

The Effect of Vitamin C as Antioxidant on the Toxic Effects Due to Deltamethrin Pesticide on Morphometric and Histopathological Parameters of ovary in the Rats

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The pesticides are the wide range of chemical compounds that have made in order to eliminate the agricultural and sanitarian pests. The objective of this study was to check the effect of Deltamethrine pesticides on Morphometric and histopathological parameters of ovary in rats. In this study, 63 adult female Wistar rats were divided into 9 groups of 7. Samples in 0.5 ml, every day at 8:00 a.m for 14 days were injected intraperitoneally. The control group received no medication. group 1 received 1 physiologic serum, group 2 received 20 mg/kg bodyweight, vitamin C, experimental groups of 1, 2 & 3 received 2.5, 5 & 10 mg/kg bodyweight doses of Deltamethrin, respectively. experimental groups of 4, 5& 6 received, 2.5, 5 & 10 mg/kg bodyweight doses of Deltamethrin respectively and 20mg/kg body weight of vitamin c. Next, histological and hormonal performed then, the data analysis statistically by ANOVA(one-way analysis of variance) and Duncane tests. In significant level, ($p < 0.05$) was determined by SPSS software version 15. The numbers of the primary follicles in experimental groups of 1, 2 & 3 showed a significant decrease toward control group. The primary follicles in experimental group of 3 have a significant decrease. In experimental group of 2,3, the secondary follicles showed a significant decrease toward control group. Number of corpus Luteum also in experimental groups of 1, 2, 3, 5 & 6 have a significant decrease toward control group. The number of atresia follicles experimental group of 2 & 3 have a significant increase toward control group. The results of this study show that Deltamethrin may cause changes in morphometric and histopathological parameters of ovary in rats and vitamin c also show mild antioxidant toward the toxic effect of Deltamethrin. Thus, Deltamethrin may cause the detrimental effects on ovary tissue and somewhat vitamin c has reduced the detrimental effects.

Key words: Deltamethrin, vitamin c, histopathology, ovary, the rat.

Despite the detrimental effects of pesticides on environment and other organisms, unfortunately the most effective and perhaps the only applicable way combat with the pests is the use of chemical pesticides^{1,2}. When toxins are entered into food chain, since one species of organism is at the top of the food chain, biomagnifications has

occurred and is caused to chemical condensation. Pollutant materials that have the most extensive environmental effects, are poorly hydrolyzed and they have movement in water, soil and air. And they show the bioaccumulation. Thus, some attempts have done to estimate as bioaccumulation potential of organic chemicals in environment to have method for appropriate treatments to confronted or resolved (Dehghani,1389). Also, people may exposure to risks of present factors, before realizing the risk of existence factors in environment ,people

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may exposure directly and detrimental effects may be appeared³.

Most insecticides are sensitive on nervous system and are the controller the body and so, it will be appropriate target for chemical compounds attack. These compounds are very effective and works quickly. Insecticides have different positions in nervous system and constitutive unit of it (neuron). These points include axons, neural groove, messengers and receptors. Pyrethroids are the insecticides that are most applied in farms ad houses in order to control pests and pesky insects⁵. Deltamethrin is the second group of pyrethroids toxins that its general name is Deltamethrin and its other name is Decamethrin and it is of insecticides' classification . How its effects are peptic and contact insecticides that is used against leafminer of round spots of fruit trees and sugar beet's prodyna^{4,6}. Deltametrine are the insecticides which cause of death by making sodium channels opened in nervous system⁷.

People in their life are permanently exposed to natural and synthetic (artificial) chemicals. many of these materials are useful for people and some other can threaten their health and may exposure their life to risks. There are a lot of ways in order to be polluted by chemical materials. The fetus can infected by mother's body during pregnancy³. And chemical pollutions can be transmitted from mother to baby through mother's milk. Certain pesticides can be stored in pet's fat and enter into food chain³.

