

The Sorghum Story

*An Ancient, Healthy and Nutritious
Old World Cereal*



***SORGHUM: THE
SMART
CHOICE***

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10 Reasons To Enjoy Grain Sorghum

1. Grain sorghum tastes good! Sorghum's neutral flavor blends well with the flavors of additional ingredients.
2. Grain sorghum is available as whole grain whether popped as a snack, milled into flour or cooked whole as a cereal or pilaf. (Check labels)
3. Grain sorghum is high in potassium (350 mg/100 g) and low in sodium (6 mg/100 g) therefore promoting healthy blood pressure¹.
4. Grain sorghum is gluten-free enabling those with celiac disease to consume a healthy whole grain product.
5. Grain sorghum is rich in health promoting phytochemicals: phenolic acids, sterols, policosanols, and anthocyanins ².
6. Grain sorghum and sorghum flour are rich in minerals: magnesium, copper, manganese, iron and zinc¹.
7. Grain sorghum and sorghum flour are rich in vitamins: thiamin, riboflavin, niacin, vitamin B-6 and pantothenate¹.
8. Grain sorghum is rich in macronutrients: containing 11 percent protein, 75 percent carbohydrate and 3 percent total fat¹.
9. Grain sorghum grown in the U.S. is free of condensed tannins that may interfere with mineral absorption².
10. Grain sorghum¹ and sorghum flour³ are excellent sources of fiber ranging from 6.3-11.1g and 6.6g per 100g respectively.

References

1. USDA National Nutrient Database for Standard Reference, Release 24 (2011). Item #20067
2. Awika JM, Rooney, LW. Sorghum phytochemicals and their potential impact on human health. *Phytochemistry* 2004;65:11991221.
3. USDA National Nutrient Database for Standard Reference, Release 24 (2011). Item # 20648

The Sorghum Story

An Ancient, Healthy and Nutritious Old World Cereal

Sorghum is Africa's contribution to the small number of elite grains that supply about 85 percent of the world's food energy. Only four other foods rice, wheat, maize, and potatoes are consumed in greater amounts. Sorghum is the dietary staple of more than 500 million people in more than 30 countries of the semi arid tropics, thus being one of the most familiar foods in the world¹. Sorghum is indeed an ancient grain. Dahlberg and Wasylkowa² reported on sorghum remains found in the Nabta Playa archaeological site in the Western Desert, in southern Egypt, dating back to 8000 B.C.E.

Sorghum is valued for its grain, stalks and leaves. Many people in the U. S. are familiar with sorghum for the syrup made from the sweet juice in stalks of certain sorghum varieties or for the use of sorghum in silage or for pastures. The U.S. produces "food grade sorghum" a white colored grain grown on a "tan" plant that produces light colored glumes used to produce a gluten-free, bland flour suitable for incorporation into many cereal-containing food products. Specialty sorghums are under study for health promoting properties.

Sorghum is inherently gluten-free and was demonstrated to be safe for people with celiac disease³. Gluten enteropathy or celiac disease is caused by sensitivity of the gut to the grain storage protein, gluten. Gluten is a component of wheat, and gluten-like proteins are found in oats, barley and rye that are also problematic. Diarrhea occurs in about 70 percent of patients often up to 3-4 times per day⁴ with accompanying nutrient and fluid losses. Celiac disease results in malabsorption of nutrients and thus other problems in many patients. In an already nutritionally vulnerable person, celiac disease can be devastating. The treatment for individuals with celiac disease is to avoid all foods containing gluten⁵.

