



# Baking for Special Diets

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## AFTER READING THIS CHAPTER, YOU SHOULD BE ABLE TO:

1. Identify and describe nutritional concerns associated with baked goods and desserts.
2. Identify and describe allergy and food intolerance concerns associated with baked goods and desserts.
3. Identify the three ways to modify an ingredient in a baking formula to make the formula suitable for a specialized diet.
4. Using a knowledge of ingredient functions, describe how to reduce or eliminate fat, sugar, gluten, and dairy products in baking formulas.



**WHAT IS “HEALTHFUL”** food? First, of course, the food must not cause harm. In light of our increasing awareness of food allergies, certain foods that are perfectly safe for some people are anything but healthful for those who are allergic to one or more of their ingredients. Second, to be healthful, a food must contribute to our well-being. It might be argued that even a rich dessert that has no nutritional value and is high in fat and sugar can contribute to our emotional well-being simply because it is delicious and satisfying. Most pastry chefs would probably agree with that statement. However, what we usually mean when we say a food is healthful is that it is high in nutrients and low in calories from fat and sugar.

It is sometimes said that bakers are in the “fat business” because the products they make are high in fat. This is not completely true, or at best it is misleading. Many of the most important products of the bakeshop are low in fat or are fat-free, from French breads to fruit compotes and meringues. Still it is true that other products, such as pastries and cookies, are high in fat and low in nutrients other than calories. To address this, many pastry chefs today are trying to develop more healthful versions of popular items. More importantly—because allergic reactions can be fatal—cooks, bakers, and pastry chefs alike are responding to the very real problem posed by food allergies by producing foods that are both delicious and safe for their customers.

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## DIETARY CONCERNS

**DIET AND HEALTH** are increasingly in the news. Rising obesity rates regularly are in the headlines. Increasing numbers of people suffer from food allergies. Health problems caused by diet are increasing the costs of medical care. Often, it seems, people are too afraid of food to enjoy it. At the same time, our love affair with restaurants and bakeries continues to grow. People want food they can enjoy and that is also healthful.

Dietary concerns can be divided into two broad areas: those about nutrition, and those about food allergies and intolerances. Having good nutrition means consuming a varied diet that includes essential vitamins, minerals, proteins, and other nutrients. At the same time, it means limiting the intake of foods that can be harmful in large quantities. Managing weight gain requires limiting calories, especially calories from fats and sugar. The term *empty calories* refers to foods that provide few nutrients per calorie. Foods of high *nutrient density* are those that have a high level of nutrients per calorie. Fruits, vegetables, and whole grains are examples of foods with high nutrient density, while refined sugar and flour have low nutrient density.

For the customer, choosing nutritious foods is optional. Even people who usually choose nutritious foods can enjoy a rich pastry or choose a piece of white bread over whole grain. Enjoying limited sweets as part of a balanced diet provides enjoyment without necessarily having ill effects. For those with food allergies, however, choosing the right foods can be a matter of life or death. Allergic reactions can range from discomfort to severe illness and even death, so addressing these concerns is of great importance to all food service workers.

In this chapter, we approach nutrition concerns and allergies in separate sections because they require somewhat different approaches to finding alternatives in the bakeshop. After exploring the main dietary issues, we examine ways to modify formulas for special needs. The chapter concludes with a selection of formulas that give examples of ways to satisfy special dietary needs. These formulas were developed using the techniques outlined in this chapter.

Dietary baking is a large and complex subject, one that encompasses many subtopics, such as gluten-free baking and baking with sugar substitutes. Many books have been written about each of these subtopics, so this chapter is intended to serve only as an introduction to them, to familiarize you with the main issues and the general procedures for devising formulas suitable for restricted diets. Consult the Bibliography (p. 755) for books that delve more deeply into the topics touched on here. In particular, you will find collections of formulas for many different dietary purposes.

### Nutrition in the Bakeshop

The role of the baker or pastry chef in preparing nutritious foods varies greatly, depending on the part of the industry in which he or she works. Food services in schools, hospitals, and nursing homes must, of course, plan menus to meet basic nutritional needs. A qualified dietitian is usually required in such establishments. On the other hand, retail bakers and restaurant pastry chefs have a primary responsibility to prepare a variety of attractive and flavorful items that will sell. For them, it is often good business to include more healthful preparations among the items they offer, but many customers will still prefer chocolate mousse over fruit compote.

Satisfying nutritional concerns has two aspects: providing desirable nutrients and avoiding undesirable nutrients. A **nutrient** is a substance that is essential for the functioning or growth of an organism. For this discussion, we divide nutrients into two categories:

1. Nutrients that provide energy: fats, carbohydrates, and proteins. (Note that proteins can be used by the body for energy, but their more important function is to provide the building blocks of all cells. See Basic Nutrients Reviewed sidebar.)
2. Nutrients that are needed for metabolism, or basic body functioning, including all the chemical processes that take place within cells: vitamins, minerals, and water.

A healthful, balanced diet is one that includes all the nutrients in just the right amounts, not too much or too little of any of them. For many people, balancing the diet means consuming foods with more vitamins and minerals—the metabolism nutrients—and less fat and carbohydrates—the energy nutrients.

## Increasing Desirable Nutrients

In our culture, foods from the bakeshop form a relatively small part of the normal diet. Thus, we don't normally look to these foods—desserts, pastries, and breads—to give us more than a small part of our essential nutrients each day.

Nevertheless, bakers can take some steps to give customers the option of choosing items with more vitamins, minerals, and fiber (see the Fiber sidebar). The most significant sources of valuable vitamins and minerals among bakeshop ingredients are whole grains, fruits, and nuts. Bakers have ways of incorporating these ingredients to give customers the option of choosing more nutritious breads and desserts. For example:

- Replace part of the white flour in doughs and batters with whole wheat flour. Replacing up to 2 ounces per pound (125 g per kg) usually has only a small effect on dough formation. Replacing more than this can be done, but the bread or other product is likely to be heavier.

## BASIC NUTRIENTS REVIEWED

**Carbohydrates** are the body's most important sources of food energy. These compounds consist of long chains of carbon atoms with oxygen and hydrogen atoms attached to the sides. Starches and sugars are the most important dietary carbohydrates.

**Fats** supply energy to the body in highly concentrated form. Also, some fatty acids are necessary for regulating certain body functions. Third, fats act as carriers of fat-soluble vitamins.

**Proteins** are essential for growth, for building body tissue, and for basic body functions. They can also be used for energy if the diet doesn't contain enough carbohydrates and fats.

**Vitamins** are present in foods in extremely small quantities, but they are essential for regulating body functions. Unlike proteins, fats, and carbohydrates, they supply no energy, but some of them must be present in order for energy to be utilized in the body. Water-soluble vitamins (the B vitamins and vitamin C) are not stored in the body, so they must be consumed every day. Fat-soluble vitamins (A, D, E, and K) can be stored in the body, but the total amount eaten over time must be sufficient.

**Minerals**, like vitamins, are also consumed in small quantities and are essential for regulating certain body functions. Major minerals include calcium, chloride, magnesium, phosphorus, sulfur, sodium, and potassium. Trace minerals, eaten in even smaller amounts, include chromium, copper, iron, zinc, and iodine. Of all these, sodium, the major mineral in table salt, can contribute to high blood pressure if eaten in large quantities, as it too often is.

**Water** supplies no energy, but the body can't function without it. The adult human body is 50 to 60 percent water by weight.

