

# Association between milk fatty acids in early lactation and subsequent reproductive performance of modern high-yielding dairy cows

S. Jorjong<sup>1</sup>, G. Opsomer<sup>2</sup>, J. Chen<sup>3</sup>, A. T. M. van Knegsel<sup>4</sup>, B. Kemp<sup>5</sup>, V. Fievez<sup>6</sup>

<sup>1</sup>Laboratory for Animal Nutrition and Animal Product Quality, Faculty of Bioscience Engineering, Ghent University, Coupure Links 653, 9000 Gent, Belgium

<sup>2</sup>Department of Reproduction, Obstetrics and Herd Health, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820, Merelbeke, Belgium

<sup>3</sup>Adaptation Physiology Group, Department of Animal Science, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

<sup>4</sup>Adaptation Physiology Group, Department of Animal Science, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

<sup>5</sup>Adaptation Physiology Group, Department of Animal Science, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

<sup>6</sup>Laboratory for Animal Nutrition and Animal Product Quality, Faculty of Bioscience Engineering, Ghent University, Coupure Links 653, 9000 Gent, Belgium

## Abstract

Negative energy balance (NEB) and hyperketonemia in early lactating dairy cows have been shown to impair subsequent reproductive performance. As a NEB is associated with specific changes in milk fatty acid composition, the objective of this study was to investigate the association between milk fatty acids and subsequent reproductive performance. Two experiments were conducted with 92 (experiment 1) and 93 cows (experiment 2), which allowed to assess reproductive performance in terms of first milk progesterone rise, resumption of ovarian cyclicity, as well as interval between calving and pregnancy. Progesterone concentrations, available in milk sampled thrice weekly from week 2 until 100 days in milk (DIM), allowed to determine the onset of luteal activity (at least 2 succeeding milk samples with progesterone  $\geq 2$  ng/ml) and to classify observations into 3 categories (normally, abnormally or not resuming ovarian cyclicity within 100 DIM). Additionally, weekly blood plasma BHBA and NEFA (weeks 2 to 8 after calving) were available, as well as milk fatty acid parameters (weeks 2 to 4 after calving), i.e. the C18:1 cis-9-to-C15:0 ratio and the corrected milk fat C18:1 cis-9 concentration (obtained by subtracting from each observation an experiment-dependent basal level which was calculated as the mean of the 80% lowest milk fat C18:1 cis-9 concentrations). Both these blood and milk parameters were compared across the 3 categories for onset of luteal activity and were further used to run survival analyses in which days to first progesterone rise after calving as well as calving to pregnancy interval were investigated for the both experimental datasets, grouped by blood plasma BHBA ( $\geq$  vs.  $< 1.2$  mmol/L, experiment 2 only), blood plasma NEFA ( $\geq$  vs.  $< 0.6$  mmol/L), corrected milk fat C18:1 cis-9 ( $\geq$  vs.  $< 3.98$  g/100 g FA) and milk fat C18:1 cis-9-to-C15:0 ratio ( $\geq$  vs.  $< 45$  g/g, experiment 2 only). In experiment 1, none of the

blood metabolites nor milk fatty acid parameters differed among cows with normal, abnormal or no resumption of ovarian cyclicity within 100 DIM. However, in experiment 2, blood plasma BHBA concentration, milk fat C18:1 cis-9-to-C15:0 ratio and corrected milk fat C18:1 cis-9 concentrations increased in cows which did not resume ovarian cyclicity within 100 DIM when compared with cows with normal resumption of ovarian activity. However, neither plasma BHBA nor NEFA concentrations were associated with days postcalving to first progesterone rise or interval from calving to pregnancy. Interestingly, cows having a corrected milk fat C18:1 cis-9 concentration exceeding the threshold of 3.98 g/100 g FA or milk fat C18:1 cis-9-to-C15:0 ratio exceeding the threshold of 45 g/g showed a prolonged interval from calving to first luteal activity and from calving to pregnancy. In conclusion, elevated milk fat C18:1 cis-9-to-C15:0 ratios and corrected milk fat C18:1 cis-9 concentrations were associated with no resumption of ovarian cyclicity within 100 DIM and prolonged interval from calving to pregnancy, although these associations only were observed in situations of more severe NEB (i.e. in experiment 2 but not in experiment 1).

*Keywords: milk fatty acids, reproductive performance, dairy cow, negative energy balance*