

Sonic hedgehog supplementation of oocyte and embryo culture media enhances development of IVF porcine embryos

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Abstract

We investigated the expression of sonic hedgehog (SHH) receptor PTCH1 and its co-receptor smoothed (SMO) in fertilized porcine embryos. Effects of exogenous SHH on embryonic development and expressions of survival- and pluripotency-related genes were also determined. We found that PTCH1 and SMO are expressed from two-cell to blastocyst embryos. When oocytes or fertilized embryos were respectively cultured in the maturation or embryo culture medium supplemented with SHH (0.5 mg/ml), their blastocyst rates and total cell numbers increased ($P < 0.05$) compared with the untreated control. When cultured simultaneously in the in vitro maturation (IVM) and in vitro culture (IVC) media supplemented with SHH, the oocytes gained increased blastocyst rates and total cell numbers in an additive manner, with reduced apoptotic indices ($P < 0.05$). Interestingly, SHH treatment did not affect the expression of the BCL2L1 (BCL-XL) gene, yet reduced BAX expression. Blastocysts cultured with various SHH regimes had similar pluripotency-related gene (POU5F1 (OCT-4) and CDX2) expression levels, but blastocysts derived from SHH treatment during IVM had higher ZFP42 (REX01) expression ($P < 0.05$). The highest ZFP42 expression was observed in the blastocysts derived from SHH-supplemented IVC and from dual IVM and IVC treatments. The levels of acetylated histone 3 (AcH3K9/K14) increased in the two-cell and the four-cell embryos when IVM and/or IVC media were supplemented with SHH ($P < 0.05$). Our findings indicate that SHH conferred a beneficial effect on preimplantation development of porcine embryos, particularly when both IVM and IVC media were supplemented with SHH, and the effects may be further carried over from IVM to the subsequent embryonic development.

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