Relationship between Nutritional Status and Immunological Parameters in Prepartum and Postpartum Dairy Cattle

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Introduction

Lack of information on animal and plant nutrient status in relation to pre- and postpartum stress makes producers of marginal operations reluctant to change feeding management. Nutrient requirements change with each phase of production. For example, dietary nutrient alterations, including trace element status, can influence host immunocompetence. This ultimately leads to a decrease in production parameters as weight gain, calf birth weight, milk yield and quality, and results in economic losses for the producer and consumer. Reliable methods to accurately assess nutritional state, and establish reference values for immunological parameters, during specified production stress periods will allow nutritional intervention to optimize the production unit. The main objective of the study was to develop methodology to evaluate immunological and trace element status of cattle under nutritional stress associated with various stages of reproduction.

Materials and Methods

This preliminary study used Holstein and Jersey cows and 16 first-calf heifers. During the early dry period, animals were maintained in pasture lots on orchardgrass hay (OGH). Two weeks prior to calving, t mixed ration (TMR) (35#/day) and OGH were fed. Postpartum animals were placed into the milking herd with access to TMR and fresh water, and milked twice daily. Blood samples were obtained from each animal weekly for 3 weeks prepartum; within 24 hrs of calving; and weekly for 3 weeks postpartum for analysis of specific antioxidant activity, immune cell function, trace element status, and non-esterified fatty acids (NEFA). Milk yield, body weight and condition score, incidence of mastitis, health problems, and calf birth weigh were recorded.

Results and Conclusions

There were significant effects based on phase of production (Table 1) and identifiable correlations between nutritional and immunological responses in these animals. These immune parameters warrant further investigation as reliable predictors of nutritional status in dairy animals.

Table 1. Mean immune status responses by stage of cow.

Reproductive stage	DCF* (%)	Vit E (ppm)	Vit A (ppb)	Cu (ppm)	Zn (ppm)	NEFA (mEq/L)
Preparturition	43.9±5.8	5.36±.25	0.40±.018	0.60±.035	0.57±.042	0.31±.043
Parturition	71.2±6.2	3.49±.22	0.24±.031	0.67±.040	0.36±.020	0.61±.061
Postparturition	64.1±3.1	4.84±.22	0.38±.022	0.68±.034	0.49±.020	0.55±.034
Contrast p-values						
Pre vs. Part.	0.056	0.001	0.001	0.296	0.017	0.001
Pre vs. Post	0.015	0.083	0.632	0.176	0.150	0.005

*DCF reflects oxidative capacity of bovine neutrophils *in vitro*.