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INVESTIGATION OF RESIDUAL PESTICIDES IN SOME VEGETABLE PLANTS IN SAUDI ARABIA

Abdullah Saati

Assistant Professor of Environmental Health & Toxicology Consultant of Occupational Hygiene
Dept. of Community Medicine and Pilgrims Healthcare,
Faculty of Medicine, Umm Al-Qura University

ABSTRACT:

Pesticides are used for pest management and vector control in agricultural areas, but many farming communities are not adequately informed about the hazards associated with the chemicals. As a result, farmers use pesticides without full understanding of their impact on human health and the environment. Human contacts with pesticides, whether in the field, during pesticide application, weeding, pruning, harvesting, re-entry to collect fire wood, vegetables or in the houses for killing mosquitoes, cockroaches, fleas and flies. Storing pesticides may lead into acute and/or chronic exposures, with adverse health consequences. Although the inhalation, dermal and oral routes of exposure are the most common, pesticide residues in food and water may add to indirect exposures common in the general population.

This study aimed to develop and evaluate a rapid automated screening method for determining pesticides residues in seven green vegetables (rocket, mint, parsley, leek, dill, lettuce and spinach) collected from different sources in Saudi Arabia markets. Thirty nine samples from green vegetables were used in this study. Six types of green vegetables were taken from the open markets (16 samples) and seven types were taken from supermarket (21 samples). These samples were screened for pesticides residues by using Turbo Matrix Headspace Trap system in conjunction with a Perkin Elmer Clarus soo GC/MS. The classes of pesticides which are detected in this study are herbicides, rodenticides and fungicides. The obtained results revealed that the Dinitrotoluidine [1-hydroxy-4-(p-toluidine) anthraquinone] was detected in rocket and parsley, which are presents in supermarket but not found in mint, dill, lettuce and spinach. The Oxadiazolinon (N, O-dimethyloxos tephene) herbicide was found only in rocket purchased from open market. It was found that the dill obtained from the open market was the only plant which contains all kinds of rodenticides like cyano-phenolic (3-cyano-6-triflorom ethylphenantherine), sodium flouroacetate (3-methyl-1-phenyl-2- azafluorenone), hydrogen cyanide (1-cyano-6-trifloromethylphenantherine) and arsenical (arsine,1,2-phenylenebis dimethyl). Hydrogen cyanides were detected in dill only. Identified types of pesticides have shown more occurrences in open market samples than the supermarket samples. The contamination level of pesticide residues considered a possible public health problem. Regular monitoring of a greater number of samples for pesticide residues, especially the imported is needed.

INTRODUCTION:

I has been observed that a diet containing fresh fruit and vegetables far outweigh potential risks from eating very low residues of pesticides in crops (Brown, 2004). Increasing evidence (Dietary Guidelines, 2005) shows that eating fruit and vegetables regularly reduces the risk of many cancers, high blood pressure, heart disease, diabetes, stroke, and other chronic diseases.

If the credits of pesticides include enhanced economic potential in terms of increased production of food and fibre, and amelioration of vector-borne diseases, then their debits have resulted in serious health implications to man and his environment. There is now overwhelming evidence that some of these chemicals do pose a potential risk to humans and other life forms and unwanted side effects to the environment (Forget, 1993; Igbedioh, 1991; Jeyaratnam, 1985). No segment of the population is completely protected against exposure to pesticides and the potentially serious health effects, though a disproportionate burden, is shouldered by the people of developing countries and by high risk groups in each country (WHO, 1990). The world-wide deaths and chronic diseases due to pesticide poisoning number about 1 million per year (Environews Forum, 1999).

Pesticide sprays can directly hit non-target vegetation, or can drift or volatilize from the treated area and contaminate air, soil, and non-target plants. Some pesticide drift occurs during every application, even from ground equipment (Glotfelty and Schomburg, 1989). Drift can account for a loss of 2 to 25% of the chemical being applied, which can spread over a distance of a few yards to several hundred miles. As much as 80–90% of an applied pesticide can be volatilised within a few days of application (Majewski, 1995).

