Master Food Volunteer Notebook

KANSAS STATE UNIVERSITY
Extension

Kansas State University Extension

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Mission/Vision Statement

The information in this book provides a basic common core of knowledge to complement the food-related expertise volunteers already possess. This training is not intended to be comprehensive. It is expected that users will continue to expand their research-based food knowledge to help reach current and untapped audiences with information on enjoying food in delicious, safe, and healthy ways.

Who are the Master Food Volunteers?

This section will help explain why the Master Food Volunteer program was created, what Master Food Volunteers do, and how they are tied to the Cooperative Extension Service. This section also helps explain the many tasks to be performed, and suggests ways to improve telephone, writing and public presentation skills.

Key Concepts

- Overview of the Cooperative Extension Service
- Resources for the Master Food Volunteer
- Creation of the Master Food Volunteer Program
- A Master Food Volunteer's responsibilities and jobs
- Suggestions to improve telephone, public speaking, and writing skills

Overview of the Cooperative Extension Service

The Cooperative Extension Service (CES) was created when Congress saw the need to educate the average citizen about agriculture and mechanical fields. This led to the passing of the Morrill Act in 1862 which created "Land Grant Universities."

To be even more effective, Congress saw the need for research to supplement the educational programs. Congress passed the Hatch Act in 1887 to provide research facilities to study agriculture, mechanical and other related problems.

Disseminating this information was accomplished by passing the Smith Lever Act of 1914 to establish the Cooperative Extension Service. Extension offices are in every Kansas county to "extend" the information and education to the public. Extension agents are considered faculty of Kansas State University.

Organization of the Cooperative Extension Service in Kansas

As a Master Food Volunteer, the majority of your contacts will be through your local K-State Extension office. The local agents will determine how to teach and administer the Master Food Volunteer program to fit the educational needs of the county program. Your primary contact will be the local family and consumer sciences agent. Because no K-State Extension agent knows the answers to all questions from the public, technical assistance from the university is available through specialists in food science, food safety, human nutrition, and other subjects.

Creation of the Master Food Volunteer Program

The idea of creating a Master Food Volunteer Program (MFVP) resulted from the need to expand the food science and human nutrition program in the counties. Citizens are becoming more aware of food issues and nutritional needs within various communities, which can create more

questions for the agent. In some areas, the agent may never reach some consumers because of time restraints. The MFVP focuses on the subjects of food safety, food science, food preparation, and home food preservation.

Consequently, the MFVP will help reach current and untapped audiences to provide consumers with up-to-date knowledge so they can enjoy food in many new ways. MFVP participants can gain a sense of community spirit, accomplishment, and intellectual stimulation.

The Master Food Volunteer Program was developed and is maintained under the Family and Consumer Science program area's direction. Local Family and Consumer Science Agents manage the volunteers they train.

Program Guidelines, Policies and Procedures

Age Requirement

A potential Master Food Volunteer must demonstrate an interest in food, nutrition and cooking; have enthusiasm for acquiring and sharing new knowledge, and have a sincere commitment to volunteerism and community betterment.

Trainee Application and Selection Process

The application and selection process for an individual to become an MFV intern is made at the local/county level. Individuals are selected based on an applicant's interests, the current need in the local program, and the individual's successful completion of the application and selection process.

The process requires an individual to:

1. Complete a written application and submit it to the local county or district extension office.
2. Participate in an interview to help determine the individual's fit within the program, and how the program aligns with the applicant's interests in volunteering.
3. Successfully clear any required background checks required by the State, including, but not limited to, a criminal background check.
4. Receive confirmation of selection.
5. Complete an assessment of current knowledge of food and nutrition information so Extension staff can assess the best training opportunities to provide.
6. Pay application fee required by the county, district or regional office.

Completed application materials are confidential information and are to be held in a locked file in the county or district extension office.

Master Food Volunteer Internship/Certification/ Re-certification

When MFV course classes are completed, trainees begin a one-year-long MFV internship. During this period, interns will provide at least 40 hours of volunteer service on locally approved MFV projects within their communities. Following the completion of this volunteer service commitment, MFV Interns are graduated to active Master Food Volunteers. The volunteer receives a certificate, an MFV apron, and an official Master Food Volunteer name badge. Active status is valid for one calendar year.

To remain active in the program, individuals must annually sign the memorandum of agreement and complete an annual minimum of 10 hours of continuing education and 20 hours of volunteer service after the first year of internship.

Using the Master Food Volunteer Title

The title "Master Food Volunteer" should only be used when doing unpaid volunteer work for K-State Extension. It should not be used to imply that Cooperative Extension is endorsing any product or place of business. Volunteers may not accept unsolicited reimbursements or gifts. It is inappropriate to seek or accept speaking engagements for pay while participating in authorized Extension activities and using the Master Food Volunteer title.

Master Food Volunteers should neither advertise nor promote their places of business while volunteering; and they should not use their MFV status to solicit business. When performing MFV activities, MFVs are agents of K-State Extension and Kansas State University. Appearing at a commercial activity, having association with commercial products, or giving implied university endorsement of any product or business is improper. K-State Extension, of which the Master Food Volunteer Program is a part, must be viewed as a source of unbiased, research-based information.

It is appropriate for Master Food Volunteers to seek reimbursement from program sponsors for the cost of travel or materials needed to conduct the class. An individual may also list his or her MFV education and volunteer service experience on a resume.

Types of Master Food Volunteer Opportunities

Project selection is based on community need, availability of volunteers, and educational impact. Here are examples of few volunteer activities to spark ideas:

- Answer food preservation questions and teach classes.
- Answer holiday food safety and preparation questions.
- Teach cooking classes.
- Provide leadership and teaching skills in an after-school cooking class.
- Assist with educational displays at health fairs and community events.
- Write food and nutrition lessons for a variety of audiences.
- Support 4-H/youth food leaders.
- Lead a 4-H or youth food project.
- Test pressure canner gauges.
- Present displays at farmers markets.
- Write food-related articles for newspapers.
- Judge foods at county fairs/cooking classes.
- Assist with summer library programs regarding food and food safety.
- Cooking from food pantries.
- Manage a volunteer program.

Your county extension agent will provide you with a "job description" to better outline your role as a volunteer with K-State Extension.

Using Research-Based Information

Providing research-based information is at the core of K-State Extension's work, purpose, and mission. As extension volunteers, you are expected to uphold university research-based findings, even when the information is new or different from a volunteer's personal experience or opinion.

Volunteers are provided with core course education, resources, and other information, all of which are based on research by K-State and other university experts. These resources help make informed choices. While it is important to respect individual beliefs,it is expected to make recommendations based on scientifically defensible

information from K-State or other reputable sources. While information from K-State Extension is always the first choice as a resource, information from other state extension services and academic sources may also be used.

Volunteer Code of Ethics

As an Extension Master Food Volunteer, I will:

- Treat audiences with respect, care and acceptance. I know that all people have skills and talents that can be used to help others and improve their community.
- Honor my volunteer commitment. I will strive to live up to my volunteer time commitment by working the hours needed to fulfill the role I have accepted.
- Keep records, distribute materials and support the Extension system. I will distribute research-based materials to Extension audiences, keep required records, and turn them in on time. I will assist audiences with enrollment, active participation, and recognition.
- Seek training for my volunteer role. I will participate in meetings, self-study, or other training programs that will help me work more effectively with Extension audiences.
- Make all reasonable efforts to assure equal access to participation for all audiences, regardless of race, creed, color, sex, national origin, age, or disability.
- Provide a safe environment. I will not harm audiences in any way, whether through sexual harassment, physical force, verbal or mental abuse, neglect, or other harmful experiences.
- Not use alcohol or any illegal substances (or be under its influences) while participating in Extension activities.
- Operate machinery, vehicles, and other equipment in a safe and responsible manner. When operating a motor vehicle, I will have a valid driver's license and the legally required insurance coverage.
- Refrain from endorsing specific brands, products, or businesses.
- Obey the laws of the locality, state and nation.
- Work as a "team player" for the good of all persons. I will work cooperatively with other adult volunteers for the good of all those involved in the program.
- Work within the Extension system. As a volunteer, I am accountable to the county Extension Executive Board/ District Governing Body, the state Cooperative Extension Service, and the state University for my actions.

Communication Skills

Good communication skills will help you effectively answer their questions or explain a concept. Many times you will not be able to see a person's problem and will have to rely on verbal communication to solve the problem.

As you discuss a problem with a consumer, think of all the possible conditions that may lead to the problem. Ask questions to get more details. It may be a good idea to summarize the problem to the consumer to make sure you understand their problem. People will interpret information in many ways based on voice changes, gestures, facial expressions, body language, and words. Therefore, it is always good to make sure you both understand the problem equally.

No one person knows everything about food. Therefore, some volunteers will be more comfortable with certain food topics. ***The important thing is to know how and where to search for answers for unfamiliar topics. When in doubt, take the person's name, address, and phone number and then research the problem for a proper answer or ask your extension agent or specialist for help.***

Etiquette for the Internet, Email, Social Media, and Listservs

Reasons for using electronic communication technologies:

- To share knowledge.
- To build community.
- To support each other as volunteers.

Guidelines

- **Show respect for clients and other volunteers.** Any K-State Volunteer who makes derogatory or inappropriate comments regarding race, gender, age, religion, sexual orientation, or does not show respect for others are subject to immediate removal and/or disciplinary action at the discretion of the program coordinator in accordance with Master Food Volunteer Program Policies.
- **Agree to disagree.** If you disagree with what someone has said online, put diplomatic communication skills into practice as you express that disagreement.
- **Ranting online is unacceptable.**
- **Avoid typing in all capital letters.** It's hard to read completely capitalized messages and IT IS CONSIDERED SHOUTING in the online community.

If you need to emphasize a word or two, use asterisks, underline, boldface, or italicize the words.

- **Avoid confidential, personal, or legally sensitive information.** When posting as a Volunteer, you are representing Kansas State University. Messages should be businesslike and reflect the organization and its policies. Examples of confidential information would be participant addresses, phone numbers, marital status, or other personal details. If in doubt, contact your local extension personnel for clarification.
- **Avoid sarcasm, teasing, and joking in comments.** Readers cannot readily determine that you are kidding, and your comments could be misconstrued. If you are not sure how your ideas and comments will be taken, ask someone to read them before sending them.

Dealing with technical problems

- For questions about personal computer equipment, Internet access, connection speed, or personal software, contact your Internet provider or software company help desk.
- For help with the online hours reporting system, contact Tech Support within the Online Reporting System at *kansasmfv.org* or your local supervisor.

Write Well Online

1. **1. Use proper grammar and punctuation, and spell correctly.** Poorly written emails are a bad reflection on you. Pay attention to style, spelling, grammar, syntax, and all the other rules of written communication. It will make a difference in how your message is perceived.
2. **Explain things completely.** Electronic communication tends to be brief. Make certain that you include enough information to tell the whole story or answer the question adequately.
3. **On the other hand, be concise.** Keep your email brief and to the point. Make sure it clearly expresses your thoughts and ideas. Delete the irrelevant portions of the original message; just leave the portion that you are replying to. Put your reply at the top of the message, so the recipient doesn't have to scroll to the bottom to find it.
4. **Read your message before you send it.** Double-check it before you click the send button.
5. **Fill in the subject line.** Many people who receive dozens of emails a day appreciate seeing something in the subject line because it helps them prioritize the email and find it after it has been filed. Keep the subject line short. If you don't fill in the subject line, many people will think that your message is either a virus or spam.
6. **Sign your email.** Email addresses are not always comprised of people's names. The receiver may not be familiar with your email address and thus many choose not to respond.

(Adapted from "Email Netiquette", by Matthew Riedel, Rutgers University; Source: Iowa State University Master Gardener Handbook)

Using the Telephone

When using the telephone, you are representing K-State Extension. You can leave a lasting impression on a person by the way you communicate while on the phone. Below are some tips when using the telephone.

- When the telephone rings, answer promptly.
- Identify yourself to personalize the call and get the conversation started.
- Be friendly while being a good listener.
- Focus on the conversation.
- Show you are alert and ready to help the caller.
- Use simple, straight forward language, avoid slang terms.
- Speak clearly and vary the tone of your voice.
- If you must leave the conversation, put the call on hold or lay the receiver down gently. If it takes longer, ask if you can return the call. Thank them for waiting.
- When answering for someone else, be tactful. It is best to say "Mr. Smith is away from his desk right now. May I ask him to call you?" Be sure to get the name, time, date, and phone number. Double check for accuracy.
- Sometimes, a caller may be frustrated and take their frustrations out on you. Be calm and courteous. As long as you are trying, you are doing your job.

Writing Tips

Volunteers may be asked to write publications or news articles. This will utilize writing skills. A well-written project should be organized and simple. Here are some tips to create a good written project.

- Start with a good, simple title.
- Do not mislead the audience.
- Create an outline to organize your subject and topics to be covered.
- Write a topic sentence for each paragraph, then expand on that topic.
- Simplicity is essential to clear writing.
- Avoid slang, jargon, flowery, or obscure language.
- Shorten documents by removing adjectives or articles (a, an, the).
- Use a dictionary.
- As a research-based organization, note that while we sometimes mention specific products, companies, or brands for clarity, it is not to be considered an endorsement.

Public Presentations

There will be many opportunities to give public presentations. This may be in the form of demonstrations, informational talks, workshops, or managing booths. Public presentations take preparation and practice to be successful. Here are some tips for a successful presentation.

- The core structure is a title, introduction, body and summary.
- The title should be short, descriptive and describe the subject immediately.
- The introduction explains the goal/content.
- The body contains the majority of information and tells the public what they wanted to hear.
- The summary gives the major points of the presentation in a short, concise manner.
- Know your audience.

- Know your subject.
- Make sure it is timely and appropriate.
- Know the length of the presentation.
- ALWAYS PRACTICE!
- Make displays and visuals easy to read.
- Be organized with all materials.
- Advertise the presentation in newsletters, newspapers, radio or TV public service announcements.
- A sponsor may be helpful to promote the presentation.
- Organize pre-registration when necessary.
- As a research-based organization, note that while we sometimes mention specific products, companies or brands for clarity, it is not to be considered an endorsement.

Managing Programs

Volunteers are an expansion of program services to make the County or District Extension Agent more efficient. However, the Agent must still head the program. Volunteers can become managers of programs to facilitate other volunteers. Program planning and goal-setting with the Agent helps determine specific needs and the type of projects to plan. Volunteers must keep records of their work.

Reporting Volunteer Hours Online

Records of Volunteer and continuing education hours are important for documenting volunteer status, recognizing milestones in a volunteer's history, and are an important part of Extension's annual reports to federal and state funding agencies. Data collected from online reporting

is used to generate reports about Volunteer impact and help illustrate the value of the program.

The K-State Master Food Volunteer Program uses an online reporting system. It can be found at: *kansasmfv.org*. After setting up an account, volunteers use this tool to enter their hours and specific volunteer activities. The volunteer year follows the calendar year; volunteer and continuing education hours are due by December 31st of each year. Volunteers are encouraged to report their hours throughout the year on an ongoing basis. Late submission of hours may not be included in state or federal reports about the program or count towards county volunteer hour summaries.

Email and Internet access is required of all volunteers to report their continuing education and service hours. If a volunteer does not have a computer or Internet access at home, it is their responsibility to work with the local county extension staff to receive in-person assistance in reporting hours at the county office or other site such as a public library.

Reporting Contacts

The goal of asking volunteers to report contacts they make is to gain an accurate picture of the effectiveness of the program. Volunteers should work with the supervising agent to devise a system for collecting and reporting the number of contacts made during their educational activities. Volunteers report the number of people they interact with as a Volunteer, NOT the number of questions they answer. When several volunteers interact with an individual at an event such as a county fair, only one contact should be reported for all. While each volunteer reports his or her own volunteer hours for the event, the contact number should be reported only once.

Examples:

- A local event draws a total of 320 people. This is the number of people that this program event reaches. Although people attend various classes taught by several volunteers throughout the day, only the total number of people attending the event should be reported. The local coordinator/leader or a designated volunteer reports the 320 people online when they report volunteer hours for the event.
- Two volunteers answer questions at a cooking session. During the day, 40 people are engaged in learning at the educational session, and both volunteers work together to help the 40 people. One volunteer may be responsible for reporting all 40 contacts, or each volunteer may report 20 contacts. In the end, only the number of people who attended the clinic should be reported, in this case 40.

TV, radio, newspaper and magazine articles: When volunteer activities involve the media, report the number of articles/broadcasts produced for a given media outlet. Then report the circulation or audience of that media outlet.

Examples:

- A volunteer writes a monthly cooking/nutrition column for a local newspaper. The circulation of the paper is 15,000, so report this one time as 12 articles with a circulation of 15,000.
- A volunteer hosts a weekly one-hour-long radio show for eight weeks during the summer on a local station. The station has a listening audience of 45,000, so in this situation, report eight one-hour radio shows on a station with an audience of 45,000.

Using K-State Extension and Master Food Volunteer Branding and Logo

K-State Extension claims the right and ownership to the names, symbols, graphics, logos, trademarks, and service marks associated with the university. K-State's logos and marks cannot be used without permission from the appropriate K-State representatives. Branding and marketing guidelines can be found at *k-state.edu/communications-marketing/brand-style/voice-style/*. The website also includes contact information if you have questions about using the wordmarks.

Volunteer Reimbursements for Master Food Volunteer Program Expenses

Participants receive no money for their services. If an individual does collect a stipend for something they do, they are no longer considered a volunteer and thus are not covered for liability purposes for that activity. Volunteers may submit and be reimbursed by their local county or district programs and the state office, as appropriate, for actual out-of-pocket expenses supporting Volunteer activities, but pre-approval for expenditures is required.

Extension Nondiscrimination Statement

The following nondiscrimination statement is required on all publications created by K-State Extension campus and field staff.

- This institution is committed to providing equal opportunity for participation in all programs, services, and activities. Program information may be available in languages other than English. Language access requests and reasonable accommodations for persons with disabilities, including alternative means of communication (e.g., Braille, large print, and American Sign Language), may be requested by contacting the event contact (insert name) four weeks prior to the start of the event (insert deadline date) at (insert phone number and email). Requests received after this date will be honored when it is feasible to do so. Language access services, such as interpretation or translation of vital information, will be provided free of charge to limited English proficient individuals upon request.

Short version:

- Kansas State University is an equal opportunity provider and employer.

K-State Extension's access for all information is here: *extension.k-state.edu/about/access-and-opportunity/*

Media Release

To collect and use images, video, film, and other media for extension programs, a signed media release needs to be on file. The release should list all identifiable individuals (including other extension employees) who are principal players in the media and include a description of how the signer's image will be used. A media release form can be obtained from K-State Extension, and signed forms must be held on file at the appropriate local extension program office. As part of their application process, Volunteer trainees are asked to sign a blanket media release. Here are additional guidelines regarding release forms:

- Individuals under the age of 18 need the signature of a parent or guardian. The names and addresses for minors should be obtained and releases sent to parents/guardians before the photos are taken; otherwise, obtain signatures before the images are used in extension materials.

- Individuals who are identifiable in a group should sign releases whenever possible. This includes individuals visible in the foreground of large groups being photographed or videotaped in a public place (outside on the sidewalk or street) or in a public building (a big meeting).
- When photographing personal or private property (a garden, house, place of business, a commercial building, etc.), ask the owner to sign the release. If you are shooting images of public property, there is no need to obtain written consent.

Liability and Accident Coverage as a Volunteer

Volunteers are subject to Kansas state law of Immunity from Liability for Volunteers of Nonprofit Organizations as described in Section 60-3601 of the Kansas Extension Service Administrative Handbook found at *ksre.k-state.edu/employee_resources/admin_handbook/AdminHandbk_complete.pdf*.

Evaluating Work

To ensure satisfaction of volunteer work, evaluations must be completed to determine volunteer performance and the adequacy of support from the Extension office. This will also help determine if the tasks you are performing are worthwhile to you and for K-State Extension. An evaluation will help you decide if you want to continue as a Master Food Volunteer.

The Program Rewards

Volunteers are not paid with money, but with gratitude by fellow workers, extension agents, and the citizens you work with during programs. The sense of accomplishment and pride in a job well done make up the rewards that you alone collect.

Topics for Further Study/ Training

- Strategies for Teaching Youth/Developmental Learning Stages
- Strategies for Teaching Adults
- Strategies for Teaching Limited Resource Audiences
- Team Building Skills Communication Skills
- Marketing/Promoting Extension Activities
- How to Do a Food Demonstration

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This publication will be made available in an accessible alternative format or in languages other than English upon request. Please contact *ksrenews@ksu.edu* to request translation services.

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Chapter 1

Basic Nutrition

Basic Nutrition

Upon completion of this lesson, you will be able to:

1. Identify the six essential nutrients for health.
2. Identify the importance of nutrients from the various food groups.
3. Explain the guidelines and recommendations for healthy eating from the *Dietary Guidelines for Americans*.
4. Understand the key concepts of building balanced meals.
5. Define a healthy eating pattern.
6. Identify the recommended amounts of food from the different food groups for healthy eating.

Key Concepts

- Nutritious eating helps people throughout all stages of life feel their best and reduce the risk of disease.
- The *Dietary Guidelines for Americans* provide recommendations for healthy eating.
- Risk for developing heart disease, certain cancers, stroke, type 2 diabetes, osteoporosis, obesity, high blood pressure, and high cholesterol can be reduced by following a healthy eating pattern and meeting physical activity recommendations.
- The USDA food patterns provide specific recommendations for all foods and beverages consumed over time.
- All nutrients have important functions in the body.
- A healthy eating pattern limits: saturated fats and trans fats, added sugars, and sodium.

The Basics of Nutrition

Following a healthy eating pattern during all stages of life that meets dietary guidelines helps prevent chronic disease and promotes good health. To understand the importance of eating a variety of foods from all food groups, it is important to have a basic understanding of the nutrients needed for the body to function properly.

Nutrients

Food supplies various nutrients that the body uses for energy, growth, maintenance, and repair, and to keep the body systems working properly. There are six major nutrients that our bodies need: carbohydrates, proteins, fats, vitamins, minerals, and water. Of these nutrients, carbohydrates, proteins, and fats are considered macronutrients because they are needed in larger quantities. Other nutrients and compounds found in food are important for health, as well, including antioxidants. When we do not consume enough nutrients, we can become deficient. Nutrient deficiencies can lead to reduced quality of life, illness, and disease. Nutrient deficiencies can occur in populations with abundant food supplies — adequate calories but lacking vitamins and minerals — as well as in impoverished or underdeveloped cultures.

While nutrient needs are very specific and individualized, in general, macronutrient ratios should be 45 to 65 percent of total calories from carbohydrates, 10 to 35 percent from protein, and less than 35 percent from fat.

Calories

Calories are a measurement tool, like inches or cups. Calories measure the energy a food or beverage provides from the carbohydrate, fat, and protein it contains. Alcohol also provides calories, but it is not essential for survival. When broken down in the body, they provide energy.

Calories give you the fuel or energy you need to work, play, and think — even to sleep! When choosing what to eat and drink, it's important to choose nutrient-dense foods that provide many vitamins and minerals without too many calories, unhealthy fats, and added sugars.

Food to Calories

Carbohydrate = 4 calories per gram

Protein = 4 calories per gram

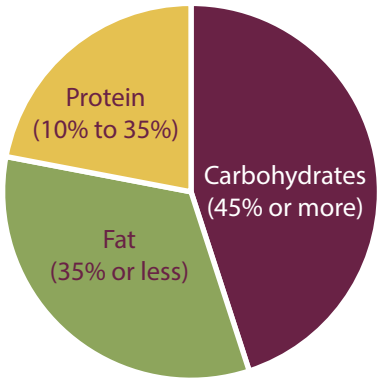
Fats = 9 calories per gram

Alcohol = 7 calories per gram

Carbohydrates

Carbohydrates are the body and brain's main source of energy. Carbohydrates may be simple (e.g., sugars) or complex (e.g., starches). Complex carbohydrates are many simple sugar molecules linked together. These carbohydrates take longer to digest in the body and give a longer-lasting form of energy. Foods that contain complex carbohydrates are considered healthier because many of them contain fiber, vitamins, and minerals. Foods that contain complex carbohydrates include legumes, some fruits, vegetables, and whole grains.

Simple carbohydrates, known as sugars, are molecules that are quickly broken down by the body and give an immediate supply of energy. Simple carbohydrates are naturally found in foods like fruits and milk but are often a main ingredient in processed foods such as cereal, cakes, cookies, and sugar-sweetened beverages. A healthy eating pattern limits added sugars to less than 10 percent of daily calories.



Fiber

Fiber is an important part of carbohydrates. Fiber is the part of the plant not broken down by the digestive system and passes through the body without contributing calories. Research about increased fiber consumption has shown many benefits, including, but not limited to, reduced cancer incidence, lower risks of cardiovascular disease and diabetes, improved mental health, and a robust gut microbiome. Additionally, gastrointestinal disorders such as constipation, diverticulosis, and diverticulitis are linked with a low-fiber diet. Fiber also helps you feel full, making weight control easier.

Dietary fiber is classified as insoluble or soluble. Insoluble fiber is found in foods such as wheat bran, whole grains, nuts, seeds, and some fruits and vegetables. This type of fiber does not dissolve in water. It supports regular bowel movements by

increasing the bulk and transit time of stools. Soluble fiber is found in legumes, oats, nuts, flax seed, and some fruits and vegetables. This type of fiber dissolves in water, forming a gel-like substance that helps slow digestion, lower blood cholesterol levels, and regulate blood sugar levels. Both types of fiber are needed, and many foods contain both soluble and insoluble fiber.

