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Energy Status and Reproductive Performance in Dairy Cattle in New Zealand

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Sulav Shrestha

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Abstract

Blood and milk parameters other than ketones have been used extensively to monitor the risk of negative energy balance (NEB) and reproductive inefficiency in dairy cows. However, few such studies have been conducted in New Zealand. The aim of this study was to investigate the benefits of using milk parameters as a monitoring tool in addition to blood beta-hydroxybutyrate (BHB) and non-esterified fatty acids (NEFA) to better predict risk of submission within three weeks of planned start of mating (PSM).

A prospective study was conducted in 135 dairy cows from five different pasture-fed, spring-calving commercial dairy farms in Manawatu district of New Zealand from July to November, 2014. Blood samples were analyzed for NEFA and BHB, both pre-calving (up to 2 weeks before expected calving date) and post-calving (2 weeks after calving). Fat, protein, lactose, BHB, and urea concentrations were measured in milk samples taken 2 weeks post-calving, repeating approximately at 4 week intervals until 6 weeks after PSM. The reproductive outcome variable tested was whether or not the cows were inseminated in the first 3 weeks of PSM.

NEB was seen in 57/135 cows pre-calving (based on blood NEFA [BN1] ≥ 0.4 mmol/L) and 47/135 cows post-calving (based on blood BHB [BB2] ≥ 1.2 mmol/L) giving 95% confidence interval, while 21.5% of the cows showed negative reproductive outcome. Strong correlations between milk components values meant that of the 20 milk component tests, data from only 10 were included in the logistic regression.

Milk BHB sampled in the second month after calving (B2) was the only near significant variable in the final logistic regression model ($p = 0.061$) with the mean values for cows submitted in the first 3 weeks of the breeding season being 0.05 mmol/L, and for cows which were not submitted 0.09 mmol/L. Overall, this study could not provide any evidence on advantage of adding milk parameters to blood information in improving the accuracy in predicting 3-week submission rate. However, the relatively low power of this study and limited negative outcomes suggest this need to be confirmed by taking more animals and choosing other reproductive outcome such as 3-week or 6-week in-calf rate.

Key words: NEB, BHB, NEFA, milk parameters, 3-week submission rate

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List of Abbreviations

ATP	Adenosine tri-phosphate
BCS	Body condition score
BHB	Beta-hydroxybutyrate
CB	Cross breed
CNS	Central nervous system
CPT-I	Carnitine palmityltransferase-I
DA	Displaced abomasum
F	Friesian
GnRH	Gonadotrophin releasing hormone
IGF-I	Insulin-like growth factor-I
J	Jersey
LH	Luteinising hormone
LIC	Livestock Improvement Corporation Ltd
MFAT	Ministry of Foreign Affairs and Trade
MUAEC	Massey University Animal Ethics Committee
NEB	Negative energy balance
NEFA	Non-esterified fatty acid
NZDS	New Zealand Development Scholarship
NZVP	New Zealand Veterinary Pathology
PSM	Planned start of mating
PVD	Purulent vaginal discharge
ROC	Receiver operating characteristics
RP	Retention of placenta
RR	Relative risk

SCK	Subclinical ketosis
TAG	Triglycerides
TCA	Tri-carboxylic acid
VFA	Volatile fatty acid
VLDL	Very low-density lipoprotein

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