Occurrences and risk assessment of pesticide residue in tea in Egypt

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Abstract:

Tea is one of the most consumed beverages after water, but unfortunately, the application of pesticides and heavy metals in crops make it unsafe for use. This research was conducted to evaluate the risk of heavy metals and pesticides in samples of natural source tea (Gardens) and different local market brands, the tea pests showed a higher tolerance/ resistance status due to the formation of a greater amount of esterases, glutathione S-transferase and acetylcholinesterase, using GC-MS/MS analysis and LC-MS/MS analysis for 450 pesticides residues, no pesticide residues were detected in 30% of samples, on the other hand, a 60% had detectable pesticide residues, 10% exceeding the MRLs and the highest frequently detected pesticides were tolfenpyrad followed by thiamethoxam. ADI showed that long term exposure of Egyptian consumers to pesticide residues through the consumption of some tea does not associate with health risks. However, it should be borne in mind that the current study is limited to tea.

Introduction

A pesticide may be a substance or combination of substances proposed for thwarting, demolishing, repelling, or diminishing the hurt of any vermin (Sushma *et al*., 2015). Also, pesticides are any substance or blend of substances of chemical or organic fixings aiming for repulsing, crushing, or controlling any pest, or for controlling plant development. The bug can be frightening crawlies, plant microorganisms, weeds, molluscs, feathered creatures, warm-blooded creatures, angle nematodes (Roundworms), and living beings that equal individuals for food, devastate property, spread or offer assistance pass on or spread afflictions, or are seen as an unsettling influence (Son *et al*., 2010).

The most well-known utilized pesticides incorporate insect poisons, herbicides, fungicides and rodenticides (Winchester *et al*., 2009). The other less eminent pesticides incorporate advancement controllers, plant defoliants, surface sanitisers and a few pool manufactured substances (Bhandari *et al*., 2019).

Most customarily, pesticides are utilized in prosperity ranges and agricultural yields. They are important in common prosperity for slaughtering vectors of the disease, like mosquitoes whereas, bothers hurting agricultural yields are slaughtered by pesticides. Regularly, pesticides are conceivably

noxious to other non-target life shapes, counting individuals. Along these lines, it is vital to utilize them safely and organize them fittingly (Elbaz *et al*., 2009).

Organochlorine insecticides and their metabolites (Sigma DDT, sigma HCH, HCB, Heptachlor, Epoxide heptachlor, and Aldrin) were found in samples of black and green tea, and fruit tea. The mean concentration of the organochlorine compounds in the black tea ranged from 0.0002 to 0.003 mg/kg of product, and in the green and fruit teas from 0.0001 to 0.003 mg/kg, in no case the violation of the Maximum Residues Limits was observed K. (Góralczyk *et al*., 2000).

The tea pests showed a higher tolerance/ resistance status due to formation of greater amount of esterases, glutathione S-transferase and acetylcholinesterase. Thus, over reliance on pesticides end up with pesticide residue in making tea (DDT - 10.4-47.1%; endosulfan - 41.1-98.0%; dicofol- 0.0-82.4%; ethion - 0.0-36.2%; cypermethrin - 6.0- 45.1%) (Gurusubramanian *et al*., 2008).

In this study we make a survey to detect pesticide residues in tea and estimation of daily and weekly intake.

Materials and methods

1. Instruments and apparatus:

Agilent Gas Chromatograph system 7890A equipped with tandem mass spectrometer 7000C series GC. Includes the Triple Quadrupole GC/MS/ MS EI mainframe, EI ion source, ion gauge controller with routine femtogram-level limits of detection and quantitation ultra-low noise, superior selectivity, inlet: splitless, carrier gas: helium with flow rate 1.830 ml/ min.

