Effects Of Barley Grass Powder (*Horidium Vulgare*) On Some Biochemical Parameters In *Tilapia nilotica* Exposed To Pestban Insecticide

Abou Hadeed A H, Nabela I E, Saleh F M Sakr* and Samah A A*

Dept. of Forensic Med. & Toxicology, Faculty of Veterinary Medicine, Zagazig University

* Dept. of Fish Diseases, Central Lab. for Aquaculture Researches (Abbassa)

ABSTRACT

Pestban (chloropyrifos) is an organophosphate insecticide widely applied in agriculture and aquaculture, induces oxidative stress due to generation of reactive oxygen intermediate and changes in the antioxidant defense system.The present study was aimed to determinate 96hrs madian lethal concentration (LC_{50}) of pestban in Tilapia fish (*Oreochromis niloticus*) and study effect of barley grass powder on some biochemical parameters in Tilapia nilotica exposed to pestban. The 96hrs LC_{50} was equal to 0.36 mg/l. The fish exposed to1/10 LC_{50}(0.036mg/l) and 1/20LC_{50} (0.018mg/l) of pestban for either one, four and eight weeks showed inhibition of brain cholinesterase (ChE) and significantly increased superoxide dismutase (SOD), malondialdehyde (MDA), glutathione reductase (GR) in gills , liver and muscle comparing with control . Addition of barley grass powder 10% or 20% improve the level of antioxidant enzymes SOD, GR and MDA in gills ,liver and muscle than that in exposed to pestban alone while no change in brain cholinesterase.

These findings suggest that barley grass powder is positively effective in pestban toxicity in fish.

INTRODUCTION

Health conscious consumers today are looking for more than wholesome, nutritious food to maintain good health. They also want to avoid the ever-increasing levels of pesticides and other chemicals in our environment. Periodic use of internal cleaning programs may help to eliminate pesticide residues *(1).*

Pestban is trade name for agriculture-use product of chloropyrifos(CPF) (48%EC) *(2).* CPF is a broad-spectrum organophosphate insecticide(OP) and commercially used for more than a decade to control foliar insects that affect agricultural crops *(3).* CPF passes via air-drift or surface runoff into natural waters,where it is accumulated in different organisms living in water, especially fish, thus making it vulnerable to several discernible effects *(4).*

Organophosphates are, enviromental toxicants, known to inhibit acetylcholinesterase (AChE) *(5).* They are equally toxic to vertebrate and invertebrate aquatic animals even at low concentration (ng to µg/l levels); fish are particularly sensitive to organophosphate toxicants *(6).*

Generation of reactive oxygen species(ROS), which may lead to oxidative stress, indicating the role of ROS in pesticide toxicity *(7).* Antioxidant defenses such as catalase (CAT), superoxide dismutase (SOD), and glutathione reductase (GR) are involved to counteract the toxicity of ROS *(8).* So the antioxidants in fish could be used as biomarkers of exposure to aquatic pollutants *(9).*

Barley Grass provides balanced nutrition including an abundance of minerals (potassium, calcium. magnesium, iron, copper, phosphorus, manganese and zinc), 18 amino acids, antioxidant enzymes, beta-carotene and vitamins B1, B2, B6 and C, , It is also an excellent source of Chlorophyll which helps to gently detox form the environmental pollutants *(10).*

MATERIAL AND METHODS

Fish

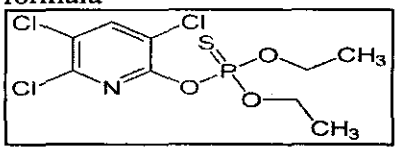
Study was conducted on *Oreochromis niloticus* freshwater fish, (40±5g g, 12.5±0.5cm cm). Fish were transferred to Central Laboratory for Aquaculture Research (CLAR) Abbassa, Sharkia Governorate with in plastic bags. The bags were cut open and the fish were disinfected with 0.1% KMnO4 solution for few seconds and acclimitized under laboratory conditions for two weeks in 1000 liter water tanks, filled with well aerated tap water and fed on basal fish diet under

laboratory condition PH 7.1-7.5 ,temperature at 26± 5°C before transferring them to the test glass aquaria .

Insecticide

Pestban 48%EC

Structural formula



Registered trade name(s): Pestban ,Dursban®, Lorsban®,Pyrinx ,DMS-0971.

Chemical name:O,O-diethyl-O-3,5 6-trichlor-2-pyridylphosphorothioate Molecular formula:$C_9H_{11}CL_3NO_3PS$. M.W.: 350.57. Organic solvent: 79% w/w isooctane,43%w/w in methanol, readily soluble in other organic solvents *(11).*

Barley Grass

Barley grass green plant with 30cm lenght were collected from different areas of Sharkia Governorate.

Determination of the 96-hrs median lethal concentration (96-hrs LC_{50}) of Pestban insecticide

Fish were exposed to varying levels of the toxicant for 96hrs.First trial (0.1, 0.2 ,0.3, 0.6), second trail (0.06, 0.07, 0.08, 0.09) and Third trail (00.0, 0.07, 0.08, 0.09, 0.1, 0.2, 0.3, 0.4, 0.5 and 0.6mg/l) of Pestban were freshly prepared and distributed in test glass aquaria; each one contains 10 fish (*O.niloticus*).Control fish were maintained simultaneously in separate aquaria without Pestban. All aquaria were kept for 96 hrs under the same conditions of aeration, temperature, PH and photoperiod as during acclimatization period .Mortality was assessed along the experimental period *(17).*

Barley grass powder

Barley grass was cut with 30cm length then slowly dried at Muffle Furnace without delay (within 60 minutes of being cut) at temperature 38°C to preserve all nutrients and to maintain the maximum potency of its vitamins, amino acids, enzymes, chlorophyll and other ingredients contents. Then grind, using electric blender, resulting in a new generation micro-fine powder*(13).* Chemical analysis of barley grass powder,was estimated *(14)* (Table 1)

Table 1. Nutritional analysis of barley grass powder

Protien	Fat	Fiber	Ash
30%	7%	15%	16%

The basal control diet was formulated *(15)* from practical ingredients to satisfy all known nutrient requirements of Nile tilapia . Barley grass diet 10% or 20% barley grass powder experimental diets were formulated to meet the requirement of experimental fish *(16)*.Both types of the experimental diets (control diet and barley grass diet) were prepared at the Fish Nutrition Department ,Central laboratory for Aquaculture Research.