Using antioxidant in infertility treatment is axiomatic^{8,9}. The results suggest that lack of vitamin C & E due to the strong antioxidant properties have protected gametes from free radicals' damage. Vitamin C has three functions

in relation to fertility:

1. Collagen synthesis increase
2. Effect on production of sexual hormones
3. Protect of sexual cells against free radicals

Ovary has cycles of histological changes and also steroid and peptide secretion which is related to vitamin c. Ovary has been known as a major stored position with the highest concentration in the internal, granulose and luteal section¹¹.

In this review, the objective is to investigate the effect of antioxidant of vitamin c on the toxic effect caused by Deltamethrin pesticide on morphometric and histopathological parameters of ovary in rats to identify the appropriate antioxidant in order to reduce the side effects of Deltamethrin.

MATERIAL AND METHODS

in this research, 63 mature female Wistar rats with approximately age 75 days and approximately weight 190g \pm 15 were purchased from laboratory animal breeding and maintenance center of shiraz medical university and they were divided into 9 groups of 7. After one week, testing course it mean injection was begun this one week was for animals accustomed to the new environment. Compressed dishes were prepared to feed animal from livestock and poultry company, maintained temperature of 22 \pm 2 °C and they were hold a cycle of 12 hour lightness and 12 hour darkness. Water and food are specially existance for rats during the whole testing without any restriction on their disposal. The Deltamethrin was prepared from Moshkfam company. Deltamethrin is soluble in water. The entire testing course is lasted 14 days. Lethal dose of Deltamethrin was determined equal

Table 1. Animals grouping according to receive different amount of Deltamethrin

Injection course	Amount of vitamin c use	Amount of Deltamethrin use	Number(n)	Groups
14days	-	-	7	Control(o)
14days	-	Physiologic serum	7	Control(s ₁)
14days	20mg/kg	-	7	Control(s ₂)
14days	-	2.5mg/kg	7	Experimental group 1(d2.5)
14days	-	5mg/kg	7	Experimental group2(d5)
14days	-	10mg/kg	7	Experimental group 3(d10)
14days	20mg/kg	2.5mg/kg	7	Experimental group 4(d2.5+c)
14days	20mg/kg	5mg/kg	7	Experimental group 5(d5+c)
14days	20mg/kg	10mg/kg	7	Experimental group 10(d10+c)

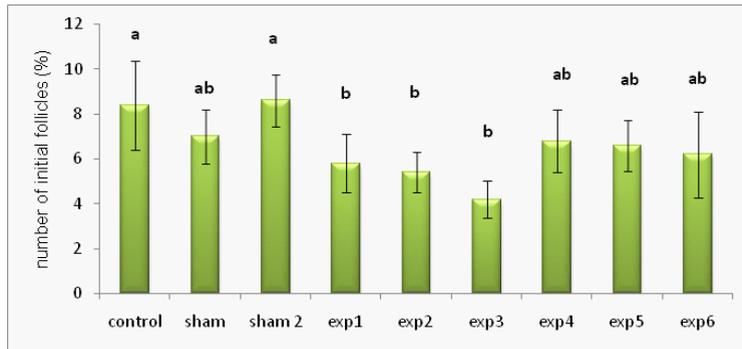


Chart 1. Compares average numbers of initial follicles after influence of Deltamethrin in gonads