## FIBER

The term **fiber** refers to a group of complex carbohydrates that can't be absorbed and used by the body. Thus, fiber supplies no calories. However, fiber is important for the proper functioning of the intestinal tract and the elimination of body waste. In addition, there is evidence that sufficient dietary fiber helps prevent some kinds of cancers and helps lower cholesterol in the blood. Fruits and vegetables, especially raw, and whole grains supply dietary fiber.

- Replace part of the white flour with whole-grain flour from another grain, such as oats, barley, amaranth, buckwheat, soy, or millet, or a grain product such as wheat germ, wheat bran, or oat bran. For yeast breads, you may need to use a wheat flour with higher gluten to compensate for the lack of gluten in these other grains.
- Add a small amount of flaxseed meal to doughs to provide beneficial fiber and fatty acids.
- Use flaxseeds, rolled oats, sunflower seeds, and other grains and seeds as toppings for breads, rolls, and quick breads.
- Seek out more whole-grain and mixed-grain bread formulas. There are several in this book, and many more are available in bookstores, libraries, and online.
- Add ground nuts in small quantities to dough formulas, and add chopped nuts to muffins and pastries.
- Add raisins and other dried fruits to breads and other baked goods. (See, for example, the Fig Hazelnut Bread on page 159.)
- Offer more desserts made with fruits, such as fruit compotes and fruit coulis.

## Reducing Undesirable Nutrients

The idea of reducing nutrients to be more nutritious may seem a contradiction, but the fact is that many people consume far too many energy-producing nutrients in the form of fats, sugars, and starches. As a result, many people suffer from obesity, heart disease, diabetes, and other ailments related to diet. For the baker, this is a difficult problem to address because these components, especially starches, are the baker's stock in trade. For the consumer, one of the best ways to cut down on consumption of fats, starches, and sugars is simply to avoid breads and desserts, or at least reduce consumption of them. Nevertheless, the baker can take some measures to make choices easier for health-conscious consumers. To understand how to approach the problem, a short review of these energy nutrients and issues concerning them is needed.

## Calories and Weight Gain

The *calorie* (or, more correctly, the kilocalorie; see the Calories and Kilocalories sidebar) is a unit of energy measurement. It is defined as the amount of heat needed to raise the temperature of 1 kilogram of water by 1°C.

The calorie is used to measure how much of the energy the body needs to function is supplied by certain foods. Carbohydrates, proteins, and fats can be used by the body to supply energy.

- 1 gram of carbohydrate supplies 4 calories
- 1 gram of protein supplies 4 calories
- 1 gram of fat supplies 9 calories

There is a direct connection between calorie intake, physical activity, and weight gain or loss. Simply put, if you consume more calories than you burn, you gain weight. If you consume fewer calories than you burn, you lose weight. All the diet schemes and fashions in the world—at least those that are medically sound—can be reduced to this. In other words, losing weight is possible only by eating fewer calories, burning more calories through exercise, or both.

## Fat

As the above list shows, fats are a concentrated form of energy, supplying more than twice as many calories per gram as do carbohydrates and proteins. This suggests that reducing fats in the diet is an effective dietary method of weight loss. Always keep in mind, however, that some fat is necessary in the diet, both for regulating certain body functions and for carrying fat-soluble vitamins.

Fats may be classified as saturated, monounsaturated, or polyunsaturated. *Saturated fats* are solid at room temperature. Animal products—eggs and dairy products, as well as meats, poultry, and fish—and solid shortenings are the major source of saturated fats. Tropical oils such as coconut oil and palm kernel oil are also rich in saturated fats. Health experts believe eating high levels of these fats contribute significantly to heart disease and other health problems.

## CALORIES AND KILOCALORIES

In scientific terminology, the amount of heat needed to raise the temperature of 1 kilogram of water by 1°C is called a *kilocalorie*, sometimes written *Calorie* (with a capital “C”) and abbreviated *kcal*. When written with a small “c,” the term *calorie* refers to a unit of energy measurement that is only 1,000th as large—the amount of heat needed to raise the temperature of 1 gram of water by 1°C.

Nevertheless, in discussions of nutrition, the word *calorie* is commonly substituted for *kilocalorie*. Just remember that when you see *calorie* in connection with food, the real meaning is *Calorie* (or *kilocalorie*).

Polyunsaturated fats and monounsaturated fats are liquid at room temperature. Although consuming too much of any kind of fat is unhealthy, these fats are considered more healthful than saturated fats. *Polyunsaturated fats* are found in vegetable oils such as corn oil, safflower oil, sunflower oil, and cottonseed oil. High levels of *monounsaturated fats* are found in olive oil and canola oil. Recent research has suggested that monounsaturated fat may actually lower the levels of the most harmful kinds of cholesterol in the body. Both kinds of unsaturated fats are also found in other plant products as well, including whole grains, nuts, and some fruits and vegetables.

One group of saturated fats of special concern is *trans fats*. These fats occur only in small amounts in nature. Most of the trans fats in our diets come from manufactured fats subjected to a process called *hydrogenation*. Hydrogenated fats are fats that are changed from liquid to solid by adding hydrogen atoms to the fat molecules. This is the process used to make products such as solid shortening and margarine. Trans fats are of concern because they limit the body's ability to rid itself of cholesterol that builds up on the walls of arteries.

Fats are members of a group of compounds called *lipids*. Another lipid found in the body is *cholesterol*, a fatty substance that has been closely linked with heart disease because it collects on the walls of arteries and blocks the flow of blood to the heart and other vital organs. It is found only in animal products and is especially high in egg yolks, butterfat, and organ meats such as liver and brains. The human body can manufacture its own cholesterol, so not all the cholesterol in the blood is necessarily from foods. Although some cholesterol is necessary for body functions, it is not considered a nutrient because the body is able to manufacture all the cholesterol it needs. Experts generally agree it is best to keep the cholesterol in the diet as low as possible.

## Sugars and Starches

Sugars are simple carbohydrates. Simple sugars, such as glucose, are small compounds containing 6 carbon atoms. Table sugar, or sucrose, is a larger sugar molecule with 12 carbon atoms. Sugars are found in sweets and, to a lesser extent, in fruits and vegetables.

Starches are complex carbohydrates consisting of long chains of simple sugars bound together. They are found in such foods as grains, bread, peas and beans, and many vegetables and fruits.

Most authorities believe that complex carbohydrates, especially those from whole grains and unrefined foods, are better for you than simple carbohydrates. This is partly because starchy foods also have many other nutrients, while sweets have few other nutrients. Also, there is some evidence that a lot of sugar in the diet may contribute to heart and circulatory diseases. Simple sugars and refined starches are primary sources of empty calories.

Many consumers believe that honey, raw sugar, and some other sweeteners are more nutritious than refined white sugar. It is true that these products have some beneficial minerals and other nutrients, but only in tiny amounts. They are still mostly sugar. Substituting one of these for white sugar does not reduce the amount of carbohydrate in a formula.

## Sodium

As explained above, excess sodium in the diet has been linked to high blood pressure, so people with this ailment are generally advised to reduce their sodium intake. Salt is the primary source of sodium in the diet. Most of a person's salt intake, however, does not come from baked goods and desserts but rather from main courses, side dishes, and salty snacks. For people on salt-free diets, reducing or eliminating salt in desserts and pastries may be advised for them, and this can be done with only a small effect on flavor. For most people, however, this change will have only a small effect on their total sodium intake. Be careful, also, when reducing the salt content of yeast breads, as one of the functions of salt is to regulate yeast activity (see p. 89).

