Research Communication

Shortened title: Altered expression of epigenetic modifying enzyme genes

Altered gene expression of epigenetic modifying enzymes in response to dietary supplementation with linseed oil

Ran Li[1] and Eveline M. Ibeagha-Awemu[1]*

[1]Agriculture and Agri-Food Canada, Sherbrooke Research and Development Centre, Sherbrooke, Quebec, J1M 0C8 Canada

***Corresponding author:**

Dr. Eveline Ibeagha-Awemu

Agriculture and Agri-Food Canada, Sherbrooke Research and Development Centre,

Sherbrooke, Quebec, J1M 0C8 Canada

Tel:1-819-780-7249; Fax: 1-819-0000;

E-mail: eveline.ibeagha-awemu@agr.gc.ca

Summary

Recently we showed that 5% linseed oil (LSO) and 5% safflower oil (SFO) supplementation of cow's diets reduced milk fat yield by 30.38% and 32.42% respectively, accompanied by differential expression of genes and regulation by microRNAs (miRNA). This research communication addresses the hypothesis that epigenetic regulation could be involved in the

observed milk fat reduction. Thus, this study investigated the gene expression pattern of major epigenetic modifying enzymes in response to dietary supplementation with LSO or SFO. Twelve Canadian Holstein cows in mid lactation were randomly assigned to two groups (6/group) and fed a control diet for 28 days (day-28 to -1) (control period- CP) followed by a treatment period (TP) (control diet supplemented with 5% LSO (LSO treatment) or 5% SFO (SFO treatment) of 28 days (day+1 to +28). After treatment, cows in the two groups were returned to the control diet for another 28 days (day+29 to +56) (post treatment period-PTP). Milk samples were collected on day-1 (CP), +7, +28 (TP) and +56 (PTP) for RNA isolation and measurement of the expression of thirteen epigenetic modifying genes including two DNA methytrasferases (*DNMT1, DNMT3A*), four histone acetylases (*HAT1, KAT2A, KAT5* and *CREBBP*), five histone deacetylases (*HDAC1, HDAC2, HDAC3, SIRT1* and *SIRT2*) and two histone methytransferases (*EHMT2* and *PRMT1*) by qPCR. Linseed oil supplementation significantly repressed the expression of *EHMT2*, *HDAC2*, *HDAC3* and *KAT2A* on day+7 ($P<0.05$) and *DNMT3A, EHMT2, KAT2A* and *SIRT2* on day+28 ($P<0.05$) as compared with the control period (day-1) while SFO had no effect. When LSO was withdrawn, the expression of some of the genes tended to increase but did not reach control (day-1) levels at the end of the PTP. Our study demonstrated a significant role of LSO in the epigenetic regulation of fatty acid synthesis as compared to SFO. The effect of LSO may be related to its higher degree of unsaturation and might represent a different regulatory mechanism which needs further investigation.