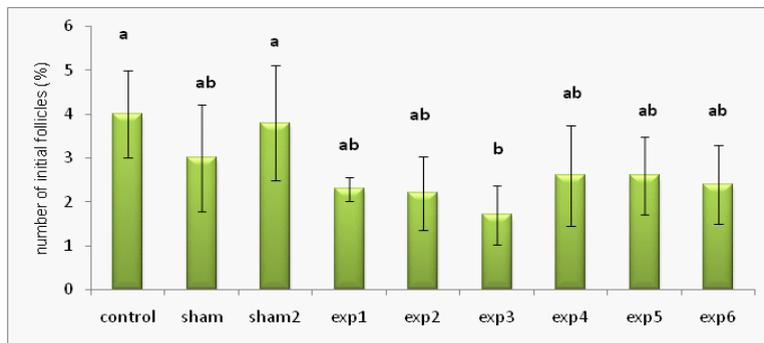


Chart 2. Compares different groups in terms of the numbers of initial follicles

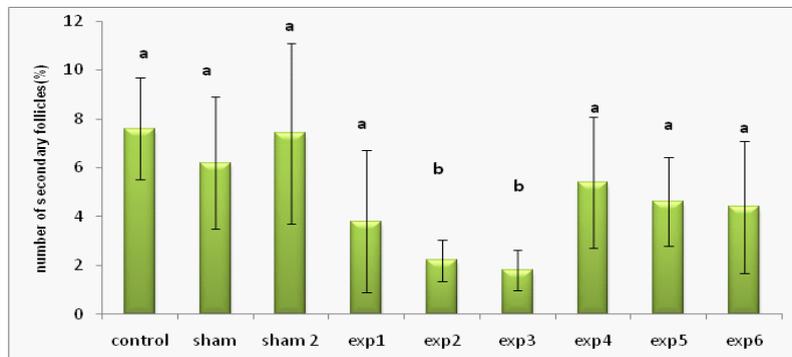


Chart 3. Compares different groups in terms of number of secondary follicles

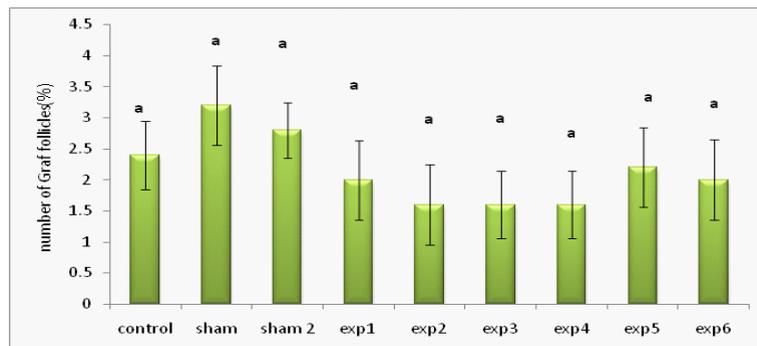


Chart 4. Compares number of Graaf follicles in gonad after effect of Deltamethrin in groups

2 mg/kg weight of rat's body. Minimum, average and maximum dose was elected for injection. The rats were randomly selected into 9 groups of 7 which their tables(1) are.

After the end of course, all groups of rats after dissect anesthesia and ovary to prepare microscope slides are separated and are fixed in 3% formalin. Then the number of initial follicles, primary, secondary, graph, corpus Luteum and follicular atresia were counted then we used of ANOVA in order to compare among attendance. Significant level was considered ($p < 0.05$). We used SPSS software version 17 to analyze data and perform statistical tests.

Findings

The number of initial follicles in experimental groups 1, 2 & 3 indicated a significant decrease towards control group (chart 1). Initial follicles in experimental groups 3 had a significant decrease (chart 2). Secondary follicles in experimental groups 2 & 3 indicated a significant decrease toward control group (chart 3). The number of corpus Luteum in experimental groups 1, 2, 3, 5 & 6 also had a significant decrease toward control group (chart 4). The number of Atresia follicles in experimental groups 2 & 3 had a significant increase toward control group ($p < 0.05$) (chart 5).

