

Effects of Different N-6/N-3 Fatty Acid Ratios and Of the Mammalian Lignan Enterolactone on Dairy Cow Endometrial Cells

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Cows fed flaxseed (rich in α -linolenic acid) have higher conception rates and lower embryo mortality when compared to cows fed Megalac (rich in saturated fatty acids (FA)) or micronized soybeans (rich in linoleic acid). Moreover, feeding flaxseed to cows can modulate gene expression and prostaglandin secretion in the uterus at the time of peri-implantation. Our objectives were to determine which flaxseed components, omega-3 FA and/or lignans, are responsible for these effects and how the different endometrial cell types (from uterus) are affected. We evaluated the effects of 6 different linoleic acid (N-6)/alpha-linolenic acid (N-3) ratios and of the enterolactone (ENL, 1 and 10 μ M) lignan on mRNA abundance of 16 selected genes and on prostaglandin E₂ (PGE₂) and F_{2 α} (PGF_{2 α}) secretion in two bovine endometrial cell types, the stromal (SC) and epithelial cells (EC). Selected genes have known or suspected roles in embryo survival or prostaglandin secretion. Results showed that mRNA abundance of several genes was modulated by the different fatty acids ratios and/or ENL and that this modulation differed between cell types. Decreasing the N-6/N-3 FA ratio lowered PGE₂ and PGF_{2 α} secretion in stromal cells (SC) and epithelial cells (EC) ($P < 0.05$). In EC, the PGE₂/PGF_{2 α} ratio was decreased only in cells that were exposed to 100% alpha-linolenic acid compared with the 100% linoleic acid treatment ($P < 0.05$). Enterolactone decreased PGE₂ and PGF_{2 α} secretion in both cell types ($P < 0.05$). In SC, the reduction in prostaglandin secretion was associated with lower mRNA abundance of the prostaglandin synthase genes *AKR1B1* and *PTGES* ($P < 0.001$). Results demonstrate that different N-6/N-3 FA ratios and ENL affect gene expression and prostaglandin secretions in bovine endometrial cells, with different effects being observed in EC and SC.

Implications: The combination of ENL with a N-6/N-3 FA ratio of 4 resulted in the greatest reduction in PGF_{2 α} secretion, thus suggesting that feeding flaxseed to dairy cows would be a more efficient way of improving conception rate than giving flax oil (rich in N-3 FA) or flax meal (rich in lignans) alone.