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Functions of Baking Ingredients

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The following is a list of baking ingredients and a description of the function each performs in baked goods. While substitutions can be made, varying the proportions of ingredients in a recipe alters the texture and flavor of the finished product.

FLOURS

Flour provides the structure in baked goods. **Wheat** flour contains proteins that interact with each other when mixed with water, forming gluten. It is this elastic gluten framework which stretches to contain the expanding leavening gases during rising. The protein content of a flour affects the strength of a dough. The different wheat flour types contain varying amounts of the gluten forming proteins. Hard wheat, mainly grown in midwestern U.S. has a high protein content. Soft wheat, grown in southern U.S. has less protein. In yeast breads, a strong gluten framework is desirable, but in cakes, quick breads and pastries, a high protein flour makes a tough product.

Bread flour is a hard wheat flour with about 12 percent protein. Bread flour is used for yeast raised bread because the dough it produces has more gluten than dough made with other flours. Sufficient gluten produces a light loaf with good volume. Slices hold together, rather than crumble.

Cake flour is a soft wheat flour that is 7.5 percent protein. The lower gluten content causes products to have a tender, more crumbly texture that is desirable in cake.

All purpose flour is blended during milling to achieve a protein content of 10.5 percent. This medium protein flour can be used for all baking purposes. If using all purpose flour in place of cake flour in a recipe, substitute 1 cup minus 2 tablespoons all purpose flour for 1 cup cake flour.

Whole wheat flour may be substituted for part of the white flour in yeast and quick bread recipes, but the volume of the finished product will be reduced. Whole wheat flour contains the nutritious germ and bran as well as the endosperm of the wheat kernel. Bran particles cut through the gluten during mixing and kneading of bread dough, resulting in a smaller, heavier loaf. If substituting a very coarsely ground whole wheat flour for all purpose flour, use 1 cup plus 2 tablespoons whole wheat flour for every cup of

all purpose flour. To substitute whole wheat flour in a white bread recipe, use half whole wheat and half bread flour for the best results.

Wheat germ, though not a flour, is often used in place of part of the flour in recipes for flavor and fiber. Protein, vitamins, minerals, and polyunsaturated fats are concentrated in the germ of grain kernels. Wheat germ, preferably toasted, can be used in place of up to 1/3 of the flour in a recipe.

The following non-wheat grain products are often used in baked goods. They are rich in protein but most do not have the potential for developing gluten. For this reason, at least 1 cup of wheat flour should be used for every 1 cup of non-wheat flour so the product will not become too heavy.

Rye flour is often used in combination with wheat flour for bread. Light rye flour can be successfully substituted for 40 percent of wheat flour in a recipe without loss of volume. Medium and dark rye flours should be limited to 30 percent and 20 percent, respectively, of the total flour amount.

Triticale flour is a hybrid of wheat and rye. It has an average protein content higher than that of wheat flour. In yeast bread dough, triticale flour has better handling properties than rye flour because it will form gluten, but does not handle as well as wheat dough. For a good quality dough, ferment yeast dough made with triticale flour for a shorter period than wheat flour dough.

Oat flour has a relatively high protein content, 17 percent, but does not form gluten. Oat flour can be substituted for as much as 1/3 of wheat flour in bread.

Corn meal is coarsely ground dried corn. Corn flour is more finely ground corn. Both corn flour and corn meal contain 7-8 percent protein on a dry basis. Neither corn meal nor corn flour will form gluten. A grainy texture in cornbread can be avoided by mixing the cornmeal with the liquid from the recipe, bringing to a boil, and cooling before mixing with the other ingredients.

Rice flour has about 6.5-7 percent protein and does not form gluten. For people who do not tolerate gluten, rice flour is an acceptable substitute for wheat, barley, rye or oat flours. In baked products, 7/8 cup of non-waxy rice flour can be used in place of 1 cup all purpose wheat flour.

Potato starch flour, another non-gluten forming flour is usually used in combination with other flours. It has a mild potato taste. For substitutions, 5/8 cup of potato flour can be used for 1 cup of all purpose flour.

