**EXPLORING ELECTROSPUN NANOFIBER ENCAPSULATION AS AN ALTERNATIVE TO CRYOPRESERVATION FOR SEMEN PRESERVATION**

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Abstract

Preservation of semen plays a crucial role in artificial insemination and livestock genetic improvement programs. Traditional cryopreservation techniques have limitations, including ice crystal formation, oxidative stress, and reduced post-thaw viability. As a solution, nanotechnology and electrospinning techniques have been explored to enhance the stability, viability, and motility of preserved semen at room temperature storage. This study investigates the use of polyvinyl alcohol (PVA) and sucrose nanofibers as a novel matrix for semen preservation. This research aims to develop a nanofiber-based medium composed of polyvinyl alcohol (PVA) and sucrose using the electrospinning process, to enhance the viability and preservation of semen. The PVA and sucrose solution was prepared by dissolving PVA in water and adding sucrose as a cryoprotectant. The mixture was electrospun under controlled conditions to produce a nanofiber matrix. Semen was mixed with the electrospun nanofibers polymeric mixture into five different formulations and the distribution of semen within the nanofiber network were evaluated using field emission scanning electron microscopy (FESEM). The semen samples were dissolved in saline and assessed for motility and viability. The electrospun PVA-sucrose nanofibers demonstrated excellent encapsulation properties, providing a protective environment for semen structure. Post-electrospinning analysis revealed that the nanofiber-based preservation medium significantly improved sperm viability and motility at Formulation 5 (reduced concentration of PVA with sucrose addition). The combination of PVA and sucrose in the nanofiber structure played a key role in maintaining semen integrity during electrospinning. This approach enhances semen quality, offering a potential alternative to conventional cryopreservation techniques. Further research is needed to optimise fiber composition, explore the incorporation of other polymeric matrix, and evaluation long-term storage effects in developing new methods for assisted reproduction material preservation without the need for freezing.

Keywords: Electrospinning, semen preservation, polyvinyl alcohol, sucrose, nanofibers, semen quality