Sorghum is used extensively worldwide in food production systems⁶. Around the world, many types and colors of sorghum are used to produce various types of traditional foods and beverages. Unfermented bread, such as chapatti and roti are common in India, while tortillas are made from sorghum in Central America and Mexico. Fermented breads such as kiswa and dosa are found in Africa, Sudan, and India, while injera is popular in Ethiopia. Stiff porridges called ugali, tuwo, karo, and mato are found throughout Africa, India and Central America, while thin porridges such as ogi, koko, and akasa can be found in Nigeria and Ghana. Couscous from sorghum can be found throughout West Africa, and boiled whole or pearled sorghums are consumed in Africa, India, and Haiti. Snack foods containing sorghum are widely produced and are found in the markets of Japan. Many types of alcoholic beverages and sour/opaque beers can be found in markets worldwide.

References

1. Board on Science and Technology for International Development, Office of International Affairs, National Research Council. (1996). *Lost Crops of Africa: Vol 1: Grains*. The National Academy Press, Washington, DC. <http://www.nap.edu/openbook.php?isbn=0309049903&page=127> Accessed June 2010
2. Dahlberg, J. A. and K. Wasylkowa. 1996. Image and statistical analyses of early sorghum remains (8000 B. P.) from the Nabta Playa archaeological site in the Western Desert, southern Egypt. *Vegetation History and Archaeobotany*, 5:293-299.
3. Ciacci, C., Maiuri, L., Caporaso, N., Bucci, C., Giudice, L. D., Massardo, D. R., Pontieri, P., Fonzo, N. D., Bean, S. R., Ioerger, B., and Londei, M. (2007). Celiac disease: in vitro and in vivo safety and palatability of wheat-free sorghum food products. *Clinical Nutrition*. 26:799-805.
4. Connon, J. J., Celiac disease. (1994) In *Modern Nutrition in Health and Disease*, Eds, M. Shils, J. A. Olson & M. Shike. 8th edition, Lea & Febiger, Philadelphia, pp 1060-1065.
5. Thompson T. (2000). Questionable foods and the gluten-free diet: Survey of current recommendations. *J. Am. Diet. Assoc.* 100:463-465.
6. Rooney, L. W., and Waniska, R. D., (2000). Sorghum food and industrial utilization. Pages 689-750 in: *Sorghum: Origin, History, Technology, and Production*. C. W. Smith and R. A. Frederiksen, Eds. John Wiley & Sons, Inc. New York.

Nutritional Attributes of Grain Sorghum

Macronutrients. Sorghum is an excellent source of energy, containing about 75 percent complex carbohydrate. Complex carbohydrates (fibers and starches) are usually digested slowly and therefore provide satiety and delayed hunger. Sorghum flour is often whole grain and thus aligns well with the 2010 Dietary Guidelines to increase dietary whole grains while keeping the suggested total dietary carbohydrate intake the same¹. A Nutrient comparison of the commodity grains — sorghum, wheat, corn, and rice— shows that with about 3.4 percent fat content, grain sorghum contains more fat than wheat and rice, but slightly less than corn. Sorghum and wheat grain contain similar amounts of protein while both contain more protein than rice and corn². Sorghum is naturally gluten-free.

Micronutrients. A comparison of 100 g of commodity sorghum to the World Health Organization (WHO) Recommended Nutrient Intakes (RNI) (3-5) for children ages 1-3 years shows the following micronutrients are met: Magnesium = 366 percent RNI; Iron based on 10 percent bioavailability = 73 percent RNI; Zinc based on moderate bioavailability = 38 percent RNI; Thiamin = 47 percent RNI; Riboflavin = 28 percent RNI; Niacin = 49 percent RNI; Pantothenate = 63 percent RNI; Vitamin B-6 = 118 percent RNI. WHO does not have an established RNI for copper and manganese, thus using the United States Recommended Dietary Allowance (RDA)⁶ criteria, 100g sorghum meets the RDA for children ages 4-8 years as follows: Copper = 245 percent RDA; Manganese = 92 percent RDA.

Iron and zinc are two of the four micronutrients (iron, zinc, iodine, vitamin A) identified⁷ as at risk in populations of developing countries. Sorghum is a good to excellent source of iron and zinc. Sorghum is rich in B complex vitamins that play a major role in energy metabolism. Sorghum's high-energy content and ready supply of B-complex vitamins are a perfect combination for energy utilization.

