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Exploring the Benefits of Autologous Adipose Stem Cells Mitochondria transfer to cryopreserved oocytes for Developing Healthy Offspring

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Background and Aims: Oocyte cryopreservation is increasingly being utilized in assisted reproductive technologies. Despite significant advances in cryoprotectant composition and cryopreservation protocols, the development potential of cryopreserved oocyte remains markedly lower than for fresh oocytes. The deleterious effects of oocyte cryopreservation on the developmental potential of oocytes may be attributed to the increased intracellular oxidative stresses and concomitant damage to the mitochondrial structure and function. This study investigated the potential of autologous adipose stem cell (ASC) mitochondria supplementation to oocytes to ameliorate post-fertilization development in cryopreserved oocytes. Moreover, we have investigated the potential for the occurrence of any aberrant phenotypes in the offspring resulting from the mitochondrial supplementation to oocytes.
Method: The cryopreserved-thawed oocytes were supplemented with ASC mitochondria concurrent with intracellular sperm injection, and thereafter, the developmental capacity of these oocytes was compared to that of the control group, as well as the quality of the mitochondria in 2-cell embryos. Further, we have developed three generations of offspring from the embryos developed after mitochondria supplementation. The breeding potential, body growth, hematological parameters, average activity patterns, body temperature changes and histology of these three generations' major organs were compared with same-age wildtype animals.
Results: Compared to their control group, the addition of mitochondria had a markedly positive effect on the progression from 2-cell embryos to blastocysts and in the production of ATP in 2-cell embryos, while the levels of reactive oxygen species remained unchanged. The progeny across all three generations exhibited no remarkable alterations regarding the factors mentioned above, concluding that none of them manifested any heritable conditions that could be ascribed to the ASC mitochondria supplementation.
Conclusion: These results suggest that ASC mitochondria supplementation could ameliorate the quality of cryopreserved oocytes and augment the embryo developmental potential, thus providing a promising approach for mitochondrial transplantation therapy to improve the development of cryopreserved oocytes.