Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5406 - 5412
Received 05 March 2021; Accepted 01 April 2021.

Protective Effect of Sodium Selenite on the Reproductive System of White Male Rats Exposureto Oxidative Stress Induced by Hydrogen Peroxide

Hanaa E. Mahood[1*]
[1]University of AL-Qadisiyah, AL-Qadisiyah, Iraq
[*]hanaa.enaya@qu.edu.iq

ABSTRACT

The study focused on two aspects: the effect of hydrogen peroxide on the levels of Spermatogonium, Speratocytes, Spermatids, Leydig cells, and Sertoli cells, the oxidation system of Glutathione and Catalase, on the Malondialdehyde (MDA), and its effect on testicular tissues in white male rats And to study the protective effect of the antioxidant sodium selenate , 21 adult male rats were used and randomly divided into three equal groups. The control group was fed a standard diet and drank water that was free of hydrogen peroxide, the treatment group T1 was fed a standard diet and given water laced with **0.5%** hydrogen peroxide and treatment group (T2) given 0.5 mg/kg diet sodium selenate as part of their diet (Soudani et al., 2012) and given water laced with**0.5%** hydrogen peroxide.

The findings revealed that hydrogen peroxide had a significant effect on the reproductive system and that the antioxidant sodium selenate had a significant effect in reducing the oxidative stress caused by hydrogen peroxide.

Keywords
sodium selenate , hydrogen peroxide , testis

Introduction

Humans are exposed to selenium through all environmental media, including air, drinking water, and food. One of the most common sources of exposure is food (Yang et al., 1989). Selenium is used in a variety of fields, including solar cells, dry photography, the production of red glass, the production of dyes, paints, and plastics, and the production of electronic devices (IARC, 2001).

It is also used to make nutritional supplements and feed for poultry and livestock, and radioactive selenium is used in medicine (Fishbein, 1983).

Selenium is found in all body tissues, with the highest concentrations in the kidney, liver, muscle, and plasma (Mistry et al., 2012). The digestive system absorbs selenium, and the rate of absorption is determined by the chemical profile of its compounds, the source of food, and the nutritional components (Whanger et al.,1996)

Selenium is absorbed in the small intestine, primarily in the duodenum.Because selenium merges with amino acids and becomes organic, this form is the most absorbable in animals, and selenium is transported after its absorption by plasma proteins as it is distributed to various tissues such as bones, hair, and red blood cells, as well as transported to the liver to bind with the amino acids component of selenocysteine. (Suzuki &Ogra, 2002).

Selenium is excreted primarily through diuresis (55-60%), with the remainder excreted through excretion and, in small amounts, sweating or exhaling (Levander et al., 1981).
Although the prevailing belief in the past was that selenium has toxic properties on the human

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5406 - 5412
Received 05 March 2021; Accepted 01 April 2021.

body and animals, it has now been determined the extent of this element's importance and its usefulness for living organisms at specific concentrations. (Brumaghim, 2009)

Selenium is an essential trace element that is extremely important in human and animal health because it is present in all tissues of the body in varying concentrations depending on the type of tissue and the level of selenium in the food (Mahan et al., 1999).

Selenium is an important antioxidant that protects the body from the effects of certain toxic elements and their accumulation in the body (Pavlik et al., 2012). The presence of many enzymes in selenium's composition is attributed to its significant effect (Kyriakopoulos, Arthur, 2007)
The enzyme glutathione peroxidase, which is found in the cytoplasm of cells, red blood cells, plasma, and liver and sperm tissues, is the most important of these (Ursini et al., 1999).

By converting reduced glutathione to oxidized glutathione, this enzyme plays an important role in regulating H2O2 levels (Arthur, 200). Thus, it works to protect cells and tissues from lipid peroxidation by removing hydrogen peroxide and then reducing the formation of hydroxyl radicals (Arteel&Sies, 2001).

When H2O2 is present in body fluids, it produces toxic chemical compounds that damage cells and other important molecules in the body such as proteins, enzymes, sugars, and nucleic acids (Stahl &Sies, 1997).

