Animal Reproduction

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FOLLICULOGENESIS, OOGENESIS AND SUPEROVULATION

Enhancing Bovine Oocyte Development: Using SCD1 Enzyme for *In vitro* Maturation

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Stearoyl-CoA desaturase 1 (SCD1) is an important enzyme in lipid metabolism, influencing fatty acid composition and fat storage. Recent evidence suggests that the presence of SCD1 is crucial for oocyte competence and embryonic development. Unsaturated fatty acids (UFAs) play an important role in bovine fertility. Oleic acid [OA; C18:1 cis-9] is an example of a UFA with positive effects on oocyte competence, with its synthesis regulated by the enzyme SCD1. The aim of this study was to develop *in vitro* maturation (IVM) strategies to increase the availability of UFAs in bovine oocytes and to evaluate the effects of modulating SCD1 enzyme activity in an IVP system, specifically on the endogenous synthesis of OA during the IVM of bovine oocytes. For this purpose, oocytes obtained from slaughterhouse ovaries were subjected to IVM, with the base medium composed of TCM 199 buffered with sodium bicarbonate, FSH, hCG, estradiol, sodium pyruvate, amikacin, and 8 mg/mL BSA (FBS-free). To standardize IVM conditions with substrate (stearic acid; SA) and product (OA) of the SCD1 enzyme, the following groups were established: A - BSA control (8 mg/mL); B - ethanol control; C - 25 µM SA; D - 50 µM SA; E - 100 µM OA; and F - 200 µM OA. Oocytes were cultured in groups of up to 50 structures in 400 µL of IVM medium, in four-well plates, without addition of mineral oil, at 38.5°C and an atmosphere of 5% CO2 in air. After 24 h of IVM, oocytes were fertilized in TALP-IVF medium supplemented with BSA, heparin, penicillamine, hypotaurine, and epinephrine for a period of up to 24 h, and then the presumptive zygotes were cultured in modified SOF medium supplemented with 1.5% FBS at 38.5°C and 5% CO2 in air. Four replicates were performed, totaling approximately 100 oocytes per group, and cleavage and blastocyst production rates were evaluated after 48 h and 7 days of IVF, respectively. Analyses were performed using GraphPad Prism 10, with proportions evaluated by the Chi-square test ($\chi 2$). Regarding cleavage rates, there were no significant differences ($P > 0.05$) between groups (A: 75/92 - 81.5%; B: 75/95 - 78.9%; C: 83/110 - 75.4%; D: 56/76 - 73.7%; E: 67/89 - 75.3%; F: 68/82 - 82.9%). Regarding blastocyst production, the two concentrations of stearic acid evaluated (C: 35/108 - 32.4%^{c}; D: 21/76 -27.6%^{c}) allowed blastocyst rates similar ($P > 0.05$) to the control groups (A: 30/92 - 32.6%^{bc}; B: 44/95 - 46.3%^{ab}), despite the higher numerical values observed in group C. When the medium was directly supplemented with OA, it was observed that the higher concentration (F: 42/82 - 51.2%^{a}) provided a rate superior ($P < 0.05$) to the BSA control group and did not differ from the 100 µM OA group (E: 37/89 - 41.6%^{abc}), indicating that OA, a product of the SCD1 enzyme, may have a positive effect on embryonic development in cattle, especially at higher concentrations. Financial support: Fapemig, CNPq.