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The Survey and Measurement of Residues of DDT (Organochlorine Pesticide) in Some Consumed Vegetables from Damghan City Market (Semnan Province of Iran)

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Abstract: Frequent and indiscriminate use of pesticides (Organochlorine, Organophosphorus and Carbamate pesticides) in agricultural crops especially in vegetables and fruits, have been extended in recent years. In this study, levels of DDT residue in four Common used vegetables (Spinach, Radish, Lettuce and Fenugreek) taken from market place of Damghan city (Spring 2011) has been studied. Firstly the Samples cleaned, rinsed, grinded and then the DDT residue extracted by acetone solvent and then the concentration determined by Gas chromatography equipped by ECD detector. The results showed that the 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). According to WHO and FAO proposed standards (permissible dose of 0.05 ppm) in vegetables, significant difference found between spinach and lettuce samples but no difference between other vegetables ($p<0.05$), that it can be result of frequent spraying with pesticides or kind of farms that the vegetables grown and cultivated.

Key words: Insecticides residues · D.D.T · Vegetables · Gas Chromatography · Damghan · Iran

INTRODUCTION

Many Efforts in agricultural systems, such as productions of Crops and vegetables have been increased in recent years in Iran and even made non-oil exports benefits for the government. In production, process of Vegetables and crops, many biotic and a biotic can cause different diseases that resulted in qualitative and quantitative decrease of the products and in many cases existence of Toxins in these plant based foods can be harmful effects for human health. One of the problems that exist in the production of vegetables and crops is How to combat diseases that unfortunately, most of the chemical methods are applied and many Farmers often without identifying diseases, repeated the spraying frequently [1-8]. This not only cause many problems for farmers and workers to load the sprayer, but also make Environmental pollutions, This issue, particularly in vegetables and fruits that are consumed as fresh has severe and important. Toxins Residues and health disadvantages for the consumer is something that the authorities should be a consideration.Excessive use of fertilizers and pesticides in vegetable planting, is an agricultural disaster and effects of pesticides Residues on human systems is not covered on any of the experts, Therefore, it is needed for application of special legal rules apply in this conditions [8-15].

DDT is an organochlorine insecticide, once used extensively in the United States, many Asian countries such as Iran, in agriculture and for the control of insects carrying malaria and typhus. In 1972, DDT was banned in the U.S., but the U.S. Department of Agriculture and the U.S. military may store and use DDT for public health emergencies. In many developing countries, public health officials continue to rely on DDT to control mosquitoes in an effort to halt the spread of malaria. DDT continues to be manufactured in the U.S. for export. Evidence of DDT's estrogen-like action was first noted in 1950 [15-18].

In Iran, especially in the north of Iran (Mazandaran Province), DDT extensively used for paddy pests and banned its use from 1970, but sometimes some farmers apply this toxin for their agriculture manner. The main reason for the harmful effects of DDT is negligible solubility in water, but instead is stored in fatty tissue. For this the water can not exit the entered toxins an gradually it accumulates in the body and cause harmful effects. DDT also can transfer to the food chain and affects on next rings in the food chain (Figure 1).

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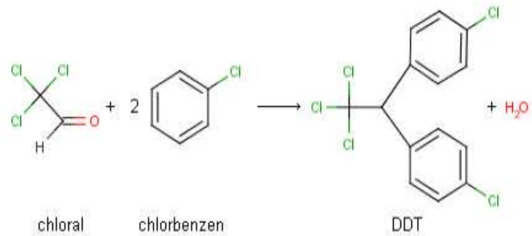

Fig. 1: The Chemical Reaction that can produce the DDT [8].

DDT is considered a persistent organic pollutant (POP), which tend to remain the environment and animals for long periods of time and can travel long distances. As a result, DDT has been found in animals, such as polar bears, whales and sea birds, quite distant from where it was used. In the U.S., children are exposed to DDT through their food, particularly meat and dairy products, because DDT accumulates in animal fats [18-25].

Human exposure occurs from the consumption of foods containing DDT residues, such as meat, fish, poultry, dairy and root and leafy vegetables. Even though DDT has not been used since the 1970s, food continues to contain residues because DDT breaks down very slowly in soil. DDT also drifts on air currents from countries where it is still legal. Nevertheless, the ban on DDT in the U.S. has caused DDT residue on foods in the U.S. to decline in recent decades.

Our exposure to DDT from food primarily comes from meat and dairy products. Fruits and vegetables with the highest levels of DDT residues, according to Consumers Union, include: U.S. grown peaches, frozen winter squash, apples and green beans; Chilean peaches and strawberries; and Mexican tomatoes and spinach. DDT was detected in squash baby food, as well [6-7].

According to the importance of food in human life and nutritional value of vegetables in your diet (especially the supply of fiber and vitamins) that can play a major role in public health and Significance of pesticide residues in these plants and also frequently suggestions of determination of residues in fruits and vegetables by Worlds organization such as WHO and FAO, we determined the Residues of D.D.T (Organochlorine Pesticide) In Some consumed vegetables from Damghan City market (Semnan Province of Iran).

MATERIALS AND METHODS

Samples Preparation: Vegetable Samples (Spinach, Radish, Lettuce and fenugreek) preparation and poison extraction [25] was performed under standard methods. Samples were washed three times to remove all dust. Attention must be paid to avoid wetting the kernel of seeds. Samples 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.