## Vegetarian Diets

A vegetarian diet is one consisting entirely or mostly of foods derived from plants. People follow vegetarian diets for a variety of reasons: concerns about nutrition and health, ethical standards, or moral, religious, or cultural beliefs.

There are several types of vegetarian diets. The *vegan* diet is the most restrictive. It includes plant products only. All animal products, including dairy and eggs, are off-limits.

*Lacto-vegetarians* eat dairy products in addition to plant products, but they will not eat other animal products. *Ovo-vegetarians* eat eggs in addition to plant products. *Lacto-ovo-vegetarians* eat dairy and egg products as well as plant products.

For the baker or pastry chef, the main ingredients of concern to vegetarians are the following:

- *Dairy products*, including milk, cream, butter, and cheese must not be included in products intended for vegans. They are acceptable for lacto-vegetarians and lacto-ovo-vegetarians.
- *Eggs* must not be included in products intended for vegans, although they are permitted for ovo-vegetarians and lacto-ovo-vegetarians.
- *Honey* should not be used in baked goods and desserts for vegans, because it is an animal product.
- *Refined sugar* poses problems for vegans. Because some cane sugar is refined with the use of animal bone char, many vegans avoid all refined sugar, to be on the safe side. If you can assure the customer that the sugar is made from sugar beets and not refined with bone char, some vegans may be willing to eat it. A safer approach is to substitute a product like date sugar or maple sugar. These products impart a distinctive flavor, however, and are also more expensive than refined white sugar. In addition, avoid using any prepared ingredient that contains sugar, because you can't be sure of the source of that sugar.
- *Gelatin* is an animal product, so it must be avoided in vegetarian products. Agar-agar, a gelatinlike product made from seaweed, can be substituted (see p. 84).



### KEY POINTS TO REVIEW

- What do the terms *empty calorie* and *nutrient density* mean, and how are they related?
- What are the six basic nutrients, and what are their functions?
- What techniques can be used to add desirable nutrients to baked goods?
- What nutrients can be reduced to create a more healthy diet?
- What are the main types of vegetarian diet?

## Allergens in the Bakeshop

An *allergen* is any substance that triggers an allergic reaction. Many foods, including many ingredients used in the bakeshop, are potential allergens. Health agencies report that more and more people are being diagnosed with food allergies each year, so this is a growing problem worldwide.

A food allergy is an abnormal response to a food triggered by the immune system. In other words, the body's immune system mistakenly believes a food item is harmful and reacts to protect the body. This reaction may include the production of chemicals that are actually harmful to the body, sometimes even fatal. A sudden, severe, allergic reaction of the immune system is called *anaphylaxis*.

The foods that most commonly spur allergic reactions are peanuts, tree nuts, eggs, fish, shellfish, milk, soybeans, and wheat. Note that, with the exception of fish and shellfish, all of these products may be found in the bakeshop. Wheat, milk, and eggs are among the baker's main ingredients.

A food allergy is not the same as a *food intolerance*. A person may develop gas and bloating after eating a particular food, but this reaction does not involve the immune system. For example, people with lactose intolerance lack an enzyme that enables them to digest milk sugar, or lactose. These individuals may develop gas and abdominal pain when they consume dairy products. For the purpose of this discussion, we treat allergies and intolerances together because they both involve foods that must be avoided by the affected customer.

In food service operations and retail bakeries, precautions must be taken both in the preparation of food and in service to customers. The following are just a few of the steps you should take.

### Food Preparation

1. Train staff to be aware of ingredients that can cause allergic reactions.
2. Read the ingredient labels on all prepared food items used in the kitchen.
3. Don't make casual or unannounced ingredient substitutions.
4. Avoid cross-contamination. For example, a "safe" food could become dangerously allergenic if it is prepared on an inadequately cleaned prep table containing dust from peanuts used in prepping an earlier item. Ideally, set up a separate prep area for preparing foods for allergy sufferers.

### Food Service

1. Service and sales personnel should be aware of the ingredients in all menu items and should be prepared to answer questions about ingredients or to consult someone on staff who knows the answers.
2. Be sensitive to customers' questions; if someone asks whether an ingredient is used, find out if that customer has an allergy. If a customer's questions cannot be answered with confidence, admit it and be prepared to suggest alternative choices.

Among bakeshop ingredients, nuts, gluten, dairy products, soy products, and eggs are the primary culprits for sufferers of food allergies and intolerances. To this list we add alcohol, which is not an allergen but which must be completely avoided by some people.

## Nuts

Peanuts and tree nuts—such as walnuts, almonds, Brazil nuts, and pecans—are among the most potent allergens. They are responsible for many of the 150 to 200 deaths from food allergies each year in the United States. (*Note:* Peanuts are not true nuts but legumes, like peas and beans, so the allergies are somewhat different.) Even trace amounts of these nuts, such as dust from peanuts left on a work surface, can trigger an allergic reaction. The only safe measure to take is complete avoidance. It is not enough, for example, to leave the nuts out of a baked item or dessert. The surest way to guarantee a product is nut-free is to make it in a separate prep area using equipment that is reserved strictly for use in preparing goods that do not contain nuts.

Fortunately for the baker or pastry chef, nuts are not critical ingredients in most baked goods. Most formulas do not call for nuts, and it is not difficult to eliminate them from those that do, or to substitute similar preparations—for example, substitute a plain meringue disk for japonaise (p. 346), or use plain short dough instead of linzer dough (p. 319).

## Gluten

**Celiac disease** is a genetic (inherited) disorder in which the intestine is unable to process gluten proteins (see the "Celiac Disease" sidebar). Symptoms may be severe, and there is no cure. The only remedy is to avoid gluten completely.

The difficulty for the baker is that gluten is the backbone of breads and many other baked goods, and is a component of wheat flour, the baker's main ingredient. In addition, gluten proteins are found in rye, barley, spelt, and oats.

Nevertheless, it is possible to bake a variety of products using gluten-free flours, such as rice, millet, buckwheat, amaranth, and quinoa flours; potato starch, cornstarch, and cornmeal; and flours from chickpeas and other legumes. The structure-building properties of gluten proteins must be supplied by other ingredients, such as egg proteins and vegetable gums. These ingredients don't work the same way as gluten, however, so the texture of the products will differ. Doughs will be less elastic, and baked items are likely to be more crumbly than similar items baked with wheat flour.

## CELIAC DISEASE

Celiac (pronounced SEE lee ak) is a disease of the immune system, like other food allergies. When gluten is ingested by someone with this disease, the gluten proteins damage the lining of the small intestine. As a result, the body is less able to absorb other nutrients. The disease has many, and varied, symptoms—including anemia, fatigue, intestinal pain, and malnutrition—making it difficult for doctors to diagnose. Only recently has the scope of the problem become more widely recognized. There are still probably many people who suffer from the disease without knowing what it is.



## Lactose Intolerance and Milk Allergies

*Lactose*, also called *milk sugar*, is a form of simple sugar found in dairy products. Some people are unable to digest lactose, and drinking milk or eating products containing lactose results in intestinal discomfort, gas, bloating, and other symptoms. Because lactose is not an important component of baked goods, lactose-free milk and other lactose-free dairy products can easily be substituted in most formulas. Other milk replacers, such as soy milk, can also be used.