Agilent technologies: HP-5 MS capillary column (5 % biphenyl to 95 % dimethylsiloxane). Column internal diameter (ID): 0.25 mm, film thickness: 0.52 μ m, folumn length: 30 m was

used. Agilent high-performance liquid chromatography equipped with tandem mass spectrometer API 4000 Qtrap (Applied biosystems) triple quadrupole mass spectrometer LC-MS/ MS with mass range m/z 50 to 2800 and equipped with atmospheric pressure ion source (Turbo V) that accepts either electro sprayer ionization (TurboIon spray) and atmospheric pressure chemical ionization (ESI/APCI) probes and can measure in negative and positive modes was used.

A Perkin Elmer quadrupole inductively coupled-mass spectrometer (Q-ICP-MS) NexION 300D - USA was used. Agilent performance liquid chromatography HPLC model HP 1100/1200 series consisting of a quaternary pump (G1311A), vacuum degasser (G13779A), autosampler (G1313A), and diode array detector (G1315D) was used.

2. Materials and reagents:

Acetonitrile, 99.9 % HPLC grade was purchased from Lab Scan. Methanol 99.9 % HPLC grade was purchased from Merck. Acetone, 99.9 % HPLC grade was purchased from Lab Scan. N-hexane, 97 % was purchased from Sigma Aldrich. Suprapur® concentrated nitric acid (HNO₃) 65 % (w/w) was purchased from Merck Germany was used.

Nitric acid 2 % (v/v) was prepared as described in anhydrous magnesium sulphate fine powder, Magnesium sulphate grit was purchased from Fluka. Sodium chloride and sodium hydroxide 99 % were purchased from Reidel de Haen. Disodium Hydrogen citrate sesquihydrate and trisodium citrate dehydrate were purchased from Fluka.

Ethyl Acetate, 99.8 % was purchased from Lab Scan. Tetradecane, 99% from HPLC grade was purchased from Sigma Aldrich. Formic Acid 98-100 % was purchased from Riedel–de Haen. Pesticide reference standards

purchased from Dr. Ehrenstorfer (Augsburg, Germany), with purities > 95 % were used to prepare stock solutions dissolved in methanol for the standard stock solution of LC-MS/MS and toluene for the stock solution of GC-MS/MS.

3. Standards preparation:

Reference standard solutions of concentration 1000 μg/ml of pesticides residues were prepared and were kept at -20 ± 2 ºC; for LC-MS/MS stock solutions using acetonitrile and for GC-MS/MS using (hexane: acetone 9:1). The solvents used are appropriate to the analyte solubility, stability and method of analysis (i.e. not negatively influencing the pesticides).

Calibration mixtures of concentration levels 0.005, 0.01, 0.05, 0.1, 0.5 μg/ml for LC-MS/MS, and, 0.01, 0.05, 0.1, 0.5 μg/ml for GC-MS/MS were prepared and stored in refrigerator at the desired. Also, a working standard of aldrin with a concentration of 0.1 μg/ml was prepared in a mixture of n-hexane/ acetone (9:1) to use as an injection standard for GC-MS/MS. For based on standards preparation procedure described.

4. Sample collection

In this study, 10 tea samples representing different brands and sources packaged in different packaging materials were collected randomly from local markets in Giza, Egypt and subjected to pesticides, it differs from type of tea such as black, green, and Oolong. The samples were coded and stored before analysis at conditions similar to those of retail shops.

5. Determination

5.1. GC-MS/MS analysis

The initial oven temperature of 70 °C for 2 min, heating from 70 to 150 °C at 25 °C /min, heating from 150 to 200 °C at 3 °C/ min, heating from 200 to 280 °C at 8 °C/min, holding for 10 min. The total run time will be 42 min. Quantification of the pesticides was performed by comparing the peak areas of the pesticides to a calibration curve of the standards, and multitude point calibration was used.

5.2. LC-MS/MS analysis

The ESI source was used in the positive mode, and N_2 nebulizer, curtain and other gas settings were optimized according to recommendations made by the manufacturer; source temperature was 400oC, ion spray potential, 5500 V, declutter potential and collision energy were optimized using a Harvard apparatus syringe pump by introducing individual pesticide solutions into the MS instrument to allow optimization of the MS/MS conditions.

