What Pesticides Have You Eaten Today?

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**Purpose of Study:**
There is a lot of concern about ingesting pesticides that could be left on fruits and vegetables. Pesticides are designed to be toxic, and their effects on people aren’t very well understood, so it’s best to avoid them when you can. I will evaluate which fruits contain the most pesticides and if washing and peeling helps to remove them.

**Hypothesis:**
If a water rinse doesn’t remove the pesticides, then the skin of the fruit must be retained then.

**Materials:**
- Assorted Fruits, peeled and unpeeled
- Assorted organic fruits, peeled and unpeeled
- Blender
- Chemicals – water, acetonitrile (ACN), acetic acid
- pesticides standards
- QuEChERS kit
- Mass-spectrometer
- Volumetric flasks and breakers
- Pipettes
- Analytical balance
- Centrifuge
- Autosampler vials
- Gloves
- Lab-coat and eye protection

**Procedure:**
1. Wash one set of grapes for 30 seconds with cold water
2. Remove peel from one set of oranges, organic oranges, bananas and organic bananas
3. Cut up fruits (except grapes) and place in individual marked containers. (Figure 1)
4. Place containers in freezer overnight
5. Blend each fruit sample and place back in container, wash blender between each sample (Figure 2)
6. Weigh out 10g of each homogenized fruit to conical tube
7. Make a standard solution of 1% acetic acid in water (v/v)
8. Add 15 mL of the standard solution to each vial and an assigned a value because it was below the instrument’s limit of quantitation (LLOQ)
9. Once completely dry, add 1mL of mobile phase (90% Water/10% ACN)
10. Spin down each vial in a centrifuge for 1 minute at >1,500 rcf
11. Shake each vial by hand for 1 minute
12. Remove 1 mL from each vial and dry down under nitrogen
13. Cut up fruits (except grapes) and place in individual marked containers. (Figure 1)
14. Dilute each vial in a centrifuge for 1 minute at >1,500 rcf
15. Add 1 mL to each vial in a centrifuge for 1 minute at >1,500 rcf
16. Remove 1 mL from each vial and dry down under nitrogen
17. Once completely dry, add 1 mL of mobile phase (90% Water/10% ACN)
18. Dilute each vial in a centrifuge for 1 minute at >1,500 rcf
19. Add a Q-sep packet from the QuEChERS kit to each vial following the instructions in the kit
20. Shake each vial by hand for 1 minute
21. Spin down each vial in a centrifuge for 1 minute at >1,500 rcf
22. Remove 1 mL from each vial and dry down under nitrogen
23. Once completely dry, add 1 mL of mobile phase (90% Water/10% ACN)
24. Dilute each vial in a centrifuge for 1 minute at >1,500 rcf
25. Add a Q-sep packet from the QuEChERS kit to each vial following the instructions in the kit
26. Shake each vial by hand for 1 minute
27. Spin down each vial in a centrifuge for 1 minute at >1,500 rcf
28. Remove 1 mL from each vial and dry down under nitrogen
29. Once completely dry, add 1 mL of mobile phase (90% Water/10% ACN)
30. Add a Q-sep packet from the QuEChERS kit to each vial following the instructions in the kit
31. Shake each vial by hand for 1 minute
32. Spin down each vial in a centrifuge for 1 minute at >1,500 rcf
33. Analyze for pesticides using a mass spectrometer

**Results:**
A summary of the most interesting pesticides found in the fruit samples are listed in Tables 1A-C. A summary of the most interesting pesticides found in the fruit samples are listed in Tables 1A-C. The items outlined in red are discussed in more detail below. These tables were generated from the mass spectrometer reports (see binder). The ng/mL numbers were generated by comparing the fruit samples to the calibration curves. Figure 6 shows an example of what the raw mass spectrum looks like for a pesticide standard. The ng/mL values were converted to parts per billion (ppb) by using the weight of the fruit and a dilution of 15 mL. (step 8 of Procedure). The maximum tolerances (ppb) reported in Tables 1A through C were found by searching the Electronic Code of Federal Regulations database online. A dash (—) indicates that there is no maximum tolerance. The maximum tolerances fell below the maximum tolerances.

In summary, in this study we found out that organic is not truly better. That the levels were right about the maximum tolerance but they were still present. Also, washing your fruits just made the labels look good. We don’t eat the skins! Some recipes ask for orange and citrus fruits. Washing your grapes just with water does not make much of a difference. Maybe they need to be washed with something stronger than water, like soap. The peel of the oranges and bananas contain most of the pesticides so it is good that we don’t eat the skin! Some recipes ask for orange and bananas. Most of the pesticides are found in the skin but is at a very low level. This is probably because it was banned for a couple years and is not widely used because it may be harmful to bees. In Graph 3 it can be seen that the peeling of the banana also made a big difference but again pesticides (Imazalil and Thiabendazole) were found in the pulp. The organic bananas contained much less pesticides and seemed to be the cleanest of all the fruits.

**Conclusions:**
This project will help people make better food choices and better understand what is going into their bodies.

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