Milk allergies are immune reactions to milk proteins, rather than to lactose. This allergy is fairly common in infants, but most children grow out of it. The allergy is uncommon in adults. Those who suffer from it must usually avoid all dairy products.

## Soy

Soy products contain at least 15 proteins, and it is not clear whether allergic reactions are caused by one or more of these proteins or by other components of soybeans. A great many prepared foods contain soy products, so it is necessary to read ingredient labels carefully. The emulsifier *lecithin*, for one, is used in many products, including chocolate, and may not be identified as derived from soybeans. As with lactose, soy products are not essential ingredients in most bakeshop formulas, so avoiding them is relatively easy, as long as bakers are attentive to ingredient labels.

## Eggs

Like milk allergy, egg allergy affects primarily infants and children, and most people outgrow it by the time they are about five years old. Nevertheless, it does affect some adults, who may react with stomach cramps, skin rashes, coughing and wheezing, or, in some cases, severe anaphylaxis (see above). The allergic reactions are triggered by one or more of the proteins in the egg. Some people are allergic to egg white proteins, while others have a reaction to the yolks.

Because many common egg substitutes are made with egg whites, these products can't be used as baking ingredients for allergy sufferers. *Eggless egg substitutes*, on the other hand, contain no egg products. They are made of flour or other starches, plus vegetable gums and stabilizers, and, sometimes, soy protein. They are intended for use in baked goods only—that is, in doughs and batters—and are not suitable for use in custards or breakfast egg preparations.

## Alcohol

Unlike the other food items discussed so far, alcohol is not an allergen, but it must be avoided by people suffering from the disease alcoholism. Trace quantities of alcohol are present in a number of products of the bakeshop or pastry department. Alcohol is a byproduct of yeast fermentation and so is present in freshly baked bread, but the amount is so small it doesn't generally pose a problem. By the time the bread cools and is stored, nearly all the alcohol has evaporated.

Small quantities of liqueurs may be used to flavor dessert syrups used to moisten cakes, but here, too, the amount per portion is usually minute. Be prepared to advise customers, however, if a dessert contains significant amounts of alcohol. In some cases, merely the flavor of the alcoholic beverage, even if the alcohol has been burned away, can trigger an undesirable reaction.



### KEY POINTS TO REVIEW

- What is the difference between food allergy and food intolerance?
- What are the most important food allergies and intolerances?

## MODIFYING FORMULAS FOR SPECIAL NEEDS

**SO FAR IN** this chapter we've focused on the ingredients or components of baking formulas and desserts that may have to be modified to accommodate special diets, and why some customers may need or desire to avoid those ingredients. It should be clear from this information that there is no single solution to dietary baking. For example, the discussion of increasing vitamins and minerals suggests adding nuts to baked goods to increase nutrients. However, the discussion of allergens indicates that nuts must be completely avoided by some customers. Similarly, for people with lactose intolerance, soy milk may be substituted for dairy milk as an ingredient, but that substitution would then make the product unsuitable for people with soy allergy.

In other words, there are many approaches to baking for special needs, but each is directed at a specific problem. No one of them is suitable for every problem or every customer.

### Ingredient Functions

Whether you want to modify an ingredient of a baking formula to reduce fat or calories or to eliminate an allergen, you must first understand the functions of that ingredient in the formula.

Three ways to modify an ingredient are to *eliminate* it, *reduce* it, or *substitute* another ingredient for it.

Eliminating an ingredient may be the best method if that ingredient does not have a major structural or flavor function in a formula. For example, eliminating the chopped nuts in a brownie or cookie formula does not affect the dough or batter, so this step can be easily taken.

Reducing the amount of an ingredient may be successful, even if the reduction makes a slight change in the finished product. For example, some quick bread formulas are high in fat. Perhaps in those formulas the fat could be reduced to make a more healthful product, one that is still appealing even if the texture is slightly drier.

Substituting other ingredients is the only option when the ingredient has a critical structural function in the baked item. Wheat flour is the main example. The gluten in wheat flour is important for the structure of many baked goods. Eliminating it would make the formula unworkable. The only option is to substitute other ingredients that can take on those structure-building functions.

The explanations of basic ingredients in Chapter 4 include lists of the primary functions of the principal ingredients. Review these sections so the functions are fresh in your mind for the following discussion. In addition, reread the discussion on cake formula balance on pages 389–390. The basic principles explained there apply to all doughs and batters. Recall that:

- Tougheners or structure builders include flour and eggs.
- Tenderizers have the opposite function of structure builders. They include fats, sugars, and leaveners.
- Moisteners include water, liquid milk, syrups, and eggs.
- Dryers include flours, other starches, milk solids, and cocoa powder.

Apply the principle of formula balance when you are modifying a formula for dietary purposes. When an ingredient is eliminated or reduced, you must balance the formula by doing one or both of the following:

1. Replace the ingredient with another that performs the same functions. For example, when reducing fat, which is a tenderizer, add or increase other tenderizers, such as sugars.
2. Reduce the amount of ingredients that have the opposite effect. For example, if you are eliminating gluten, a toughener or structure builder, also reduce the tenderizers to maintain structure.

The next section applies these principles to ingredients bakers may want to eliminate or reduce for health or dietary reasons.

## Ingredient Substitutions

The ingredients or components discussed in this section are those that may have to be reduced or omitted for dietary reasons. However, these components perform important functions in baking formulas. When one of them is reduced or eliminated, its functions must be performed by other ingredients.

### Fat

Modifying the fat content of a formula usually involves one of the following goals:

#### REPLACING SATURATED FATS AND TRANS-FATS WITH MORE HEALTHFUL UNSATURATED FATS

Recall that saturated fats are solid at room temperature. Saturated fats include the most important fats in the bakeshop: butter, shortening, and margarine. Unsaturated fats are liquid oils.

Fats in doughs and batters function as tenderizers, and they improve the mouth feel of cakes and quick breads by giving the feel of moistness. When an oil is used in place of a solid fat, the oil still performs these tenderizing and moisturizing functions. In fact, because the oil doesn't solidify at room temperature, a muffin made with oil may seem even moister than one made with solid fat.

Another important function of solid fats is to form and retain air cells when creamed with sugar. Some creaming-method batters depend entirely on these air cells for leavening. Oils cannot be creamed with sugar to form air cells. Therefore, oil cannot be substituted for solid fats when creaming is essential to leavening. However, sometimes it is possible to substitute oil for *part* of the fat. When trying this substitution, make a test batch and compare the quality of the resulting product with the regular formula. In most cases, the best procedure is to cream the solid fat with the sugar and add the oil to the batter with other liquids.

To make up for lost leavening power, increase the baking powder, or fold in whipped egg whites.

Liquid fats work better when incorporated using the muffin method, rather than the creaming method. Try reworking creaming-method formulas to convert them to the muffin method.

When the fat is butter, flavor is also another important factor. If butter is a primary flavor in the product, substituting other fats for it is likely to decrease quality. The substitution works better for products with other dominant flavors, such as chocolate cake, spice cake, and many quick breads.

There is no substitute for solid fat in laminated doughs. The rolled-in fat in some formulas may be reduced slightly, but the resulting product may not rise as well or be as flaky.

Finally, remember that oil has as much fat and calories per gram as solid fat—even more, in the case of butter—so substituting oil for solid fat does not reduce total fat or calories. It reduces unhealthful saturated fats only.