Commonly used pesticides include herbicides insecticides rodenticide and fungicides. All pesticides are toxic by their nature and they cause health hazards to human and animals. There are concerns that pesticides used to control pests on food crops are dangerous to people who consume those foods. These concerns are one of the reasons for the organic food movement. Many food crops including fruits and vegetables contain pesticide residues after being washed or peeled. Chemicals that are no longer used are resistant to breakdown for long periods may remain in soil and water and so in food (NAS, 1987).

Selective herbicides kill specific targets while leaving the desired crop relatively unharmed. Some of these act by interfering with growth of the weed and are often synthetic "imitation" of plant hormones. Herbicides used to clear waste ground, industrial sites, railways and railway embankments are non-selective and kill all plant material with which they come into contact. Herbicides represent about 70% of all agricultural pesicides used in USA (Kellogg *et al.*, 1999). They include dinitrotoluidine, oxadiazolinon, quinoline derivatives, cyano-phenoxypentenoic acid, nitrophenolic and phenolic compounds. Fungicides are used both in agriculture and to fight fungal infections in animals. Fungicide residues have been found in food for human consumption, mostly from post-harvest treatment (Brooks and Roberts, 1999).

Oral exposure is the most severe hazardous route for pesticide poisoning in human occur by accident of ingestion of contaminated food, through accidental splashing of pesticides in the face and mouth, or by rubbing the face with contaminated hands or gloves. The degree of toxicity and hazard from ingestion of pesticides is related to the toxicity of the materials, their solubility and the affected portion of the gastrointestinal tract (Jiguo *et al.*, 2007).

Inhalation of pesticide dusts, vapors, mists and gases may represent a significant occupational hazard. Dust hazards may involve the loading, mixing, and application of insecticides in powder or granular form. 25% of the inhaled pesticide is exhaled, 25% is deposited on the upper respiratory passages and subsequently swallowed and 25% is deposited on the lung (Anwar, 1997).

MATERIALS AND METHODS:

1- Samples:

Thirty nine samples from green vegetables were used in this study. Six types of green vegetables were taken from the open markets (18 samples) and seven types were taken from supermarket (21 samples). Types and sources of samples were shown in Table 1. Each sample washed with 5 ml distilled water. Sample preparation was done according to the methods of EPA (2007).

2-Head Space GC/MS:

Headspace sampling provides easy extraction of volatile compounds from liquid and solid samples, while eliminating the time consuming and error-producing steps required in other GC sample-preparation techniques (March, 2000; Matz *et al.*, 2002 and Erasmus *et al.*, 2005).

3-Calibration and Standardization:

The MS was set up for electron impact (EI) ionization at the 8260B-specified 70eV and a full Auto Tune generated was performed and saved. The Auto Tune generated parameters are shown. After Auto Tune, the multiplier was decreased to 2350 V and the emission current decreased to 75 µA because the headspace trap provided so much sensitivity that the MS sensitivity could be reduced to prolong filament life, increase stability and extend linearity concentrations. Using the standard Auto Tune parameters without modification had produce acceptable results (EPA, 2007).

Table 1: Types and sources of samples

Type of samples	Open market	Super market	Total
Rocket	3	3	6
Parsley	3	3	6
Mint	3	3	6
Leek	3	3	6
Dill	3	3	6
Lettuce	3	3	6

Spinach	**0**	**3**	**3**
Total	**18**	**21**	**39**

Table 2: Gas Chromatography Settings

Gas Chromatograph	PerkinElmer Clarus 500 GC
Headspace Connector	Universal connectror
Oven Program Initial Temperature	40°C
Holt time 1	2 min
Ramp 1	10°C/min to 100°C
Hold time 2	0 min
Ramp 2	30 °C/min to 240°C
Hold time 3	5 min
Equilibration time	0.5 min
Vacuum compensation	On
Headspace control	On
Column	Elite volatiles-30 m X 250 µm X 1.4 µ film
Carrier gas	Helium

Table 3: Mass Spectrometry Settings

Mass Spectrometer	PerkinElmer Clarus 500 MS
Mass range	35-300 u
Solvent Delay Time	0 min
Scan Time	0.1 sec
Interscan Delay Time	0.1 sec
Transfer Line Temperature	200 °C
Source Temperature	200 °C
Multiplier	350 V
Trap Emission	75 µm
Threshold	0
Software	Turbo Mass 5 with reporting

