ml at week 4, and did not differ ($P>.10$) between groups during weeks 1 to 4.

In summary, feeding protected fat between weeks 4 and 12 post partum increased plasma total cholesterol and progesterone concentrations. Whether this increase in plasma progesterone would increase pregnancy rates will require further study.

Literature Cited

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