Soy flour contains 50 percent protein and is used primarily to boost the protein content of baked goods. Soy flour cannot form gluten and does not contain starch. Its use in large amounts affects the taste of baked goods and causes them to brown quickly. An acceptable substitution is to take 2 tablespoons flour out of each cup of flour in a recipe and add 2 tablespoons soy flour.

SWEETENERS

Sucrose, (table sugar) has many functions in food other than providing sweetness. In small amounts, added sugar helps yeast begin producing gas for raising yeast dough. Sugar in large amounts slows yeast fermentation; in a very sweet dough the rising time is longer. Sugar tenderizes dough and batter products and may help the baked product to brown. Moisture is retained better in sweetened breads than in unsweetened breads. It is the sugar in cookie dough that causes spreading to occur during baking. Reducing the amount of sugar by more than 1/3 can cause loss of tenderness, moisture, browning, and sweetness. The volume may increase in a bread recipe when sugar is reduced.

Fructose in crystal form is nearly twice as sweet as sucrose and is more expensive. Fructose attracts more water than sugar, therefore, fructose sweetened products tend to be moist. Baked products made with fructose will be darker than if they were made with sucrose.

Honey is sweeter than sugar because it contains fructose. Honey has a distinctive flavor. When using honey in place of sugar, use 3/4 cup plus 1 tablespoon honey in place of 1 cup sugar and reduce the other liquid ingredients by 2 tablespoons. Even when liquid is reduced, a product that contains honey will be moist because the fructose absorbs moisture from the atmosphere. Too much honey may cause the product to become too brown.

Molasses imparts a dark color and strong flavor to baked foods. It is not as sweet as sugar. When using molasses in place of sugar, use 1-1/3 cups molasses for 1 cup sugar and reduce the amount of liquid in the recipe by 5 tablespoons. Because molasses is more acidic than sugar, it may be necessary to add 1/2 teaspoon baking soda for each cup of molasses used in substitution for sugar. Replace no more than 1/2 the sugar called for in the recipe with molasses.

The following artificial sweeteners are available for home use. They provide sweetness to homemade foods but lack the browning, tenderizing, and moisture retaining properties provided by table sugar. Specially formulated recipes are often needed to make a product with acceptable texture and appearance when using artificial sweeteners. Because the different low-calorie sweeteners vary in sweetness and bulk, package directions must be followed for the amount to use in place of sugar.

Saccharin is a heat stable noncaloric sweetener that, in its pure form is 200-300 times as sweet as sucrose. Bulking agents are added to saccharin products to aid in measuring. Saccharin has a bitter aftertaste.

Acesulfame K (Sweet OneSM) is a very low calorie sweetener that is 200 times as sweet as sucrose. It is heat stable so it can be used in baked goods. For improved texture in baked products, use acesulfame K in combination with granulated sugar. Acesulfame K reportedly has no unpleasant aftertaste.

Aspartame, commonly known as NutrasweetSM, is not heat stable so it is not an appropriate sweetener for baked goods.

SALT

Salt is used to enhance the flavors and sweetness of other ingredients in food. If salt is omitted or reduced, other spices or flavorings in the recipe should be increased slightly. In yeast dough, salt slows yeast fermentation. Omitting or reducing the amount of salt in yeast dough can cause the dough to rise too quickly, adversely affecting the shape and flavor of bread.

LEAVENING AGENTS

Baking Soda produces gas for leavening when combined with an acidic ingredient such as vinegar, lemon juice, or molasses. The volume of quick breads, cookies, cakes, and some candies depends largely on the amount of baking soda added to the batter or dough. Reducing the amount of baking soda without replacing it with another leavening agent will reduce the volume and lightness of the finished product.

Baking powder contains baking soda and the right amount of acid to react with it. Batters made with double acting baking powder rise twice; once when dry and moist ingredients are mixed together, and

again when the product is baked.

Yeast is a living microorganism until it is destroyed by heat. As yeast grows and multiplies it gives off carbon dioxide which causes the dough to rise. Its action is affected by the addition or deletion of other ingredients such as salt and sugar. Using less yeast than specified in a recipe causes the dough to take longer to reach the desired volume in the rising stages.