Eating an adequate amount and a variety of vegetables, fruits, and whole grain foods will help you consume enough fiber. Dietary fiber recommendations vary by age and gender; however, most adults

Dietary Fiber Content of Foods

	Serving size	Fiber (grams)
Breads, cereals, grains		
White wheat bread	1 slice	2.6
Whole wheat bread	1 slice	1.9
100% All bran	⅔ cup	12.0
Corn flakes	1 ½ cups	1.0
Shredded wheat	2 big biscuits	5.8
Oatmeal, cooked	1 cup	4.0
Rice, brown, cooked	1 cup	2.6
Rice, white, cooked	1 cup	1.4
Fruit (fresh unless otherwise noted)		
Honeycrisp apple, with skin	1 large	2.4
Apricots	1	2.1
Banana	1	1.9
Blackberries	1 cup	7.6
Grapes	1 cup	1.4
Grapefruit, pink and red	½	1.4
Melon, cantaloupe	1 cup	1.2
Nectarine	1	2.1
Orange	1 small	3.4
Peach	1	2.3
Pear	1 medium	5.6
Pineapple	1 cup	1.5
Plums	1 small	1.0
Prunes, dried	5	2.8
Raisins	¼ cup	1.8
Strawberries	1 cup	2.7

	Serving size	Fiber (grams)
Vegetables		
Beans, baked, canned, plain	1 cup	11.4
Beans, green, cooked	1 cup	4.3
Beets, canned	1 cup	3.0
Broccoli, raw	1 cup	2.3
Cabbage, raw	1 cup	2.2
Carrots, raw	1 cup	3.4
Cauliflower, raw	1 cup	2.1
Celery, raw	1 cup	1.6
Corn, yellow, cooked	1 cup	3.3
Lentils, cooked	1 cup	15.6
Lettuce, romaine, raw	1 cup	1.0
Lettuce, iceberg, raw	1 cup	0.9
Green peas, cooked	1 cup	8.8
Peas, split	1 cup	16.3
Potato, baked, fresh	1 medium	4.0
Sweet potato, cooked without skin	1 medium	3.8
Cherry tomatoes	1 cup	1.8
Winter squash, cooked	1 cup	5.7
Zucchini squash, cooked	1 cup	1.8
Other foods		
Almonds (24 nuts)	1 oz.	3.5
Peanuts, dry roasted (approx. 28)	1 oz.	2.4
Walnuts, English (14 halves)	1 oz.	1.9

Source: USDA FoodData Central https://fdc.nal.usda.gov/

should consume 25 to 35 grams per day. Most Americans fall short of the recommendations, consuming on average about 15 grams each day.

Dietary Fiber Recommendations by Age

Age	Male	Female
2 – 3 years	14 grams	14 grams
4 – 8 years	17 grams	20 grams
9 – 13 years	25 grams	22 grams
14 – 18 years	31 grams	25 grams
19 – 30 years	34 grams	28 grams
31 – 50 years	31 grams	25 grams
51+ years	28 grams	22 grams

Dietary recommendations are 14 grams per 1000 calories consumed.
Source: *Dietary Guidelines for Americans 2020-2025*

Protein

Proteins are long chains of amino acids that provide structure, function, and regulation of the body's tissues and organs. Proteins are essential for numerous processes in the body, ranging from repairing and building body tissues to maintaining healthy skin, muscles, hair, and bones, and even supporting a healthy immune system. Protein is found in all foods from animal sources, such as meat, poultry, fish, and dairy, and in many foods from plant sources, such as legumes, nuts, seeds, and some grains.

There are 20 amino acids that are needed to form protein structures in the body. Nine of these are essential amino acids, and 11 are nonessential amino acids. Essential amino acids are not made by the body and must come from a person's diet. Proteins

that contain all nine of these essential amino acids are called complete proteins. These can be used by the body as they are. Complete proteins are primarily animal-based foods but also include soy, quinoa, buckwheat, and amaranth. On the other hand, incomplete proteins contain only some of the essential amino acids and must be combined with other foods that contain the other amino acids. Incomplete proteins are primarily found in plant-based foods, like nuts, seeds, grains, legumes, and vegetables.

Eating foods with complementary proteins throughout the day will supply the body with all the essential amino acids needed for proper function. Complementary proteins are two or more plant-based protein sources that, when combined, provide all the essential amino acids the body needs. For example, eating beans and rice for a meal will provide the essential amino acids needed to form a complete protein. Your body does store amino acids, so it is not critical that complementary proteins be consumed in the same meal; rather, they should be consumed on the same day.

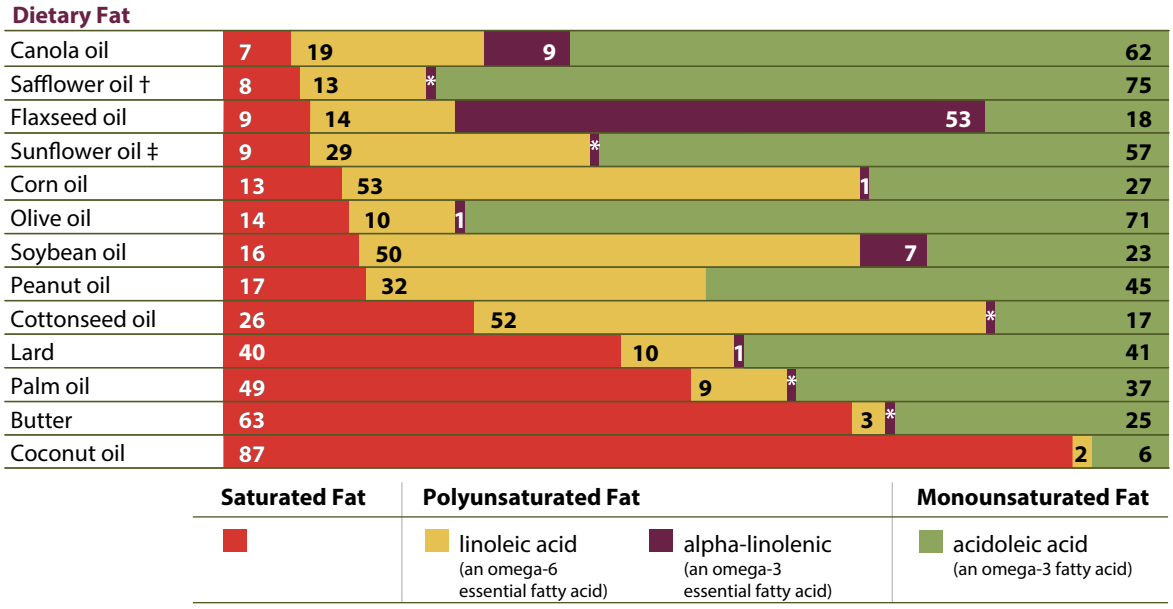
Fat

Dietary fats are categorized into four main categories: monounsaturated, polyunsaturated, saturated, and trans fat. Fat is needed for healthy growth, hormone production, energy, and to carry the fat-soluble vitamins – A, D, E, and K – through the body. Stored fat also protects the organs, insulates the body, and is a reserve source of energy. Fat also has many culinary purposes. It adds flavor to food, is important in the texture of foods, acts as an emulsifier, adds moisture, and gives the stomach a feeling of being full or satisfied. Fat is a concentrated source of energy, supplying nine calories per gram, so monitoring consumption is important to prevent overconsumption of calories.

Polyunsaturated fats are found in greatest amounts in sunflower, corn, soybean, and cottonseed oils; walnuts; pine nuts; and sesame, sunflower, pumpkin, and flax seeds. Only small amounts of polyunsaturated fats are found in most animal fats.

Monounsaturated fats are found in greatest amounts in olive, canola, peanut,

Comparison of Dietary Fats



† High Oleic ‡ Mid Oleic * Trace

Fatty acid content normalized to 100%

SOURCES: CANADIAN NUTRIENT FILE AND USDA NATIONAL NUTRIENT DATABASE ACCESSED MAY 2016

sunflower, and safflower oils, and in avocados, peanut butter, and most nuts. Monounsaturated fats are also part of most animal fats, such as fats from chicken, pork, beef, and wild game.

Fats with a higher amount of polyunsaturated and monounsaturated fats are usually liquid at room temperature and are referred to as "oils." These have been shown to reduce cholesterol and decrease the risk of cardiovascular disease compared to saturated fats.

Saturated fats are found in the greatest amounts in coconut and palm kernel oils, butter, whole-fat dairy, animal fats, and some nuts. Saturated fats are solid at room temperature and have been shown to raise cholesterol and increase the risk of cardiovascular disease.

***Trans* fats** are unsaturated (liquid) fats that have been structurally changed to be solid at room temperature. They are found primarily in partially hydrogenated vegetable oils and foods containing these oils. Naturally occurring trans fats can also be found in ruminant animal fats. These naturally occurring trans fats do not pose the same health risk as the manufactured kind. Manufactured trans fats were identified as a major contributor to heart disease and were banned from the U.S. food supply in 2018.

Vitamins and Minerals

Vitamins and minerals, known as micronutrients, are essential for good health. They are needed in smaller amounts than macronutrients and do not supply calories or energy. They work with other nutrients to support body processes and reactions, including energy production, immune system support, bone health, nerve function, blood cell production, and more. Many Americans are consuming enough calories (in many cases exceeding) but are not meeting micronutrient needs. Globally, micronutrient deficiencies are a public health concern. In the U.S., calcium, potassium, dietary fiber, and vitamin D are of public health concern. Other nutrients of concern are vitamin A, vitamin E, vitamin C, magnesium, iron, and choline.

Vitamins and minerals are important for preventing deficiency diseases. Early research focused on curing and preventing diseases such as beriberi, scurvy, and "night blindness," which were found to be caused by deficiencies of certain vitamins and minerals. Today, research is finding new connections between vitamins and minerals and cancer and heart disease.

Vitamins are classified as either water-soluble or fat-soluble. Water-soluble vitamins dissolve in water and are carried in the bloodstream. These vitamins are vitamin C and the vitamin B complex, including thiamin, riboflavin, niacin, vitamin B6, folic acid, vitamin B12, biotin, and pantothenic acid. The body needs these vitamins daily because they are not stored in the body. Excess water-soluble vitamins are excreted from the body. These vitamins, as compared to the fat-soluble vitamins, are more easily destroyed or lost in food preparation.

Fat-soluble vitamins dissolve in fat and are carried through the body attached to lipids or fat molecules. They can be stored in the fat cells in the body, so consuming an excess of these vitamins can be harmful because they may build up to toxic levels. Toxicity usually happens only when excess levels are consumed from a supplement and not from food. Fat-soluble vitamins are vitamins A, D, E, and K.

Minerals are inorganic substances that help regulate body processes and provide structure to the body. They help regulate fluid balance, nerve impulses, and muscle contractions. Some of them become part of the body structure of bones and teeth. They cannot be destroyed by the heat of food preparation and are stored in the

body. Excessive amounts can be harmful, but a normal diet is not likely to be above the safe amounts. The minerals needed in greater amounts are the major minerals: calcium, phosphorus, and magnesium. Calcium is important in building bones and teeth. It also helps the muscles contract and the heart beat. Calcium deficiencies will result in reduced bone density and a greater risk for osteoporosis. Phosphorus is also a major part of bones and teeth. Deficiencies are rare, but an excess amount may lower the level of calcium in the blood. Magnesium helps regulate body functions, maintains healthy nerves and muscles, and is a part of bones. Deficiencies of magnesium are also rare. Electrolytes are major minerals that help regulate body fluids in and out of every cell and transmit nerve impulses. Sodium, chloride, and potassium are electrolytes.

Trace minerals are those of which the body only needs a small amount. Dietary Reference Intakes have been set for iron, zinc, iodine, and selenium. Other trace minerals are chromium, copper, fluoride, manganese, and molybdenum.

Dietary supplements are available in tablet, capsule, powder, or liquid form, and can include vitamins, minerals, fiber, herbs, other botanicals, amino acid concentrates, oils, and extracts. They are often self-prescribed by people to promote good health. Nearly 60% of U.S. adults over the age of 20 took a dietary supplement in the past 30 days, according to the National Health and Nutrition Examination Survey. Taking a multi-vitamin-mineral supplement with a low dose (no more than 100 percent of the nutrient recommendation) is usually safe, but higher dosages could be harmful. A health care provider may determine special circumstances in which someone would benefit from supplements. Most Americans can get adequate nutrition from their diet if a healthy eating pattern is followed. *Learn more about dietary supplements from the Food and Drug Administration.*

Functional foods and their nutrient and non-nutrient components are making news as nutrition boosters present in many foods. There is no clear and accepted definition of functional foods, which means there are also no regulations by the Food and Drug Administration. The general consensus is that functional foods are foods that contain components that impart health benefits beyond basic nutrition. These components have always been in the foods, but new research is being conducted on their health benefits. Different compounds in food work together; therefore, to reap the benefits of functional foods a variety of foods should be consumed.

Phytochemicals are the non-nutrient chemicals of plants that contain protective, disease-preventing compounds. Phytochemicals found in tomatoes have been shown to reduce the risk of cancer of the colon, prostate, bladder, and pancreas. Phytochemicals occurring in soy products have been linked to reduced risk for breast, ovarian, and prostate cancer. Improved liver function to inactivate estrogen-like compounds that may promote breast cancer is attributed to phytochemicals in broccoli, and stimulated immune function and slowed growth of cancer cells are associated with phytochemicals in garlic. *Learn more about other phytochemicals from the Linus Pauling Institute*.

Antioxidants are certain nutrients that help keep us healthy by protecting our cells from free radicals (compounds that can harm the body) and oxidative stress. There are many environmental, health, and lifestyle factors that can cause free radicals and oxidative stress, such as pollution, alcohol, exercise, inflammation, smoking, and other toxins. Plant-based foods are the best source of antioxidants because they have naturally occurring antioxidants that protect the plant and then protect the people who consume them.

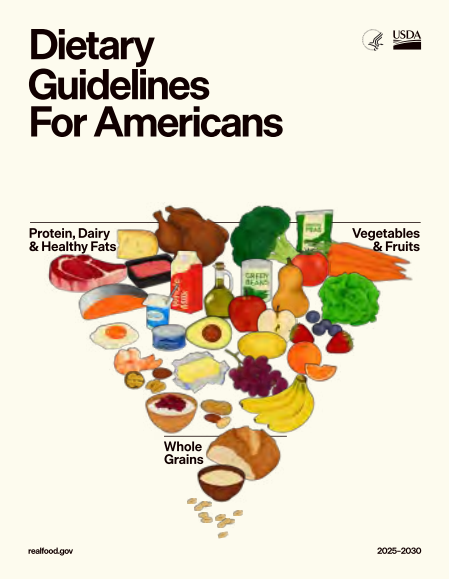
Beta carotene (which forms vitamin A), vitamin C, and vitamin E seem to promote health and to reduce the risk of chronic diseases, but only when they are consumed in foods rather than as supplements. Selenium, manganese, and certain phytochemicals have also been identified as antioxidants that protect the body's cells and prevent disease.

Water

Water is one of the body's most needed nutrients, yet one that is often overlooked. The body is about 60 percent water. All parts of the body are made up of some water and need water to function. Water regulates the body temperature and moistens body tissues. It carries nutrients and oxygen to the cells and takes waste products away. Water also helps cushion the joints and protect the organs and tissues. Water is lost throughout the day with normal body processes, such as making urine, having bowel movements, and sweating. Most people need 9 to 13 cups of water or other fluids a day in addition to eating water-rich foods (e.g., fruits and vegetables). Activity level, outdoor temperature, elevation, illness, and medications can all result in additional water loss and must be replenished. If enough water is not consumed, there is an increased risk of dehydration. Mild dehydration can impact your ability to think clearly, while severe dehydration can lead to confusion, heart problems, and kidney failure.

Dietary Guidelines

The *Dietary Guidelines for Americans*, first developed in 1980, were developed by the *U.S. Department of Agriculture* and the *U.S. Department of Health and Human Services* to give dietary recommendations for all Americans two years of age and older. These guidelines are updated and published every five years and are required by law to be based on current scientific and medical knowledge.



The *Dietary Guidelines* translate science into food-based guidance that can be relied on to help Americans choose foods that provide a healthy and enjoyable diet. Its recommendations are ultimately intended to help individuals improve and maintain overall health, consume a nutritionally adequate diet, and reduce the risk of chronic disease. The *Dietary Guidelines* are not intended to be used to treat disease, but rather to promote health and prevent disease. Thus, the *Dietary Guidelines* may be used or adapted by medical and nutrition professionals to encourage healthy eating patterns for patients. The information in the *Dietary Guidelines* can also be used to develop, implement, and evaluate Federal food, nutrition, and health policies and programs, and to develop Federal education materials.

Nutrition and Health Are Closely Related

It is well-documented that there is a direct correlation between food and health. A history of poor eating and physical activity patterns has a cumulative effect and has contributed to significant nutrition- and physical activity-related health challenges that now face the U.S. population. About 75% of all US adults — 194 million individuals — have at least one chronic disease, while nearly 50% have multiple chronic conditions, many of which are related to poor quality eating patterns and physical inactivity. These include cardiovascular disease, high blood pressure, type 2 diabetes, some cancers, and poor bone health. Approximately three out of four adults in the US and one out of five children and youth are overweight or obese. These high rates of overweight and obesity and chronic disease have persisted for more than two decades and come not only with increased health risks, but also at a high cost. The cost of diabetes health care is quite high. In fact, individuals with diabetes account for one out of every four health care dollars spent in the US.

The medical costs associated with obesity are estimated to be $173 billion annually. In 2022, the total estimated cost of diagnosed diabetes was $412.9 billion, including $306.6 billion in direct medical costs and $106.3 billion in indirect costs.

2025-2030 Dietary Guidelines

While much of the *2025-2030 Dietary Guidelines for Americans (DGA)* supports the healthy eating recommendations from previous *Dietary Guidelines* (vegetables, fruits, whole grains, and a variety of protein foods — all with little to no added sugars, saturated fats, and sodium), the 2025-2030 DGA emphasizes the importance of limiting highly processed foods and focusing on gut health. There are 11 overarching guidelines to encourage healthy eating patterns at every stage of

life. The guidelines recognize that individuals will need to make shifts in their food and beverage choices to achieve a healthy pattern that adjusts to their specific needs.

Guideline 1: Eat the right amount for you

- The calories you need depend on your age, sex, height, weight, and level of physical activity.
- Pay attention to portion sizes, particularly for foods and beverages higher in calories.
- Hydration is a key factor in overall health. Choose water (still or sparkling) and unsweetened beverages.

Guideline 2: Prioritize protein foods at every meal

- Prioritize high-quality, nutrient-dense protein foods as part of a healthy dietary pattern. Consume a variety of protein foods from animal sources, including eggs, poultry, seafood, and red meat, as well as a variety of plant-sourced protein foods, including beans, peas, lentils, legumes, nuts, seeds, and soy.
- Swap deep-fried cooking methods with baked, broiled, roasted, stir-fried, or grilled cooking methods.
- Consume meat with no or limited added sugars, refined carbohydrates or starches, or chemical additives. If preferred, flavor with salt, spices, and herbs.
- Protein serving goals: 1.2 to 1.6 grams of protein per kilogram of body weight per day, adjusting as needed based on your individual caloric requirements.

Guideline 3: Consume dairy

- When consuming dairy, include full-fat dairy with no added sugars. Dairy is an excellent source of protein, healthy fats, vitamins, and minerals.

- Dairy serving goals: 3 servings per day as part of a 2,000-calorie dietary pattern, adjusting as needed based on your individual caloric requirements.

Guideline 4: Gut health

- Your gut contains trillions of bacteria and other microorganisms called the microbiome. A healthy diet supports a well-balanced microbiome and healthy digestion. Highly processed foods can disrupt this balance, while vegetables, fruits, fermented foods (e.g., sauerkraut, kimchi, kefir, miso), and high-fiber foods support a diverse microbiome, which may be beneficial for health.

Guideline 5: Eat vegetables and fruits throughout the day

- Eat a variety of colorful, nutrient-dense vegetables and fruits.
- Eat whole vegetables and fruits in their original form. Wash thoroughly prior to eating raw or cooking.
- Frozen, dried, or canned vegetables or fruits with no or very limited added sugars can also be good options.
- If preferred, flavor with salt, spices, and herbs.
- 100% fruit or vegetable juice should be consumed in limited portions or diluted with water.

- Vegetables and fruits serving goals for a 2,000-calorie dietary pattern, adjusting as needed based on your individual caloric requirements:
  - Vegetables: 3 servings per day
  - Fruits: 2 servings per day

Guideline 6: Incorporate healthy fats

- Healthy fats are plentiful in many whole foods, such as meats, poultry, eggs, omega-3–rich seafood, nuts, seeds, full-fat dairy, olives, and avocados.
- When cooking with or adding fats to meals, prioritize oils with essential fatty acids, such as olive oil. Other options can include butter or beef tallow.
- In general, saturated fat consumption should not exceed 10% of total daily calories. Significantly limiting highly processed foods will help meet this goal. More high-quality research is needed to determine which types of dietary fats best support long-term health.

Guideline 7: Focus on whole grains

- Prioritize fiber-rich whole grains.
- Significantly reduce the consumption of highly processed, refined carbohydrates, such as white bread, ready-to-eat or packaged breakfast options, flour tortillas, and crackers.
- Whole grains serving goals: 2 to 4 servings per day, adjusting as needed based on your individual caloric requirements.

Guideline 8: Limit highly processed foods, added sugars, and refined carbohydrates

- Avoid highly processed packaged, prepared, ready-to-eat, or other foods that are salty or sweet, such as chips, cookies, and candy that have added

sugars and sodium (salt). Instead, prioritize nutrient-dense foods and home-prepared meals. When dining out, choose nutrient-dense options.

- Limit foods and beverages that include artificial flavors, petroleum-based dyes, artificial preservatives, and low-calorie non-nutritive sweeteners.
- Avoid sugar-sweetened beverages, such as sodas, fruit drinks, and energy drinks.
- While no amount of added sugars or non-nutritive sweeteners is recommended or considered part of a healthy or nutritious diet, one meal should contain no more than 10 grams of added sugars.
- When selecting snack foods, added sugar limits should follow FDA "Healthy" claim limits. For example, grain snacks (e.g., crackers) should not exceed 5 grams of added sugar per ¾ ounce whole-grain equivalent, and dairy snacks (e.g., yogurt) should not exceed 2.5 grams of added sugar per ⅔ cup equivalent.

Guideline 9: Added sugars

- To help identify sources of added sugars, look for ingredients that include the word "sugar" or "syrup" or end in "-ose."
- Added sugars may appear on ingredient labels under many different names, including high-fructose corn syrup, agave syrup, corn syrup, rice syrup, fructose, glucose, dextrose, sucrose, cane sugar, beet sugar, turbinado sugar, maltose, lactose, fruit juice concentrate, honey, and molasses. Examples of non-nutritive sweeteners include aspartame, sucralose, saccharin, xylitol, and acesulfame K.
- Some foods and drinks, such as fruits and plain milk, have naturally occurring sugars. The sugars in these foods are not considered added sugars.

Guidelines 10: Limit alcoholic beverages

- Consume less alcohol for better overall health.
- People who should completely avoid alcohol include pregnant women, people who are recovering from alcohol use disorder or are unable to control the amount they drink, and people taking medications or with medical conditions that can interact with alcohol. For those with a family history of alcoholism, be mindful of alcohol consumption and associated addictive behaviors.

Guideline 11: Sodium

- Sodium and electrolytes are essential for hydration. The general population, ages 14 and above, should consume less than 2,300 mg per day of sodium. Highly active individuals may benefit from increased sodium intake to offset sweat losses.
- For children, the recommendations vary by age:
  - Ages 1–3: less than 1,200 mg per day
  - Ages 4–8: less than 1,500 mg per day
  - Ages 9–13: less than 1,800 mg per day
- Highly processed foods that are high in sodium should be avoided.

Adults in the U.S. consume on average about 17 teaspoons of added sugar every day, more than 2 to 3 times the recommended amount. Most of the added sugar comes from sugar-sweetened beverages (25%), followed by desserts and sweet snacks (19%).

Terms To Know

These terms are essential to understanding concepts within the *2025-2030 Dietary Guidelines*.

Added sugar: When sugars or syrups are added to foods as they are processed or prepared, they are called added sugars. (Natural sugars — in fruits, vegetables, and milk — are not added sugars.) Added sugars often add calories without other nutritional value.

Dietary pattern: The combination of foods and beverages that constitute an individual's complete dietary intake over time (day, week, or year). A dietary pattern may describe a customary way of eating or a combination of foods recommended for consumption. Specific examples include *USDA Food Patterns* and the *Dietary Approaches to Stop Hypertension (DASH) Eating Plan*.

Nutrient-dense: Nutrient-dense foods and beverages provide vitamins, minerals, and other health-promoting components and have little added sugars, saturated fat, and sodium. All vegetables, fruits, whole grains, seafood, eggs, beans, peas, and lentils, unsalted nuts and seeds, fat-free and low-fat dairy products, and lean meats and poultry—when prepared with no or little added sugars, saturated fat, and sodium— are nutrient-dense foods. The term "nutrient-dense" indicates the nutrients and other beneficial substances in a food have not been "diluted" by the addition of calories from added solid fats, sugars, or refined starches, or by the solid fats naturally present in the food.

Healthy Eating Pattern

An eating pattern can be defined as the combination of foods and beverages that make up an individual's complete dietary intake over time. An eating pattern is more than the sum of its parts; it represents the totality of what individuals routinely eat and drink, and these dietary components act together in relation to health. A healthy eating pattern should be tailored to the individual's personal, cultural and traditional preferences as well as food budget and nutrition needs.

The *Dietary Guidelines* support the idea that nutritional needs should be met primarily from foods. All forms of foods – fresh, canned, dried, and frozen – can be included in healthy eating patterns. Importantly, foods should be in the most nutrient-dense form possible.

Key Recommendations

The key recommendations should be applied in their entirety to reflect an overall healthy eating pattern.

Consume a healthy eating pattern that accounts for all food and beverages within an appropriate calorie level.

A healthy eating pattern includes:

- A variety of vegetables from all of the subgroups — dark green, red and orange, legumes (beans and peas), starchy
- Fruits, especially whole fruits
- Whole grains

- Dairy, including milk, yogurt, cheese, and/or fortified soy beverages
- A variety of protein foods, including seafood, lean meats and poultry, eggs, legumes (beans and peas), and nuts, seeds, and soy products
- Healthy fats

A healthy eating pattern limits: saturated and trans fats, added sugars, and sodium.

Don't forget physical activity!

In addition to following the *Dietary Guidelines*, physical activity is important to promote health and reduce the risk of chronic disease. Diet and physical activity are the two parts of the calorie balance equation to help manage body weight. Regular physical activity can reduce the risk of chronic disease, maintain a healthy weight, strengthen muscles and bones, improve sleep, and increase energy levels. Individuals who regularly exercise have a longer and healthier life.

Adults need:

- At least 150 minutes of moderate physical activity each week.
- Muscle-strengthening exercises two or more days each week.

Children need:

- At least 60 minutes of physical activity per day, including aerobic, muscle-strengthening, and bone-strengthening activities.

Eat From A Variety of Food Groups

To learn how many servings of each food group are needed, you can access *nal.usda.gov/human-nutrition-and-food-safety/dri-calculator*.