Experimental design

Four hundred and fifty of *O. niloticus* fish were divided into four groups (Table 2).

At the end of expermintal peiods (Table 2) tissue samples (brain ,gills,liver and muscle) for biochemical studies were taken at the end of first, fourth and eighth weeks and then were preserved at -20 °C till analysis.

Laboratory analysis

Biochemical tests

Tissue samples (Brain, gills ,liver and muscle) were homogenized for 1.5 min in cold 0.25M pH 7.4 sucrose buffer(1:5, w/v) using a glass–teflon homogenizer (Heidolph S01 10R2RO) and then centrifuged at 9500 ×g for 30 min at Sorvall RC2B centrifuge. All processes were carried out at 4 °C. Supernatants were used to determine brain cholineesterase (ChE) activity and the superoxide dismutase (SOD), malondialdehyde (MDA), glutathione reductase (GR) of gills , liver and muscle by using a spectrophotometer (Shimadzu UV-mini 1240).

Brain ChE : ChE kit was purchased from SPINREACT Kit . (AChE) activity was estimated in brain *(17)* and measured at 405

nm. SOD in gills, liver, muscle: SOD kit was purchased from Bio diagnostic Kit . SOD was estimated *(18)* and measured at 560 nm.MAD in gills, liver and muscle: MDA kit was purchased from Bio diagnostic Kit.The tissues MDA concentration was determined *(19,20)* and measured at 534 nm.GR in Gills, liver, muscle : GR kit was purchased from Bio diagnostic Kit GR the enzyme was assayed and measured at 340 nm *(21)*.

Table 2. Experminental Design

Groups	Sub groups	No. of fish	Treatment	Duration
I		90	Control (-ve) basal diet	1 , 4 and 8 weeks
II		90	Control (+ve) barley grass powder diet (10%, 20%)	1 , 4 and 8 weeks
III	a	30	1/10 96-hrs LC_{50} of pestban	1 week
	b	60	1/20 96-hrs LC_{50} of pestban	4 and 8 weeks
IV	a 1	30	1/10 96-hrs LC_{50} of pestban +10% barley grass powder diet	1 week
	a 2	30	1/10 of 96-hrs LC_{50} of pestban +20% barley grass powder diet	
	b1	60	1/20 96-hrs LC_{50} of pestban +10% barley grass powder diet	4 and 8 weeks
	b2	60	1/20 96-hrs LC_{50} of pestban +20% barley grass powder diet	

Statistical analysis

Statistical analysis was performed using the one way analysis of variance (ANOVA) of SPSS *(22)*.

RESULTS AND DISCUSSION

The application of various pollutants like pesticides in the aquatic environment is known to cause several structural and functional changes in the biota. A major part of the world's food is being supplied from fish source, so it is essential to secure the health of fishes *(23)*. Recent years marked a major shift in human understanding of the role f food products in mantaining their proper health status *(24)*.

In the present study calculated 96-hrs LC_{50} of pestban to adults *O. niloticus* and it was 0.36 mg/l (Table 2) by the following equation:

96-hrs LC_{50} (mg/l)=

the highest concentration $\frac{\sum (A \times B)}{N}$

Where:

A=The difference between two successive doses.

B= The mean of dead fish in two successive groups.

N = Number of fishes in each aquarium.

Concerning the result of 96h/$LC_{50}$of pestban tabulated in Table 3 is not on the harmony with *(25, 26, 27) O. niloticus* sub adults (0.26mg/l) for lorsban,(1.57 µg/L) for CPF-methyl in larvae , (10µg/l) for CPF in fingerlings.This may be belonged to difference in fish life stagesin addittion to chemical formula of CPF respectively.

Table 3. Determination of the 96-hrs median lethal concentration (96-hrs LC_{50}) of Pestban insecticide.

Pestban conc.(mg/l)	No. of fish/group	No. of dead fish	A	B	A×B
0.00	10	0	0	0	0
0.07	10	0	0.07	0	0
0.08	10	0	0.01	0	0
0.09	10	1	0.01	0.5	0.005
0.1	10	3	0.01	2	0.02
0.2	10	4	0.1	3.5	0.35
0.3	10	5	0.1	4.5	0.45
0.4	10	6	0.1	5.5	0.55
0.5	10	6	0.1	6	0.6
0.6	10	10	0.1	8	0.8

Our result showed that brain cholinesterase of *O.niloticus* recorded significant decrease in both short-term exposure 1/10 LC_{50} (0.034 mg/L) and long - term exposure 1/20 LC_{50} (0.018 mg/L) of pestban treated groups during four and eight weeks treatment, while there was no changed after addition of barely grass powder (10%,20%) treatment in both exposure time comparing with control groups (Figs1,2).