The Multiple reactions monitoring mode (MRM) was used in which one MRM was used for quantitation and the other was used for confirmation. As the first choice, the protonated ion was chosen as the precursor ion (Q1). By varying the collision energy for the precursor ion, the products ions for each compound were optimized by selecting the most intense products ion (Q3) Table (1).

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Table (1): Methods performance for some pesticides residues.

Pesticides	Method	LOQ	REC %	RSD	R^2	P.	1st	2nd	R.
Abamectin	LC/MS/MS	0.005	88 – 116	17	0.9998	890.5	305.1	307.1	9.09
Acephate	LC/MS/MS	0.005	70 – 110	19	0.9999	184	143.0	49	1.50
Acetamiprid	LC/MS/MS	0.005	85 - 109	13	0.9999	223.1	125.9	89.9	1.96
Atrazine	LC/MS/MS	0.005	82 – 119	7	0.9998	216.1	174.0	68.1	3.91
Azoxystrobin	GC/MS/MS	0.005	77 - 118	13	0.9999	404.1	372	329.1	4.94
Bifenazate	LC/MS/MS	0.005	82 – 106	17	0.9999	301.2	198.1	170.1	5.63
Boscalid	LC/MS/MS	0.005	89 – 117	4	0.9998	343	370	343	5.2
Buprofezin	GC/MS/MS	0.005	80 – 110	6	0.9999	306.2	201.1	306.2	7.87
Carbendazim	LC/MS/MS	0.005	86 – 109	10	0.9998	192.1	160.1	192.1	1.87
Chlorpyrifos	GC/MS/MS	0.005	73 – 100	8	0.9999	349.9	97	197.8	8.21
Cyproconazole I	LC/MS/MS	0.005	94 - 111	20	0.9999	292.1	70.1	125.1	5.65
Etoxazole	LC/MS/MS	0.005	77 – 102	7	0.9999	360.2	141	113.1	8.54
Fenbuconazole	LC/MS/MS	0.005	88 – 118	2	0.9999	337.1	125.1	70.1	6.08
Iprodione	GC/MS/MS	0.005	84 – 107	5	0.9998	330.0	244.9	246.9	6.10
Neburon	LC/MS/MS	0.005	98 – 117	3	0.9999	275.1	88.0	57.1	6.28
Phenthoate	GC/MS/MS	0.005	79 – 106	8	0.9999	321.0	247.1	163.1	6.32
Profenofos	GC/MS/MS	0.005	77 – 101	7	0.9999	375.0	304.8	302.8	7.60
Ortho phenylphenol (OPP)	GC/MS/MS	0.005	80 – 104	4	0.9999	170.07	141.06	115.05	11
Propiconazol	GC/MS/MS	0.005	94 – 115	4	0.9998	342.1	69.1	159.1	6.64
Pyridaben	GC/MS/MS	0.005	87 – 103	8	0.9999	365.2	147.1	309.1	8.93
Pyriproxyfen	GC/MS/MS	0.005	85 – 116	6	0.9998	322.2	96.1	78.1	8.10
Pyrimethanil	GC/MS/MS	0.005	77 – 104	4	0.9999	200.1	107.2	82.0	4.68
Tebuconazole	GC/MS/MS	0.005	94 - 108	5	0.9998	308.1	70.0	124.9	6.49

P. Precursor ion   R. Retention time(min) 1st .   1st Qualifier   2nd .   2nd Qualifier

6. Quality control

For pesticides residues, the quantifications limits of pesticides residues were 5 µg/kg. The measurement uncertainty is expressed as expanded uncertainty and in terms of relative standard deviation (At 95% confidence level) is within the range of ± 50 % see Table (1).

7. Estimation of daily and weekly intake

Risk assessment is calculated by comparing the concentrations of residues detected, with the established acceptable daily intake (ADI). The calculated EDI was obtained by multiplying the mean concentrations of detected and the number of tea consumed based on WHO/Global Environment Monitoring System-Food Contamination Monitoring and Assessment Program average consumption diets (WHO/GEMS/FOODS) (Ghuniem *et al*., 2020 and GEMS/Foods, 2012). Acceptable daily intake (ADI) is a very import concept in chemical risk assessment. It is defined as the maximum amount of a chemical that can be ingested daily over a lifetime with no appreciable health risk. We will calculate it using this equation.

