

Determination of Dieldrin Residue in Some Vegetables from Damghan City Market (Semnan Province of Iran)

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Abstract: Vegetables and fruits with minerals, vitamins, micronutrients and antioxidants have an important role in strengthening the immune system. Both are essential resources of fibers that help the digestive system to normal performance. Since the use of pesticides in agriculture has extended, inadvertent contamination of foods with toxins has been reported repeatedly and experts have been stated warnings about the effects of these contaminants. The goal of this study, is detection of dieldrin residue in four common used vegetables (Spinach, Radish, Lettuce, and Fenugreek) taken from market of Damghan city (Spring 2011). Sample preparation and analysis of Dieldrin by Gas chromatography (equipped by ECD detector) performed exactly based on standard methods (AOAC). Based on the results amount of dieldrin in spinach sample showed the maximum (0.08 ± 0.01 ppm) but another samples showed 0.03 ± 0.01 , 0.03 ± 0.01 and 0.04 ± 0.02 ppm in radish, fenugreek and lettuce, respectively. according to WHO/FAO permissible dose for dieldrin (0.05 ppm), it is shown that the amount of this pesticide is higher than proposed stranded in spinach and there is significant difference between spinach and other vegetables ($p < 0.05$) but there is no difference between other vegetables about dieldrin. The present results can be an environmental alarm and risk factor for all agriculture and environmental agencies in Iran for more control of application of pesticides and more attention to human health and frequent monitoring of common pesticide residues in the agricultural products mainly fruits and vegetables.

Key words: Vegetables • Dieldrin Residue • Gas Chromatography • Damghan • Iran

INTRODUCTION

Types of fruits and vegetables have different nutrients and some are excellent source of carotenoids (precursor of vitamin A), vitamin C, folate, or potassium. Dark green leafy vegetables, colorful fruits and legumes are often naturally low in calories and no fat. Vegetables and fruits mostly contain cellulosic materials named "fibers". Many researchers concluded that consumption of fruits and vegetables reduces the incidence of colon cancer because the fibrous materials with acceleration of movement of food through the digestive tract can increase the gut evacuation that this reduces exposure to carcinogens. These materials also absorb the bile acids and make reduction of bacterial action on them. Fiber also helps the growth of useful intestinal bacteria [1-5].

Despite all the health benefits of vegetables, high use of pesticides and poisons in production procedures can

make absorption and influx of toxins to edible tissues and make irreversible risks to human health. According to numerous scientific reports, the prevalence of excessive gastrointestinal diseases such as cancer and cardiovascular disease has connection to the indiscriminate use of agricultural pesticides in many countries [5-10].

Organochlorine pesticides (OCPs) that are extensively used in agriculture have very high durability and stability because they have entered the body through the food chain and are stored in fatty tissue and it appears that these compounds are toxic to the nervous system. Indeed, although there are a variety of chlorinated insecticides in the environment, due to the high stability in the environment, their application were criticized by many researchers and responsible organizations and with respect to the increasing in application and production of phosphate pesticides, use and recommendation of chlorinate forms more reduced (Fig. 1) [10-13].

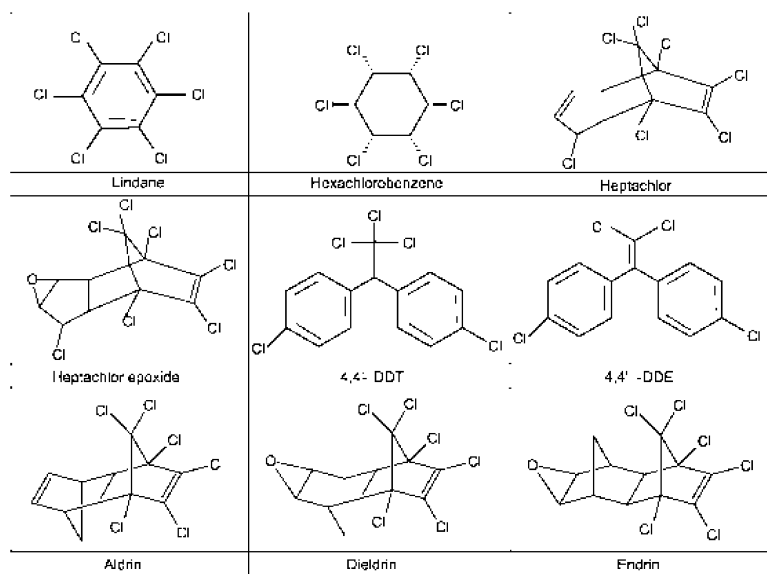


Fig. 1: Chemical structures of some common OCPs [13]