Phytochemicals. Depending on the variety, sorghum provides good to excellent sources of such phytochemicals as phenolic acids, anthocyanins, phytosterols and policosanols. These compounds are familiar to the public as a result of health claims around sterols and stanols (heart health) and the publicity attributed to the anti-oxidant properties of anthocyanins (pigmented berries-blueberries, strawberries, etc.). Awika and Rooney⁸ provide an excellent review of the potential health benefits of phytochemicals in sorghum. One category of phytochemicals, condensed tannins – regardless of grain color- is not found in U.S. sorghum varieties and most sorghum produced elsewhere⁸.

References

1. Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans (2010). USDA.
2. USDA National Nutrient Database for Standard Reference, Release 24. 2011.
3. FAO/WHO Expert Consultation on Human Vitamin and Mineral Requirements. 1998.
4. FAO/WHO/UNU Report of a Joint Expert Consultation on Human Energy Requirements. 2001.
5. WHO/FAO/UNU. Protein and Amino Acid Requirements in Human Nutrition. Report No. 935. 2007.
6. Food and Nutrition Board. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium and Zinc. National Academy Press, Washington, D.C. 2001
7. Committee on Micronutrient Deficiencies, Prevention of Micronutrient Deficiencies: Tools for Policymakers and Public Health Workers. (CP Howson, ET Kennedy and A Horwitz, Eds), National Academy Press. Washington, D.C. 1998.
8. Awika, JM and Rooney, LW. Sorghum phytochemicals and their potential impact on human health. *Phytochemistry* 65;1199-1221. 2004.

Gluten-Free Whole Grain Sorghum: An Excellent Source of Dietary Fiber

Whole grain gluten-free sorghum flour is an excellent source of dietary fiber with 6.3g-11.1g/100g flour¹. Most Americans of all ages under-consume dietary fiber with an average intake of about 15 grams versus the 25 grams that are recommended². Concentrated sources of fiber include whole grains, dried peas and beans, vegetables, nuts and fruits. Fiber is intrinsic and intact only in plants.

Dietary fibers are nondigestible forms of carbohydrates and lignin. Dietary fiber can be classified as fermentable or non-fermentable (or soluble and insoluble)---both forms are needed for good health. Along with helping provide satiety, a moderate amount of evidence suggests that dietary fibers from whole food sources protect against cardiovascular disease, obesity, and type 2 diabetes and is essential for optimal digestive health³.

The 2010 Dietary Guidelines for Americans was careful to point out that increasing total grains was not recommended. However increased consumption of the proportion of whole grains to total grains was recommended because of the need to increase whole grain fiber³. In particular, individuals with celiac disease may not consume enough dietary fiber and need gluten-free whole grains such as sorghum in their diets.

A recent study with adolescents⁴ found that higher dietary fiber intakes, but not low saturated fat or cholesterol intakes, were associated with lower incidence of metabolic syndrome. Since metabolic syndrome in adolescence leads to a higher incidence of metabolic syndrome, type 2 diabetes, and cardiovascular disease in adulthood, teens are a major group in need of education about whole grains and other sources of dietary fiber.

The Nutrition Facts panel on food labels requires that the amount of dietary fiber per serving be shown. If a food product contains at least 2.5 g/serving, the label may state the food is a good source of fiber.

Based upon an extensive review of the evidence, the FDA recently approved a health claim for whole grains that permits manufacturers to state on foods: "Diets rich in whole grain foods and other plant foods and low in total fat, saturated fat, and cholesterol may reduce the risk of heart disease and some cancers"⁵. In order to use the claim, the serving size must contain a specified amount of dietary fiber per serving. Four serving sizes are specified ranging from a 35 gram serving with 1.7 grams of fiber to a 55 gram serving with 3.0 grams of dietary fiber⁵. Thus sorghum grain is an excellent source of dietary fiber.

