

Therapeutic effects of Exosome therapy and Photobiomodulation  
therapy on the spermatogenesis arrest in male mice after scrotum

hyperthermia

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#### Abstract

Introduction: Infertility is defined as the incapability of conceiving a child through regular intercourse without the use of any form of contraception,. In men, several factors cause infertility, among which we can mention damage to sperm due to high temperature. So far, various treatments have been proposed for it, but they have not been highly effective. The current study aimed to evaluate the effect of extracellular vesicles (EXO) and photobiomodulation

therapy (PBMT) on spermatogenesis arrest in male mice after scrotum hyperthermia.

**Methods:** In this experimental study, the animals were divided into four groups: control, scrotal hyperthermia, scrotal hyperthermia + EXO (100  $\mu$ L/day) ( mice were treated for 30 days ), scrotal hyperthermia + PBMT (laser of 0.03 J/cm<sup>2</sup> for 30 s / for 30 days). Hyperthermia was induced every other day by exposure to the temperature of 43 °C for 20 minutes, five times. The isolation of EXO from umbilical cord blood plasma is was done by ultracentrifugation. After six weeks, the animals were sacrificed and the samples (blood, tissue, and sperm) were collected.

**Results:** The treated groups showed a significant increase in sperm parameters, including number, motility, viability, and morphology, as compared to the hyperthermic groups. Moreover, these favorable effects were observed in relation to the volume of testicular tissue, the number of germ cells, the number of Leydig and Sertoli cells, and the level of testosterone. Research on antioxidants showed a significant reduction in glutathione oxide (GSSG) and reactive oxygen species (ROS) in the treatment groups in comparison to the hyperthermia group ( $p < 0.001$ ).

Also, there has been a significant increase in the amount of hydrogen peroxide enzyme observed in the hyperthermia group as opposed to the treatment group ( $p < 0.001$ ).

**Conclusion:** These findings show that EXO and PBMT can improve spermatogenesis caused by hyperthermia, reduce ROS and, GSSG, and increase glutathione and sperm quality.

**Keywords:** photobiomodulation therapy, extracellular vesicles, cord blood plasma, spermatogenesis, hyperthermia