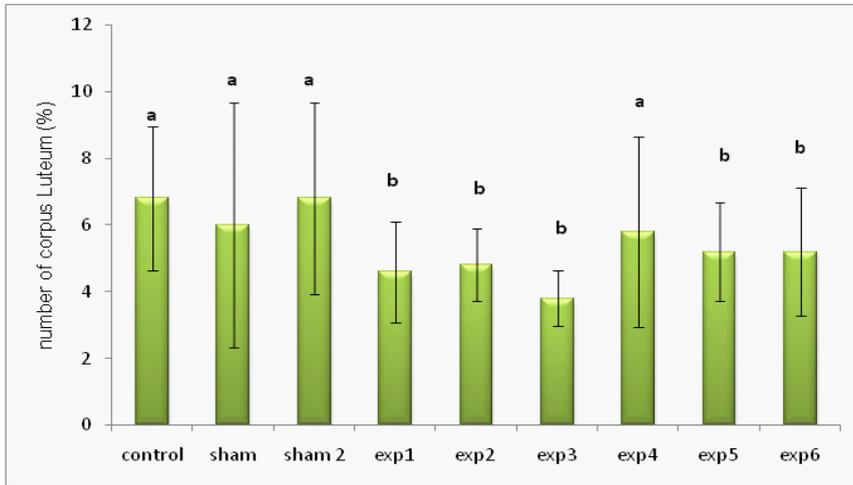


Chart 5. Compares different groups in terms of number of corpus Luteum

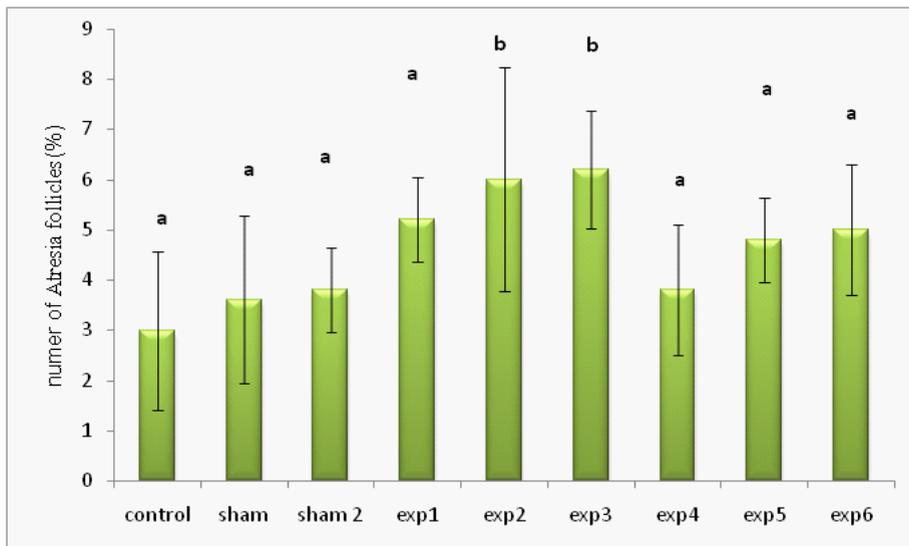


Chart 6. Compares different groups in terms of Atresia follicles

DISCUSSION

According to chart (1), the number of initial follicles in experimental groups 1, 2 & 3 indicated a significant decrease toward control group, also the number of initial follicles according to chart(2), in experimental group 3 had a significant decrease toward control group. According to chart (3) the number of secondary follicles in experimental groups 2&3 indicated a significant decrease toward control group. The number of corpus Luteum according to chart (5) in experimental groups 1, 2, 3, 5 & 6 indicated a significant decrease toward control group but the number of Atresia follicles also in experimental groups 2 & 3 had a significant increase toward control group. Regarding to the conducted studies in the past, it is stated that the number of spermary cells have been reduced after using the Deltamethrin that researchers have found the reason in making chromosomal abnormalities induced by Deltamethrin and the reduction of atomic nucleolus and spermary abnormalities¹².