Table 4: Headspace Settings

Sample introduction	PerkinElmer Turbo Matrix HS-110 Trap
Needle Temperature	90°C
Transfer Line Temperature	120°C
Oven Temperature	80°C
Trap Low Temperature	40°C
Trap High Temperature	280°C
Dry Purge (Helium)	5 min
Trap Hold Time	6 min
Desorb Time	0.5 min
Thermostatting_ Time	10 min
Pressurization Time	1 min
Decay Time	2 min
Outlet Split	20 ml/min
Column Pressure	25 psi
Vial Pressure	35 psi
Desorb Pressure	10 psi
Transfer Line	Deactivated Fused silica 20 m x 320 µm

RESULTS:

1-Herbicides:

The obtained results revealed that the Dinitrotoluidine [1-hydroxy-4-(p-toluidine) anthraquinone] are positive in rocket and parsley, which are presents in supermarket but not found in mint, dill, lettuce and spinach. The Oxadiazolinon (N, O-dimethyloxos tephene) herbicide was found only in rocket purchased from open market. The other herbicide Quinoline Deriveative (2-hydroxynaphthy1-2-quinoline), Cyanophenolic (3-cyano-6-trifloromethylphenan therine), Nitrophenolic

(2-methoxy-1-nitrophenazine-5-oxide and 3-acridinol-9-phenyl) and phenolic [phosphine, methyl bis 4-N-N-dimethyl amino) phenyl, 1-methyl-3-phenyl-4-azafluorenone, oxazole, 2-1-naphthalenyl-5-phenyl, 2,2-bis 4-methoxy-phenyl-2-ethoxy-ethane and silane, dimethyl-2-propenyl tetradecyloxy) were not found in any leaves except the dill which are present in open market (Table 5).

2-Rodenticides:

It was found that the dill obtained from the open market was the only plant which contains all kinds of rodenticides like cyano-phenolic (3-cyano-6-triflorom ethylphenantherine), sodium flouroacetate (3-methyl-1-phenyl-2- azafluorenone), hydrogen cyanide (1-cyano-6-trifloromethylphenantherine) and arsenical (arsine,1,2-phenylenebis dimethyl) (Table 6).

3-Fungicides:

Hydrogen cyanides were detected in dill only (Table 7).

Table 5: Types of herbicides detected in green leaves

Pesticide scientific name	Organic name	Types of green leaves						
		R	P	M	L	D	L	S
Dinitrotoluidine	1-hydroxy-4-(p-toluidine) anthraquinone	+ve	+ve	-ve	-ve	-ve	-ve	-ve
Oxadiazolinon	N,O-dimethyloxos tephene	+ve	-ve	-ve	-ve	-ve	-ve	-ve
Quinoline derivatives	2-hydroxynaphthy1-2-quinoline	-ve	-ve	-ve	-ve	+ve	-ve	-ve
Cyano-phenilic	3-cyano-6-trifloromethylphenantherine	-ve	-ve	-ve	-ve	+ve	-ve	-ve
Nitrophenolic	2-methoxy-1-nitrophenazine-5-oxide	-ve	-ve	-ve	-ve	+ve	-ve	-ve
	3-acridinol-9-phenyl	-ve	-ve	-ve	-ve	+ve	-ve	-ve
Phenolic	Phosphine [methyl bis 4-N-N-dimethyl amino) phenyl]	-ve	-ve	-ve	-ve	+ve	-ve	-ve
	1-methyl-3-phenyl-4-azafluorenone	-ve	-ve	-ve	-ve	+ve	-ve	-ve
	oxazole [2-1-naphthalenyl-5-phenyl]	-ve	-ve	-ve	-ve	+ve	-ve	-ve
	2,2-bis 4-methoxy-phenyl-2-ethoxy-ethane	-ve	-ve	-ve	-ve	+ve	-ve	-ve
	silane [dimethyl-2-propenyl tetradecyloxy)]	-ve	-ve	-ve	-ve	+ve	-ve	-ve