Fruits

Any fruit or 100 percent fruit juice counts as part of the fruit group. Fruits may be fresh, canned, frozen, or dried, and may be whole, cut-up, or pureed.

How much and what counts as a fruit?

Your fruit needs depend on your age, sex, height, weight, and physical activity. General recommendations are 2 cups per day for a 2,000 calorie diet. In general, 1 cup of fruit is considered the following:

- 1 cup of fresh, frozen, or canned
- 1 cup of 100 percent fruit juice
- ½ cup of dried fruit

Vegetables

Any vegetable or 100 percent vegetable juice counts as a member of the vegetable group. Vegetables may be raw or cooked; fresh, frozen, canned or dried/dehydrated; and may be whole, cut-up, or mashed.

How much and what counts as a vegetable?

Your vegetable needs depends on age, sex, and physical activity level. General recommendations are 3 cups per day for a 2,000 calorie diet. In general, 1 cup of vegetable is considered the following:

- 1 cup of raw vegetables
- 1 cup of cooked vegetables
- 1 cup of 100% vegetable juice
- 2 cups of raw leafy greens

Why is it important to eat a variety of vegetables and fruits?

Eating vegetables and fruits provides numerous health benefits — people who eat more fruits and vegetables as part of an overall healthy diet are likely to have a reduced risk chronic diseases and certain cancers. Vegetables and fruits provide nutrients vital for the health and maintenance of your body.

Health benefits

- Eating a diet rich in vegetables and fruits as part of an overall healthy diet may reduce risk for heart disease, including heart attack and stroke.
- Eating a diet rich in some vegetables and fruits as part of an overall healthy diet may protect against certain types of cancers.
- Diets rich in foods containing fiber, such as some vegetables and fruits, may reduce the risk of heart disease, obesity, and type 2 diabetes.

- Eating vegetables and fruits rich in potassium as part of an overall healthy diet may lower blood pressure, and may also reduce the risk of developing kidney stones and help to decrease bone loss.
- Eating foods such as vegetables and fruits that are lower in calories per cup instead of some other higher-calorie food may be useful in helping to lower calorie intake.

Nutrients

Most fruits and vegetables are naturally low in fat, sodium, and calories and have no cholesterol. How fruits and vegetables are prepared can affect the final amount of fat, sodium, and calories.

- Fruits and vegetables are sources of many essential, but under-consumed, nutrients, including potassium, dietary fiber, vitamin C, and folate (folic acid).
- Diets rich in potassium may help maintain healthy blood pressure. Fruit sources of potassium include bananas, prunes and prune juice, dried peaches and apricots, cantaloupe, honeydew melon, and orange juice. Vegetable sources of potassium include sweet potatoes, white potatoes, white beans, tomato products (paste, sauce, and juice), beet greens, soybeans, lima beans, spinach, lentils, and kidney beans.
- Dietary fiber from fruits and vegetables, as part of an overall healthy diet, helps reduce blood cholesterol levels and may lower risk of heart disease. Fiber is important for proper bowel function. It helps reduce constipation and diverticulosis. Fiber-containing foods help provide a feeling of fullness with fewer calories. Whole or cut-up fruits and vegetables are sources of dietary fiber; however, fruit and vegetable juices contain little or no fiber.
- Vitamin C is important for growth and repair of all body tissues, helps heal cuts and wounds, and keeps teeth and gums healthy. It also aids in the absorption of iron from non-heme sources.
- Folate (folic acid) helps the body form red blood cells. Women of childbearing age who may become pregnant should consume adequate folate from foods, and in addition 400 mcg of synthetic folic acid from fortified foods or supplements. This reduces the risk of birth defects during fetal development.
- Vitamin A keeps eyes and skin healthy and helps to protect against infections.

Commonly Eaten Vegetables by Subgroup

Dark green	Starchy	Red and orange	Beans and peas	Other
• Broccoli • Dark green leaf lettuce • Kale • Romaine lettuce • Spinach	• Corn • Green peas • Lima beans (green) • Potatoes	• Carrot • Pumpkin • Sweet potato • Acorn squash • Tomato	• Black beans • Black-eyed peas • Kidney beans • Lentils	• Asparagus • Bean sprouts • Beets • Cabbage • Cucumbers • Iceberg lettuce • Green beans

Grains

Most Americans consume enough grains, but few are whole grains. At least half of all the grains eaten should be whole grains. Any food made from wheat, rice, oats, cornmeal, barley, or another cereal grain is a grain product. Bread, pasta, oatmeal, breakfast cereals, tortillas, and grits are examples of grain products.

Grains are divided into two subgroups: whole grains and refined grains. Whole grains contain the entire grain kernel — the bran, germ, and endosperm. Examples include:

- whole-wheat flour
- bulgur (cracked wheat)
- oatmeal
- popcorn and whole cornmeal
- brown rice

Refined grains have been milled, a process that removes the bran and germ. This is done to give grains a finer texture and improve their shelf life, but it also removes dietary fiber, iron, vitamins and minerals, and other nutrients. Some examples of refined grain products are:

- white flour
- degermed cornmeal
- white bread
- white rice

Most refined grains are enriched. This means certain B vitamins (thiamin, riboflavin, niacin, folic acid) and iron are added back after processing. Fiber is not added back to enriched grains. Check the ingredient list on refined grain products to make sure that the word "enriched" is included in the grain name. Some food products are made from mixtures of whole grains and refined grains.

How much and what counts as grains?

The amount of grains recommended depends on age, height, weight, sex, and level of physical activity. Adults who need 2,000 calories a day should eat 6 ounce-equivalents per day. Children ages 4 to 8 should eat 5 ounce-equivalents per day. Remember, half of the grains should be whole.

In general, 1 slice of bread, 1 small tortilla, 1 cup of ready-to-eat cereal, or ½ cup of cooked rice, cooked pasta, or cooked cereal can be considered as 1 ounce-equivalent from the grains group.

Why is it important to eat grains, especially whole grains?

Eating grains, especially whole grains, provides many health benefits. People who eat whole grains as part of a healthy diet have a reduced risk of certain chronic diseases and cancer. Grains provide many nutrients that are vital for the health and maintenance of the body.

Nutrients

- Grains are important sources of many nutrients, including dietary fiber, several B vitamins (thiamin, riboflavin, niacin, and folate), and minerals (iron, magnesium, and selenium).
- Dietary fiber from whole grains or other foods, may help reduce blood cholesterol levels and may lower risk of heart disease, obesity, and type 2 diabetes. See Dietary Fiber table at the beginning of this chapter.
- The B vitamins thiamin, riboflavin, and niacin play a key role in metabolism – they help the body release energy from protein, fat, and carbohydrates. B vitamins are also essential for a healthy nervous system. Many refined grains are enriched with these B vitamins.
- Folate (folic acid), another B vitamin, helps the body form red blood cells.
- Iron is used to carry oxygen in the blood. Many teenage girls and women in their childbearing years have iron-deficiency anemia. They should eat foods high in heme-iron (meats) or eat other iron containing foods along with foods rich in vitamin C, which can improve absorption of non-heme iron. Whole and enriched refined grain products are major sources of non-heme iron in American diets.
- Whole grains are sources of magnesium and selenium. Magnesium is a mineral used in building bones and releasing energy from muscles. Selenium protects cells from oxidation. It is also important for a healthy immune system.

How to Increase Your Intake of Whole Grain Foods

Choose foods that name one of the following ingredients first on the label's ingredient list:

- brown rice
- popcorn
- bulgur (cracked wheat)
- barley (except pearled)
- graham flour
- whole rye
- whole grain corn
- whole wheat
- oats (rolled or steel cut)

Try some of these whole grain foods: whole wheat bread, whole grain ready-to-eat cereal, low-fat whole wheat crackers, oatmeal, whole wheat pasta, whole barley in soup, tabouli salad.

Don't be fooled by these terms as they are not whole grains: "Wheat flour," "enriched flour," "multi grain", and "degerminated corn meal".

Health benefits

- Consuming whole grains as part of a healthy diet may reduce the risk of heart disease.
- Consuming foods containing fiber, such as whole grains, as part of a healthy diet may reduce constipation.
- Eating whole grains may help with weight management.
- Eating grain products fortified with folate before and during pregnancy helps prevent neural tube defects during fetal development.

Protein

All foods made from meat, poultry, fish, dry beans or peas, eggs, nuts, and seeds are considered part of this group. Beans and peas are part of this group as well as the vegetable group. Select a variety of protein foods to improve nutrient intake and health benefits, including at least 8 ounces of cooked seafood per week. Young children need less, depending on their age and calorie needs. The advice to consume seafood does not apply to vegetarians. Vegetarian options in the Protein Foods Group include beans and peas, processed soy products, and nuts and seeds. Meat and poultry choices should be lean or low fat.

How much and what counts as protein?

The amount of food from the protein foods group you need to eat depends on age, sex, and level of physical activity. Most Americans eat enough food from this group, but need to make leaner and more varied selections of these foods. A woman 51 years or older is advised to eat 5 ounce-equivalents per day. A man 51 years or older is advised to eat 5½ ounce-equivalents per day. Children ages 4 to 8 need to eat 4 ounce-equivalents per day.

Generally, 1 ounce of meat, poultry or fish, ¼ cup cooked dry beans, 1 egg, 1 tablespoon of peanut butter, or ½ ounce of nuts or seeds can be considered as 1 ounce-equivalent from the protein foods group.

Why is it important to make lean or low-fat choices from the protein group?

Foods in the meat, poultry, fish, dry beans or peas, eggs, nuts and seeds group provide nutrients that are vital for health and maintenance of your body. However, choosing foods from this group that are high in saturated fat and cholesterol may have health implications.

Nutrients

- Diets that are high in saturated fats raise "bad" cholesterol levels in the blood. The "bad" cholesterol is called LDL (low-density lipoprotein) cholesterol. High LDL cholesterol, in turn, increases the risk for coronary heart disease. Some food choices in this group are high in saturated fat. These include fatty cuts of beef, pork, and lamb; regular (75 percent to 85 percent lean) ground beef; regular sausages, hot dogs, and bacon; some luncheon meats such as regular bologna and salami; and some poultry such as duck. To help keep blood cholesterol levels healthy, limit the amount of these foods you eat.
- Diets that are high in cholesterol can raise LDL cholesterol levels in the blood. Cholesterol is only found in foods from animal sources. Some foods from this group are high in cholesterol. These include egg yolks (egg whites are cholesterol-free) and organ meats such as liver and giblets. To help keep blood cholesterol levels healthy, limit the amount of these foods you eat.

- A high intake of fats makes it difficult to avoid consuming more calories than are needed.

Health benefits

- Meat, poultry, fish, dry beans and peas, eggs, nuts, and seeds supply many nutrients. These include protein, B vitamins (niacin, thiamin, riboflavin, and B6), vitamin E, iron, zinc, and magnesium.
- Proteins function as building blocks for bones, muscles, cartilage, skin, and blood. They are also building blocks for enzymes, hormones, and vitamins. Proteins are one of three nutrients that provide calories (the others are fat and carbohydrates).
- B vitamins found in this food group serve a variety of functions in the body. They help the body release energy, play a vital role in the function of the nervous system, aid in the formation of red blood cells, and help build tissues.
- Iron is used to carry oxygen in the blood. Many teenage girls and women in their childbearing years have iron-deficiency anemia. They should eat foods high in heme-iron (meats) or eat other non-heme iron containing foods along with a food rich in vitamin C, which can improve absorption of non-heme iron.
- Magnesium is used in building bones and in releasing energy from muscles.
- Zinc is necessary for biochemical reactions and helps the immune system function properly.
- EPA and DHA are omega-3 fatty acids found in varying amounts in seafood. Eating 8 ounces per week of seafood may help reduce the risk for heart disease.

Protein Food Sources

Meats

Lean cuts of:

- Beef
- Ham
- Lamb
- Pork
- Veal

Game meats:

- Bison
- Rabbit
- Venison

Lean ground meats:

- Beef
- Pork
- Lamb

Organ meats:

- Liver
- Giblets

Other meats:

- Lean luncheon meats

Dry beans and peas

- Black beans
- Black-eyed peas
- Chickpeas (garbanzo beans)
- Falafel
- Kidney beans
- Lentils
- Lima beans (mature)
- Navy beans
- Pinto beans
- Soy beans
- Split peas
- Tofu (bean curd made from soy beans)
- White beans
- Bean burgers:
  - Garden burgers
  - Veggie burgers
- Tempeh
- Texturized vegetable protein (TVP)

Fish

Fin fish such as:

- Catfish
- Cod
- Flounder
- Haddock
- Halibut
- Herring
- Mackerel
- Pollock
- Porgy
- Salmon
- Sea bass
- Snapper
- Swordfish
- Trout
- Tuna

Shellfish such as:

- Clams
- Crab
- Crayfish
- Lobster
- Mussels
- Octopus
- Oysters
- Scallops
- Squid (calamari)
- Shrimp

Canned fish such as:

- Anchovies
- Clams
- Tuna
- Sardines
- Salmon

Poultry

- Chicken
- Duck
- Goose
- Turkey
- Ground chicken and turkey

Eggs

- Chicken eggs
- Duck eggs

Nuts and seeds

- Almonds and Brazil nuts
- Cashews
- Hazelnuts (filberts)
- Mixed nuts
- Peanuts
- Peanut butter
- Pecans
- Pistachios
- Pumpkin seeds
- Sesame seeds
- Sunflower seeds
- Walnuts

Why is it important to eat 8 ounces of seafood per week?

Seafood contains a range of nutrients, notably the omega-3 fatty acids EPA and DHA. Eating about 8 ounces per week of a variety of seafood contributes to the prevention of heart disease. Smaller amounts of seafood are recommended for young children.

Seafood varieties that are commonly consumed in the United States that are higher in EPA and DHA and lower in mercury include salmon, anchovies, herring, sardines, Pacific oysters, trout, and Atlantic and Pacific mackerel (not king mackerel, which is high in mercury). The health benefits from consuming seafood outweigh the health risk associated with mercury, a heavy metal found in seafood in varying levels.

What are the benefits of eating nuts and seeds?

Eating peanuts and certain tree nuts (for example, walnuts, almonds, and pistachios) may reduce the risk of heart disease when consumed as part of a diet that is nutritionally adequate and within calorie needs. Because nuts and seeds are high in calories, eat them in small portions and use them to replace other protein foods, such as some meat or poultry, rather than adding them to what you already eat. In addition, choose unsalted nuts and seeds to help reduce sodium intake.

Dairy

All fluid milk products and many foods made from milk are considered part of this food group. Foods made from milk that retain their calcium content are part of the group, while foods made from milk that have little to no calcium, such as cream cheese, cream, and butter, are not. Calcium-fortified soymilk (soy beverage) is also part of the dairy group. Most milk group choices should be fat-free or low-fat.

How much and what counts as dairy?

A woman 51 years or older is advised to eat 3 cups per day. A man 51 years or older is advised to eat 3 cups per day. Children ages 4 to 8 need to eat 2½ cups per day. In general, 1 cup of milk or yogurt, 1 cup calcium-fortified soy or almond milk, 1½ ounces of natural cheese, or 2 ounces of processed cheese can be considered as 1 cup from the dairy group. It is important to note that calcium-fortified foods and beverages may not provide the other nutrients found in dairy products. Check the product labels.

Dairy is important to a healthy diet

Consuming dairy products provides health benefits, especially improved bone health. Foods in the dairy group provide nutrients vital for health and maintenance of your body. These nutrients include calcium, potassium, vitamin D, and protein.

Why is it important to make fat-free or low-fat choices from the dairy group?

Choosing foods from the dairy group high in saturated fats and cholesterol can have health implications. Diets high in saturated fats raise "bad" cholesterol levels in the blood. The "bad" cholesterol is called LDL (low-density lipoprotein) cholesterol. High LDL cholesterol, in turn, increases the risk for coronary heart disease. Many cheeses, whole milk, and products made from them are high in saturated fat. To help keep blood cholesterol levels healthy, limit the amount of these foods you eat. In addition, a high intake of fats makes it difficult to avoid consuming more calories than are needed.

Nutrients

- Calcium is used for building bones and teeth and in maintaining bone mass. Dairy products are the primary source of calcium in American diets. Diets that provide 3 cups or the equivalent of dairy products per day can improve bone mass.
- Diets rich in potassium may help maintain healthy blood pressure. Dairy products, especially yogurt, fluid milk, and soymilk (soy beverage), provide potassium.
- Vitamin D functions in the body to maintain proper levels of calcium and phosphorus, thereby helping to build and maintain bones.

Nutritional Value of Dairy Milk and Non-Dairy Alternatives

	Cow's Milk (low-fat)	Soy	Almond	Coconut	Rice
Calories and nutrients					
Calories	110	110	60	80	120
Protein	8g	8g	1g	<1g	1g
Fat	2.5g	4.5g	2.5g	5g	2.5g
Carbohydrates	12g	9g	8g	7g	23g
Vitamins and minerals (% daily value)					
Calcium	**30**	45	45	45	30
Phosphorus	**25**	**25**	NA	NA	**15**
Potassium	**10**	**10**	**1**	**1**	**15**
Riboflavin	**25**	30	30	NA	NA
Vitamin B-12	**20**	50	50	50	25
Vitamin A	10	10	10	10	10
Vitamin D	25	30	25	25	25

B Naturally Occurring
Good Source = 10% - 19% DV
Excellent Source = 20% + DV

Health benefits

- Intake of dairy products is linked to improved bone health and may reduce the risk of osteoporosis.
- The intake of dairy products is especially important to bone health during childhood and adolescence, when bone mass is being built.
- Intake of dairy products is associated with a reduced risk of cardiovascular disease and type 2 diabetes, and with lower blood pressure in adults.

Oils

Oils are fats that are liquid at room temperature, like the vegetable oils used in cooking. Oils come from many different plants and from fish. Oils are NOT a food group, but they provide essential nutrients. Therefore, oils are included in USDA food patterns.

Some commonly eaten oils include:

- canola oil
- corn oil
- cottonseed oil
- olive oil
- safflower oil
- soybean oil
- sunflower oil

Some oils are used mainly as flavorings, such as walnut oil and sesame oil. A number of foods are naturally high in oils, such as:

- nuts
- olives
- some fish
- avocados

Foods that are mainly oil include mayonnaise, certain salad dressings, and soft (tub or squeeze) margarine with no trans fat. Check the Nutrition Facts label to find margarines with 0 grams of trans fat. Amounts of trans fat are required to be listed on labels.

Most oils are high in monounsaturated or polyunsaturated fats, and low in saturated fats. Oils from plant sources (vegetable and nut oils) do not contain any cholesterol. In fact, no plant foods contain cholesterol.

What about solid fats?

A few plant oils, however, including coconut oil, palm oil, and palm kernel oil, are high in saturated fats and for nutritional purposes should be considered to be solid fats. Solid fats are fats that are solid at room temperature, like butter and shortening. Solid fats come from many animal foods and can be made from vegetable oils through a process called hydrogenation. Some common fats are:

- butter
- milk fat
- beef fat (tallow, suet)
- chicken fat
- pork fat (lard)
- stick margarine
- shortening
- partially hydrogenated oil

How are oils different from solid fats?

All fats and oils are a mixture of saturated fatty acids and unsaturated fatty acids. Unsaturated fatty acids include monounsaturated and polyunsaturated fats. Oils are fats that are liquid at room temperature, like the vegetable oils used in cooking. Oils come from many different plants and from fish. Oils contain more monounsaturated (MUFA) and polyunsaturated (PUFA) fats

Solid fats contain more saturated fats and/or trans fats than oils. Saturated fats, trans fats, and cholesterol tend to raise "bad" (LDL) cholesterol levels in the blood, which in turn increases the risk for heart disease. To lower risk for heart disease, cut back on foods containing saturated fats, trans fats, and cholesterol.

How much is my allowance for oils?

Some Americans consume enough oil in the foods they eat, such as:

- nuts
- fish
- cooking oil
- salad dressings

Others could easily consume the recommended allowance by substituting oils for some solid fats they eat. A person's allowance for oils depends on age, sex, and level of physical activity. A woman 31 years or older is advised to eat 5 teaspoons per day. A man 31 years or older is advised to eat 6 teaspoons per day. Children ages 4 to 8 are advised to eat 4 teaspoons per day.

Why is it important to consume oils?

Oils are not a food group, but they do provide essential nutrients and are therefore included in USDA recommendations for what to eat. Most of the fats eaten should be PUFA or MUFA fats. Oils are the major source of MUFAs and PUFAs in the diet. PUFAs contain some fatty acids that are necessary for health called essential fatty acids. Because oils contain these essential fatty acids, there is a small allowance for oils in the food guide.

The MUFAs and PUFAs found in fish, nuts and vegetable oils do not raise LDL cholesterol levels in the blood. In addition to the essential fatty acids they contain, oils are the major source of vitamin E in typical American diets.

While consuming some oil is needed for health, oils still contain calories. In fact, oils and solid fats both contain about 120 calories per tablespoon. Therefore, the amount of oil consumed needs to be limited to balance total calorie intake. The Nutrition Facts label provides information to help make smart choices.

Frequently Asked Questions

Q. Doesn't everyone need a multivitamin supplement for more energy?

A. Vitamins and minerals have no calories, so they cannot supply energy. However, vitamins and minerals do have a direct role in converting food into energy and are critical for many other energy reactions in the body. Deficiencies may lead to fatigue and low energy. Most people can get the nutrients they need from a balanced diet. In certain cases, fortified foods and dietary supplements may be useful in providing one or more nutrients that otherwise might be consumed in less than recommended amounts.

Q. Which is more nutritious — honey, maple syrup, brown sugar, or white sugar?

A. All have the same macronutrient content at 16 calories and 4 grams of carbohydrates per teaspoon. Honey and maple syrup have slightly more vitamins and minerals than brown sugar and white sugar but should still be consumed in moderation due to the high sugar content. Honey and maple syrup are sweeter than sugar, so less may be used to sweeten a food. Honey is a mixture of sugars formed from the nectar of local plants by bees. Maple syrup is made from the sap of maple trees. Brown sugar is sugar crystals flavored with molasses and is slightly less sweet than white sugar. White sugar is refined sugar from sugar cane or sugar beets.

Q. Why is coconut oil or palm oil not recommended?

A. Coconut, palm, and palm kernel oils (tropical oils) are solid at room temperature because they have high amounts of saturated fatty acids and are therefore classified as solid fats rather than as oils.

Q. Does cooking in an iron skillet improve the iron content of food?

A. Yes, foods containing a small amount of acid, such as tomatoes, citrus juice, and vinegar, dissolve a small amount of iron from the skillet into the food.

Terms

Adequate Intake (AI): A recommended average daily nutrient intake level based on approximations or estimates of nutrient intake by a group of apparently healthy people. An AI is used when the Recommended Dietary Allowance cannot be determined.

Amino acids: The building blocks supplied by protein that build, repair, and maintain tissue.

Basal metabolism: The basic rate at which the body uses energy and burns calories with only automatic body functions such as breathing, digesting food, and replacing cells.

Cholesterol: The fat-like substance found only in animal foods.

Diverticulosis: A health condition where pouches or pockets formed in the colon wall.

DHA: (Docosahexaenoic acid)-polyunsaturated omega-3 fatty acid.

EPA: (Eicosapentaenoic acid)-polyunsaturated omega-3 fatty acid.

Hydrogenation: The process to make unsaturated oils stable and solid at room temperature.

Recommended Dietary Allowances (RDA): The average daily dietary intake level that is sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals in a particular life stage and sex group.

Saturated fats: Fats that have all the hydrogen molecules their chemical chain can hold. These fats come mainly from animal foods and tropical oils and are firm at room temperature.

Trans fatty acids: An unhealthful fatty acid formed during the process of hydrogenation.

Triglycerides: Scientific name for fat both in the body and in food.

Unsaturated fats: Fats that have one (monounsaturated) or more (polyunsaturated) hydrogen bonds missing from the chemical chain. These fats are soft or liquid at room temperature and come mainly from plant sources.

Resources

Dietary Guidelines for Americans dietaryguidelines.gov

The American Dietetic Association Complete Food and Nutrition Guide. Fifth Edition. 2017. Duyff, R.L.

Dietary Supplements fda.gov/food/dietary-supplements

National Library of Medicine. Dietary Fiber. medlineplus.gov/dietaryfiber.html

Sugar: More than Just a Sweetener bookstore.ksre.k-state.edu/pubs/sugar-more-than-just-a-sweetener-fact-sheet_MF2929.pdf

Liquid Assets: The Value of Fluids to Your Health bookstore.ksre.k-state.edu/pubs/liquid-assets-the-value-of-fluids-to-your-health-fact-sheet_MF2739.pdf

American Diabetes Association diabetes.org

American Heart Association heart.org

Mediterranean Diet medinsteadofmeds.com

DASH (Dietary Approaches to Stop Hypertension nhlbi.nih.gov/education/dash-eating-plan

Micronutrients for Health lpi.oregonstate.edu/publications/micronutrients-health

Centers for Disease Control and Prevention (CDC). Chronic Disease Prevention and Health Promotion cdc.gov/chronicdisease/index.htm

Check Yourself Questions

1. What are trans fats?
2. Which type of cholesterol is sometimes referred to as the "good cholesterol"?
3. Calories are a measure of energy from food that the body uses for energy or stores if there is an excess. Which three major nutrients provide energy?
4. Fiber can promote good health by:
    a. giving you energy
    b. aiding with digestion
    c. protecting you from cancer
    d. protecting you from heart disease
5. What foods are included in the protein group?
6. Which class of vitamins can be stored in the body?
7. Which nutrient is one of the most important, but often overlooked? We need it each day.
8. Can taking a dietary vitamin and mineral supplement make up for poor food choices?
9. Which is the most important food group?
10. What food group does pizza belong to?

Answers

1. This refers to trans fatty acids formed during the process of hydrogenation. An example is in making vegetable shortening.
2. The high-density lipoproteins (HDL) is sometimes called the "good cholesterol." It carries cholesterol away from the body cells and back to the liver for disposal.
3. Protein and carbohydrates each supply 4 calories per gram. Fat supplies 9 per gram and alcohol supplies 7 per gram. Vitamins, minerals, water, and fiber contain no calories.
4. b, c, and d. Fiber does offer protection from heart disease and some cancers as well as aiding with digestion, but because it is not digested, it does not provide energy.
5. The protein group includes meat (beef, pork) poultry, fish, nuts, seeds, eggs, dried beans and peas, and lentils. Cheese, milk, and soy from the dairy group, are also sources of protein.
6. Fat soluble vitamins are carried by fats through the body and can be stored in body fat. Water-soluble vitamins are carried in fluids in the body, and the excess vitamins are excreted from the body.
7. Water. Most people need 8 to 12 cups of water and other fluids a day, but we often forget to drink that much.
8. No. Supplements may supply some vitamins and minerals but a varied and balanced eating plan is needed for a healthy eating plan.
9. None. All food groups are important and are the building blocks of a healthy eating plan.
10. Pizza is one of the combination foods (like soups, casseroles, and sandwiches) that contain foods from several groups. Pizza may have foods from the grain, protein, vegetable, and dairy groups.