Phospholipids and cholesterol are key components in the synthesis of cell membranes, vitamins, and a variety of sex hormones such as testosterone. When attacked by free radicals produced by hydrogen peroxide in the presence of oxygen, organic peroxides are formed, which change their biological nature and render them ineffective (Casaretty, 1968).

As cellular membranes are composed of phospholipids that can be oxidized and form lipid peroxidation, free radicals can also affect the cell by breaking down cell membranes, increasing permeability, and losing control over the specialized functions of the cell, and mucous membranes can also be destroyed in cell organelles, the most important of which is Lysozyme, as well as Free radicals have the ability to break down living molecules (Stahl &Sies, 1997).

Materials and methods

In this study, 21 adult white males were used, weighing between 180-220 kg, were divided into three equal groups,The treatment continued for four weeks, as follows:

Control group (C): It consisted of 7 animals who were fed a standard diet and drank water that was free of hydrogen peroxide.

The treatment group (T1): consisted of 7 animals who were fed a standard diet and given water laced with **0.5%** hydrogen peroxide (Al Kanani, 1998).
Treatment group (T2): 7 animals were given 0.5 mg/kg diet sodium selenate as part of their diet (Soudani et al., 2012) and given water laced with**0.5%** hydrogen peroxide.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5406 - 5412
Received 05 March 2021; Accepted 01 April 2021.

Following the conclusion of the experiment, which lasted, the animals were anesthetized using chloroform and blood was withdrawn directly from the heart using a 5 ml syringe , 3 ml of blood were placed in clean anticoagulant test tubes, and the samples were centrifuged for 15 minutes to separate the serum and perform tests. The animals' testes were then extracted for histological examination.

Results

The study's findings, as shown in Table (1), revealed a significant decrease in the level of probability (P <0.05) in Glutathione and Catalase levels, as well as a significant increase in MDA levels in the T1 group compared to the control group C.While the T2 group had a significant increase in glutathione and catalase levels, the T1 group had a significant decrease in MDA. Glutathione and catalase levels remained significantly lower in T2 compared to the control group.

Table (1): ShowEffect of selenium on the level of glutathione, Catalase and malondialdehyde level in rats exposed to oxidative stress caused induced by hydrogen peroxide**.**

Standards Groups	Glutathione (U/ml)	Catalase (U/ml)	MDA (µmol/L)
Control C	**3.48±0.05 a**	**0.78 ±0.03a**	**1.2 8±. 0.0 2a**
T1	**1.99 ±0.0 4b**	**0.4 8 ±0.0 3b**	**2.71 ±0.07b**
T2	**2.84 ±0.0 7c**	**0.62 ±0.0 2c**	**1.64 ±0.05 c**
L.S.D	**0.56**	**0.1**	**0.3**

*Value represent the mean ± the standard error
* Different letters in one column indicate significant differences (P <0.05) between the totals

WithSpermatogonium, Speratocyte, spermatid ,Leydig cells and Sertoli cells remaining significantly lower in T2 compared to control group.

Table (2) shows a significant decrease in the number of Spermatogonium, Speratocytes, Spermatids, Leydig cells, and Sertoli cells in the T1 group compared to the control group C. While the T2 group had a significant increase in the number of Spermatogonium, Speratocytes, Spermatids, Leydig cells, and Sertoli cells when compared to the T1 group.

Table (2): showsEffect of selenium on the level ofSpermatogonium, Speratocyte, spermatids,Leydig cells andSertoli cells in rats subjected to oxidative stress caused by hydrogen peroxide**.**

Groups	Spermatogonium	Speratocyte	Spermatid	Leydig cells	Sertoli cells
Control C	71.2±0.35	91.2±0.1	108.1±o.o6	16.8±o.o7	22.6±0.53
T1	45.1±0.04	56.2±0.05	71.2±0.02	9.2±0.25	13.6±0.61
T2	63.1±0.01	78.8±0.06	91.1±0.09	13.2±0.06	17.8±0.61
L.S.D	6.8	7.1	14.3	2.8	3.7

*Value represent the mean ± the standard error
* Different letters in one column indicate significant differences (P <0.05) between the totals

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5406 - 5412
Received 05 March 2021; Accepted 01 April 2021.

The histological examination revealed that the parts taken from the testis in the control group of white male rats were of normal composition. The presence of expanding seminiferous tubules filled with sperm indicates that the spermatocytes are at various stages Figure (1).

