Dietary exposure assessment of malathion residue for some fruits, vegetables and herbs in Egypt during 2002

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ABSTRACT

A study of Malathion residue was conducted in the central laboratory pesticide residues analysis and heavy metals. Malathion one of the most widely applied organophosphate insecticide, It is a slightly toxic compound in EPA toxicity class III. A total of 12919 samples of 57 different types of fruit, vegetables and aromatic medicinal plants samples were examined for malathion residues during 2002, eighteen commodities represent 28.65 % were completely free of malathion residues. Thirty nine commodities represent total 9218 samples fruit (362), vegetables (1643) and aromatic medicinal plants (7213) with percentages 71.35 % of total examined samples have malathion residues. Only 4.43 % of total contaminated commodities (408 samples) were below limit of determination (LOD = 0.02 ppm), 22.07 % at LOD or more However 77.93 % of those samples are not contaminated with malathion residues. Only 6.06 % of the samples exceeded MRL's of malathion residues comparing with national, codex and EU-MRL's Malathion residues was the detected frequently in Lemon and pomegranate samples with percentages of 20 % and 15.15 %, respectively. Lemon showed the highest violation percentages 13.33 %. The main contributors to total intake of malathion is root vegetables 56.57 %,. The major contributors crops to total intake of malathion are potatoes 47.95 %. Data showed that our results goes with the EPA total diet studies results . The total dietary intake of malathion 0.0011 mg/kg. body weight /day is lower than ADI (0.02 mg/kg body weight) and contributing only 5.5 % of ADI . Therefore dietary exposures to malathion are still so far and not a case for Egyptian consumer concern

Key words: Malathion, Exposure assessment, Residue, Monitoring, Fruits and Vegetables, Herbs, Aromatic and medicinal plants

INTRODUCTION

Malathion is an insecticide used for agricultural and non-agricultural purposes and it is released to the environment primarily

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through spraying on agricultural crops and at agricultural sites, spraying for home and garden usage, spraying for public health use in both urban/residential and nonresidential areas. The insecticide is also released to the environment using fogging equipment. Malathion is a slightly toxic compound in EPA toxicity class III. Malathion is a General Use Pesticide (GUP).

Once malathion is introduced into the environment, it may be activated by atmospheric photooxidation, or degraded by hydrolysis, or biodegradation mediated by microorganisms found in most sediment, soils, and water. Malaoxon, the oxon generated from malathion, is more toxic than malathion and is formed by the oxidation of malathion and may also be present as an impurity in the parent compound. Three of five studies that have investigated the carcinogenicity of malathion have found that the compound does not produce tumors in the test animals. The two other studies have been determined to be unacceptable studies and the results discounted. Available evidence suggests that malathion is not carcinogenic but the data are not conclusive National Cancer Institute,1979, Cancer Assessment Review Committee (CARC), 2000.

Malathion is an organophosphate pesticide of relatively low acute toxicity compared to other organophosphates. Signs and symptoms of acute toxicity are typical of those induced by organophosphate insecticides as a group, except that larger doses are required to produce them. The no observed adverse effect level (NOAEL) of 50 mg /kg/day was established from a range finding study and a developmental toxicity study in rabbits based on maternal toxicity Gallo, M. A. and Lawryk, N. J, 1991.

Monitoring programs can be contribute in improving safety of food, warning of actual and potential food contamination via food and evaluations of possible health hazards throughout providing continuous information on levels of environmental pollution in the country. Public concern over pesticide residues on vegetables and fruits has been increasing in recent years. The risk to human health is due to pesticide residues in the edible parts.

The objectives of food contamination monitoring programmes are to safeguard health, to improve the management of food and agricultural resources as well as preventing economic losses.

The benefits to be derived from the National Monitoring Programmes are improved food safety, warning of problems of contamination, provision of intake data for evaluation of health hazards, better management and use of natural resources and a series of measures of good agricultural practice (GAP). The current study was conducted as a part of the main national food contamination monitoring program that has been carried out in Egypt since 1988, Dogheim *et al.*, 1988,1990,1991,1999, 2001, 2002.