Table 6: Types of rodenticides detected in green leaves

Pesticide Scientific name	Organic name	Types of green leaves						
		R	P	M	L	D	L	S
Cyano-phenilic	3-cyano-6-trifloromethylphenantherine	-ve	-ve	-ve	-ve	+ve	-ve	-ve
Sodium flouroacetate	3-methyl-1-phenyl-2- azafluorenone	-ve	-ve	-ve	-ve	+ve	-ve	-ve
Hydrogen cyanide	1-cyano-6-trifloromethylphenantherine	-ve	-ve	-ve	-ve	+ve	-ve	-ve
Arsenical	arsine,1,2-phenylenebis dimethyl	-ve	-ve	-ve	-ve	+ve	-ve	-ve

Table 7: Types of fungicides detected in green leaves

Pesticide Scientific name	Organic name	Types of green leaves						
		R	P	M	L	D	L	S
Hydrogen cyanide	1-cyano-6-trifloromethylphenantherine	-ve	-ve	-ve	-ve	+ve	-ve	-ve
Arsenical	arsine,1,2-phenylenebis dimethyl	-ve	-ve	-ve	-ve	+ve	-ve	-ve

Rocket (R), Parsley (P), Mint (M), Leek (L), Dill (D), Lettuce (L), Spinach (S).

DISCUSSION:

Food quality and safety are receiving increasing attention in the food sector nationally and internationally. Emerging private sector regulations are increasingly perceived as market entrance barriers within this development all over the world (Morland *et al.*, 2002). The growing use of pesticides accounts for a significant portion of the increase in food productivity over the past several decades. Pesticides clearly have assisted in controlling pests and maintaining the availability of low cost and high quality food. Risk of dietary exposure to pesticides residues also has been of public concern while solid scientific evidence has not been completely established. Pesticides in food were considered to be the most hazardous to human health (EPA, 1986).

Crops (vegetables and fruits) are an important part of a healthy diet as they are a significant source of vitamins and minerals. Quality of these crops can be affected by pest as part of nature profile. However, these pests can be controlled by (Dayan *et al.*, 1999). Pesticides constitute a very important group of highly toxic compounds, therefore usage of pesticides in agriculture practice and public should be controlled. The levels of pesticide residues in foodstuffs are harmful to human based on a long range exposure (intake). Previous studies found that there was an association between pesticide in crops and cancer (NAS, 1987).

Pesticides residues on crops are monitored with reference to Maximum Residue limits and are based on analysis of quantity of a given pesticides remaining on food product samples. Maximum residual level is maximum quantity of pesticide that may still be present on the crop at point of safe that is legally permitted in, or on crops or a food commodity, allowed by national governments which are set to determine legal trading limit that are not an indicator of risk to health. It ensures the safety of food for consumers and regulates international trade. Multi-residue methods are required to monitore pesticide residues. The analytical performance was demonstrated by the analysis of extracts from lettuce, orange, apple, cabbage, grape and wheat flour, spiked at three concentration levels ranging from 0.01 to 0.10 mg/Kg pesticide or its metabolite (Maurice and Andre, 2007). Gas chromatography (GC) with selective detection coupled to mass spectrometry (GC-MS) are the analytical methods which more frequently applied to the analysis of pesticide residues in foods, fruit, vegetables and cereals (Ana *et al.*, 2004).

In this study identification of the type of pesticides present in vegetables in Saudi Arabia is addressed. GC/MS technique was used in this study for this reason. In addition, one of the most useful techniques was used in this study is headspace trap. Headspace trap can omit the step for sample preparation which makes the techniques used in this investigation is more faster and reliable. Headspace technique can increase the sensitivity of the analysis as there is no addition of extraction solvents that can dilute the target compound concentration in the sample.

Results of the present study revealed that dinitrotolidine is positive in supermarket rocket and parsley, while oxadiazolinon is positive only in open market rocket. The other herbicides (quinoline derivatives, nitrophenolic and phenolic) are positive in open market dill. These results are consistent with previous findings in which herbicides are found in crops (Conde *et al.*, 2006 and Zheng-Min *et al.*, 2006).

