

Analysis of cholesterol lipoprotein separations in
Holstein dairy cattle by anion-exchange high-
performance liquid chromatography

Abstract of Doctoral Thesis

Tomoya Takahashi

Graduate School of Veterinary Medicine and Life Science
Nippon Veterinary and Life Science University

Lipid metabolism in dairy cows are significantly active for during the transition period. Recently, anion-exchange (AEX) high-performance liquid chromatography (HPLC) methods are recently developed and can measure serum lipoproteins such as total cholesterol, HDL-C, LDL-C, IDL-C, and VLDL-C with rapid, high isolation efficiency in humans and rabbits. However, AEX-HPLC analysis has not been applied in dairy cows. Therefore, the current study investigated the basis examination whether AEX-HPLC methods could measure bovine lipoprotein fraction. Elution peaks of HDL-C and LDL-C by AEX-HPLC analysis were separated specifically. Analytical evaluation of HDL-C and LDL-C with intra- and inter-assay CVs were below 10 %, respectively. Excellent linearity was demonstrated with HDL-C and LDL-C of the dilutions tested. Furthermore, positive correlation coefficients between the values of total cholesterol, HDL-C, and LDL-C were determined between AEX-HPLC and ultracentrifugation methods and between AEX-HPLC and GP-HPLC. Therefore, these results suggest that AEX-HPLC would be a useful method for evaluating the lipoprotein fraction in dairy cows.

The lipoprotein fraction in dairy cows with different lactation stages measured by AEX-HPLC methods were compared between fineness S daily farmer (superior of milk quality performance and reproduction performance) and poor I daily farmer in Miyagi prefecture. Significant difference was observed in changes in LDL-C/Total-C (%) between 2 daily farmers. LDL-C/Total-C (%) increased from early lactation to mid lactation, and thereafter decreased from mid lactation to late lactation in S dairy farmers. Meanwhile, LDL-C/Total-C (%) did not show any significant changes during lactation stages in I dairy farmers. These results suggested that metabolic pathway of VLDL→IDL→LDL is activated by transferring the triglyceride to mammary gland for plenty milk production in S dairy farmer.

We focused on the lipid metabolism during transition period. Firstly, for creating a reference value, the changes in lipoprotein fraction in 10 healthy

daily cows during transition period were evaluated by AEX-HPLC method. Secondly, we compared lipoprotein fraction between healthy dairy cows and 19 dairy cows with perinatal disease. LDL-C and HDL-C showed trend of low levels for fatty liver and milk fever group. It was indicated that low LDL-C showed decreased fat evacuation from liver by VLDL, therefore we might have access to LDL-C for curative interposition.