EDI $=\Sigma RLi \times Fi / Bw$
RLi = residue level of the vegetable;
Fi = food consumption data
BW= Body weight.

Results and discussion

1. Pesticides occurrences:

Pesticides used in agricultural areas in the world to eliminate pests that damage the fruits, vegetables and herbs provide an unquestionable benefit for agricultural production. However, after their application, pesticide residues remain on the crops and constitute a risk for the human health because of their toxicity so the monitoring data obtained from this study enable decision makers to take corrective actions towards risk management. Pesticide residues are substances that remain on or in air, water, soil, or food following its use. Even food grown without direct pesticide use can still contain residues due to spray drift from nearby farms, long range air transport, or existing groundwater or soil contamination (Magkos *et al*., 2003). Samples were analyzed for detection of 450 pesticides. The MRLs of Codex Alimentarius were used for comparison when those limits were available. In the absence of Codex MRLs, European limits were used.

A total of ten samples of tea during 2019 was collected from the Egyptian local market. The detected pesticides, minimum, maximum, detected levels, numbers and percentages of violating samples are shown in Table and Figure. Table (2) and Figure (1) shows the residue level of different pesticides detected and the percentage of samples with residue level exceeding MRL in tea samples during 2021. No pesticide residues were detected in 30% of samples on the other hand a 60% had detectable pesticide residues, 10% exceeding the MRLs.
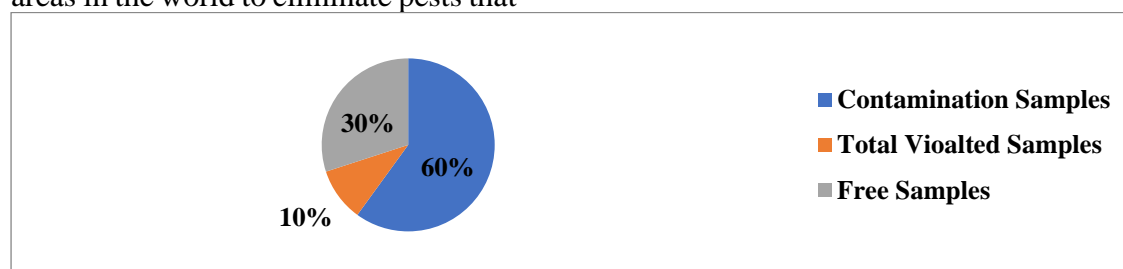

Figure (1): The contamination and the violation percentage in tea samples during 2020.

Table (2): Show the mean, maximum and minimum concentration.

NO.	Pesticide	EU Limits	Mean	Max	Min
1.	Acetamiprid	0.05	0.10	0.16	0.06
1.	Ethion	NO	0.12	0.12	0.12
2.	Thiacloprid	NO	0.06	0.06	0.06
3.	Thiamethoxam	20	0.27	0.27	0.27
4.	Fenpyroximate	8	0.02	0.02	0.02
5.	Propargite	5	0.03	0.03	0.03
6.	Chloropyrifos	2	0.02	0.03	0.01
7.	Hexaconazole	0.05	0.03	0.03	0.03
8.	Bifenthrin	0.5	0.07	0.18	0.01
9.	Cyflutrin	NO	0.03	0.05	0.01
10.	Cyhalothrin Lambda	0.01	0.03	0.06	0.01
11.	Cypermethrin	15	0.05	0.09	0.01
12.	Deltamethrin	5	0.04	0.05	0.02
13.	Fenpropathin	3	0.02	0.04	0.01
14.	Oxyflurofen	NO	0.01	0.01	0.01
15.	Propoconazole	NO	<LOQ	0	0
16.	Indoxcarb	5	0.02	0.02	0.01
17.	Pyridaben	0.05	0.02	0.02	0.02
18.	Triazophos	0.02	0.01	0.01	0.01
19.	Quinalphos	0.05	0.03	0.03	0.03
20.	Metalaxyl	NO	0.03	0.03	0.03
21.	Buprofezin	0.05	0.11	0.13	0.09
22.	Lufenuron	0.05	0.03	0.04	0.01
23.	Tolfenpyrad	30	0.39	0.39	0.39
24.	Imidacloprid	50	0.06	0.08	0.03
25.	Carbendazim	0.1	0.07	0.07	0.07
26.	Chlorantraniliprole	0.02	<LOQ	0	0
27.	Chlofenapyr	60	0.07	0.1	0.03

