Effect of n-3 FA supplementation on lipid metabolism in bovine blastocysts produced in vivo and in vitro

The omega-3 family (n-3 FAs) of fatty acids is characterized by a wide spectrum of pro-health activities, including stimulation of reproductive processes. As omega-6 dominates in standard feeds used in cattle nutrition (e.g., corn silage), the availability of components rich in n-3 EFAs is limited to flax and fish oil. In this project, another source of n-3 FAs will be used, which is *Camelina sativa* cake (CSc). *Camelina sativa* is an oil plant with minimal cultivation requirements and tolerance of water shortages. CSc is a by-product of oil production. It contains 25-40% of unsaturated FAs and natural antioxidants that significantly increase the life time of this product (high antioxidant potential). We demonstrated a positive effect of supplementing the ruminant diet with CSc on milk quality (a health-promoting FA profile). The available literature confirms the positive effect of n-3 FAs from various sources on the quality of bovine oocytes and embryos, however, there are no studies on the effect of CSc in the context of embryo quality. Our preliminary results of *in vivo* studies on heifers fed diet enriched in n-3 FAs showed improved quality of blastocysts, which implanted at higher rate. We also observed higher levels of n-3 FAs in the blood and blastocysts of supplemented heifers. Although the impact of n-3 fatty acids on the quality of bovine oocytes and embryos has been well characterized the underlaying mechanisms are still not discovered. **Thus this project will be mainly focused on answering the question whether improved quality of embryos produced in the environment enriched in n-3 FAs is related to changes in lipid metabolism.** For the purpose of this project bovine embryos at blastocysts stage (7 days post insemination) will be collected *in vivo* from heifers fed CSc supplemented diet and *in vitro* after applying a standard IVM/IVF/IVC procedure with media supplemented with n-3 FAs.

There two novel aspects addressed by this proposal: 1) application of *Camelina Sativa* cake (CSc) reach in n-3 FA as dietary supplement in the context of reproductive processes and 2) a complex analysis of selected aspects of lipid metabolism in the first embryonic cell lines – inner cell mass (ICM) and trophectoderm (TE) of the bovine blastocyst. We assume that improved quality of blastocysts developing in the environment enriched with n-3 FAs ensues from distinct changes in the FA metabolism as well as transcript profile which are also unique for ICM and TE.

The aim of this project is to characterize selected aspects of lipid metabolism in bovine blastocysts on day 7 post insemination produced *in vivo* and *in vitro* in environment enriched with n-3 FAs. This in turn may help to answer the question whether improved quality of n-3 supplemented embryos can be related to changes in their lipid metabolism. Apart from embryos, the analyses will cover the basic reproductive parameters, e.g., the dynamics of ovarian follicle growth, the quality and number of corpus lutea and the hormonal and fatty acid profiles of the blood.

The project will utilize modern research procedures including *in vitro* and *in vivo* production of bovine embryos, studies of gene expression and fatty acid profile, immunofluorescent localization of proteins in cells.

This project will provide a comprehensive characterization of lipid metabolism in *in vivo* and *in vitro* produced bovine blastocysts and dissected cell lines (ICM, TE). Analysis of the transcriptome data may result in identification of molecular markers associated with lipid metabolism by identification of differentially expressed genes (DEG).