Undergraduate students, population, Health & wellness

Determination of OCPs and POPs residues in local produce in Qatar and their health implications

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Abstract

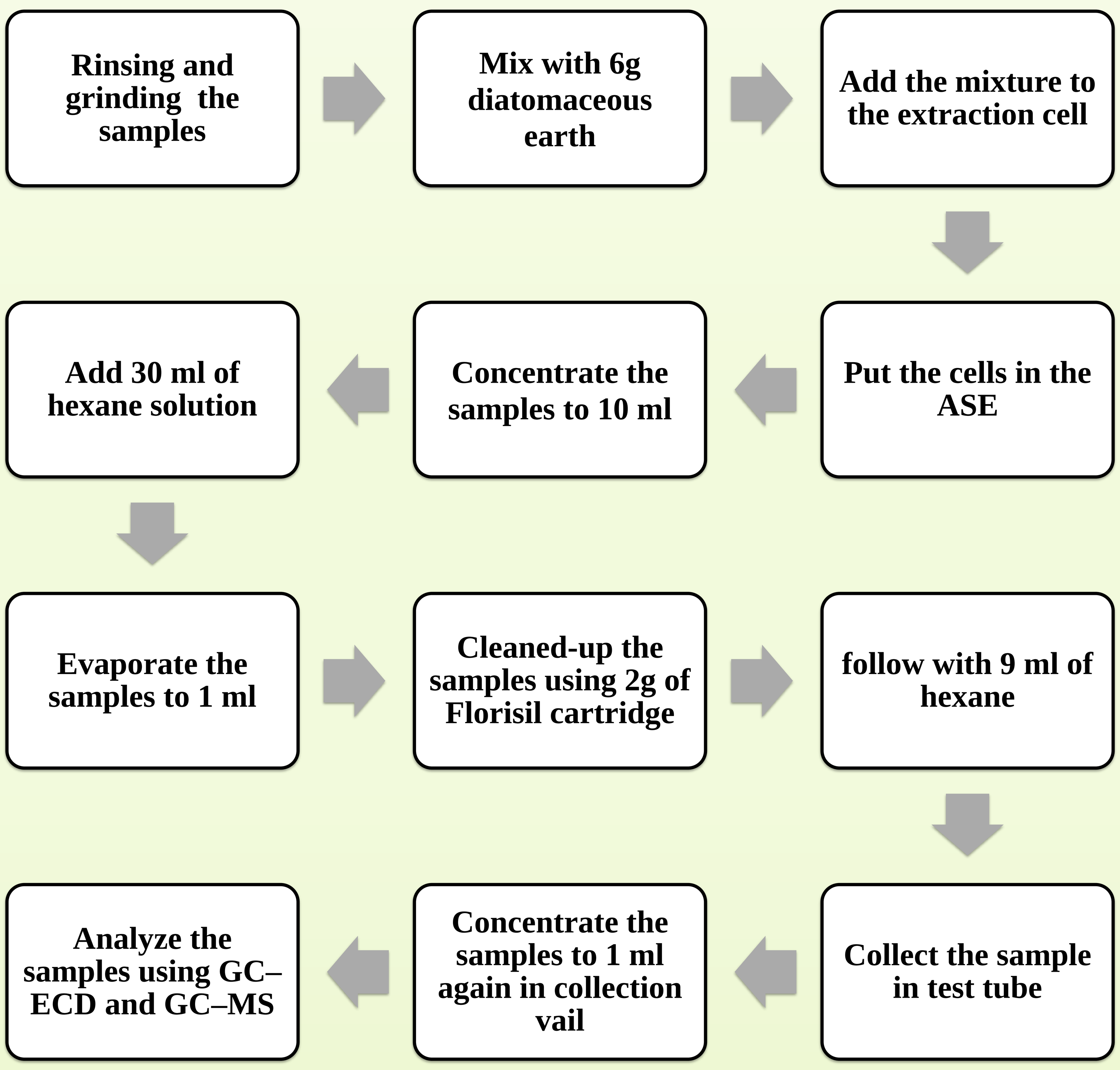
In this study, a total of 49 samples of fruits and vegetables (dates, leafy vegetables and fruiting vegetables) produced locally in the farms in Qatar and 42 samples of soil and water from these farms were analyzed using Gas Chromatography-Electron Capture Detector (GC/ECD), and Gas Chromatography-Mass Spectrometry (GC-MS) to detect residual levels of organochlorine pesticides (OCPs). The levels of OCPs of all samples were below the MRLs. The correlation analysis results showed that water and soil could be a potential source of the contamination of a-BHC, b-BHC, heptachlor, g-chlordane and endrin in the fruit and vegetable samples. In this study, a risk assessment analysis was also performed to estimate daily intake of OCPs by Qatari population. The risk assessment study revealed that the intake of the studied OCPs posed no risk to human health due to their levels of intake below MRLs.

