Chapter 15

Food Analogs: Substitute Ingredients

Objectives

- **List** the four main functions of food analogs.
- **Distinguish** between nutritive and nonnutritive sweeteners.
- **Compare** the performance of fat replacers to the performance of fat.
- **Describe** advantages and disadvantages of potassium chloride as a salt substitute.

Functions of Food Analogs

- Food analogs are natural or manufactured substances used in place of traditional food products or ingredients
- Food analogs are designed to
  - save money
  - change the nutritive value of food
  - improve the performance of foods and compounds

continued

Functions of Food Analogs

- Food analogs are designed to
  - replace foods that are restricted for health reasons
- Examples of food analogs include
  - texturized protein made from soybeans that costs less than meat and is lower in fat
  - artificial sweeteners that are ideal for people with diabetes

The Pros and Cons of Food Analogs

Pros

- offer low-fat and reduced-calorie options
- keep prices of food products reasonable
- allow more food options for people with heart disease, food allergies, and diabetes

Cons

- viewed as drawbacks to the current food supply by some
- are not "natural"
- may tempt some people to avoid eating a variety of foods

Sugar Substitutes

- Consumer demand for lower-calorie foods tasting like high-calorie favorites prompted their development
- The sugar substitutes
  - add sweetness without adding as many calories as sugar
  - are important in many restricted diets
- Nonnutritive sweeteners provide no calories but nutritive sweeteners do

Nonnutritive Sweeteners

- **Saccharin**
  - remains stable in a wide range of foods under extreme processing conditions
  - was the first artificial sweetener
  - is 2,000 times sweeter than sugar
  - has a bitter aftertaste in high concentrations
  - has not been found to cause cancer in humans after 20 years of research

continued

Nonnutritive Sweeteners

- **Aspartame**
  - is a dipeptide made from aspartic acid and the amino acid phenylalanine
  - tastes almost identical to sugar, but is 200 times sweeter
  - is safely consumed at levels up to 50 mg per kilogram of body weight per day
  - is used in drinks, puddings, gelatins, chewing gum, and frozen desserts

continued

Nonnutritive Sweeteners

- **Acesulfame K** (acesulfame potassium)
  - is an organic salt
  - is 130 times sweeter than sugar
  - is stable in high temperatures
  - has no known side effects
  - is approved for use in chewing gum, drinks, instant tea and coffee, gelatins, and puddings

continued

Nonnutritive Sweeteners

- Stevioside is
  - a natural extract from the leaves of a plant
  - up to 300 times sweeter than sugar
  - stable at high temperatures and in acids

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continued

Nonnutritive Sweeteners

- **Sucralose**
  - is a disaccharide made in a 5-step process that replaces 3 hydroxyl groups with chlorine
  - is 600 times sweeter than sugar
  - cannot be digested, so it adds no calories
  - remains stable in processing, is soluble in water, and is easily added to foods

continued

Nonnutritive Sweeteners

- Neotame
  - is from L-aspartic acid and L-phenylalanine combined with a methyl ester group and a neohexyl group
  - is 7,000 to 13,000 times sweeter than sugar
  - remains stable in high heat and is approved for baking applications
  - works as a flavor enhancer when used in low levels

Nutritive Sweeteners

- **Polyols** are a group of low-calorie sweeteners that
  - are also known as sweet alcohols
  - are found naturally in apples, berries, and plums
  - include sorbitol, mannitol, xylitol, maltitol, lactitol, erythritol, isolmalt, D-Tagatose, and hydrogenated starch hydrosylates (HSH)
  - helps control moisture content

continued

Nutritive Sweeteners

- Polyols
  - improve texture and reduce browning
  - extend the shelf life
  - do not promote tooth decay
  - may act as a laxative if eaten in large amounts
  - have a synergistic effect in food
  - are found in baked goods, ice cream, candy, and chocolates

New Developments in Sweeteners

- *Brazzein* is a supersweet protein found in a vine plant that
  - is 2,000 times sweeter than sugar
  - remains heat stable at 98°C (208°F) for 2 hours
  - is stable across a wide pH range
  - can be genetically engineered in maize, then extracted through ordinary milling

continued

New Developments in Sweeteners

- Artificial sweeteners are combined with a **bulking agent** to enhance the texture or thicken the consistency of food products
  - Polydextrose is a bulking agent that mimics the mouth feel of sugar and is used in reduced-calorie products
  - Other bulking agents include alginates, gum acacia, pectin, and xanthan gum

Fat Substitutes

- The average American consumes more fat than is recommended
- Health concerns caused researchers to develop substitutes that mimic fat in foods
  - Food scientists look for ways to keep the positive qualities of fat while reducing or eliminating negative qualities

Starch-Based Fat Replacers

- These lower-calorie fat replacers
  - mimic the mouthfeel of fat
  - cannot create flaky texture in baked goods
- The most common types are
  - vegetable gums, dextrins, maltodextrins, polydextrose, and pectin
- Carrageenan helps low-fat hamburgers retain juices

continued

Starch-Based Fat Replacers

- Oatrim, a hydrolyzed oat flour, is used commercially in baked goods
- Cellulose gels are used in low-fat salad dressings

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Protein-Based Fat Replacers

- **Simplesse** is made by a process called microparticulation
  - Milk and egg proteins are heated and processed to form balls that swell in water and mimic the mouthfeel of fat
- This fat replacer is unsuitable for frying
  - Uses include frozen desserts, mayonnaise, salad dressings, yogurt, butter, puddings, cheese, and baked goods

continued

Protein-Based Fat Replacers

- LITA is made from corn gluten
- Trailblazer is made from egg white and milk
- Starch and protein-based fat replacers release flavor all at once rather than gradually
- Sugar is often increased in foods with fat replacers to make up for a lack of flavor

Manufactured Fats

- **Olestra**
  - is a sucrose polyester with 6 to 8 fatty acids attached at the site of hydroxyl groups on a sucrose molecule
  - can be solid or liquid depending on the fatty acids used
  - looks, feels, and performs like fat
  - cannot be digested by the body and therefore provides no calories

continued

Manufactured Fats

- SALATRIM
  - is derived from soybean oil and other natural fat sources
  - is made of 3 fatty acids attached to a glycerol molecule
  - will not endure frying
  - provides about half the calories of fat
  - may cause abdominal discomfort, nausea, bloating, and headaches at 40 grams per day

Salt Substitutes

- Most Americans consume more sodium than the body needs
- High levels of sodium are connected to high blood pressure, a risk factor for heart disease
  - This is the reason for salt substitute research
- Sodium is often a hidden additive in processed foods

continued

Salt Substitutes

- Potassium chloride
  - may benefit heart patients on low-sodium diets that need extra potassium
  - has a slightly bitter aftertaste
- Potassium is a soft metal that combines with chlorine to form salts
- Other salt substitutes include
  - sodium-free herbs and spices

Recap

- Food analogs have several functions including
  - saving money
  - altering the nutritive value of foods
  - improving food performance
  - offering an alternative option for restricted diets

continued

Recap

- Nonnutritive sweeteners provide no calories, but nutritive sweeteners do
- Fat replacers perform the same functions as fat in food products
- Potassium chloride, herbs, and spices are salt-free alternatives that are used to season foods