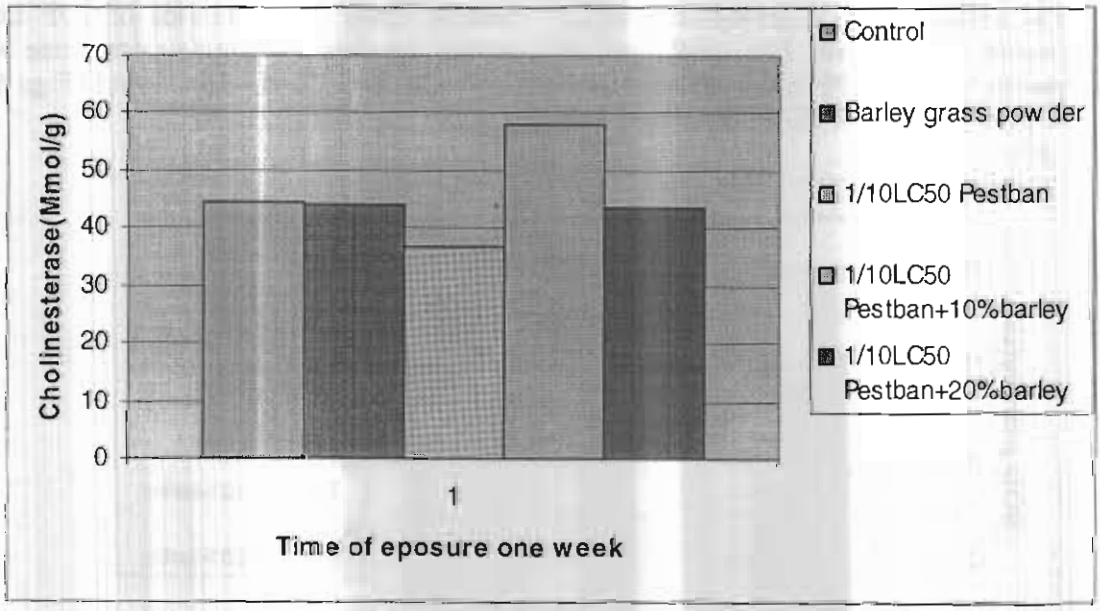


Fig. 1. Effects of short -term exposure 1/10 LC_{50} of pestban on brain choline esterase (Mmol/g)of *Tilapia nilotica* for 1 week.

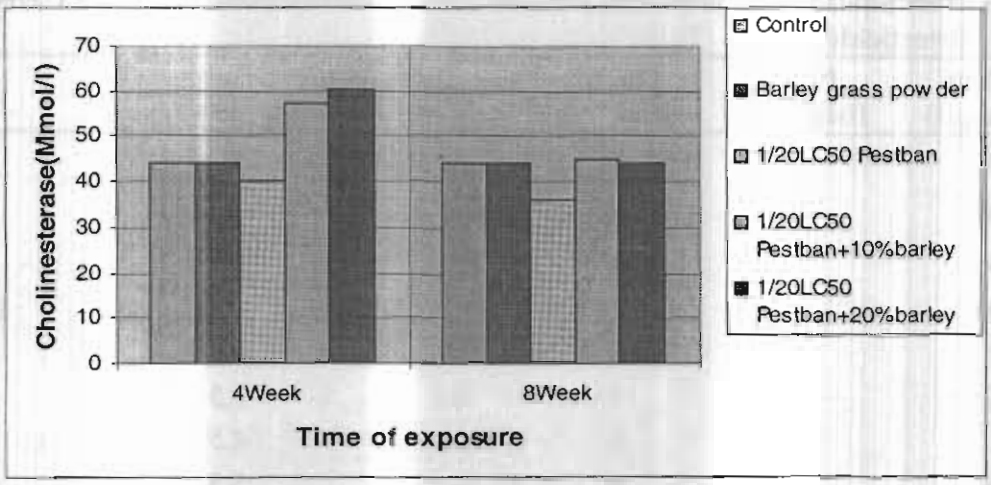


Fig. 2. Effects of long–term exposure 1/20 LC_{50} of pestban on brain cholinesterase of *Tilapia nilotica* for 4 and 8 weeks.

The inhibition of brain AChE activitywas similarly recorded *(4, 27,28)* during exposure to CPF in different fish species. Moreover it has been found that the inhibited brain AChE is greater than that in gill tissue euryhaline fish, (*O. mossambicus*) after exposure to CPF *(29)*. Similarly in brain and muscle ,AChE inhibited in common carp (*Cyprinus carpio L.*) after exposure to CPF*(30)*.The inhibition of ChE is mainly due to CPF oxon which is the metabolic desulfaration of the compand in fish liver *(31-33)*.

The present study,showed significant increased of SOD activity in gills,liver and muscle of *O.niloticus* treated with pestban during exposure for one week to(1/10 LC_{50}) and for four and eight weeks to (1/20 LC_{50}). Addition of barley grass powder had slight affect on SOD activity in gills ,liver and muscle tissue at all periods of CPF exposure ,while no changes in gills during one week of exposure comparing with control (Figs 3-5).

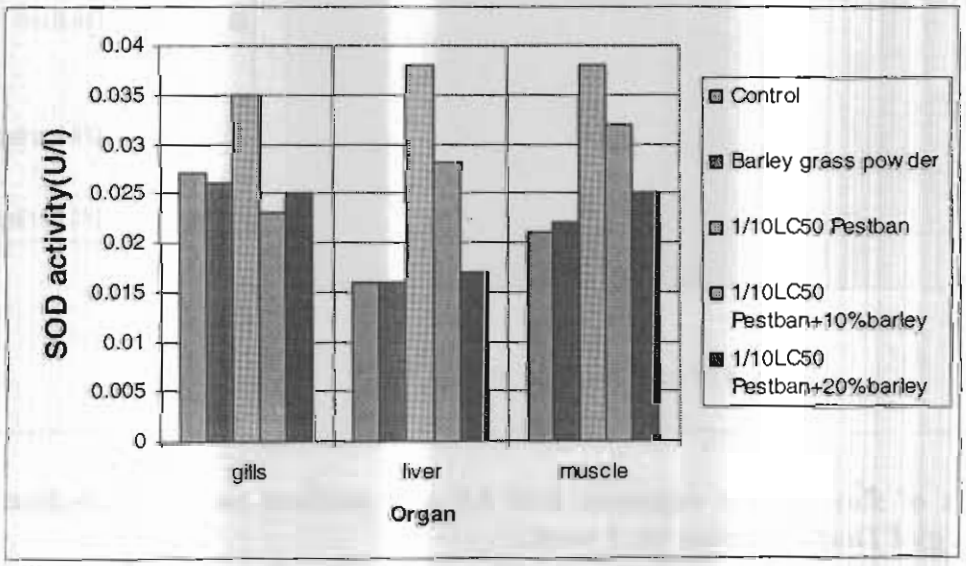


Fig. 3. Effects of exposure to 1/10 LC_{50}(0.036 mg/L) of pestban for one week on SOD activity in gills, liver and muscle of *Tilapia nilotica*.

