Glyphosate, Phorate, and Monocrotophos Hazardous Pesticide Usage and Its Public Health Impact – An Empirical Analysis

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Abstract

Background: Pesticides are used extensively around the world and it has many health significance due to the usage of glyphosate,phorates, and monocrotophos that were mainly used as organophosphate pesticides in all the countries. **Aim:** To evaluate the countries which banned glyphosate, phorates, and monocrotophos hazardous pesticide usage and to assess the severity of risks caused by exposure of the pesticides.**Methodology**: This study was based on a review of scientific publications on usage of hazardous pesticides such as glyphosate, phorates, monocrotophos, and its impact on public health.Data were retrieved from the manual and electronic database by using the search engines (PubMed and google scholar). **Results**: European countries had banned glyphosate, phorate, and Monocrotophos pesticides within the year 2015 to 2019 whereas in India, two states namely Punjab and Kerala had banned glyphosate pesticides by the year 2018 to 2019, Phorates pesticides had banned in 2019, and monocrotophos pesticides were banned by the two states namely Punjab and Maharashtra in the year 2018. Glyphosate pesticides caused more impact on cancer and other health effects in the body in contrast to the other two pesticides had a lesser impact on cancer.**Conclusion**: Chemical pesticides can protect and improve farm productivity. However, their inimical and environmental health effects makes an inadequate long-term solution. Hence, to overcome this problem, there must be minimization of the usage of chemical pesticides and introduction of eco-friendly natural pesticides, which are easily accessible, low cost, and healthy method of a pest control system.

Keywords: *Glyphosate, Monocrotophos, Phorates, healtheffects, Pesticides*

Introduction

Vegetal safeguard had been developed to increase the food production because of the rise in the demand of the world.Organophosphate pesticides (OPs) are the major class of pesticides in agricultural applications. These are easily degradable but more toxic than organic chlorines. According to the Environmental Protection Agency (EPA), these are the three mainly used organophosphate pesticides namely; glyphosate, monocrotophos, and phorates for pest control all over the world and these were banned in so many countries due to ill effects of the pesticides. This study is based on these three pesticides along with health significance. All the three pesticides are sold in various formulations like liquid-solid concentrations,powder form and ready to use liquid form.

Glyphosate is a broad-spectrum systemic herbicide and a crop desiccant. It has been registered as a pesticide in the United States since 1974 and it was the most commonly used herbicide in the United States. Glyphosate is a widely used weed killer worldwide in farms, lawns, etc[1].Glyphosate is an organophosphorus compound, indicatively phosphonate that primarily

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inhibits the enzyme called 5-enolpyruvyl shikimate 3-phosphate synthase. The Monsanto chemist John E. Franz first discovered Glyphosatein 1970.Finally, in the year, 1994 Monsanto established the trade name for glyphosate herbicide called Roundup and it was used with "Roundup Ready" genetically modified organisms (GMOs) [2, 3].

Phorate is an organophosphateused as an insecticide and acaricide that is used to control a wide variety of sucking and chewing insects. It is used in agriculture as a systematic insecticide and sold under several names, but most commonly used is Thimet.Phorate is a restricteduse pesticide and one among the most poisonous chemicals used for pest control. The toxicity of the phorate is very high. Being an organophosphate, phorate interferes with the function of the nervous system by inhibiting the enzyme acetyl cholinesterase. Chemically, it is an organophosphate, *O,O*-diethyl *S*-(ethylthio) methyl phosphorodithioate. They are abundantly toxic to animals as well as humans[4, 5].

Similar tophorates,Monocrotophos is an organophosphate used to control the pest. It directly acts on the central nervous system by inhibiting the enzyme named as anacetyl cholinesteraseand these varieties of pesticides are known to be neurotoxins causing muscle twitching, depression, and paralysis, etc.As it was a Restricted Use Pesticide (RUP),it could be used only by certified applicators.The trade name for Monocrotophos are, Azodrin, Bilobran, Crisodrin, Monocil 40, Monocron, Nuvacron, Pillardrin, and Plantdrin[6]. WHO classified it as a mandatory hazardous pesticide in 1986. Therefore, the United States ceased to continue the use of Monochrotophos in the year 1988and further European countries also banned the use of the same. However, it is still in use in India[7]

Merely for once in India it was banned to be used on vegetables in 2005. However, currently, monocrotophos is used to grow cotton. The present study aims to evaluate the countries that banned the hazardous pesticides namely glyphosate, phorate, and monocrotophos, because of public health impact.

