SAR Journal of Psychiatry and Neuroscience

Abbreviated Key Title: *SAR J Psychiatry Neurosci*
Home page: https://sarmedjournals.com

ISSN 2707-7764 (P)
ISSN 2709-6939 (O)

Review Article

Imidacloprid Influence on Prion Protein as a Probable Cause of Creutzfeldt –Jakob Disease

Mosab Nouraldein Mohammed Hamad*
Medical Parasitology Department, Faculty of Health Sciences, Elsheikh Abdallah Elbadri University, Berber, Sudan

***Corresponding Author**
Mosab Nouraldein Mohammed Hamad

Article History: | Received: 02.06.2021 | Accepted: 06.07.2021 | Published: 12.07.2021 |

Abstract: Imidacloprid is an insecticide used widely in the United States and Canada to kill insects that cause harm in farms and affect wide range of vegetables, seeds and fruits crops. In this review we use many evidences to suggest the responsibility of chronic exposure to Imidacloprid in development of Creutzfeldt –Jakob disease by causing modification phosphatidylinositol anchor on the prion protein. Excess use of these insecticide in Canada and US lead to occurrence of most cases of CJD in both countries. Experimental work needed to confirm this hypothesis.

Keywords: Creutzfeldt- Jakob disease, Prion protein, Imidacloprid, Insecticides, Crops pollution.

INTRODUCTION

Creutzfeldt-Jakob disease (CJD) is a rapidly progressive, invariably fatal neurodegenerative disorder believed to be caused by an abnormal isoform of a cellular glycoprotein known as the prion protein. CJD occurs worldwide and the estimated annual incidence in many countries, including the United States, has been reported to be about one case per million population.

Classic CJD is a human prion disease. It is a neurodegenerative disorder with characteristic clinical and diagnostic features. This disease is rapidly progressive and always fatal. Infection with this disease leads to death usually within 1 year of onset of illness [1].

Imidacloprid [1-(6-chloro-3-pyridylmethyl)-N-nitroimidazolidin-2-ylideneamine] belongs to a new chemical family of chloronicotinyl compounds whose mode of action on the insect nervous system differs from that of traditional neurotoxic products. Imidacloprid, a strong systemic compound, is effective against several sucking and mining pests [2], it blocks postsynaptic nicotinergic acetylcholine receptors. No clinical description of symptoms was available as both patients were found dead.

In the only other report of human poisoning, the toxicant, a combination of 9.7% imidacloprid, < 2% surfactant, and N-methyl pyrrolidone (solvent), produced drowsiness, disorientation, dizziness, oral and gastroesophageal erosions, haemorrhagic gastritis, productive cough, fever, leukocytosis, and hyperglycaemia in a patient who made an uneventful recovery in four days (2). Our patient manifested fever and drowsiness. Although the initial tachycardia could be attributed to nicotinic effects of the compound, it is unclear if the bradycardia was due to toxic effects or metabolic disturbances. The vomiting again could have been secondary to gastric irritation; however, this was not evaluated with an upper gastrointestinal scopy [3].

Study done by Kumiko Taira showed that; total 91 data including 15 data from CKD patients, and 76 data from non-CKD participants, The symptoms frequently complained of by 91 participants were recent memory loss with food diary 67.0%, muscle symptoms 60.4%, chest pains or palpitation 57.1%, general fatigue 52.7%, anger 51.6%, headache 49.5%, restlessness 34.1%, auditory hallucination 33.0%, and dizziness after stand up 31.9% [4].

Imidacloprid exerts toxic effects on the non-target organs, such as the salivary glands, which increases the efficacy of this compound in the management of stink bug infestations [5], and we suggest that it induces same effect in human upon chronic exposure to it.

A study done by Kara *et al*. showed that; that there were negative effects of IMI on learning of infants and the adverse effects of IMI increase in a dose-dependent (2 and 8 mg/kg dose) manner. Additionally, in the adult experimental group, adverse effects were only observed at high doses [6], and accumulation of imidacloprid over time upon chronic exposure to these chemical in contaminated vegetables, seeds or fruits or even polluted water may influence the cognitive functions in adults.

A study done by A. Decourtye *et al*. showed that; Imidacloprid impairs memory and brain metabolism in the honeybee (Apis mellifera L.) [7], and we hypothesize that chronic exposure to this chemical may affect brain functions in human.

Imidacloprid cause salivations and muscles weakness in animals and disorientation in human [8]. A study done by Sriapha *et al*. showed that; Cases of acute imidacloprid poisoning are mostly mild. Gastrointestinal symptoms and minor neurological presentations are common, while the mortality rate is low. In addition to a large amount of ingestion, the primary presence of cardiovascular effects, central nervous system effects, dyspnea, and diaphoresis are associated with death [9].