MATERIALS AND METHODS

Sampling

A total of 12919 samples of Local and imported vegetables, fruits and some aromatic medicinal plants were collected from different local markets representing 5 Egyptian Governorate include (Qalyubiya- Giza – Ismailia – Minufiya – Beni suef throughout 2002. The vegetables, fruit and medicinal plant samples that selected for the survey were, demonstrated in table (1). Two kg from vegetables, fruits and 500g from aromatic medicinal plants for each commodity was thoroughly homogenized and prepared according to Codex Alemintariuos Guidelines, 1993. Malathion residues are subjected for analysis in all samples .

Pesticide Residues Analysis

Official method of AOAC, 1995 was followed with some modifications which were, the sample and the solvent amounts are only half of those in AOAC method. Rotary evaporator and air below are used instead of kuderna-Danish concentrators. The total volume of acetone extract is measured for result calculations. However, the AOAC method uses tabulated water percentages of commodities. After drying, aromatic phase is concentrated just to dryness. The dried samples were dissolved in hexane /acetone containing 0.3 µg/ml of ditalimphos as an internal standard for GC determination.

GC Determination

The detection and confirmation of presence of residues in the samples depends on the use of two chromatography columns of different polarities equipped with nitrogen-phosphorus detectors (NPD) installed in one GC instrument with one injector. Quantitative determinations are made using ditalimphos as an internal standard.

Quality Assurance:

The analytical method and instruments were fully validated as part of a laboratory quality assurance system and are accredited by Finnish Accreditation Service FINAS (center of metrology and accreditation) Finland. The criteria of quality assurance of the codex committee are followed to determine the performance of the multiresidue method. This quality system is referred to ISO/IEC Guide 17025.

The average recoveries percent of the tested pesticides on chamomile were ranged between 80-102% at spiking levels 0.07 -0.1 mg/kg, with coefficient of variation (CV %), 2.5-13%. However, the average recoveries, coefficient of variation (CV%) of the tested compounds on pepper samples at spiking levels 0.02-0.5 mg/kg were 80-106%, 2-19% respectively. The reproducibility expressed as relative standard deviation was less than 20%. The limit of quantification was 0.02 mg/kg. The measurement uncertainty including random and systematic error at 95% confidence level is less than 10%. Blank sample is fortified with the pesticides mixture and analyzed as normal sample with each set of samples. The results are recorded on control charts. Repeated analysis of old samples is regularly followed to control reproducibility

♦ **Apparatus**

(a) Gas chromatography: HP 5890 equipped with double Nitrogen Phosphorus Detector (NPD) with two capillary columns, injector 225°C, detector 280°C. Operating conditions: Hydrogen 3.5 ± 0.1 ml/min, Air 100-110 ml/min, and Nitrogen carrier gas 25 ml/min.

Chromatography columns are:

(1) PAS-5 NPD tested ultra 2 silicon, 25m x 0.32 mm, and film thickness 0.52 um

(2) PAS - 1701 NPD tested 1701 silicon, 25 m x 0.32 mm, film thickness 0.25 um.

Temperature programmes of both GC instruments are; initial temperature 90°C for 2 min, ramp (1) 20 (°C / min) to 150°C, ramp (2) 6 (°C/min) to 270°C hold 15min.

♦ **Reagents**

• **Solvents and chemicals**

(a) Acetone, dichloromethane, n-hexane, petroleum ether, (Pestiscan chromatography grade or similar quality).
(b) Anhydrous sodium sulphate (Riedel-de Haen), sodium chloride

♦ **Pesticide reference standards**

Malathion reference material is certified standard provided by Dr. Ehrenstorfer laboratories Gmbh, Gogginger Str. 78 D- 8900 Augsburg and financed by FAO (Food and Agriculture Organization of the United Nations), Rome, Italy.

