

KITCHEN SCIENCE: Baking for Special Needs

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Experience “test-kitchen” science in classrooms or out-of-school programs! Use griddles, waffle irons, ovens or skillets!

- Do-It-Yourself (DIY) baking is part of an “active lifestyle,” burning 125+ calories per half hour of shopping, *mis en place* preps, mixing and clean-up!
- DIY baking helps meet the needs of a variety of “customers.”
- Choose ingredient adaptations and use with almost any favorite recipe to meet a special need—reduced sodium; adding whole grains, fruits or veggies, nuts, potassium; ingredient allergies. (See example recipe.)

1) View or print control recipe, Orange Raisin Nut Bread, website www.calraisins.org/recipe/orange-raisin-nut-bread. Bake this prize winning recipe as the **control** product. Note: Flavors and moisture will improve if bread/muffins are sampled the day after baking the bread.

2) Assign each baking scientist or team one substitution (*variable*) to test for customer acceptability. Label each product with a number and variable being tested. Insert a paper strip with the variable number written on it and place paper between batter and pan side before baking begins.

Substitution (*variable*) options:

- **Reduce sodium.** Help achieve the recommended 2300mg sodium per day. See how recipe tastes as “low sodium” (140 mg or less per serving).
 - Use unsalted butter for salted butter, reduce salt to 1/8 teaspoon and add 1 teaspoon favorite dry spice or 1 tablespoon orange/lemon zest, substitute buttermilk with 1 cup yogurt OR mix 1 tablespoon lemon juice or vinegar + milk to equal 1 cup.
- **Ingredient allergies.** (Choose ONE as a variable.)
 - **Egg** – substitute for 1 large egg = 1/4 cup soft tofu OR 1 tablespoon flax meal + 3 tablespoons water.
 - **Lactose or casein** – substitute plain, unflavored almond, soy or rice milk for dairy milk and sour as recipe directs.
 - **Wheat** – substitute for whole wheat, all-purpose, cake, or bread flours. Options: Barley and rye flours (contain some gluten to improve texture and volume); also corn, oat, tapioca, rice, quinoa, and sorghum flours; potato starch. Use one type or a blend: Ex: 1/3 corn flour, 1/3 barley flour, 1/3 potato or corn starch, 1 teaspoon xanthan gum/cup flour. May increase leavening 1/4 or 25%.
- **Boost protein and heart healthy fats.** Include toasted, unsalted nuts or seeds (soy, pepitas, sunflower, sesame).
- **Agave nectar sweetener.** 2/3 cup agave nectar for 1 cup brown sugar; reduce liquid by 1/4 cup (more about gave nectar at www.chsugar.org and www.dominosugar.org).
- **Add moisture, flavor and boost nutrients.** Choose ONE. Add with liquids: 1/2 cup grated carrots, apple or zucchini, canned pumpkin OR mashed, cooked sweet potato.
- **Reduce fat.** Use skim or 1% milk.
- **Gluten-free.** Do not use wheat, barley or rye flours. **Gluten-free Flour Blend:** 2 cups brown rice flour, 2/3 cup potato starch, 1/3 cup tapioca flour, 1 teaspoon xanthan gum. Mix well. Makes 3 cups. (Recipe courtesy of www.landolakes.com) More at www.homebaking.org Glossary, Gluten-free or www.csaceliacs.org.



Flour Variables

- **Make it whole grain.** Switch half to 3/4 of the flour in the recipe to whole wheat flour – whole white wheat flour will provide a lighter color, milder taste
- **Add grain variety.** Replace 1/4 cup wheat flour with 1/4 cup of a non-wheat whole grain flour or meal. Options include: cornmeal, oatmeal, flax meal OR barley, brown rice, quinoa, sorghum, soy or spelt flour



3) Copy A Matter of Taste Evaluation forms for consumer taste-test. (For best flavor, sample product the day after baking.) Tally the results for each product. Calculate the percentages for each category. (Ex: 15 of 25 marked product was “just right” – 15 ÷ 25 = 60%) (Note: A 60% or higher positive response in a category is an acceptable customer rating. A lower % of acceptance means the product will not “sell,” improvement needed.)

4) Provide Baking Science Lab Variations Evaluation to each team. Record assessments of each product variable for texture, moisture, tenderness, flavor, color.

- Have teams discuss their observations during preparation, baking, and sampling.
- Based on their **Lab Variations Evaluation** and consumer *Matter of Taste* responses, have them target what needs to improve (rankings below 60%) and how they may improve the product. (Ex: add/reduce liquid; increase/reduce oven temperature; shorter/longer bake time).

5) Pricing and Value. Bring or assign participants to find prices for specialty muffins or mixes at local supermarkets, bakeries, coffee houses.