A study done by Lin *et al*. showed that; Acute Imidacloprid Poisoning Caused Prolong Depression of Butyrylcholinesterase [10].

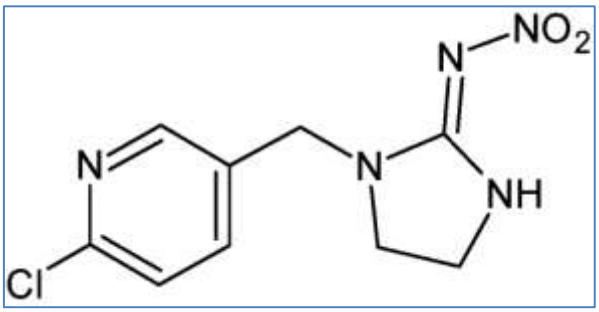

Fig-1: Shows the chemical structure of imidacloprid

Canadian farmers will still have access to imidacloprid for use on most crops, Health Canada's Pest Management Regulatory Agency (PMRA) says in a published decision on May 19, 2021 [11].

Study done by Puredy showed that; High-dose exposure to systemic phosmet insecticide modifies the phosphatidylinositol anchor on the prion protein [12], and I suggest that Imidacloprid is capable to induce this modification and cause Creutzfeldt-Jakob disease.

CONCLUSION AND RECOMMENDATIONS

Chronic exposure to Imidacloprid in polluted vegetables, fruits, seeds and water lead to modify the phosphatidylinositol anchor on the prion protein and lead to development of Creutzfeldt- Jakob disease. Experimental research is recommended to confirm that, through detection of Imidacloprid levels in urine and blood of CJD patients.

ACKNOWLEDGEMENT

I am very grateful to supervisors of Douad Research Group, Facebook page, https://www.facebook.com/groups/DaoudResearch, because they made me search about the probable etiology of Creutzfeldt - Jakob disease. So brain storming by such post may lead to positive outcomes.

REFERENCES

1. https://www.cdc.gov/prions/cjd/index.html.
2. Suchail, S., Guez, D., & Belzunces, L. P. (2000). Characteristics of imidacloprid toxicity in two Apis mellifera subspecies. *Environmental Toxicology and Chemistry: An International Journal*, *19*(7), 1901-1905.
3. David, D., George, I. A., & Peter, J. V. (2007). Toxicology of the newer neonicotinoid insecticides: imidacloprid poisoning in a human. *Clinical toxicology*, *45*(5), 485-486.
4. Taira, K., Kawakami, T., Weragoda, S. K., Herath, H. A. S., Ikenaka, Y., Fujioka, K., & Komori, M. (2021). Urinary Concentrations of Neonicotinoid Insecticides and Tubular Biomarkers, and Clinical Symptoms in Chronic Kidney Disease Patients, Their Family Members and Others in Dry-zone of Sri Lanka: a Small Scale Field-based Case-Control Study.
5. Castellanos, N. L., Ferreira-Filho, N. A., Rodrigues, H. S., Martinez, L. C., Serrão, J. E., & Oliveira, E. E. (2021). Imidacloprid-mediated alterations on the salivary glands of the Neotropical brown stink bug, Euschistus heros. *Ecotoxicology*, *30*(4), 678-688.
6. Kara, M., Yumrutas, O., Demir, C. F., Ozdemir, H. H., Bozgeyik, I., Coskun, S., & Bal, R. (2015). Insecticide imidacloprid influences cognitive functions and alters learning performance and related gene expression in a rat model. *International journal of experimental pathology*, *96*(5), 332-337.
7. Decourtye, A., Armengaud, C., Renou, M., Devillers, J., Cluzeau, S., Gauthier, M., & Pham-Delègue, M. H. (2004). Imidacloprid impairs memory and brain metabolism in the honeybee

(Apis mellifera L.). *Pesticide biochemistry and physiology*, *78*(2), 83-92.
8. http://npic.orst.edu/factsheets/archive/imidacloprid.html.
9. Sriapha, C., Trakulsrichai, S., Tongpoo, A., Pradoo, A., Rittilert, P., & Wananukul, W. (2020). Acute Imidacloprid Poisoning in Thailand. *Therapeutics and Clinical Risk Management*, *16*, 1081.
10. Lin, C. C., Li, H. J., & Chiu, T. F. (2015). Acute Imidacloprid Poisoning Caused Prolong Depression of Butyrylcholinesterase. *J Clin Toxicol*, *5*(261), 2161-0495.
11. https://germination.ca/imidacloprid-still-allowed-for-use-in-canada/
12. Purdey, M. (1998). High-dose exposure to systemic phosmet insecticide modifies the phosphatidylinositol anchor on the prion protein: the origins of new variant transmissible spongiform encephalopathies?. *Medical hypotheses*, *50*(2), 91-111.