As for the T1 group, dissociation of the spermatogenic cells was observed, and the lumen of the seminiferous tubule contains a small number of sperms Figure (2).

Positive tissue changes were observed in the t2 group, with large numbers of sperms in the tubule lumen in addition to primary and secondary spermatocytes. Figure (3).

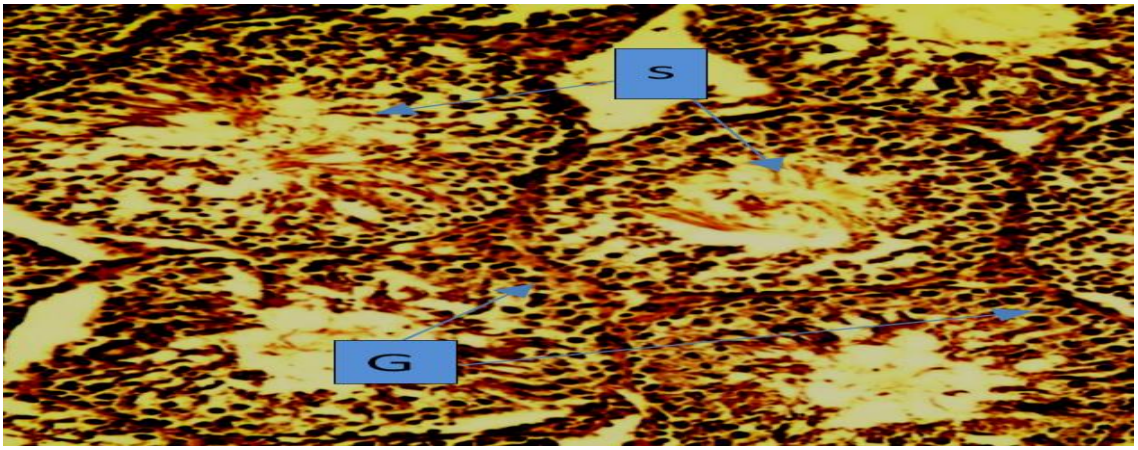

Fig (1): A cross-section of the testis in the control group showing a normal structure represented by dilated tubules filled with sperm(S),spermatogonia (G). H&E 10x

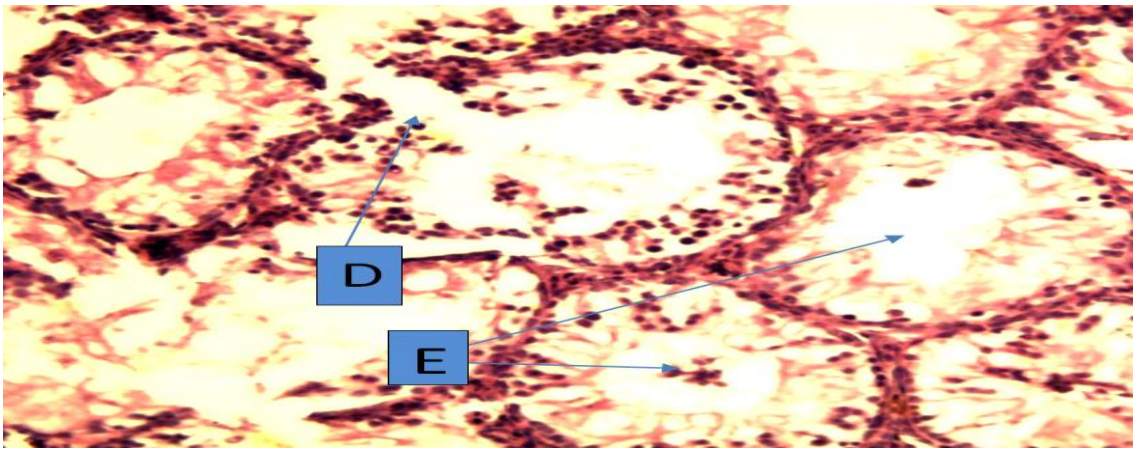

Fig (2): A cross-section of the testis in the T1 group showing the lumen of the seminiferous tubule contains a small number of sperms (S) & Degeneration (D) . H&E 10x

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5406 - 5412
Received 05 March 2021; Accepted 01 April 2021.