Also in other study, it is stated that Deltamethrin caused to decrease the number of children in future generation¹³. In the past, it had been claimed that Deltamethrin caused to increase the number of atresia and non-fertilized follicles and reduction in the number of total ovule in special type of fish that its name is zebrafish .it is also expressed that Deltamethrin caused to decrease follicle-genes in higher doses¹⁴. Between different brands, oxidative stress in normal ovarian cycle has been known. Follicular fluid includes macrophages, leukocytes and cytokines that all of them were considered as known sources of reactive oxygen species (ROS)^{8&9}. It is notable that a certain amount of active oxygen(O_2^- , H_2O_2) is required in order to meet the biological needs of the ovary. Present ROS in follicles fluid play a role in sperm maturation, follicle-genes and steroid hormones production in ovary. However, female reproductive system specially ovarian is more sensitive to reactive oxygen species and free radicals and if their rates exceed to certain amount, it can lead to infertility.

The presence of high ROS in ovary follicles caused to loss the follicles fluid antioxidant system and damage directly on Oocyte⁸⁻⁹. According to the previous studies that were conducted,

Deltamethrin cause the induction of oxidative stress and damage to membranes of some organisms¹⁵. Also in other study, it is stated that Deltamethrin decreased the glutatione level and plasma antioxidant but increased lipid peroxidation in all lymphatic and plasma organs and it is observed in similarity assessment between delthmethrin to cyclophosphamide¹⁶. Thus, reduction in all different follicles specially in higher doses and lack of vitamin c can be caused to increase the reactive oxygen species. In other studies, it is claimed that Deltamethrin caused to inhibit the protein phosphatase as a insecticides. Calcineurin is a Cytoplasmic Phosphatase serine-threonine that be active with Phosphorylating of transcription factor NFAT (nuclear factor of activated T). This protein is affected by the process of meiotic cells of Oocyte and as a result, Deltamethrin affects the protein to prevent the Oocyte maturation¹⁷. Thus, this issue can be another reason of ovarian follicles decrease and Atresia follicles increase in experimental groups.

According to charts related to ovary tissue changes, it can be expressed that in some situations in faced with high concentration of free radicals, the lack of antioxidant enzymes are observed in body. Non-enzymatic antioxidant consumption such some vitamins increase the body's ability in removing free radicals¹⁸. Among vitamins, vitamin c has been recognized as antioxidant and some studies have shown this vitamins cause to restrain free radicals and it can improve the toxic effects of some pesticides^{19,20}. Vitamin c is an antioxidant with low and effective molecular weight in aqueous phase which protected from different parts of the cells against soluble oxygen and nitrogen's free radicals in water²¹. So, according to chart (1) the number of initial follicles showed the most decrease in experimental group 3 and the least decrease in experimental group 4 was observed that is indicative of the positive effect of vitamin c. Also, according to chart⁶, the number of Atresia follicles indicated the most frequency in experimental group 3 and the least frequency in experimental group 4 that is the sign of the positive effect of vitamin c on neutralizing the destructive effects of Deltamethrin toxin.

CONCLUSION

The results of the present study indicated

that Deltamethrin can possibly cause changes on morphometric and histopathological parameters of ovary in rats and vitamin c showed slight antioxidant effect toward the toxin effect of Deltamethrin. So, Deltamethrin probably cause the destructive effects on ovary and vitamin c has nearly decreased the destructive effects.