References

1. USDA National Nutrient Database for Standard Reference, Release 24 (2011). Item # 20648.
2. http://www.cdc.gov/nchs/nhanes/nhanes2005-2006/nhanes05_06.htm
3. <http://www.cnpp.usda.gov/publications/dietaryguidelines/2010/dgac/report/d-5-carbohydrates.pdf>
4. Carlson JJ, Eisenmann JC, Norman GJ, Ortiz KA, Young. Dietary fiber and nutrient density are inversely associated with the Metabolic Syndrome in US adolescents. 2011. JADA, 111;1688.
5. <http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodLabelingNutrition/FoodLabelingGuide/ucm064919.htm>

Nutrient Values for 100 grams Gluten-Free Grains: Sorghum, Buckwheat, Amaranth and Quinoa

Nutrient	Unit	Sorghum	Buckwheat	Amaranth	Quinoa
		NDB # 20067	NDB # 20008	NDB # 20001	NDB # 20035
Energy	kcal	339	343	371	368
Protein	g	11.3	13.25	13.56	14.12
Total Fat	g	3.3	3.4	7.0	6.1
Carbohydrate	g	74.6	71.5	65.25	64.16
Fiber	g	6.3*	10.0	6.7	7.0
Calcium	mg	28	18	159	47
Iron	mg	4.4	2.2	7.6	4.57
Magnesium ₁	mg	190	231	248	197
Phosphorus	mg	287	347	557	457
Potassium	mg	350	460	508	563
Sodium	mg	6	1	4	5
Zinc ₁	mg	2.3	2.4	2.9	3.1
Copper ₁	mg	1.08	1.10	0.52	0.29
Manganese ₁	mg	1.63	1.30	3.33	2.03
Iodine	ug	n/a	n/a	n/a	n/a
Selenium ₂	mcg	trace	8.3	18.7	8.5
Vitamin C	mg	0	0	4	n/a
Thiamin	mg	0.237	0.101	0.116	0.360
Riboflavin	mg	0.142	0.425	0.200	0.318
Niacin	mg	2.927	7.020	0.923	1.520
Pantothenate ₁	mg	1.25	1.233	1.457	0.772
Vitamin B-6 ₁	mg	0.59	0.210	0.591	0.487
Folate, total ₁	mcg	0.02	30	82	184
Vitamin B-12	mcg	0	0	0	0
Vitamin A ₃	IU	16	0	2	14
Vitamin D	ug	0	0	0	0
Vitamin E ₁	mg-ATE	1.2	n/a	1.19	2.44

Nutrient values: USDA National Nutrient Database for Standard Reference, Release 25 (2011)

*Total dietary fiber value is for white sorghum. Updated by USDA 2011. Other types of sorghum range from 8.8 to 11.1 g/100g

Additional published sorghum data as noted.

1. Waniska and Rooney 2000.

2. Neucere and Sumrell 1980.

3. Barrow-Agee Laboratories, LLC, Memphis, TN 2010.

n/a = not available

Nutrient Values for 100 grams Whole Grain Sorghum, Wheat and Rice Flours and Whole Grain Yellow Cornmeal

