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Sébastien Elis, Svetlana Uzbekova. Enriched n-3 polyunsaturated fatty acid diet modified oocyte lipid composition and may influence oocyte quality in Prim Holstein dairy cows. 34. Annual Meeting AETE, Sep 2018, Nantes, France. , 2018. hal-02736214

HAL Id: hal-02736214

<https://hal.inrae.fr/hal-02736214>

Submitted on 2 Jun 2020

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A287E Support biotechnologies: Cryopreservation and cryobiology, diagnosis through imaging, molecular biology, and “omics”

Enriched n-3 polyunsaturated fatty acid diet modified oocyte lipid composition and may influence oocyte quality in Prim Holstein dairy cows

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Keywords: n-3 PUFA, oocyte lipids, dairy cows.

Administration of long chain n-3 polyunsaturated fatty acid (n-3 PUFA) diet to dairy cows may impact oocyte quality (Elis et al, Animal Reproduction Science 164:121, 2016). Addition of docosahexaenoic acid (C22:6 n-3) during IVM led to higher blastocyst rate after IVF (Oseikria et al, Theriogenology 85(9):1625, 2016) and significantly changed oocyte lipid content (Elis et al, J Ovarian Res 10(1):74, 2017). The present objective was to compare lipid content of the oocytes from the dairy cows supplemented with n-3 or n-6 PUFA-enriched diet. Oocyte-cumulus complexes were aspirated by OPU after hormonal ovarian stimulation, from 18 primiparous Holstein dairy cows after 3 or 9 weeks of supplementation with 1% dry matter of either n-3 PUFAs (n = 9, micro encapsulated fish oil, OMG750®) or n-6 PUFA (n = 9, micro encapsulated soy oil, OMG Soy®) (Kemin). N-3 PUFA level in plasma and follicular fluid was measured after 2, 5 and 7 weeks of supplementation. Immature oocytes from n-3 and n-6 diet groups (60 and 61 oocytes, respectively) were denuded from CC and analyzed individually using an UltrafleXtreme MALDI-TOF/TOF instrument in positive reflector mode, with DHAP matrix. Lipid spectral profiles (3000 shots per spectra) were acquired for each oocyte. M/z peaks were detected in the range of 160 to 1000 m/z. Values of the normalized peak heights (NPH) were quantified and compared between the two groups by t-test with Benjamini-Hochberg correction. Multivariate Principal Component Analysis (PCA) was performed using differential NPHs. Lipids were identified by high-resolution mass spectrometry LC-MS or by direct infusion combined to top-down MS/MS analyses, and annotated according to Lipid maps database. Concentration of eicosapentaenoic acid (C20:5 n-3) and total n-3 PUFA significantly increased in n-3 group, after 2 weeks of diet in plasma, and after 5 weeks in follicular fluid, as compared to n-6 group. Body weight and milk production did not differ. Lipid profiles of the oocytes showed significant difference between n-3 and n-6 diets (97 up-regulated and 91 down-regulated peaks, P < 0.05, fold change > 2). PCA allowed clear discrimination of n-3 and n-6 groups. 40 differential peaks were identified (496-827 m/z); among them 12 phosphatidylcholines (PC), 3 phosphatidylethanolamines (PE, C36), 2 sphingomyelins (SM, C35) and lyso-phosphatidylcholine LPC 22:4 were more abundant in n-3 oocytes, whereas 14 PC, PE 30:0, SM 34:1, two LPC (16:0 and 18:0) and two triglycerides (46:1, 47:1) were more abundant in n-6 group. These variations indicated profound changes in composition of several lipid classes from oocyte membrane and intracellular pool, occurring after only few weeks of n-3 or n-6 PUFA dietary supplement. These cellular lipid changes may influence oocyte capacity to develop better blastocysts after IVF in n-3 supplemented cows (see Elis et al, AETE 2018), and highlight the importance of identifying beneficial oocyte lipid profile to improve embryo biotechnologies issues.

Bovomega3 project was funded by Val de Loire Region, France.