RESULTS AND DISCUSSION

A total of 12919 samples of 57 different types of fruits, vegetables, and aromatic medicinal plants samples were examined for malathion residues during 2002.

Results are shown in table (1) & (2). Eighteen commodities represent 3701 samples with percentages 28.65 % were completely free of malathion residues. Malathion residues are usually analyzed by multiresidue method capable of detecting up to 82 or more pesticides. Thirty nine commodities represent total 9218 samples of fruit (362), vegetables (1643) and aromatic medicinal plants (7213) with percentages 71.35 % of total examined samples have malathion residues.

Tables (1) & (2) showed the levels of malathion residue detected in fruits, vegetables and aromatic medicinal plants samples. European union (EU), Egyptian Organization of Standardization (EOS) and codex maximum residue limits were followed and due to lack of malathion codex MRL's on such these commodities combinations. The EU maximum residue limits was used followed by EOS then codex to evaluate the results. In few cases, extrapolation was followed in such crops that didn't include in codex or at any guidelines and produced locally such as grape leaf and molokhia and larkspur flower. The contaminated commodities have detectable malathion residues below limit of determination (LOD) were found in 408 sample with 4.43%, contaminated samples at LOD (LOD = 0.02 ppm) or more were 1626 sample with 17.64%, meaning the total contaminated samples were 2034 sample (408 + 1626 sample) with 22.07%, However the samples not contaminated with malathion residues were 7184 sample with 77.93% . Only 559 sample represent 6.06% exceeded MRL's of malathion

residues comparing with national, codex and EU-MRL's. Malathion residues was the detected frequently in Lemon and pomegranate samples with percentages of 20 % and 15.15%, respectively also lemon showed the highest violation percentages 13.33 %.

In case of aromatic medicinal plants malathion residue was the detected frequently in anise seed ,cumin, fennel and dry dill samples with percentages of 90.87, 78.98, 66.16 and 43.24 %, respectively and also Anise seed and cumin showed the highest violation rate with percentages 72.6, 69.32 % followed by dry dill and green mint with percentages 14.41 and 11.32 % respectively which indicates that we need to put a extensive plane to apply good agricultural practices for malathion use for those commodities.

Hot chili and molokhia showed the lowest contamination rates 0.72 % and 1.8% respectively without any violation percentages. No violation observed in cantaloupe, guava, peach and pomegranate in fruits, all fruiting vegetables are free of malathion residue, potatoes, green onion and lettuce have slightly violation percentages 0.69, 0.86 and 1.28 % respectively but the rest of leafy vegetables are without of any violation. However, in case of aromatic medicinal plants verbascum, dry and green celery samples were without any violation. Hibiscus samples showed the lowest contamination rate than all herbs 2.74%.

EPA moved swiftly in applying existing scientific methodology to determine hazards of the registered organophosphorus (OP) insecticides to infants and children, but new ground had to be broken if exposure was going to be aggregated and cumulated across dietary and non-occupational pathways. Aggregation of exposure seemed quite straightforward and logical. Simultaneously cumulating exposure to multiple OP pesticide residues was more problematic. No one had done it before. EPA 1999.

The FQPA established a stringent health-based standard (a reasonable certainty of no harm) for pesticide residues in foods to assure protection from unacceptable pesticide exposure and to strengthen health protections from pesticide risks for sensitive populations. In addition, the FQPA required the U.S. Environmental Protection Agency EPA to consider the cumulative effects on human health that may result from exposure to mixtures of pesticides FQPA 1999. In response, the EPA

Office of Pesticide Programs (OPP), in consultation with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) scientific advisory panel, has developed guidelines for the cumulative risk assessment of pesticides that share a common mechanism of toxicity EPA 2002a, 2002b.

