



Faculty of Women for Arts,
Science & Education
Department of Zoology

Possible Protective Role of VitaminB₁₂ against Silicon Dioxide (SiO₂) 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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﴿ قلوا سبحانك لا علم لنا الا ما علمتنا ﴾

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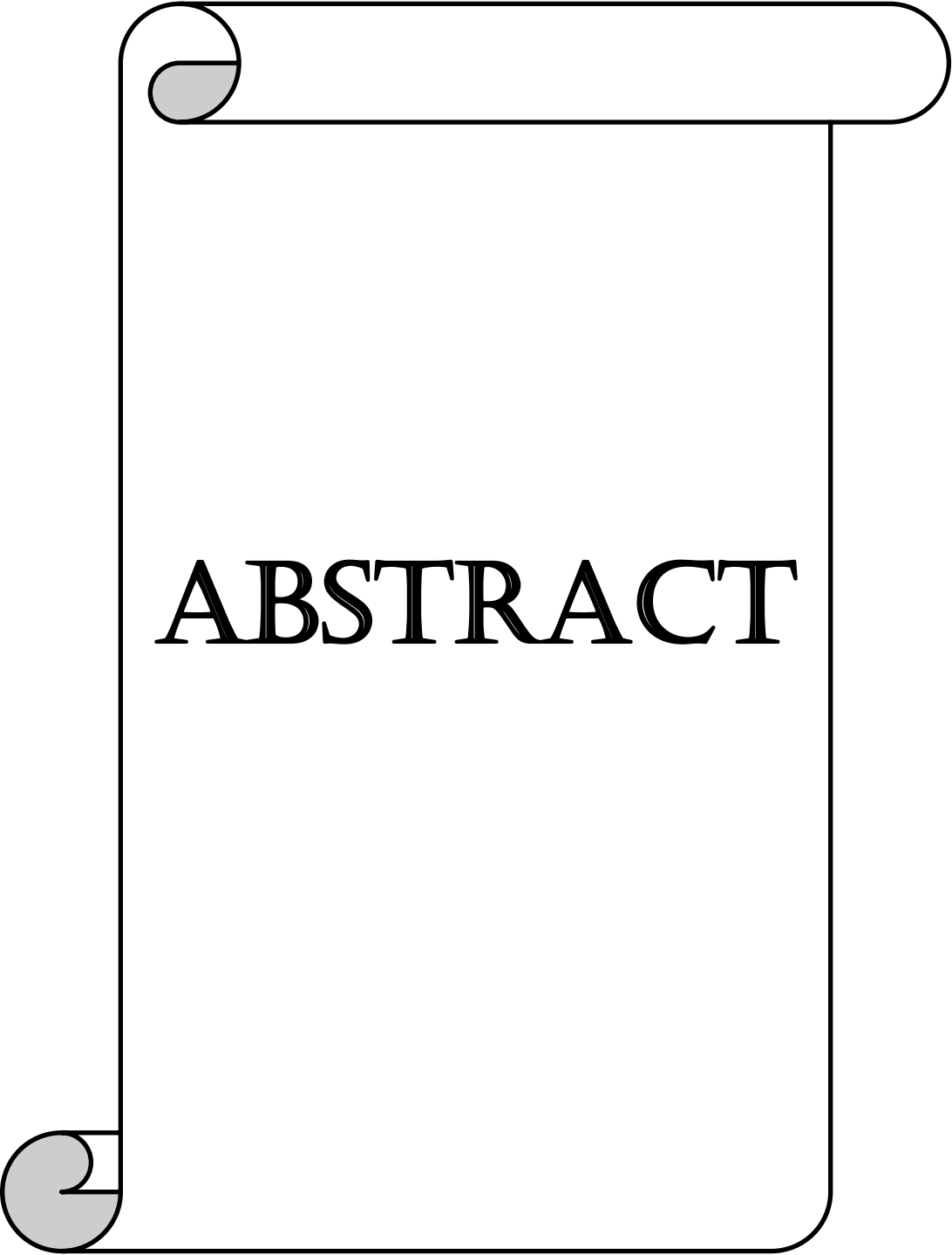
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ABSTRACT

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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 B₁₂ is used as an antioxidant and offers protection against the oxidative stress. The present study aimed to investigate the protective role of vitamin B₁₂ against the hepatotoxic potency of silicon dioxide nanoparticles (SiO₂ 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.B₁₂): Rats were treated with saline for 4 weeks then treated with therapeutic dose of Vit.B₁₂ (0.6 mg/kg b.wt.) daily for another 4 weeks. Group 3 (SiO₂ NPs): Rats were treated orally with saline for 4 weeks then given SiO₂ NPs (500 mg/kg b.wt.) twice a week for another 4 weeks. Group 4 (SiO₂ NPs, Vit.B₁₂): Rats were administrated with SiO₂ NPs at dose (500 mg/kg

b.wt.) twice a week for 4 weeks then treated with vit.B₁₂ (0.6 mg/kg b.wt.) daily for another 4 weeks. Group 5 (SiO₂ NPs + Vit.B₁₂): Rats were treated orally with saline for 4 weeks then treated with SiO₂ NPs along with Vit.B₁₂ for another 4 weeks. Group 6 (Vit.B₁₂, SiO₂ NPs + Vit.B₁₂): (Protective group) Rats were treated with vit.B₁₂ for 4 weeks then received SiO₂ NPs in association with vit.B₁₂ 1 hour prior to Vit.B₁₂ 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 SiO₂ 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 SiO₂ 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 SiO₂ NPs decreased polysaccharides and total proteins in the hepatocytes. The immunohistochemical studies exposed an increase in both caspase-3 and p53 activity after SiO₂ NPs administration.

In SiO₂ NPs followed by vitamin B₁₂ group and SiO₂ NPs with vitamin B₁₂ group, vitamin B₁₂ showed slight and

moderate improvement in all the previous parameters according to antioxidative effect of vitamin B₁₂.

On the other hand, vitamin B₁₂ followed by SiO₂ NPs with vitamin B₁₂ group showed marked recovery in all these alterations induced by SiO₂ NPs.

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