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Chapter 2

Smart Choices in the Kitchen: Planning, Adapting, and Eating Well

Meal Planning

Upon completion of this lesson, the Master Food Volunteer will be able to:

1. Plan meals with a balance of colors, textures, and temperatures.
2. Plan meals with the best use of time and money resources.
3. Understand the Nutrition Facts labels and use them to make healthy food choices.
4. Change a menu or recipe to follow the recommendations of the Dietary Guidelines for Americans.
5. Change a recipe to reduce or increase the yield amounts or use substitutions for ingredients.

Key Concepts

- Careful use of time and money resources will allow the cook to prepare nutritious and appetizing foods on a limited budget or schedule.
- A good balance of color, texture, temperature, and flavor will enhance the presentation of the meal to appeal to all the senses.
- Planning family mealtimes results in more healthful eating.
- The Nutrition Facts label is a useful tool to make healthy food choices.
- Changes in the recipe can make food more nutritious or make the recipe more suitable for the family's needs.

Meal Planning

Meal planning is the process of deciding what to eat over a specific period, usually a day or week. Meal planning not only helps improve nutrition and overall diet quality but can also help save time, minimize food waste, stick to a budget, and support chronic disease management (such as diabetes).

To successfully meal plan, it is important to first consider your schedule and lifestyle. Understanding which days you have time to cook and which days you may need to eat leftovers, along with which day(s) you will grocery shop, helps create a plan that works best for you.

A second crucial step to meal planning is taking inventory of what you already have in your pantry, refrigerator, and freezer. Often you can create a meal with what you already have on hand, and in doing so will save money and reduce food waste.

A third component of meal planning is having a list of go-to meals that can be rotated each week, reducing the stress of coming up with new meals every week.

Lastly, meal planning should include the meals prepared at home as well as those eaten away from home and snacks. *[Note: Refer to Chapter 1 for the specific recommendations.]* By considering the total day's food, a better balance of nutrition and calories will be achieved. Keep the following suggestions in mind when planning meals:

- Incorporate variety — not only should a meal have a variety of foods to be appealing, but it is more likely to be nutritious.
- Take family and personal preferences into account. Food trends seen in magazines and restaurants often prompt people to try new foods.
- Consider resources of time and money when planning meals.
- Include foods of a variety of colors, shapes, textures, flavors, and temperatures. It will be visually attractive and tastefully appetizing.
- Use food suitable to the season and situation.
- Plan the meal so that preparation can be done in the time allowed and all foods are ready to eat at the same time.
- Start with the foods that will take the longest to prepare and use the available time during that preparation for other food tasks.
- Use equipment for more than one food preparation task.
- Plan no more than one complicated food for each meal. Some foods can be prepared ahead of time.
- Plan meals ahead for a week or several days to make better use of shopping and preparation times.
- Take advantage of appliances that save time, such as the microwave oven, pressure cooker, air fryer, or slow cooker.
- Prepare one-dish meals to save time and clean up.
- Use your freezer to stock up meals for when there is limited time to prepare something.
- If using convenience foods for quick preparation when time is short, remember that many convenience foods are higher in added salt and sugar and should be consumed in moderation.

Money and Time Management

The amount of money that a family spends on food will vary according to income, customs and traditions, availability of food, and dietary needs. There is no "right" amount for all families; however, surveys show that in the United States, about 11 percent of disposable income goes to all food purchases, with about 6 percent being spent on food away from home. As income rises, more is spent on food, but it is a smaller share of income. Households with the lowest income spent 32.6 percent of their income on food, while households with the highest income spent only 8 percent of their income on food.

Here are some shopping techniques that can be used by anyone to help get the most from their food dollars.

- Create a shopping list of the items needed based on the meals and snacks planned. Be sure to check your inventory first to prevent over-purchasing items that are already on hand.
- When shopping, stick to your pre-made list to eliminate impulse buying.
- Shop when the store is featuring specials and at a time when the store is not too busy.
- Eat a small snack or meal before you go to the store. Do not shop when you are hungry as this results in impulse purchasing, often of less healthy foods.
- Plan meals and the shopping trip around the grocery ads to take advantage of special values. Coupons are helpful for items that are needed only if they really do offer the best price.

- Buy fruits and vegetables that are in season for better quality and savings. These may be found at farmers markets as well as the grocery store.
- Use unit pricing for a better comparison of cost. Prices are usually given as a price per unit, such as an ounce or a pound. In this way, the prices of foods in different-sized containers can be compared. Many people are surprised to find that the largest container is not always the best buy.
- Consider the intended use of the product. If a food will be mixed into a casserole or combined with another food, a lower-quality and lower-priced food may be acceptable.
- Remember, different types of food (fresh, frozen, canned) may be priced differently at different times of the year. Canned or frozen can be as healthy as fresh; remember to watch for added sugars and sodium.
- Buy the correct amount of food for the planned meal to eliminate waste and save money.
- If purchasing bulk, opt for items that are shelf-stable or can be frozen. Purchasing in bulk can save money but only when it does not result in food waste.

Food Labels

Food labels give the consumer a great deal of information. They are another tool to help consumers make informed decisions about the foods they consume and make healthier choices when making purchases. Food labels include: Nutrition Facts labels, ingredient lists, date labels, front-of-package labels, and certain claims like organic or gluten-free.

The Nutrition Facts label is mandated by the Food and Drug Administration and is found on the side or back of a packaged food or beverage. The basic information included is the serving information, calories, nutrients, and the percent Daily Value (%DV) guide. The Nutrition Facts label was updated in 2016, and all manufacturers had until 2021 to comply with the new label requirements.

- The Nutrition Facts label provides information about calories and nutrients in one serving of that food.
- The serving size reflects the amount that people typically eat or drink. For example, both a 12-ounce can of soda and a 20-ounce bottle of soda are listed as 1 serving on the Nutrition Facts label. It is not a recommendation for how much you should eat or drink.
- The percentages given for the %DV are for an individual on a 2,000-calorie-a-day diet. Daily values needed for individuals may be higher or lower depending on their calorie needs.

Nutrition Facts

8 servings per container

Serving size **2/3 cup (55g)**

Amount per serving

Calories **230**

	% Daily Value*
Total Fat 8g	**10%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**13%**
Dietary Fiber 4g	**14%**
Total Sugars 12g	
Includes 10g Added Sugars	**20%**
Protein 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 240mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

General guidelines for using the %DV are to consider 5% DV or less as low and 20% DV or more as high. We should consume foods that are higher in %DV of dietary fiber, vitamin D, calcium, iron, and potassium, and lower in %DV of saturated fat, sodium, and added sugars.

- The nutrition information reflects those nutrients affecting today's greatest health concerns. Previously listed nutrients, vitamin A and C, were replaced with vitamin D and potassium.

The ingredient label includes all ingredients used in the food, ranked from the most to the least by weight. Ingredients are listed by their commonly recognized names and must list out food allergens.

Health or other claims labels are regulated by governmental food agencies. Foods labeled "low fat" or "high fiber" can help the consumer make food choices based on nutrition. Health claims are permitted if based on scientific evidence and allowed by FDA regulations. There are twelve approved health claims covering things such as calcium and osteoporosis, folic acid and neural tube defects, and sodium and hypertension. Other claims include 'healthy', organic, and gluten-free.

The product date label provides guidance on storage durations to ensure the quality of products. They are not an indicator of food safety (except for infant formula) and are not intended to be a safety date. Food dates are not required by law, but are often voluntarily applied to products by manufacturers. The wording on the label should be clear as to its meaning; however, there is no uniform or universally accepted description of the different phrases on packages. Confusion about food date labels is a major source of food waste at the consumer level. Food that is past its date label may still be safe to eat. If spoilage is evident, throw it out.

- **"Best if Used By/Before" date** is an indicator of when peak quality may begin to deteriorate. It may be used for a longer time, but the quality will be reduced.
- **"Sell by" date** refers to the last day the product should be on the store shelf. This date is often used for inventory management by companies.
- **"Use by" date** gives the consumer a guideline for how long the product will be good to use. It may be used for a longer time, but the quality will be reduced.
- **"Freeze-By" date** gives the consumer guidance on when a product should be frozen to maintain quality.

Other mandatory information on labels includes the product name, net weight or volume of product, manufacturer, or distributor.

Making Meals More Nutritious

Recipes may be adapted to make the food more nutritious, such as by reducing salt, sugar, or fat, or by increasing fiber or calcium. Changes may be more easily accepted by family members if they are made gradually. Ingredient substitutions may be made if those called for are unavailable or not favored.

Reducing Fat

Reducing the amount of fat, specifically saturated fat, in a recipe is a common change that makes a food healthier and reduces calories. Keep in mind that fat does serve a culinary purpose. It helps with mouth feel, adds flavor, and is a vessel to carry fat-soluble vitamins.

- Use lower-fat versions of ingredients in casseroles and main dishes, such as 97% lean ground turkey instead of 85%.

- Use leaner cuts of meat, trimming the visible fat.
- Use skim or low-fat dairy products.
- Use low fat cooking methods such as broil, grill, roast, bake, microwave, or steam. Drain grease or blot with a paper towel once meat is cooked to further reduce fat.
- Replace some meat in dishes with beans, whole grains, or vegetables.
- Substitute two egg whites or an egg substitute for a whole egg.
- Cook foods in a pan sprayed with vegetable oil cooking spray or a small amount of broth or water instead of melting fat in the pan.
- Use oils instead of solid fats when cooking.

Recipes for baked products are a little harder to change compared to other recipes. The properties of fat tenderize, add moisture, and help the product rise; all are important for high-quality baked products. Generally, fat may be successfully reduced by one-fourth to one-third in baked products.

Applesauce, nonfat yogurt, or pureed fruit may be used instead of fat in some products, such as quick breads. Using vegetable oils instead of solid fats will reduce the amount of saturated fat. However, liquid oils do not function the same as solid fats in a product, so the end result may not be the same as the original. However, by gradually changing a recipe, the new product can become a new favorite, and the original recipe long forgotten.

Reducing Sugar

Decreasing the sugar in a product also reduces the calories and carbohydrates. Sugar may be eliminated or reduced from some fruit and baked preparations. However, similar to fat, sugar does have culinary purposes. It affects texture, moisture, browning, leavening, volume, and more. That being said, we do need to be aware of how much added sugar we

consume in a day, and reducing sugar in recipes is a great starting point.

- Use spices (cinnamon, nutmeg, and ginger) and extracts (vanilla, almond, maple, etc.) to enhance sweetness without extra sugar.
- Use applesauce, mashed bananas, or other fruit to replace some sugar, especially in quick bread.
- Artificial sweeteners may be used, but some may produce a bitter taste when heated.
- In baked products, sugar may be reduced by one-fourth to one-third with good results. Beware of reducing the sugar too much in baked products, as it will result in a lower-quality product.
- Use unsweetened or low-sugar jams and jellies when a recipe calls for jam or jelly.
- Reduce the amount of frosting, omit the frosting completely, or do a dusting of powdered sugar on baked goods.

When reducing sugar in baking while keeping good results, try these guidelines (Source: American Dietetic Association Complete Food and Nutrition Guide):

- For cakes and cake-like cookies, use ½ cup sugar per 1 cup of flour.
- For muffins and quick breads, use 1 tablespoon sugar for 1 cup of flour.
- For yeast breads, use 1 teaspoon sugar for 1 cup of flour.

Reducing Salt

It is recommended that most adults should consume no more than 2,300 milligrams (mg) per day (ideally 1,500 mg); however, the average intake is approximately 3,400 mg per day. Many people need to reduce the amount of salt or sodium in recipes because of dietary concerns, specifically those with high blood pressure. Removing the salt shaker from the table will help reduce the amount of salt used by habit. Salt is used mainly for taste enhancement in foods. However, it acts as a preservative in cured or pickled foods, helps control the rising action of yeast in bread, and is needed in these preparations. Salt may

be reduced or eliminated in most other foods, but it will require that the taste buds adjust. Many commercially prepared sauces, broths, and canned foods are high in sodium.

- Use fresh, low-sodium, or no-sodium sauces, broth, and canned vegetables.
- Rinse canned vegetables with cool tap water to remove some of the sodium used in processing.
- Herbs and spices can add flavor, and garlic or onion powders can substitute for garlic or onion salts. [See Chapter 10 for more on herbs and spices.]
- Pasta, noodles, rice, or hot cereals can be cooked with little or no added salt.
- If necessary, salting food lightly just before serving will make the food taste saltier because the flavor will be on the food's surface.
- Read the Nutrition Facts label and choose lower-sodium options.

Increasing Potassium

While reducing sodium is a good way to support good health and reduce high blood pressure, a potassium-rich diet is also needed, as potassium is an important nutrient for lowering blood pressure. It is important to consult with your health care provider as some medications taken to treat high blood pressure require the individual to eat only moderate amounts of potassium. It may also reduce the risk of developing kidney stones and possibly decrease bone loss with age. It is recommended that adults consume 2,600 mg per day (females) to 3,400 mg per day (males). Potassium-rich food sources are green leafy vegetables, fruits from the vines, and root vegetables.

Increasing Fiber

Fiber promotes health in many ways, and high fiber foods are often rich in other important nutrients. Adding whole-grain cereals, fruits, and vegetables to your daily eating plan is a good way to increase fiber. Fiber may also be added to the preparation of some foods. Make sure at least half of your daily grains are whole by choosing whole-grain pastas, breads, and cereals to increase fiber. Here are some ways to add fiber to meals:

- When baking grain products, whole grain flour may be substituted for one-half of the all-purpose white flour.
- Add fruit and vegetables to any dish:- such as mixing with eggs, casseroles, soups, salads, sandwiches, and pasta dishes.
- Legumes and lentils can be added to casseroles and soups.
- Fruits and vegetables prepared with skins or peels, when possible, will have more fiber.
- Bran or wheat germ can add fiber to cooked cereals, casseroles, and meatloaf.
- Use oat flour or oats in baked dishes and as binders of meatballs.
- Sprinkle fiber-rich nuts and seeds over salads, in smoothies, and more.
- Dried fruit and nuts may be added to breads, cookies, and quick breads.

Increasing Calcium and Vitamin D

Many people do not get the calcium and vitamin D necessary to support healthy body functions. By adding enriched soy, almond milk, or dairy products to foods, calcium and vitamin D can be increased. Incorporating other calcium and vitamin D-rich foods is also important.

- Dry milk, evaporated milk, or plain yogurt can be added to casseroles, meat loaf, mashed potatoes, and thick soups without much change to the finished product.
- Plain yogurt, especially "Greek" yogurt, can be substituted for some or all of the sour cream in salad dressings, spreads, and dips.
- Cooked cereal and hot cocoa can be made with milk or enriched soy or almond milk instead of water.
- Shredded cheese can be added to casseroles, soups, salads, and vegetables.
- Calcium-enriched tofu can be mixed in casseroles, scrambled eggs, and stir-fry dishes.
- Dark leafy greens and broccoli can be added to hot or cold dishes.
- Add canned sardines or canned salmon (with bones) to dishes.

Note: Not all calcium-rich foods contain vitamin D, so check the Nutrition Facts label.

Changing the Amount or Yield of a Recipe

The number of servings needed may be different from what the recipe yields. For a large family or group, it may need to be increased. For a small family, it may need to be decreased. This is generally an easy math formula for multiplying or dividing.

Most recipes can be doubled successfully. However, larger equipment may be needed for preparing and additional time may be added for cooking. It is often better to use two pans for baked products instead of one large pan to allow for more even cooking. Recipes for foods that are mixed, such as soups and casseroles, can be increased or decreased easily. When increasing recipe size, extra time is needed to reach the end-point cooking temperature at which foods would be safely cooked, and when decreasing a recipe size, less cooking time may be needed to prevent the food from burning or overcooking.

For large-quantity cooking, a quantity cookbook such as *Food for Fifty* or recipes from a food service manual are helpful. Recipe books are also available for cooking for one or two people.

Substitutions

Substitutions are often needed because ingredients are unavailable, to change the flavor for personal tastes, and to meet dietary needs such as reducing sodium or sugar. It is helpful to keep a good substitution chart handy in the kitchen. The Kansas State University publication, *Ingredient Substitutions*, L730, lists substitutions for many foods. *The Joy of Cooking*, by Rombauer, Rombauer-Becker, and Becker, also has an extensive listing of possible substitutions.

Food Allergies vs. Food Intolerances

It is essential to know the difference between a food intolerance and a food allergy to protect one's health and ensure safe food practices. Both conditions involve an adverse reaction to a specific food, but the causes, symptoms, and severity differ. Allergies and intolerances are diagnosed by your health care provider through reviewing symptoms and laboratory tests. Consult with your health care provider if you suspect an allergy or intolerance.

Food Allergies

Food allergies cause the body's immune system to react, usually because of a food protein component, and require the elimination of foods containing that component. Even the smallest amount of the allergen

can cause a severe or life-threatening reaction. Any food can cause an allergic reaction; however, there are nine allergens that are responsible for 90% of reactions. They are often referred to as the "Big 9" and include:

- Milk
- Eggs
- Peanuts
- Tree nuts
- Fish
- Shellfish
- Soy
- Wheat
- Sesame (added January 2023)

Signs and symptoms of an allergic reaction include:

- Hives or skin rash
- Swelling of lips, face, and/or throat
- Difficulty breathing or wheezing
- Vomiting or diarrhea
- Anaphylaxis (life-threatening reaction that requires immediate medical attention)

Prevention is the key to allergies. Always check food labels and ingredient lists as food allergens are required by federal law to be listed on food packaging. Avoid cross-contact during food preparation and storage (e.g., use separate utensils, use gloves, wash hands, label all containers, etc.). Some food labels may have a statement that the item was processed in a facility that also processes [allergen], which indicates a risk of cross-contact where an allergen, not listed as an ingredient, could have unintentionally gotten into the food through shared equipment or facilities. This is a voluntary advisory statement, not required by law, and doesn't guarantee the level of risk, so it is best to avoid such products if one has a severe allergy to the mentioned allergen. Lastly, if a severe life-threatening reaction occurs, it is essential to know how to respond. Always contact 911 in cases of severe allergic reactions.

Food Intolerances

Food intolerances may cause symptoms similar to food allergies, such as nausea, diarrhea, or abdominal cramps, but do not involve the immune system and are not life-threatening. The most common food intolerances are lactose, gluten, and certain food additives (sulfites, MSG, etc.). Some food intolerances may require eliminating foods entirely, while some may allow small servings as tolerated. The best way to prevent or manage food intolerances is to identify and avoid or reduce the foods, use enzyme supplements (e.g., lactase for dairy), and provide alternative food options such as gluten-free products.

Food Trends

There are several dietary patterns and food trends that may be followed by individuals. People may follow a specific eating pattern or trend for health, cultural, or ethical reasons. It is important to note the potential benefits and risks, cost, nutrients, personal health, lifestyle, and other factors that may positively or negatively influence eating patterns.

- A **Mediterranean Diet** emphasizes fruits and vegetables, whole grains, and heart-healthy proteins and fats. Research has shown that eating a Mediterranean diet may decrease the risk of chronic diseases, protect against cognitive decline, and help maintain a healthy weight.
- A **Vegetarian Diet** focuses on the exclusion of some animal products. Individuals following a vegetarian diet should give special attention to intakes of protein, iron, zinc, and vitamin B12, as well as calcium and vitamin D, if avoiding milk products. Adequate intake of all essential amino acids can be achieved by eating a variety of foods throughout the day, focusing on nuts, seeds, legumes, beans, and soy.
- A **Vegan Diet** focuses on the exclusion of all animal products, including meat, eggs, milk, and anything else made with animal products. Similar to the vegetarian diet, individuals following a vegan diet should pay attention to specific nutrients and prioritize careful planning of meals to meet nutrient needs.
- A **Gluten Free Diet** excludes all sources of gluten (wheat, rye, and barley). This diet is primarily for those who have celiac disease (an autoimmune disorder triggered by gluten) or gluten intolerance; however, more and more individuals are choosing to avoid gluten without the diagnosis of these two disorders. It is important to read the Nutrition Facts label and ingredient list on processed products to ensure there is no gluten in the product. For individuals with celiac disease, it is critical to prevent cross-contact with gluten-containing foods.
- A **Plant-Based Diet** focuses on consuming foods that are derived from plants. It is not as strict as vegetarian or vegan diets and may still incorporate small amounts of animal products; however, the focus of the plate is whole plant-based foods. Research has shown that eating a plant-based diet may decrease the risk of chronic diseases, reduce inflammation, and help maintain a healthy weight.
- The **DASH Diet (Dietary Approaches to Stop Hypertension)** is designed to lower blood pressure in individuals with hypertension. It focuses on increasing fruits and vegetables, whole grains, lean proteins, and low-fat dairy, while limiting sodium, red meat, and added sugar. Research shows that following the DASH Diet reduces blood pressure and cholesterol and decreases the risk of chronic diseases and cardiovascular events.

- A **Ketogenic Diet** significantly reduces carbohydrate intake and increases fat and protein intake. The diet forces the body to use fat for energy instead of carbohydrates. This diet is often used to help reduce the frequency of epileptic seizures in children, but has also been made into a popular diet to promote rapid weight loss. There are many risks associated with this diet, including nutrient deficiencies, kidney problems, and constipation. This diet should be closely supervised by a healthcare provider.
- **Intermittent Fasting** follows an eating pattern that has specific time frames for eating, usually fasting for 12-16 hours per day. There is less focus on what you eat, rather than when you eat. Individuals considering intermittent fasting should consult with their healthcare provider, as it is not safe for everyone, and individuals may experience dangerous side effects if fasting for long periods of time. Research shows potential short-term health impacts, but long-term impacts are inconclusive.
- A **Paleo Diet** focuses on foods presumed to have been consumed during prehistoric times through hunting and gathering. There is an emphasis on whole, unprocessed foods, and they do not consume any grains, legumes, or dairy. It focuses primarily on meat, fish, fruits, vegetables, nuts, and seeds. Research is limited on the health benefits of the paleo diet, and long-term risks are not known. The paleo diet avoids whole grains, dairy, and legumes, which all provide important nutrients for health.

Food trends reflect the changes in culture, just as all other trends do. Each year, new food trends emerge. Food trends not only affect the health of consumers but also the

health of the economy and food businesses as well.

- **Sustainability** has been a trending food topic for several years. Ethical and fair-trade products, local and seasonal produce, organic, and product packaging are all at the top of consumers' minds. Additionally, more and more consumers want to know where and how their food is produced and want to consume a diet that has low environmental impact. See *Making Everyday Choices for a Healthy, Sustainable Diet* (MF3060) for ideas and information you can use to make food more sustainable.
- **Plant-based proteins** are at the top of consumers' minds and are expected to continue to grow. Consumers are purchasing plant-based proteins due to perceived health benefits, environmental concerns, animal welfare, and to try something new.
- **Gut health** has been growing in popularity as multiple health organizations have highlighted the importance of a healthy gut as a crucial component for overall health and well-being. Foods and beverages that are fermented or have added prebiotics are becoming increasingly popular. Yogurt, kimchi, kefir, sourdough, kombucha, prebiotic sodas, and prebiotic snacks are examples of foods available to support good gut health.
- **Unique (ancient) grains and different flours** are being used more and more by consumers. People are choosing more whole-grain foods from less common plant sources like rye, barley, amaranth, millet, sorghum, and quinoa. Additionally, bean and lentil flours are commonly seen on store shelves in the form of various pastas, crackers, and chips.

Terms

Biotechnology: the science of using living organisms (plants, animals, bacteria) to develop new products.

Convenience foods: prepackaged foods for which part of the preparation has already been done to allow the cook to have a "home-cooked" product in a shorter time.

End-point cooking temperature: the internal temperature of a food at the end of the cooking time.

Fusion cooking: Foods developed by combining flavors or ingredients characteristic of different cultures.

Food allergy: An immune response to certain food components; may be life-threatening.

Food intolerance: sensitivity to certain food components that is not life-threatening; often confused with food allergies.

Nutrition Facts panel: the section of a food label that lists required and voluntary information about certain nutrients.

One-dish meals: casseroles or combinations of foods that include several parts of a meal, such as meat, vegetable and pasta and served as a meal without many other foods.

Product dating: the dates listed on the food label tell the "Use by" or "Sell by" recommendations.

Shelf life: the amount of time a product may remain stored in the grocery store or home before losing quality or becoming unsafe.

Sustainable diets: diets that meet present needs without compromising the ability of future generations to meet their needs.

Tofu: a cheese-like curd made from soybeans and a good source of protein and calcium.

Unit pricing: the method used by some grocers of showing the price of products by a common measurement such as ounces, so that comparisons may be made between choices.

Frequently Asked Questions

Q. *Is the wax on fruits and vegetables safe to eat?*

A. Yes. The wax is used to seal in moisture, protect the food from bruising and prevent spoilage. The produce should be rinsed under running water, using a vegetable brush to remove dirt, bacteria, and pesticide residues.

Q. *Are foods sold in "health food stores" more nutritious than foods from the supermarket?*

A. Not necessarily. Supermarkets and health food stores both sell healthy, nutritious foods. Overall, the variety of foods of a health food store may be limited, but they may offer unusual foods not found in the supermarket. Health food stores may charge more for foods also found in the supermarkets.

Q. *Is couscous a grain?*

A. Couscous is a pasta made with ground semolina wheat. It is a good source of B vitamins. It can be made from whole grain, but more typically is made from enriched refined grain.

Q. *True or False: If a food is labeled as "multigrain," does that mean it is whole grain?*

A. False. "Multigrain" means that the product contains more than one kind of grain. The food may or may not contain whole grains.

Resources

Food Allergies
fda.gov/food/nutrition-food-labeling-and-critical-foods/food-allergies

Food: A Handbook of Terminology, Purchasing and Preparation. Eleventh Edition, 2006. American Association of Family and Consumer Sciences

The American Dietetic Association Complete Food and Nutrition Guide. 5th Edition. 2017. Duyff, R.L.