In the framework it is stated that a cumulative risk assessment of substances that cause a common toxic effect by a common mechanism will not be conducted until an aggregate exposure assessment of each substance has been completed. This framework is need more studies to be finalized . The risk to human health is due to pesticide residues in the edible parts of the crop and the consequent daily intake of these residues. The acceptable daily intake (ADI) of the malathion derived from the chronic toxicity data. The established ADI value of malathion in Egypt are indicated in codex published by Food and Agriculture Organization of united nations (FAO) which is 0.02 mg/kg body weight. The EDI (Estimated daily intake) of a malathion by Egyptian people is calculated from the Middle Eastern food consumption GEMS / food data and malathion residue monitoring data using an average body weight of 60 kg.

The current exposure assessment addressed only the risks posed by malathion residue in vegetables and herbs. The contributors to total intake of malathion are in descending order as follows root vegetables 56.57 %, dry herbs 18.78 %, fruits 10.37 %, Leafy vegetables 9.29 %, green herbs 4.09 % and fruiting vegetables 0.91 %. The major contributors crops to total intake of malathion are potatoes 47.95 % followed by anise seed 11.65 %, green onion 8.62 %, lettuce 7.03 %, orange 4.5 and green mint 3.25 %.

The Food Quality Protection Act (FQPA), "put an additional tenfold margin of safety for the malathion residue and other sources of exposure shall be applied for infants and children to take into account with respect to exposure and toxicity to infants and children. Both the National Research Council/National Academy of Sciences report Pesticídes in the Diet of Infants and Children and the FQPA language based on its findings, clearly state the purpose of the additional, child-protective FQPA tenfold safety factor. EPA,2002c.

Because malathion is one of the most frequently detected pesticides in the EPA total diet studies there is a great potential for

exposure of the general population to malathion by consumption of food containing residues of the chemical. However, based on a risk assessment of malathion conducted by the EPA using, in part, the Dietary Exposure Evaluation Model (DEEM), neither acute nor chronic dietary exposure to malathion (plus malaoxon) is a concern for the majority (95^{th} exposure percentile) of the U.S. population. EPA, 2000.

The risk exposure assessment of malathion residues results are shown in Table 3 . Data showed that our results goes with the EPA total diet studies results. The total dietary intake of malathion 0.0011 mg/kg body weight /day is lower than ADI (0.02 mg/kg body weight) and contributing only 5.5 % of ADI. Therefore dietary exposures to malathion are still so far and not a case for a concern

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Table (1) : Monitoring data of malathion residues in some fruits and vegetables collected from local markets in 2002.

Product Name	Total No. of samples	Freq. %	contaminated samples		Min. Conc. ppm	Max. Conc. ppm	Mean ppm	MRL's mg/kg	No of samples violated	Violation %
			No	%						
Fruits										
Cantaloupe	79	3.80	10	12.66	0.05	0.18	0.103	0.5 CXL*	0	0.00
Guava	77	1.30	8	10.39	0.10	0.10	0.100	0.5 CXL*	0	0.00
Lemon	15	20.00	4	26.67	0.05	2.10	0.770	0.05 EOS	2	13.33
Oranges	127	2.36	15	11.81	0.05	0.08	0.063	0.05 EOS	2	1.57
Peach	31	9.68	5	16.13	0.05	0.42	0.200	6.00 CXL	0	0.00
Pomegranates	33	15.15	10	30.30	0.06	0.09	0.070	0.5 CXL	0	0.00
Vegetables										
Fruiting vegetables										
Green beans	404	0.74	14	3.47	0.01	0.05	0.023	0.5 CXL*	0	0.00
Hot Chili	138	0.72	1	0.72	0.13	0.13	0.130	0.5 CXL	0	0.00
Pepper	166	1.20	6	3.61	0.11	0.19	0.150	0.5 CXL	0	0.00
Strawberry	57	1.75	3	5.26	0.05	0.05	0.050	1 CXL	0	0.00
Leafy vegetables										
Grape leaf	69	1.45	5	7.25	0.09	0.09	0.090	0.5 EOS*	0	0.00
Lettuce	78	2.56	4	5.13	0.06	4.00	2.030	0.5 EOS*	1	1.28
Molokhia	111	0.90	2	1.80	0.07	0.07	0.070	0.5 EOS*	0	0.00
Spinach	71	1.41	3	4.23	0.49	0.49	0.490	0.5 EOS*	0	0.00
Root vegetables										
Green Onion	116	7.76	16	13.79	0.05	0.78	0.249	0.5 EOS*	1	0.86
Potatoes	433	2.54	18	4.16	0.08	1.70	0.540	0.5 EOS	3	0.69