#### REDUCING THE TOTAL AMOUNT OF FAT

Reducing the fat in a formula means reducing the total amount of tenderizers. To maintain the desired texture of the baked item, then, you must either substitute other tenderizers, reduce the tougheners, or both.

Use the following techniques when reducing total fat:

##### To Reduce Tougheners

- Use a softer flour. For example, substitute cake flour for pastry flour, or substitute pastry flour for part of the bread flour.
- Substitute whole-grain flours, especially of a gluten-free grain, for part of the wheat flour.
- Reduce the quantity of egg. You will probably have to increase other liquids to make up for the lost moisture of the egg.
- Avoid overmixing, which develops gluten.
- Avoid overbaking, which dries the product and also toughens protein.

##### To Increase Tenderizers in the Formula or Add Other Tenderizers or Moisteners in Place of the Fat

- Increase sugars. Liquid sweeteners such as honey, molasses, corn syrup, and maple syrup are useful for this purpose.

- Add a fruit or vegetable purée. Many purées can substitute for fats to increase the tenderness and moistness of a baked item, such as applesauce, prune purée, date purée, squash or pumpkin purée, fruit jelly or jam, banana purée, and fruit juice concentrates. Select a flavor that blends well with the flavors of the baked item.
- Add a dairy fat substitute. Fat-free buttermilk, sour cream, and yogurt can be substituted for part of the fat. They increase moistness, and their acidity tenderizes the gluten. Unlike fruit or vegetable purées, they don't change the flavor significantly.
- Use reduced-fat margarine or butter. These products contain less fat and more water and milk protein than regular margarine and butter. They can be substituted in many quick breads and cakes.

Finally, remember that there are many low-fat items already in the baker's standard repertory. For example:

- Use a low-fat icing, such as fondant or boiled icing, instead of buttercreams on cakes.
- Use angel food or sponge cakes instead of high-fat creaming-method and high-ratio cakes.
- Use baked meringues instead of short doughs in pastries and tarts.
- Use fruit fillings instead of high-fat fillings such as frangipane and cream cheese.

## Sugar

In addition to adding sweetness and flavor, sugars perform the following functions in baked goods:

- They create tenderness and fineness of texture.
- They retain moisture, thus improving texture and keeping qualities.
- They act as creaming agents with fats, to provide leavening.
- They give crust color because of their browning properties.

When sugar in a formula is reduced, these functions must be performed by other ingredients.

Some customers who want to reduce or eliminate refined white sugar in their diets have no objection to natural sugars like honey, even though they may have the same number of calories. Another granular sugar, such as date sugar or maple sugar, can be substituted for white sugar in equal weights without other changes to the formula. If a liquid sugar is used, such as honey, brown rice syrup, molasses, or maple syrup, the following adjustments to the formula may be necessary:

- Liquid sugars have no creaming ability, so other forms of leavening must be substituted. You may be able to mix the batter by the muffin method rather than the creaming method, as long as you increase the quantity of baking powder.
- If a large quantity of liquid sugar is used, reduce the other liquids in the formula.
- Not all liquid sugars have the same sweetening power, so you may have to adjust quantities. Brown rice syrup, for example, is only 30 to 60 percent as sweet as white sugar, whereas honey is sweeter than white sugar.

*Sugar substitutes* are used when it is necessary to reduce the total quantity of sugar in a formula. Sugar substitutes are chemicals that have a sweet taste, usually much sweeter than sugar, but no or little nutritional value. Aspartame and saccharin are intensely sweet chemicals often used as beverage sweeteners, but they have little use in baking because they don't perform any of the functions of sugar listed above, other than providing sweetness. Also, aspartame is destroyed by heat, so it is of no use in baked goods. Furthermore, these sweeteners leave aftertastes that are unpleasant to many people, and there are also questions about their safety.

*Sucralose* is the most useful sugar substitute in baked goods. It is sold under the brand name Splenda. Pure sucralose is 600 times sweeter than sugar. For baking, it is mixed with a bulking agent called *maltodextrin* to give it the same sweetening power and texture as an equal volume of sugar. This product is called *granular sucralose*. In pies, cookies, quick breads, dessert sauces, and custards, substitute an equal volume of granular sucralose for the sugar in the formula. (Granular sucralose has 96 calories per cup/240 mL, primarily from the bulking agents, while granulated sugar has 770 calories for the same volume.)



Sucralose.

Granular sucralose, however, does not have good creaming abilities, it does not contribute to browning, it doesn't contribute to texture, and it does not improve keeping quality as sugar does. When these functions are important, the usual technique is to substitute granular sucralose for *half* of the sugar in the formula, thus reducing the number of calories from sugar by half. A so-called baker's blend, consisting of half granular sucralose mixed with half sugar, is available, but it is more cost-effective to make the blend yourself.

Please note that when you are substituting granular sucralose for sugar, you must substitute an *equal volume*, not an equal *weight*, because the granular sucralose is much lighter than sugar. One cup (240 mL) granular sucralose weighs about 25 grams, slightly less than 1 ounce.

When baking with sucralose, monitor the products carefully for doneness. You can't rely on the usual amount of crust browning as a doneness indicator because the product won't brown as well.

*Isomalt* is another sugar substitute, discussed in Chapter 26 in connection with decorative sugar work (p. 684). It is white and granular in appearance and can be substituted for an equal weight of regular sugar. Isomalt has only half the calories of sugar, but it also has only half the sweetness, so it is not a suitable substitute in all formulas. Also, it is not easily digested and can cause intestinal discomfort and bloating when eaten by some people.

## Gluten

Perhaps the biggest challenge for a baker is making baked goods without gluten. Gluten is a component of wheat flour and is a major structural component of most baked goods.

Wheat flour supplies the bulk of most baked goods. This bulk-forming function can be duplicated simply by substituting other flours and starches for wheat flour. The structure-building functions of gluten proteins, however, are more difficult to duplicate (see pages 96–100 to review gluten formation and functions). Gluten-free baked goods must contain other ingredients that help build structure, or the item will be excessively crumbly, will not hold together, or will not rise. For some items, such as certain quick breads, egg protein can provide the necessary structure.

Vegetable gums, including pectin, are also used to provide necessary structure. Pectin is a component of fruit jellies, preserves, and purées. Adding these to gluten-free quick breads and other batters may improve the structure and texture. Powdered vegetable gums (see p. 84) can be used for the same purpose without adding the sweetness and flavor of fruit products. Xanthan gum is perhaps the most useful gum in gluten-free baking.

Some starches, such as cornstarch, can also partly compensate for an absence of gluten. Gelatinized cornstarch, for example, forms a firm gel that can improve the structure of some baked goods.

The following flours and starches can be used to make gluten-free baked goods. Usually, a mixture of several performs better than any single one. Keep in mind that each of these absorbs a different quantity of water, which means you will have to do some experimenting and adjusting of liquids when making substitutions in formulas.

- Amaranth flour\*
- Arrowroot
- Buckwheat flour
- Chickpea (garbanzo) flour
- Fava bean flour
- Garfava flour (blend of garbanzo and fava flours)
- Cornmeal
- Corn flour (like cornmeal but finer in texture)
- Cornstarch
- Millet flour\*
- Nut flours (not suitable, obviously, when nut allergies are a concern)
- Potato starch
- Quinoa flour\*
- Rice flour



Xanthan gum.

