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RESEARCH ARTICLE
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The role of selenium nanoparticles in reducing the effect of hydrogen peroxide on some hormones of female albino rats

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ABSTRACT

The study was conducted to evaluate the role of selenium and nanoselenium in reducing the effect of hydrogen peroxide on female hormones, and used 40 adult females and were randomly divided into four equal groups, the control group(C) , Water was given only Treatment group (T1): Hydrogen peroxide was given 1% with drinking water Treatment group (T2): Hydrogen peroxide was given 1% with drinking water and nanoselenium was dosed at a dose of 0.5mg/kg of body weight. Treatment group (T3): Hydrogen peroxide was given 1% with drinking water and regular selenium was dosed at a dose of 0.5mg/kg of body weight. the results of the current study showed that there was a significant increase in all the hormones studied in the two groups that dosed hydrogen peroxide with normal and nano selenium The best result was in the nanoselenium group.

Keywords: *Selenium, Nano-Selenium, FSH, LH, Estrogen, Progesterone and Prolactin*

INTRODUCTION

Submicroscopic particles with unique characteristics such as low bulk density, high surface area, specific surface chemistry, surface charge, multiple functionalities, and solubility are known as nanoparticles (NPs). Pharmaceuticals, treatments, pathophysiology, and the development of specialized medical care all owe a great deal to their contributions (Khurana et al., 2019). Several pathological conditions, including hypercholesterolemia, certain types of cancer, and cardiovascular disorders, can be mitigated by selenium, which is present as selenocysteine in 25 human proteins and enzymes (Bai et al., 2017). Selenium's unique growth-modulating properties stem from its role as a cofactor in thioredoxin reductase and glutathione peroxidase. Torres et al. (2019) found that SeNPs' biological activity is proportional to their particle size, with higher levels of activity occurring at smaller particle sizes. (Yazdi et al., 2012) SeNPs are employed as nutritional supplements, antitumor agents (both in vitro and in vivo), and antibacterial agents. SeNPs have been shown to have anti-aging, antioxidant, anti-diabetic, immunity-boosting, inflammation-reducing, fertility-boosting, brain-boosting, disease-fighting, arthritis-fighting, asthma-fighting, arthritic, muscular dystrophy-curing, virus-fighting, and thyroid-regulating effects. The numerous advantages of selenium nanoparticles (SeNPs), including their low toxicity, biocompatibility, and chemical stability, have led to a rise in interest in their manufacture and application. These days, SeNPs can be found in many people's diets as a supplement (Wang, Zhang, & Yu, 2007). SeNPs have been reported to have remarkable anticancer and therapeutic characteristics, with much reduced cytotoxicity compared to inorganic selenium compounds. The

activation of selenosomal enzymes was used by Zhang, Wang, and Xu (2008) to demonstrate that SeNPs exhibited unique antioxidant properties in vitro and in vivo.

MATERIAL AND METHODS

Experimental design

In this experiment, 40 rats, 90-day-old females, were used, and their weight ranged between (160 -170) g. They were randomly divided into 4 groups; each group includes 10 rats, as follows:

Control group (C): Water was given only.

Treatment group (T1): Hydrogen peroxide was given 1% with drinking water for 30 days

Treatment group (T2): Hydrogen peroxide was given 1% with drinking water and nanoselenium was dosed at a dose of 0.5mg/kg of body weight for 30 days.

Treatment group (T3): Hydrogen peroxide was given 1% with drinking water and regular selenium was dosed at a dose of 0.5mg/kg of body weight.

Collection samples

All animals was sacrificed after 30 days of the experiment, as anesthesia was done using a mixture of 0.3 ml of ketamine and 0.1 ml of xylazine per kg of body weight intraperitoneally I.P, after which blood samples were drawn from the heart directly. Then it was placed in tubes that did not contain the EDTA anticoagulant and placed obliquely, then placed in a centrifuge to obtain blood serum. The tubes were kept at a temperature of -20 °C until tests hormones were conducted to measure the levels of follicle-stimulating hormone, luteinizing hormone, estrogen, progesterone and Prolactin. All ELISA kits obtained from ABO company from Switzerland.

RESULTS

The study found that the level of FSH was significantly lower ($P<0.05$) in group T1 compared with the control group, while the level of FSH was significantly greater ($P<0.05$) in groups T3 and T2, respectively. In T2 than in T3 and the control group overall (fig.1)

In contrast to the control group, where luteinizing hormone LH levels were found to be significantly lower (P0.05) in the T1 group, levels of LH were found to be significantly higher ($P<0.05$) in the T3 and T2 groups. Compared to the control group, it was elevated in T2 but not T3 (fig. 2).

There was a statistically significant decrease ($P<0.05$) in progesterone levels between the T1 and control groups, while there was a statistically significant increase ($P<0.05$) between the T3 and T2 groups, with the progesterone level being higher in Group T2 compared to T3 compared to the control group (fig.3).