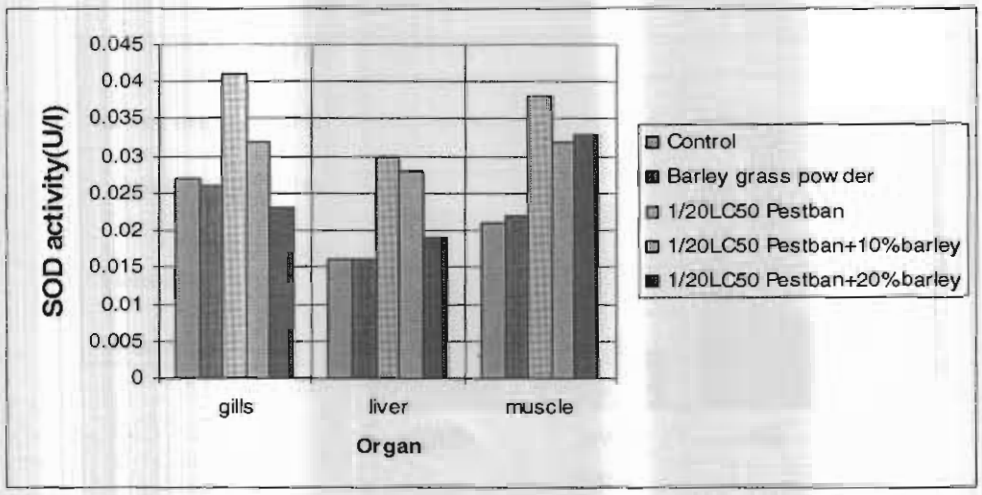


Fig. 4. Effects of exposure to 1/20 LC_{50}(0.018 mg/L) of pestban for 4 weeks on SODactivity in gills, liver and muscle of *Tilapia nilotica*.

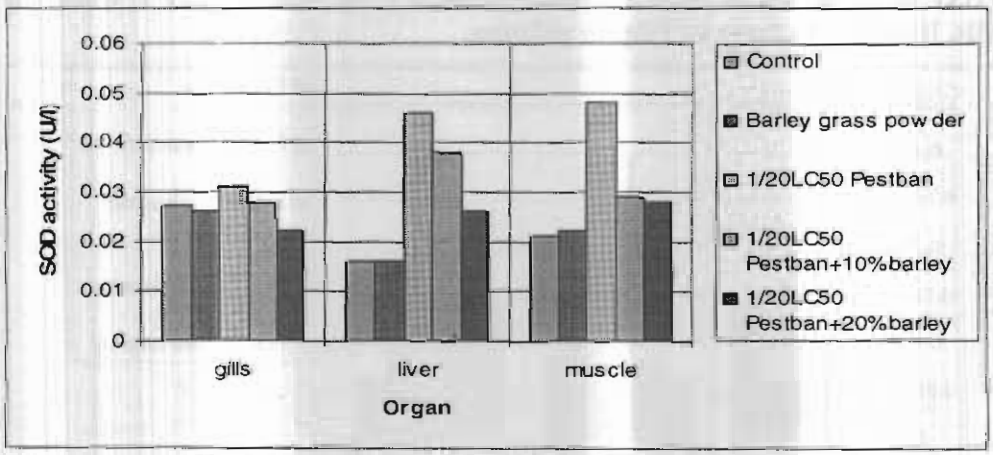


Fig. 5 . Effects of exposure to 1/20 LC_{50}(0.018 mg/L) of pestban for 8 weeks on SOD activity in gills, liver and muscle of *Tilapia nilotica*.

It has been reported that when the euryhaline fish, *Oreochromis mossambicus* was exposed to sub-lethal concentration (30 µg/L) of profenofos for 28 days GST and SOD activities showed transient increases in gill, viscera and muscle, but decreased in brain *(34)*.An increased of SOD is attributted to increased ROS generation and alterations in antioxidants or free oxygen radicals scavenging enzyme systems in aquatic organisms due to pesticide toxicity *(35)* .Also this increase indicates an increase in O_2^- production *(36)*. The elevated levels of antioxidant enzymes demonstrate a pollutant-induced adaptive response in fish, and is an attempt to protect the body against the generated ROS *(37,38)*. The apparent increase in SOD activity in the fish may be due to the production of superoxide anions which led to the induction of SOD, to convert the superoxide radical to H_2O_2 *(39)*. An increase in the activity of CAT and SOD is usually observed in the case of exposure to environmental pollutants since SOD-CAT system represents the first line of defense against oxidative stress*(40)*.

Our result revealed that gills,liver,muscle MDA of *O. niloticus* increased significantly during both exposure to 1/10 or 1/20$LC_{50}$with pestban while slight improvement in barley grass powder treated groups was observed specially in muscle varied between increases, decreases and no changed comparing with control groups (Figs 6-8).

