Feeding a Diet Supplemented with Flaxseed Reduced Degenerated Embryos and Activated Genes Involved in Embryonic Cell Survival and Viability

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Our research group has previously reported that cows fed a diet supplemented with flaxseed have lower pregnancy loss than those fed sunflower. The main objectives of this study were to determine: (1) the influence of diets supplemented with oilseeds: flax (FLX), sunflower (SUN) or canola (CAN) on the development, quality and gene expression profile of embryos collected from dairy cows (Experiment 1); and (2) the effects of adding serum collected from cows fed FLX or SUN to the in vitro embryo culture medium on embryo development and the expression of selected genes (Experiment 2). In Experiment 1, non-lactating Holstein cows received one of three diets supplemented with (8% dry matter) rolled FLX (n=8), SUN (n=7) or CAN (n=8). After a minimum 35-day diet adaptation, ovarian status was synchronized and super-stimulated with follicle stimulating hormone. Cows were then artificially inseminated twice with semen of the same sire and ova/embryos recovered non-surgically 7½ days after AI. Cows fed FLX had fewer ($P<0.05$) mean degenerated embryos (0.7±0.4 vs. 1.9±0.5 and 1.9±0.6) and a greater proportion of viable embryos than cows fed CAN or SUN (87.3 vs. 76.3 and 69.4%, respectively). Feeding cows FLX altered the expression of 175 genes in their embryos compared to embryos from cows fed CAN or SUN. The differentially expressed genes were mainly involved in cellular growth and proliferation, and cellular development. In Experiment 2, blood samples were collected at estrus from the same cows used in Experiment 1, for harvesting serum. Adding 5% serum collected from cows fed FLX compared to SUN, to embryo culture medium, increased the expression of genes responsible for cell proliferation, differentiation, and pregnancy recognition in Day 8 embryos in vitro without affecting morphological development. Results suggest that a FLX-based diet may be reducing embryonic death in dairy cows through enhanced embryonic cell survival and viability.

Take Home Message: A diet supplemented with flaxseed (high in Omega-3 fatty acids) reduced degenerated embryos, increased embryo viability and enhanced expression of genes regulating cell growth, proliferation and pregnancy recognition. Reduction in pregnancy losses observed in cows fed flax in previous studies may be occurring through some of these mechanisms.