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Policy Brief

Promotion of Possible Protective Methods for Farmers During Exposure to Pesticides (Diazinon): A Policy Summary

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Abstract
According to the estimates of the World Health Organization (WHO), more than three million poisonings with organophosphorus derivatives occur every year, and in the meantime, more than 250 000 deaths will occur in the future. Globally, 30% of suicide cases occur with the use of organophosphorus derivatives. Organophosphorus toxins are widely used due to their stability and low cumulative effects on the ecosystem. Diazinon, as one of the organophosphates, is widely utilized in agriculture and veterinary medicine. This poison is highly toxic to humans and animals. As stated by various studies, stores of unauthorized supply of poisons and lack of proper monitoring of the permissible limit of poisons, as well as the sale of poisons without a prescription, farmers' ignorance, and indiscriminate planting of crops that are not based on traditional agriculture, can be caused by various factors related to improper use. In addition, the excessive use of pesticides and agricultural poisons can cause short- and long-term effects on health. Enhancing the antioxidant capacity is an effective solution to weaken the toxic effects of diazinon. Garlic and garlic supplements are used in many countries for their blood lipid-lowering, anti-platelet effects, and beneficial blood circulation. Some garlic products seem to have liver-protective, immune-system-enhancing, and anticancer, chemical-preventive, and antioxidant activities. The anti-inflammatory and antioxidant effects of garlic oil have been shown in different tissues. In today's world, an effective solution/decision-making for such problems based on evidence is recommended by compiling a policy brief. Therefore, to demonstrate evidence-based policy options, taking into account the existing obstacles and opportunities, it seems necessary to use intervention strategies and planning to reduce the consumption of pesticides and increase the level of protection for farmers.
Keywords: Farmers, Pesticide, Organophosphorus, Protective methods, Policy summary

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The Necessity of Writing a Policy Summary

Currently, the level of environmental pollution with various pollutants such as metals, pesticides, and mycotoxins is increasing globally; these pollutants have a significant impact on the stability of the ecosystem and the survival of living organisms. Insecticides are among the chemical pollutants that affect the environment, and their excessive use leads to major health problems (1). Since the last four decades, organophosphorus poisons have replaced other poisons such as chlorinated hydrocarbons due to their stability in the environment and their low cumulative effects (2). According to the estimates of the World Health Organization (WHO), more than three million poisonings with organophosphorus derivatives occur annually; in the meantime, more than 250 000 deaths will occur in the near future. Overall, 30% of suicides globally occur with the use of organophosphorus derivatives (3). In Iran, the average consumption of poisons per hectare is 400 g, while their globally average consumption is 1.7 kg; in other words, the consumption of poisons in the agricultural products of Iran is a quarter of the world average. The WHO estimates that there are between 3.5 and 5 million cases of acute unintentional poisoning worldwide each year. Among these, 3 million cases are severe, resulting in 20 000 deaths per year (4). These toxins have been reported as the third cause of poisoning and the main cause of death due to poisoning in Iran (3). Diazinon (0, 0-diethyl O-2-isopropyl-6-

