Colorado State University Extension

Gluten-Free Baking

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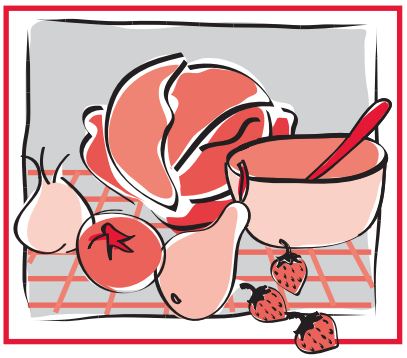

What is Gluten?

Gluten is most often associated with wheat and wheat flour but can also found in barley, rye, and triticale – a wheat hybrid. Gluten proteins in wheat flours make dough elastic and stretchy, and trap gas within baked goods, providing a light, airy structure. Spelt is closely related to wheat and is *not* suitable for use in gluten-free products. Additionally, gluten can be found in products made with these grains like salad dressing, sauces and even toothpaste.

The Food and Drug Administration (FDA) requires all foods containing major allergens to be labeled. They also are working to establish gluten-free labeling standards for foods that contain no gluten or gluten at such a low level they have not been shown to produce a reaction. The proposed limit for gluten-free designation is 20 parts per million.

The best advice is to read the label carefully and contact the manufacturer if you are unsure about the gluten status of a food product. Keep in mind, however, that other gluten-containing grains, like barley and rye, are not required to be labeled, so "wheat-free" is not the same as "gluten-free."

Baking without Gluten

Baking without gluten (as found primarily in wheat flour) can be challenging because gluten contributes important properties to various types of baked products like cookies, cakes, pastries and breads. Gluten development is not as important for cookies as it is for cakes, so gluten-free flours can be substituted with similar results. Cakes and other types of batter-based products, like pancakes, need gluten for its gas-retaining ability that produces a light and airy interior structure and a tender crumb.

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In addition to replacing the wheat flour with gluten-free flour, other additives can hold gas. These products include xanthan gum and guar gum that can be found in the baking or natural food section of the grocery store. Bread is perhaps the most challenging gluten-free baked product to make because gluten provides structure, creates a tender crumb, and retains gas. With experimentation and practice, a combination of gluten-free flours and gums can be used to create a loaf with good volume, softness and texture.

Although it is not a baked product, pasta is usually made from hard wheat flour. The gluten component not only gives structure to the noodles but also keeps the starch in the flour from leaching into the cooking water or becoming too sticky. These properties can be approximated with the use of gluten-free flours in combination with eggs and xanthan gum.

Replacement Products

A wide variety of gluten-free flours, starches and baking aids can be used in combination to produce high-quality baked goods and pasta. Recipes calling for 2 cups of flour or less are more easily adapted, especially those that use cake flour because they contain lower levels of gluten. Many of the alternative grains and pseudo-cereals commonly found in the marketplace are listed in Table 1. Pseudo-cereals are "false cereals" that are not derived from grasses (as are true cereals), but come from other plants that have seeds that can be used in the same manner as cereal-based grains. Table 1 summarizes the profile and qualities of these grains and pseudo-cereals.

White rice flour and starches usually can be stored in the pantry but because of higher fat and protein content, purchase whole grain flours and meals in smaller quantities and store in the refrigerator or freezer. Because of the relatively short shelf-life, you may want

Quick Facts

- Baking without gluten can be challenging because gluten contributes important properties to baked goods.
- A wide variety of gluten-free flours, starches and baking aids can be used to produce high quality baked products.
- Using combinations of various gluten-free products can enhance nutritional content.
- Gluten-free baking is a trial-and-error process.

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The most common binder in gluten-free baking are eggs. Eggs can replace many of the functions that gluten provides, such as binding, enhancing texture and helping set the structure of the final product.

to take a small taste of the flour before blending to determine if a rancid taste has developed. Several of these flours, such as almond, can be made at home with a coffee grinder.

Flour Blends

Baking books and online resources frequently offer gluten-free flour blend formulations for use in making cookies, cakes, quick breads and yeast breads. The formula might include three or four different types of flours and starches and make 2 to 12 cups of blended flour. Flours with stronger flavors typically make up no more than 25 percent to 30 percent of the total blend and are balanced by neutral flours and starches. Stronger tasting flours (such as bean flours) generally are used in small quantities in recipes that feature delicate flavors. A higher percentage of these flours can be used in baked goods that include nuts, chocolate, or a high level of spice. Flour blends for quick breads often contain 1/2 teaspoon xanthan gum per cup of flour while yeast breads contain 3/4 teaspoon per cup of flour blend.

Gums and Binders

The most common binder in gluten-free baking are eggs. Eggs can replace many of the functions that gluten provides, such as binding, enhancing texture and helping set the structure of the final product. Besides eggs, which are protein-based, two starch-based products often used to bind and thicken gluten-free baked products are guar gum and xanthan gum. These products are largely interchangeable and are used in small amounts (1/2 to 1 teaspoon per cup of flour) to add volume and texture to baked goods. Both are also commonly carried in large grocery chains, either in the baking aisle or natural foods section of the store.

High Altitude Gluten-free Baking

Baking at high altitude (greater than 3000 feet above sea level) can be challenging when using traditional wheat flour recipes. Liquids evaporate faster and gases in cakes and breads expand quicker, requiring adjustments to ensure a good final product. When wheat flour is replaced with gluten-free flour(s) these same challenges remain, although there are no set guidelines on how to successfully compensate for the altitude change. The home cook is advised to experiment with recipes, first making any necessary adjustments for the altitude change and then altering the recipe further as needed to adjust for the properties of the gluten-free flours. For assistance with high altitude baking, see the Colorado State University Extension brochure, *High Altitude Food Preparation Guide*, available at http://www.ext.colostate.edu.