The violated compounds in tea samples were acetamiprid, ethion,thiacloprid, thiamethoxam, fenpyroximate, propargite,chloropyrifos, hexaconazole, thiacloprid, fenpyroximate, bifenthrin, biphenyl cyflutrin, cyhalothrin lambda, cypermethrin, deltamethrin, fenpropathin, oxyflurofen, propoconazole, indoxcarb, pyridaben, triazophos, quinalphos, metalaxyl, buprofezin lufenuron, tolfenpyrad, imidacloprid, carbendazim, chlorantraniliprole, chlofenapyr, carbendazim.The highest frequently detected pesticides were tolfenpyrad followed by thiamethoxam. It differs from type of tea such as black, green, and Oolong. It is required to compensate the matrix effects by a matrix-matched calibration which could be more efficient than by ECHO technique in LC/MS and GC/MS system. In this study, analytically confirmed pesticides-free organic sample were used as blank matrix. The blank green tea sample was selected as the representative matrix for green and the blank black tea sample was selected as the representative matrix for black samples. For the determination of matrix effects, the responses of the standard solutions prepared in solvent were compared with the responses of the standard solutions prepared in pesticides-free blank tea sample.

The safety qualities were paid more attention by the consumers all over the world. For the purpose of

control of tea pests in the tea production, chemical pesticides are applied. Due to the following aspects, the residue level on/in tea plant is much higher than that on/in other crops under the same applied dosage. As with other crops, control of pests of pesticide is widely used in tea production. However, due to the above mentioned characteristics that differentiate from other crops, the suitable pesticides used in tea production are somewhat different from the pesticides used in other crops. That is high efficiency to target pests, low acute toxicity, easy to degrade under natural condition, no taint to tea aroma. Up to now, the popular chemical pesticides used in tea production are as follows : Endosulfa , Imidacloprid > Bifenthrin, Cypermethrin > Deltamethrin >Acetamiprid> Propagite. Overview of the MRL violations per country of origin China was 17.6 % in Non-compliant Products including tea, According to the results of determination of China tea sample (Around 50,000 tea samples), those pesticides that higher than the MRL standards of EU are as follows: Fenvalerate > Fenpropathrin > Imidacloprid > Acetamiprid. However, the percentage of tea samples that higher than the MRL standards issued by EU was decreased significantly in recent years.

The results of recovery as indicated by relative standard deviations confirmed that the methodology, including extraction and cleanup procedure are suitable for the tea matrix (Table 3). The QuEChERS method offered the limit of quantification of 0.002 for 450 pesticides. The number of samples categorized as per residue levels are tabulated in Table (1). Percentage distribution of samples of different residues is presented in Figure (1). Acetamiprid residues were detected in

