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Processed Organic Foods: Are they free from pesticide residue?

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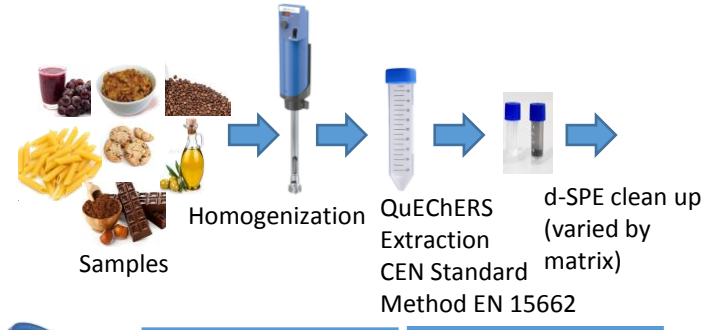
INTRODUCTION

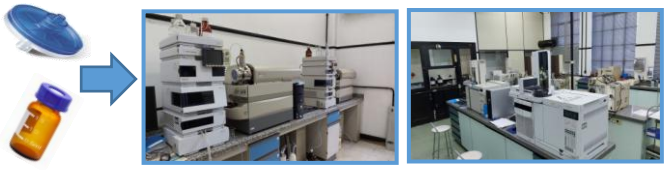
Organic farming is being propagated worldwide due to growing concern for food safety and its direct bearing on human health. The purchase of organic products is linked to sustainable, conscious consumption and green consumption. But what about the processed organic foods that are currently being offered in the supermarket, are they free from pesticide residue?

OBJECTIVE

Check for the presence of 228 pesticides in processed organic foods by analyzing 45 samples including breakfast cereal, sugar, wheat flour, cookie, pasta, olive oil, juice, coffee, chocolate, and chocolate powder, and spice, collected from June to December 2020 in markets in São Paulo city, Brazil.

MATERIALS AND METHODS





LC-MS/MS **AND** GC-MS/MS

Note: For the oil olive matrix, the S19 method was used.

Liquid Chromatographics Conditions

Analytical Column: Zorbax C18 100 mm × 2.1 mm and 3.5 µm particle
Mobile Phases: A – H_2O : MeCN (95 + 5) and B – H_2O : MeCN (10 + 90) both with 2 mM Amonium Formate + 0.1 % Formic Acid
Gradient Program: started at 5% B, constant 1 min, goes to 30% B (in 0.1 min), linear to 100% B (up to 10 min), after constant 9 min 100% B; post time: 10 min using 5% B
Flow Rate: 0.25 mL/min **Injection Volume:** 10 µL **Temp. column:** 40°C
Detector: Sciex 3200 Qtrap **LC:** Agilent 1200 Series LC Systems
2 transitions each compound using scheduled mode.

Gas Chromatographics Conditions

Injector: Splitless Purge: 30 mL/min at 0.75 min at 250°C
Analytical Column: Agilent HP-5ms Ultra Inert 15 m x 250 µm x 0.25 µm
Carrier Gas: He **Flow Rate:** 1 mL/min **Injection Volume:** 1 µL
Oven temperature: 60 °C held for 1 min, increased at 40 °C/min to 120 °C, increased at 5 °C/min to 310 °C, total run time 40.5 min and a cool-down and equilibration time of 0.5 min.
Post-Column Backflush for 4 min
Detector: Agilent 7000 GC/MS Triple Quad **GC:** Agilent 7890A GC System
3 transitions each compound using time segments mode

Pesticides Analyzed:

