IJBPAS, February, 2020, 9(2): 41-47

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

GERBIL: AS AN INDICATOR OF PESTICIDE POLLUTION IN AGRICULTURE FIELDS

GODHA M[1*] AND JAIN PK[2]

Department of Life and Basic Sciences, Jaipur National University, Jaipur, Rajasthan, India

***Corresponding author: Emails: [1]meenagodha.phd@gmail.com; [2]pj9331@gmail.com**

Received 17th Aug. 2019; Revised 6th Sept. 2019; Accepted 2nd Sept. 2019; Available online 1st Feb. 2020

https://doi.org/10.31032/IJBPAS/2020/9.2.4932

ABSTRACT

Pesticides are chemical substance used in agricultural land to protect the crops and increase the production and also accumulate in food chain causing risks to mammals. Gerbil is easily found in agricultural fields and is a most destructive pest of crops and stored grains in Northern India, especially in the desert of Rajasthan. They possess similar physiological and biological mechanism to human beings. Therefore present study is focused on pesticide pollution in agricultural fields taking the Gerbil as a biological indicator by analyzing the pesticide residue in liver, kidney and brain of Gerbil. The Gerbil was randomly collected from the agricultural fields of Jaipur. They were not given any pretreatment and their tissues (Liver, Kidney and Brain) were directly taken for analyzing organo-chlorine pesticide and their extent of contamination was estimated by GLC. In present study enough concentration of organo-chlorine pesticide residue was found in tissues of Gerbil which enter the animal via food chain directly or indirectly and it reveals that Gerbil can be used as an indicator of pesticide pollution in agricultural fields. The tissues found were laced with pesticides and the brain had the maximum amount of total HCH while liver and kidney had the maximum amount of DDT respectively.

Keywords: GLC, Organo-chlorine pesticide, Rajasthan, Bioindicator, Contamination, Residue

INTRODUCTION

Man in his urge to flourish on earth has unintentionally created many problems of great magnitude. He started the extensive use of pesticides in agriculture and public

health as early as 1944 **[1]**. In agriculture, pesticides are widely used to control weeds, pests, diseases, and other plant pathogens to increase the production **[2]**. Despite their usefulness, pesticides could pose potential risks to food safety, the environment, and all living things. The widespread application of pesticides in agriculture, public health, industry and in homes can result in the accumulation of pesticides in environment **[3]**. By the use of pesticides in the last five decades, the quantity and quality of food is improved. But their adverse effect on untarget organisms has also increases **[4]**.

World pesticide expenditure reaches more than $ 30 billion annually with pesticides alone accounting for nearly one third of the total amount **[5]**. The persistent use of organo-chlorine pesticides such as DDT, dieldrin, aldrin, chlordane, heptachlor etc. remain in soil for many years and even decades. They are progressively transferred from soil to edible crops, grass, herbivores and eventually to man. The wide spread use of pesticides and the presence of their residues in aquatic biota and food commodities has resulted in their accumulation in almost every human being and causing various health problems like carcinogenicity, mutagenicity and teratogenicity **[6]**. The International Agency for Research on Cancer (2015) classifies DDT as group 2A "probably Carcinogenic to humans **[7]**. To view the health of natural eco system, bio indicators like plants, animals, planktons and microbes are used **[8]**. Animal indicators also help in detecting the amount of toxins present in the tissues of animals **[9]**. The organo-chlorine pesticides mainly affect central nervous system and liver of mammals. All the members of organo-chlorine compounds are neurotoxic substances **[10]**. The majority of modern pesticides owe their toxicity as they are able to attack the nervous system as the primary target. Poisoning the nervous system is the quickest and surest way of chemically upsetting the regular body mechanism. Pesticides also alter the taste responses in Gerbil **[11]**. The present study is designed to access the organo chlorine pesticide residue levels in kidney, liver and brain of Gerbil.

MATERIALS AND METHODS

Pesticides are perhaps one of the most ubiquitous of the potentially harmful chemicals encountered in the environment. Considering the fact that a wide variety of pesticides accumulate almost at all the trophic levels so a continued surveillance on the levels of contaminants becomes an important task to ensure the wellbeing of human progeny.

Therefore, present study embodies to monitor the pesticide pollution in the agricultural fields, taking the Gerbil as a biological indicator by analyzing the pesticide residues in liver, brain and kidney of Gerbil.

Toxicants selected:

Organo-chlorine pesticides due to their non-biodegradable nature are persistent in the environment. The persistent organo-chlorine pesticides remain in soil for many years and even decades. The study was concentrated mainly on organo-chlorine pesticides.

Collection of Sample:

The Gerbil (*Meriones hurrianae* or Jerdon) was randomly collected from the agricultural fields of Jaipur. They were not given any pretreatment and their tissues (brain, kidney, liver) were directly taken for analyzing organo-chlorine pesticide and the extent of contamination was estimated by GLC.