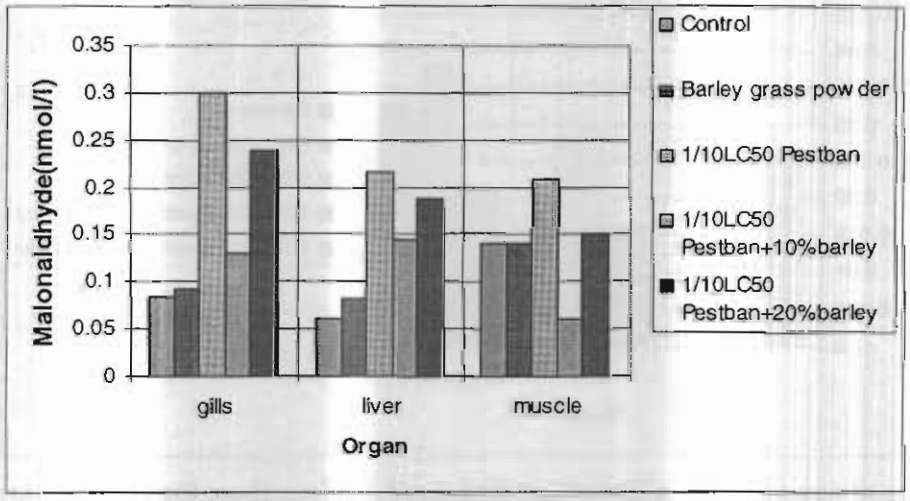


Fig. 6. Effects of exposure to 1/10 LC_{50}(0.036 mg/L) of pestban for 1 week on MDA in gills, liverand muscle of *Tilapia nilotica*.

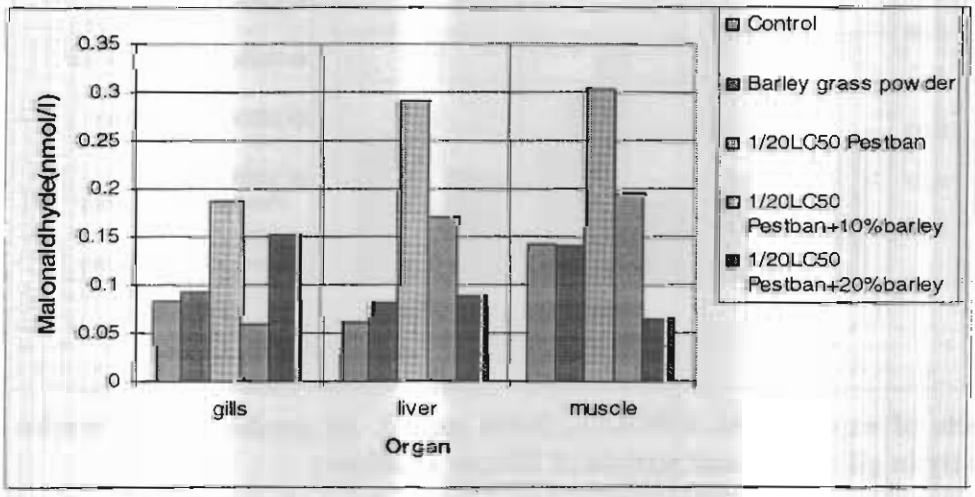


Fig 7. Effects of exposure to 1/20 LC_{50} (0.018mg/L) of pestban for 4weeks on MDA in gills, liver and muscle of *Tilapia nilotica*.

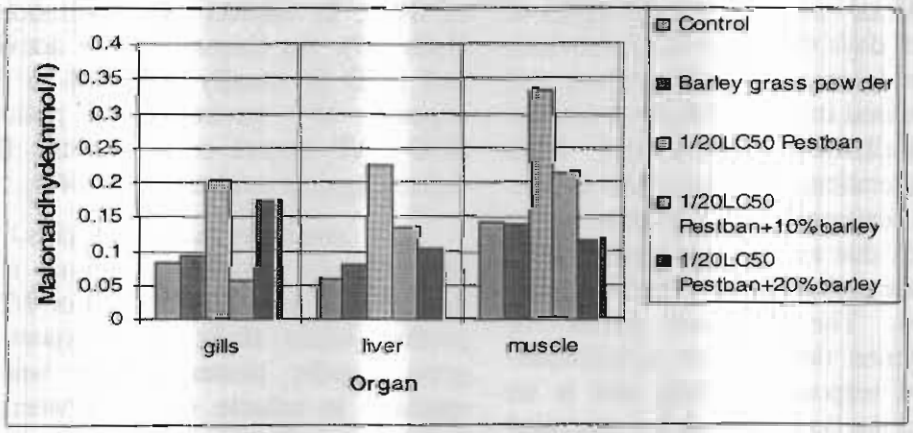


Fig. 8. Effects of exposure to 1/20 LC_{50}(0.018mg/L) of pestban for 8weeks on MDA in gills, liver and muscle of *Tilapia nilotica*.

Elevated levels of lipid peroxidation observed in the present study,was also recorded in mosquitofish, (*Gambusia affinis*) exposed to CPF(*4*).and on carp (*Cyprinus carpio*) and catfish (*Ictalurus nebulosus*) exposed to dichlorovos *(6)*.An increased MDA is liberated as the end product of lipid peroxidation. Lipid peroxidation is a complex process resulting from free radical reactions in biological membranes, which are rich in polyunsaturated fatty acids. It forms lipid hydroperoxides which decompose double bonds of unsaturated fatty acids and destructs membrane lipids *(41,42)*. It is known that $OH^{\cdot}$ can initiate lipid peroxidation in tissues*(43)*.

Improvement MDA in fish treated with barley grass powder treated groups may be due to 2"-O-GIV glycosylisovitexin Flavonoids which present only in young barley grass,which is an extremely effective as antioxidant and preventing free-radical oxidation of lipids found in the skin and blood, enhances the antioxidant actions of vitamin C and also helps in preventing the formation of the toxic compounds as malonaldehyde and acetaldehyde, which are known to denaturate proteins and DNA*(44)*.

Our result revealed that gills, liver GR of *O. niloticus* during exposure to1/10 or 1/20 LC_{50} to pestban increased significantly while decrease in muscle specially at eight weeks and also in barley grass powder treated groups with little significant increase comparing with control (Figs 9-11).

