Biospectra : ISSN : 0973-7057, Vol. 15(2), September, 2020, pp. 275-280
An International Biannual Refereed Journal of Life Sciences

60(AS).
Animal Science

ISSN : 0973-7057

Int. Database Index: 663 www.mjl.clarivate.com

Nuvan (DDVP,2,2-dichlorovinyl dimethyl phosphate) induced biochemical toxicity in an air breathing fish, *Anabas testudineus* (Bloch 1792)

Sushma Swaraj*
Department of Zoology, B.N.Mandal University, Madhepura, Bihar, India

Received : 11th May, 2020 ; Revised :14th June, 2020

Abstract- Nuvan, also scientifically known as Dichlorvos is chemically 2,2-dichlorovinyl dimethyl phosphate (DDVP) is an isomer of organophosphate pesticides used commonly to control the insect pest both in standing agricultural field & stored grain products. Nevertheless, the pesticide has adverse effect on the other beneficial organisms such as fishes present in the habitat. This investigation report is related with the toxic effect of Nuvan on the biochemical parameters of an air breathing fish *Anabas testudineus* commonly known as climbing perch having edible value. Different concentrations of Nuvan has been taken for examining the acute toxicity to a fresh water fish *Anabas testudineus* LC^{50} value calculated for the acute toxicity, which was 0.024 ml/L. Biochemical study of kidney Glycogen, Protein profile, Lipid profile, Cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL) after 24hrs, 48hrs, 72hrs and 96 hrs exposure to lethal toxicity of Nuvan.

Key words: Nuvan, biochemical toxicity, *Anabas testudineus,* organophosphate

INTRODUCTION

Pollution of aquatic ecosystems by extensive and indiscriminate use of toxic chemicals by drift, runoff, drainage and leaching has become one of the most important problems worldwide.[1] Among various toxic pesticides, organophosphates have become the most widely used class of insecticides in the world replacing the low persistent and problematic organochlorine compounds and rapid biodegradability.[2,3] Dichlorvos (dimethyl-2,2-dichlorovinyl phosphate) is one of the most widely used organophosphorus insecticides used in the control of various pest & ectoparasitic that infect domestic animals, stored grains and non - target animals of tropical aquaculture. It is also used to combat outdoor and in-home mosquito vectors of several tropical diseases.[4] The insecticide is highly toxic to fishes and other aquatic organisms. It is a powerful nerve poison, since it inhibits the ACHE(Acetyl choline esterase) activity in the nervous system by blocking synaptic transmission in cholinergic neurons with disruption of the nerve function causing parasympathetic disorders and death of the organism.[5] Fishes are the most important inhabitants of the aquatic ecosystems which are more frequently exposed to and affected by these toxic pesticides because it is believed that regardless of where the pollution occurs, it will eventually end up in the aquatic environment.[6,7]

*Corresponding author :
Phone : 9802308841
E-mail : sushmas793@gmail.com

Pesticides can accumulate in fish and affect human health too via ecological cycling and biological magnification.[8] The present study is an attempt to estimate the biochemical changes in kidney of fresh water fish *Anabas testudineus* exposed to various concentration of nuvan for different duration of exposure.

Several authors evaluated the toxicity and other effects of dichlorvos as a potential chemical contaminant on various commercially and ecologically important fish species. 96h LC50 values of dichlorvos to different fish species have been reported: *Anabas testudineus* - 2.35mg/L etc.[9,10,11]

MATERIALS AND METHODS

Collection of the sample species:-

25 fresh samples of the live fish, *Anabas testudineus* were collected from the local fish market of Madhepura, Bihar & kept in the control glass aquarium tank of 20 liter capacity which was sterilized with 1% $KMnO_4$ & washed two times with non-chlorinated water. The average length and weight of fishes were 10-12 cm and 50-60 g respectively. The control fishes were acclimatized for one week before exposure to the nuvan LC doses. The water used for toxicity test contained 20-25°C and 7.2 pH during acclimations they were fed with market food or egg yolk twice a day. Feeding was stopped 24 hr before starting the experiment. Dead fish (If any) was removed from aquaria as soon as possible to avoid water fouling and water was changed after 2 or 3 days.

Exposure treatments of fishes with different concentration of nuvan:-

Syngenta India Ltd make organophosphate nuvan (DDVP) was used the present study. Four aquaria were set up for each concentration & duration of exposure which contained five fishes in 15 L dechlorinated water. Two different concentrations of nuvan- 2.5ppm & 5ppm were taken in each set of four tanks separately & regular observation on the fishes behavior, morphological changes indicative of biochemical alterations as well as casualty were noticed before taking the blood samples for biochemical assay.

