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Assessing the Biological Effects of *Mitracarpus scaber*-Synthesised Silver Nanoparticles Against Testosterone- Induced Benign Hyperplasia in Rats

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Introduction

Studies have shown that benign hyperplasia (BPH) significantly impacts the quality of life of affected individuals and the prevalence of BPH is on the increase in low- and middle-income countries. Currently, the drugs used for the management of BPH are associated with several side effects.

Materials and methods

This study evaluated the efficacy of silver nanoparticles (AgNPs) biosynthesised using aqueous extract of *Mitracarpus scaber* for the management of testosterone-induced benign hyperplasia in rats. The whole plant of *M. scaber* was extracted using distilled water and the subsequent extract was used in conjunction with a 0.1M AgNO₃ solution at 100°C to produce silver nanoparticles of *M. scaber* aqueous extract (Aq-AgNPs). Aq-AgNPs were then analysed utilising x-ray diffraction analysis (XRD), field emission scanning electron microscopy (FESEM), transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FTIR) and UV-visible spectroscopy. Before Aq-AgNPs were examined for their chemopreventive activity against benign hyperplasia, their acute toxicity was determined in mice. Subsequently, male albino rats were exposed to testosterone propionate at the rate of 3 mg/kg to induce benign hyperplasia for 14 days. The experiment involved twenty-five (25) adult male albino rats randomly divided into five groups (1 to 5; n = 5). Group 1 received only subcutaneous injection of olive oil daily while the other groups got 3 mg/kg/daily of testosterone propionate (TP) subcutaneously only; BPH group (2), TP plus 50 mg/kg/daily crude extract (3), TP plus 50 mg/kg/daily of Aq-AgNPs (4), and TP plus 5 mg/kg/daily of Finasteride orally (5). The animals were sacrificed after 14 days, serum collected and assayed for prostate-specific antigen (PSA), interleukin-6 (IL-6), malondialdehyde (MDA), glutathione (GSH), alanine amino transferase (ALT) and creatinine levels, while the prostate was collected for histological analysis.

Results and discussion

The result of the characterisation methods indicated that Aq-AgNPs was isotropic (peak maxima of 419 nm). In addition, Aq-AgNPs had an average particle size of 91.5 nm. Acute toxicity investigation revealed that Aq-AgNPs at concentrations of up to 4,000 mg/kg b.wt. did not show any fatalities or symptoms of toxicity in mice. The findings regarding chemopreventive effects on benign hyperplasia revealed that Aq-AgNPs caused a significant ($p < 0.05$) reduction in prostate weight as well as ameliorated epithelial cell proliferation in rats induced with benign hyperplasia. In comparison to the BPH group as well as other groups, Aq-AgNPs excellently ($p < 0.05$) decreased the mean concentrations of PSA, IL-6, MDA, ALT and creatinine levels. Also, Aq-AgNPs restored depleted levels of GSH caused by benign hyperplasia.

Conclusions

The findings showed the potential anti-inflammatory, antioxidant, nephroprotective and hepatoprotective effects of Aq-AgNPs which implies that it could be used as an adjunct in the treatment of benign hyperplasia.

Keywords: Benign hyperplasia, Biological effects, Hydrothermal synthesis, *Mitracarpus scaber*-synthesized silver nanoparticles