Extraction and Detection: The 50 gr of each grinded sample was transferred to Erlenmeyer 250 ml. In order to extract of DDT, 100 ml N-Hexane was added to Erlenmeyer containing sample, because have aliphatic stretchers and appropriate solubility in organic solvents. The appropriate volume of solvent for extraction is nearly two fold of what has had sample. The Erlenmeyer in steps was placed on shaker for 20 min. (50 shakers per min) to permit the solvent perfectly penetrates that followed by 5 min motionless state. Using of Buckner funnel and filter paper (watman No. 42), samples were filtrated and taken to next step. In this stage, samples were transferred to vacuum distillatory with the optimum temperature (70°), according to boiling point of the solvent (n-Hexane) and decomposition point of the Analyte. Following the solvent evaporating, Acetone was added to residual contents in volumetric flask to desired volume then moved to special vials for GC. The vials must be closed tightly labeled and covered with aluminum foil. Vials were transferred to investigation Center laboratory for GC analysis. The extraction was carried out according to AOAC and eventually injection to GC and detection by ECD indicated the presence of DDT in samples. DDT was identified in all samples [25-30].

Statistical Analysis: Since there is no available previous data to establishing a comparison and to concluding an increase or decrease in residual DDT, in this study dealing with two hypotheses have been considered:

- There is significant difference between vegetables studied in Damghan Market place about DDT concentration.
- There is no significant difference between vegetables studied in Damghan Market place about DDT concentration. The first hypothesis will test by using student's t-test and later by using one-way ANOVA ($p<0.05$).

RESULTS AND DISCUSSION

Results of Analysis of DDT residue in four studied samples (Spinach, Radish, Lettuce and fenugreek) collected from Damghan marketplace (spring 2011) shown in Figure 2.

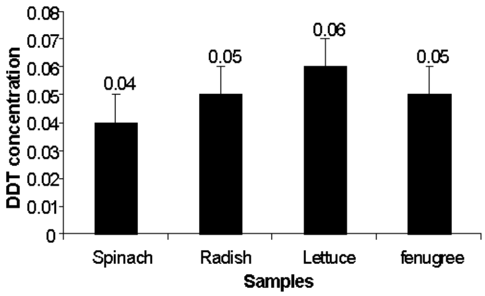

Fig. 2: The mean of DDT residues in four common vegetables from Damghan market place (ppm). Note: Number of Samples was 40 for each vegetable.

According to Figure 2, the remaining amount of DDT showed the highest amount in Lettuce with 0.06±0.01 ppm (Mean± Standard Deviation) and the lowest found in spinach with amount of 0.04±0.01 ppm. With regard to the standards proposed by the FAO/WHO about remaining Chlorinated toxins (less than 0.05 ppm) in vegetables and although we measured slightly higher amount in Lettuce from standards, but there was no significant differences based on statistical analysis ($p<0.05$).

However, statistical analysis using ANOVA and comparison of toxin remaining in four vegetables, it was shown significant difference between spinach and lettuce samples but no difference between other vegetables ($p<0.05$).

The results indicate that amount of DDT residue is higher in Lettuce and near in Radish and fenugreek to proposed WHO/FAO standards, that it can be result of frequent spraying with pesticides or kind of farms that the vegetables grown and cultivated. 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 these vegetables.

Many investigations performed about measurement of pesticides residues in Fruits and vegetables. for example Bhanti and Taneja [31], performed analysis of summer and winter vegetable samples during 2002-2003 for Lindane, Endosulphan and DDT contamination based on Gas Chromatograph-Electron Capture Detector with capillary columns. Their results showed that the contamination levels of winter vegetables (average concentration of 4.57, 6.80 and 5.47 ppb respectively for Lindane, Endosulphan and DDT) were found to be slightly higher than the summer vegetables (average concentration of 4.47, 3.14 and 2.82 ppb respectively for Lindane, Endosulphan and DDT).the results of this study is confirmed current investigation.

In other study, DDT and some pesticides (ΣDDTs, Σchlordane, Σheptachlor and Σaldrins) residues detected in conventionally and organically produced vegetables. Based on the results Lettuce showed a high variability in pesticide uptake regarding varieties and tillage practices. Based the results, environmental conditions like presence or absence of trees, hedgerows or nearby to conventional farms influenced on OCP occurrence and levels in vegetables organically grown [32].

CONCLUSION

With regard to the results of this study, in comparison with the standard of public health about vegetables and fruits, fortunately there is no a serious concern and since there is no comprehensive and exact information on the current consumption of this toxin in the city and also for high lipophilic properties of these toxins as well as having a long half-life and many types of Metabolites, there is deep concern and seriously it is necessary for evaluation of soil and agricultural products during distribution and use of pesticides. In the following some suggestion given for more and effective treatment to usage of pesticides in Agriculture procedures:

- Continuous measurement of pesticide residues and their metabolites in a variety of common vegetables and fruits produced by this city and other neighboring towns according to pesticide usage statistics.
- Continuous measurement of pesticide residues in food and agricultural products according to pesticide usage statistics.
- Assessment of pesticide residues in marine products, because the water overflows eventually from agricultural areas into the sea.
- Assessment of pesticide residues in secondary products such as olive oil, orange essential oil.
- Study of pesticides used in agriculture products and the impact processing manners on reduction of pesticide residues.
- Usage of New alternative methods of pest control using natural bio-pesticides (Biological Control) for control and reduction of Agricultural pest.
- General and Professional Education to large segments of people, especially farmers on the optimum use of pesticides, through the relevant agencies or organizations.

- Establishment of information centers on toxins and environmental pollutants that are active as (24 h) to provide necessary information about poison control to all users.
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