

# Gluten-Free Baking: A Guide to Gluten-Free Flours

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## Gluten & Celiac Disease

- ❖ *Gluten* is the main protein found in wheat, barley, and rye.<sup>1</sup>
- ❖ *Celiac disease* is a genetic, autoimmune disease in which the immune system views gluten as harmful.<sup>1</sup>
- ❖ When people with celiac disease consume gluten, the immune system causes inflammation that damages the small intestine. This damage prevents the small intestine from properly absorbing the macro-(CHO, protein, lipid) and micronutrients (vitamins and minerals).<sup>1</sup>

## Can Gluten-Free Flour Replace Wheat Flour?

- ❖ Wheat flour performs many different functions and is made up of both protein (gluten) and starches. It makes pie crust flaky, cookies chewy, and breads crusty.
- ❖ There is no single gluten-free flour that can replicate all these functions, so gluten-free flour blends must be utilized to achieve structure, lightness, and good flavor.<sup>2</sup>
- ❖ Certain gluten-free flour varieties are derived from whole grains and provide a wide range of vitamins, minerals, fiber, protein, antioxidants, and other naturally occurring components.

## Xanthan Gum

- ❖ Xanthan gum serves as the ‘glue’ that binds gluten-free ingredients together. It provides gluten-free baked goods with structure. Using too much can produce a heavy, gummy texture so it is important to use an optimal ratio of gum to flour:<sup>4,8</sup>
- ❖ Cakes: 1/4 tsp per cup flour
- ❖ Cookies: 1/4 to 1/2 tsp per cup flour
- ❖ Quick breads: 1/4 to 1/2 tsp per cup flour
- ❖ Muffins: 1/4 to 1/2 tsp per cup flour
- ❖ Baked goods requiring kneading: 1 to 2 tsp per cup flour

## Alternative Gluten-Free Flours

Flour	Notable Nutrients	Qualities	Baking Properties
Almond	❖ Low CHO, high protein ❖ High in fiber, vitamin E, and MUFA	❖ Sweet, nutty flavor	❖ Flavor, structure, and moist crumb ❖ Allows for a better rise ❖ Helps gluten-free baked goods brown more quickly ❖ Recommended for cookies, cakes
Amaranth	❖ Whole grain, complete protein ❖ High in fiber, iron, calcium, and the amino acids lysine, methionine, and cysteine	❖ Sweet, earthy/nutty flavor ❖ Granular texture	❖ Can yield a sticky texture ❖ Best combined with other flours
Brown Rice	❖ Rich in fiber, vitamins, and minerals	❖ Dark color, nutty taste	❖ Yields a heavier/denser product ❖ Higher protein content enhances dough extensibility ❖ One-to-one substitute for one to two tbsp. flour ❖ Recommended for cakes and breads
White Rice	❖ Rich in CHO, low in fat	❖ Odorless, bland flavor ❖ Easily digested	❖ Yields a light, moist texture ❖ One-to-one substitute for one to two tbsp. flour ❖ Recommended for cakes, breads
Buckwheat	❖ High in fiber, protein, and lysine ❖ High in B and E vitamins, as well as phosphorus, magnesium, iron, copper, manganese, and zinc ❖ High proportion of essential amino acids; closer to being a complete protein than many other plant sources ❖ Good source of linoleic acid, an essential fatty acid	❖ Robust, earthy flavor	❖ A complementary flour to a gluten free flour blend ❖ Imparts protein and a rich flavor to baked goods ❖ Recommended for pancakes, crepes
Coconut	❖ Low in CHO, high in fiber	❖ Subtle coconut fragrance and flavor	❖ Absorbs a lot of liquid and can easily become dense so recipes typically call for a small amount ❖ An excellent thickener ❖ Provides chewiness ❖ Recommended for cakes, muffins, pancakes, cookies

