



How to Turn Your Kitchen into a Lab!

Charlotte P. Brennan, PhD, Food Science Specialist

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Frequently, consumers find themselves with a good ingredient that is similar to something they are familiar with, but does not have quite the same properties. An example is a food ingredient normally used by the food industry, but not usually available to households. The “recipes” used by industry do not directly convert to the quantities prepared in the home. The immediate question is then “What do I do with it?” or “How much of this should I substitute for whatever was normally used?” Dietary restrictions or allergies and just plain curiosity may also motivate the desire to experiment with food products.

Many of the questions received by the Extension Service do not have clear-cut obvious answers. Extension personnel would have to experiment with the product before being able to answer specific questions. The nice thing is you already have the resources at hand to run your own experiments, and the final decision on what works best will be made by the people who will be eating the product! All that is needed to get you started are a few guidelines. Just about any type of good product can be tested at home with the exception of home canning methods which require specialized equipment to establish safe procedures.

As an example for the following guidelines, let us consider making a cake using oil instead of shortening.

General Guidelines for Your Research

✓ 1. Deciding on your variables.

There is considerable latitude in what you want to test. For example, if you wanted to find out how to use a bag of corn sugar, you could test a direct substitution of corn sugar for sucrose (household sugar) in a variety of products. Or you could try using different ratios of sucrose and corn sugar in one or more products. The cooking method could also be the variable. Candy made from corn sugar would have different final cooking temperature requirements than would candy made from sucrose.

For my oil substitution in a cake problem, I plan to start with a direct substitution of oil for fat in a conventional cake recipe and depending upon the results of this, decide on what other variables, if any, are needed. Who knows, I may be lucky and have a good cake on the first try!

✔ 2. What are you going to use for comparison?

Should you have a control? Sometimes memory of the characteristics of a product is all you have to go on; however, it is much better to have a control. A control is the product made in the normal way with the normal ingredients. This provides a sample for comparison purposes.

For my cake control, I plan to make a cake using a favorite recipe. Cakes freeze well for up to 3 months, and since I really don't feel like making two cakes the same day, I will freeze half of the cake and serve my family the other half of the cake.

✔ 3. Don't vary too many things at the same time.

If you change the proportion of several ingredients and also the cooking method in the same samples, you will not be able to figure out which of the changes caused your results. This is known as confounding your data.

Let us say that not only did I want to use oil in the place of shortening in a cake, but I also wished to cut down on calories and sugar. Therefore, I made a cake with half of the usual fat and with half the usual sugar. The final cake was tough, flat and coarse in texture. By trying out three different things at one time, I didn't save time since I don't know if the results are caused by: 1) substitution of oil for shortening, 2) decrease in fat level, 3) decrease in sugar level, or 4) some combination of these. All I know is that the combination that I tried was not successful.

✔ 4. Hold everything constant except your variable when preparing your samples.

If you don't do everything exactly the same each time, you run the risk of accidentally confounding your results. This means use the same ingredients, combine with ingredients in the same order, mix it for the same amount of time, cook it under identical conditions (same oven temperature, rack position, time) and in general repeat your techniques as closely as possible. Write down how you went about making the product so that you will remember if you wish to try another variable at a later date.

I decided that I would make two cakes using oil as the fat, but try different mixing methods to see if that would make a difference. For the first cake, I followed the conventional methods (fat was creamed with the sugar, eggs then added and the mixture beaten until light, dry ingredients and milk alternately added while mixing). The second cake was made with a one-step method (all ingredients placed in bowl and then beaten). The only problem was I forgot that I didn't have enough cake pans, so the second cake was baked in an angel food cake pan. The second cake looks a bit taller, but I don't know if this is due to the second mixing method or due to the pan. Once again, I've confounded the results.

✔ 5. Analyzing your results.

A research lab may have sophisticated instruments, however, you can make important observations in your kitchen.

A. Physical testing. A critical observation of the samples can be very valuable regardless of the product. Line up all of the samples that you have made and look at them with a critical eye for color, textural, and volume differences. This technique can be used for a wide variety of products. Is there a difference in the graininess of the fudge? Did one variable of cookies spread more than another? Are the bread loaves of different sizes? Did one version of jelly set up stronger than another? Are there any color differences?

B. The final test is how well it tastes, so run a taste panel using your family members and friends as judges. One of the rules for conducting taste panels is not to tell your judges which sample is which. It can bias them. Put each sample on a plate or in a bowl and label with something like “X,” “Y,” and “Q” or numbers like “359” and “298.” (Letters like A, B, C, D, and F are not recommended. They have grade implications.) A second rule is not to let judges influence the other judges. Either have the judges write their results or comments, or have them judge the samples with no one else present. You can have the judges tell you which sample they like the best, next best, and least (this is a ranking test), or give each sample a number from a scale of 1 to 10 with 10 meaning the product is perfect and 1 for an extremely poor quality (this is a rating test). Once everyone has made an independent decision, it is okay to talk about the samples.

For physical measurements on my cake samples, I lined up the control, and the two oil-containing cakes and looked at them carefully. The control had a finer grain. The one-bowl method cake seemed to be slightly finer grained than the oil-containing conventional method. Next, the cakes were sliced into similar size pieces and labeled 159, 484, and 753. Family members and friends were given ballots and told to rate the cake slices on a scale from 1 to 10 for how well they liked the appearance, texture, and flavor of each cake.

✔ 6. Flops and where to go from there.

Flops are disappointing, however, they are to be expected.

It is especially helpful in explaining your results to have information on the role of the various ingredients in your product. Some cookbooks include information, however, a better source is a food preparation or experimental food text book. See if your library has anything that will help you.

Be sure to consider if there is a direction in your flops relating to your variables.

At this stage, I have three samples of cakes (control, oil in conventional method, oil in one-bowl method). Neither of the oil variables had produced a very good cake, but the one bowl method seems a little better. In going back and rereading the section in a text book on the role of fats in cakes, I found that one of the functions of shortening is to provide air sites which the gas produced by the baking powder will expand into cells. The oil did not hold enough air in the system which was one reason why the cell structure was so coarse. At this stage, I need to figure out a way of incorporating more air into the batter, or accept the fact that I will have a coarse textured cake as long as I try to use oil in the place of shortening.

✔ 7. Is it repeatable?

Most research labs will repeat the variables a minimum of two or three times to make sure that the results are real. You may not wish to spend this much time on it, however, it would be a good idea to, at least, repeat your final formulation before you send the recipe to all your friends.

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