samples no. 4, 9 and 10 with concentration (0.16, 0.06 and 0.07) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. Ethion, thiacloprid, thiamethoxam, fenpyroximate, propargite, hexaconazole, thiacloprid, fenpyroximate, propargite, hexaconazole, thiacloprid, fenpyroximate, oxyflurofen and propoconazole were detected in sample no. 4 with concentration (0.12, 0.06, 0.27, 0.02, 0.03, 0.03. 0.01, 0.01 , 0.01 and LOQ) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. In 1.92 % of total samples analysed, dicofol and hexaconazole residues were detected which were below the EU MRL of 20.0 and 0.05 μg g−1, respectively. Ethion and quinalphos were detected in 3.63 and 13.89 % of the samples, respectively, which were below the EU MRL of 3.0 and 0.1 μgg−1 (Kottiappan *et al*., 2013). Chloropyrifos residues were detected in samples no. 3, 4, 5, 9 and 10 with concentration (0.01, 0.01, 0.01, 0.02 and 0.03) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. Bifenthrin residues were detected in samples no. 4, 6, 9 and 10 with concentration (0.01, 0.04, 0.06 and 0.18) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. Biphenyl residues were detected in samples no. 3 and 6 with concentration (0.01 and 0.01) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. Cyflutrin residues were detected in samples no. 4 and 10 with concentration (0.01, and 0.05) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. Cyhalothrin Lambda residues were detected in samples no. 4, 6, 9 and 10 with concentration (0.02, 0.01, 0.02 and

0.06) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. cypermethrin residues were detected in samples no. 4, 5, 9 and 10 with concentration (0.06, 0.01,0.02 and 0.09) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. Deltamethrin residues were detected in samples no. 4 and 6 with concentration (0.02 and 0.05) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. Fenpropathin residues were detected in samples no. 4, 6, 8, 9 and 10 with concentration (0.03, 0.01, 0.01 and 0.04) mg/kg of the total samples analysed which were below the codex alimentarius MRL value. Indoxcarb, pyridaben, triazophos, quinalphos, metalaxyl, lufenuron, tolfenpyrad, imidacloprid, carbendazim, chlorantraniliprole, and chlofenapyr were detected in sample no. 9 and 10 with concentration (0.02 and 0.01 indoxcarb, 0.02and <LOQ pyridaben, 0.03 and 0.03. Triazophos 0.01 and 0.01, quinalphos and metalaxyl in sample no. 10 is 0.03 mg/kg, lufenuron 0.04 and 0.01, tolfenpyrad in sample no. 9 is 0.39 mg/kg, imidacloprid 0.03 and 0.08, carbendazim and Chlorantraniliprole is in sample no.10 (0.07 and <LOQ) of the total samples analysed which were below the codex alimentarius MRL value. Apart from this sample no. 9 and 10 showed the presence of buprofezin and chlofenapyr residues (0.13 and 0.09) and (0.03 and 0.1) respectively, however, the contents were exceeding the codex alimentarius MRL. Among the samples surveyed in Munnar and Nilgiris region, 6.17 and 19.70 % of the total samples showed detectable levels of residues of pesticides. Among the samples surveyed in gudalur and wayanad (India), 35.29 and 6.52 %, respectively,

of the total samples showed detectable levels of pesticide residues (Kottiappan *et al*., 2013). It is well known that only hot water extract of black tea (Tea brew) is used for human consumption and not the green tea as such. Hence, it is evident that the possible route of exposure to pesticide residues is the black tea. The real cause depends on the quantum of the residues leached from black tea into tea brew and not on the mere presence of residues in the black tea. All the regulatory agencies, including (Chinese and japan) have fixed the maximum residue levels of pesticides in black/green tea since these are the commodities being traded. However, the residues of pesticides that leach into the brew is abysmally low, and in the majority of cases, the residues do not leach into the brew, making it safer than any other similar drink. The leaching of residues into the brew depends on the solubility of the pesticide in water (Jaggi *et al*., 2001).

Earlier large-scale survey of teas produced in the tea factories of South India had been carried out for a period of 3 years from 2006 to 2008 and tea samples were analysed for the residues of certain pesticides. Analytical data proved that <0.5 % of tea samples had pesticide residues which were below their MRL (Seenivasan and Muraleedharan, 2011). Extensive surveys were carried out during 2009 to 2011. Though the residues of ethion, quinalphos, hexaconazole, dicofol, propargite and fenpropathrin were most commonly found, only one sample exceeded the MRL fixed for hexaconazole by European Union (Kottiappan *et al*., 2013).

Table (3): Recovery of fortified pesticides in tea.