Nutrient	Unit	Sorghum Data from Medallion Labs, 8/2013*	Wheat NDB # 20481	Rice NDB # 20061	Cornmeal NDB # 20020
Energy	kcal	369	340	363	362
Protein	g	9.55	13.21	7.23	8.12
Total Fat	g	3.43	2.5	2.78	3.59
Carbohydrate	g	75	71.97	76.48	76.89
Fiber	g	6.7	10.7	4.6	7.3
Calcium	mg	13	34	11	6
Iron	mg	3.5	3.6	1.98	3.45
Magnesium	mg	128	137	112	127
Phosphorus	mg	255	357	337	241
Potassium	mg	361	363	289	287
Sodium	mg	1	2	8	35
Zinc	mg	1.78	2.6	2.45	1.82
Copper	mg	0.28	0.41	0.23	0.19
Manganese	mg	1.32	4.07	4.01	0.5
Iodine	ug	n/a	n/a	n/a	n/a
Selenium	mcg	n/a	61.8	n/a	15.5
Vitamin C	mg	1.53	0	0	0
Thiamin	mg	0.44	0.5	0.44	0.39
Riboflavin	mg	0.07	0.17	0.08	0.29
Niacin	mg	3.71	4.96	6.34	3.63
Pantothenate	mg	0.41	0.6	1.59	0.43
Vitamin B-6	mg	0.29	0.41	0.74	0.3
Folate, total	mcg	n/a	44	16	25
Vitamin B-12	mcg	0	0	0	0
Vitamin A	IU	<50	9	0	214
Vitamin D	ug	n/a	0	0	0
Vitamin E	mg-ATE	0.5	0.71	1.2	0.42

*Mean value of 3 commercial whole grain sorghum flours analyzed by Medallion Labs, Minneapolis, MN. 8/2013
 USDA National Nutrient Database for Standard Reference. Release 24. 2011.

n/a = not available

Grain Sorghum Nutrients Compared to the WHO RNI of Children Ages 1-9 Years

Nutrient	Unit	Sorghum 100 g	RNI		%RNI		RNI		%RNI	
			1-3 y	1-3 y	4-6 y	4-6 y	7-9 y	7-9 y		
Energy	kcal	339	997	34	1301	26	1629	21		
Protein	g	11.3	12.25	92	16.65	68	26.05	43		
Total Fat	g	3.3								
Carbohydrate	g	74.6								
Fiber	g	6.3								
Calcium	mg	28	500	6	600	5	700	4		
Iron ₄	mg	4.4	5.8	73	6.3	70	8.9	49		
Magnesium ₁	mg	190	60	366	76	250	100	190		
Phosphorus	mg	287								
Potassium	mg	350								
Sodium	mg	6								
Zinc _{4 1}	mg	1.54	4.1	38	4.8	32	5.6	28		
Copper ₁	mg	1.08		**		**		**		
Manganese ₁	mg	1.63		**		**		**		
Iodine	ug	n/a	90		90		120			
Selenium ₂	mcg	trace	17	<1	22	<1	21	<1		
Vitamin C ₃	mg	2	30	<1	30	<1	36	<1		
Thiamin	mg	0.237	0.5	47	0.6	40	0.9	26		
Riboflavin	mg	0.142	0.5	28	0.6	24	0.9	16		
Niacin	mg	2.927	6	49	8	37	12	24		
Pantothenate ₁	mg	1.25	2	63	3	42	4	31		
Vitamin B-6 ₁	mg	0.59	0.5	118	0.6	98	1	59		
Folate, total ₁	mcg	0.02	150	<1	200	<1	300	<1		
Vitamin B-12	mcg	0	0.9	0	1.2	0	1.8	0		
Biotin	ug	n/a	8		12		20			
Vitamin A ₃	IU	16	1333	1	1500	<1	1666	<1		
Vitamin D	ug	n/a	5		5		5			
Vitamin E a-TE ₁	mg	1.2	5	<1	5	<1	7	<1		
Vitamin K	mcg	n/a	15		20		25			

References

FAO/WHO Expert Consultation on Human Vitamin and Mineral Requirements. 1998.

FAO/WHO/UNU Report of a Joint Expert Consultation on Human Energy Requirements. 2001

WHO/FAO/UNU. Protein and Amino Acid Requirements in Human Nutrition. 2007

Nutrient Values: USDA National Nutrient Database for Standard Reference. Total dietary fiber value is for white sorghum. Other types of sorghum

Grain Sorghum and International Food Aid

Special populations such as infants and children, pregnant and lactating women and the elderly are at nutritional risk in affluent developed countries, but their vulnerability increases when food-insecurity, diseases such as HIV/AIDS, malaria, intestinal worms, or poverty, civil unrest, and drought are imposed. These populations are at risk for both macronutrients (protein, fat, carbohydrate) and micronutrients (vitamins and minerals).