Sorghum flour

Soy flour

Tapioca flour and starch

\* These items are sometimes contaminated with wheat during processing and shipping, so caution is necessary.

Of these ingredients, rice flour, potato starch, tapioca starch, and cornstarch are especially useful because they have relatively little flavor of their own and thus most closely approximate white wheat flour.

Commercial gluten-free mixes also are available for various purposes. For example, one commercial pizza dough mix contains rice flour, potato starch, cornstarch, crystallized honey, guar gum, and salt.

The grains and other ingredients listed next contain gluten proteins and so are *not suitable* for gluten-free diets:

Barley

Kamut

Malt (made from barley)

Oats

Puffed rice cereal (may be processed in a facility that also processes wheat)

Rye

Semolina

Spelt (farro)

Triticale

Wheat

Gluten-free items, even with structure-building ingredients added, always have a markedly different texture from similar items made with wheat flour. The strength and elasticity of gluten can't be duplicated by other ingredients. In general, gluten-free baked goods have a more crumbly or grainy texture.

## Dairy

Dairy ingredients in baking formulas are modified to achieve either of two goals: to reduce the fat and calories from full-fat dairy products, or to make the product lactose- and allergen-free.

In many formulas, full-fat milk can be replaced with low-fat or nonfat milk without significantly changing the characteristics of the finished product. If, however, the fat from the milk is an important structural component of the baked item, you may have to compensate by making some of the adjustments discussed in the section on fat. Low-fat and fat-free sour cream can be substituted for regular sour cream in some formulas, and fat-free yogurt often works in place of sour cream, as does whole-milk yogurt.

Lactose intolerance and milk allergies require a different approach, usually the complete elimination of all dairy ingredients. Recall that lactose, which some people can't digest, is a form of sugar present in milk. Milk allergies, on the other hand, involve the proteins in milk products. Many lactose-free dairy products, including fluid milk, are available and can be consumed by people who are lactose intolerant. Lactose-free, however, is not the same as dairy-free. People with milk allergies cannot consume lactose-free milk.

Many types of milk substitutes are available. These can replace milk in most formulas to make the product suitable for anyone with a milk allergy or lactose intolerance. Soy milk is perhaps the most familiar, although this of course is not suitable for people with soy allergies. Other commercially available milk substitutes are made from rice, almonds, quinoa, potatoes, sesame seeds, and coconut. (Coconut milk, unlike the other products, is high in fat—17% or more.) Some of these are available in powdered as well as liquid form.

Dairy-free margarines can be substituted for butter in almost any formula. Read the label carefully, however, as many margarines contain milk protein. Margarines labeled *parve* or *pareve* are dairy-free.

## Eggs

Egg yolks contain fat and cholesterol, while egg whites are fat-free. If the goal is to reduce fat and cholesterol, use egg whites in place of an equal weight of whole eggs in doughs and batters when the egg is used as a binder.

When egg foams are used for leavening, egg-white foams can often be substituted for whole-egg foams. Of course, when the eggs are also a main structural component of a baked item, using egg-white foams in place of whole eggs causes too great a change in the product. For example, if you substitute egg whites in a genoise sponge cake formula, the product will no longer be a genoise but something more like an angel food cake.

For egg allergies, substituting egg whites is not acceptable. All egg products must be eliminated. Commercial baking egg substitutes (described on p. 698) containing starches and gums are designed to be used in place of eggs in doughs and batter.

Other starches, gums, and proteins can substitute for eggs to replace their binding power. Flaxseed meal is rich in gums and soluble fiber and is a useful egg replacement. To use, mix 1 tablespoon (15 mL) flaxseed meal with each 4 ounces (120 g) flour in the formula. Tapioca flour and arrowroot can be used in the same way. Alternatively, try substituting an equal weight of puréed tofu or puréed banana for the eggs in batter formulas. (Tofu, a soy product, can't be used for people with soy allergies.)



### KEY POINTS TO REVIEW

- What are the four categories of baking ingredients based on their structural functions? What are the most important ingredients in each category?
- What techniques can be used to reduce fat in a formula?
- What techniques can be used to reduce sugar in a formula?
- What techniques can be used to eliminate gluten from a formula?
- What techniques can be used to eliminate dairy and eggs from formulas?

## FORMULAS

**AS WRITERS, PUBLISHERS**, dietitians, and chefs have become aware of dietary issues related to baking and desserts, many books have become available that contain collections of recipes specialized for all sorts of diets, from low-fat and sugar-free to gluten-free, lactose-free, and other allergen-free diets. A few of these books are listed in the Bibliography (p. 755). More recipes can be found online and at any bookstore.

The purpose of this chapter is to explain the dietary reasons for modifying baking formulas and to outline the techniques you can use to adapt formulas to meet these dietary needs. It is not intended to be a comprehensive collection of dietary recipes. Nevertheless, it is useful to examine a few formulas that have been developed by applying the principles discussed in the first part of this chapter. Included are examples of gluten-free formulas, low-fat versions of high-fat baked goods, sugar-free formulas, and lactose-free formulas.

## LOW-FAT APPLE HONEY MUFFINS

Ingredient	U.S.	Metric	%
Whole wheat flour	12 oz	340 g	75
Oat flour	4 oz	110 g	25
Baking powder	1 oz	30 g	6
Cinnamon	0.1 oz (1½ tsp)	3 g	0.6
Cardamom	0.03 oz (½ tsp)	1 g (2 mL)	0.2
Applesauce, unsweetened	1 lb 4 oz	560 g	125
Honey	10 oz	280 g	62.5
Egg whites, beaten	4 oz	110 g	25
Raisins	6 oz	170 g	38
<b>Total weight:</b>	<b>3 lb 9 oz</b>	<b>1617 g</b>	<b>356 %</b>



### PROCEDURE

#### MIXING

Muffin method (p. 217):

1. Sift together the flours, baking powder, and cardamom.
2. Mix together the applesauce, honey, and egg whites.
3. Add the liquid ingredients to the dry ingredients and mix just until combined.
4. Mix in the raisins.

#### PANNING

Use paper muffin cups to line muffin pans, or spray the pan with a nonstick spray. Fill tins one-half to two-thirds full. Exact weight depends on pan size. Average sizes are 2 oz (60 g) for small muffins, 4 oz (110 g) for medium muffins, and 5–6 oz (140–170 g) for large muffins.

#### BAKING

375°F (190°C) for approximately 20 minutes, depending on size.



## LOW-FAT MULTIGRAIN BROWN BREAD

Ingredient	U.S.	Metric	%
Whole wheat flour	7 oz	200 g	44
Cornmeal	4 oz	110 g	25
Rye flour	3 oz	85 g	19
Oat flour	2 oz	55 g	12
Baking soda	0.7 oz (3½ tsp)	18 g	4
Ginger	0.14 oz (2 tsp)	4 g (10 mL)	0.9
Nutmeg	0.07 oz (1 tsp)	2 g (5 mL)	0.45
Cinnamon	0.06 oz (1 tsp)	1.8 g (5 mL)	0.4
<hr/>			
Low-fat buttermilk	1 lb	450 g	100
Molasses	6 oz	170 g	38
Prune purée (see Note)	8 oz	225 g	50
Egg whites, lightly beaten	3 oz	85 g	19
<b>Total weight:</b>	<b>3 lb 1 oz</b>	<b>1405 g</b>	<b>313 %</b>

### PROCEDURE

#### MIXING

Muffin method (p. 217):

1. Sift together the flours, baking soda, and spices.
2. Mix together the buttermilk, molasses, prune purée, and egg whites.
3. Stir the liquids into the dry ingredients just until combined.