The results showed a significant decrease in estrogen levels ($P<0.05$) in the T1 group when compared to the control group, an increase in estrogen levels ($P<0.05$) in the T3 group when compared to the T2 group, and an increase in estrogen levels ($P<0.05$) in the T2 group when compared to the T3 group and the control group (fig.4).

We discovered that prolactin levels were considerably lower in the T1 group than in the control group ($P<0.05$), higher in the T2 group than in the T3 group, and significantly higher in the T3 group than in the control group ($P<0.05$) (fig.5).

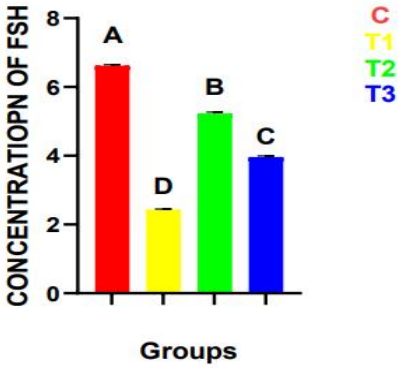

Fig 1: Effect of H2O2 and selenium and Nano-Selenium on FSH

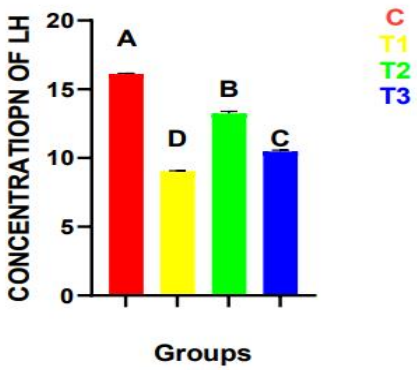

Fig 2: Effect of H2O2 and selenium and Nano-Selenium on LH

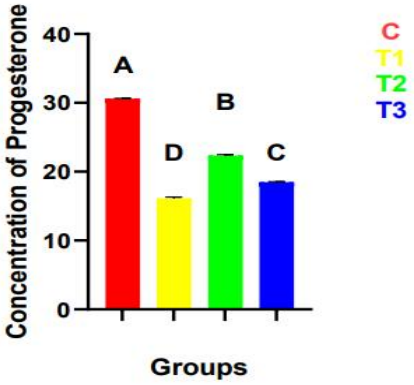

Fig 3: Effect of H2O2 and selenium and Nano-Selenium on Progesterone

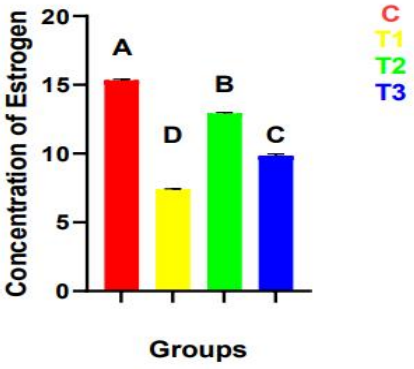

Fig 4: Effect of H2O2 and selenium and Nano-Selenium on Estrogen

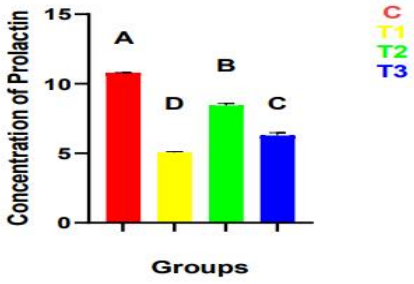

Fig 5: Effect of H2O2 and selenium and Nano-Selenium on Prolactin

DISCUSSION

The decrease in LH and FSH due to oxidative stress. Damage to the intracellular environment caused by OS can alter cellular activities and increase the risk of illness or cell death. Exposure of rats to an oxidative stress stimuliation (Muthuvel et al., 2006; Yang et al., 2014) resulted in DNA damage to endometrial cells and subsequent embryonic death. The pathophysiology of female infertility and the normal functioning of the female reproductive system have both been linked to oxidative stress in recent years (Bedaiwy et al., 2002; Agarwal and Allamaneni, 2004). Additional reactive oxygen species (ROS) are generated by any chemical agent that inhibits pituitary secretion (likely hydrogen peroxide's effect). Similarly,

Moeini et al. (2018) found that a diet high in zinc, magnesium, and selenium increased milk production in goats. 2009). A Role for Selenium in Function According to research by Ramamurthy et al. (2013), selenoproteins are crucial to a wide variety of important physiological processes in both humans and animals. Despite its widespread physiological roles, this component's fine line between beneficial and harmful effects raises public safety concerns. As a result, it's difficult to put in place novel components that are both non-toxic and somewhat safe. Lower toxicity and increased activity mean that Se-NPs can be safely supplied with little risk of adverse effects (He et al., 2014; Jang et al., 2016).