- (Codex) Codex Alemintariuos commission, (Min) Minimum, (Max) Maximum, (EC) European union (MRL's) Maximum Residue Limits, (Freq Frequency , (EC) European union , (EOS) Egyptian Organization of Standardization, (ppm) part per million (*) Extrapolated.
- The commodities (apple 2342, fig 27, grape 138, pear 23,Mandarin 1 plum 20, cucumber 123, Egg plant 117, Green peas 79, okra 69, Squash 113, Tomato 149,cabbage 87, dry Molokhia 86, carrot 91 and water cress 87) 3552 samples are free of malathion residues
- Total No of contaminated commodities of fruit and vegetables 2005 samples

Table (2): Monitoring data of malathion residues in some herbs collected from local markets in 2002.

Product Name	Total No. of samples	Freq. %	contaminated samples No	contaminated samples %	Min. Conc. ppm	Max. Conc. ppm	Mean ppm	MRL's mg/kg	No of samples violated	Violation %
Herbs_Dry herbs										
Anise Seed	219	90.87	204	93.15	0.06	20.000	3.364	0.5 EOS*	159	72.60
Basil	737	2.04	27	3.66	0.07	0.500	0.160	0.5 EOS*	16	2.17
Calendula Flower	74	5.41	4	5.41	0.06	0.200	0.095	0.5 EOS*	4	5.41
Calendula Petals	35	2.86	2	5.71	0.53	0.530	0.530	0.5 EOS*	1	2.86
Chamomile	1022	31.70	369	36.11	0.05	21.000	0.937	0.5 EOS*	127	12.43
Caraway	228	2.19	9	3.95	0.13	0.650	0.272	0.5 EOS*	1	0.44
Cumin	176	78.98	139	78.98	0.11	25.000	4.162	0.5 EOS*	122	69.32
Dry Celery	39	5.13	2	5.13	0.19	0.270	0.230	0.5 EOS*	0	0.00
Dry Coriander	276	4.32	16	5.76	0.07	6.200	0.903	0.5 EOS*	3	1.08
Dry Dill	111	43.24	57	51.35	0.05	13.000	1.160	0.5 EOS*	16	14.41
Dry Mint	2442	8.80	325	13.31	0.05	23.000	0.474	0.5 EOS*	30	1.23
Dry Parsley	135	22.96	47	34.81	0.05	0.670	0.156	0.5 EOS*	1	0.74
Fennel	526	66.16	372	70.72	0.05	17.000	0.348	0.5 EOS*	41	7.79
Hibiscus	219	0.91	6	2.74	0.07	0.300	0.185	0.5 EOS*	0	0.00
Larkspur Flower	4	25.00	1	25.00	0.30	0.300	0.300	0.5 EOS*	0	0.00
Marjoram	619	31.02	273	44.10	0.05	1.700	0.197	0.5 EOS*	17	2.75
Tillio	4	25.00	1	25.00	0.18	0.180	0.180	0.5 EOS*	0	0.00
Verbascum	17	5.88	3	17.65	0.34	0.340	0.340	0.5 EOS*	0	0.00
Green herbs										
Celery	13	38.46	5	38.46	0.16	0.340	0.242	0.5 CXL*	0	0.00
Green Coriander	89	3.37	7	7.87	0.22	0.990	0.480	0.5 CXL*	1	1.12
Green Dill	86	12.79	18	20.93	0.06	7.100	1.549	0.5 CXL*	3	3.49
Green Mint	53	24.53	15	28.30	0.05	3.700	0.940	0.5 CXL*	6	11.32
Green Parsley	87	4.60	8	9.20	0.06	1.100	0.480	0.5 CXL*	2	2.30