#### PANNING

Spray the insides of 8½ × 4½ in. (22 × 11 cm) loaf pans with nonstick spray. Scale 1 lb 8 oz (700 g) batter per pan.

#### BAKING

375°F (190°C), about 50 minutes

**Note:** If prune purée is not available, soak pitted prunes in just enough warm water to cover, then purée the prunes and water in a food processor.



## LOW-FAT CHOCOLATE PIE

**Yield:** one 9-in. (23-cm) pie

Ingredient	U.S.	Metric	<b>PROCEDURE</b>
Skim milk	1 pt	500 mL	
Sugar	2 oz	60 g	
Cornstarch	2 oz	60 g	
Sugar	2.5 oz	75 g	
Cocoa powder	1 oz	30 g	
Skim milk	8 fl oz	250 mL	
Vanilla extract	0.25 fl oz (1½ tsp)	7 mL	
9-in. (23-cm) low-fat graham cracker pie shell (below)	1	1	

### VARIATIONS

#### LOW-FAT CHOCOLATE PUDDING

Reduce the cornstarch to 1.5 oz (45 g). Prepare as in basic recipe, omitting pie shell.



## LOW-FAT GRAHAM CRACKER PIE SHELL

**Yield:** one 9-in. (23-cm) pie shell

Ingredient	U.S.	Metric	<b>PROCEDURE</b>
Graham cracker crumbs	4.5 oz	125 g	
Raspberry jam	2 oz	55 g	

## NO-SUGAR-ADDED LEMON COOKIES

Ingredient	U.S.	Metric	%
Butter, soft	8 oz	225 g	50
Sucralose, granular	1.3 oz (12 fl oz)	36 g	8
Salt	0.12 oz (½ tsp)	3.5 g	0.8
Grated lemon zest	0.5 oz	14 g	3
Eggs	3 oz	85 g	19
Vanilla	0.33 oz (2 tsp)	10 g	2.4
Pastry flour	1 lb	450 g	100
Baking powder	0.4 oz (2½ tsp)	11 g	2.5
<b>Total weight:</b>	<b>1 lb 13 oz</b>	<b>834 g</b>	<b>185 %</b>

## VARIATION

## NO-SUGAR-ADDED CINNAMON COOKIES

Omit the lemon zest. Add 1% (0.16 oz/4.5 g; about 1 tsp/5 mL) cinnamon.

## PROCEDURE

## MIXING

Creaming method (p. 486):

1. Combine the butter, sucralose, salt, and zest in the bowl of a mixer fitted with the paddle attachment. Cream until light, scraping down the bowl as necessary to make sure all ingredients are evenly blended. (Note that the mixture will not cream as well as butter and sugar.)
2. Add the eggs a little at a time; mix until each addition is completely absorbed before adding more.
3. Blend in the vanilla.
4. Sift together the flour and baking powder. Add to the mixing bowl and mix at low speed until evenly blended and smooth.

## MAKEUP

Icebox method:

1. Divide the dough into approximately 8-oz (230 g) parts.
2. Roll each into a cylinder 1 in (2.5 cm) thick. Wrap each tightly in plastic film and refrigerate for several hours or overnight.
3. Slice ¼ in. (6 mm) thick. Bake on parchment-lined sheet pans.

## BAKING

350°F (160°C), about 10 minutes

## REDUCED-SUGAR APPLE SPICE CAKE

Ingredient	U.S.	Metric	%	PROCEDURE
Pastry flour	1 lb	500 g	100	<p><b>MIXING</b></p> <p>Muffin method:</p> <ol style="list-style-type: none"> <li>1. Sift together the dry ingredients.</li> <li>2. Mix together the applesauce, molasses, oil, and eggs until well blended.</li> <li>3. Add the dry ingredients to the liquids and mix just until smooth.</li> </ol> <p><b>SCALING AND BAKING</b></p> <p>Refer to the weights for high-fat cakes in the table on page 392. When a weight range is given, use the lower end of the range. Use the temperatures indicated in the table.</p>
Sucralose, granular	1.25 oz	40 g	8	
Baking soda	0.5 oz	15 g	3	
Baking powder	0.16 oz (1 tsp)	5 g	1	
Salt	0.16 oz (¾ tsp)	5 g	1	
Cinnamon	0.08 oz (1 tsp)	2.5 g	0.5	
Ginger	0.05 oz (¾ tsp)	1.5 g	0.3	
Ground cloves	0.05 oz (¾ tsp)	1.5 g	0.3	
Nutmeg	0.03 oz (⅜ tsp)	1 g	0.2	
Applesauce, unsweetened	1 lb 4 oz	625 g	125	
Molasses	11.5 oz	360 g	72	
Vegetable oil	3 oz	95 g	19	
Eggs, beaten (or liquid egg substitute)	6 oz	190 g	38	
<b>Total weight:</b>	<b>3 lb 10 oz</b>	<b>1841 g</b>	<b>368 %</b>	
<p><b>Note:</b> This formula is called “reduced-sugar” rather than “no-sugar-added” because of the sugar content of the molasses. No other sugar is added.</p>				

## GLUTEN-FREE CHOCOLATE CAKE

Ingredient	U.S.	Metric	%	PROCEDURE
Butter	8 oz	240 g	80	<p><b>MIXING</b></p> <p>Creaming method (p. 381)</p> <p><b>SCALING AND BAKING</b></p> <p>See the table on page 392. Butter and flour the pans heavily (using flour from a gluten-free grain, such as rice), or line with parchment. The cake is very tender, even when cooled, and may break if it doesn't release easily from the pan. Handle cake layers carefully when assembling and icing.</p>
Sugar	14 oz	420 g	140	
Bittersweet chocolate, melted	4 oz	120 g	40	
Eggs	6.7 oz	200 g	67	
Rice flour	6.5 oz	195 g	65	
Potato starch	2.5 oz	75 g	25	
Tapioca flour	1 oz	30 g	10	
Xanthan gum	0.16 oz (1¼ tsp)	4.8 g	1.6	
Baking soda	0.25 oz (1¼ tsp)	7.8 g	2.5	
Baking powder	0.18 oz (1 tsp)	5.4 g	1.8	
Salt	0.18 oz (½ tsp)	5.4 g	1.8	
Buttermilk	8 oz	240 g	80	
Water	4 oz	120 g	40	
Vanilla	0.17 oz (1 tsp)	5 g	1.7	
<b>Total weight</b>	<b>3 lb 7 oz</b>	<b>1668 g</b>	<b>556 %</b>	

## GLUTEN-FREE YEAST BREAD

Ingredient	U.S.	Metric	%
Rice flour	1 lb	500 g	67
Potato starch	3 oz	95 g	12.5
Cornstarch	2 oz	60 g	8
Tapioca flour	3 oz	95 g	12.5
Sugar	1 oz	30 g	4
Nonfat milk solids (or powdered milk replacer)	2.5 oz	75 g	10
Xanthan gum	0.5 oz (5 tsp)	15 g	2
Salt	0.5 oz	15 g	2
Instant yeast	0.5 oz	15 g	2
<hr/>			
Butter or margarine, melted	2 oz	60 g	8
Water, warm	1 lb 12 oz	875 g	117
Distilled white vinegar	0.33 oz (2 tsp)	10 g	1.4
Egg whites, lightly beaten	6 oz	190 g	25
<b>Total weight:</b>	<b>4 lb 1 oz</b>	<b>2035 g</b>	<b>271 %</b>

### PROCEDURE

#### MIXING

1. Sift all the dry ingredients (a) into the bowl of a mixer fitted with the paddle attachment. Mix on low speed until the ingredients are uniformly blended.
2. With the machine running on low speed, slowly add the melted butter (b), water (c), and vinegar. Blend the ingredients together.
3. Add the egg whites. Turn the machine to high speed and mix for 3 minutes. Note that the mixture forms a batter, not a dough (d).

