

**Summary of the DVM thesis No 25876, Faculty of Veterinary Medicine, Urmia University.**

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**Thesis Title:** Rat chemical castration with intra-testicular injection of white onion juice-derived carbon quantum dots: histological and spermatological evidence

**Abstract:**

Carbon quantum dots (CQDs) can induce apoptosis, suppress proliferation, and target various types of cells selectively. The present study was aimed to evaluate chemical castration using intra-testicular injection of CQDs in rats. Fifteen male rats were divided into three groups including intact, intra-testicular injections of normal saline (0.50 mL), and CQDs (40 mg/kg in 0.50 mL normal saline). The CQDs were synthesized from white onion (*Allium cepa*) juice using one-step hydrothermal carbonization method. The rats were anesthetized using intra-peritoneal injection of 40.00 mg/kg ketamine and 5.00 mg/kg xylazine. Using hypodermic needle, normal saline and CQDs-containing normal saline were injected into each testicle. On day 60, the rats were anesthetized and castrated surgically. Epididymal sperm count, viability, motility, morphological abnormalities, and DNA damage were studied. Histopathological analysis was performed to evaluate the testicular histo-architecture. In comparison to the intact and normal saline groups, marked tubular depletion and atrophy, as well as germ cells degeneration were noted in CQDs group. No live spermatozoa were found in this group, and pronounced reduction in sperm concentration and escalation in morphological abnormalities were observed following CQDs injection. Non-metallic CQDs are non-toxic, yet their applications in the field of medicine are not widely documented. The cytotoxic effects of CQDs through the lysosomal damage and mitochondrial dysfunction, can induce apoptosis and/or necrosis. The results of this study showed that intra-testicular injection of CQDs could effectively induce infertility in male rats. Further mechanism-oriented studies using different doses of CQDs are recommended.

**Keywords:** Castration, Rat, histology, Carbon quantum dots, Sperm