Figure 1: Experimental protocol

RESULTS AND DISCUSSION

In present study Gerbil were taken from the agricultural field as the indicator of organo chlorine pesticides pollution. Then their tissues brain, liver, kidney were analyzed in GLC. The tissues were found laced with pesticides and the brain had the maximum amount of total HCH (8.785ppm), while liver and kidney had the maximum amount of DDT (6.987 ppm) and (1.400 ppm) respectively **(Table 1)**.

The total organo chlorine pesticide level in brain was found to be 15.354 ppm. In liver it was 11.400 ppm followed by kidney which had the concentration of 2.580 ppm of organo chlorine pesticides. Thus the total organo chlorine pesticide burden in animal was (29.334) ppm **(Figure 2)**.

Table 1: Organo chlorine pesticide levels in different tissue of Gerbil collected from agricultural fields.

Organo-chlorine residues	Tissues		
	Brain	Liver	Kidney
α-HCH	0.117	.022	0.71
β-HCH	8.62	.003	.045
γ-HCH	.048	.410	.081
TOTAL HCH	8.785	0.435	0.197
Heptachlor	0.0035	.067	.025
H. Epoxide	1.01	.424	.387
TOTAL HEP	1.0135	0.491	0.412
Aldrin	.116	3.879	.571
DDE	4.83	.602	1.07
DDD	.016	6.385	.330
DDT	.602	ND	ND
TOTAL DDT	5.44	6.987	1.400
TOTAL	15.354	11.400	2.580

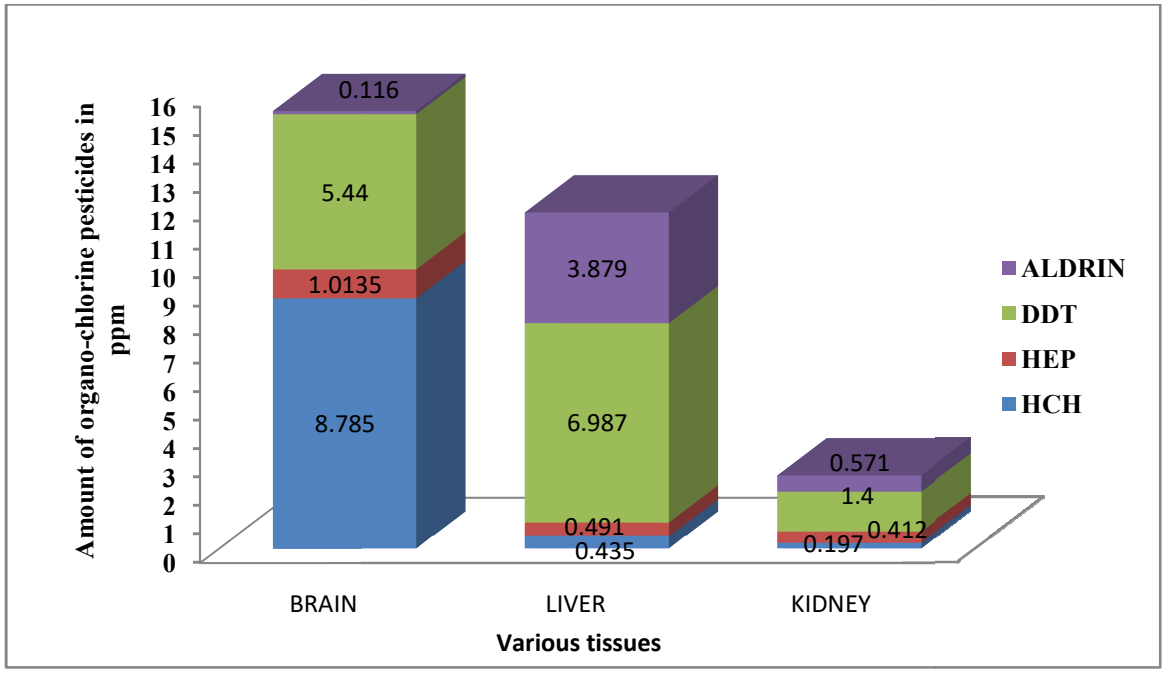

Figure 2: Organo-chlorine pesticide residue levels in tissue of brain, liver and kidney of Gerbil

CONCLUSION

In present study *Meriones hurrianae* (JERDON), the Indian desert Gerbil was selected as an indicator of pesticide pollution, which is a most destructive pest of crops and stored grains in Northern India, especially in the desert of Rajasthan. The values reported in the literature of WHO (1995) indicates that mice and rats are more sensitive to pesticide **[12]**. Present study also indicate pesticide residue in various tissues of Gerbil. The mechanism by which the organo chlorine pesticides exert their toxic action on the target or non-target organisms depends largely on the biochemical processes of the animal and the physiochemical properties of the organo

chlorine compounds. Liver being the main site of metabolic activity in the body and is highly active in both toxifying and detoxifying pesticides, was selected for the study purpose. It acts as a vital processing organ where nutrients absorbed from the G.I. tract and transformed into material required by specialized tissue of the body. All organo chlorine compounds are neurotoxic substances. Present study also indicates that all organo chlorine pesticide was found in brain. The maximum amount of HCH was found in brain. BHC causes damage to the endocrine glands of Gerbil **[13]**. The combination of DDT and dialdrin is much more toxic to the liver of rats than administering each pesticide separately **[14]**.