Food for Fifty. Mary Molt. 14th Edition, 2017

Reducing the Size of Recipes. University of Nebraska-Lincoln Extension.
food.unl.edu/article/reducing-size-recipes

DASH Eating Plan
nhlbi.nih.gov/education/dash-eating-plan

Institute of Food Technologists
ift.org

National Restaurant Association
restaurant.org

Topics for Further Study/ Training

- Vegetarianism
- Veganism
- The Importance of Family Meal Time Meal Planning for Aging Populations Meal Planning for Youth
- Special Dietary Concerns (e.g., celiac disease, diabetes, food allergies/intolerances)
- Meal Planning on a Budget Recipe Costing
- Meals for Camping/Picnics Healthy Holiday Foods/Cooking
- Cooking for One/Small Households Planning Snacks/Healthy Snacks

Bulk Cooking/Month of Meals Quick Scratch Cooking

- Using Technology in Meal Planning and Preparation
- Using Unique Foods: Putting New Cuts of Meat, Unusual Fruits & Vegetables, and Exotic Grains on Your Menu
- Sustainable Food

Additional Publications

Ingredient Substitutions (L730)

Making Everyday Choices for a Healthy, Sustainable Diet (MF3060)

What's on a Food Label (L883)

Everyone to the Table (MF2784)

Healthy Food Options for Fall/Winter Gatherings (available through the K-State Extension Nutrition website)

Check Yourself Questions

1. (T or F) The larger container of a product is always the least expensive.
2. The listing of ingredients used in a food is given in what order on the food label?
   a. descending (greatest to least)
   b. ascending (least to greatest)
   c. random
   d. alphabetical
3. "Use by" on the label means:
   a. the store should have sold it by this date
   b. do not use after this date
   c. should be used by this date
   d. nothing
4. To increase a cake recipe by two times, the most successful method is:
   a. double ingredients, use a large container to mix and a large pan to bake
   b. make two batches, mix them together, bake together in a large pan
   c. double ingredients, bake in two pans
   d. double ingredients, bake in four pans
5. "Fusion cooking" refers to
   a. adding melted cheese to a dish
   b. blending flavors and techniques from various cultures
   c. cooking at a high temperature
   d. convenience foods to cook by microwave

continued

Check Yourself Questions, cont.

6. What are some food trends of today?
7. Most of the fats consumed should be:
    a. cholesterol
    b. trans fats
    c. monounsaturated and polyunsaturated
    d. saturated
8. Which food should not have salt eliminated completely from the recipe?
    a. vegetables
    b. breads
    c. meats
    d. fruits
9. Practices to improve food sustainability include:
    a. decreasing packaging
    b. buying fresh produce in season
    c. eating nutrient-rich foods
    d. buying food with recycled/recyclable packaging
10. What is required for vegetarians to get adequate amounts of all essential amino acids needed for protein?
    a. eating complementary proteins at every meal
    b. eating a variety of foods over the course of the day
    c. taking supplements
    d. eating some animal protein

Answers

1. False — The largest container is not always the least expensive. Unit pricing will help the consumer determine the cost per unit.
2. A — The ingredients are listed on the label with the food found in the greatest amount first, followed by others in descending order.
3. C — "Use by" means that the food should be used by the consumer before the date given. The food may lose quality or become unsafe after that date.
4. C — When a cake recipe is doubled, ingredients may be combined in mixing but will bake more evenly in two pans.
5. B — "Fusion cooking" refers to the practice of blending flavors and techniques from various cultures to create a new food.
6. There are many food trends today. Some of these include functional foods, fusion cooking, increased use of fruits and vegetables, wide variety of grains, availability of fresh produce, vegetarian diets, gourmet cooking, environmental awareness and biotech possibilities.
7. C — Polyunsaturated and monounsaturated fats should make up the majority (20 to 35 percent of total calories). Only limited amounts of fats should be saturated, cholesterol or trans fats.
8. B — Salt is necessary in bread making because it helps control the growth of the yeast.
9. A, B, C, and D — All are examples of practices to improve food sustainability.
10. B — A variety of foods will provide all essential amino acids in the diet.

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Chapter 3

Cooking Techniques

Cooking Techniques

Upon completion of this lesson, the Master Food Volunteer will be able to:

1. Describe the various procedures possible for methods of cooking food.
2. Understand the characteristics and time factors of each method.
3. Be able to determine which method is the best option for the food and the situation.
4. Understand food safety concerns for each of the different methods.
5. Assess the use of special cooking appliances such as slow cookers and bread machines.

Key Concepts

- Heating or cooking food causes changes that can make the food more appetizing as flavors and aroma are released. Food also becomes more palatable as the texture changes.
- Nutrients are sometimes affected by the preparation method.
- Choosing the most appropriate method of preparation will enhance the food and preserve nutrients.
- Conventional cooking methods can be classified as moist heat, dry heat, and combination. Each can affect food differently.
- Microwave cooking is a fast, easy way to cook food, but special techniques must be understood to successfully cook with microwaves.
- Convection cooking requires a convection oven with heated air circulating to bake the product more evenly and quickly.
- Slow-cooker cooking is done in an appliance designed to cook food slowly at low temperatures with moist heat.
- Bread machines perform all the steps of making homemade bread in one appliance. The machine is programmed to mix, knead, and bake bread in 2 to 5 hours.

Conventional Methods

Moist Heat

Cooking with moist heat adds liquid or steam to the cooking process. This is used when foods need to absorb liquid (such as rice or dry beans) or to tenderize tough cuts of meat. Cooking in a flavored liquid, such as a broth, adds to the flavors of the food, while plain water adds only moisture. Foods may be boiled, simmered, poached, steamed, blanched, stewed, or stir-fried in liquids.

Boiling involves the highest temperatures (212˚F) and the greatest agitation. Hearty vegetables and starches are often boiled, but the high temperature could toughen protein foods such as meat and eggs. The rapid bubbling could also break up more delicate foods such as fish.

Simmering is cooking at a lower temperature (185-205˚F) than boiling. The liquid is only slightly bubbling. Most foods cooked in liquid should be simmered. Bringing the water to a boil before adding the food will

adjust for the cooling that will occur when adding cold foods. Braising and stewing are two methods that use simmering to cook foods.

Poaching foods involves placing the food submerged in liquid that is hot but not bubbling, usually between 160-180°F. Delicate foods such as poached eggs, fish, or pears may be cooked by this method.

Steaming involves placing food on a rack above boiling water and wrapping or tightly covering the food with a lid so that it cooks in steam produced from boiling liquid. A pressure cooker will steam foods in a shorter cooking time because the pressure will allow the temperature of the steam to heat higher than the boiling point. Steaming retains the most nutrients and color of fruit and vegetables.

Dry Heat

Dry-heat methods cook food without added moisture. Dry-heat cooking will allow food to brown and develop a crisp or tender crust while staying moist and tender inside. Dry-heat cooking uses air, direct heat, or fat to cook the food. Baking, roasting, broiling, grilling, sautéing, and frying are dry heat methods.

Roasting and baking are done in an oven. The term roasting is usually used to refer to meat, poultry, fruits, vegetables, and nuts; while baking refers to breads, pastries, desserts, casseroles, and fish. In a conventional range oven, the temperature is controlled by a thermostat. Oven temperatures are sometimes referred to by descriptive terms.

Keep warm	170° to 200°F
Very low	250° to 275°F
Low	300° to 325°F
Moderate	350° to 375°F
Hot	400° to 425°F
Very hot	450° to 500°F

When roasting or baking over an open heat source, the distance from the heat and the intensity of the heat determine the temperature.

Broiling is a high-heat cooking method used for tender meats and fish, some vegetables, and for finishing dishes. The heat source is from above and is varied by the distance of the cooking rack from the heating element.

Grilling is done over an open heat source with the food placed on a rack. It is a popular outdoor cooking method often referred to as barbecuing. The food, usually meat, needs to be turned to cook on both sides. The rack will leave grid marks characteristic of grilling. High heat produces smoky flavor, grill marks, and caramelization.

Food may be cooked on a solid cooking surface, such as a griddle, with a small amount of fat or a nonfat cooking spray to prevent sticking. The temperature is lower than grilling, around 350°F. This is called griddling. The griddle may be a separate appliance, a part of the range, or over an open heat source.

It is important to note that grilling meats at high temperatures can lead to the formation of carcinogenic compounds. When grilling, marinating meat, avoiding charring the meat or removing it before eating, flipping the meat often, and not putting meat directly over the heat area are all ways to reduce the risk of consuming carcinogenic compounds.

Sautéing and frying are cooking food in oil or fat. It is generally a quick way of cooking, but it does add fat calories to the cooked food.

- Pan frying is the most common method of frying. Meat, poultry, fish, and vegetables are commonly fried. A moderate amount of fat is used over medium heat. Food may be sliced for quick cooking or in serving-sized pieces. The food will need to be turned to cook thoroughly.
- Sautéing cooks smaller pieces of food in a small amount of oil. A low to medium temperature is used, and food is stirred or moved quickly as it cooks. The pan and oil should be hot enough to sear the food as soon as it is added. It is important to preheat the pan and not to overload the pan so that the food can cook quickly.
- Deep-fat frying immerses the food in a large amount of hot fat, where it fries until done. Fats with a high smoking point, such as vegetable oils and shortenings, should be used. It is important that the fat be kept at the correct temperature.
- Oil that is too low in temperature will allow the food to absorb fat, and a temperature that is too high will cause the oil to begin to break down and not be usable. If too hot, it can actually flame or start a fire. The food will also cook too quickly, becoming burned or overcrusted on the outside while being underdone in the center if the oil is too hot.
- Most foods are deep-fat fried at 365°F. A wire basket in the pan of hot oil will allow the cook to lower and remove the food safely.

Microwave Ovens

Microwave ovens have become very popular in today's homes and work sites. However, choices of power settings, food, and cookware can greatly affect the quality of the cooked food. Newer microwaves perform functions other than microwaving. Some will grill, offer convection cooking, warming, and proofing options. Before purchasing a microwave, check with the manufacturer or appliance dealer to determine its functions.

Microwaves penetrate the food surface and cook by causing the food molecules to vibrate, producing friction, which heats the food. The heat is conducted through the food, cooking by internal heat. A standing period following cooking time is important with microwave-cooked food because the energy continues to produce heat for a short time after the food is removed from the microwave oven. This is known as "standing time" or "carryover cooking time." It occurs for a longer time in dense foods, such as a whole turkey or beef roast, than in less-dense foods, such as bread.

Microwave-oven cooking power will range from 400 to 1,000 watts. The higher the cooking power, the faster the food will be cooked. The wattage can usually be found on the back of the oven with the serial and model numbers. Cooking levels can be regulated and are listed on the oven by percentage (10 to 100 percent) or description (low-medium-high).

Microwave energy is absorbed by water, fat, and sugar. Foods higher in these ingredients will heat faster. If a food has a pocket of fat or water enclosed, it may heat rapidly enough to explode. For this reason, it is important to puncture skins or membranes that contain fat or water. Concentrations of fat and sugar can also create hot spots that may cause unexpected burns. It is important to handle food carefully when removing it from the microwave and

serving it. Even when the container may feel cool, the food can be hot enough to burn.

Several factors affect how evenly microwaved foods will cook.

- Dense foods such as meat or squash will take longer to cook.
- Larger, unevenly shaped foods will cook more slowly than small, uniformly shaped pieces.
- Colder foods will take longer.
- A larger amount of food will take longer to cook than a smaller amount.
- Techniques such as cutting food into smaller, uniform pieces and arranging the pieces of food in a circle will help the food cook more evenly.
- Placing denser and thicker pieces toward the outside of the container is helpful.
- Leave spaces between pieces of food when possible.
- Stirring, rotating, and turning food will also help it cook evenly.
- Covering foods will help them cook faster and stay moist as steam is held in. There will also be less splattering from the food while it cooks. Cover foods tightly with plastic wrap or a glass lid for steaming or cover loosely with wax paper for a drier food.

The types of cookware to use in the microwave are important.

- Plastic is a popular choice, but not all types of plastic will withstand the high temperatures of microwave-cooked foods. Items should be marked "microwave safe."
- Cooking in paper is a unique feature of the microwave oven, but the choice should be sturdy enough to support the food and not made of recycled paper. Most glass and ceramicware that is suitable for the oven is usable in the microwave oven if it doesn't contain metallic trim or glazes.

- Many utensils are manufactured especially for microwave use that are safe to use in the microwave and shaped to promote even cooking.

Cooking times will vary with oven models and types of food. General guidelines are usually given in the owner's manual and cookbooks. It is best to check the progress of the food as it cooks to avoid tough, overcooked food.

- Many people enjoy the use of a microwave oven for thawing and reheating foods.
- Defrosting should be done on a lower power setting to avoid cooking the corners or edges of the food.
- Food should be removed from the store packaging and separated if possible.
- Defrosting will be more even if food is rearranged and rotated often.
- Standing time will allow food to continue defrosting evenly as well.
- To assure food safety, foods thawed in the microwave should be cooked immediately after thawing.

Microwave ovens work well for reheating previously cooked foods.

- Food should be heated thoroughly to the center.
- A probe thermometer is helpful in determining temperatures.
- Food will reheat more evenly if it is stirred and rotated.
- As a rule, allow 3 to 4 minutes per pound when reheating refrigerated foods.
- A smaller, lighter food, such as a roll, will reheat in 10 to 15 seconds.
- Leftovers must be reheated to 165°F.

For preparing meals in the microwave oven, plan more time to allow cooking several foods together.

- Foods that will only take a short amount of time can be prepared during the standing time at the end of cooking.
- Some foods, such as casseroles, may need to have the liquid reduced because there will be less evaporation of moisture.
- Pierce whole vegetables, egg yolks, or pockets of fat to allow expansion with heat and prevent the food from bursting open.
- Plastic coverings should be vented to allow steam to escape.
- Reduce seasonings because lack of evaporation intensifies flavors. If salt is added, meats and vegetables should be salted after cooking.
- Because foods will not brown as in conventional cooking, sauces or seasonings are often used to create a similar appearance to conventionally cooked foods.
- Many commercially prepared and packaged foods are available for microwave cooking that include specific directions and times.

Convection Ovens

A convection oven cooks similarly to a conventional oven except that it circulates the heated air throughout the oven for a more even temperature. This also decreases the cooking time. Food will brown more evenly. When baking in a convection oven, the oven temperature will usually be decreased by 25° to 50°F. A convection oven cooks more rapidly than a conventional oven but not as quickly as a microwave oven. Some combinations of convection and microwave ovens are marketed.

Pressure Cooker

At sea level, water boils at 212˚F (100˚ C). A pressure cooker creates a higher-pressure environment and cooks food at a higher temperature. The cooking temperature rises as the steam pressure rises. For example, at 15 pounds of pressure, the temperature is 250˚F (121˚ C). There are two types of pressure cookers — electric and stovetop. With an electric pressure cooker, the pressure and time can be set. The cooker will automatically regulate the pressure for the set amount of time and then decrease the pressure on its own. Stovetop pressure cookers cost less, but require more attention. With stovetop pressure cookers, pressure and time are controlled by the cook.

Pressure cookers are useful for reducing cooking time. The greatest savings are gained when cooking foods requiring 20 minutes or more. They are especially good when cooking beans, chicken thighs, rump roast, brown rice, bulgur, stews, and vegetables such as carrots, potatoes, and winter squash. Tender foods such as spinach can easily be overcooked in a pressure cookers.

Some electric pressure cookers have a canning option. This should not be used for canning foods because research has not shown that it reaches proper temperature to safely can foods. See Chapter 11 for more information about safely canning foods.

Slow Cookers

A slow cooker, also known as a Crock Pot®, is designed to cook foods slowly, between 170˚ to 280˚F, taking from 4 to 12 hours. This allows the cook to do preparations early, start the food cooking, and leave it for a period of time. The slow cooker is especially helpful in cooking less tender cuts of meat, soups, and stews, and for set-it-and-forget-it cooking.

Many recipes can be adapted for the slow cooker.

- Recipes that can have most of the ingredients added at the first part or portion of the cooking time are good choices.
- Usually, liquid is reduced to about one-half the amount called for in the recipe.
- Products that absorb liquid such as rice or pasta may need more liquid.
- Rice and pasta should be added near the end of the cooking period so they will not become overcooked.
- Crushed or ground seasonings are added near the end of the cooking time.
- To avoid curdling, sour cream and milk are added near the end of the cooking time.

Most slow cooker appliances have temperature settings of low, medium, and high. Others have more elaborate controls with a variety of options for temperature control. It is important to know the temperatures of these settings for best cooking results and food safety. The temperature may be checked by heating the appliance filled with water and testing with a thermometer.

Safe food handling and preparation practices should be followed when using a slow cooker.

- Never reheat leftovers in the crock pot. Reheat on the stove, oven, or microwave before transferring to a slow cooker to hold it warm.
- Preheating the slow cooker or cooking on high for 1 hour, then switching the temperature to low can help food get out of the danger zone quicker.
- Do not add frozen meat or poultry to the crock pot. Thaw frozen food completely in the refrigerator at least overnight before cooking in the crock pot.
- Do not add dry red kidney beans to a slow cooker. Soak and boil them for at least 10 minutes before adding to destroy dangerous toxins.
- Ensure pieces are uniform for even cooking.
- Always check the temperature of the food to ensure it has reached a safe internal temperature.
- Do not remove the lid excessively, as that drops the temperature and extends cooking time.

Bread Machines

The bread machine has become very popular to reduce the time spent in the kitchen making bread, while enabling the baker to produce the taste and smell of homemade bread. Different features are available, and prices vary. The delayed bake timer is one of the most popular features.

- Bread machine pans are available in 1-, 1.5-, and 2-pound sizes, and shapes vary by manufacturer. Most produce a tall loaf, but some make a more traditional style loaf.
- All-purpose flour may be used instead of bread flour, but the recipe may need to be adjusted. Check the manufacturer's guidelines. Vital wheat gluten may be added to help improve bread quality and volume.
- A high-protein flour, such as bread flour, is recommended. Bread flour is a wheat flour with a high gluten content.

- Active dry yeast works well in bread machines, and bread machine yeast is also available.
- The order in which the ingredients are added is important, and the directions that came with the bread machine should be followed.
- Some models have a separate yeast dispenser that holds the yeast until it is time to knead the bread.
- Wet ingredients should be kept separate from the yeast if the machine is being set to delay the process of mixing.
- When using the timed delay, perishable ingredients such as milk, eggs, or vegetable purees should not be used. The delayed time could allow spoilage.
- Dry milk may be substituted for fresh milk. (One tablespoon of dry milk equals about ¼ cup of fresh milk.) Replace the liquid with equal amounts of water.
- Ingredients should be at room temperature unless the machine has a preheating cycle.
- Butter or margarine are cut into small pieces before adding.
- Dough should be checked during the first 5 to 10 minutes of the first kneading cycle. Just as humidity affects traditional bread making, a dry or humid day can affect how the flour absorbs the liquid in a bread machine. The dough should not look wet and stick to the sides (add flour if it does) or be dry and crumbly (add liquid).

Air Fryer

The air fryer has become a popular item for healthier cooking as an air fryer requires no oil to cook food, unlike a conventional fryer. Air fryers use circulated hot air, like a convection oven, to cook the food. There are other benefits beyond healthier cooking, such as faster cooking, less energy used, more nutrients retained, and better texture of certain foods.

When purchasing an air fryer, there are many considerations, such as size, functions, and cost. Air fryer sizes can range from 2-3 quarts used for one or two people, 5-6 quarts for larger family meals, and 7-10 quarts for large items such as whole turkeys. Some air fryers can bake, roast, air fry, reheat, dehydrate, and much more so identifying intended use can help purchasers make the best decision.

When using an air fryer, special consideration should be given to their use and safety.

- Do not overcrowd the basket. Allowing the air to have enough space to circulate the food will help with even cooking.
- When cooking, treat the basket as a hot pan. Do not touch the basket anywhere except the designated handle and also place the hot basket on a potholder or other heat-safe surface.
- Use a lower temperature to ensure food is cooked on the inside while keeping the outside from becoming too dark or crispy.
- Move your air fryer away from the wall when using it to allow the vents to work properly. If directly under a countertop or in a corner, you may notice the area surrounding the air fryer will feel warm to the touch. Hot air will be pushed out of the unit as it cooks and may melt or catch flammable items on fire if they are too close to the heat source.
- When converting a recipe from oven to air fryer, reduce the temperature by 25°F and reduce the cooking time by about 20%. Check food as it cooks and increase time or temperature as needed.

Table 1. Temperatures important in food preparation.

	Temperatures	
	°F	°C
Deep-fat frying	350 – 450	177 – 232
Boiling water	212	100
Simmering	180 – 211	82 – 99
Scalding	150	65
Lukewarm	100	40

Terms

Air Fry: To cook by circulating hot air around food.

Bake: To cook by dry heat in an oven or oven-type appliance.

Barbecue: To roast slowly on a rack over heat from a flame, coals or electric heat unit. The food is often brushed with a sauce.

Baste: To moisten with a sauce or drippings during cooking to prevent drying or add flavor.

Batter: A mixture of flour, liquid, and other ingredients that can be poured.

Beat: To mix until smooth by using a wire whisk, spoon, or mixer to add air to the mixture.

Blanch: To rapidly heat fruits or vegetables in steam or boiling water before freezing or drying to loosen skins and inactivate enzymes, often followed by a cool water rinse.

Blend: To mix two or more ingredients together well.

Braise: To cook meat or poultry over low heat in a covered pan with a small amount of liquid or steam.

Broil: To cook by direct heat on a rack.

Brown: To cook with medium to high heat until the food turns brown.

Combine: To mix two or more ingredients together to a uniform consistency.

Cream: To mix foods, usually fat and sugar, together until smooth and soft.

Deep Fry: To cook food submersed in hot oil.

Dilute: To make less strong by adding liquid.

Dissolve: To melt a solution in liquid.

Dough: a mixture of flour, water, and other ingredients that can be kneaded or rolled.

Flake: To break into small pieces, usually with a fork.

Fold: To combine one ingredient with another gently by sliding the spatula through the mixture to minimize the loss of air.

Fry: To cook in fat.

Garnish: To add an edible, small decorative food to the plate.

Grate: To chop into small bits by rubbing food on a grater or processing in a blender or food processor.

Grease: To rub fat on the surface of a utensil to prevent food from sticking during cooking.

Grill: To cook food on a rack with direct heat.

Gluten: The elastic substance (protein) formed by kneading wheat flour and liquid.

Knead: To work dough by pressing, folding, and stretching to develop the gluten to build the bread structure.

Lukewarm: The temperature of about 95°F at which foods are neither hot nor cold.

Marinade: The juice or other liquid used to marinate foods.

Marinate: To let foods soak in a liquid of oil, juices, or vinegar and seasonings to flavor the food.

Mix: To combine two or more ingredients.

Pan-broil: To cook uncovered over high heat, usually in a frying pan, pouring off accumulated fat.

Pan-fry: To cook over high heat in a small amount of fat.

Parboil: To boil until partially cooked; cooking may be completed by another method.

Poach: To cook in a hot liquid, carefully retaining the shape of the food.

Roast: To cook uncovered in an oven.

Sauté: To cook or brown in a small amount of fat.

Scald: To heat liquid to just below the boiling point, to pour boiling water over food, or to dip food briefly in boiling water.

Scallop: To bake pieces of food with a sauce or other liquid.

Sear: To brown the surface of food quickly with high heat.

Simmer: To cook food over low heat just below boiling point, 180° to 210°F.

Smoking point: The temperature at which fat begins to smoke when heated; it will vary for different types of fat.

Standing time: The time following the heating time during which food continues to cook from the heat it has absorbed.

Steam: To cook in steam over boiling water.

Steep: To let food stand in liquid below the boiling point so it will extract flavor or color.

Stew: To simmer food in a liquid.

Stir: To mix foods or ingredients together.

Stir fry: To fry thinly sliced food quickly in a small amount of oil while stirring.

Toast: To brown by direct heat.

Toss: To mix foods lightly with a lifting motion.

Warm: The temperature of 105° to 115°F.

Whip: To beat food quickly to add air to increase the volume.

Frequently Asked Questions

Q. *What should the temperature of my slow cooker be on the low setting?*

A. The temperature should be about 200˚F., hot enough to be sure the food is kept above 160˚F.

Q. *What do I need to look for when I buy a bread machine?*

A. There are many choices available; choose a machine with the features that suit your individual budget and circumstances. Features to consider are: pan size, display and control panel, delayed bake timer, cool-down feature, keep-warm feature, viewing window, crust color selection, convection fan, yeast dispenser, and choices of cycles.

Q. *What methods should be used for cooking less tender cuts of meat?*

A. Moist heat methods such as simmering or stewing will make roasts, ribs, round steak and less tender cuts of meat more tender. A sauce or other liquid may be used at a temperature below 195˚F. The liquid should not boil. Cooking bags may also be used.

Q. *How do you know if a cut of meat will be tender or tough?*

A. Cuts of meat vary in tenderness; those of young animals and in parts of the animal that get little exercise (such as the back) will be more tender. Muscles that have become thicker by exercise or age will be tougher. Cuts from near the backbone, often with the rib or T-bone attached will be tender. Tender cuts include sirloin cuts, loin or short loin cuts, rib cuts, and leg, round or ham cuts. Meat may be tenderized by mechanical means such as pounding, cutting, or grinding.

Resources

Bread Machine Baking. Lora Brody and Millie Apter. Morrow, William & Co. 1995

Introductory Foods. Barbara Scheule and Marion Bennion. 14th Edition. Pearson Publishing Co. 2014

Slow Cookers and Food Safety
fsis.usda.gov/food-safety/safe-food-handling-and-preparation/food-safety-basics/slow-cookers-and-food-safety

Cooking Safely in the Microwave Oven
fsis.usda.gov/food-safety/safe-food-handling-and-preparation/food-safety-basics/cooking-microwave-ovens

Grilling and Food Safety
fsis.usda.gov/food-safety/safe-food-handling-and-preparation/food-safety-basics/grilling-and-food-safety

Deep Fat Frying and Food Safety
fsis.usda.gov/food-safety/safe-food-handling-and-preparation/food-safety-basics/deep-fat-frying

Topics for Further Study/ Trainings

- Using Specialty Cooking Equipment
- Advanced Cooking Techniques
- Ethnic Cooking

Check Yourself Questions

1. What are some examples of dry heat cooking?
2. What are some advantages of moist heat cooking for certain foods?
3. What foods will cook quicker in the microwave oven because microwaves will be attracted and absorbed by the food?
4. What materials are good for microwave containers?
    a. plastic
    b. metal
    c. ceramic
    d. glass
5. How is a convection oven different from a conventional oven?
6. Slow cookers should cook foods within what range of temperatures?
7. Why should the timed delay feature of the bread machine not be used with recipes which contain milk?
8. Why should high temperatures not be used for meats and eggs?
9. A wok is sometimes used for cooking vegetables in a small amount of fat at a high temperature, what is this method of cooking called?
10. What is an advantage to air frying food?

