

**Hematological Indices of Feed Utilization  
as Predictors of Postpartum Diseases:  
Metritis, Retained Placenta and Mastitis**

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The role of nutrition in animal health has long been a source of interest and concern. When evaluating the effects of nutrition on animal health, investigators often examine the type, quality and content of feeds, and the management practices used to feed animals. While these factors are important, a more definitive measure of the nutritional status of an animals are the levels of different nutritional constituents in their blood. This is a specific measure of what the animal has actually processed to the hematological level, regardless of outside factors which may affect how the animal ingests and digests materials.

Serum lipid levels have been associated with many diseases. Excessively lowered levels of serum cholesterol have been associated with an overall increase in metritis (Lotthammer et al., 1971). Cows with cholesterol levels outside what is considered normal were found to have rates of metritis nearly five times that of those with normal levels (Sommer and Marx, 1969). Cows with high serum levels of non-esterified fatty acids (NEFAs) had higher rates of retained placenta (Huszenicza et al., 1988) than those with more normal NEFA levels. Though there may be no clinical symptoms, both high levels of NEFA and low levels of cholesterol are indicative of hepatic lipidosis (Haraszti et al., 1985; Holtenius and Hjort, 1990), which has been positively associated with increased rates of morbidity, culling and disease mortality (Gerloff et al., 1986). None of the previous studies indicated have identified any specific mechanisms for why serum lipid levels should have any effect on disease rates, but some have hypothesized that serum lipid levels, especially cholesterol, are indicators of the presence of unseen metabolic disturbances which may be the primary contributors to disease (Sommer and Marx, 1969).

Other non-disease factors have been found to affect serum cholesterol and NEFA levels. Increases in cholesterol are linked with increases in serum lipids (Kweon et al., 1986). During the course of a lactation, it has been found that cholesterol decreases before calving, increases until approximately 100 days postpartum, then declines until calving again (Tainturier et al., 1984). Plasma lipids decrease before calving and rise during the rest of the lactation (Tainturier et al., 1984; Gerloff et al., 1986).

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High producing cows have higher total lipid and cholesterol levels than dry cows, indicating a positive correlation between serum levels and milk production (Kweon et al., 1986).

Despite the body of current research, there is limited information in situations where investigators evaluated the roles of cholesterol and NEFA levels in postpartum diseases using population-based longitudinal studies. Therefore, this study proposes to test the hypothesis that serum cholesterol and NEFA levels can be used as predictors of metritis, retained placenta and mastitis.

**MATERIALS AND METHODS:**

A longitudinal study was conducted in which 260 cows were randomly selected from a random sample of 50 Michigan dairy herds. Two blood samples were taken from each cow, one during the last three weeks before calving and the other during the first three weeks postcalving. The sera were used to test for the quantity of cholesterol and NEFAs. Age, calving and monthly disease occurrence information were kept for each animal for three months postpartum, and a survey of herd management methods were collected at the beginning of the study.

Hypothesis testing was broken into four distinct phases: 1) using prepartum serum levels only; 2) using postpartum serum samples only; 3) using the rate of change from prepartum to postpartum serum levels with the D statistic:

$$D = \frac{\text{postpartum sample level} - \text{prepartum sample level}}{\text{number of days between samples}} \quad (1)$$

and 4) using the NEFA/cholesterol ratio for both pre- and postpartum samples:

$$\text{NC Ratio} = \frac{\text{NEFA level}}{\text{Cholesterol level}} \quad \dots \quad (2)$$

Primary analysis included descriptive statistics of all variables of interest and correlation analysis. Based on the results of correlation analysis, logistic and survival analyses were used. The occurrence of disease (metritis, retained placenta, and mastitis) were 0/1 response variables. Onset of disease, measured as the number of months from calving to the onset of disease, was also used as a response variable. Serum NEFA and cholesterol levels, measured as mmol/l and mg/dl respectively, were the primary independent variables of interest. Independent variables also included information on herd nutritional and maternity management. A term for herd effect was used, and interaction terms were defined for the cholesterol/NEFA relationship and other cases where correlation was found between other independent variables.

## RESULTS/DISCUSSION:

Using logistic regression, models were developed for the metritis, mastitis and retained placenta. Precalving NEFA and cholesterol levels, and the changes in NEFA and cholesterol from pre- to postpartum were predictors of the occurrence of metritis and retained placenta. The NEFA/cholesterol ratio, however, did not predict any of the three diseases. Using survival analysis, postcalving cholesterol levels were predictive of the occurrence of metritis.

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