Title:

The prospective protective effect of selenium nanoparticles against chromium-induced oxidative and cellular damage in rat thyroid.

Authors:

Kamel MA Hassanin[1] Samraa H Abd El-Kawi[2] Khalid S Hashem[1]
[1]Department of Biochemistry, Faculty of Veterinary Medicine, [2]Department of Histology, Faculty of Medicine, Beni-Suef University, Beni-Suef, Egypt

Journal:

Int J Nanomedicine. 2013; ٨:١٧١٣-١٧٢٠. doi: ١٠,٢١٤٧/IJN.S٤٢٧٣٦. Epub ٢٠١٣ May ١.

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Abstract:

BACKGROUND:
Nanotechnology has enabled researchers to synthesize nanosize particles that possess increased surface areas. Compared to conventional microparticles, it has resulted in increased interactions with biological targets.

OBJECTIVE:
The objective of this study was to determine the protective ability of selenium nanoparticles against hexavalent chromium-induced thyrotoxicity.

DESIGN:
Twenty male rats were used in the study, and arbitrarily assigned to four groups. Group 1 was the control group, and was given phosphate-buffered saline. Group 2 was the chromium-treated group and was given K2Cr2O7 60 μg/kg body weight intraperitoneally as a single dose on the third day of administration. Group 3 was the nano-selenium-treated group and was given selenium nanoparticles (size 3-20 nm) 0.5 mg/kg body weight intraperitoneally daily for 5 consecutive days. Group 4 was the nano-selenium chromium-treated group, which received

selenium nanoparticles for 5 days and a single dose of K2Cr2O7 on the third day of administration.

MATERIALS AND METHODS:

Blood samples were collected from rats for measuring thyroid hormones (free triiodothyronine [T3] and free thyroxine [T4]) and oxidative and antioxidant parameters (malondialdehyde [MDA], reduced glutathione [GSH], catalase, and superoxide dismutase [SOD]). Upon dissection, thyroid glands were taken for histopathological examination by using paraffin preparations stained with hematoxylin and eosin (H&E) and Masson's trichrome. Immunohistochemical staining was performed for detecting cellular proliferation using Ki67 antibodies.

RESULTS:

The present study shows that K2Cr2O7 has a toxic effect on the thyroid gland as a result of inducing a marked oxidative damage and release of reactive oxygen species. This was shown by the significant decrease in free T3 and T4 and GSH levels, which was accompanied by significant increases in catalase, SOD, and MDA in the chromium-treated group compared to the control group. Se nanoparticles have a protective effect on K2Cr2O7-induced thyroid damage, as a result of correcting the free T3 and T4 levels and GSH, catalase, SOD, and MDA compared to the K2Cr2O7-treated group. Administration of nano-selenium alone in the nano-selenium-treated group had no toxic effect on rats' thyroid compared to the control group.
The biochemical results were confirmed by histopathological, immunohistochemical and pathomorphological studies.