Answers

1. Baking, roasting, grilling.
2. Moist heat cooking will tenderize meat and allow dry foods to absorb liquid.
3. Those foods higher in fat, water, and sugar will cook faster because microwaves are absorbed by these ingredients.
4. A — plastic (labeled microwave safe), C — ceramic (if it does not contain metallic trim or glazes), D — glass.
5. A convection oven circulates heated air throughout the oven for a more even temperature.
6. Slow cookers should cook between 170˚ to 280˚F. It is important to cook at temperatures above 170˚F to kill any bacteria present in the food.
7. The delayed start time could allow spoilage of perishable ingredients such as milk, eggs, yogurt, or vegetable purees.
8. High temperatures can toughen protein foods such as meat and eggs.
9. Stir fry is the technique of cooking vegetables in a small amount of fat at a high temperature.
10. Advantage — quick cooking method and adds less calories compared to traditional frying.

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Chapter 4

Basic Principles for Preparing Food

Basic Principles for Preparing Food

Upon completion of this lesson, the Master Food Volunteer will be able to:

1. Increase basic skills of standard methods of preparing food products.
2. Understand and be able to use standard measuring equipment efficiently.
3. Understand and be able to follow a standard recipe correctly.
4. Be able to define terms used in recipes and determine the technique for that term.
5. Understand the functions of ingredients.
6. Be able to substitute ingredients when needed.

Key Concepts

- Food is evaluated as it is served, just as fair entries are evaluated when entered. Appearance, flavor, aroma, texture, tenderness, and doneness are points to consider in home food preparation.
- Food preparation requires skill and knowledge. Some basic preparation techniques are valuable for preparing an involved recipe as well as serving a simple dish.
- Understanding a recipe, using the correct equipment, and measuring accurately are important in food preparation.

Basic Principles

Food is a part of everyday life. The preparation of food is important to its enjoyment and nourishment. For food to be appetizing, appealing, and healthy, the person preparing the food should understand principles of food preparation, such as mixing, cooking temperature, and how ingredients interact.

Recipes are widely available in cookbooks, on the internet, in magazines, and from friends and family. Recipes from your local extension service are also available to demonstrate nutritious choices. It is important to choose a recipe that is accurate and easy to understand. Recipes may be written in three forms; standard form (listing of the ingredients needed first, followed by the instructions for preparation listed by steps), action form (instructions for the method given beside the list of ingredients needed), or descriptive form (listing of the ingredients needed, the amounts, and the instructions in columns). Every cook should understand the basics of *mise en place*, a French culinary term that means everything in place. Before beginning to prepare any food, the cook should always read the recipe and check the recipe's list of ingredients needed before beginning preparation to ensure that everything needed is available. They should also gather and arrange all of the equipment needed for the recipe, prep their ingredients, and organize their space for ease and use during the cooking. For ease of reading ingredients, the standard or descriptive forms are often preferred. Additional information about the yield of the recipe and nutrition information are also helpful.

Using a Recipe

A recipe is a set of instructions for preparing a dish. Most recipes contain at least the following information:

- **Title:** A descriptive name for the dish.
- **Description:** A short narrative providing additional information that may not be included in the ingredients and directions, such as serving suggestions, substitutions, or recipe origins.
- **Yield:** The number of servings and serving size.
- **Ingredient list:** A list of items and the amount needed to make the recipe.
- **Directions:** Chronological steps detailing how to prepare the recipe.

Following a Recipe

When you make a dish using a recipe, read the entire recipe before starting, and understand the terminology and ingredients that the recipe uses before you start to cook.

Since baking is a science, it is essential that a recipe is followed as written for the best result. When following other recipes that do not involve baking, some modifications can be made to the recipe to adjust for personal preferences without negatively impacting the recipe.

Measuring

Accurate measuring is important for the success of a recipe. Standard measuring cups and spoons should be used for consistent results. Incorrect measuring can result in too much or too little of an ingredient, which could change the texture or flavor of the final product. A standard set of dry measuring cups includes 1, ½, ⅓, and ¼ cup measurements, while a standard set of measuring spoons includes 1 tablespoon, 1 teaspoon, ½ teaspoon, and ¼ teaspoon measurements. Standard liquid measuring cups include 1, 2, or 4 cup capacities with smaller incremental measurements clearly marked on the sides of the measuring vessel.

Dry measuring cups are typically straight-sided, graduated in size, and have a handle. They are used to measure a standard amount of dry ingredients, such as flour, sugar, cornmeal, or brown sugar. Other ingredients such as apple sauce, yogurt, and peanut butter are also measured in dry measuring cups. Dry ingredients are spooned into the cup and leveled off with a straight-edged utensil. Brown sugar is firmly packed into the cup before being leveled off.

Liquid measuring cups are clear and made of glass or plastic and have a lip for pouring. The cup is marked with lines for measuring different amounts of liquid. Place the cup on a flat surface, pour in the liquid, and bend down to see the measurement at eye level. Measure the bottom curve of the liquid. Examples of liquids include water, milk, vegetable oil, and liquid sweeteners.

Measuring spoons are used to measure small amounts of dry or wet ingredients such as salt, baking powder, baking soda, spices, and flavorings.

Some recipes, especially those developed for food services, may list measurements by weight. As food products vary in weight for volume, it is best to use a food scale or refer to a conversion chart reference for adapting the recipe.

Knowing measurement equivalents is important when increasing or decreasing a recipe, or when a needed measuring utensil is not available.

3 teaspoons = 1 tablespoon

2 tablespoons = 1 fluid ounce

4 tablespoons = ¼ cup

5⅓ tablespoons (or 5 tablespoons + 1 teaspoon) = ⅓ cup

16 tablespoons = 1 cup

8 ounces = 1 cup

16 ounces = 1 pound

2 cups = 1 pint

2 pints (or 4 cups) = 1 quart

4 quarts (or 16 cups) = 1 gallon

1 kilogram = 2.2 pounds

1,000 grams = 1 kilogram

1 liter = 1.06 quart

Abbreviations are sometimes used, including:

t. or tsp. = teaspoon

T. or tbsp. = tablespoon

c. = cup

pt. = pint

qt. = quart

lb. or # = pound

Ingredients should be measured by a standard method to ensure the measurement is correct. Specific methods for measuring are:

Flour and cornmeal: First, stir the flour or cornmeal in its original container to release settling and compaction that has happened over time. Next, spoon the flour or cornmeal lightly into the cup, mounding above the rim of the dry measuring cup. Level with a straight-edged knife or spatula. All-purpose flour usually does not require sifting; however, some cake recipes may instruct to do so. Sift flour onto a sheet of wax paper or into a bowl. Lightly, place flour into a measuring cup. Level with a straight-edged knife or spatula. A colander is a good substitute if you do not have a sifter.

Solid fats, vegetable shortening: Spoon into dry measuring cup and pack, level with a straight-edged utensil. Some special measuring cups are made for shortening with a sliding bottom that can be adjusted for various amounts. The shortening is pushed out with the slide after measuring. If the measuring cup is rinsed with water before using, the shortening will be less likely to stick to the cup. Shortening can also be measured in a liquid measuring cup by filling the cup with enough water to equal 1 cup, including the shortening (example: ⅓ cup shortening would need ⅔ cup water). The shortening is spooned into the water and pushed under the water, when the water level reaches 1 cup, it contains the correct measure of shortening.

Stick margarine or butter and solid shortening usually have amounts printed on the wrapper or container and may be cut to the needed amount.

Brown sugar: Brown sugar should be firmly packed into the dry measuring cup, unless the ingredient list specifically says not to pack the brown sugar. The excess is leveled off with a straight-edged utensil.

White sugar: Spoon into dry measuring cup and level with a straight-edged utensil.

Powdered sugar: Lightly spoon into dry measuring cup and level with a straight-edged utensil. Some recipes will instruct to sift the powdered sugar. This is also a good idea if the powdered sugar has lumps.

Liquids: Measure in a glass or plastic clear measuring cup with measurements marked on the side. After filling, place the cup on a level, flat surface and view at eye level to make sure the top surface of the liquid is at the measurement line.

Baking powder, cornstarch, cream of tartar, spices, salt: Dip dry measuring spoon into container and fill to heaping (mounded above the level of the spoon or cup). Level with straight-edged utensil.

Cooking with a Recipe

When preparing food from a recipe, it is important to follow the recipe instructions carefully, especially the first time the recipe is used. If there is something missing or unclear in the directions, refer to similar recipes in other resources. If changes are desired after the first preparation, the cook may plan for those, making note of changes for the next preparation.

Some other things to keep in mind:

- Ingredients should be at room temperature. The optimum temperature for softened butter, margarine, or shortening is 65°F.
- Times and temperatures are important in oven baking. Oven temperatures can be checked with an oven thermometer, available at most hardware or discount stores.
- The oven should be preheated 15 to 30 minutes for most baked products to allow the rising action to begin immediately after putting the product in the oven.
- Pans should be placed in the center of the oven with space for air circulation around them, unless otherwise instructed in the directions.
- Foods will bake faster in dark or dull pans; however, this can cause overbrowned crusts in some foods. Shiny pans will allow for more even baking. Glass absorbs heat more quickly than metal, and oven temperatures should be reduced 25°F when using glass pans.
- Pans not treated with a non-stick surface usually require some greasing before the food is placed in them. This can be done by lightly greasing the pan using the fat (e.g., butter, shortening, coconut oil, ghee) of your choice and a paper towel to evenly spread, or

by using a non-stick cooking spray. Flouring pans will help products such as cakes release from the pan more easily. Flour may be sprinkled on by hand or a shaker, coating the pan evenly by tipping and shaking out the excess.

- The correct size pan, as recommended by the recipe, will help ensure that the product will bake completely in the time suggested. If you decrease or increase pan size, adjust cook time accordingly.
- If a recipe says *1 cup chopped onions*, the onions should be chopped first, then measured. However, if a recipe says *1 cup walnuts, chopped*, the walnuts should be measured first, then chopped.
- Ingredients are listed in a recipe in the order they appear in the directions.

Equipment

Equipment that is in a kitchen may differ, but it is assumed that there will be the basic range, refrigerator, and sink. Many kitchens also have a microwave oven and other small appliances to help in food preparation. Small appliances are available to do many tasks that can often be done in a conventional method, such as a rice steamer or deep fat fryer. When choosing small appliances, it is important to evaluate the amount of use and convenience they will give, considering the cost and storage considerations. Refer to chapter one on understanding the basics of certain types of equipment based on different cooking methods.

Basic tools are needed for food preparation. Each cook should choose these according to the type of foods most frequently prepared. Cookware, including pans for the top of the range, oven, and microwave, are available in a wide range of sizes, prices, and materials. Utensils range from the simple, which may be a wooden spoon, to specialized "gadgets" with specific uses. A trip through a discount store kitchen aisle or a kitchen specialty shop will supply most kitchens. A list of helpful cooking tools is available from University of Nebraska-Lincoln Extension: *food.unl.edu/article/cooks-tools-30-time-saving-kitchen-tools/*.

Charts

Often, substitutions are needed for an ingredient that is not available. Common substitutions are listed in the K-State Research and Extension publication, *Ingredient Substitutions*, L730. (*bookstore.ksre.ksu.edu/pubs/L730.pdf*).

It is helpful to know the functions of ingredients in food preparations. A problem with the finished product may result from the wrong ingredient or proportion. Recipes may also be changed more easily if one understands the purpose of the ingredients.

Understanding weights for common ingredients is also important. A list of volume, ounces, and grams equivalencies for common ingredients can be found at *kingarthurbaking.com/learn/ingredient-weight-chart*.

Terms

Cooking terms are used in many recipes to give clear instructions. Some of these terms are listed below.

Alternating: A recipe may instruct "add dry and wet ingredients alternating." Mix all wet ingredients (milk and water) together. Mix all dry ingredients (flour, salt, baking soda, spices) together. Start and end with dry ingredients:

- add ⅓ of dry ingredients
- add ½ of wet ingredients, mix,
- add ⅓ of dry ingredients, mix,
- add ½ of wet ingredients, mix,
- add ⅓ of dry ingredients, mix.

Bake: To cook by dry heat in the oven.

Batter: A mixture of flour, liquid, and other ingredients which can be stirred or poured.

Beat: To mix well with an electric mixer or a spoon until smooth.

Blend: To mix two or more ingredients thoroughly.

Boil: To heat in water that is boiling, bubbles continually rise to the surface and break.

Chop: To cut into small pieces. Pieces do not need to be a consistent size.

Coat: To cover a food by dipping or spreading it with another substance.

Combine: To stir together to make a uniform mixture.

Cream: To mix shortening and sugar until creamy.

Cube: To cut food into uniform squares.

Cut: To divide food with a knife or scissors.

Cut in: To work shortening into flour with pastry blender or forks using cutting motion until shortening is distributed in small particles.

Dice: To cut into small cubes.

Dilute: To add liquid to make the mixture less strong.

Dissolve: To melt or liquefy an ingredient into a solution.

Divided: Ingredient will be used in more than one place. Read entire recipe to determine how the ingredient is divided.

Dry ingredients: Those ingredients that are dry, including flour, salt, baking powder, baking soda, and spices.

Dust: To sprinkle lightly with a dry ingredient, such as flour or sugar.

Fold: To mix new ingredients into a mixture with the spatula motion of down, across, and up.

Garnish: To add edible decoration to a food as it is served.

Glaze: To cover with a glossy mixture that adds flavor and appearance to the food.

Grate: To rub food across a grater to make small particles.

Grease: To rub the surface of the pan with fat to prevent food from sticking.

Grind: To cut or crush food into small pieces with a grinder, blender, or food processor.

Julienne: To cut food into long, thin strips.

Knead: To mix and work the dough by hand or machine.

Lukewarm: Temperature around 95°F; when tested on the inside of the wrist, it will not feel hot or cold.

Mince: To chop or cut into very small pieces.

Mix: To combine ingredients until thoroughly blended.

Pinch: The small amount of a dry ingredient that can be held between the thumb and forefinger for an estimated measure.

Puree: To make food into a thick, smooth mixture with a food mill or blender.

Reconstitute: To add water to restore concentrated foods to their original form.

Reduce: To decrease the volume of liquid by rapid boiling.

Rehydrate: To cook or soak dehydrated foods to restore liquid taken out by drying.

Roux: A mixture of flour and melted fat to make gravy or white sauce.

Scald: To heat to just below the boiling point.

Sift: To shake dry ingredients, usually flour, powdered sugar, or cocoa, through a mesh to add air and separate the lumps from the loose particles.

Simmer: To cook in liquid at a temperature just below boiling. Tiny bubbles will form around the edge of the pan.

Steep: To let food stand in a liquid just below the boiling point to release the flavor or color.

Stir: To mix with a circular motion.

Strain: To separate solid food from liquid with a strainer.

Toss: To mix foods lightly with lifting motions.

Warm: Temperature between 105° and 115°F.

Whip: To rapidly beat foods to add air and volume.

Frequently Asked Questions

Q. My brown sugar is hardened, is it still okay to use?

A. Brown sugar tends to harden because the molasses loses moisture over time. To prevent hardening, store brown sugar in a tightly sealed container or heavy-duty resealable bag, place a small piece of terra-cotta (soaked in water and damp-dried to remove excess water) in the container, or add a slice of fresh bread in the container. If the brown sugar is already hardened, place the sugar in a microwave-safe bowl, cover with a damp paper towel, and heat in 20-second intervals until softened, or place a slice of bread in the sealed container with the sugar, and it will soften by the next day.

Q. *Can artificial sweeteners be used in food preparations?*

A. Sugar has many other functions besides sweetness, so the browning, spreading, and other characteristics may change the final product. A sugar substitute that contains some real sugar will help retain those attributes better. Do not replace more than half the sugar in baked goods with a sugar substitute. Many artificial sweeteners will become bitter when heated and do not work well in baked or cooked products. Saccharin and acesulfame K-based sweeteners may be used in all kinds of recipes. Always test a recipe made with a sugar substitute before serving it to others, as it may not meet your standards.

Q. *Why do I need to preheat my oven?*

A. Preheating ensures the oven reaches the correct temperature before baking starts. Many baked goods rely on immediate heat for proper rise and texture.

Q. *What kind of food thermometer do I need?*

A. Choose a thermometer designed for the use desired. A meat thermometer will work well for poultry, roasts, ham, casseroles, meatloaves, and egg dishes. A meat thermometer may be inserted in food before and during cooking. An instant-read digital thermometer should not stay in during cooking; it gives a quick reading when inserted. A microwave thermometer is designed for use in the microwave oven only. A candy thermometer is designed for high temperature liquids on top of the range.

Resources

Food: A Handbook of Terminology, Purchasing and Preparation. American Association of Family and Consumer Sciences. 2013.

Food & Nutrition for You. Authors: Weixel and Wempen. 2010.

Essential Living Skills: Essential Food, Nutrition, and Physical Activity Skills. Kansas State Research and Extension *ksre.ksu.edu/bookstore/pubs/S134B.pdf*

Home Baking Association. *homebaking.org*

Topics for Additional Study/Trainings

- Making Recipes Healthier
- Nutrient Analysis

Check Yourself Questions

1. What is the abbreviation for pound?
2. How many ounces in a pound?
3. How many tablespoons are in a stick of butter or margarine?
4. What ingredient should be packed when measuring?
5. What type of baking pans will produce the most evenly-browned cookies?
6. How should cake pans be prepared before baking?
7. When mixing ingredients alternately, how many parts of the liquid and the dry ingredients will you have?
8. If one recipe calls for diced potatoes and one recipe calls for cubed potatoes, which would have the smallest pieces of potatoes?
9. What is the difference between reconstitute and rehydrate?
10. To add air and volume to a product, would you stir, fold, or whip?

Answers

1. Lb. or #
2. 16 ounces = 1 pound
3. 8 tablespoons, 1 stick of butter or margarine = ½ cup
4. Brown sugar should be packed when measuring.
5. Shiny pans reflect heat and bake more evenly.
6. Cake pans should be lightly oiled or greased with a paper towel and fat or sprayed with a nonstick cooking spray and dusted with flour.
7. Generally, the liquid would be added in two separate parts and the dry ingredients in three separate parts: dry, liquid, dry, liquid, dry.
8. Diced particles are smaller than cubed.
9. Reconstitute is to add liquid to a concentrate that has had the liquid removed. Rehydrate is to soften or plump food that has been dried, by cooking or soaking.
10. The rapid motion of whipping will add air and volume.

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S157 June 2026

Chapter 5

Whole Grains, Ancient Grains, and Gluten-Free Foods

Basic Principles

Upon competition of this lesson, the Master Food Volunteer will be able to:

1. Identify different types of grains used in foods.
2. Explain the general principles of cooking or baking grain foods.
3. Understand the various techniques for different baked products.
4. Determine causes of problems in baked products.
5. Understand how to prepare rice, pasta and other grain foods.

Key Concepts

- Tips to incorporate and choose more whole grains into your diet.
- Nutritional recommendations for consuming whole grains.
- Learn about sprouted grains.
- Learn about ancient grains.
- Challenges and guidelines for making gluten-free baked goods.

Whole Grains

Any food made from wheat, rice, oats, cornmeal, barley, or another cereal grain is a grain product. Bread, pasta, oatmeal, breakfast cereals, tortillas, and grits are examples of grain products.

Grains are divided into two subgroups, whole grains and refined grains. Whole grains contain the entire grain kernel — the bran, germ, and endosperm. Examples of whole grains include whole-wheat flour, bulgur (cracked wheat), oatmeal, whole cornmeal, and brown rice.

Tips to Help You Eat Whole Grains

At meals:

- To eat more whole grains, substitute a whole-grain product for a refined product — such as eating whole-wheat bread instead of white bread or brown rice instead of white rice. It's important to *substitute* the whole-grain product for the refined one, rather than *adding* the whole-grain product.
- For a change, try brown rice or whole-wheat pasta. Try brown rice stuffing in baked green peppers or tomatoes and whole-wheat macaroni in macaroni and cheese.
- Use whole grains in mixed dishes, such as barley in vegetable soup or stews and bulgur wheat in a casserole or stir-fry.
- Create a whole grain pilaf with a mixture of barley, wild rice, brown rice, broth, and spices. For a special touch, stir in toasted nuts or chopped dried fruit.
- Experiment by substituting whole-wheat or oat flour for up to half of the flour in pancake, waffle, muffin, or other flour-based recipes. They may need a bit more leavening.
- Use whole-grain bread or cracker crumbs in meatloaf.

- Try rolled oats or a crushed, unsweetened whole-grain cereal as breading for baked chicken, fish, veal cutlets, or eggplant parmesan.
- Try an unsweetened, whole grain ready-to-eat cereal as croutons in salad or in place of crackers with soup.
- Freeze leftover cooked brown rice, bulgur, or barley. Heat and serve it later as a quick side dish.

As snacks:

- Snack on ready-to-eat, whole-grain cereals such as toasted oat cereal.
- Add whole-grain flour or oatmeal when making cookies or other baked treats.
- Try 100 percent whole-grain snack crackers.
- Popcorn, a whole grain, can be a healthy snack if made with little or no added salt and butter.

What to Look for on the Food Label

- Choose foods that name one of the following whole-grain ingredients first on the label's ingredient list:
  - brown rice
  - buckwheat
  - bulgur
  - millet
  - oatmeal
  - popcorn
  - quinoa
  - rolled oats
  - whole-grain barley
  - whole-grain corn
  - whole-grain sorghum
  - whole-grain triticale
  - whole oats
  - whole rye
  - whole wheat
  - wild rice
- Foods labeled with the words "multi-grain," "stone-ground," "100% wheat," "cracked wheat," "seven-grain," or "bran" are usually not whole-grain products.

- Color is not an indication of a whole grain. Bread can be brown because of molasses or other added ingredients. Read the ingredient list to see if it is a whole grain.
- Use the Nutrition Facts label and choose whole-grain products with a higher percent Daily Value (percent DV) for fiber. Many, but not all, whole grain products are good or excellent sources of fiber.
- Read the food label's ingredient list. Look for terms that indicate added sugars (such as sucrose, high-fructose corn syrup, honey, malt syrup, maple syrup, molasses, or raw sugar) that add extra calories. Choose foods with fewer added sugars.
- Most sodium in the food supply comes from packaged foods. Similar packaged foods can vary widely in sodium content, including breads. Use the Nutrition Facts label to choose foods with a lower percent DV for sodium. Foods with less than 140 mg sodium per serving can be labeled as low-sodium foods. Claims such as "low in sodium" or "very low in sodium" on the front of the food label can help you identify foods that contain less salt (or sodium).

Whole Grain Tips for Children

- Set a good example for children by eating whole grains with meals or as snacks.
- Let children select and help prepare a whole-grain side dish.
- Teach older children to read the ingredient list on cereals or snack food packages and choose those with whole grains at the top of the list.

How Many Grain Foods Are Needed Daily?

The amount of grains you need to eat depends on your age, sex, and level of physical activity. Recommended daily amounts are listed in the table below. Most Americans consume enough grains, but few are whole grains. At least half of all the grains eaten should be whole grains. Current Dietary Guidelines recommend consuming 2 to 4 servings of whole grains each day.

Below are examples of specific amounts that count as 1 ounce-equivalents.

- **Bagel:** 2 inch mini bagel, ½ regular-size bagel, ¼ large bagel
- **Biscuit, muffin:** 1 small (2-inch diameter)
- **Breads:** 1 regular slice, 1 small slice French, 4 snack-size slices rye bread
- **Ready-to-eat breakfast cereal:** 1 cup flakes or rounds, 1¼ cups puffed
- **Cooked grains (e.g., bulgur, couscous, quinoa):** ½ cup cooked
- **Cornbread:** 1 small (2½ inches by 1 inch by 1½ inches)
- **Crackers:** 5 whole wheat crackers, 2 rye crisp breads, 7 square or round crackers
- **English muffin:** ½ muffin
- **Oatmeal:** ½ cup cooked, 1 packet instant, 1 ounce (⅓ cup) dry (regular or quick)
- **Pancakes, waffles:** 1 (4½-inch diameter), 2 small (3-inch diameter)
- **Popcorn:** 3 cups, popped
- **Rice, pasta:** ½ cup cooked, 1 ounce dry
- **Tortillas:** 1 small flour (6-inch diameter), 1 corn (6-inch diameter)

The *Whole Grains Council* has *Whole Grain Stamps* to help consumers identify the amount of whole grains in a product. The goal is to consume at least 48 grams (48 g) of whole grains every day.

- If a product bears **the 100% Stamp**, then ***all* grain ingredients are *whole* grain**. There is a minimum requirement of 16 grams (16 g) — a full serving — of whole grain per labeled serving, for products using the 100% Stamp.
- If a product bears **the 50%+ Stamp, at least half of its grain ingredients are *whole* grain**. There is a minimum requirement of 8 grams (8 g) — a half serving — of whole grain per labeled serving, for products using the 50%+ Stamp. The 50%+ Stamp was added to the Whole Grain Stamp family in 2017.
- If a product bears **the Basic Stamp**, it contains at least 8 grams (8 g) – a half serving – of whole grain, but may also contain some refined grain.

10 Tips: Choosing Whole-Grain Foods

Whole grains are important sources of nutrients such as zinc, magnesium, B vitamins, and fiber. There are many choices available to make half your grains whole grains. But whole-grain foods should be handled with care. Over time, and if not properly stored, oils in whole grains can cause spoilage. Consider these tips to select whole-grain products and keep them fresh and safe to eat.