Fungicides and rodenticides were not detected in all types of investigated green leaves of vegetables except dill obtained from open market which showed positive results for fungicides and rodenticides. Phosphine poisoning increases levels of superoxide dismutase and malondialdehyde in non-survivors, while catalase was inhibited (Chugh *et al.*, 1996). Oxidation of phosphine can lead to formation of reactive phosphorylating species (Lam *et al.*, 1991), thus suggesting that effects on cholinesterase may be possible (Garry and *et al.*, 2001). Studies of grain fumigant applicators (Potter *et al.*, 1993) and *in vitro* studies of human red blood cells (Potter *et al.*, 1991) have shown that significant phosphine-induced inhibition of red blood cell cholinesterase occurs at concentrations of phosphine exceeding 10 µg/ml.

The use of pesticide was observed to be high, with over 40 different formulations, probably because farmers assume that the only solution to pest problems is to spray more frequently and using different types of pesticides (Dinham, 2003). In previous studies conducted in some of the study areas (Ngowi, 2003) it was revealed that farmers were not receiving agricultural extension service hence have attempted various means especially in pesticides use when dealing with pest problems but were constrained by the lack of appropriate knowledge. However, pesticide usage in the study area seems to be highly influenced by manufacturers and pesticides vendors who were carrying out their business right in the farming communities and very interested in achieving large sales of their pesticides. This is a typical situation in many developing countries where the choice of pesticides to be used by farmers is influenced by the suppliers (Snoo *et al.*, 1997; Epstein and Bassein, 2003). In African countries, many government extension programs encourage the use of pesticides (Abate *et al.*, 2000), but do not consider their effects in the environment and health risks. As a result and coupled with lack of basic knowledge of pesticides, farmers' decisions on what pesticides and how to use do not have a bearing on health or safety of the environment. Epstein and Bassein (2003) observed that farmers used more pesticides because they based the applications on calendar spray pesticides program without necessarily giving much priority to health and environmental considerations.

The high dependence on pesticides by vegetable farmers is an indication that they are not aware of other pest management strategies that are effective, inexpensive and yet friendly to the environment. Pest management strategies including intercropping (Legutowska *et al.*, 2002) and tillage type and crop rotation

(Hummel *et al.*, 2002) have been shown to significantly reduce insect pests. There is a need to bring to the attention of those farmers existing alternative pest management strategies that are cost effective and environmentally friendly.

The obtained results are in agreement with those obtained by Hall *et al.* (2004). Who found that methoxyfenozide [3-methoxy-2-methylbenzoic acid 2-(3,5-dimethylbenzoyl)-2-(1,1-dimethylethyl) hydrazide; RH-2485], in the formulation of INTREPID, was applied to various crops. Analysis of methoxyfenozide was accomplished by utilizing liquid-liquid extraction and partitioning, followed by liquid chromatography-tandem mass spectrometry (LC-MS/MS). Method validations for fruits, vegetables, and mint are reported. Methoxyfenozide mean recoveries ranged from 72 to 129% over three levels of fortification. The overall average of mean recoveries is 97$\pm$10%. The limit of quantitation for fruits, artichoke, cucumber, squash, and refined sugar was 0.010 ppm, with a detection limit of 0.005 ppm. For all other crops, the limit of quantitation was 0.050 ppm, with a detection limit of 0.025 ppm. No residues were found greater than the limit of quantitation in control samples. Residues above the limit of quantitation were found in all matrices except refined sugar. Foliage (bean, beet, pea, and radish) had greater residue levels of methoxyfenozide residue than their corresponding roots or pods. Other crop matrices contained<1.0 ppm of methoxyfenozide except artichoke, which had a mean of 1.1 ppm. Pendimethalin [N-(1-ethylpropyl)-3,4- dimethyl -2,6-dinitrobenzenamine], in the form-ulation of Prowl (a commercial herbicide), was applied to various crops. Analysis of pendimethalin and its metabolite [4(1-ethylpropyl)amino-2-methyl-3,5-dinitrobenzyl alcohol] was accomplished by utilizing liquid-liquid partitioning, gel permeation chromatography (GPC) for nuts and mint, solid-phase extraction (SPE) cleanup, and gas chromatography (GC) with a nitrogen--phosphorus detector (NPD). Method validation recoveries for fruits, nuts, vegetables, grass, and mint are given for both compounds. Pendimethalin average recoveries ranged from 71% to 126% over two levels of fortification. Pendimethalin metabolite average recoveries ranged from 69% to 123% over two levels of fortification. The quantitation limit for all crops except mint was 0.050 ppm. The quantitation limit for mint and mint oil was 0.10 ppm. Residues greater than the limit of quantitation were found for pendimethalin in apple pomace, fresh and dry fig, grass screenings, mint oil, almond hulls, green onion, and tomato pomace (wet and dry). Residues greater than the limit of quantitation were found for pendimethalin metabolite in grass screenings, grass straw, and almond hulls. All other crop analysis for pendimethalin and its metabolite were below the limit of quantitation (Engebretson *et al.*, 2001).

