

Tauroursodeoxycholic acid supplementation improves bovine in vitro fertilization rates

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Bile acids are traditionally known for their role in lipid digestion and absorption but recently have been shown to be endocrine signaling molecules. In an observational study, women with high levels of ursodeoxycholic acid in follicular fluid had oocytes with better developmental potential. Another study showed that supplementation of the taurine conjugated ursodeoxycholic acid (TUDCA) to bovine embryos during the culture phase improves resistance to endoplasmic reticulum stress and increases development rates. The effects of supplementation during the maturation phase, where the oocytes are in contact with follicular fluid have not been studied; therefore, the aim of our study was to determine the effects of TUDCA supplementation during the maturation phase or culture phase on embryo development rates. We hypothesized that TUDCA supplementation during maturation phase improves embryo development.

Study design

Bovine oocytes were collected from slaughterhouse ovaries and assigned to one of 4 treatment groups: Control group with no TUDCA exposure, in vitro maturation (IVM) group supplemented with 200 μ M of TUDCA during the oocyte maturation phase only, in vitro culture (IVC) group supplemented with 200 μ M TUDCA during the embryo culture phase only, and IVM/IVC group which were supplemented with 200 μ M TUDCA during the maturation and culture phases of embryo production. Embryos were evaluated on days 3, 7 and 10 after fertilization to determine cleavage, blastocyst, and hatched blastocyst rates, respectively. The effects of treatment on cleavage, blastocysts and hatched blastocyst rates were determined using a mixed-model ANOVA (PROC GLIMMIX) of SAS version 9.4. Treatment was the fixed effect and the effect of week was included as a random variable to control for replicate variability. Post-hoc Tukey test was used to determine differences between treatment groups.

Results

A total of 896 embryos were included in the study. There were no differences in cleavage rates between treatment groups ($P=0.44$). Blastocyst rates were higher in the IVM group (60% of cleaved embryos) compared with the Control group (42% of cleaved embryos; $P=0.0004$) and the IVC group (40% of cleaved embryos; $P=0.006$); and tended to be higher than the IVM/IVC group (47% of cleaved embryos; $P=0.07$). The hatch blastocyst rates were higher in the IVM group ($P=0.02$) compared with the IVC group and tended to be higher compared with the Control group ($P=0.08$).

Discussion/conclusion

We found that TUDCA supplementation during the IVM stage improved blastocyst rates and tended to improve hatched blastocyst rates compared with the control group. We did not observe an improvement of blastocyst rates in the IVC group compared with the control group in our study. TUDCA may have application as a supplement for bovine in vitro fertilization to improve embryo development rates.

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