1. **Search the label.** Whole grains can be an easy choice when preparing meals. Choose whole-grain breads, breakfast cereals, and pasta. Look at the Nutrition Facts label and ingredients list to find choices lower in sodium, saturated (solid) fat, and added sugars.
2. **Look for the word "whole" at the beginning of the ingredients list.** Some whole-grain ingredients include whole oats, whole-wheat flour, whole-grain corn, whole-grain brown rice, and whole rye. Foods that say "multi-grain," "100% wheat," "high fiber," or are brown in color may not be a whole-grain product.
3. **Kids can choose whole grains.** Your kids can choose whole grains at school. Encourage healthier choices at home by adding whole grains into their favorite recipes, meals, and snacks.
4. **Find the fiber on the label.** If the product provides at least 3 grams of fiber per serving, it is a good source of fiber. If it contains 5 or more grams of fiber per serving, it is an excellent source of fiber.
5. **Is gluten in whole grains?** People who can't eat wheat gluten can eat other whole grains if they choose carefully. There are many whole-grain products, such as buckwheat, certified gluten-free oats or oatmeal, popcorn, brown rice, wild rice, and quinoa that fit gluten-free diet needs.
6. **Check for freshness.** Buy whole-grain products that are tightly packaged and well sealed. Grains should always look and smell fresh. Also, check the expiration date and storage guidelines on the package.
7. **Keep a lid on it.** When storing whole grains from bulk bins, use containers with tight-fitting lids and keep in a cool, dry location. A sealed container is important for maintaining freshness and reducing bug infestations.
8. **Buy what you need.** Purchase smaller quantities of whole-grain products to reduce spoilage. Most grains in sealed packaging can be kept in the freezer.
9. **Wrap it up.** Whole-grain bread is best stored at room temperature in its original packaging, tightly closed with a quick-lock or twist tie. The refrigerator will cause bread to lose moisture quickly and become stale. Properly wrapped bread will store well in the freezer.
10. **What's the shelf life?** Since the oil in various whole-grain flours differs, the shelf life varies too. Most whole-grain flours keep well in the refrigerator for 2 to 3 months and in the freezer for 6 to 8 months. Cooked brown rice can be refrigerated 3 to 5 days and can be frozen up to 6 months.

Sprouted Whole Grains

Currently, there is no official definition of a "sprouted grain." According to the Cereals and Grains Association, "Malted or sprouted grains containing all of the original bran, germ, and endosperm shall be considered whole grains as long as sprout growth does not exceed kernel length and nutrient values have not diminished. These grains should be labeled as malted or sprouted whole grain."

When a grain seed sprouts, enzymes within the grain transform endosperm starch into simpler molecules that are more easily digested. Therefore, when consumed, you get the goodness of whole grains that are more readily digested. The sprouting process apparently increases the bio-availability of some vitamins and minerals.

The process of sprouting grains must be controlled to get maximum benefit. The combination of the right amount of time, moisture, and temperature are important to get the best end product. Companies that sprout grains use carefully controlled conditions to get the enzymatic process to perform at its peak.

According to the Whole Grains Council, sprouted whole grains offer these *possible health benefits*:

- Sprouted brown rice fights diabetes.
- Sprouted buckwheat protects against fatty liver disease.
- Cardiovascular risk is reduced by sprouted brown rice.
- Sprouted brown rice decreases depression and fatigue in nursing mothers.
- Decreased blood pressure is linked to sprouted barley.

Ancient Grains

There is no official definition of "ancient grains." However, the *Whole Grains Council* defines ancient grains loosely as grains that are largely unchanged over the last several hundred years. Therefore, modern wheat, which has been bred and changed over time, is not an ancient grain. Grains such as quinoa, amaranth, Kamut®, spelt, farro, millet, and teff would be considered ancient grains.

Here is some information about three of the more common ancient grains:

- **Quinoa:** A versatile grain that cooks quickly and is good in soups, salads, and baked goods. Quinoa is a small round grain similar in appearance to sesame seeds. It is also high in protein.
- **Kamut®:** This large, oversized grain is two to three times bigger than wheat. It has a rich, buttery flavor and is easily digested.

- **Farro:** This grain is popular in Italy. It is a dark, earthy grain often used in salads and risottos.

Ancient grains are certainly healthier than refined grain products such as white bread or refined crackers. However, healthy whole grains do not need to be exotic. Common foods such as brown rice, whole-grain pasta, oatmeal, popcorn, and whole-wheat bread offer many health benefits and often at lower prices. To get the different nutrients each grain has to offer and balance cost, eat a variety of grain foods.

Cereal Grains

Many grains are eaten as cereals. Cooking allows the starch to absorb liquid, which will swell and soften the grain.

Grains and cereals are cooked in water to soften before using. Package directions give times and amounts of water to use. Most grains have added vitamins to replace those lost in milling and should not be rinsed before preparing to conserve those vitamins.

Rice

Rice is one of the world's oldest foods and is now a staple for two-thirds of the world's population. Rice can be used in soups, salads, main dishes, and desserts. Rice is available as brown rice (whole grain) and white rice (refined). Rice flour is also available, and is popular with those who are allergic to wheat products or have gluten intolerance.

Many types of rice are grown. Long grain rice is a long, slender kernel. Medium grain rice has a kernel that is 2 to 3 times longer than it is wide. Short grain rice has an almost round kernel. Aromatic rice has a natural aroma and a flavor similar to popcorn or roasted nuts. Sweet rice is an opaque white grain that is very sticky when cooked.

Rice is available in several forms. The most common in the U.S. is precooked white or brown rice that has been completely cooked and dehydrated after milling, also referred to as instant rice. It is very quick to prepare . Regular rice is milled, with the hull and bran layer removed and is usually enriched.

Parboiled rice has been processed with steam pressure before milling and makes a fluffy cooked product with separate kernels. Brown rice has only the hull removed and when cooked is slightly chewy with a nut-like flavor.

Rice is cooked in water with optional salt, oil, margarine or butter. The amount of water varies according to the type of rice. The package should give instructions for preparation. The water and rice are brought to a boil, covered and simmered until the rice is tender and the liquid is absorbed. Yield is 3 to 4 cups for 1 cup of uncooked rice. Rice is fluffed with a fork before serving.

Bulgur

Bulgur is precooked cracked wheat. It may be sold as a pilaf or tabouli mix. It may be used in meatloaf, soup, a casserole with meat, or as a meat substitute. It may also be used in quick breads, salads, and baked goods for a nutty taste.

Couscous

Couscous is a type of pasta made from wheat; it may be served as a side dish by itself or with vegetables.

Corn

Corn grains produce cornmeal for baked products, polenta (an Italian-style cornmeal), and hominy. Hominy is made from corn treated with lye and can be baked or made into stews, soups, or grits.

Barley

Barley is used in salads and soups or as a substitute for rice. Hulled barley is a whole grain as only the inedible outer hull is removed. Milled barley is called pearled barley and is often used in soups and stews. Pearled barley is not considered a whole grain because some or all of the bran is removed. This kind of barley is commonly found in grocery stores and cooks faster than hulled barley.

Gluten-Free Foods

Baking without gluten (as found primarily in wheat flour) can be challenging because gluten contributes important properties to various types of baked products such as cookies, cakes, pastries, and breads. Gluten development is not as important for cookies as it is for cakes, so gluten-free flours can be substituted with similar results. Cakes and other types of batter-based products, such as pancakes, need gluten for its gas-retaining ability, which produces a light and airy interior structure and a tender crumb.

Recipes calling for 2 cups of flour or less are more successful with gluten-free flour products. Those that use cake flour are easier to adapt as well, because that type of flour contains lower amounts of gluten.

White rice flour and starches can be stored in the pantry but because of a higher fat and protein content, whole-grain flours and meals should be purchased in smaller quantities and stored in the refrigerator or freezer to prevent rancidity.

Some types of flours are flour blends. Flours with stronger flavors would make up no more than 25 to 30 percent of the total blend and should be balanced with neutral flours and starches. It is not advised to use stronger flavored flours, such as bean flours, in delicate recipes. A higher percentage of these flours may be used in baked goods

that include nuts, chocolate, or a high level of spice. Flour blends for quick breads often contain ½ teaspoon xanthum gum per cup of flour, while yeast breads require ¾ teaspoon per cup.

Gluten-free flour dough will be stickier, heavier, and softer than regular wheat flour dough because there is little to no elasticity to the dough without the gluten. For these reasons, use a batter beater, not a dough hook, and a heavy-duty stand-up mixer to beat extra air into the dough and help blend it thoroughly.

Gluten-free baking can be a trial-and-error process. Here are some tips that can help achieve successful results.

To Increase Nutrition

- Combine a variety of gluten-free flours to maximize nutrition.
- Use whole-grain or enriched gluten-free flours (vitamins and minerals have been added).
- Substitute up to ¼ cup ground flaxseeds plus ¼ cup water for ¼ cup flour in a recipe (flax will absorb more moisture).

To Increase Moisture

- Add gelatin, an extra egg, or oil to the recipe.
- Honey or rice malt syrup can help retain moisture.
- Brown sugar often works better than white sugar.
- Dough enhancers improve tenderness and staling resistance.

To Enhance Flavor

- Add chocolate chips, nuts, or dried fruits.
- Double the amount of spices.

To Enhance Structure

- Use a combination of gluten-free flours and mix together thoroughly before adding to other ingredients.

- Add dry milk solids or cottage cheese into recipe.
- Use evaporated milk in place of regular milk.
- To reduce grainy texture, mix rice flour or corn meal with liquid. Bring to a boil and cool before adding to the recipe.
- Add an extra egg or egg white if the product is too crumbly.
- Do not overbeat; kneading time is shorter since there is no gluten to develop.
- When using a bread machine, use only one kneading cycle.

Leavening

- Starch flours need more leavening than wheat flours.
- Rule-of-thumb: start with 2 teaspoons baking powder per cup of gluten-free flour and adjust downward as needed for altitude.
- If baking soda and buttermilk are used to leaven, add 1⅛ teaspoon cream of tartar for each ½ teaspoon baking soda used to neutralize acid.
- For better rise, dissolve leavening in liquid before adding to other ingredients or add a little extra baking powder.

Texture/Lightness

- Sift flours and starches prior to measuring. Combine and sift again (together) after measuring to improve the texture of the product.
- Hold gluten-free dough at least ½ hour (up to overnight) in the refrigerator to soften and improve the final texture of the product.
- In products made with rice flour or cornmeal, mix with the liquid called for in the recipe. Bring to a boil and cool before adding to recipe to help reduce grainy texture.

Baking Pans and Utensils

- Bake in smaller-than-usual portions at a lower temperature for a longer time (small loaf pans instead of standard size; use mini-muffins or English muffin tins instead of large muffin tins).
- Use dull or dark pans for better browning.
- Keep a separate sifter to use with gluten-free flours to prevent cross-contact with gluten.

Freshness

- Gluten-free baked goods can lose moisture and quality quickly. Wrap them tightly and store in the refrigerator or freezer in an airtight container to prevent dryness and staling.
- Refrigerate all flours for freshness and quality but bring to room temperature before measuring.

Resources

food.unl.edu

blogs.extension.iastate.edu

bookstore.ksre.ksu.edu/pubs/4H488.pdf

wholegrainscouncil.org/

Additional Resources

Healthy Whole Grains

Wheat Foods Council

Kansas Wheat

Whole Grains Council

Home Baking Association — Converting a Recipe to Whole Grains

Profiles of Alternative Grains and Pseudo-Cereals: Gluten-Free Flours and Starches

Type	Characteristics
Amaranth	Pseudo-cereal native to South America Higher in protein, fiber, and iron than most grains; provides structure and binding capability; pleasant, peppery flavor Best used in combination with other gluten-free flours
Arrowroot	Used as thickener and in baking similarly to cornstarch
Bean/Legume	Legume flours include fava beans, garbanzo beans, soybeans Good source of protein and fiber Best used in combination with other gluten-free flours to balance taste and texture Bean flours complement sorghum flour
Buckwheat	Nutritious grain rich in B-vitamins, magnesium, dietary fiber and antioxidants Strong, somewhat bitter flavor Best used in pancakes or yeast breads in combination with neutral gluten-free flours
Chia (Salba)	Like flax, ground chia seeds can add nutritional value to baked goods Neutral in flavor
Corn flour	Used in breads, waffles, and tortillas
Cornmeal	Used in spoon breads and baking powder-leavened breads
Corn starch	Works well in combination with tapioca starch
Flax	Ground flax seeds increase nutritional value High in soluble fiber, which allows gel formation; retains moisture and gives spongy texture to baked goods Nutty, bold flavor Adds color to baked goods
Millet	Powdery consistency, color similar to cornmeal Delicate, sweet flavor Suitable for use in flatbreads and muffins
Montina (Indian rice grass)	Milled from a grass native to Montana High in fiber and protein
Nut	Nut flours include almond, pecan, walnut, hazelnut, filbert, and chestnut Contribute flavor and nutrition to baked products Best used in combination with other gluten-free flours to balance taste and texture

Profiles of Alternative Grains and Pseudo-Cereals: Gluten-Free Flours and Starches

Type	Characteristics
Quinoa	Pseudo-cereal native to South America Good source of protein, folate, copper and iron Mild, slightly nutty flavor Suitable for cookies, cakes and breads
Potato flour	Neutral flavor Blends well with stronger flavored flours
Potato starch	Provides a light consistency to baked products; helps retain moisture, combines well with eggs; bland flavor, low in fiber and nutrients
Rice, Rice bran	Comes in brown, white and sweet varieties Best used when combined with other gluten-free flours and binders or gums Neutral flavor Sweet rice flour is used in pie crusts and as a thickener
Sorghum (milo)	Tropical cereal grass native to Africa Sweet, nutty flavor Best when used with other neutral gluten-free flours and gums
Teff	Small cereal grain native to Africa Taste similar to hazelnuts Very high in nutrients Ability to gel makes it a good thickener
Tapioca	Starchy, sweet flavor Adds chewy texture to breads Used in blends to improve color and crispiness of crusts

Check Yourself Questions

1. What is the definition of a whole grain?
2. If bread has a brown internal color, is it a whole grain bread?
3. How do I know a grain product is considered a good source of fiber?
4. Are ancient grains healthier than traditional grains such as wheat?
5. What kinds of grains are considered gluten-free?

Answers

1. Whole grains contain the entire grain kernel — the bran, germ, and endosperm. Examples of whole grains include whole-wheat flour, bulgur (cracked wheat), oatmeal, whole cornmeal, and brown rice.
2. Color is not an indication of a whole grain. Bread can be brown because of molasses or other added ingredients. Read the ingredient list to see if it is a whole grain.
3. If the product provides at least 3 grams of fiber per serving, it is a good source of fiber. If it contains 5 or more grams of fiber per serving, it is an excellent source of fiber.
4. Ancient grains are certainly healthier than refined grain products such as white bread or refined crackers. However, healthy whole grains do not need to be exotic. Common foods such as brown rice, whole grain pasta, oatmeal, popcorn, and whole-wheat bread offer many health benefits and often at lower prices.
5. There are a variety of gluten-free grain products. Typically, a combination of three to four types of flour are used in baking. Some examples are from rice, sorghum, beans, potatoes and tapioca.

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S157 June 2026

Chapter 6

Preparing Fruits and Vegetables

Basic Principles

Upon completion of this lesson, the Master Food Volunteer will be able to:

1. Discuss guidelines for using fruits and vegetables in meals.
2. Understand the forms of fruits and vegetables available at stores and the best form for a specific use.

Key Concepts

- A wide variety of fruits and vegetables are available in grocery stores today, and general preparation methods can be used on most produce.
- Careful preparations will retain nutrients, making the fruit or vegetable both nutritious and appetizing.
- Fruits and vegetables are easy and often quick to prepare.

Fruits

Fruits are available in familiar varieties such as apples and bananas, and today in growing amounts of less familiar varieties. Fruit, as a sweet ending for a meal or as a snack, provides more nutrition than many traditional desserts or snacks.

Buying and Serving Fruit

- Choose good-quality fruit that is fresh and free of blemishes and bruises. Fruit should be mature, of full size, and color. By buying fruit in different stages of ripeness, fruit will be at its peak quality at different times rather than all at once. Purchase fruit that has reached

its full color. Fruit purchased when green, except bananas, usually will not continue to ripen. However, after fruit has started to ripen, it may be hastened by placing it in a brown paper bag at room temperature. Ripe fruit will be soft to the touch and very aromatic.

- Fresh fruit will keep for several days in the refrigerator at 35° to 40°F. Most fruits can be eaten raw. To prevent the enzymatic browning that occurs in some fruits, cut surfaces may be dipped in citrus juice, such as orange or lemon.
- Fruit may also be cooked and served hot or cold. Cooking and the addition of spices, other fruits, or other foods can vary the presentation.
  - When cooking, it is best to use as little liquid as possible to retain natural sweetness. Poaching will retain the fruit's shape. Fruit is submerged into simmering poaching syrup of sugar and water and cooked until tender. The syrup will help the fruit retain its shape.
  - Fruit may also be stewed when retaining the shape is not desired. Fruit sauces may be created by cooking small pieces of fruit with water until the fruit softens and the texture is broken up.
  - Firm fruits may be baked. Many fruits can be successfully cooked in the microwave. This quick method retains the flavor and shape of the fruit.
- Canned and frozen fruits are available and may be stored for a longer time, making them convenient and available. Fruit juices are made from most fruits and found in the grocery store in canned, frozen, concentrated, and powder forms.
- Dried fruits are convenient for snack mixes or for use in recipes. They should be stored in a dark, cool space and can be soaked in a small amount of hot water before use. Fruit leathers have become a popular snack. They are made with a fruit puree.

Vegetables

Various parts of edible vegetable plants are eaten — stems, roots, leaves, bulbs, flowers, seeds, even the fruits. Some vegetables are actually the fruit of a plant, but are classified as vegetables because of the way they are used. Some examples are tomatoes, cucumbers, and eggplants.

Buying and Serving Vegetables

- When buying vegetables, the consumer can choose fresh, frozen, or canned. Dried vegetables are found in soup and boxed casserole mixes, as well as packaged individually, such as dried peppers, tomatoes, and mushrooms. Store most fresh vegetables in the crisper drawer of the refrigerator, except potatoes, sweet potatoes, and onions. Those vegetables should be stored in a cool, dry place. Onions should ideally be stored away from potatoes because onions emit ethylene, which can cause potatoes to sprout.
- Most vegetables are cooked to soften the fiber and make starches more digestible. Some, such as broccoli, carrots, cauliflower, celery, jicama, mushrooms, radishes, sweet peppers, and tomatoes, can also be eaten raw. Many people like to cut these vegetables into serving sizes and keep them in a bag in the refrigerator for quick use. It is important to thoroughly rinse vegetables that will be eaten raw.
- Those vegetables with tough fiber and thick skins are better cooked. Cooking changes the texture, color, and flavor of vegetables and destroys some of the vitamins. The time it takes to cook vegetables depends on the size of the pieces and the variety and maturity of the vegetable. Vegetables should be cooked to a tender, but still crisp, stage.

Overcooked vegetables may become mushy, develop strong flavors, and lose nutrients. Similar cooking methods are used for fresh, frozen, and canned vegetables, but frozen and canned foods will take less time to cook.

- A common method of cooking vegetables is in a saucepan with water. The water is brought to a boil, vegetables added and brought to a boil again. Then the heat is lowered, and the vegetables are covered and allowed to simmer until tender.
- Vegetables may be steamed in a basket over a saucepan. This method conserves nutrients.
- Microwaving is also a way to conserve nutrients, color, texture, and flavor. This is a quick method that uses a small amount of water. The vegetables will continue to cook during a three-minute resting time following microwaving. Vegetables with intact skins, such as whole potatoes, should be pierced to allow steam to escape. Microwaving is an especially good method for reheating leftover vegetables to prevent greater losses of vitamins.
- Vegetables with a high moisture content may be baked, such as starchy (not waxy) potatoes, and sweet potatoes. Vegetables are often added to cook with a roast or roasted with a small amount of oil or liquid in the oven. Various methods of frying vegetables may be used, such as sauté, stir-fried, deep fried, or pan fried. These methods add fat to the vegetable and are discussed in Chapter 3.
- Cruciferous vegetables — including broccoli, brussels sprouts, cabbage, cauliflower, and turnips — have a strong cooking aroma. Store in the refrigerator and cook quickly until just tender-crisp.

- Shorter cooking times help vegetables retain their bright colors as well as nutrients. Adding a little lemon juice or vinegar to the cooking water of beets and red cabbage will help retain color in these vegetables.
- Many recipes for side dishes and main dishes provide a variety of ways to prepare and cook vegetables. Choose methods that conserve the quality, flavor, and nutrients of the vegetable.

Phytochemicals

In recent years, research has been discovering that fruits and vegetables are playing a much more significant role in overall health. In addition to the necessary dietary nutrients that plants provide — minerals, vitamins and fiber — they also produce compounds called phytochemicals.

Phytochemicals are not necessary nutrients in the diet, but they have protective, disease-preventing properties that may help guard against diseases such as cancer, diabetes, cardiovascular disease, and hypertension. Like any other newly discovered chemical, potential health benefits and risks must be investigated. Research must be done to determine optimal intake levels for different genders, age groups, and body types.

Phytochemicals can be incorporated into the diet quite easily. Most consumers do not eat the recommended servings of fruits and vegetables each day. Some simple solutions are:

- Always keep fruits and vegetables on hand.
- Drink 100% fruit juice instead of soda.
- Add fruit to cereal, yogurt, pancakes, muffins, etc.
- Purchase chopped vegetables from the salad bar to use as snacks.
- Add vegetables to soups.
- Buy dried fruits for an easy snack.

Some promising foods that can help prevent diseases include:

- Cruciferous vegetables such as broccoli, cauliflower, and bitter greens can help reduce cancer risk.
- Celery and an overall healthy diet may help reduce high blood pressure.
- Tomatoes and watermelon contain lycopene, which may help prevent cancer and heart disease.
- Deeply colored fruits and vegetables (beets, dark greens, blueberries, oranges, etc.) contain high levels of antioxidants that may help prevent cancer.

Besides fruits and vegetables, other food sources of phytochemicals include soy foods of all types, flaxseed, nuts, and green tea.

Dietary supplements are very popular among consumers looking for quick results. However, these supplements will only provide selected components in a concentrated form, which can lead to over-consumption. It is recommended to consume a well-rounded diet to get the diversity of compounds that naturally occur in foods. Research is finding that many phytochemicals depend on other plant chemicals to confer beneficial health effects.

With changes occurring in labeling laws, the Food and Drug Administration (FDA) is allowing preapproved health claims to promote foods with phytochemicals and their potential health benefit.

Storing Fresh Vegetables

Fresh fruits and vegetables are perishable and have limited shelf life. After harvesting, vegetables are still viable and continue to respire by using oxygen and releasing carbon dioxide. This process occurs naturally and contributes to deterioration of appearance, texture, and flavor. The faster the respiration rate, the faster it will deteriorate.

Moisture loss is another factor that contributes to spoilage. Most fruits and vegetables have a high moisture content, but moisture is no longer replaced when a plant is harvested. This results in moisture loss and wilting. The key to properly storing vegetables is to slow respiration rate and moisture loss.

Purchasing Imperfect Produce

Imperfect produce is sometimes referred to as "ugly" or "misfits." These products generally do not meet the beauty standards of retailers or consumers. To prevent these products from being wasted, there is a movement to sell imperfect produce. Nutritionally, imperfect produce is just as good as perfect produce. One major benefit of imperfect produce — it costs less than perfect produce. **Note:** Imperfect is not the same as "past ripeness," which is actually less nutritious.

Shopping at Ethnic and Farmers Markets

Ethnic and farmers markets are great places to find new and unfamiliar fruits and vegetables. Many markets will also offer recipes and preparation tips. If you are unsure how to use produce, ask. Most retailers are happy to help you learn to use their products.

Terms

Ascorbic acid: Vitamin C. A vitamin that may be used on fruit to prevent or slow the darkening of cut light colored fruit.

Cruciferous: Vegetables from the cabbage family (bok choy, broccoli, brussels sprouts, cabbage, cauliflower, collards, kale, kohlrabi, mustard greens, radishes, rutabaga, turnip, turnip greens, and watercress).

Enzymatic browning: The darkening of the cut edge of some fruits and vegetables due to oxidation when the fruit is exposed to air.

Poach: To cook in hot liquid, carefully retaining the shape of the food.

Steam: To cook over boiling water in a closed container.

Frequently Asked Questions

Q. When must you peel fruits and vegetables?

A. When the peel cannot be eaten. Otherwise, the peel adds fiber. Many vitamins and minerals are found in or close to the peel.

Q. Is drinking a glass of juice as good as eating a piece of fruit?

A. A ¾ cup serving of 100% fruit juice counts as a serving of fruit, but will not contain all the fiber that a piece of fruit does.

Q. What is the difference between mature and ripe fruit?

A. Mature fruits are fully grown but are still hard and have not reached full flavor yet. Ripe fruits are softer and have a more developed flavor.

Additional Publications

Harvest and Storage of Fruits and Vegetables (MF661)

Academy of Nutrition and Dietetics Videos

Fight Bac!® like a ProducePro

Check Yourself Questions

1. What are three qualities to look for in choosing fresh fruits and vegetables?
2. How can you keep fresh cut fruit from turning brown?
3. What are some undesirable changes that can happen if vegetables are over-cooked?
4. How may fruit be cooked to retain its shape?
5. How may fruit be ripened?
6. How does cooking change fruits and vegetables to make them more edible?
7. What parts of vegetable plants may be eaten?
8. What are two things about microwaving vegetables that need to be considered?
9. To what stage or doneness should vegetables be cooked?
10. When should fruits and vegetables be rinsed with water?

Answers

1. Fresh produce should be of a typical shape for the variety, free of blemishes, and not discolored.
2. Freshly cut, light-colored fruit can be dipped in lemon juice or sprinkled with ascorbic acid and water to prevent browning.
3. Overcooking vegetables can cause them to become mushy in texture, dark in color, lose their flavor or develop unpleasant flavors, and lose nutrients.
4. Poaching fruit in gently simmering liquid will retain the shape. Adding sugar to the cooking liquid will also help fruits retain their shape.
5. If the fruit has started to ripen, ripening may be hastened by placing it in a brown paper bag at room temperature.
6. Heat softens the fiber in fruits and vegetables, making them more tender.
7. Different parts of edible plants may be eaten. Depending on the species, the stem, root, leaves, bulbs, flowers, seeds, and fruit of vegetable plants are eaten.
8. When microwaving vegetables, remember to pierce intact skins, such as potatoes, and to allow a resting or standing time at the end of the cooking time when the vegetable will continue to cook.
9. To retain flavor, nutrients, and color, cook vegetables as short a time as possible, until they are tender but still firm or crisp.
10. All fruits and vegetables should be rinsed with water before using, even if they will be peeled. Rinse snack vegetables and fruits to keep in the refrigerator for easy access. Rinse thick-skinned vegetables with a brush. Unless the produce is dirty, it can be rinsed just before using. Rinsing before storing may cause the vegetable to spoil quicker or to mold.