Methodology

This study was based on a review of scientific publications on glyphosate, phorate, monocrotophos hazardous pesticide usage, and its public health impact. Data were retrieved from the manual and electronic database by using the search engines (Pubmed and google scholar).The countries had banned these pesticides and the harmful effect on public health were the main source of the data collected, and the data were analyzed by the empirical analysis method. A literature search to collect relevant data was performed using keywords phorate, glyphosate, and monocrotophos. Articles which were related to glyphosate, phorates, and monocrotophos were only included other than native languages thatwere excluded.

Results

TABLE 1: Glyphosate, Phorate, Monocrotophos-banned countries in worldwide

Pesticide	Banned countries	Year
Glyphosate8-9	In India -kerala Punjab	2018 2019
	Six eastern countries · Oman · Saudi Arabia · Kuwait · United arab emirates · Bahrain · Qatar	2015 -2016

Cont... **TABLE 1: Glyphosate, Phorate, Monocrotophos-banned countries in worldwide**

	European countries Czech republic Denmark France Italy Netherlands	 2018 2018 2017 2016 2015
	Belgium Canada Columbia Australia Bermuda Brazil Greece New Zealand Portugal Spain Srilanka Sweden Switzerland United kingdom Vietnam	 2017 2019 2015 2017 2019 2013 2015 2018 2017
Phorate10-11	European union Brazil India	2016 2016 2019
Monocrotophos14	USA European union In India Maharashtra And Punjab	 2016 2017 2018

Table 1 shows that most of the European countries had banned the glyphosate,phorate and Monocrotophos pesticides within the year 2015 to 2019 whereas in India,two states namely Punjab and Kerala had banned glyphosate pesticides within the year 2018 to 2019, Phorate pesticides were banned in 2019,monocrotophos pesticides were banned in two states of India (Punjab and Maharashtra) in the year 2018.

TABLE 2:Glyphosate, Phorates, Monocrotophos Pesticides-Impact on Health.

Pesticide	Carcinoma	Other effects
Glyphosate 12	Non-Hodgkin lymphoma or multiple myeloma Acute myeloid leukemia B Cell lymphoma Pancreatic islet cancers	Mammary gland diseases and obesity Males result in prostate disease and Females result in kidney disease Parkinson disease Nonalcoholic fatty liver disease Abortions and congenital abnormality in children Anxiety and depression
Phorate13-14	Prostate cancer	Neurological effects, gastrointestinal effects,cardiovascular effects, respiratory tract effects
Monocrotophos15	Growth of breast cancer cells	Respiratory tract infection, blurred vision, nausea, vomiting, diarrhea, and headache. Severe cases may lead to psychosis, arrhythmia, coma and cardiac arrest leading to death.

Table 2 shows that the glyphosate pesticides causing more impact on cancer and other effects in the body in contrary to the other two pesticides on cancer.

Discussion

The purpose of this study wasto investigatephorates, glyphosate, and monocrotophos. In the present study, the health effects caused by these pesticides were observed. Although previous studies had observed a suggestive increase in the risk of Non-Hodgkin's lymphoma and leukemia associated with the use of glyphosate pesticides.

The increasing use of pesticides causes chemical pollution resulting in potential health hazards to livestock.The data collected could be used as an aid for a better understanding of pesticides related illness and the countries had banned these pesticides. There is a need to convey the message of preventing adverse health effects and promoting the public health.

Repeated use of insecticide, herbicide, and other chemical pesticides leads to the mutated evolution of such insects, plants, and other organisms to resist themselves against chemical attacks. Killing all the insects is not the desired result here, as many healthy ecosystems require an abundance of beneficial insects, microbes, and fungi both in the soil and in theplants. In 2015, the World Health Organization's International Agency for Research on Cancer (IARC) classified glyphosate as probably carcinogenic to humans, and after reviewing the studies, the international scientists established the association between glyphosate and Non-Hodgkin lymphoma[8-13].

