Evaluation of Non-Esterified Fatty Acids (NEFA) through the Transition Period as a Predictor of Clinical Disease

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Introduction

During the transition period, most dairy cows will transiently visit a state of negative energy balance and hence have elevated non-esterified fatty acids (NEFA) levels; however, only a subset of cows and farms develop levels of clinical illness past acceptable limits. Previous studies have demonstrated an association between NEFA levels above a certain cut-point and displaced abomasums. The objective of this study was to evaluate pre- and post-partum NEFA levels and their association with clinical disease in northeast US dairy herds.

Materials and Methods

A prospective cohort study was conducted with the following herd inclusion criteria: non-problem dairies, > 250 milking cows, free-stall housing, feeding TMR, and using DHIA and/or DairyCOMP 305. A convenience sample of these herds was visited by study personnel. Blood was collected from approximately 20 healthy pre-partum (2 -14 days before calving) and 20 different healthy post-partum (3 -14 DIM) animals on the initial farm visit, with 1/3 of each group being heifers. Time of sample collection versus time of feeding was recorded. Farm personnel were provided case definitions and an instrument to track the incidence of these diseases: left-displaced abomasum (LDA), clinical ketosis, metritis, and retained placenta (RP). All serum was delivered (using appropriate temperature/storage methods) to Cornell College of Veterinary Medicine for measurement of NEFA using a Hitachi 917 auto-analyzer. Cut-points were identified as the NEFA value with the highest combined sensitivity and specificity for diseases. The odds of disease given that the animal had NEFA values ≥ a cut-point and the area under the ROC curve (AUC-ROC) were evaluated. Statistical analyses were performed using SAS version 9.1 and MedCalc version 9.5.2.0.

Results

A total of 104 herds, averaging 838 cows each, were used for analysis. Results from 2,678 animals (1,298 pre-partum and 1,380 post-partum) were evaluated. The incidence of disease in animals sampled pre-partum was: LDA, 3.57; ketosis, 6.89; milk fever, 1.66; RP, 6.9; RP and/or metritis, 12.2; and any of the four diseases 19.6%. The incidence of disease in animals sampled post-partum was: LDA, 3.16; ketosis, 4.89; metritis, 2.48; and for any of these three diseases 11.4%. The following cut-points were determined: Animals sampled pre-partum: LDA, NEFA ≥ 0.27; clinical ketosis, ≥ 0.26; milk fever, ≥ 0.54; retained placenta, ≥ 0.37; RP and/or metritis, ≥ 0.38; LDA or ketosis or RP or metritis, ≥ 0.29 mEq/L. Animals sampled post-partum: LDA, NEFA ≥ 0.72; clinical ketosis, ≥ 0.57; metritis, ≥ 0.36; and LDA or ketosis or metritis, ≥ 0.57 mEq/L. The following AUC-ROC were deterimined: Animals sampled pre-partum: LDA, 0.618; ketosis, 0.582; milk fever, 0.521; RP, 0.547; RP and/or metritis, 0.575; and any of the four diseases, 0.586. Animals sampled post-partum: LDA, 0.813; ketosis, 0.708; metritis, 0.640; and any of the three diseases 0.709. The following odds of disease were determined: Cattle sampled pre-partum above the set cut-points were 2.1 more likely to develop LDA, 1.8 times more likely to develop clinical ketosis, 2.4 times more likely to have retained placenta (RP), and 2.1 times more likely to have RP and/or metritis. Cattle sampled post-partum animals above the set cut-points were 11 times more likely to develop LDA, 3.6 times more likely to develop clinical ketosis, and 13.2 times more likely to develop metritis.

Significance

These data demonstrate that NEFA levels above a particular point can be predictive of certain diseases as others have demonstrated; however, this study introduces lower cut-points and expands on information about post-partum NEFA's. Additionally, this study encompasses the larger, modern free-stall dairy typical of the northeast USA and, as such, may reveal differences in the previously stated cut-points which ultimately reflect differences in management systems.