Child malnutrition is the first indicator that hunger problems exist in countries. Even though the incidence of global childhood malnutrition has declined, the incidence of childhood malnutrition in Africa has not. UNICEF¹ reported that in sub-Sahara Africa in 2007 that the annual number of under-5 deaths was 4,480,000 and that the expected life span was 50 years. There are many reasons for stunting, low weights and deaths in children, but major among them are inappropriate or inadequate diets.

Sorghum grain is indigenous to Africa; therefore it is a familiar food. It is used in many different food systems, including porridges, gruels, breads, pancakes, dumplings, couscous and non-alcoholic fermented beverages. The FAS-USDA Food Aid Report for fiscal year 2010 shows shipments for sorghum grain through Sept. 30, 2010. The report shows that the sorghum grain shipped as part of food aid was 510,000 metric tons at a value of \$105,585,500². In addition to sorghum grain's flexibility in food systems and high consumer acceptability, it makes significant contributions to the nutritional value of diets of populations at risk. It is competitively priced, and non-GMO.

Emphasis on more traditional African diets such as sorghum grain or millet rather than an introduced crop such as maize needs more consideration. Researchers⁽³⁾ questioned the wisdom of increasing maize consumption in Africa relative to its aflatoxin (*Aspergillus*) content and health consequences. The U.S. limits aflatoxin levels in sorghum grain to 20 ppb, as does Nigeria⁽⁴⁾. Williams et al.⁵ reported a positive association between HIV transmission frequency and maize consumption in Africa and suggested that fumonisin (*Fusarium verticillioides*), primarily a maize contaminate, was more likely than aflatoxin to explain the relationship between food and cancer in Africa. His group⁵ concluded that the corn-fumonisin-HIV link needs more research and that by removing or reducing maize or by consuming alternate foods, 1,000,000 HIV transmissions could be avoided annually (cutting transmission rates by 50 percent). Sorghum grain is a good choice for food aid.

References

1. UNICEF The State of the World's Children. 2009. www.unicef.org
2. <http://www.fas.usda.gov/excredits/FoodAid/Reports/2010FoodAidTable4.pdf>
3. Williams JH, Phillips TD, Jolly PE, Stiles JK, Jolly CM, and Aggarwal D. Human aflatoxicosis in developing countries: A review of toxicology, exposure, potential health consequences, and interventions. *Am J Clin Nutr.* 2004;0;1106-1122.
4. FAO (2004). Worldwide regulations for mycotoxins in food and feed in 2003. FAO Food and Nutrition Paper, 81. Food and Agriculture Organization of the United Nations. Rome, Italy. P 1-180.
5. Williams JH, Grugg JA, Davis JW, Wang J, Jolly PE, Ankrah N, Ellis WO, Afriyie-Gyawu E, Johnson N M, Robinson AG, and Phillips TD. HIV and hepatocellular and esophageal carcinomas related to consumption of mycotoxin-prone foods in sub-Saharan Africa. *Am J Clin Nutr.* 2010;92;154-160.

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range from 8.8 to 11.1 g/100g. Release 25. 2011. Published sorghum data as noted.

1. Waniska and Rooney 2000; 2. Neucere and Sumrell 1980; 3. Barrow-Agee Laboratories, LLC, Memphis, TN 2010.
4. Iron RNI based on 10 percent bioavailability; Zinc RNI based on moderate bioavailability. n/a = not applicable or not available

** Using the US RDA of 1.5 mg for copper and 440 mcg for manganese, the percent of RDA for children 4-8 years of age for manganese (1.63 mg/100g) is 92 percent and for copper (1080 mcg) is 245 percent.

