

## The Study of the Effect of Chlorpyrifos Insecticides on Blood Proteins in Mice

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**Abstract:** One of the most common methods to prevent destruction of crops is using pesticides. Therefore, pollution of water sources by pesticides is considered as one of the environmental problems. One of the most widely used pesticides is Dursban, also known by its general name chlorpyrifos. This insecticide belongs to a group of organophosphorous insecticides with contact and digestive influences and little fumigation properties. The purpose of this study is to investigate the effects of Dursban on the laboratory mouse blood proteins. In this study, 48 female mice of Balb/C kind were tested by dividing into 6 groups. Control group and experimental groups 1-5, respectively received a dose of 0.03, 0.3, 3, 1.5 and 15 ppm of Dursban in daily drinking water for 31 days. At the end of the experiment, phlebotomies and samples were transferred to the laboratory. The obtained data was evaluated with SPSS software at probable level of  $p < 0.05$ .

**Key words:** Dursban, *Mus musculus*, mouse, albumin, globulin, pesticides

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### INTRODUCTION

To prevent the destruction and loss of their crops which requires expenses, time and discomfort and also through population growth and limitations of the production of various food products, human beings use different methods for the sake of control and excretion of vegetable pest. One of the most common methods is the use of pesticides. Pollution of water sources by pesticides is considered as one of the environmental problems. Pesticides with significant concentration enter into the environment through industrial effluents and agricultural drainage (Chiron *et al.*, 2000). Pesticides used in agriculture can enter into water sources through direct washing or irrigation of consumed places. Also, the rainfall on sprayed areas before their degradation can cause toxins to surface sources. In addition, pesticides can access to the aquifers through layers of soil and during penetration of water. In some cases, pesticides can enter into the air and as a result pollute surface water sources and soil through rainfall. The entrance of pollutants into water resources due to heavy resistance against environmental factors, soluble in water and toxicity to organisms can have harmful effects on human health and the environment (Arcury *et al.*, 2003). In terms of chemical structure, pesticides are classified to chlorinated pesticides, organophosphates and organo nitrogen (carbamate) and Pyrethroids.

About 50% of the insecticides used in the world are organophosphate (Casida and Quistad, 2004). Dursban, also known by its general name chlorpyrifos is a group of organophosphorous insecticides with contact and digestive influences and little fumigation properties. This insecticide belongs to a chemical group of organophosphates. The range of chlorpyrifos consumption is wide. Chlorpyrifos plays its role by affecting the normal functioning of the nervous system. This will occur by cutting down acetylcholine which is a neurotransmitter (Christensen *et al.*, 2009). Studies have been done suggest that chlorpyrifos is considered as one of the most important environmental contaminants (Christensen *et al.*, 2009). According to Institute of Standards and Industrial Research of Iran, the maximum allowable pesticide in drinking water is 0.3 mg L (Arcury *et al.*, 2003). Due to the use of chlorpyrifos in numerous occasions with regard to its side effects and that now-a-days the toxic effects of environmental pollutants is going to be tested on animals in the first place (West, 1985), this thesis investigates the effect of chlorpyrifos on the laboratory mouse blood proteins.

### MATERIALS AND METHODS

In this study, 48 laboratory female mice of Balb/C kind were taken. The samples were in natural conditions for a month in animal nests. Then, the mice were randomly

divided into 6 groups of 8. The dose of chlorpyrifos was selected due to residual levels of pesticides in groundwater of the study area (Dehghani *et al.*, 2012). Chlorpyrifos used in emulsifiable concentrates or EC, 40/8% belongs to Iranian Raja Company.

**Control group:** No substance was added to the drinking water of this group. Treatment group 1; 0.3 ppm chlorpyrifos was added to the drinking water. Treatment group 2; 0.3 ppm chlorpyrifos was added to the drinking water. Treatment group 3; 1.5 ppm chlorpyrifos was added to the drinking. Treatment groups 4; 3 ppm chlorpyrifos was added to the drinking water. Treated group 5; 15 ppm chlorpyrifos was added to the drinking water. After putting the groups in this condition for 1 month, the blood samples were drawn and were transferred to the laboratory for final testing. These experiments comply with the rules of the National Institute for Care and Use of Animal Laboratory. The results of experiments were analyzed using one-way ANOVA and Duncan's test ( $p < 0.05$ ) and SPSS software.