Quantitative biochemical assay:

Blood samples from each treated fish for four different hours of exposure-24 hrs, 48hrs, 72 hrs & 96 hrs were collected 24 hrs after exposure till the death in all the four tanks. The biochemical parameters were quantitatively estimated by Glycogen, total protein, total lipid, total cholesterol, high density lipoprotein & low density lipoprotein methods respectively.[12-17] The data was analyzed statistically by log dose/probit regression line method, which was calculated 0.024ml/L. All the fish from each of the control & treated group were anesthetized and the kidney was removed after completion of their exposure time.

RESULTS AND DISCUSSION

From the experiment as conducted above the comparative data on the toxicity of nuvan with respect to different quantitative biochemical assay has been shown below in Table no 1 & 2 that shows a great variation when exposed to different time period. Glycogen content seemed to get reduced with increase in the doses of nuvan during different exposure. Similar finding has also been reported by different authors, they observed loss of glycogen *Channa punctatus*, reported decrease kidney glycogen in *Channa gachua* (Ham.) due to overcome the stress of pollution after M-45 interaction.[18,19,20]

While protein content also showed great variation in its at different exposure of time. Similar findings was also reported by other authors with decrease protein content in *Channa punctatus* after the exposure of pesticide due to the increased energy demands for the compensation of stress.[21,22]

As per the picture of biochemical assay showed in the graph I & II (related to Table 1,2) lipid is the only parameter that reflects rising trend in its quantitative concentrations in fishes treated with both the doses of nuvan (2.5 & 5ppm).

The concentration of LDL & HDL reflect most decreasing trend due to nuvan toxicity whereas glycogen & total protein also followed the path of decline. Similar results were also shown with respect to cholesterol, HDL & LDL are synthesized by both liver and intestine and low density lipoprotein is synthesized in the liver only. The present findings also get support with the finding of Lowry and Sargent in fishes who reported the increase lipid metabolism during stress condition. Similar findings were also reported by Sadadamani and Kalamani in *Channa punctatus*. Thus the present study showed that organic pesticides induced alteration in different

biochemical level such as glycogen, protein, lipid, cholesterol, HDL & LDL depending on different exposure of time.

The alterations in the biochemical parameter also exhibit its corresponding linkage with the overall metabolism & physiology of the fishes which comparatively remain in high order of biological activities in control condition. Therefore, direct or indirect the nuvan intoxication has adverse impact on the overall biology, metabolism & physiology of fishes in general & *Anabas testudineus* in particular.

The arbitrary use of nuvan in agricultural field is therefore not eco-friendly as it can create adverse impact on the important food resource - fishes present in the crop field or adjoining ponds.

Table 1: Nuvan intoxication (2.5ppm concentration) in biochemical parameters of *Anabas testudineus* during different exposures

Sl no.	Parameters	Control group	Treated group			
			24 hrs	48 hrs	72hrs	96hrs
1	Glycogen	0.9805	0.9731	0.9089	0.8262	0.8092
2	Total protein	0.6570	0.6209	0.5667	0.5087	0.4998
3	Total lipid	1.4311	1.7945	1.7085	1.6954	1.6739
4	Cholesterol	0.5119	0.5066	0.4976	0.4709	0.4535
5	HDL	0.6127	0.5562	0.3291	0.2650	0.1989
6	LDL	0.3460	0.3787	0.1614	0.2240	0.1785

Graph I: Histogram showing the alterations in biochemical parameters of fishes *Anabas testudineus* treated with 2.5ppm nuvan.

