

KITCHEN SCIENCE: Baking for Special Needs

Prepared/tested by Sharon Davis, Family & Consumer Sciences Education, www.homebaking.org



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, p.2.)

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. 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” (140mg or less per serving)

- Use unsalted butter for salted butter
- Reduce salt to 1/8 teaspoon
- Add 1 teaspoon favorite dry spice or 1 tablespoon orange/lemon zest when reducing salt
- For 1 cup buttermilk, use 1 cup yogurt OR mix 1 tablespoons lemon juice or vinegar + milk to equal 1 cup

- **Ingredient allergies.** (Choose ONE as a variable.)

- **Egg** – substitute for 1 large egg = ¼ 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, sour as recipe directs
- **Wheat** – substitute a gluten-free flour blend for the whole wheat and all-purpose 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 with whisk or mixer wire whip. Makes 3 cups. (Recipe courtesy of www.landolakes.com.) For more information read *More About Food Allergies*, and visit Glossary, Gluten-free, www.homebaking.org.

- **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 ¼ cup (more about agave nectar at www.candhsugar.com and www.dominosugar.com)
- **Add moisture, flavor and boost nutrients.** Choose ONE. Add with liquids: ½ cup grated carrots, apple or zucchini, canned pumpkin OR mashed, cooked sweet potato
- **Low fat.**
 - For 1 cup buttermilk, use 1 cup low fat yogurt OR 1 tablespoon lemon juice or vinegar + low fat milk to equal 1 cup



Flour Variables

- **Make it whole grain.**

Switch half to ¾ 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 form 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” – $15 \div 25 = 60\%$) (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!

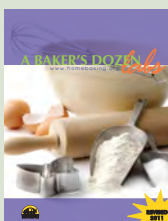
- Sample your product with a local baker, food service, child care or coffee house to see if one of these specialty products could be served or sold to their customers.
- Demonstrate your new knowledge and products for a local food pantry, after-school club or child care center.
- Sell your products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

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
Baker's 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



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 71U; Folate 15mcg; Iron (8%) 1.6mg; Omega 3 fatty acids, 1g; Omega 6 fatty acids, 3g

Whole Grain Orange Raisin Nut Muffins or Bread

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



Ingredients

- 1 ½ cups (180g) whole wheat flour
- ½ cup (60g) all-purpose flour
- ¼ cup (33g) whole yellow cornmeal OR wheat germ OR oatmeal
- 1 ½ teaspoons (6g) baking powder
- 1 teaspoon (4.5g) baking soda
- ⅛ to ¼ teaspoon (3g) salt
- 1 cup (220g) firmly-packed brown sugar OR ⅔ cup (224g) dark agave nectar*
- ½ 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)
- ¼ 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 ¼ 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 ½ 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.



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

More About Food Allergies



For Teacher:

Download resources about food allergies from the Newsletter archives of *Food Insight*. The International Food Information Council (IFIC) Foundation provides science-based information on health, nutrition and food safety for the public good. Sign up for *Food Insight* online newsletter at www.ific.org.

“Myths and Facts About Food Allergy”

Myth: Lots of people have food allergies.

Reality: Daryl Altman, M.D., American College of Allergy, Asthma and Immunology/Allergy Information Services: “In surveys, nearly one-in-three American adults indicate they are allergic to some foods. In reality, two percent of the population is food allergic. Food allergies should be diagnosed by a board-certified allergist.

Children are most susceptible to food allergy – up to five percent have some type of food allergy. Common allergens such as milk and eggs may be outgrown by age five.

90% of serious allergic reactions to food are from eight foods: peanuts, tree nuts, dairy, soy, wheat, eggs, fish and shellfish. (*Food Insight* newsletter archives, search Food Allergies, Nov/Dec 1997-2012.)

Myth: Any negative reaction to food is a food allergy.

Reality: Food allergy is a very specific reaction involving the immune system of the body. Food allergies are rare, food intolerances or sensitivities are more common. An intolerance, like lactose (milk sugar) intolerance, may result in a bloated feeling or gas after consuming milk or dairy products. Milk allergy can have life-threatening consequences. It is important to have a board-certified allergist diagnose a food allergy so it can be managed, and so foods essential to your health are not unnecessarily avoided.

Myth: A food allergy means I’ll just get a runny nose.

Reality: No – food allergy is rare but is a serious condition. Food allergy is a reaction of the body’s immune system to a certain component, usually a protein, in a food or ingredient.

Reactions are mild – vomiting, diarrhea, skin rashes and runny nose, sneezing or coughing, within hours or days after eating – to serious, such as a reaction called anaphylaxis, occurring within seconds, minutes or hours of eating. Anaphylaxis causes hives, swelling, choking, severe vomiting and even shock. Food-allergic persons who may have anaphylaxis reaction should have an emergency plan in place with teachers, schools, friends.

Celiac Disease – Celiac disease is a hereditary autoimmune disease where gluten adversely affects the small intestine, as well as contributes numerous other symptoms that vary among people. It is a lifelong, sometimes fatal disease, and those affected must avoid wheat, rye and barley. It estimated to affect approximately 1 percent of the U.S. population and many go undiagnosed. Blood tests can be done although they are not 100% accurate. An intestinal biopsy is the gold standard for detecting celiac disease.

Gluten-Sensitivity – although there are no tests for gluten-sensitivity, sufferers often have the same symptoms as those with celiac disease except their small intestine is not damaged. Approximately 6% of Americans are thought to be gluten-sensitive and must avoid wheat, barley and rye forever.

Wheat-Allergic people have an IgE-mediated response to wheat protein (not necessarily the gluten portion). These individuals must only avoid wheat, and not other grains. Most children who are allergic outgrow the allergy.

Bake a Gluten-Free Waffle

Visit www.argostarch.com for a crisp gluten-free waffle. Choose from 1 of 5 gluten-free variations (Banana, Cornmeal, Plain, Lemon-Blueberry, Pumpkin).



Important Food Allergy Resources

National Institute of Allergy and Infectious Diseases (NIAID)
View 2011 food allergy management practices and guidelines.
www.niaid.nih.gov/topics/foodallergy/clinical/pages/default.aspx
The American Academy of Allergy, Asthma and Immunology
(1-800-822-2762) www.aaaai.org
Celiac Sprue Association, Gluten-Free guidance (1-877-CSA-4CSA)
www.csaceliacs.org
Food Allergy Network (1-800-929-4040) www.foodallergy.org
International Food Information Council *Food Insight*,
www.foodinsight.org
Home Baking Association, Glossary, www.homebaking.org

A MATTER OF TASTE Evaluation



Product name: _____ Age/Grade : _____ Date: _____

The food tasted: _____ very good _____ good _____ okay, but not my favorite _____ needs improvement

The food tasted: _____ sweet _____ bitter _____ salty _____ sour _____ not what I expected _____ just right

The color is: _____ great _____ too pale _____ too dark _____ not right for the product

The aroma (smell) is: _____ too strong _____ too weak _____ just right _____ not good

The product is: _____ too moist _____ moist _____ dry _____ crumbly

The food looks: _____ yummy _____ okay _____ not quite there yet

I would enjoy eating this food again: _____ yes _____ no _____ maybe

Comments:



Baking Science Lab Variations Evaluation



| VARIATION | TEXTURE | TENDERNESS | AROMA | FLAVOR | COLOR |
|-------------------|---------|------------|-------|--------|-------|
| LAB 1 original | | | | | |
| LAB 2 _____ | | | | | |
| LAB 3 _____ | | | | | |
| LAB 4 _____ | | | | | |
| LAB 5 _____ | | | | | |
| LAB 6 _____ | | | | | |