How to Bake and Cook with Grain Sorghum Flour

*By Carol Fenster, author of **Gluten-Free 101***

Baking Gluten Free with Sorghum Flour

“What can you bake with if you can’t use wheat flour?” Sorghum is an excellent replacement for wheat flour in baking because its light color and mild flavor won’t interfere with the color or flavor of food, making it appropriate for all types of baked items—breads, muffins, pasta, cakes, cookies, and pies. In fact, sorghum tastes much like wheat flour and produces baked goods that look and taste much like wheat versions. Sorghum flour does not require refrigeration and is readily available in health food stores and many supermarkets.

Gluten-free flours work better when blended with other flours. Sorghum flour’s protein provides structure and stability. It blends well with potato starch (or cornstarch), which lightens the crumb and tapioca flour, which promotes browning of the crust and a bit of “chew” for mouth-feel. The following general-purpose blend works well in all types of gluten free baking:

Carol’s Sorghum Flour Blend

1 ½ cups sorghum flour

1 ½ cups potato starch (or cornstarch)

1-cup tapioca flour

Whisk together until thoroughly blended. Store, tightly covered, in a dark, dry place.

Converting Recipes to Gluten-Free

Many people want to bake their family favorites without wheat flour. The easiest way to convert an existing recipe is to replace the wheat flour with the same amount of Sorghum Flour Blend (see above). Then, add xanthan gum (a polysaccharide in powder form that is essential for replacing the function of gluten—available in health food stores) in appropriate amounts so baked goods rise and don’t crumble. Some recipes convert with no changes; others require some adjustment. If the batter or dough looks too stiff, add more liquid (a tablespoon at a time) to reach the desired consistency. If the batter is too wet, add more sorghum flour blend (a tablespoon at a time) to reach the desired consistency. Write the changes you make in the margin of your recipe so you know what to do next time.

Sorghum Flour for Frying

Sorghum flour can be used in the same amount as wheat flour for batters in deep-fat frying or dredging meats and vegetables before pan-frying. Its dry texture makes a crispy coating without gumminess or stickiness. Its mild flavor and color blend right in with the food you’re frying.

Sorghum Lemon-Blueberry Muffins

Adapted from Gluten-Free 101 by Carol Fenster (Savory Palate, 2010)

Dry Ingredients

2 ⅓ cups Sorghum Flour Blend (see left)
 ¾ cup granulated sugar
 1-tablespoon baking powder
 1 ½ teaspoons xanthan gum
 ¾-teaspoon salt

Wet Ingredients

1-cup milk of choice, at room temperature
 ⅓ cup melted unsalted butter or canola oil
 2 large eggs, at room temperature
 1 tablespoon grated lemon peel
 1-teaspoon vanilla extract

Add-Ins

1-cup fresh blueberries

Topping

1-tablespoon sugar
 1-tablespoon sorghum flour
 1 teaspoon melted butter or canola oil
 1 teaspoon grated lemon peel

[1] Preheat the oven to 375°F. Generously grease a standard 12-cup non-stick muffin pan.

[2] Whisk the dry ingredients together in a large bowl. In a separate bowl, whisk the wet ingredients thoroughly until very smooth.

[3] Make a well in the dry ingredients and add wet ingredients with a spatula until just moistened and then gently stir in the blueberries. Divide the batter evenly in the pan. In a small bowl, combine the sugar, sorghum, butter, and lemon peel with a fork until crumbly and sprinkle on each muffin.

[4] Bake until the muffin tops are lightly browned, approximately 20 to 25 minutes or until a toothpick inserted in the center of a muffin comes out clean. Serve warm. Makes 12 muffins.



Sorghum: A Sustainable, Water Sipping Crop

In the United States, sorghum is grown primarily on dryland acres, with the Sorghum Belt stretching from Southern Texas to South Dakota. Sorghum is among the most efficient crops in conversion of solar energy and use of water. Approximately 6.2 million acres of sorghum were planted in 2012 in the U.S.

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