Garbanzo Bean	❖ High in protein and fiber ❖ Good source of iron and calcium	❖ Mild, sweet flavor ❖ Slightly yellowish color ❖ Imparts an aftertaste ❖ Intense, earthy odor	❖ Works well in cakes or quick breads with strong flavors ❖ Use up to 25% garbanzo bean flour in a gluten-free flour blend ❖ Recommended for breads, pizza
Millet	❖ Rich in B vitamins, especially niacin, B <sub>6</sub> , thiamin, riboflavin, and folic acid, along with calcium, iron, potassium, magnesium, and zinc ❖ High in protein and fiber	❖ Pale yellow color ❖ Mild, subtly sweet flavor ❖ Easily digested	❖ Produces a light and moist texture ❖ Provides versatility ❖ Good thickening agent ❖ Recommended for muffins, quick breads, cookies, corn breads, and items containing yeast
Sorghum	❖ High in protein and fiber, low in CHO ❖ High in iron, calcium, potassium, phosphorus, and B vitamins	❖ Smooth texture ❖ Nutty, subtly sweet flavor ❖ Light color	❖ Yields delicate breads and muffins ❖ Imparts structure to baked goods ❖ Yields flavor like wheat and imparts a whole-wheat appearance ❖ Has binding abilities like gluten ❖ Creates baking versatility when added to other flours ❖ Good thickening agent ❖ Recommended for breads, muffins
Tapioca	❖ Good source of CHO	❖ Mild flavor ❖ Easily digested	❖ Used as a thickening agent ❖ Helps prevent breads from crumbling ❖ Lightens baked goods while adding chewiness, making it perfect for cookies and pizza crusts ❖ Helps gluten-free products brown ❖ Recommended for cookies, breads, pizza crusts

Table 1. Notable nutrients, qualities, and baking properties of common alternative gluten-free flours.<sup>2-9</sup>

## Cost Analysis

Flour	Whole Wheat Flour	AP Flour	GF AP Flour	Almond	Amaranth	Brown Rice	White Rice	Buckwheat	Coconut	Garbanzo Bean Flour	Millet	Sorghum	Tapioca
Cost (8oz)	\$0.60	\$0.60	\$1.70	\$6.30	\$3.49	\$1.23	\$1.13	\$1.44	\$2.50	\$1.35	\$1.21	\$1.52	\$1.70

Table 3. Cost analysis comparing whole wheat, all-purpose, and alternative gluten-free flours. Values highlighted in green indicate the highest-priced options.

## Nutrition Comparison

Grain (1/4 cup)	Energy (kcal)	Fiber (g)	CHO (g)	Protein (g)	Fat (g)	Iron (%DV)	Calcium (%DV)
Whole Wheat	140	5	27	6	0.5	8	2
GF All-Purpose	120	4	25	3	0.5	6	2
Almond	160	2	5	4	5	0	2
Amaranth	110	3	20	4	2	12	4
Brown Rice	140	2	31	3	1	4	0
White Rice	150	1	32	2	0.5	0	0
Buckwheat	100	4	21	4	1	6	1
Coconut	120	5	9	3	1.5	6	6
Garbanzo Bean	110	5	18	6	2	10	4
Millet	110	4	22	3	1	5	0
Sorghum	120	3	25	4	1	8	0
Tapioca	110	0	27	0	0	0	0

Table 2. Nutrition comparison of whole wheat flour to alternative gluten-free flours. Values highlighted in green indicate flours that are high in fiber, low in carbohydrates, high in protein, and/or high in iron.<sup>3,10-13</sup>

Consumers can use this information to prepare a gluten-free flour blend that complements their individual nutrition needs. Similarly, a registered dietitian may use this information to make an evidence-based recommendation to their clients.

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## Conclusion

- ❖ Many brands of all-purpose gluten-free flour blends are available on the market. They are convenient, since they can be substituted cup-for-cup in recipes with wheat flour, but they can be quite expensive. For this reason, consumers following a gluten-free diet may elect to prepare their own gluten-free flour blend.<sup>2</sup>
- ❖ Commercially available gluten-free all-purpose flour blends typically include white or brown rice, garbanzo bean, tapioca, sorghum, and/or millet flour.<sup>3,11</sup>
- ❖ Flours that are made from grains must be *labeled gluten-free* since cross-contamination during the production process may occur.<sup>2</sup>
- ❖ The baking properties, nutrition, cost, and availability of the various alternative gluten-free flours, in addition to individual taste preferences, must be considered when preparing a gluten-free flour blend.
- ❖ Ask me about how this research has improved my own personal gluten-free baking!

## References

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