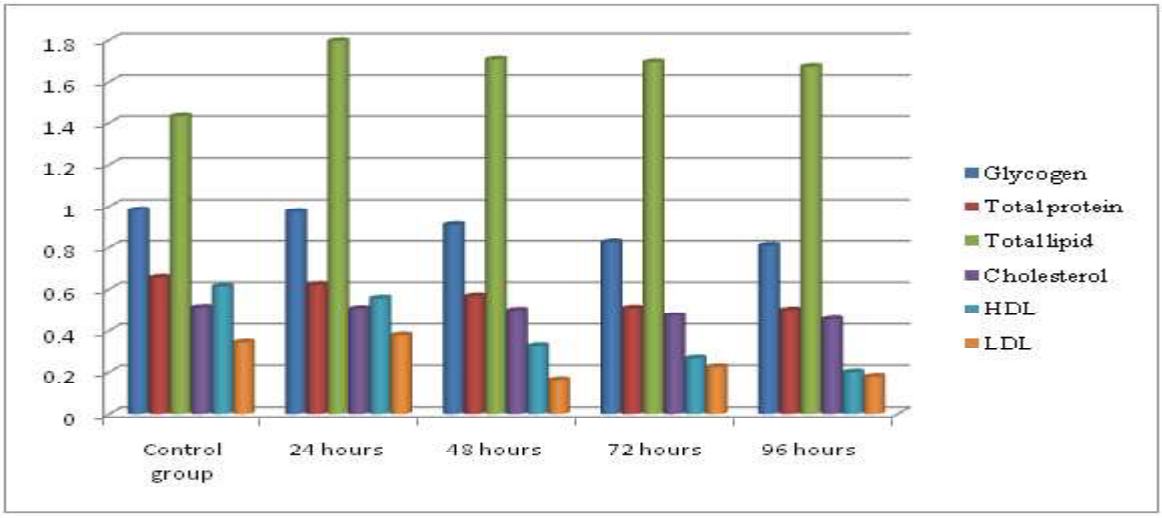
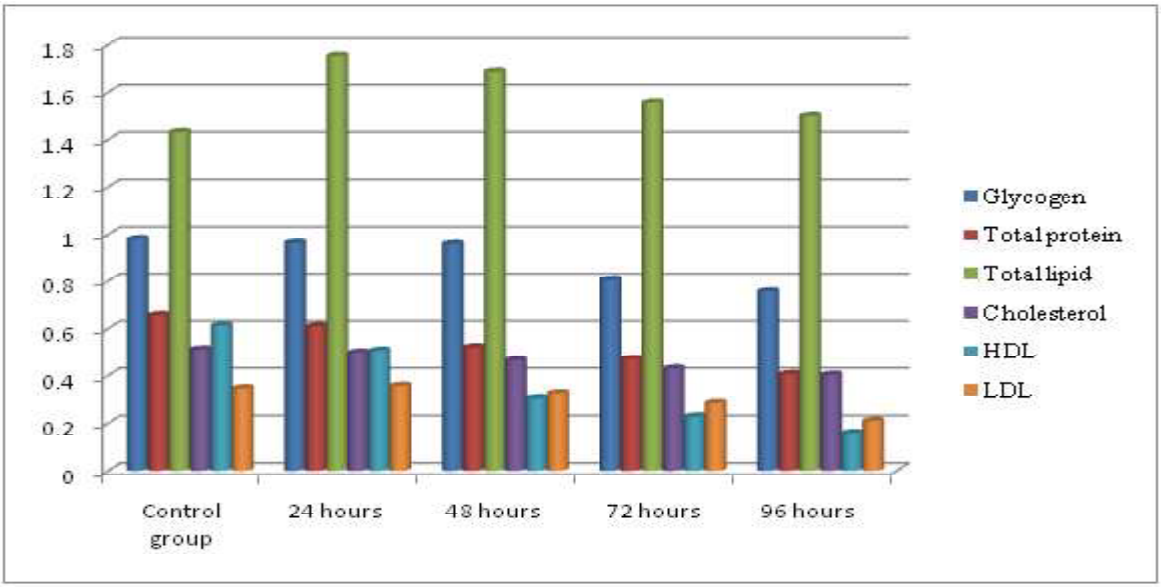


Table 2: Nuvan intoxication (5ppm concentration) in biochemical parameters of *Anabas testudineus* during different exposures

Sl no.	Parameters	Control group	Treated group			
			24 hrs	48 hrs	72hrs	96hrs
1	Glycogen	0.9805	0.9631	0.9589	0.8062	0.7564
2	Total protein	0.6570	0.6101	0.5212	0.4709	0.4065
3	Total lipid	1.4311	1.7542	1.6898	1.6578	1.6023
4	Cholesterol	0.5119	0.4987	0.4655	0.4298	0.4034
5	HDL	0.6127	0.5067	0.3043	0.2286	0.1578
6	LDL	0.3460	0.3568	0.3256	0.2856	0.2098

Graph II: Histogram showing the alterations in biochemical parameters of fishes *Anabas testudineus* treated with 5 ppm nuvan



ACKNOWLEDGEMENT

The author is very thankful to Prof. R.B Jha, R.M College, Saharsa & Prof. Dr. Arun Kumar, Head Dept. of Zoology, B.N Mandal University, Madhepura for their valuable guidance and critical suggestions for completion of this research paper.

