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Niacin improves developmental competence of in vitro grown porcine oocyte

Takayuki Yamochi[1], Shu Hashimoto[1], Yoshiharu Morimoto[2].
1. Reproductive Science, Graduate School of Medicine, Osaka Metropolitan University.
2. HORAC Grand Front Osaka Clinic

Introduction: In vitro culture systems have been developed for growing oocytes to study their growth and explore the potential use of growing oocytes as a source of fertilizable ova. However, the viability and developmental competence of in vitro grown oocytes are still low. It has been reported that niacin improves cellular functions, such as energy metabolism, antioxidant capacity, and mitochondrial biogenesis, by increasing intracellular NAD+ content. In the present study, we investigated the effect of niacin on the in vitro growth of porcine oocytes obtained from early antral follicles.

Methods: Porcine growing oocytes were cultured in a medium containing 0-10 mM niacin for 12 days. To assess oocyte viability and growth, their morphology and ooplasm diameter were measured every 2 days. After culture, oocytes were stained with Nonyl Acridine Orange (NAO) and Mitotracker Orange (MTO) to examine mitochondrial mass and activity, and fluorescence intensity was captured using a confocal microscope. Furthermore, the in vitro grown oocytes cultured with 10 mM niacin were evaluated for maturation, fertilization, and developmental competence. Additionally, the intracellular GSH content of mature oocytes was assessed by staining them with Thiol Tracker violet.

Results: Niacin did not affect the viability and growth of porcine oocytes, regardless of the concentration. Niacin did not improve the fluorescence intensity of NAO and MTO in oocytes cultured with concentrations up to 1 mM. However, 10 mM niacin significantly increased the relative fluorescence intensity of NAO, suggesting an increase in mitochondrial mass. Moreover, while meiotic maturation of oocytes was not affected, 10 mM niacin significantly improved the fertilization rate and blastocyst formation rate after ICSI. The intracellular GSH content of in vitro grown oocytes in both the control and 10 mM niacin groups was significantly lower than that of in vivo grown oocytes. The intracellular GSH content of in vitro grown oocytes slightly increased with 10 mM niacin treatment.

Conclusions: The data from this study demonstrate that the presence of 10 mM niacin during in vitro oocyte growth accelerates mitochondrial biogenesis and supports the fertilization and developmental competence of growing porcine oocytes.