#### PANNING, PROOFING, AND BAKING

Note that this batter does not have a fermentation period like regular yeast doughs.

1. Grease loaf pans and dust with rice flour.
2. Fill pans half full of the batter.
3. Proof until double in bulk.
4. Bake at 400°F (200°C) for about 50 minutes, depending on the size of the loaves.



A



B



C



D



## GLUTEN-FREE CHOCOLATE CHIP COOKIES

Ingredient	U.S.	Metric	%
Butter or margarine	5 oz	150 g	50
Granulated sugar	4 oz	120 g	40
Brown sugar	4 oz	120 g	40
Salt	0.12 oz (½ tsp)	4 g	1.25
Eggs	3 oz	90 g	30
Vanilla extract	0.16 oz (1 tsp)	5 g	1.6
Cornstarch	3.5 oz	105 g	35
Tapioca flour	3.5 oz	105 g	35
Chickpea (garbanzo) flour	2 oz	60 g	20
Rice flour	1 oz	30 g	10
Baking soda	0.12 oz (¾ tsp)	4 g	1.25
Xanthan gum	0.05 oz (½ tsp)	1.5 g	0.5
Chocolate chips	7 oz	210 g	70
<b>Total weight:</b>	<b>2 lb 1 oz</b>	<b>1004 g</b>	<b>334 %</b>

### PROCEDURE

#### MIXING

Creaming method:

1. Cream together the butter, sugars, and salt until light.
2. Add the eggs a little at a time, waiting before each addition is absorbed before adding the next.
3. Add the vanilla.
4. Sift or mix together the dry ingredients and blend them into the creamed mixture.
5. Stir in the chocolate chips.

#### MAKEUP

Drop method: Drop ¾ oz (22 g) portions onto parchment-lined sheet pans.

#### BAKING

Bake at 350°F (175°C), about 12 minutes

**NOTE:** This formula is adapted from the formula on p. 493.



## GLUTEN-FREE BROWNIES

Ingredient	U.S.	Metric	%
Unsweetened chocolate	12 oz	338 g	75
Butter	1 lb 8 oz	675 g	150
Eggs	1 lb 3 oz	525 g	117
Sugar	2 lb 5 oz	1050 g	233
Salt	0.25 oz	7 g	1.5
Vanilla extract	1 oz	30 g	6
Rice flour	10 oz	284 g	63
Potato starch	4 oz	112 g	25
Tapioca flour	2 oz	54 g	12
Xanthan gum	0.25 oz	7 g	1.5
Walnuts or pecans, chopped (optional)	12 oz	338 g	75
<b>Total weight</b>	<b>7 lb 9 oz</b>	<b>3420 g</b>	<b>759 %</b>

### PROCEDURE

#### MIXING

1. Melt the chocolate and butter together in a double boiler. Let the mixture cool to room temperature.
2. Mix the eggs, sugar, salt, and vanilla together until well blended, but do not whip to a foam.
3. Blend in the chocolate mixture.
4. Sift together the dry ingredients. Fold them into the chocolate mixture.
5. Fold in the nuts, if desired. Leave them out, of course, if nut allergies are a concern.

#### PANNING

Grease sheet pans or other baking pans and dust them with rice flour. Pour the batter into the pans. One recipe is enough for one full-size sheet pan, two half-sheet pans, four 9 × 13-in. (23 × 33 cm) pans, or six 9-in. (23-cm) or 8-in. (20-cm) square pans.

#### BAKING

325°F (165°C) for 45–50 minutes.



## LACTOSE-FREE CRÈME CARAMEL

**Yield:** 12 portions, 5 oz (150 g) each

Ingredient	U.S.	Metric	<b>PROCEDURE</b>
Sugar	12 oz	375 g	
Water	2 fl oz	60 mL	
Eggs	1 lb	500 g	
Sugar	8 oz	250 g	
Salt	½ tsp	2.5 g	
Vanilla extract	1 tbsp	15 mL	
Soy milk (see <i>Note</i> )	2½ pt	1250 mL	
<p><b>Note:</b> For soy allergies, use another of the milk substitutes listed on page 703 in place of the soy milk.</p>			



## LACTOSE-FREE MANGO COCONUT ICE CREAM

**Yield:** about 3 qt (3 L), depending on overrun

Ingredient	U.S.	Metric	<b>PROCEDURE</b>
Egg yolks	4 oz (6 yolks)	125 g (6 yolks)	
Sugar	12 oz	375 g	
Coconut milk	8 fl oz	250 mL	
Coconut milk	2 pt 8 fl oz	1250 mL	
Mango purée	1 lb 8 oz	750 g	
Lime juice	3 fl oz	90 mL	
Sugar	3 oz	90 g	

1. Combine the egg yolks, sugar, and first quantity of coconut milk in a bowl. Whip until smooth and evenly mixed.
2. Scald the remaining coconut milk and gradually beat it into the egg mixture.
3. Heat in a hot-water bath or a double boiler, stirring constantly, until the mixture thickens enough to coat the back of a spoon. Immediately remove from the heat and set in an ice-water bath to stop the cooking. (See page 264 for guidelines on preparing crème anglaise.)
4. Chill the mixture thoroughly. Refrigerate overnight.
5. Mix the mango purée, lime juice, and sugar until evenly blended. Chill for several hours or overnight.
6. Combine the custard mixture and the mango purée. Freeze in an ice cream freezer.

## TERMS FOR REVIEW

empty calorie	vitamin	lipid	anaphylaxis
nutrient density	mineral	cholesterol	food intolerance
nutrient	calorie	vegan	celiac disease
fiber	saturated fat	lacto-vegetarian	lactose
carbohydrate	polyunsaturated fat	ovo-vegetarian	lecithin
fat	monounsaturated fat	lacto-ovo-vegetarian	sucralose
protein	trans fat	allergen	



## QUESTIONS FOR DISCUSSION

- Describe five ways to increase the vitamin, mineral, and fiber content of yeast breads.
- True or false: Replacing the sugar in a muffin formula with honey makes the muffins more nutritious. Explain your answer.
- A guest at a catered banquet tells the waiter she is allergic to nuts and can't eat the cake that is being served for dessert, a white cake with chocolate icing decorated with walnut halves. The waiter removes the nuts from the cake and serves it to the customer. Is this the proper response? Explain your answer.
- Which of the following ingredients can be used to make cookies for people with celiac disease: barley flour, rye flour, whole wheat flour, spelt flour, oat flour?
- Name and describe the three basic ways to modify an ingredient or ingredient quantity in a formula to make the formula suitable for special dietary needs.
- Explain why it is important to understand the function of an ingredient in a baking formula when you want to eliminate that ingredient for customers who are allergic to it.
- Why is it especially important to avoid overmixing if you reduce the butter content of a muffin formula?