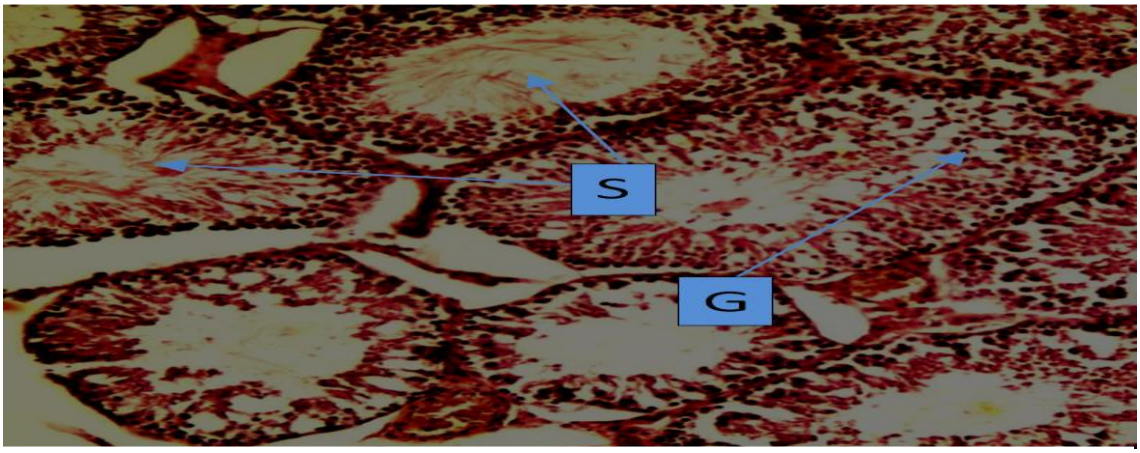

Fig (3): A cross-section of the testis in the T2 group showing The tubules appear almost full of sperm(S) as does the proliferation of spermatogonia (G). H&E 10x

Discussion

Oral administration of hydrogen peroxide causes oxidative stress, which can result in the generation and production of large amounts of active oxygen species, which can lead to the death of cells and tissues, including sperm, by changing the nature of proteins in the sperm's plasma membranes.(Aitken *et al.*, 1987).

It is the active oxygen types. What is responsible for protein breakdown and reorganization, resulting in sperm activity loss? Including the antioxidant enzyme clutathione peroxidase (GSH-PX), which works to protect cells and tissues from oxidative damage. (Aziz, 2000).

The active oxygen species destroy the cells in the testis that are responsible for the secretion of the hormone testosterone, resulting in a decrease in the secretion of the hormone responsible for prostate and seminal vesicle functions, as well as a decrease in the number of sperm (Ishihara et al., 2000).

Selenium is a trace element that can suppress free radicals and protect cellular components like proteins, chromosomes, and DNA from oxidative damage. This is due to the antioxidant role of selenium in protecting cells from the harmful effects of free radicals, It is also involved in the production of antioxidant enzymes such as GPX and TrxR, which neutralize active oxygen species ROS and protect cells from oxidative damage (Zwalak&Zaporowska , 2012; Erkekoglu et al., 2014a).

Conclusion

That hydrogen peroxide has a significant impact on the reproductive system, and that the antioxidant sodium selenate helped to reduce the oxidative stress caused by hydrogen peroxide.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5406 - 5412
Received 05 March 2021; Accepted 01 April 2021.

References

[1] Al-Kinani, Intisar Rahim Obaid (1998). A study of the susceptibility of oxidative damage to hydrogen peroxide in events of atherosclerosis lesions in chickens. Doctoral thesis in veterinary pathology. College of Veterinary Medicine, University of Mosul.

[2] Aitken, R. J., and Clarkson, J. S. (1987), Cellular basis of defective sperm function and its association with the genesis of reactive oxygen species by human spermatozoa, J. Repord. Fertil. 81: 459-469.

[3] Arthur, J.R. (2000). The glutathione peroxidase. Cell Mol. Life Sci. 57(13): 1825-1835.

