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Effects of polystyrene nanoparticles on bovine oocyte in vitro maturation

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Oocyte in vitro maturation (IVM) is a critical process in assisted reproductive technologies and is highly susceptible to external environmental factors. The aim of this study was to investigate the effects of polystyrene nanoparticles (PS-NPs) on bovine oocyte nuclear and cytoplasmic maturation. Cattle immature oocytes, obtained from abattoir ovaries, were divided into 5 groups, and matured for 22 h in presence of 0-5-50-100-200 µg/ml of PS-NPs (size 100 nm). Exp. 1: after IVM, oocytes were stained with Hoechst 33342 to evaluate nuclear maturation rate. Exp. 2: after IVM and in vitro fertilization (IVF), oocytes were stained with Hoechst 33342 to assess cytoplasmic maturation. Exp. 3: after IVM, oocytes were stained with CellTracker Blue or H2DCFDA to determine intracellular levels of glutathione (GSH) and reactive oxygen species (ROS) respectively. Data were compared using Chi Square test or GLM and Dunnett post-hoc (IBM SPSS Statistics, significance at P<0.05). A higher rate of matured oocytes was observed in PS0 (62.6%), PS5 (56.9%), and PS50 (59.4%) than in PS100 (31.7%), and PS200 (35.0%), and the degeneration rate was increased in PS200 (20.0%) than in PS0 (9.3%), PS5 (8.3%), and PS50 (6.6%), while PS100 (13.9%) showed intermediate values. No differences were observed in IVF parameters and GSH or ROS levels. These results show that 100 nm PS-NPs at 100 and 200 µg/ml can inhibit bovine oocyte nuclear maturation and induce oocyte degeneration. Although there is still lack of information about the size and concentration of PS-NPs present in mammal tissues and organs, their accumulation along the food chain and ease of penetration are well documented. In conclusion, PS-NPs might be considered a threat for female fertility.

Session 4

Poster 16

Effects of undernutrition and hydroxytyrosol during last third of pregnancy on newborn vitality and cortisol levels of cow-calf pair

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Undernutrition in late pregnancy is a common scenario in extensive systems. Hydroxytyrosol (HT) is a polyphenol present in olive leaves with antioxidant properties. We aimed to determine effects of undernutrition and HT supplementation on newborn vitality and cortisol levels of pregnant Parda de Montaña (Pa) and Pirenaica (Pi) cows and their offspring. Cows (n=109) were allocated to 4 groups (feeding level (100 vs 60% requirement) x HT (0 vs 178 mg HT/kg unifeed)) from the 28th week (w) of gestation to calving (w40). A calf vitality test was performed at birth. Cortisol was determined in blood samples in dams (gestation w37; lactation w1) and calves (w1; w4 of age). A chi-square test for vitality (feeding, HT, breed, type of calving, calf sex, dam age) and a mixed linear model for cortisol (feeding, HT, breed, time as fixed effects, animal as random effect) were performed. Dystocia reduced calf rate with optimal attitude (68 vs 99%; P<0.001), strong finger suckling reflex (73 vs 91%; P<0.05), optimal mucous color (73 vs 94%; P<0.01) and non-protrusive tongue (70 vs 98%; P<0.01). Undernutrition increased cortisol levels in calves (27.6 vs 19.2 nmol/L; P<0.01) but not in dams. Cortisol was higher at calving in dams (12.4 vs 17.5 nmol/L, for w28 and w40) and calves (31.9 vs 14.9 nmol/L; P<0.001). Cortisol values were greater in Pi dams (16.8 vs 13.1 nmol/L; P<0.05) and calves (27.0 vs 19.8 nmol/L; P<0.01). In short, undernutrition in last third of pregnancy increased cortisol levels only in calves. Calves from dystocic parturitions showed the weakest vitality. Funded by PID2020-113617RR-C21 FETALNUT. Research group A25-23R.