- (Min) Minimum, (Max) Maximum, (EU) European union (MRL's) Maximum Residue Limits, (Freq) Frequency, (EU) European union, (EOS) Egyptian Organization of Standardization, (ppm) part per million, (*) Extrapolated
- The commodities (Rosemary 7 and lemon grass 142) 149 samples are free of malathion residues.
- Total No of contaminated commodities of herbs 7213 samples

Table (3). The estimated daily intake and intake percentage of malathion residues for fruits, vegetables and herbs according to middle eastern food consumption data.

Product Name	Malathion residues Mean	Middle eastern Food consumption gm/person/ day	Estimated Daily Intake (EDI) ug/day	% Intake
Fruits				
Cantaloupe	0.103	16.0	1.65	2.48
Guava	0.100	3.1	0.31	0.47
Lemon	0.770	1.9	1.46	2.20
Oranges	0.063	47.1	2.97	4.50
Peach	0.200	2.5	0.50	0.75
Pomegranates	0.070	0.0	0.00	0.00
Subtotal fruit			**6.89**	**10.37**
Vegetables				
Fruiting vegetables				
Green beans	0.023	3.5	0.08	0.12
Hot Chili	0.130	0.1	0.01	0.02
Pepper	0.150	3.4	0.51	0.77
Strawberry	0.050	0.0	0.00	0.00
Subtotal Fruiting vegetables			**0.60**	**0.91**
Leafy vegetables				
Grape leaf	0.090	7.8	0.70	1.05
Lettuce	2.030	2.3	4.67	7.03
Green Molokhia	0.070	7.8	0.55	0.83
Spinach	0.490	0.5	0.25	0.38
Subtotal Leafy vegetables			**6.16**	**9.29**
Root vegetables				
Green Onion	0.249	23.0	5.73	8.62
Potatoes	0.540	59.0	31.86	47.95
Subtotal Root vegetables			**37.59**	**56.57**
Subtotal Vegetables			**44.35**	**66.74**

Cont. Table (3)

Product Name	Malathion residues Mean	Middle eastern Food consumption gm/per/d	Estimated Daily Intake (EDI) ug/d	% Intake
Herbs				
Dry herbs				
Anise Seed	3.364	2.3	7.74	11.65
Basil	0.160	0.3	0.05	0.08
Calendula Flower	0.095	0.0	0.00	0.00
Calendula Petals	0.530	0.0	0.00	0.00
Chamomile	0.937	0.3	0.28	0.42
Caraway	0.272	0.3	0.08	0.12
Cumin	4.162	0.5	2.08	3.13
Dry Celery	0.230	0.1	0.02	0.03
Dry Coriander	0.903	0.5	0.45	0.68
Dry Dill	1.160	0.1	0.12	0.18
Dry Mint	0.474	2.3	1.09	1.64
Dry Parsley	0.156	0.1	0.02	0.03
Fennel	0.348	0.3	0.10	0.15
Hibiscus	0.185	0.1	0.02	0.03
Larkspur Flower	0.300	0.0	0.00	0.00
Marjoram	0.197	0.1	0.02	0.03
Tillio	0.180	2.3	0.41	0.62
Verbascum	0.340	0.0	0.00	0.00
Subtotal Dry Herbs			**12.48**	**18.78**
Green herbs				
Green Celery	0.242	0.5	0.12	0.18
Green Coriander	0.480	0.5	0.24	0.36
Green Dill	1.549	0.1	0.15	0.23
Green Mint	0.940	2.3	2.16	3.25
Green Parsley	0.480	0.1	0.05	0.08
Subtotal Green Herbs			**2.73**	**4.09**
Subtotal Herbs			**15.21**	**22.89**
Total			**66.45**	**100**

- Calculated Dietary Intake for Malathion = 66.45 /1000/60 = 0.0011 mg/kg. body weight /day.
- Acceptable Daily Intake of Malathion (ADI) = 0.02 mg/kg body weight.
- Total estimated dietary intake for Malathion as a percentage of set ADI = 0.0011 * 100 / 0.02 = 5.5 %.