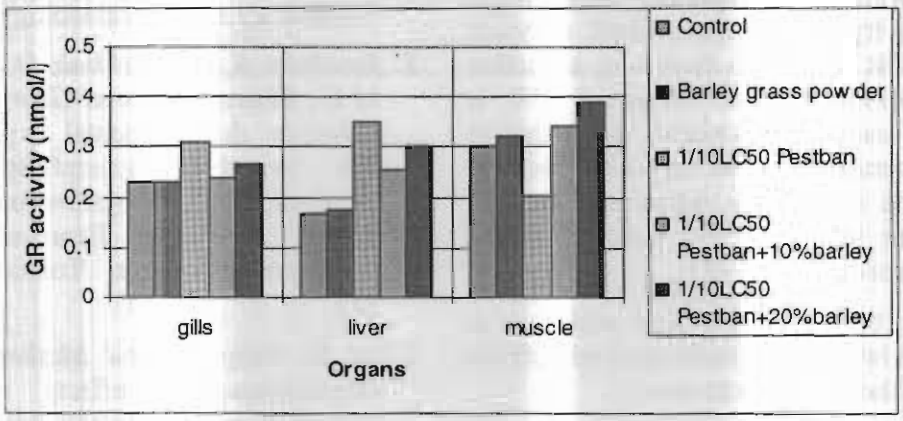


Fig. 9. Effects of exposure to 1/10 LC_{50}(0.036mg/L) of pestban for 1 week on GR activity in gills, liver and muscle of *Tilapia nilotica*.

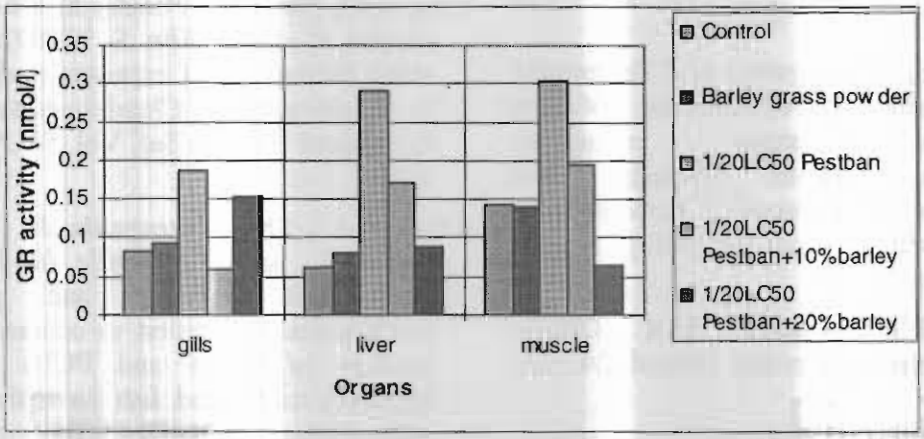


Fig. 10. Effects of exposure to 1/20 LC_{50}(0.018mg/L) of pestban for 4 weeks on GR activity in gills,liver and muscle of *Tilapia nilotica*.

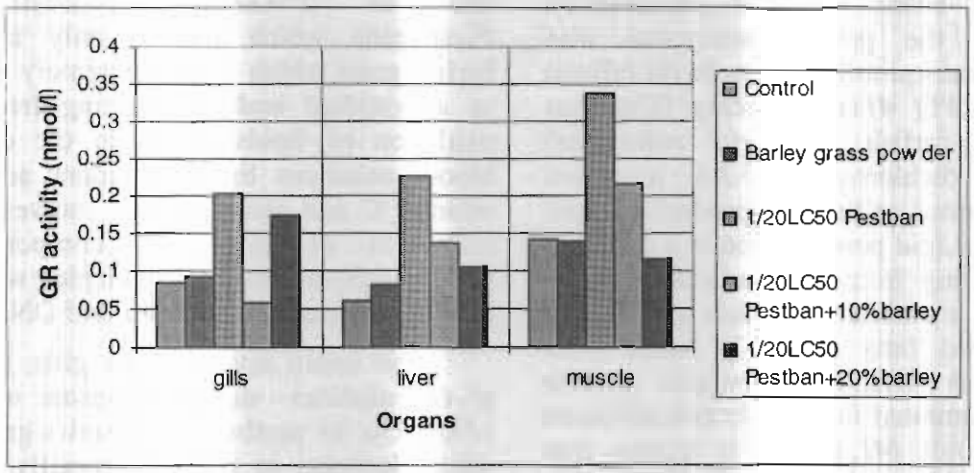


Fig. 11. Effects of exposure to1/20 LC_{50}(0.018mg/L) of pestban for 8 weeks on GR activity in gills ,liver and muscle GR of *Tilapia nilotica*.

On the other hand mosquito fish, (*Gambusia affinis*) after exposure to 297mg/L CPF the activity of the antioxidant enzymes SOD, CAT, GR in viscera However, induction in lipid peroxidation and increased GR is attributted to increased oxidative stress due to excessive generation of free radicals generated by CPF***(4)***.The increase in antioxidant enzyme activities were related to the maintenance of lipoperoxide concentration ***(43)***.

It could be concluded that addition of barley grass powder can ameliorate toxic effects of pestban on the tested parameter.

REFERENCES

1. ***Terry Bob (2010):*** Barley Grass Neutralizes Pesticides *in Vitro* .www.wheat grass kits .com.

2. ***Hosney A K H, E A Agamy; G Z TahaandM M ElHusseini (2010):***Influence of the Actinomycete natural metabolite "Spinosad"on certain locusts and Grasshoppers (*Orthoptera : Acrididae*) in Egypt. Egyptian journal of biological pest control,20(2):175-177.

3. ***Rusyniak, D E , Nanagas, K A , (2004):*** Organophosphate poisoning. Neurol. 24:197–204.

4. ***Kavitha P and Rao J Venkateswara (2008):*** Toxic effects of chlorpyrifos on antioxidant enzymes and target enzyme acetylcholinesterase interaction in mosquito fish, *Gambusia affinis* Environmental Toxicology and Pharmacology 26: 192–198.

