AIN SHAMS UNIVERSITY
Faculty of Women for Arts,
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Department of Zoology

Possible Protective Role of VitaminB_{12} against Silicon Dioxide (SiO_2) Nanoparticles- Induced Liver Toxicity in Adult Male Rats.

A thesis submitted for the degree of M. Sc. of Science of Zoology

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ABSTRACT

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Silicon dioxide nanoparticles are increasingly used in various applications including agriculture, industrial, medical and cosmetics despite of their toxicity. It causes lipid peroxidation, oxidative DNA damage, disruption of cell membrane, mitochondrial damage, apoptosis induction and anti-proliferative activity. Vitamin B_{12} is used as an antioxidant and offers protection against the oxidative stress. The present study aimed to investigate the protective role of vitamin B_{12} against the hepatotoxic potency of silicon dioxide nanoparticles (SiO_2 NPs) in adult male rats.

Sixty male albino rats were used to study the biochemical analysis of liver function parameters, including ALT, AST, ALP, and albumin in the blood serum while, MDA, SOD and GSH were evaluated in liver tissue.

In addition, the histological alteration, histochemical changes including polysaccharides and total proteins as well as immunohistochemistry study was detected. The experimental animals were divided into six groups, 10 rats each. Group1 (control): Rats received 0.5 ml of 0.9% saline orally for 8 weeks. Group 2 (Vit.B_{12}): Rats were treated with saline for 4 weeks then treated with therapeutic dose of Vit.B_{12} (0.6 mg/kg b.wt.) daily for another 4 weeks. Group 3 (SiO_2 NPs): Rats were treated orally with saline for 4 weeks then given SiO_2 NPs (500 mg/kg b.wt.) twice a week for another 4 weeks. Group 4 (SiO_2 NPs, Vit.B_{12}): Rats were administrated with SiO_2 NPs at dose (500 mg/kg

b.wt.) twice a week for 4 weeks then treated with vit.B_{12} (0.6 mg/kg b.wt.) daily for another 4 weeks. Group 5 (SiO_2 NPs + Vit.B_{12}): Rats were treated orally with saline for 4 weeks then treated with SiO_2 NPs along with Vit.B_{12} for another 4 weeks. Group 6 (Vit.B_{12}, SiO_2 NPs + Vit.B_{12}): (Protective group) Rats were treated with vit.B_{12} for 4 weeks then received SiO_2 NPs in association with vit.B_{12} 1 hour prior to Vit.B_{12} treatment for additional 4 weeks.

The results of the present study revealed that the mean final body weight decreased and the absolute and relative liver weights were increased after SiO_2 NPs administration. There was a very highly significant increase in ALT, AST, ALP and MDA while, there was a significant decrease in albumin, SOD and GSH levels.

The histological studies displayed deleterious alterations in the hepatic tissue where SiO_2 NPs caused distortion of hepatic architecture with swollen vacuolar degeneration and necrosis of hepatocytes. Some nuclei of the degeneration cells showed pyknosis and the other showed karyolysis. Inflammatory cellular infiltration and dilatation of the blood vessels, meanwhile the collagen fibers increased. Histochemical studies revealed that SiO_2 NPs decreased polysaccharides and total proteins in the hepatocytes. The immunohistochemical studies exposed an increase in both caspase-3 and p53 activity after SiO_2 NPs administration.

In SiO_2 NPs followed by vitamin B_{12} group and SiO_2 NPs with vitamin B_{12} group, vitamin B_{12} showed slight and

moderate improvement in all the previous parameters according to antioxidative effect of vitamin B_{12}.

On the other hand, vitamin B_{12} followed by SiO_2 NPs with vitamin B_{12} group showed marked recovery in all these alterations induced by SiO_2 NPs.

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