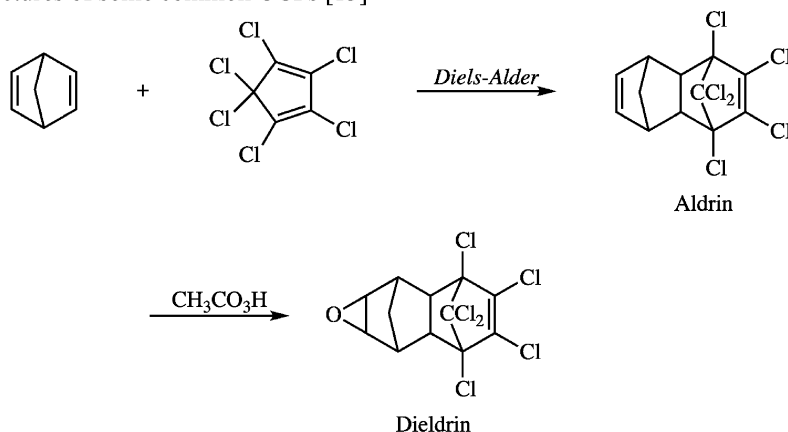


Fig. 2: Dieldrin production mechanism [19-20]

Organochlorine pesticides risk can occur through a procedure known bio accumulation So that the drainage of fields and areas that are contaminated with these toxins can cause the water pollution and enter to small plankton and other microorganisms in the water and saved in the cells and tissues of marine organisms, after that we can see the iterance of these materials to next chain of food and finally, the concentration of toxins in the fat tissue increases with the age. This procedure also known to bioconcentration factor (BCF), in the other hands, BCF is uptake of organic compounds by biota from either water or food. Many toxic organic chemicals attain concentrations in biota several orders of magnitude greater than their aqueous concentrations, and therefore, bioaccumulation poses a serious threat to both the biota of surface waters and the humans that feed on these surface-water species [14-18].

Dieldrin is an organochlorine insecticide that is now banned in the U.S. and many other countries such as Iran, but is highly persistent and for this property still presents in the environment and considered as pollutant. Dieldrin mostly used for production of cotton, corn and citrus crops that extensively treated for control of diseases carried by insects, such as mosquitoes and tsetse flies, for termites, and as a wood preservative. Dieldrin is considered a persistent organic pollutant (POP), which tend to remain in the environment and tend to inter to fatty tissue of animals for long periods of time and can travel among food chain (Fig. 2).

As Dieldrin can exist in breast milk in low level, then women farmers should be aware form contamination with agriculture pesticides. However, risks resulted from dieldrin exposure is very lower than the growth benefits for babies. The most important medical disorders about

dieldrin exposure are allergies, respiratory illnesses, and skin problems. Many reports showed Low levels of dieldrin in fish, meat, dairy products, and vegetables, in particular root vegetables, squash, melons and cucumbers. dieldrin can inter to the pulp of root vegetables, squash, melons and cucumbers, then the washing and peeling of these vegetables can not reduce pollution [21].

Although the fruits and vegetables are important sources of vitamins and minerals, but toxic materials, especially heavy metals and agriculture pesticides, can affect on health condition of crops and vegetables and also, probable drainage of pesticides and toxic materials from agriculture fields to the rivers and water reservoirs, is another significant risk, then this study decide to monitoring and determination of dieldrin residue (Organochlorine Pesticide) in some consumed vegetables from Damghan City market (Semnan Province of Iran).

MATERIALS AND METHODS

Vegetable Samples (Spinach, Radish, Lettuce, and Fenugreek) selected and prepared from Damghan market place (spring 2011). All preparation and poison extraction was performed under standard methods [22]. Samples were washed three times to remove all dust and then were dried by sunlight perfectly. Dry samples were separately milled and this step was carried out two times for each sample to achieve better extracts. All laboratory guidelines for GC analysis (ECD detector) exactly performed based on AOAC manual. Since there is no available previous data to establishing a comparison and to concluding an increase or decrease about dieldrin residue, we proposed hypothesis that There is significant difference between vegetables studied in Damghan Market place about dieldrin concentration and test of this proposal performed by using student's t-test and later by using one-way ANOVA ($p < 0.05$).

RESULTS AND DISCUSSION

The results given from Analysis of dieldrine residue in four studied vegetable samples (Spinach, Radish, Lettuce, and Fenugreek) taken from Damghan city market place (spring 2011) shown in Fig. 3 and Table 1.