[4] Aziz, B. N. (2000), Effects of hydrogen peroxide – induced oxidative stress on epididymal sperms of mice, Iraqi J. Vet. Sci., 13(1): 61-6

[5] Arteel, G.E.&Sies, H. (2001). The biochemistry of selenium and glutathione system. Envir. Toxicol. Pharmacol. 10: 153-158.

[6] Brown, K.& Arthur, R. (2007). Selenium, selenoproteins and human health: a review. Pub. Heal. Nutr. 4: 593-599.

[7] Casarett, A. P. (1968). Radiation Biology. New Yourk State veterinary college, cornell university

[8] Erkekoglu, P.; Giray, B.; Rachidi, W.; Hininger-Favier, I.; Roussel, A.; Favier, A.&Hincal, F. (2014a). Effects of di(2Ethylhexyl)Phthalate on testicular oxidant/antioxidant status in selenium-deficient and selenium-supplemented rats. Envir. Toxicol. 29: 98–107.

[9] Fishbein, L. (1983). Environmental selenium and its significance. Fundam. Appl. Toxicol. 3: 411-419, IARC (International Agency for Research on Cancer). (2001). Selenium and compounds. Lyon, France. 3- 9.

[10] Ishihara, M., Itoh, M., Miyamoto, K., Suna, S., Takeuchi, Y., Takenaka, L. and Jitsunari, F. (2000), Spermatogenic disturbance Induced by di-(2-ethyl hexyl) Phthalate is Significantly Prevented by treatment with Antioxidant Vitamins in the rat, Int. J. Androl., 23: 85-94

[11] Levander, O.A.; Sutherland, B.; Morris, V.C.& King, J.C. (1981). Selenium balance in young man during selenium depletion and repletion. Amer. J. Chem. Nutr. 34: 2662-2669.

[12] Mahan, D.C.; Cline, T.R.&Richert, B. (1999). Effects of dietary levels of selenium-enriched yeast and sodium selenite as selenium sources fed to growing-finishing pigs on performance, tissue selenium, serum glutathione peroxidase activity, carcass characteristics, and loin quality. J. Anim. Sci. 77: 2172-2179

[13] Mahood, H.E. (2021). Autophagy in PlantsduringNutrient Starvation, Osmotic and Heat Stresses. Annals of R.S.C.B.25(3). pp. 7933- 7944

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5406 - 5412
Received 05 March 2021; Accepted 01 April 2021.

[14] Mistry, H.; Pipkin, F.; Redman, C.& Poston, L. (2012). Selenium in reproductive health. Amer. J. Obstet. Gynecol. 6: 21-30.

[15] Pavlik, A.; Slama, P.&Havlicek, Z. (2012). Effect of dietary selenium forms on selenium blood concentration in Laying hens. J. Microbio. Biotech. Food Sci. 1: 1082-1089 .

[16] Soudani, N.; Troudi, A.; Amara, I.; Bouaziz, H.&Zeghal, N. (2012). Ameliorating effect of selenium on chromium (VI) induced oxidative damage in the brain of adult rats. J. Physiol. Biochem. 68(3): 397-409

[17] Stahl, W. and Sies, H. (1997). Antioxidant defence: Vitamins E and C and carotenoids.Diabetes. 46: 514-518

[18] Suzuki, K.T.&Ogra, Y. (2002). Metabolic pathway for selenium in the body. Food Addit. Contam. 10(19): 974-983.

[19] Ursini, F.; Heim, S.; Kiess, M.; Maiorino, M.; Roveri, A.; Wissing, J.&Flohe, L. (1999). Dual function of the selenoprotein GSH-PX during sperm maturation. Sci. 285: 1393-1397.

[20] Whanger, P.; Vendeland, S.; Park , Y.& Xia, Y. (1996). Metabolisum of subtoxic levels of selenium in animals and human. Ann. Clin. Lab. Sci. 26(2): 99-113.

[21] Yang, G.; Yin, S.&Zhuo, R. (1989). Studies of safe maximal daily dietary Se-intake in a seleniferous area in China.Regul. Toxicol. Pharmacol. 30: 180-215

[22] Zwalak, I.&Zaporowska, H. (2012). Selenium interactions and toxicity: a review. Cell Bio. Toxicol. 28: 31-46 .