الملخص العربي

دراسة مخاطر السمية لمتبقيات الملاثيون في بعض محاصيل الفاكهة والخضر والأعشاب الطبية في مصر خلال عام 2002

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المعمل المركزي لتحليل متبقي المبيدات والعناصر الثقيلة في الأغذية

وزارة الزراعة – مركز البحوث الزراعية

تم إنشاء المعمل المركزي لتحليل متبقيات المبيدات و العناصر الثقيلة في الأغذية بالتعاون بين وزارة الزراعة المصرية ودولة فنلندا لعمل الاختبارات وتقيم الاستخدام الأمن للمبيدات في مصر. مركب الملاثيون احد المركبات الفسفورية المستخدمة بصورة واسعة لمقاومة الآفات. تم تصنيف مركب الملاثيون كمركب بالرتبة الثالثة بسيط السمية في وكالة حماية البيئة الأمريكية. تم اختبار عدد 12919 عينة من 57 نوع من أنواع الخضر والفاكهة وكذلك النباتات الطبية والعطرية لمبيد الكلوربيريفوس مثيل لعام 2002 حيت وجد أن 18 نوع من أنواع المحاصيل المختبرة تمثل نسبة 28.65 % خاليه من متبقيات هذا المبيد بينما 39 نوع من أنواع هذة المحاصيل باجمالى 9218 عينة 362 فاكهة 1643 خضر و 7213 نباتات الطبية و العطرية بنسبة إجمالية 71.35 % من مجموع العينات المختبرة ملوث بمتبقي مبيد الملاثيون وتعتبر هذة الأنواع من المحاصيل ملوثة. أشارت النتائج إلى أنة 4.43 % تمثل 408 عينة من مجموع أنواع المحاصيل الملوثة تحت حدود التقدير (0.02 جزء في المليون) كما أن 22.07 % عند أو أعلى من حدود التقدير لمتبقي مبيد الملاثيون بينما 77.93 % من مجموع أنواع هذة المحاصيل غير ملوث بمتبقي مبيد الملاثيون. أشارت النتائج إلى أنه 6.06 % من مجموع أنواع المحاصيل الملوثة تتعدى الحدود القصوى المسموح بها مقارنة بالحدود القصوى المسموح بها محليا أو حدود منظمة الكودكس وكذلك الحدود الأوروبية. تم تعيين متبقي مبيد الملاثيون بصورة متكررة في عينات الليمون والرمان بنسبة 20 % و 15.15 % على التوالي كما سجل الليمون أعلى نسب تعدى للحدود القصوى 13.33%. أشارت النتائج إلى أن محاصيل الخضر الجذرية هي أكثر المحاصيل مشاركة في المتناول الغذائي اليومي بمتبقي مبيد الملاثيون حيث وصلت هذه النسبة إلى 56.57% حيث كان محصول البطاطس اكبر المشاركين في مجموع المتناول اليومي . كما أظهرت الدراسة أن مجموع المتناول اليومي للخضر والفاكهة وكذلك النباتات الطبية والعطرية للمحاصيل المختبرة لهذا المبيد للإنسان المصري 0.0011 مليجرام لكل كيلو جرام من وزن جسم الإنسان في اليوم وهذه القيمة اقل من قيمة المتناول اليومي المسموح به وهو 0.02 مليجرام لكل كيلو جرام من وزن جسم الإنسان في اليوم ويمثل فقط 5.5 % من قيمة المتناول اليومي المسموح به وهذا يعنى أن التعرض لمتبقي مبيد الملاثيون بعيدا جدا عن مستوى الخطورة إلى الآن بالنسبة للمستهلك المصري.