Pesticide	Fortification level	Recovery%
Bifenthrin	0.01	86
Buprofezin	0.01	74
Chlofenapyr	0.01	72
Chloropyrifos	0.01	84
Cyflutrin	0.01	91
cypermethrin	0.01	89
Deltamethrin	0.01	82
Fenpropathin	0.01	79

2 . The risk assessment of pesticide residue in tea:

Acceptable daily intake (ADI) is a very import concept in chemical risk assessment. It is defined as the maximum amount of a chemical that can be ingested daily over a lifetime with no appreciable health risk as Table (4).

Humans can get exposed to various chemical substances via oral route (i.e, eating food, drinking groundwater, hand to mouth transfer). It is necessary to determine the maximum amount of a chemical that can be ingested on a daily basis to protect human health. That is why we need to calculate the Acceptable Daily Intake (ADI). For pesticide residues and food contaminants, ADI may also be called Tolerable Daily Intake (TDI). The US Environmental Protection Agency has replaced ADI and TDI.

Table (4): Accepted daily intake.

No.	Pesticide	Accepted daily Intake (Range) mg/kg bw.
1	Acetamiprid	0.07
2	Ethion	0.01
3	Thiacloprid	0.01
4	Thiamethoxam	0.01
5	Fenpyroximate	0.01
6	Propargite	0.01
7	Chloropyrifos	0.01
8	Hexaconazole	0.01
9	Bifenthrin	0.01
10	Biphenyl	0.125
11	Cyflutrin	0.01
12	Cyhalothrin Lambda	0.125
13	Cypermethrin	0.02
14	Deltamethrin	0.02
15	Fenpropathin	0.02
16	Oxyflurofen	0.01
17	Propoconazole	0.07
18	Indoxcarb	0.01
19	Pyridaben	0.01
20	Triazophos	0.01
21	Quinalphos	0.01
22	Metalaxyl	0.08
23	Buprofezin	0.01
24	Lufenuron	0.01
25	Tolfenpyrad	0.01
26	Imidacloprid	0.06
27	Carbendazim	0.03
28	Chlorantraniliprole	0.01
29	Chlofenapyr	0.03

The present results showed that, the long term exposure of the Egyptian consumers to pesticide residues through the consumption of some tea does not associate with health risk. However, it should be borne in mind that the current study is limited to a tea. Moreover, the estimated risk assessment via long-term exposure is based on toxicological evaluation of the single compounds and not based on an evaluation of cumulative exposure to multiple pesticide residues.

Pesticides can have a cumulative "toxic loading" effect both in the immediate and long term, and each person accumulates and responds to chemicals in a way that is biochemically and biographically unique. From birth, we build up a chemical "body burden" that reflects a combination of childhood and workplace exposures, pesticide residues on food, chemicals in home and personal care products and the quality of air and water in our communities.

The process of dietary pesticide risk assessment has been presented the process estimation of pesticide residue levels, estimation of food consumption patterns, and characterization of risk based on a comparison of exposure estimates with toxicological criteria have been identified. Each component of the process is subject to considerable uncertainty that may compromise the accuracy of the final risk assessment. In estimating pesticide residue levels, common practices range from highly theoretical models assuming that all residues are present at a predetermined level (Typically at the tolerance level) to the use of market basket survey data obtained at the time the food is ready for consumption (GadAlla *et al*., 2015; Kawahara *et al*., 2007; Darko and Akoto, 2008 and Osman, 2011).

In this study, analysis by Q-ICP–MS has *been* a fast, simple, and reliable methodology for the determination of some potentially toxic elements in tea samples, while QuEChERS extraction method followed by analysis by GC-MS/MS and LC-MS/MS has been a fast, easy, and reliable methodology for the determination residues in tea samples after acetonitrile extraction/partitioning and cleanup by dispersive SPE. We get 60% had detectable pesticide residues, 10%, exceeding the MRLs also pesticides detected non-carcinogenic risk and carcinogenic risk were evaluated, but that even after a long time consumption gets bad effect on human and basket survey data obtained at the time the food is ready for consumption.

These kinds of studies would contribute to the identification of low-quality fruit tea products on the market and assure a high safety profile of tea.

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