5. ***Jacobson S M , Birkholz D A , McNamara M L , Bharate S B and George K M (2010):*** Subacute developmental exposure of zebra fish to the organophosphate pesticide metabolite, chloropyrifos-oxon, results in defects in Rohon Beardsen soryneuron development. Aquat. Toxicol., 100(1):101-111.

6. ***Hai D, Varga S and Matkovics M (1997):*** Organophosphate effects on antioxidant system of carp (*Cyprinus carpio*) and catfish (*Ictalurus nebulosus*). Comp. Biochem. Physiol., 117C:83-88.

7. ***Sayeed I, Parvez S , Pandey S, Bin-Hafeez B , Haque R , Raisuddin S (2003):*** Oxidative stress biomarkers of exposure to deltamethrin in freshwaterfish *Channapunctatus Bloch.* Ecotoxicol Environ Saf, Vol. 56 ,No. 2:. 295-301.

8. ***Orbea A , Ortiz-Zarragoitia M , Sole M , Porte C and Cajaraville M P (2002):*** Antioxidant enzymes and peroxisome proliferation in relation to contaminant body burdens of PAHs and PCBs in bivalve molluscs, crabs and fish form the *Urdaibai* and *Plentzia estuaries* (Bay of Biscay). Aquat. Toxicol. 58: 75–98.

9.Ahmad I , Hamid T , Fatima M , Chand H S , Jain S K , Athar M , Raisuddin S (2000): Induction of hepatic antioxidants in freshwater catfish (*Channa punctatus Bloch*) is a biomarker of paper mill effluent exposure. Biochim. Biophys. Acta 1523: 37–48.

10.Hagiwara Y , Sayuki S , Miyauchi, T , Otake H , Abe S , Kuramoto M and Takada K (1979): Study on green barley extract. Presented at the 99th National Meeting of the Japanese Society of Pharmaceutical Science, Sapporo .

11.Merck (1989): Merck index: an encyclopedia of chemicals, drugs, and biologicals. 11th ed. Budavari S, ed. Rahway NJ: Merck & Co., Inc. 2194.

12.Behrens A andKarber L (1953): Determination of LC_{50}.Arch.Fur.Exp.Path and pharm., 28:177-183.

13.David C (2006): Green Foods for the Prevention and Treatment of Diseases. The Collison Newsletter November. http://www.huntlycentre.com.

*14.N R C National Research Council, (1993):*Nutrient requirements of fish. Committee on Animal Nutrition. Board on Agriculture. National Research Council. National Academy Press. Washington DC, USA.

*15.Kim K , Wang X , Choi S , Park G , Koo J and Bai S (2003):*No Synergistic effects by the dietary supplementation of ascorbic acid, α-tocopheryl acetate and selenium on the growth performance and challenge test of Edwardsiellatarda in fingerling Nile tilapia,*Oreochromis niloticus.* Aquac.Res ., 34 :1053-1058.

16.AOAC (1990): Association of Official Analytical Chemists. The Official Methods of Analyses Association of Official Analytical Chemists International.5th edition, Arlington, VA, USA.

17.King M and Kaplan A (1984): Cholinesterase .Clin Chem the C.V. Mosby Co. St Louis. Toronto. Princeton; 1108-1111.

18.Nishikimi M, Roa N A and Yogi K (1972): Biochem. Bioph. Res. Common., 46: 849 – 854.

19.Satoh K (1978): Serum lipid peroxide in cerebrovascular disorders determined by a new colorimetric method. Clinica Chimica Acta 90: 37-43

20.Ohkawa H , Ohishi W and Yagi K(1979): Assay for lipid peroxides in animal tissues by thiobarbituric acid reaction.Anal biochemical 95(2):351-8.

21.Goldberg D M and Spooner RJ (1983): Methods of Enzymatic Analysis (Bergmeyen, H.V. Ed.).Vol 3: 258 – 265.

*22.Snedecor, G and Cochran W (1969):*Statistical Methods 6th.ed.Iowa State Univer. Press. Atmes. Iowa, USA.

23.Tripathi G Harsh S (2002): Fenvalerate-induced macro molecular changes in the catfish, *clarias batrachus.* J. Environ. Biol.; 23:143-146.

24.Stepanowska J J and Sawicka J H (2006): Comparative nutrition of cassava in common carp. Ann Rev.Nutr.,17:501-526.

*25.Gehad A E I (2010):*Some Biological effects of lorsban pesticide on a freshwater fish (*Oreochromis Niloticus Linnaeus*).Ph.D .faculty of Science .Cairo University.

26.GUI A (2005): Investigation of acute toxicity of chloropyrifos –methyl on Nile tilapia (*Orechromis niloticus L.*). Larva. Chemosphere. 59:163-166.

27.Chandrasekera L K H U and Pathiratne A (2005): Response of brain and liver cholinesterases in Nile tilapia, *Oreochromis niloticus*, to single and multiple exposures of chlorpyrifos and carbosulfan. Bulletin of Environmental Contamination and Toxicology Vol. 75 No. 6: 1228-1233.

28. Rao J V, Rani C H S, Kavitha P, Rao R N and Madhavendra S S (2003): Toxicity of chlorpyrifos to the fish *Oreochromis mossambicus.* Bulletin of Environmental

Contamination and Toxicology 2003 Vol. 70 No. 5: 985-992.

29.Rao J V and Pathakoti Kavitha (2010): Toxicology Unit, Biology Division, Indian Institute of Chemical Technology, Hyderabad 500 607 (AP), India. , Zeitschrift für Naturforschung. Section C, Biosciences Vol. 65 No. 3/4: 303-306.

30.Xing H , Wang J, Li J , Fan Z , Wang M and Xu S (2010): Effects of atrazine and chloropyrifos on acetyl cholinesterase and carboxyl esterase in brain and muscle of common carp.Ecotoxicol.Environ. Saf., 30 (1):26-30.

31.Chambers J E and Carr R L (1995): Biochemical mechanisms contributing to species differences in insecticidal toxicity, Toxicology 105: 291–304.