Introduction

Fruits and vegetables are essential components of the human diet. They provide numerous vitamins, trace minerals and antioxidants responsible for maintaining a healthy body. However, these products may contain toxic pesticides from soil and water (Fenik, Tankiewicz, & Biziuk, 2011). Pesticides that are the compounds present in different groups of chemical structures are applied to agricultural products at several steps of farming and post-harvest production (Bakirci et al. 2014). Pesticides are among the Persistent Organic Pollutants (POPs) that are highly resistant to environmental degradation. Therefore, POPs could bioaccumulate to a hazardous level in the environment, which may negatively affect human health. These pesticides fall under the Organochlorine Pesticides (OCPs) which are the most used types of pesticide groups in agriculture due to their high efficiency in the protection of crops from damage and pest infestations

Methodology

91 samples of vegetables, dates, soil and water were collected randomly from seven local farms in Qatar. 10g of each sample were weighed and 6g of Diatomaceous earth were mixed with them, then added in extraction cell in Dinoex-Accelerated Solvent Extractor (ASE 200 and ASE 350). 1 liter of each water sample was transferred to a separating funnel where 5 ml of Hydrochloric acid (HCl) and 60 ml of Dichloromethane were added. The samples were shaken. The separation procedure was repeated 3 times. 5 g of anhydrous sodium sulfate were added. The extracted samples were concentrated to 10 ml. Hexane solution (30 ml) were added to the concentrated samples. Then, the samples were evaporated to 1 ml. The EPA method 3620C-Florisil Cleanup was used. The extracted samples (1 ml) were cleaned up using 2g of Florisil cartridge. The Florisil cartridge was eluted with 4 ml of hexane. Then, 1 ml of the extracted samples were added to the cartridge followed by 9 ml of hexane and collected in a test tube. After that, the samples were concentrated again into 1 ml using nitrogen evaporator (DIONEX SE 500) and were collected in a collection vial. After that, Gas Chromatography –electron capture detector (ECD) and GC–MS scan mode was used. The intake of OCPs from fruits and vegetables was estimated based on the daily consumption per capita of the total Qatari population in 2012-2013 data.



Results

Table 5. Estimated intakes of 10 tested OCPs through fruits and vegetable consumption by total population in Qatar

OCPs	Mean (mg/kg)	Intake[1] (mg/day)	MRLs (mg/kg)	Pesticide exposure
a-BHC	0.00038	0.00022	0.01	Below the MRLs
b-BHC	0.00077	0.00044	0.01	Below the MRLs
Heptachlor	0.00354	0.00200	0.01	Below the MRLs
Aldrin	0.00095	0.00054	0.01	Below the MRLs
g-Chlordane	0.00011	0.00006	0.02	Below the MRLs
Endosulfan I	0	0	0.01	Omitted
a-Chlordane	0.00018	0.00011	0.02	Below the MRLs
Dieldrin	0.00036	0.00020	0.01	Below the MRLs
Endrin	0.00342	0.00195	0.05	Below the MRLs
Methoxychlor	0.03187	0.01820	0.01	Above the MRLs

[1] The daily intake of OCPs was calculated by multiplying total mean of each pesticide detected in fruit and vegetable samples by the total daily intake of Qatari population (0.571 mg/day).