REFERENCE

1. **Cerejeira MJ, Viana P, Batista S, Pereira T, Silva E, Valerio MJ, Silva A, Ferreira M and Silva FAM, 2003.** Pesticides in Portugal surface and ground waters. *Water Res.,* **37:**1055-1063.
2. **Oruc EÖ, Üner N, Sevgiler Y, Usta D and Drumaz H, 2006**. Sublethal effects of organophosphate diazinon on the brain of *Cyprinus carpio*. *Drug Chem. Toxicol.*, **29:** 57-67
3. **Ye J, Zhao M, Liu J and Liu W, 2010.** Enantioselectivity in environmental risk assessment of modern chiral pesticides. *Env. Poll.,* **158(7):** 2371-2383.
4. **Assis CRD, Amaral IPG, Castro PCF, Carvalho JLB and Bezerra RS, 2007.** Effect of Dichlorvos on the acetyl cholinesterase from Tambaqui (*Colossoma macropomum*) brain. *Env. Toxicol. Chem.,* **26(7):** 1451-1453.
5. **Nguyen VC, Nguyen TP and Mark B, 2008.** Brain cholinesterase response in the snakehead fish (*Channa striata*) after field exposure to diazinon. *Ecotoxicol. Env. Safe.*, **71:** 314-318.
6. **Scott GR and Sloman KA. 2004.** The effects of environmental pollutants on complex fish behaviour: integrating behavioural and physiological indicators of toxicity. *Aqua. Toxicol.,* **68(4):** 369-392.
7. **Firat O, Kargin F and Kötemen Y, 2011.** A comparative study on the effects of a pesticide (cypermethrin) and two metals (copper, lead) to serum biochemistry of Nile tilapia, *Oreochromis niloticus*. *Fish Physiol. Biochem.,* **37(3):** 657-666.
8. **Chebbi SG and David M, 2011.** Modulation in the protein metabolism under sublethal concentration of Quinalphos intoxication in the freshwater common carp, *Cyprinus carpio* (Linnaeus, 1758). *Int. J. Pharma. Biol. Arch.,* **2(4):** 1183-1189.
9. **Patar AA, Hassan WRM, Hashim N and Yusof FZM, 2015.** Toxicity Effects of Malathion, Dichlorvos and Temephos on acetylcholinesterase in climbing perch (*Anabas testudineus*). *Adv. Env. Biol.,* **9(21):** 81-86.

10. **Kumar S. 2014.** Acute toxicity evaluation of Nuvan in liver of *Channa puncatus* (Bloch). *Adv. Res. Agri. Veter. Sci.,* **1(1):** 31-34.

11. **Kumar S and Gautam RK, 2014.** Study of biochemical toxicity of nuvan in *Channa punctatus* (Bloch.). *Adv. Res. Agri. Veter. Sci.,* **1(1)**: 31-34.

12. **Montgomery R. Determination of glycogen, 1957**. *Archives of Biochemistry and Biophysics*. **67(2):** 378-386.

13. **Dumas BT, Wastson W, Biggs MG. 1971.** Albumin standard and the measurement of serum albumin with bromocresol green. *Clin. Chem. Acta.* **31:** 87-96.

14. **Folch J, Lees M, Stanley GHS, 1957.** A simple method for the isolation and purification of total lipids from animal tissues. *J. Biol. Chem.* **226:** 497-509.

15. **Wybenga DR, Pileggi VJ, Dirstine PH, Di Giorgio J, 1970.** Direct manual determination of serum total cholesterol with a single stable reagent. *Clin. chem.* **12:** 980-984.

16. **Warnick GR, Ngugan T, Albers A. 1985.** A comparison of improved precipitation methods for quantification of high density lipoprotein cholesterol. *Clin. chem.* **31:** 217-22.

17. **Friedwald WT, Levy RI, Fredickson DS, 1972.** Estimation of concentration of low density lipoprotein in plasma without use of the preparative ultracentrifuge. *Clin. chem.* **18:** 499-502.

18. **Murthy AS & Devi AP, 1982.** The effect of endosulfan and its isomers on tissue Protein, glycogen and lipid in the fish *Channa Punctatus*. *Pesticide Biochem Physiol.* **17:** 280-286.

19. **Kumar R, Kumar S & Narain R. 1996.** Effect of dithane M-45 on biochemical composition in some organs of *Channa gachua* (Ham.). *Him. J. Environ. Pollot.* **6:** 273-275.

20. **Joshi N, Kumar S, 1986.** Some biochemical responses in *Paralelphusa mosoniana* (Handerson) during sub lithel monocrotophos poisoning. *Him. J. Environ*. **10:** 83-86.

21. **Tilak KS, Veeraiah K, Koteswara Rao D. 2004.** Biochemical changes induced by chlorpyrifos, an organophosphate compound in sublithal to fresh water fish *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*. *J. Environ. Biol.* **26(2):** 341-347.

22. **Ramamurthi K, 1988.** Impact of hephochloron hematological and selected biochemical parameters in fresh water fish *Channa punctatus* (Bloch.). Ph.D. Thesis S.V.S. Torupati, India.

23. **Sastry KV, Siddiqui A, 1984.** some hematological, biochemical and enzymological parameters of a fresh water teleost fish *Channa punctatus* exposed to sub lethal concentrations of quinalphas. *Pestic. Biochem. Physiol.* **22:** 8-13.

***