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A safe and effective strategy to improve the development capacity of oocytes; Autologous mitochondria supplementation from adipose stem cells

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Introduction: We have verified that supplementing cryopreserved-thawed murine oocytes with mitochondria derived from adipose stem cells (ASC) during intracytoplasmic sperm injection (ICSI) enhances their capacity for post-fertilization development (Udayanga et al., 2022). This study aimed to explore the potential for the occurrence of transgenerational aberrant phenotypes in the offspring develop from ASC mitochondrial supplementation to oocytes.

Materials and Method: The cryopreserved-thawed oocytes were supplemented with mitochondria derived from adipose stem cells (ASC) simultaneously with ICSI. Subsequently, we successfully generated three successive generations of offspring from the embryos that developed following the supplementation of mitochondria. To confirm the presence of abnormal transgenerational phenotypes, comparative analyses of the breeding potential, body growth, histopathological parameters, haematological parameters, average activity patterns, and body temperature changes were conducted and compared in both male and female animals of the three offspring generations and same-age wildtype (WT) animals.

Results: Both male and female animals across all three generations were capable of producing offspring that were, on average, comparable to the reference WT animals' breeding potentials. And the body growth patterns observed up to 8 weeks in all three generations did not exhibit any significant differences when compared to WT animals. No significant histopathological abnormalities were observed in the major organs, including the brain, heart, liver, kidneys, lungs, ovaries, and testes, of all three generations. Additionally, no significant differences were observed in haematological parameters when compared to the WT counterparts. Further, the average activity pattern and body temperature changes were monitored continuously over a period and found to be comparable to those observed in the WT counterparts.

Conclusion: These results suggest that ASC mitochondria supplementation may not manifest any heritable abnormal conditions. Thus, we suggest that ASC mitochondria supplementation could be a promising and safe approach of mitochondrial transplantation therapy to improve the development potential of oocytes that have compromised mitochondrial performances.