Present study also indicates the maximum amount of DDT and aldrin was found in liver. Organo chlorine residues are detected in measurable concentrations in brain, liver and kidney because of the world wide pollution of air, water, soil and foods. The concentrations vary from region to region according to chemical, climatic, socio-economic and geographic factors. Persisting pesticides used in agriculture are found in relevant concentrations in agriculture products from there they enter the nutritional chain **[15, 16]**.The extent of hazard depends on the amount of residue and its toxicity, the residues of these organo chlorine pesticides gradually increase as they pass from lower to higher trophic level through a process of bio-magnification. In present study enough concentration of organo chlorine pesticide residue was found in Gerbil tissues (liver, kidney and brain) which enter the animal via food chain directly or indirectly. From present study it is evident that Gerbil can be used to monitor the pesticide pollution in agricultural fields.

AKNOWLEDGEMENT

We thank individuals and the institution (Department of Zoology, University of Rajasthan, Jaipur) for providing their valuable advice and facility during preparation of the manuscript.

Author Contributions: This study was conceptualized by Meena Godha. The literature were reviewed and data were analyzed Priya Kumari Jain. Draft manuscription, further review, editing was done by Meena Godha and Priya Kumari Jain.

CONFLICT OF INTEREST: Nil

REFERENCES

[1] Lillie R.D. and Smith M. I. Pathology of Experimental Poisoning in cats, rabbits and rats with 2,2-Bis (Para-Chlorophenyl) -1,1,1-tricholoroetane, U.S. Public Health Reports. 59:979. 1994.

[2] Christos A.D. and Ilias G.E. Pesticide Exposure, Safety Issues and Risk Assessment Indicators**.** Int J Environ Res Public Health, 8(5), 2011, 1402–1419.

[3] Kumar A., Soni I., Bhatnagar P. and John P.J. Organochlorine pesticide residues in milk and blood of women from Anupgarh, Rajasthan, India, Environmental Monitoring and Assessement**,** 2006, 116, 1-7.

[4] Özkara A., Akyil D. and Konuk M. Chapter Pesticides, Environmental Pollution and Health http://dx.doi.org/10.5772/63094. 2016.

[5] Fairchild J. Structural and functional effects of Herbicides on non-target organisms in aquatic ecosystems with an emphasis on atrazine. Chapter 18. 2011.

[6] Bassil K.L., Vakil C., Sanborn M., Cole D.C., Kaur J.S. and Kerr K.J. Cancer health effects of pesticides: Systematic Review. Canadian Family Physician, 53, 2007, 1704 – 1711**.**

[7] IARC Monographs. Evaluate DDT, Lindane and 2, 4 – D. World health organization, 2015

[8] Parmar T.K., Rawtani D. and Agrawal Y.K. Bioindicators: the natural indicator of environmental pollution. Frontiers in Life Science, 9(2), 2016, 1-9.

[9] Khatri N. and Tyagi S. Influences of natural and anthropogenic factors on surface and ground water quality in rural and urban areas. Frontiers in life science. 8(1), 2015, 23-39.

[10] Kenneth A.H. The chemistry of pesticides. 1st edition, ISBN –13:978-3527259694. 1987.

[11] Schiffman S.S. and Nagle H.T. Environmental Pollutants alter taste responses in the Gerbil, Pharmacol Biochem Behav. 52(1), 1995, 189-194**.**

[12] WHO 1985. Data sheets on Pesticides.

[13] Hashim K.A., Sreedevi K.K.A., Santosh S. and Sobha V. Study on the influence of Benzene Hexa Chloride in certain Endocrine glands of Gerbil. Proceedings of World Congress on Engineering

London, U.K. 2, (2009) ISBN: 9789881821010.

[14] Kimbrough R.D., Gaines T. B. and Linder R. E. The ultra-structure of liver of rats fed DDT and dialdrin. Archs. Environment Health Reports, 22(4), 1971, 460-67**.**

[15] Ehrlich P.R. and Mooney H.A. Extinction, substitution and Eco system Services. Bioscience. 33(4), 1983, 248-254.

[16] Clarkson T.W. Environmental Contaminants in the Food Chain. Am J Clin nutr, 61(3), 1995, 682S – 686S.