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REFERENCES

1. Senanayak N, Johnson R. Acute polyneuropathy after poisoning by a new Organophosphate insecticide. *N engle j med*, 1992; **302**: 155-157.
2. Zhang CH, Malhorta SV. Increased paraoxon detection by acetylcholine esterase inactivation with ionic liquid additives. *Talanta*, 2005; **67**: 560-563.
3. Justin VT, Toshio N. Potent Modulation of Tetrodotoxin-Sensitive and Tetrodotoxin-Resistant Sodium Channels by the Type II Pyrethroid Deltamethrin. *The journal of pharmacology and experimental therapeutics*, 1998; **284** (3): 958- 965.
4. Elliott M, Janes NF. Synthetic pyrethroids-a new class of insecticide. *Royal Society of Chemistry*, 1978; **7**: 473-505.
5. Szegletes T, Balint T, Szegletes Z, Nemcsok J. *In Vivo* Effects of Deltamethrin Exposure on Activity and Distribution of Molecular Forms of Carp AChE. *Ecotoxicology and Environmental Safety*, 1995; **31**(3): 258- 263.
6. Barrueco C, Herrera A, Caballo C, de la Pena E. Induction of structural chromosome aberrations in human lymphocyte cultures and CHO cells by permethrin. *Teratogenesis, carcinogenesis, and mutagenesis*, 1994; **14**: 31-38.
7. Luck M, Jeyaseelan I and Scholes RA., Ascorbic acid and fertility. *Biology of Reproduction*. 1995; **52**: 262-266.
8. Sekhon LH, Gupta S, Kim Yan Agarwal A. Female Infertility and antioxidants. *Current Women's Health Reviews*. 2010; **6**: 84-95.
9. Deane HW., Histochemical observation on the ovary and oviduct of the albino rat during the estrus cycle. *Am J Anat*. 1952; **91**: 363-413.
10. Biskind GR and Glick D., Studies in Histochemistry. V. The vitamin C concentration of the corpus luteum with reference to the stage of the estrus cycle and pregnancy. *J Biol Chem*.1936; **113**: 27-34.
11. Bhunya SP, Pati PC., Effect of deltamethrin, a synthetic pyrethroid, on the induction of chromosome aberrations, micronuclei and sperm abnormalities in mice. *Mutagenesis*, 1990; **5**(3): 229- 232.
12. Patricia G, Ausana C, Luisa O, Armindo R., Effects of deltamethrin on the reproduction of *Trichogramma cordubensis* (Hymenoptera: Trichogrammatidae). *Biocontrol Science and Technology*, 2007; **16**(7): 699- 708.
13. Koc ND, MusMN, Kayhan FE, Colak S., Histopathological changes in ovaries of zebrafish (*Danio rerio*) following administration of deltamethrin. *Fresenius Environmental Bulletin*, 2009; **18**(10): 1872- 1878.
14. Sayeed I, Parvez S, Suwarna P, Bilal BH, et al., Oxidative stress biomarkers of exposure to deltamethrin in freshwater fish, *Channa punctatus* Bloch. *Ecotoxicology and Environmental Safety*, 2003; **56** (2): 295- 301.
15. Birsen Aydin., Effects of thiacloprid, deltamethrin and their combination on oxidative stress in lymphoid organs, polymorphonuclear leukocytes and plasma of rats. *Pesticide Biochemistry and Physiology*, 2011; **100**(2): 165-171.
16. Perta J, Chmelikova E, Zalmanova T, Tumova L, Kheilova K, et al., Pyrethroids cypermethrin, deltamethrin and fenvalerate have different effects on in vitro maturation of pig oocytes at different stages of growth. *Cambridge Journals*, 2012; 1- 9.
17. Hundekari IA, Suryakar AN, Rathi BD., Oxidative stress and antioxidant status in Hutchinsonin JSM., *Controlling Reproduction*: 2008; 36-5.
18. Kashif SM, Zaidi R, Banu N., Antioxidant potential of vitamins A, E and C in modulating oxidative stress in rat brain. *Clinica Chimica Acta*, 2004; **340**(1-2): 229-233.
19. Kalender S, Kalender Y, Durak D, Ogutcu A, Uzunhisarcikli M, Sitki Cevrimli B, Yildirim M. Methyl parathion induced nephrotoxicity in male rats and protective role of vitamins C and E. *Pes Biochem Physiol*, 2007; **88**(2): 213-218
20. Jurczuk M, Brzóska MM, Moniuszko Jakoniuk J., Hepatic and renal concentrations of vitamins E and C in lead- and ethanolexposedrats. An assessment of their involvement in the mechanisms of peroxidative damage. *Food Chem Toxicol*, 2007; **45**(8): 1478-1486.