Dissipation rates of boscalid [2-chloro -N-(4'-chlorobiphenyl-2-yl) nicotinamide], pyraclostrobin [methyl 2-[1-(4-chlorophenyl) pyrazol-3-yloxymethyl]-N-methoxycarbanilate], lufenuron [(RS)-1-[2,5-dichloro-4-(1,1,2,3,3,3-

hexafluoropropoxy) phenyl]-3-(2,6-difluorobenzoyl)urea] and lambda-cyhalothrin [(R)-cyano (3-phenoxyphenyl) methyl (1S,3S)-rel-3-[(1Z)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate] in green beans and spring onions under Egyptian field conditions were studied. Field trials were carried out in 2008 in a Blue Nile farm, located at 70 kilometer (km) from Cairo (Egypt). The pesticides were sprayed at the recommended rate and samples were collected at pre-determined intervals. After treatment (T(0)) the pesticide residues in green beans were 7 times lower than in spring onions. This is due to a different structure of vegetable plant in the two crops. In spring onions, half-life (t(1/2)) of pyraclostrobin and lufenuron was 3.1 days and 9.8 days, respectively. At day 14th (T(14)) after treatment boscalid residues were below the Maximum Residue Limit (MRL) (0.34 versus 0.5 mg/kg), pyraclostrobin and lambda-cyhalothrin residues were not detectable (ND), while lufenuron residues were above the MRL (0.06 versus 0.02 mg/kg). In green beans, at T(0), levels of boscalid, lufenuron and lambda-cyhalothrin were below the MRL (0.28 versus 2 mg/kg; ND versus 0.02 mg/kg; 0.06 versus 0.2 mg/kg, respectively) while, after 7 days treatment (T(7)) pyraclostrobin residues were above the MRL (0.03 versus 0.02 mg/kg). However, after 14 days the residue level could go below the MRL (0.02 mg/kg), as observed in spring onions (Hanafi *et al.*, 2010). Pesticide residues are found in soil and air, and on surface and ground water across the countries, and urban pesticide uses contribute to the problem. Pesticide contamination poses significant risks to the environment and non-target organisms ranging from beneficial soil microorganisms, to insects, plants, fish, and birds. Contrary to common misconceptions, even herbicides can cause harm to the environment. In fact, weed killers can be especially problematic because they are used in relatively large volumes. The best way to reduce pesticide contamination (and the harm it causes) in our environment is for all of us to do our part to use safer, non-chemical pest control methods.

CONCLUSION:

Identified types of pesticides have shown more occurrence in open market samples than the supermarket samples.

The contamination level of pesticide residues could be considered a possible public health problem. The results also emphasize the need for regular monitoring of a greater number of samples for pesticide residues, especially the imported ones.

GC/MS is an accurate, fast, precise and easy-to-maintain technique which is used to identify drugs, pesticides, environmental analysis, unknown samples of food, beverages and perfumes. Headspace is a unique technique in which sample preparation is easy and convenient. There is no need to empty the lines to remove residual contamination and there is no risk of sample foam contamination of purge-and –trap device.

Public awareness about pesticides can be increased by more appropriate education programs based on pesticide control should be initiated at national level.

