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Effect of coenzyme Q10 supplementation on post-vitrification mouse embryo development

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ABSTRACT

Objective: To investigate the effects of coenzyme Q10 (CoQ10) supplementation on post-vitrification embryo development and gross morphology.

Methods: Balb/c mouse embryos were cultured in potassium simplex optimised medium (KSOM) with varying CoQ10 concentrations [0 (control), 20, 40, and 60 µM]. The most effective CoQ10 concentration (40 µM) was selected for subsequent post-vitrification morphology study. Embryos were randomly divided into four groups: Group A (non-vitrified without CoQ10), Group B (non-vitrified with CoQ10), Group C (vitrified without CoQ10), and Group D (vitrified with CoQ10), followed by vitrification at the 8-cell stage. Survival rates and development until the blastocyst stage were evaluated through morphological examinations using ASEBIR's system, distinguishing normal and abnormal embryos.

Results: Supplementation of 40 µM CoQ10 significantly increased blastocyst formation (95%) compared to the control group (92%), 20 µM (62%), and 60 µM (56%) ($P < 0.001$). Following vitrification, Group D exhibited a significant increase in blastocyst formation (92%) compared to Group C (82%) ($P < 0.05$). Morphological assessments indicated superior embryo quality in Group B over Group D during the cleavage stage, morula, and blastocyst ($P < 0.05$).

Conclusions: CoQ10 supplementation exhibits promising potential to enhance preimplantation embryo development, increase blastocyst formation rates, and improve embryo quality post-vitrification. This offers a promising approach to mitigate oxidative stress on embryos, potentially improving overall assisted reproductive technology outcomes.

KEYWORDS: Coenzyme Q10; Antioxidant; Embryo development; Vitrification; Morphology; Assisted reproductive technology

1. Introduction

Infertility is a condition characterized by the inability of a

couple to achieve pregnancy after consistent, unprotected intercourse for at least 12 months. This widespread issue affects millions of individuals of reproductive age worldwide, causing significant emotional and social distress[1]. Assisted reproductive technology (ART) encompasses a range of medical treatments and procedures involving the manipulation of human eggs, sperm, and embryos outside the body to facilitate pregnancy. Prominent forms of ART, such as *in-vitro* fertilization (IVF), intracytoplasmic sperm injection (ICSI), gamete intrafallopian transfer, and pronuclear stage tubal transfer, have emerged as effective solutions. Nevertheless, despite advancements, only 35% of couples undergoing ART procedures achieve a live birth[2].

One promising advancement in the field of ART is the vitrification technique for cryopreserving mammalian embryos. Vitrification's

Significance

In recent years, assisted reproductive technology (ART) usage has surged due to global infertility. Despite advancements, success rates remain low. Factors such as oxidative stress from vitrification may contribute to this. Antioxidant supplementation has been shown to have beneficial effects on embryo development, but coenzyme Q10 research is limited. This study revealed that coenzyme Q10 supplementation positively impacted embryo development, notably increasing blastocyst formation and improving morphology. It potentially offers protective benefits against cryodamage and improves ART outcomes.

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