Exposure to phorates causes various effects on multiple organs like the kidney, lungs, heart, liver, brain. Exposure of phorates to the skin is very fast and easily absorbable causing Allergy. Even though its toxicity is high, it is stillused in the United States[13, 14]. Monocrotophos is lethal because of its action on the central nervous system of the human body. Monocrotophos is an acutely toxic pesticide that can be absorbed by various routes like skin contact, ingestion, and inhalation. It causes different health problems in organs like the lungs, brain, heart, eyes, and kidney with furthermore acute toxicity to birds, animals, and aquatic organisms[15-18].

So introducing other predator insects like (ladybugs, praying mantic) or (creating a good habitat for them as well as building soil fertility can also be an effective pest management approach. Bio pesticides are a certain type

of pesticides derived from animals, plants, bacteria, and certain minerals.

There are almost 122 and above biochemical pesticides registered with the Environmental Protection Agency (EPA) which include 18 floral attractants, 20 plant growth regulators, 6 insect growth regulators, 19 repellants, and 36 pheromones[18]. Natural pesticides alternatively to Chemical pesticides could enhance agriculture and hence awareness must be created pertaining to it.Natural pesticides are so cost-effective and easy accessibility, affordability to all the farmers.

Thus, monocrotophos can be replaced by Neem, a bio insecticidethat has the same property of monocrotophos and is used to control a variety of sucking, chewing and boring insects and spider mites on Cotton, Sugarcane, peanuts, and tobacco. Glyphosate can be replaced by Phoma Macro stoma, a bio herbicidethat has the property of glyphosate and can be used to control broadleaf weeds. Finally, phorate is replaced by d-limenone and linalool(citrus tree),Sabadilla dust (shoenocaulon Officinale), Rotenone(Lonchocarpus spp.Derris elliptical),Neem leaf, Neem seed cake, and aqueous tobacco extract which are bio insecticide havingthe same property of phoratesand are used to control a wide variety of sucking and chewing insects, mites, some nematodes, and rootworms[19].

However, the state government cannot go ahead with implementing the move. Since pesticides are governed by agencies like the Central Insecticide Board (CIB) and hence banning of the product will need a decision from the Union agriculture ministry asexclaimed by a senior official involved in the issue. Nowadays awareness programs should be arranged for farmers to reduce the use of toxic pesticides. In the future, biochemical pesticides can be used instead of spending chemical pesticides with natural treatments and remedies, which result in more sustainable elimination of pests and insects.

For sustainable development of economics, based on our limited knowledge of inferential information, the domain of pesticides illustrates a certain ambiguity in which people are undergoing lifelong exposure[20]. Thus, there is a reason to develop health education based on knowledge and practice. To disseminate within the community to minimize human exposure to pesticides.

LIMITATIONS

There may be some possible limitations in this study due toa lack of sources related to the pesticides. There were few difficulties in collecting precise data.Method used to collect data had limited ability to conduct a thorough analysis of the research.Only compact data were collected leading to an inaccurate result.

CONCLUSION

Chemical pesticides can protect and improve farm productivity. However, their inimical health and environmental effects makes an inadequate for along-term solution. The chemical pesticides are responsible for enfeebling the plant root system and further affects the fertility of the soil. Even these kinds of chemical pesticides not only affect the target organisms but also kills the non-target organisms but also they contaminate the growing crops and it becomes unfit for consumption. The use of chemical pesticides can dwindle the performance of biological control organisms such as natural predators and parasites. Organophosphates, which are used as pesticides banned in many countries but in contrary still, these are highly used in few countries knowing its serious health hazards. We can overcome this problem by minimizing the usage of chemical pesticides and introducing eco-friendly biochemical pesticides that are easily accessible, low-cost and healthy method of a pest control system that will finally lead to an era of truly sustainable agriculture.

Ethical Clearance: Department of Public Health Dentistry

Conflict of Interest: Nil

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