2-4-6 trichlorophenol, 2-aminobezimidazole, 3-hidroxi carbofuran, abamectin, acephate, acetamiprid,acrinathrin, alachlor, aldicarb, aldicarb sulfoxide, aldicarb sulphon, aldrin, alpha-chlordane, alpha-cypermethrin, alpha-endosulfan, alpha-HCH, ametryn, amicarbazone, amitraz, anilazine, atrazine, azinphos-ethyl, azinphos-methyl, azoxystrobin, benalaxyl, benfluralin, benfuracarb, benomyl, beta-cyfluthrin, beta-endosulfan, beta-HCH, bifenthrin, bispiribac-sodium, bistrifluron, bromopropylate, butylate, captafol, captan, carbaryl, carbendazim, carbofuran, carbophenothion, carbosulfan, cartap, chlordane, chlorfenapyr, chlorfenson, chlorfenvinphos, chlorfluazurom, chlorobenzilate, chlorothalonil, chlorprophan, chlorpyrifos, chlorpyrifos-methyl, cis permethrin, clethodim, clomazone, clothianidin, cyanazine, cyazofamid, cycloate, cyfluthrin (I, II, III, IV), cyhexatin, cymoxanil, cypermethrin (I, II, III, IV), cyproconazole, cyromazine, DDD-pp' and op', DDE-pp' and op', DDT-pp' and op', delta-HCH, deltamethrin, demeton-S-methyl and metabolites, diazinon, dichlofluanid, dichlorvos, dicloran, dicofol, dicofol op', dicrotophos, dieldrin, difenoconazole (I and II), dimethenamid- P, dimethoate, dinocap, disulfoton, diuron, dodecaclor (Mirex), endosulfan sulphide, endrin, epoxiconazole, EPTC, esfenvalerate, ethion, etofenprox, famoxadone, fenamidone, fenamiphos, fenarimol, fenbutatin oxide, fenchlorphos, fenitrothion, fenoxaprope-ethyl, fenpropathrin, fenson, fensulfothion, fenthion, fenvalerate, fipronil, flazasulfuron, fluazinam, flufenoxuron, flumetralin, fluquinconazole, flutiacete metil, flutriafol, folpet, fonofos, formothion, gamma-chlordane, heptachlor, heptachlor epoxy A and B, hexachlorbenzine, hexazinone, imazalil, imidacloprid, iprodione, iprovalicarb, kresoxim, lambda-cyhalothrin, lindane, malaoxona, malathion, metalaxy-M, methamidophos, methidathion, methiocarb, methomyl, methoxychlor, methylpentachlorophenyl sulphide, mevinphos, milbemectin, molinate, monocrotophos, naled, nicosulfuron, nitrofen, novaluron, omethoate, oxamyl, paraoxona-ethyl and methyl, parathion-ethyl, parathion-methyl, PCBs (28, 52, 101, 138, 153 and 180), pebulate, pendimethalin, pentachloroaniline, pentaclorofenol, pethoxamid, phenothiol (MCPA – thioethyl), phentoate, phorate, phosalone, phosmet, piperonyl butoxide, pirimicarb, pirimiphos-methyl, prochloraz, procymidone, profenofos, profluralin, prometon, prometryn, propaquizafop, propargite, propazine, propiconazole (I and II), propoxur, propyzamide, prothioconazole, pyraclostrobin, pyretrins (I and II), pyridafenthion, pyriproxyfen, quintozene, simazine, spirodiclofen, spiromesifen, tebuconazole, tecnazene, tefluthrin, terbuthylazyne, terbutryn, tetrachlorvinphos, tetraconazole, tetradifon, tetrasul, thiabendazole, thiacloprid, thiamethoxam, thiazopyr, thiobencarb (benthiocarb), thiometon, thiophanate-methyl, tolylfluanid, trans permethrin, triadimefon, triadimenol, tri-allate, triazophos, triclorfon, trifloxystrobin, triflumuron, trifluralin, trinexapac-ethyl, triticonazole, vamidathion, vernolate, and vinclozolin.

RESULTS

Sample	Pesticide	Quantity (mg/kg)	Uncert. (mg/kg)
breakfast cereal	pirimiphos-methyl	0.04	0.0208
breakfast cereal	pirimiphos-methyl	0.03	0.0163
breakfast cereal	pirimiphos-methyl	0.1	0.0453
breakfast cereal	pirimiphos-methyl	0.15	0.0639
pasta	pirimiphos-methyl	0.01	0.0064

MRL 5.0 mg/kg for wheat/maize

The pirimiphos-methyl insecticide is widely used in storage grain, so a possible contamination source may have been during the grain stocking used as raw material to prepare the processed food.

CONCLUSION

The presence of synthetic chemicals does not necessarily preclude that the food can be considered organic, as they may have been contaminated with pesticides unintentionally. We highlight the need to monitor processed organic samples and also the fact that Brazilian processing companies still face difficulties in finding organic raw-material.

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SÃO PAULO GOVERNO DO ESTADO