Baking Tips

Gluten-free baking can be a trial-and-error process. Here are some tips that can help achieve successful results.

To Increase Nutrition

- Use a variety of gluten-free flours in combination to maximize nutrition (Table 1).
- Use whole grain or enriched, gluten-free flours (vitamins and minerals have been added).
- Substitute up to 1/4 cup ground flaxseeds plus 1/4 cup water for 1/4 cup flour in a recipe (flax will absorb more moisture).

To Increase Moisture

- Add gelatin, extra egg or oil to the recipe.
- Honey or rice malt syrup can help retain moisture.
- Brown sugar often works better than white.
- Dough enhancers improve tenderness and staling resistance.

To Enhance Flavor

- Add chocolate chips, nuts, or dried fruits.
- Double the amount of spices.

To Enhance Structure

- Use a combination of gluten-free flours and mix together thoroughly before adding to other ingredients.
- Add dry milk solids or cottage cheese into recipe.
- Use evaporated milk in place of regular milk.
- To reduce grainy texture, mix rice flour or corn meal with liquid. Bring to a boil and cool before adding to recipe.
- Add extra egg or egg white if product is too crumbly.
- Do not over beat; kneading time is shorter since there is no gluten to develop.
- When using a bread machine, use only one kneading cycle.

Leavening

- Starch flours need more leavening than wheat flours.
- Rule-of-thumb: start with 2 teaspoons baking powder per cup of gluten-free flour and adjust downward as need for altitude.
- If baking soda and buttermilk are used to leaven, add 1 1/8 tsp. cream of tartar for each 1/2 teaspoon baking soda used to neutralize acid.
- For better rise, dissolve leavening in liquid before adding to other ingredients or add a little extra baking powder.

Texture/Lightness

- Sift flours and starches prior to measuring. Combine and sift again (together) after measuring to improve the texture of the product.
- Hold gluten-free dough at least 1/2 hour (up to overnight) in the refrigerator to soften and improve the final texture of the product.
- In products made with rice flour or corn meal, mix with the liquid called for in the recipe. Bring to a boil and cool before adding to recipe to help reduce grainy texture.

Baking Pans and Utensils

- Bake in smaller-than-usual portions at a lower temperature for a longer time (small loaf pans instead of standard size; use mini-muffins or English muffin tins instead of large muffin tins).

Table 1. Profiles of Alternative Grains and Pseudo-cereals.

Gluten-free Flours & Starches	
Type	**Characteristics**
Amaranth	Pseudo-cereal native to South America Higher in protein, fiber and iron than most grains Provides structure and binding capability Pleasant, peppery flavor Best used in combination with other gluten-free flours
Arrowroot	Used as thickener and in baking similarly to cornstarch
Bean/Legume	Legume flours include fava beans, garbanzo beans, soybeans Good source of protein and fiber Best used in combination with other gluten-free flours to balance taste and texture Bean flours complement sorghum flour
Buckwheat	Nutritious grain rich in B-vitamins, magnesium, dietary fiber and antioxidants Strong, somewhat bitter flavor Best used in pancakes or yeast breads in combination with neutral gluten-free flours
Chia (Salba)	Like flax, ground chia seeds can add nutritional value to baked goods Neutral in flavor
Corn flour	Used in breads, waffles, and tortillas
Corn meal	Used in spoon breads and baking powder-leavened breads
Corn starch	Works well in combination with tapioca starch
Flax	Ground flax seeds increase nutritional value High in soluble fiber which allows gel formation; retains moisture and gives spongy texture to baked goods Nutty, bold flavor Adds color to baked goods
Millet	Powdery consistency, color similar to cornmeal Delicate, sweet flavor Suitable for use in flatbreads and muffins
Montina (Indian rice grass)	Milled from a grass native to Montana High in fiber and protein
Nut	Nut flours include almond, pecan, walnut, hazelnut, filbert, and chestnut Contribute flavor and nutrition to baked products Best used in combination with other gluten-free flours to balance taste and texture
Quinoa	Pseudocereal native to South America Good source of protein, folate, copper and iron Mild, slightly nutty flavor Suitable for cookies, cakes and breads
Potato flour	Neutral flavor Blends well with stronger flavored flours
Potato starch	Provides a light consistency to baked products Helps retain moisture, combines well with eggs Bland flavor, low in fiber and nutrients
Rice, Rice bran	Comes in brown, white and sweet varieties Best used when combined with other gluten-free flours and binders or gums Neutral flavor Sweet rice flour is used in pie crusts and as a thickener
Sorghum (milo)	Tropical cereal grass native to Africa Sweet, nutty flavor Best when used with other neutral gluten-free flours and gums
Teff	Small cereal grain native to Africa Taste similar to hazelnuts Very high in nutrients Ability to gel makes it a good thickener
Tapioca	Starchy, sweet flavor Adds chewy texture to breads Used in blends to improve color and crispiness of crusts

- Use dull or dark pans for better browning.
- Keep a separate sifter to use with gluten-free flours to prevent cross-contact with gluten.

Freshness

- Gluten-free baked goods can lose moisture and quality quickly. Wrap them tightly and store in the refrigerator or freezer in an airtight container to prevent dryness and staling.
- Refrigerate all flours for freshness and quality but bring to room temperature before measuring. Home Freezing of Vegetables, Charlotte M. Dunn, Circular B-1219, University of Wisconsin Extension Service, Madison, Wis.

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Additional Resource

For information on baking gluten-free products or following a gluten-free diet, see CSU Extension bulletin 530A, *Wheat, Gluten, Egg and Milk-Free Recipes* and Fact Sheet 9.375, *Gluten-free diet guide for people with Celiac Disease*, J. Li.