REFERENCES

1. Agarwal A. and S.S. Allamaneni, (2004). Role of free radicals in female reproductive diseases and assisted reproduction. Reproductive BioMedicine Online 9: 338-347.
2. Bai, Z.; Ren, T.; Han, Y.; Rahman, M.; Hu, Y.; Li, Z.; Jiang, Z. Influences of dietary selenomethionine exposure on tissue accumulation, blood biochemical profiles, gene expression and intestinal microbiota of Carassius auratus. Comp. Biochem. Physiol. Part C: Toxicol. Pharmacol. 2018, 218, 21–29.
3. Bedaiwy M.A., T. Falcone, R.K. Sharma, J.M. Goldberg, M. Attaran, D.R. Nelson andA. Agarwal, (2002). Prediction of endometriosis with serum and peritoneal fluid markers: a prospective controlled trial. Human Reproduction 17: 426-431.
4. Gökçe A., S. Oktar, A. Koc and Z.Yonden, (2011). Protective effects of thymoquinone against methotrexateinduced testicular injury. Human and Experimental Toxicology, 30: 897-903
5. Moeini, M.M; Karami, H. and Mikaeili, E.Effect of selenium and vitamin E supplementation during the late pregnancy on reproductive indices and milk production in heifers. Anim. Reprod. Sci. 114: 109- 114. (2018).
6. Muthuvel R., P. Venkataraman, G. Krishnamoorthy, D.N. Gunadharini, P. Kanagaraj, A. Jone Stanley, N. Srinivasan, K. Balasubramanian, M.M. Aruldhas and J. Arunakaran, (2006). Antioxidant effect of ascorbic acid on PCB (Aroclor 1254) induced oxidative stress in hypothalamus of albino rats. Clinica Chimica Acta, 365: 297-303.
7. Khurana, A.; Tekula, S.; Saifi, M.A.; Venkatesh, P.; Godugu, C. Therapeutic applications of selenium nanoparticles. Biomed. Pharmacother. 2019, 111, 802–812.
8. Torres, D.J.; Pitts, M.W.; Hashimoto, A.C.; Berry, M.J. Agrp-Specific Ablation of Scly Protects against Diet-Induced Obesity and Leptin Resistance. Nutrients 2019, 11, 1693.
9. Yazdi, M.H.; Mahdavi, M; Varastehmoradi, B.; Faramarzi, M.A. and Shahverdi, A.R. (2012): The immunostimulatory effect of biogenic selenium nanoparticles on the 4T1 breast cancer model: an in vivo study. Biol Trace Elem Res. 149: 22–28.
10. Zhang, Y.; Zhou, Y.; Schweizer, U.; Savaskan, N.E.; Hua, D.; Kipnis, J.; Hatfield, D.L.; Gladyshev, V.N. Comparative Analysis of Selenocysteine Machinery and Selenoproteome Gene Expression in Mouse Brain Identifies Neurons as Key Functional Sites of Selenium in Mammals. J. Biol. Chem. 2008, 283, 2427–2438.
11. Wang, H., Zhang, J., Yu, H., 2007. Elemental selenium at nano size possesses lower toxicity without compromising the fundamental effect on selenoenzymes: comparison with selenomethionine in mice. Free Radic. Biol. Med. 42, 1524–1533.
12. Zhang, J.S., X.F. Wang, and T.W. Xu, (2008). Elemental selenium at nano size (nano-Se) as a potential chemopreventive agent with reduced risk of selenium toxicity: Comparison with Se-methylselenocysteine in mice. Toxicology Science, 101: 22-31
13. Yang L., B. Zhang, Y. Yuan, C. Li and Z. Wang, (2014). Oxidative stress and DNA damage in utero and embryo implantation of mice exposed to carbon disulfide at peri-implantation. Human and Experimental Toxicology, 33: 424-34.
14. Shaimaa J. AL sabaaghi and Hanaa E. Mahood.(2022) Effects of Levetiracetam Drug an Magnesium on Hematological Parameter and some Biochemical Parameters in White Rats. Pakistan Journal of Medical and Health Sciences, 16(3).
15. Ramamurthy Ch, Sampath KS, Arunkumar P, Kumar MS, Sujatha V, Premkumar K, Thirunavukkarasu C. Green synthesis and characterization of selenium nanoparticles and its augmented cytotoxicity with doxorubicin on cancer cells. Bioprocess Biosyst Eng. 2013; 36:1131-1139. 49.
16. He Y, Chen S, Liu Z, Cheng C, Li H, Wang M. Toxicity of selenium nanoparticles in male Sprague–Dawley rats at supranutritional and nonlethal levels. Life Sci 2014; 115:44- 51. 50.
17. Jang D-Y, Kim S-J, Jeong J-H, Nam SY, Kim J-S, Yun YW, et al. Protective effects of sodium selenite and selenium nanoparticles against experimental colon carcinogenesis in mice. Prev Vet Med 2016; 40:101-108.