- List all the ingredient costs and have labs total their costs for each lab recipe.
- How many muffins did your lab make? Divide total ingredient cost by number of muffins.
- Compare your muffin costs with commercial muffin prices. How much would you charge for one of your muffins at a coffee house? Six muffins?
- You may compare cost of your lab’s dry ingredient mixture weight with the cost of a commercial muffin/quick bread mix. Compare the same net oz/gm weight of mix.



6) Portion Size, Nutrient Comparisons. Discussion:

1. One ounce is considered one grain serving. How many grain servings are in one lab muffin.
2. How do the lab muffins compare in weight/size to commercially baked muffins? (View or assign Portion Distortion Quiz, www.nhlbi.gov). What are several results of super-sizing?
3. How do sodium, fat, total calories, sugars and nutrients compare? Does this muffin qualify for “low sodium” labeling? Whole grain label? (See www.wholegrainscouncil.org)
4. What are the benefits for baking these products at home? How would you market them?

7) Share the Wealth!

- Sample your product with a local baker, food service, child care or coffee house to see if one of these specialty products could be served or sold to their customers.
- Demonstrate your new knowledge and products for a local food pantry, after-school club or child care center.
- Sell your products at a bake sale fundraiser. Promote each unique product if “low sodium” or “whole grain” or for an allergy.



Whole Grain Orange Raisin Nut Muffins or Bread

Makes 14 medium muffins (3oz/85g) or 1 large loaf (14 slices)



Ingredients

- 1 1/2 cups (180g) whole wheat flour
- 1/2 cup (60g) all-purpose flour
- 1/4 cup (33g) whole yellow cornmeal OR wheat germ OR oatmeal
- 1 1/2 teaspoons (6g) baking powder
- 1 teaspoon (4.5g) baking soda
- 1/8 to 1/4 teaspoon (3g) salt
- 1 cup (220g) firmly-packed brown sugar OR 2/3 cup (224g) dark agave nectar*
- 1/2 cup grated carrot OR apple OR cooked sweet potato OR pumpkin
- 1 large egg OR 1 tablespoon (6.5g) flax meal + 3 tablespoons water (mix; let stand 5 minutes)
- 1 cup buttermilk OR yogurt OR 1 tablespoon lemon juice + 1% milk to equal 1 cup sour milk (mix; let stand)
- 1/4 cup (2oz/56g) melted unsalted butter
- 1 tablespoon (6g) grated orange peel
- 1 teaspoon vanilla
- 1 cup (160g) conditioned California raisins**
- 1 cup (117g) toasted, chopped nuts OR unsalted seeds (pumpkin pepitas, sunflower, or soy nuts)

*Reduce milk 1/4 cup if using agave nectar

**Cover raisins with water or orange juice, then drain

Directions

1. Preheat oven to 350° F for loaf or 400° for muffins. Lightly grease 9 x 5 x 2 1/2 inch loaf pan OR grease bottoms or line 14 muffin cups.
2. In a large mixing bowl, measure or weigh the first six dry ingredients. Blend well with whisk.
3. In a second bowl whisk to blend well the sugar or agave nectar, grated carrot, egg/egg substitute, milk, melted butter, orange peel and vanilla.
4. Add conditioned raisins and nuts or seeds to dry mixture. Make a large dip in the center of the mix; add liquid mixture. Stir together only until all the ingredients are moistened.
5. Scoop batter into prepared loaf pan or muffin cups (filling 2/3 full). Bake loaf 45 to 50 minutes at 350° F or muffins 18 to 20 minutes at 400° F. Cool pan 5 minutes on wire rack.
6. Turn loaf or muffins onto rack to cool, then wrap. Store one day at room temperature or freeze.



(Product is even better eaten/sampled the next day.)

Nutrition Facts:

One of 14 pieces (3oz/85g) provides: Calories 263; 5g protein; 42g total carbohydrates (17g sugars, 14g starch, 4g dietary fiber); 9g total fat (3g sat. fat, 0g trans fat); 10mg cholesterol; 130mg sodium; 198mg potassium; Vit. A (15%) 813IU; Calcium (6%) 51mg; Vit. C (4%) 2mg; Vit. D 7IU; Folate 15mcg; Iron (8%) 1.6mg; Omega 3 fatty acids, 1g; Omega 6 fatty acids, 3g

(Nutrition facts based on first ingredient in this recipe.)

Supporting Sites and Resources

California Raisin Board - www.loveyourraisins.com
 Choose My Plate - www.choosemyplate.gov
 C and H or Domino Sugar/Agave nectar
www.chsugar.com www.dominosugar.com
 Home Baking Association - www.homebaking.org
 Glossary/guides/links
 DIY Baking Channel, how-to demo, cornbread
 A Baker's Dozen Labs Manual
 Bakers Dozen DVD
 Land O'Lakes Test Kitchens - www.landolakes.com
 Portion Distortion - www.hp2010.nhlbihin.net/portion
 Wheat Foods Council - www.wheatfoods.org
 Whole Grains Council - www.wholegrainscouncil.org

