

Relationships between the Concentration of IGF-1 in Serum in Dairy Cows in Early Lactation on Reproductive Performance and Milk Yield

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Introduction

The quality of the transition period determines the lactation of dairy cows and its profitability. In early lactation over 90% of the dairy cows are in a negative energy balance (NEB). NEB has its peak in the first four weeks post partum and is associated with major alterations in the growth hormone, insulin-like growth factor (GH-IGF) axis. The catabolic situation leads to GH resistance of the hepatic tissue because the liver GH receptors are down regulated in dairy cows. The early lactation period in dairy cattle is characterized by elevated blood GH concentrations while insulin is down regulated. A low IGF-1 concentration in serum is the consequence of this metabolic situation. Another result of this metabolic situation is the induction of gluconeogenesis and ketogenesis in the liver. The cause of low fertility in dairy cows is multifactorial. The objective of our study was to describe concentrations of IGF-1 in serum in the post partum period of multiparous, high yielding, dairy cattle. We evaluated the effect of the concentration of IGF-1 in serum on reproductive performance.

Materials and Methods

A total of 417 multiparous Holstein-Frisian cows with no clinical signs of a systemic illness in the first 12 hours after calving were enrolled. Serum samples for IGF-1 were collected within 12 hours after calving and on day 4, 10, 20 and 40 post partum (pp). For the measurement of the concentration of IGF-1 in serum an immunometric chemiluminescence immunoassay was used. All cows were inspected for signs of clinical endometritis on day 20 by rectal examination. We calculated a linear regression line utilizing the five measurements of IGF-1 concentration in the post partum period. All study animals were categorized into two groups based on the slope of their values (positive or negative). Animals with a negative linear regression coefficient were assigned to the group “negative IGF-1” and animals with a positive regression coefficient to the

“positive IGF-1” group. To assess reproductive performance, the parameters days to first service, days open, first service conception rate, overall conception rate, percentage of pregnant cows, and culling for infertility were used. Proportions were compared by Chi-square-analysis. Time to first service and days open were compared by the U-test (Mann-Whitney, Kruskal Wallis test). Odds ratios and the 95% confidence intervals were calculated for the likelihood of the study animals conceiving depending on their classifications as described. Statistical analysis was carried out using SPSS (Version 12.0, SPSS Inc. Munich, Germany). The level of significance was set at $p < 0.05$.

Results

The mean concentration of IGF-1 ranged from between 57 (+/-18.9 ng/ml), within the first 12 hours, to 74 (+/- 19.9ng/ml) on day 40 pp. The results of our study indicated that the absolute level of the concentration of IGF-1 in serum in the early post partum period (the area under the curve, AUC) is more important to predict reproductive performance of individual cows than the regression line of five IGF-1 measurements of the IGF-1 concentration in serum in the early post partum period. With regards to the IGF-1 profiles of the individual cows, we categorized the study animals in high and low IGF-1 classes. Cows with a higher IGF-1 concentration in serum had significantly higher first service conception rates (41.3% vs. 29.5%) and fewer days open (104.8+45.3 vs. 118.4+50.5) than cows with low IGF-1 concentration ($p < 0.05$). Other reproductive performance parameters did not differ between the two classes.

Significance

In conclusion, our study indicates multiple measurements of the concentration of IGF-1 in serum in the post partum period can be used as predictors for reproductive performance in dairy cows.