FATS

Fat, in the form of solid shortening, margarine, or butter; or in the liquid form of oil contributes tenderness, moistness, and a smooth mouthfeel to baked goods. Fats enhance the flavors of other ingredients as well as contributing its own flavor, as in the case of butter. In baked goods such as muffins, reducing the amount of fat in a recipe results in a tougher product because gluten develops more freely. Another tenderizing agent such as sugar can be added or increased to tenderize in place of the fat. A small amount of fat in a yeast dough helps the gluten to stretch, yielding a loaf with greater volume.

Shortening: Shortening is 100 percent fat and is solid at room temperature. It is often made of hydrogenated (solidified by adding hydrogen) vegetable oils, but sometimes contains animal fats. The flakiness of pastry comes from solid fat such as shortening or lard rolled in layers with flour. In some recipes for cookies or cake, shortening is creamed with sugar to trap air. A lighter product will result. There are emulsifiers in shortening to help emulsify shortening and liquid. This means that oil and water stay mixed together, creating an even distribution of flavors and a consistent texture in batters and dough.

Butter is made from cream and has a fat content of at least 80 percent. The remaining 20 percent is water with some milk solids. Butter imparts a good flavor without a greasy mouthfeel to baked goods because it melts at body temperature.

Margarine is made from fat or oil that is partially hydrogenated, water, milk solids, and salt. Vitamins and coloring are usually added also. The fat or oil can be of animal or vegetable origin. Margarine has the same ratio of fat to non-fat ingredients as butter (80:20), and can be used interchangeably with butter.

Reduced fat substitutes have less than 80 percent fat. These do not work the same as butter or margarine in baked goods, though some specially formulated recipes can be found on the packages of these products. Fat free margarines also are available and contain no fat. These margarines are best used as spreads.

Oil is used in some muffin, bread and cake recipes. Oil pastry is mealy rather than flaky. To substitute oil for butter or margarine, use 7/8 cup oil for 1 cup butter or margarine. If oil is used in place of a solid fat for some cake recipes, the texture will be heavier unless the sugar and egg are increased.

EGGS

Eggs serve many functions in baked goods. They add flavor and color, contribute to structure, incorporate air when beaten, provide liquid, fat, and protein, and emulsify fat with liquid ingredients. Reducing or omitting egg yolks can result in less tenderness. Reducing or omitting egg whites can result in less volume. Cakes made without the emulsifying action from the egg yolk may not have a uniform flavor and texture. If a low fat, low cholesterol baked product is desired, use 2 egg whites for 1 whole

egg; the white has very little fat or cholesterol. When a recipe calls for an egg, the best size to use is a 2 oz. Grade A large egg.

LIQUIDS

Liquids are necessary in baked goods for hydrating protein, starch and leavening agents. When hydration occurs, water is absorbed and the chemical changes necessary for structure and texture development can take place. Liquids contribute moistness to the texture and improve the mouthfeel of baked products. When water vaporizes in a batter or dough, the steam expands the air cells, increasing the final volume of the product.

Milk contributes water and valuable nutrients to baked goods. It helps browning to occur and adds flavor. When making yeast dough, milk should be scalded and cooled before adding to other ingredients. This is done to improve the quality of the dough and the volume of the bread.

Juice may be used as the liquid in a recipe. Because fruit juices are acidic, they are probably best used in baked products that have baking soda as an ingredient.

References:

American Home Economics Association. *Handbook of Food Preparation*. 8th edition. 1980.

Charley, H. *Food Science*. 2nd edition. New York: Macmillan Publishing Company. 1986.

Dobler, M. *Gluten Intolerance*. Revised edition. Chicago: American Dietetic Association. 1991.

McGee, H. *On Food And Cooking: The Science And Lore of the Kitchen*. New York: Macmillan Publishing Company. 1984.

Penfield, M., and Campbell, A. *Experimental Food Science*. 3rd edition. San Diego: Academic Press, Inc. 1990.

Rombauer, I., and Becker, M.R. *Joy of Cooking*. 13th edition. New York: Bobbs-Merrill Company, Inc. 1975.

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