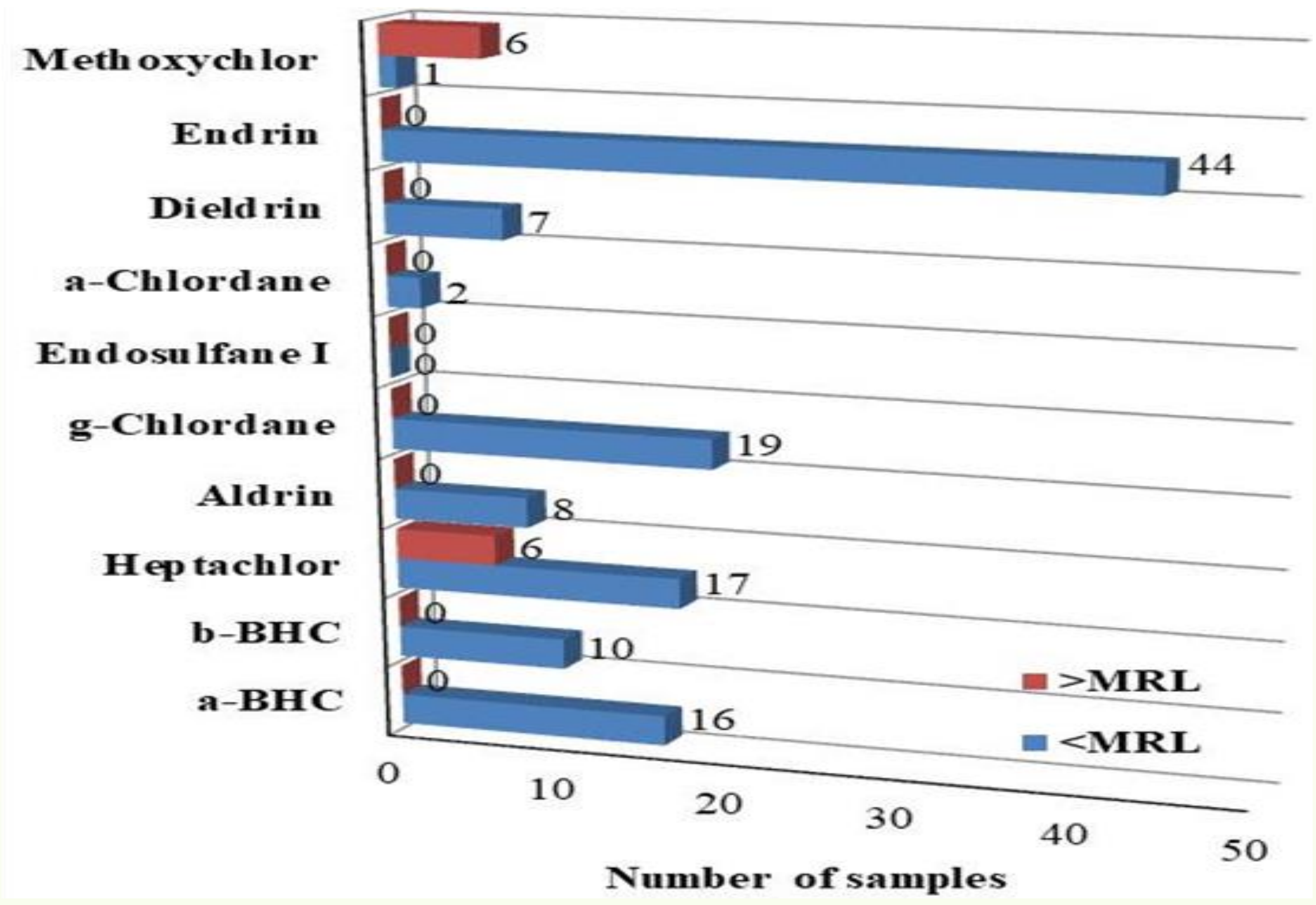


Figure: Occurrence of pesticide residues in fruit and vegetable samples. For each pesticide detected, the number of samples with residue levels below or above MRL is indicated.

Conclusion

This study tested fruits and vegetable samples collected from 7 Qatari farms in different locations. The correlation analysis results showed that water and soil could be a potential source of the contamination of a-BHC, b-BHC, heptachlor, g-chlordane whereas endrin was the source of OCP in the fruit and vegetable samples. Endosulfane was not detected any of the fruit and vegetable or soil and water samples. The level of endrin was higher in date samples while the levels of heptachlor, endrin and methoxychlor were higher in fruiting vegetable samples. On the other hand, the levels of b-BHC and dieldrin in leafy vegetable samples were higher than the levels detected in date and fruiting vegetable samples. However, the levels of OCPs of all samples were below the MRLs. It can be concluded from these results that the level of pesticide residues in the produce of Qatar has limits that are lower that the minimum levels as per the Stockholm standards and poses no health risk.

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