According to Fig. 3 and Table 1, it is obvious that all vegetable samples showed amount of dieldrin residue. Based on results amount of dieldrin in spinach showed the highest (0.08 ± 0.01) and lowest amount was about Radish and fenugreek (0.03 ± 0.01). If we can compare

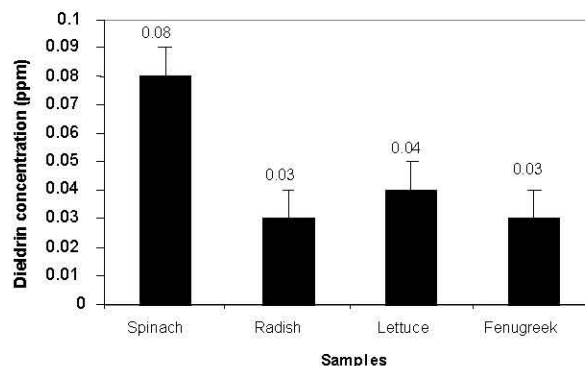


Fig. 3: Mean of dieldrin residue in some common consumed vegetables from Damghan market palce (ppm).

Table 1: Number of samples, mean and standard deviation about dieldrin concentration from form tested vegetables (Damghan market place, Iran).

Sample	Number of samples	Mean of Dieldrin (ppm)	Standard Deviation
Spinach	40	0.08	0.01
Radish	40	0.03	0.01
Lettuce	40	0.04	0.02
Fenugreek	40	0.03	0.01

current results to WHO/FAO proposed standard about dieldrin residue in vegetables (0.05 ppm), spinach show higher than world standard and statistical analysis explain significant difference in comparison with standard ($p < 0.05$). ANOVA analysis confirmed the significant difference between spinach with other three vegetables about dieldrin concentration but there was no different between radish, lettuce, and fenugreek ($p < 0.05$).

The highest concentration of dieldrin residue in spinach in comparison to others and that all samples are near to proposed limitation of WHO/FAO standards, then we can conclude that frequent spraying with pesticides or kind of farms that the vegetables grown and cultivated can be the basic and necessary factors for this contamination. Other factors are non-optimal use of these pesticides in previous years or even botanical characteristics of each of these vegetables for example existence of high fat in them.

As there are no previous records about monitoring of pesticides in Damghan City, we can refer to some other studies that confirm the current results. Donnarumma et al., studied the distribution of dieldrin in soil and its translocation to roots and the aerial parts of vegetable crops grown in greenhouses and fields. Detection of pesticide performed by gas chromatography-electron

capture detector (GC-ECD) and confirmed by gas chromatography-mass spectrometer (GC-MS). The results showed a translocation of residues in cucurbitaceous fruits and flowers confirming that zucchini, cucumber and melon are crops with high uptake capability. The maximum level of dieldrin residue at 0.01 mg/kg was found to be a threshold value to safeguard the quality production of cucurbits. Tomato, lettuce and celery were identified as substitute crops to grow in contaminated fields [23].

In another similar study, Adeyeye and Osibanjo, investigated the Residues of organochlorine pesticides in fruits, vegetables and tubers from Nigerian markets. In their paper, in the vegetables, total HCH, HCB, total DDT and aldrin were detected from 95, 53, 50 and 30%, respectively, of all samples. Aldrin+dieldrin, total HCH, and total DDT were detected from 98, 79 and 49%, respectively, of all tuber samples. Other pesticides were below their detection limits. The average levels were generally low and none were above the FAOs maximum residue limits. The results showed similarity with current study [24].

Recently, Afshari *et al.*, investigated the levels of DDT residue in four Common used vegetables (Spinach, Radish, Lettuce, and Fenugreek) taken from market place of Damghan city. According to their results, amount of DDT residue in lettuce samples had maximum concentration (0.06 ± 0.01 ppm) and lowest amount found in spinach (0.04 ± 0.01 ppm). They also confirmed that the main reasons of contamination was frequent spraying with pesticides and growth conditions of vegetables in Damghan City [25].

CONCLUSION

Increasing of human population led to the need for food and to address this need during the twentieth century, the human actions caused the bigger problems in nature that the most important of these problems is infections in humans and the environment. To resolve this problem, through the use of improper methods made other new problems. Although the use of pesticides in agriculture is beneficial for kinds of pathogens control, but these compounds can cause illness and death in human. These problems are results of the direct and indirect contact with pesticides.

Important factor in the chronic toxicity of pesticides having a long-term accumulation in the body and the accumulation of toxins in the body in all subjects seen by indirect contact through food, inhalation, or skin absorption. Types of chemical fertilizers and pesticides

absorbed by plants and stored in the edible parts of plants. Generally, crops such as vegetables that are regularly spraying and harvested after spraying, it is necessary to measurement and evaluation of pesticide residues and their comparison with the maximum allowable level is very important [26-27].

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