## RESULTS AND DISCUSSION

**The amount of blood albumin:** The amount of albumin were measured in Plasma Electrophoresis of laboratory mice and the results showed that the blood albumin levels of mice had a significant decrease in group 5 in comparison with the control group ( $p < 0.05$ ) (Fig. 1).

**The amount of  $\alpha$ -1-globulin:** The results show that the levels of  $\alpha$ -1 blood globulin had a significant increase in group 5 in comparison with the control group, ( $p < 0.05$ ) (Fig. 2).

**The amount of  $\alpha$  2-globulin:** The amount of  $\alpha$ -2 blood globulins of group 4 which received toxin has been a significant increase ( $p < 0.05$ ) (Fig. 3).

**The amount of  $\beta$  globulins:** There is no significant change between the amount of mice  $\beta$  globulins receiving toxin in comparison with the control group ( $p < 0.05$ ) (Fig. 4).

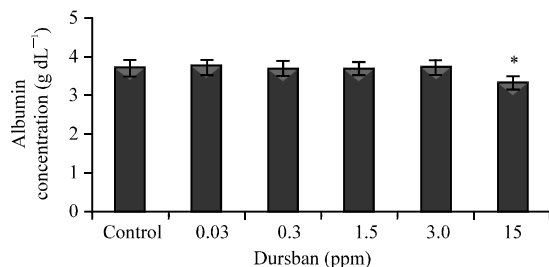


Fig. 1: Dursban effect on the concentration albumin

**The amount of gamma globulins:** In this study, there is no significant change between the amount of mice gamma globulins receiving toxin in comparison with the control group ( $p < 0.05$ ) (Fig. 5).

**The amount of A/G ratio:** A comparison of the A/G ratio (albumin to globulins) in group 5 which have received toxin showed a significant decrease in comparison with the control group by using statistic tests ( $p < 0.05$ ) (Fig. 6).

The amount of albumin and globulin and the ratio of these 2 proteins show the image of the liver function. Albumin synthesis decreases in various diseases, particularly in liver diseases and often the ratio of albumin to globulin decreases in plasma of patients with liver

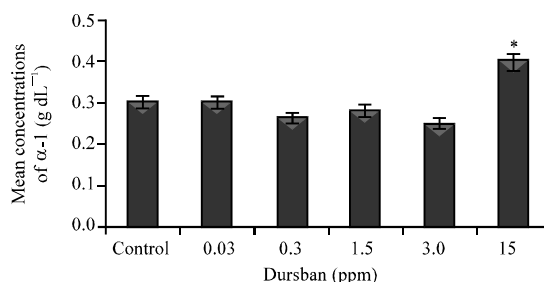


Fig. 2: Dursban effect on the concentration  $\alpha$ -1

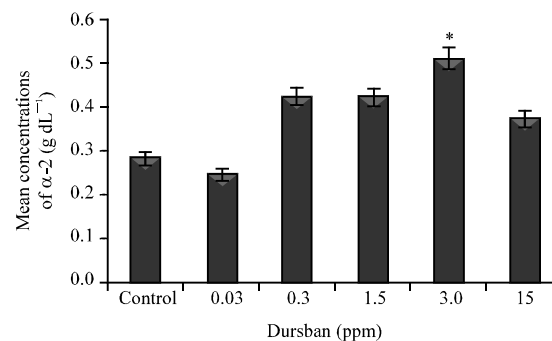


Fig. 3: Dursban effect on the concentration  $\alpha$ -2

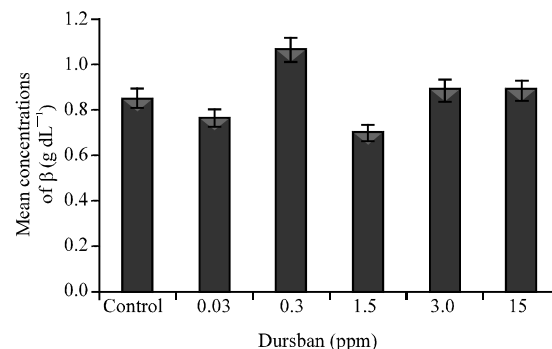


Fig. 4: Dursban effect on the concentration beta ( $\beta$ )

