

EFFECTS OF INTRAEPIDIDYMAL INJECTION OF EUGENOL, MAGNETITE NANOPARTICLES, AND THEIR CONJUGATE ON SPERM PARAMETERS AND TESTOSTERONE LEVELS IN WISTAR RATS

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INTRODUCTION: The search for safe, effective, low-cost alternatives to surgical castration has intensified in the context of population control of stray animals. Intraepididymal injection of chemical agents stands out as a promising strategy to induce male infertility. Eugenol is a phenolic compound with benefic biological properties and also reproductive toxicity relying upon the concentration. It can be conjugated to magnetite nanoparticles (Fe_3O_4), forming eugenol· Fe_3O_4 , enhancing its retention and bioavailability in tissues. **OBJECTIVE:** To evaluate the effects of a single intraepididymal injection of eugenol, Fe_3O_4 , and eugenol· Fe_3O_4 on testosterone levels and sperm parameters. **MATERIAL AND METHODS:** Magnetite nanoparticles were synthesized by the co-precipitation method. After synthesis, eugenol was added to the suspension. Thirty-two adult rats were divided into control (Tween 20 2%; vehicle), eugenol, Fe_3O_4 , and eugenol· Fe_3O_4 groups ($n = 8/\text{group}$). Each animal was anesthetized to inject 5 μg of each treatment into caput epididymis (CEUA 35/2023). Seventy days later, the animals were euthanized to collect serum, testis, and epididymis for hormone quantification. Sperm from the cauda epididymis were harvested to assess sperm parameters. **RESULTS AND CONCLUSION:** FTIR and XRD results confirmed the formation of magnetite and the presence of eugenol in the sample. Epididymal testosterone levels were lower in rats exposed to eugenol ($1.4 \pm 0.4 \text{ ng/mL}$) and eugenol· Fe_3O_4 ($1.7 \pm 0.9 \text{ ng/mL}$) than in control rats ($3.3 \pm 0.3 \text{ ng/mL}$; $p < 0.05$). Serum (Control: 3.5 ± 2.2 ; Eugenol: 3.8 ± 2.2 ; Fe_3O_4 : 3.9 ± 1.6 ; Eugenol· Fe_3O_4 : $3.5 \pm 0.9 \text{ ng/mL}$) and testicular testosterone (Control: 8.5 ± 1.1 ; Eugenol: 8.1 ± 1.1 ; Fe_3O_4 : 8.2 ± 1.9 ; eugenol· Fe_3O_4 : $8.8 \pm 1.6 \text{ ng/mL}$) did not differ among groups ($p > 0.05$). Treated rats showed lower sperm motility (Eugenol: $6.0 \pm 8.9\%$; Fe_3O_4 : $16.0 \pm 30.5\%$; Eugenol· Fe_3O_4 : $12.0 \pm 13.0\%$) than their controls ($79.0 \pm 5.5\%$; $p < 0.05$). The percentage of sperm with normal morphology and membrane integrity reduced in rats exposed to eugenol ($p < 0.05$), but not in those receiving Fe_3O_4 and eugenol· Fe_3O_4 ($p > 0.05$). In conclusion, eugenol impaired epididymal testosterone levels and sperm parameters. Nanoparticles of eugenol· Fe_3O_4 , in turn, caused less damage to sperm parameters than eugenol.

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