32.Chambers, J E and Carr R L (1993): Inhibition patterns of brain acetylcholinesterase and hepatic and plasma aliesterases following exposures to three phosphorothionate insecticides and their oxons in rats. Fund. Appl. Toxicol. 21:111-119.

33.Sanchez-Hernandez J C and Walker C H (2000): *In vitro* and *in vivo* cholinesterase inhibition in *Lacertides* by phosphonate- and phosphorothioate- type organophosphates, Pesticide Biochemistry and Physiology 67 :1–12.

34.Kavitha P and Rao J Venkateswara (2009): Sublethal effects of profenofos on tissue-specific antioxidative responses in a Euryhyaline fish, *Oreochromis mossambicus*. Ecotoxicology and Environmental Safety September, volum 72 issue 6:1727-1733.

35.Livingstone D R (2001): Contaminant-stimulated reactive oxygen species production and oxidative damage in aquatic organisms, Mar.pollut .Bull 42(8):656-66.

36.Zhang J F , Wang X R , Guo H Y , Wu J C and Xue Y O (2004): Effects of water-soluble fractions of diesel oil on the antioxidant defences of the goldfish *Carassius auratus*. Ecotoxicol. Environ. Safety 58: 110–116.

37.Van der Oost R, Beyer J and Vermuelen N P E (2003): Fish bioaccumulationand biomarkers in environmental risk assessment: a review, Environ.Toxicol. Pharmacol. 13:57–149.

38.Regoli F , Winston G W, Gorbi S, Frenzilli G, Nigro M, Corsi I and Focardi S (2003): Integrating enzymatic responses to organic chemical exposure with total oxyradical absorbing capacity and DNA damage in the European eel *Anguilla anguilla*, Environ. Toxicol. Chem. 22: 2120–2129.

39.Farombi E O, Ajimoko Y R and Adelowo O A (2008): Effect of Butachlor on Antioxidant Enzyme Status and Lipid Peroxidation in Fresh Water African Catfish, (*Clarias gariepinus*) Int. J. Environ. Res. Public Health 5(5): 423-427.

40.Pandey S , Parvez S , Sayeed I , Haque R , Bin-Hafeez B and Raisuddin S (2003): Biomarkers of oxidative stress: a comparative study of river Yamuna fish *Wallago attu* (Bl. & Schn.). Sci Total Environ, 309:105-15.

41.Sulak O , Altuntao I, Karahan N, Yildirim B, Akturk O, Yilmaz H R and Delibas N (2005): Nephrotoxicity in rats induced by organophosphate insecticide methidathion and ameliorating effects of vitamins E and C, Pestic. Biochem. Phys. 83:21–28.

42.Kalender S , Kalender Y, Ogutcu A, Uzunhisarcikli M, Durak D, Acikgoz F (2004): Endosulfan-induced cardiotoxicity and free radical metabolism in rats: the protective effect of vitamin E, Toxicology 202 :227–235.

43.Lackner R (1998): Oxidative stress in fish by environmental pollutants. Fish Ecotoxicol. 86: 203–224.

44.Osawa T, Katsuzaki H, Hagiwara Y, Hagiwara H and Shibamoto T (1992):A Novel Antioxidant Isolated from Young Green Barley Leaves J.Agric.Food Chem..40(7):1135-1138.

الملخص العربى

تأثير بودرة الشعير الأخضر على بعض التغيرات الكميائية لاسماك البلطى النيلى المعرضة لمبيد الحشرى البستبان

على حيدر أبو حديد، ، نبيلة امام الشرقاوى، صالح فتحى صقر*، وسماح عطية*

قسم الطب الشرعى والسموم كلية الطب البيطرى جامعة الزقازيق

* قسم أمراض الاسماك - المعمل المركزى لبحوث الأسماك بالعباسة

البستيبان هو احدى المبيدات الفسفورية العضوية المستخدمة فى الزراعة والاستزراع السمكى ويسبب الاكسدة الناتجة عن تكوين بعض الايونات الحرة والتى تسبب فى ظهور الانزيمات المضادة للاكسدة .اوضحت الدراسة ان الجرعة النصف مميتة لمبيد البستبان خلال ٩٦ساعة هى ٠,٣٦ملى جرام/لتر . تم دراسة دور بودرة الشعير الاخضر فى الحماية من التاثير السام لمبيد البستبان على اسماك البلطى النيلى (٤٥± ٥جم و١٢,٥± ٠,٥سم)المعرضة ١٠/١من الجرعة النصف مميتة لمدة اسبوع و ٢٠/١من الجرعة النصف مميتة لمبيد البستبان لمدة ٤ و ٨ اسابيع وكذلك المضافة لها بودرة الشعير الاخضر مقارنة بالمجاميع الضابطة. تم دراسة تاثيرالمبيد و بودرة الشعير الاخضر على انزيم الكولين استيرز فى المخ وانزيم السوبر اوكسيد ديسميوتيز ومالوندالدهيد وانزيم الجلوتاثيون ريدكتيز فى الخياشيم والكبد والعضلات. اوضحت الدراسة ان الاسماك المعالجة ببودرة الشعير الاخضر لم يتغيرمع انزيم الكولين استيرز فى المخ مع تحسن طفيف فى كلا من وانزيم السوبر اوكسيد ديسميوتيز و مالوندالدهيد وانزيم الجلوتاثيون ريدكتيز فى الخياشيم والكبد والعضلات .الاسماك المعرضة للمبيد فقط تبين نقص فى انزيم الكولين استيرز فى المخ مع زيادة ملحوظة فى انزيم السوبر اوكسيد ديسميوتيز ومالوندالدهيد وانزيم الجلوتاثيون ريدكتيز فى الخياشيم والكبد والعضلات .

لذلك نوصى باضافة بودرة الشعير الاخضر الى عليقة اسماك البلطى لما لة من دورايجابى فى الحماية من تاثير المبيد.