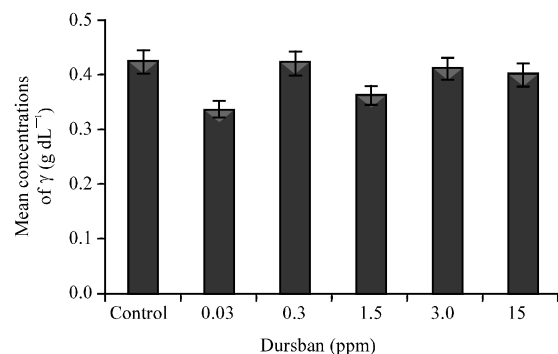


Fig. 5: Dursban effect on the concentration gamma ( $\gamma$ )

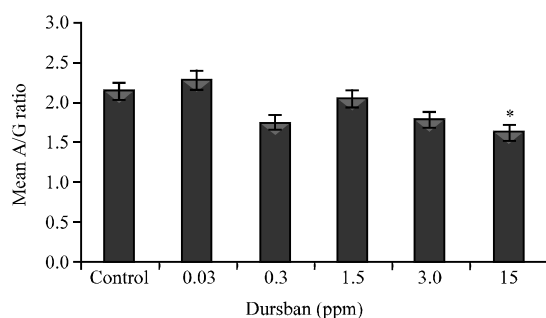


Fig. 6: Dursban effect on the A/G ratio

diseases (Malekniya *et al.*, 2000). The results of this study on mice showed that the ratio of albumin to globulin significantly reduced in the group which received the highest amount of chlorpyrifos in drinking water and also the reduction of the amount of albumin in the same group shows that the added venom caused liver damage or loss of protein in the urine due to kidney damage. This issue is in agreement with previous studies on the impact of chlorpyrifos on liver (Mansour and Mossa, 2010) and kidney (Ambali *et al.*, 2007) disorders. Besides, albumin as an antioxidant (Roche *et al.*, 2008) may be used in the fight against oxidation which is caused by chlorpyrifos. The exposure of chlorpyrifos and the emergence of hypoproteinemia which is matched with previous studies (Ambali, 2009) is partly attributed to lymphocytic leukopenia (Goel *et al.*, 2006). Given these cases, the added can reduce immune system (Rabideau, 2001). With the increasing of  $\alpha$ -1-globulin which the largest component of it consists of the  $\alpha$ -1-anti-proteinase, its increase is in response to acute inflammation (Isnard *et al.*, 2004). The main proteins are in the rank of  $\alpha$  2-globulin, containing  $\alpha$  2-macro and hepta globulin. The use of Dursban causes significant increase in the amount of  $\alpha$  2-globulin. The increasing of permeability of glomerular capillaries in nephrotic syndrome causes the expansion of the amount of  $\alpha$  2-

macro globulin to ten times or more by losing other small proteins. The reduction of albumin and  $\alpha$ -1-globulin and the increasing of  $\alpha$  2-macro globulin have been seen in this disease in electrophoretic pattern (Dugenci *et al.*, 2003). Transferrin consists the highest  $\beta$ -globulin forms. This protein transfers ferric ions from stored inside the cell irons or mucous ferritin to bone marrow (Jacobs and Worwood, 1975). Given the widespread use of this pesticide on several occasions, it is suggested that an optimal use of these pesticides should be managed.

## CONCLUSION

The results of this study show that chlorpyrifos decreases blood albumin and the ratio of albumin to globulin. Also, chlorpyrifos increases the amount of  $\alpha$ -1 and 2-globulin. Based on the results, chlorpyrifos will not affect  $\beta$  globulins and gamma globulins. According to this study, the added Dursban poison can be the cause of reducing immune system, liver and blood diseases. Given the widespread use of this pesticide on several occasions, it is suggested that an optimal use of these pesticides should be managed.

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