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Artificially Increasing Cortical Tension Improves Mouse Oocytes Development by Attenuating Meiotic Defects During Vitrification

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Oocyte cryopreservation demonstrates great benefits in the conservation of animal germplasm resources and assisted reproductive technology. However, vitrification causes damages in oocytes, which would lead to the decrease of oocyte quality, and embryonic development post fertilization. Cytoskeleton plays an important role in regulating cell shape, organelle migration, cell division and mechanical signal transduction. Cortical tension is a reflection of the physiological state and contractile ability of cortical cytoskeleton. Appropriate cortical tension is prerequesite for normal oocyte meiosis. In the present study, oocyte cortical tension was examined by evaluating the levels of cortical tension-related protein pERM (Phospho-Ezrin/Radixin/Moesin) and pMRLC (Phospho-Myosin Light Chain 2). We found that the cortical tension of vitrified oocytes was decreased. Increasing cortical tension of vitrified oocytes by adding 10 μg/ml ConA during *in vitro* culture could significantly improve the polar body extrusion rate and embryo development. Furthermore, increasing the cortical tension could improve spindle positioning, maintain kinetochore-microtubule (KT-MT) attachment, strengthen spindle assembly checkpoint (SAC) activity, and reduce the aneuploidy rate in vitrified oocytes. In conclusion, vitrification induced a remarkable decrease in cortical tension, and increasing the cortical tension could rescue the meiosis defect and improve oocyte quality.

Keywords: oocyte vitrificaion, cortical tension, meiosis, spindle assembly checkpoint, aneuploidy

INTRODUCTION

In oocyte meiosis, errors in chromosomes segregation generate eggs with an abnormal number of chromosomes. When fertilized, these eggs lead to aneuploid embryos. It is well known that aneuploidy would induce severe cellular dysfunction since each chromosome encodes thousands of genes (Webster and Schuh, 2017). Oocyte chromosome (or bivalent) segregation errors are usually classified to chromatids