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methylpyrimidin-4-yl phosphorothioate) is a common organophosphorus insecticide used as an insecticide, acaricide to control insects, and soil and foliage pests. It is utilized in a wide range of products, such as rice, fruits, wine grapes, sugarcane, corn, and potatoes (5). Diazinon toxicity is not limited to insects, but its harmful effects on non-target species, including humans, mammals, and birds, have been reported in various studies (6). Basically, the primary mechanism of diazinon poisoning is due to the inhibition of the acetylcholinesterase enzyme through phosphorylation, leading to the accumulation of acetylcholine in the cholinergic synapses of the nervous system and the creation of cholinergic syndrome (7). The mechanism of toxicity of organophosphates is inhibition of acetylcholinesterase enzyme (8). Significant evidence indicates that secondary cellular and molecular events are involved in sub-chronic and chronic poisoning, and oxidative stress plays an important role in this regard. In fact, oxidative stress has been proposed as the main mechanism of toxicity caused by organophosphates such as diazinon (9). Oxidative stress is defined as a disturbance in the balance between the production of reactive oxygen species (free radicals) and antioxidant defense (10). Free radicals are naturally produced in the human body; they can have positive or negative effects. To limit these harmful effects, an antioxidant system (enzymatic antioxidants such as catalase, glutathione peroxidase, and superoxide, as well as non-enzymatic antioxidants such as vitamin E, C, A, glutathione, and uric acid) is necessary (11). Plants respond to stresses in the environment by creating useful non-toxic compounds, many of which act as antioxidants when consumed (12). Natural antioxidants may act as agents that reduce and absorb free radicals, as complexers of pro-oxidant metals, and as quenchers. Oxygen generators act alone (13). Garlic is a bulbous plant that grows to a height of 1.2 meters. There are different subspecies of garlic, the most important of which are hard-neck and soft-neck garlic (7). Garlic has these effects due to having more than 200 chemical substances containing sulfur compounds (allicin, alliin, and aguen), volatile oils, enzymes (allinase, peroxidase, and myrosinase), carbohydrates (sucrose and glucose), and minerals (selenium). Amino acids such as cysteine, glutamine, isoleucine, and methionine protect cells from the harmful effects of free radicals, and bioflavonoids such as quercetin and cyanidin, allistatin I, and allistatin II (8). In a recent study, it was found that garlic oil rich in garlic organosulfur compounds is effective in modulating the expression of drug-metabolizing enzymes in phases I and II in the transcription stage, and as a result, the combinations of diallyl sulfide, diallyl disulfide, and diallyl trisulfide in garlic oil affect the drug metabolism system in the liver and have a moderating effect (9). In developing areas, unauthorized supply stores, lack of proper supervision regarding the permissible limit of poisons and the sale of poisons without a prescription, ignorance of farmers, and indiscriminate planting of crops that are not typical of traditional agriculture that requires high amounts of poisons can be related to various reasons. Incorrect and indiscriminate use of pesticides and agricultural poisons can produce short- and long-term health effects. Based on various studies, it is clear that all management processes of poisons and pests in the country need quality improvement. Globally, it is recommended that a policy brief be compiled for such decision-making cases based on evidence. The study was developed to show evidence-based policy options, taking into account the existing obstacles and opportunities, to reduce the consumption of pesticides and increase the level of protection for farmers so that health planners and policy-makers implement strategies and intervention plans with more confidence.

Criticism of Current Conditions

Based on the studies conducted in this field, improving the possible protective methods of farmers by using herbal supplements during contact with pesticides (organophosphorus), during the use of pesticides in Iran, as well as the skills of searching, understanding, and evaluating and applying information and health services, is low (14).

Policy Recommendations

1. Increasing periodic, controlled monitoring of poisons in accordance with global standards of consumption
2. Using modern and high-tech equipment in order to identify the exact level of residue in different products
3. Increasing awareness among farmers and training them on how to use, maintain, and apply pesticides from certified supply centers
4. Using herbal supplements and antioxidants native to the country and reporting their effectiveness as confirmed by clinical trial studies in order to reduce secondary complications.

Recommendation One. Planning and Implementation Level: Jihad Agriculture Organization

It is recommended that the safe exposure limit for each product be determined in accordance with global protocols and periodically monitored and evaluated by specialized and trained experts.

Second Recommendation. Planning and Implementation Level: Food and Drug Organization and Standards Department

They are suggested in the periodical and field evaluations of samples prepared in the field, and the supply fields in terms of the permitted limit and the residual concentration of the pesticide are examined with the available advanced devices and, if necessary, considering the most accurate and up-to-date methods in the world to be used for measurement.

Third Recommendation. Planning and Implementation Level: Jihad Agriculture and Environment Organization

It is recommended that periodic training programs be

conducted by environmental experts and toxicology experts to increase the awareness of farmers and pesticide workers regarding health problems for consumers and their health risks.

Fourth Recommendation. Planning and Implementation Level: University of Medical Sciences

It is recommended at scientific and academic levels, such as universities, research institutes, and knowledge companies, to express all kinds of natural and industrial antioxidants using laboratory methods and clinical trial studies to produce safe herbal supplement products such as flax seed supplement, garlic, and other native herbal and medicinal products of the country to increase the protection against the possibility of poison workers and farmers exposed to periodical contact with pesticides against short- and long-term risks.

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Competing Interests

There is no conflict of interests between the authors.

Ethical Approval

This study has been reviewed and approved by the ethics committee of Hamadan University of Medical Sciences with code IR.UMSHA.REC.1401.853.

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