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فحص متبقيات المبيدات في بعض نباتات الخضر في المملكة العربية السعودية

عبد الله ساعاتي

أستاذ صحة البيئة والسموم المساعد

قسم طب المجتمع والرعاية الصحية للحجيج – كلية الطب – جامعة أم القرى – المملكة العربية السعودية

مبيدات الآفات يمكن أن تلوث التربة والهواء والماء وغيرها من النباتات كونها تستخدم على نطاق واسع لمكافحة الآفات والنواقل في المناطق الزراعية، ولكن لا توجد معلومات كافية حول المخاطر المرتبطة بهذه المواد الكيميائية. ونتيجة لذلك يستخدم المزارعون المبيدات دون فهم كامل لتأثيرها على صحة الإنسان والبيئة. ويؤدى الاتصال المباشر بين الإنسان والمبيدات الحشرية سواء في المزارع، خلال استخدام المبيدات والتعشيب والتقليم والحصاد، وإعادة دخول لجمع الحطب، والخضروات أو قتل البعوض والصراصير والبراغيث والذباب في المنازل، وكذا تخزين المبيدات إلى التعرض الحاد أو المزمن لهذه المواد السامة، مما ينجم عنه عواقب ضارة بالصحة. وعلى الرغم من أن التعرض للمبيدات يمكن أن يحدث عن طريق الاستنشاق والجلد والفم، والتى تعتبر أكثر طرق التعرض شيوعاً إلا أن التعرض لمتبقيات المبيدات في الأغذية والمياه يتم بطريقة غير مباشرة في عموم السكان.

تهدف هذه الدراسة إلى تطوير وتقييم طريقة لتحديد بقايا المبيدات في سبع أنواع من الخضروات (الجرجير، والنعناع والبقدونس والكراث والشبت والسبانخ والخس) تم جمعها من مصادر مختلفة في أسواق المملكة العربية السعودية.

استخدمت في هذه الدراسة تسع وثلاثون عينة من الخضروات. منها ستة أنواع من الخضروات من الأسواق المفتوحة (١٨ عينة) وسبعة أنواع من السوبر ماركت (٢١ عينة). تم فحص هذه العينات لمتبقيات المبيدات باستخدام جهاز A Perkin Elmer Clarus 600 MS/GC . وأصناف المبيدات التي تم الكشف عنها في هذه الدراسة هي مبيدات الأعشاب ومبيدات القوارض ومبيدات الفطريات.

وجد أن المبيد العشبى Dinitrotoluidine [١ – ٤– هيدروكسي (ف طولويدين) غليكوسيد]، يوجد في الجرجير والبقدونس التي تعرض في محلات السوبر ماركت، ولكن لا يوجد في النعناع والشبت والخس والسبانخ.

كما تم العثور على المبيد العشبي Oxadiazolinon (tephene dimethyloxos - O ، N) فقط في جرجير التي تم شراؤها من السوق المفتوحة. أما بخصوص مبيدات القوارض فقد وجد أن الشبت الذي يتم الحصول عليه من السوق المفتوحة. هو النبات الوحيد الذي يحتوي على جميع أنواع مبيدات القوارض مثل الفينول cyano – (٣– cyano – ٦– azafluorenone – ٢ – الميثيل فينيل – ١ – ٣) الصوديوم flouroacetate ، (ethylphenantherine triflorom)، وسيانيد الهيدروجين (١ – cyano – ٦– trifloromethylphenantherine) ومركبات الزرنيخ (أرسين،١،٢ phenylenebis – ثنائي ميثيل). كما تم الكشف عن سيانيد الهيدروجين في الشبت فقط من المبيدات الفطرية.

ولقد أظهرت نتائج الدراسة وجود أنواع محددة من المبيدات في عينات السوق المفتوحة أكثرمن عينات السوبر ماركت. ويمكن النظر في مستوى التلوث من مخلفات المبيدات مما تسببه من مشاكل صحية عامة. والتأكيد أيضاً على ضرورة الرصد المنتظم لعدد أكبر من العينات لمتبقيات المبيدات، وخصوصا المستورد منها.