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Chapter 7

Preparing Dairy Foods, Eggs, Meats, and Legumes

Preparing Dairy Foods, Eggs, Meats and Legumes

Upon completion of this lesson, the Master Food Volunteer will be able to:

1. Determine cooking methods for various types of protein foods.
2. Understand the characteristics of different milk products and how they can be used in food preparation.
3. Recognize different varieties of cheese and choose types suitable for different preparations.
4. Better understand preparation methods of egg-based foods.
5. Be able to identify which cuts of meat come from what part of the animal.
6. Determine cooking methods for less tender cuts of meat.

Key Concepts

- Dairy products, eggs, meat, and legumes are all good sources of protein.
- Protein may become tough when cooked. Using the proper temperature and time is important for each food.
- Dairy foods form the base of a variety of side dishes, desserts, and main dishes. The variety of products gives great possibilities for food preparation.
- Eggs require careful preparation for desired results, but can produce light and tender products.
- Meat is available from several species of animals in a wide variety of cuts. Different techniques are best for cooking various cuts depending on the location of the cut, type of meat, tenderness, and degree of fat.

Dairy Foods

Milk

Dairy food products all start from milk, a food that is high in protein, vitamin A, riboflavin, vitamin B12, calcium, phosphorus, magnesium, and zinc. Milk also contains saturated fat and cholesterol. Low-fat milk will produce products that are also lower in fat and cholesterol. Milk products used in food preparation are listed below:

Whole milk is fresh fluid milk with 3 percent fat.

Skim milk or nonfat milk is fluid milk with most of the fat removed; it will have 0.5 percent fat or less.

Low-fat milk is fluid milk with some of the fat removed, usually packaged referring to the percentage of fat, ½%, 1%, 2%.

Fortified milk includes most liquid milk; usually vitamins A and D have been added.

Pasteurized milk is milk that has been processed with heat to kill disease-causing bacteria. All commercially sold milk is pasteurized.

Raw milk is milk that has not been pasteurized. The use of raw or unpasteurized milk is not recommended.

Homogenization is the process of blending the liquid and the fat so that the cream does not separate. All commercially processed milk is homogenized.

Flavored milk is milk mixed with a flavoring, such as chocolate. Products labeled chocolate milk drink or chocolate flavored drink are not the same as milk, and they often contain added sugar. Other flavors include French vanilla, caramel, strawberry, and more. Flavored milk provides calcium, protein, vitamin D, vitamin A, vitamin B12, potassium, phosphorus, riboflavin, and niacin. When compared to soda and fruit drinks, flavored milks are a more nutritious choice. Flavored milks come in reduced fat, low-fat, and fat-free varieties.

Other Milk Products

The fat produced in milk is used as a rich addition in many recipes.

- **Whipping cream** has the highest fat content with 30 to 40 percent. It may also be marketed as light whipping cream (30 to 35 percent fat) or heavy whipping cream (36 to 40 percent fat). Whipping cream may be beaten into a foamy topping for desserts or used to thicken sauces.
- There are many artificial substitutes for whipped cream; many are lower in fat and calories but vary in flavor and texture.
- **Light cream** is often called coffee cream or table cream and is about 18 percent fat.
- **Half-and-half** has a lower fat content, 10 to 12 percent; a lower-fat version is also available on the market.

Milk products may have water removed to create products that are more shelf stable and easily used in recipes.

- **Evaporated milk** may be made from whole milk or skim milk, and about 60 percent of the water is removed. It is sterilized and canned. It may be reconstituted for use as regular milk or used as a concentrate. Evaporated skim milk may be used as an alternate coffee creamer. Some people taste a "cooked" flavor with evaporated milk.
- **Condensed milk or sweetened condensed milk** has about 60 percent of the water removed and is sweetened heavily with sugar.
- **Dried milk** is available in whole and nonfat powders. It may be dissolved in water and used as fresh liquid milk.
- Once any of the canned milks have been opened or the dry milk reconstituted, the product should be treated as fresh milk and stored in the refrigerator.

Some milk products are fermented with specific bacteria to create distinctive flavors and textures.

- **Yogurt** is a thick, custard-like product with a tangy taste. It may be plain or flavored. It is usually made with low-fat milk and offers a low-calorie choice for breakfast, snacks or desserts.
  - **Greek yogurt** is probably best known for its tangy flavor and smooth, velvety texture that sets it apart from the taste and texture of regular yogurt. The difference of taste and texture is a result of the unique straining process. It is strained to remove most of the whey, which results in a thicker and creamier texture. This straining process also removes some of the lactose content, meaning that Greek yogurt is higher in protein than regular yogurt, making it an ideal substitute for a variety of recipes.
  - **Milk kefir** is a fermented beverage that originated centuries ago near the Caucasus Mountains in Eastern Europe. Kefir is the Turkish word for "good feeling," appropriately named for its associated health benefits. The starter culture (called 'kefir grains') looks like small cauliflower florets. Kefir grains consist of lactose-fermenting and non-lactose fermenting yeasts as well as lactic- and acetic acid-producing bacteria, surrounded by a protein matrix called kefiran. Kefir can be considered a 'functional food' since it may provide health benefits beyond supplying nutrients and calories. Kefir is usually sold as a ready-to-drink beverage in both plain and flavored varieties. It can be enjoyed as a refreshing drink, added to smoothies, or used in recipes as a replacement for buttermilk, yogurt, or sour cream. Kefir is similar to yogurt, with its slightly sour flavor and presence of probiotics. However, both yeast and bacteria contribute to kefir's fermentation, whereas only bacteria are involved in the making of yogurt.
- **Sour cream** is thicker than yogurt and has a tangy flavor. It is often used as a dip and may be used in cooking or baking. It should be room temperature when it is to be added to a hot mixture to help keep it from curdling. Sour cream is available in full-fat, reduced-fat, and no-fat products.

Cheese

Cheese is a dairy food made from the process of separating the proteins and other solids in milk from the liquid (called whey). The solids that remain (called curds) are processed to form different types of cheese.

Uncured cheeses have a milder flavor and have not gone through an aging process. Uncured cheeses include:

- **Cottage cheese** is a soft, moist, mild cheese available in small or larger curds. Often considered a "dieter's food," there are various fat levels available. Cottage cheese or creamed cottage cheese will have 4% or more fat. Low-fat cottage cheese contains 0.5% to 2% fat. Nonfat cottage cheese is made from skim milk and has less than 0.5% fat. Cottage cheese is used in salads, dips, and cooked foods.
- **Farmer cheese** is similar to cottage cheese, but firmer.
- **Cream cheese** is a pasteurized mixture of milk and cream with 12% fat. It is often used in salads, sandwiches, spreads, and dips. It also comes in low-fat or fat-free choices.
- **Neufchatel** is similar to cream cheese, but lower in fat.
- **Ricotta** is made from whey rather than the curd of the separated milk product. It is very moist and has a bland, yet semi-sweet, flavor. It is often used in Italian cooking, such as lasagna.

Cured or ripened cheeses are cheeses that have the curds treated with heat, bacteria, enzymes and/or molds, and salt over a controlled period of time in a controlled environment. There are many varieties of cured cheeses, but they fall in these general classifications.

- **Blue cheeses** have a tangy, spicy flavor, are semi-soft, and sometimes crumbly. These cheeses are white, marbled with veins of blue-green mold. The mold

in blue cheese is safe to eat because it is not toxic, unlike some other molds. Blue (Bleu), Gorgonzola, and Stilton cheeses are of this variety. They are used in salads, dips, and dressings.

- **Cheddar** is a hard cheese from pasteurized whole milk, and it can vary in flavor from mild to extra sharp. Flavor is determined by the aging period. Related cheeses are Monterey Jack and Colby, which are milder and are aged for less time. These cheeses are probably the most common and are used in many foods, including sandwiches and cooked foods.
- **Swiss** is the hard, waxy, sweet cheese with holes in it. The holes are made by carbon dioxide bubbles during the aging period. It is used for sauces, sandwiches, and salads.
- **Dutch cheeses** include Edam and Gouda. They are mild and semi-soft to hard-textured and may have small "eyes." Frequently they are packaged with a red wax coating. They are enjoyed with fresh fruit and crackers.
- **Grating cheeses** are hard, brittle cheeses such as Parmesan and Romano. They have a longer curing period and are stronger in flavor. They are usually used grated over salads or Italian foods.
- **Pasta Filata cheeses** are "stretched curd" cheeses. During the processing period, the curd is kneaded and shaped. Mozzarella, string cheese (a type of mozzarella), and provolone are examples. Provolone is usually smoked and may be packaged bound by a cord. These cheeses are used as snacks, sandwiches, and in cooking, especially Italian recipes.
- **Surface-ripened cheeses** are produced with a bacterial or mold culture grown on the surface. This gives each cheese variety its flavor and texture. Brie and camembert are soft cheeses with varying flavors and are originally from France. They are often served as dessert cheeses. Limburger is a strong flavored, strong smelling creamy cheese of Belgium. Muenster is a smooth, creamy, almost sweet, flavored cheese.
- **Feta** is a crumbly, sharp, and salty cheese. It was originally made in Greece from sheep's milk and is often used in cooked foods.

Processed cheeses are made from a blend of fresh and aged natural cheeses with added emulsifiers to produce a uniform flavor and texture. The flavor is less distinctive, but the cheese is easy to slice, there is no waste, and it melts easily. In processing, these cheeses are poured into a mold to retain the shape. Sliced processed cheese is often packaged in individually wrapped slices. Processed cheese food is a similar product, but softer. It may have flavorings added. Processed cheese spread has a higher moisture content.

Cheese enhances the taste of many foods but is heat sensitive, so care must be taken to avoid overheating the prepared food. Cheese melts at temperatures of 300° to 325°F. It is often cubed or shredded to add to foods. High temperatures of more than 350°F and too long of a cooking time can cause the cheese to toughen, become stringy, and the fat to separate. Many cheeses are available in a lower-calorie version, but because they contain less fat, they won't melt as well as regular cheese.

Dairy Desserts

Some favorite desserts are made from dairy foods. Ice cream, puddings, and cheesecakes are among those. Often these are higher calorie choices, but lower calorie options can be found.

Ice cream made at home is a treat for special occasions in many families. The

preparation includes blending the ingredients and hand-turned churning or the use of an electric ice cream freezer. Many recipes are available; however, older recipes with raw eggs that are not cooked into a custard are strongly discouraged. A well-chilled mixture and container will freeze faster. The container should be filled only to about two-thirds of the capacity to allow room for expansion, which gives a lighter texture.

Puddings may be starch-thickened or baked and consist of milk, sugar, and flavorings. Starch-thickened puddings usually contain cornstarch and may be molded. Some cream puddings may contain eggs. These puddings are boiled to cook the starch that thickens the mixture. Baked puddings are similar to custards and contain additional ingredients such as rice or bread. A pan of water in the oven with the pudding during baking will help diffuse the oven heat and keep the pudding from separating. Soft pie fillings are also a type of pudding. Instant pudding mixes are available and make a quick and easy dessert or snack that may be served warm or cool.

Cheesecakes are a rich dessert of eggs, uncured cheese, and liquid. It is important to follow the balance of ingredients and order of instructions given in the recipe for a successful cheesecake. The cheese being used should be at room temperature and beaten until light and fluffy before other ingredients are added. Overbeating later in the process can cause the cheesecake to rise well during baking but fall afterward and become dense and cracked. Cheesecakes should be baked in a slow oven for a long period of time. A pan of hot water on the lower rack of the oven will help eliminate cracks. When the cheesecake is baked, it may still appear soft in the center, but it will firm as it cools. The cheesecake may be cooled in the oven with the door slightly ajar. The cooked cheesecake should be stored in the refrigerator, in its pan, at least 6 hours before serving.

Eggs

Eggs can be prepared in many ways or added to other foods to thicken, moisten, or add flavor. Eggs are a good source of high-quality protein. Because protein can become tough or separate at high temperatures, it is important to cook eggs at a low temperature for a short time. If cooked too long or at too high a temperature, the white shrinks and becomes tough and rubbery, the yolk becomes tough, and its surface may turn gray-green. Bacteria can grow rapidly in eggs, and it is important to use only clean, uncracked eggs and not leave eggs or egg dishes at room temperature for more than two hours. Egg dishes do not stand well and should be served soon after preparation. Raw eggs will keep in the refrigerator for 4 to 5 weeks. As the egg ages, the white becomes thinner and spreads more when broken. Therefore, fresher eggs are best for fried eggs or poached eggs.

Eggs are a popular breakfast food, and there are five basic ways of preparing eggs for breakfast or quick meals.

- **Fried eggs** are cooked in a skillet with a small amount of fat. They may be turned or basted to cook on both sides. For basting, a lid is placed over the frying egg so the top is gently steamed/cooked.
- **Scrambled eggs** are blended, sometimes with a small amount of milk, and stirred as they cook in a skillet.
- **Baked eggs or shirred eggs** are baked in a small shallow baking cup individually in the oven.
- **Poached eggs** are cooked in simmering water in a saucepan. They are broken into a saucer and slipped carefully into gently swirling hot water, one at a time. After simmering for 3

to 5 minutes they are lifted out with a slotted spoon.

- **Hard-cooked eggs** may be used for several recipes, such as deviled eggs, pickled eggs, scotch eggs, or salads. Eggs that are a week or two old before cooking will peel more easily after cooking than fresh eggs. The green ring sometimes found in hard-cooked eggs next to the yolk is from a reaction with the sulfur in the egg white that resulted from too high a temperature or holding the egg at a higher temperature too long.

Eggs may be cooked in the shell to a varying degree of doneness — hard-cooked, soft-cooked, or medium-cooked. For this method, eggs are arranged in a single layer in a sauce pan and covered with water. After the water boils, the pan is removed from the heat and eggs stand in the hot water to continue cooking. After 15 minutes, they are cooled with cold water and removed from the shell to serve or use in recipes.

The properties that make the egg coagulate with heat also make it possible to make delicate baked egg recipes. Omelets, frittatas, and soufflés often sound more difficult to cook than they are.

- **Omelets** are similar to scrambled eggs, beginning with a mixture of egg, liquid, and seasonings. During cooking, the egg mixture is allowed to set at the edges while tilting the pan and lifting the egg mass with a spatula to let the uncooked mixture run to the edges. A filling is added to one side and the mixture is folded over the filling and flipped out of the pan.
- A **frittata** is similar to a flat omelet; the egg mixture and filling ingredients are mixed together and poured into the pan to cook until eggs are almost set. It may be removed from the heat to finish cooking or it may be placed in the broiler for a few minutes to brown.
- **Soufflés** are made with a white sauce and separated eggs. The yolks and added ingredients such as shredded cheese or chopped vegetables are added to the white sauce. Egg whites are beaten until stiff, and the yolk/sauce mixture is folded into the whites.
- **Custards** are defined as a mixture of mainly eggs, milk, and sugar that is cooked or baked. Custards can be a simple dessert or the base of many other dishes. The usual proportion is one egg and 2 tablespoons sugar to 1 cup of milk. It is important to add heated milk gradually to the beaten eggs to prevent overcooking. The coagulation of the egg during cooking makes the custard thicken. Custards may be stirred as they cook to remain pourable or baked without stirring. Custards should not be heated to an internal temperature higher than 185°F. The quiche is a type of custard baked in a pie shell. Homemade ice cream is often made from a custard base; this is preferred to using raw eggs.
- **Stratas** are made by pouring a custard-type egg and milk mixture over cubed bread and cheese.
- **Meringues** are the result of whipped egg whites that are sweetened and stabilized with sugar. This airy mixture can be used to top pies or other desserts, mixed with dried fruit or nuts for cookies and candies, or to top ice cream for Baked Alaska. When beating egg whites, it is important to use equipment that is very clean and free of any type of fat because fat will inhibit the foam formation. Glass and metal bowls work best. Care should be taken that no part of the yolk gets into the white as the eggs are separated. Whites at room temperature will beat to greater volume. Cream of tartar may be added

(⅛ teaspoon per egg) before beating to help stabilize the foam. The foam should be beaten just until it no longer slips when the bowl is tilted. Beaten egg whites will increase 6 to 7 times in volume. Sugar is added slowly during beating, 2 tablespoons per egg for soft meringues and 4 tablespoons per egg for hard meringues. Soft meringues are used on pies with the meringue spread to the edges to seal before baking. Baking will set the meringue and give it a golden brown color. Meringues are more successful on a dry day. Humidity causes the sugar to absorb moisture, making the meringue limp and sticky.

Meat

Meat is a good source of complete protein and the main dish for many meals. Meat generally denotes edible portions of cattle, swine, and sheep as well as fish and poultry. Meats are available at the grocery store in fresh, frozen, canned, and cured forms.

Red meats, such as beef, pork, and lamb, have similar preparation methods. Cuts of meat are taken from the muscle sections of the animal and vary in tenderness and amount of fat. Meat from young animals and cuts from parts of the animal that get less exercise will be more tender. Fat also affects tenderness; the more the meat is marbled with fat, the more tender it will be.

Meat is inspected by the USDA and is graded according to standards that include texture and appearance of the meat, marbling, and age of the animal. A complete list of Grades and Standards can be found at *hams.usda.gov/grades-standards*.

Beef and lamb are graded on quality levels that apply a uniform standard to retail meat.

- **Prime** is the highest grade and the most expensive. It is well marbled with fat, tender, and flavorful. It is found most often in fine dining restaurants. Prime cuts are ideal for broiling, roasting, or grilling.
- **Choice** is the most common grade found in retail stores. It has less marbling but is still tender and flavorful. Less tender Choice cuts are perfect for braising, roasting, or simmering on the stovetop with some liquid.
- **Select** is less expensive with less marbling; it may be offered as a store brand. Select grade meat is great for marinating or braising.
- For graded lamb, **Good** is used for the Select level. Pork is more uniform in quality and is only graded acceptable and unacceptable.

Meat cuts are identified at the grocery store with identification labels that tell the kind of meat (pork, beef, lamb, or veal), the carcass area (sometimes called the primal or wholesale cut), and the specific retail name. For more information on meat labeling, see *Meat Product Labeling and Marketing: What Do All Those Words Really Mean?* (MF3209).

The number of servings per package will vary. Three ounces of cooked meat is considered a serving. Boneless cuts without any waste will usually produce four servings per pound, as there will be some weight loss with juices and/or fat lost during cooking. Cuts with bone included will make 2 to 3 servings per pound. Extremely bony cuts such as ribs may only produce 1 to 1½ servings per pound. Five servings per pound are usually allowed for variety meats.

Flavor, color, and texture are affected by the cooking methods. The color changes from pink or red to beige or brown. Flavor develops and the texture changes as the meat loses fat and moisture and shrinks. The muscle fibers will become more tender with cooking. Meat overcooked by dry heat will be tough, stringy, and chewy. If

overcooked by moist heat, it will be mushy and flavorless. Generally, tender cuts of meat are cooked by dry heat, while less tender cuts are cooked by moist heat. See Chapter 3 for explanations of cooking methods. Meat should be cooked to the recommended internal temperature for food safety. Always use a food or meat thermometer to check for doneness.

Variety Meats

Variety meats are organs, glands, and other tissues that are not part of the dressed carcass. These include liver, lamb and veal kidneys, tongue, heart, and brains. The intestines of pigs are cleaned and made into chitterlings. Tripe is made from the stomach lining of cattle. Sweetbreads are from the thymus gland or pancreas of beef or veal.

Beef

Beef is one of the most widely used meats in the United States. The variety of cuts and recipes make a wide range of food preparations possible. Roasts, steaks, and ground beef are popular choices for many meals.

Beef varies in tenderness according to the part of the animal from which the cut comes and the age of the animal. Those cuts from the suspension muscles that are not used in movement — the rib, short loin, and sirloin cuts — will be more tender. These cuts will roast, broil, or grill well. The muscles that provide movement have more connective tissue and will be less tender. The leg or round, chuck, or shoulder are less tender, and the shank, brisket, and flank are the least tender. These less tender cuts will cook well with moist heat methods such as braising. They can also be roasted at a low temperature for a long period of time. Less tender cuts of meat can also be marinated in a food acid such as vinegar or lemon juice for 6 to 24 hours in the refrigerator before cooking. Some cuts are mechanically tenderized to make ground beef or cubed steaks and can be used in a variety of ways. Stew meat is cut into cubes and cooks well in moist heat.

The fat in beef is found throughout the meat, called marbling, as well as around the outside, called cover. The marbling enhances the flavor and juiciness. The covering helps retain juices while cooking and can be trimmed before serving. The lean part of the meat should be bright red in the package. Vacuum packed beef may have a purplish color but will return to red when exposed to air.

Ground beef may vary in its fat content, but should not be more than 30 percent fat. Ground round will be the leanest type, followed by ground chuck. A consumer can compare the amount of white showing in the package to choose leaner blends. The fat content is also on the label.

Beef is cooked to a degree of doneness best measured by a meat thermometer for internal temperature. Steaks and roasts should be cooked to a minimum of 145˚F, medium at 160˚F, and well done at 170˚F. Ground beef should be cooked to an internal temperature of 160˚F.

Veal

Veal is the meat from very young calves, 1 to 3 months old. It has a mild flavor and very little fat. The cuts are similar to those of beef including roasts, cutlets, and chops. Because veal is from young animals, all cuts are very tender.

Pork

Pork is available in a variety of cuts and serving sizes. Fresh pork may be roasts and chops. Ground pork is also available. Cured pork has been processed with a preservative that gives a distinctive flavor and is often also smoked. This meat is usually rosy-pink in color. Ham is a popular cured product and may be found ready-to-cook or fully-cooked. Pork is also made into processed meats such as sausage, frankfurters, smoked sausages, salami, bologna, and chopped ham.

Leaner cuts will be those that have “leg” or “loin” in the name. Examples are tender-loin, center loin chop, and sirloin roast.

Ground pork should be cooked to an internal temperature of 160˚F. All other pork cuts should be cooked to an internal temperature of 145˚F and allowed to rest at least 3 minutes before consuming. Most cuts can be cooked by dry heat or moist heat methods.

Lamb

Meat from lamb is generally marketed from a young animal and is tender with a delicate flavor. Popular cuts are roasts, lamb chops, and leg of lamb, which may be prepared by many of the same methods used for other red meats.

Ground lamb should be cooked to a minimum internal temperature of 160°F. All other lamb cuts should be cooked to a minimum internal temperature of 145°F and allowed to rest at least 3 minutes before consuming.

Poultry

Poultry meat includes pheasant, chicken, turkey, duck, and goose, as well as smaller game birds such as quail, pigeon, and prairie chicken. Generally, poultry is of two types of meat, white and dark. The white meat is found on the breast and wings and will have less fat, a milder flavor, and will cook faster. Dark meat is from the legs, back, and other parts of the bird. Some birds, such as duck and goose, are all dark meat. The dark meat is more moist, has more fat, and will take longer to cook. The edible organs are called giblets and are often packaged inside the body cavity of a whole cleaned bird and should be removed before cooking. Poultry is sold whole or in cut pieces. Cut pieces may be packaged as a cut up bird or as a package of one cut (such as breasts or legs). It is usually more economical to buy a whole bird and cut it up at home.

Poultry should be cooked at a moderate heat of 325° to 350°F. Popular preparation methods include fried, baked, and roasted. Internal temperature of all poultry should reach 165°F when cooking is completed. Poultry is easily flavored by herbs and spices and combines well with other foods for combination dishes.

Most poultry is sold as young birds, which produce more tender meat. Suitable cooking methods are broiling, barbecuing, roasting, or frying. Mature birds are usually labeled as "mature" or "old" and will be less tender. They are suitable for moist-heat cooking methods such as stewing or baking, or for use in soups, casseroles, salads, or sandwiches.

All poultry is highly perishable and careful handling is recommended. Food safety guidelines should be followed using clean counters and utensils plus attention to times and temperatures for storage and cooking. For more information on poultry preparation, see the USDA information at *fsis.usda.gov/food-safety/safe-food-handling-and-preparation/poultry*.

Fish

Fish is the meat lowest in fat. Many health benefits are attributed to eating fish. Fish is available in many forms, including fresh, frozen, pickled, dried, smoked, and cured.

Fish "cuts" are few and similar, but the variety of species of fish provide a range of flavor characteristics and food choices. There are two basic types of fish; fin fish with fins and internal skeletons, and shellfish with external shells but without fins or internal bones. Sometimes fish are also classified by the type of water they live in — freshwater fish coming from inland lakes, rivers, and ponds, and saltwater or seafood fish from oceans and seas. Fish farms also produce freshwater and saltwater fish and some shellfish.

When preparing fish from a recipe, it is possible to substitute one species of fin fish for another if they are similar in flavor and texture. Some choices for those fish that are light in color, mild flavored, and with a tender texture are catfish, cod, flounder, haddock, halibut, perch, pike, pollock, pompano, red snapper, sole, trout, turbot, and whitefish. For a fish with a stronger flavor, firmer texture, and dark color choices are bluefish, mackerel, salmon, swordfish, and tuna.

Fish may also be cut into fillets (a lengthwise cut with most bones removed) or steaks (a cross cut).

Fish is naturally very tender and will cook quickly. Baking, frying, and broiling are popular methods of preparation. Usually, 10 minutes per inch of thickness is allowed for cooking. If a sauce is used, 5 minutes per inch is added. Fish is done when the flesh is opaque and flakes easily. Care should be taken that the fish does not overcook or dry out during cooking.

Shellfish are of two types. Crustaceans have long bodies with jointed limbs and shell coverings. These include crab, crayfish, lobster, and shrimp. Mollusks are soft bodied, with a shell covering. Clams, mussels, oysters, scallops, and squid are of this type.

Seafood is a significant source of omega-3 fatty acids in the diet. Omega-3s are long-chained polyunsaturated fats that are more unsaturated than vegetable oils. They have been found to boost the immune system responses. They also reduce risks from heart disease, depression, rheumatoid arthritis, allergies, bipolar disorder, attention deficit hyperactivity disorder, stroke, lupus, and a type of renal disease. Examples of omega-3s include eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and alpha linolenic acid (ALA). In nutrient analysis statements, omega-3 values are usually the sum of EPA and DHA. The adult daily requirement is estimated at 300 to 400 mg per day. Some foods high in omega-3s include various types of fish, flaxseed, oat and wheat germ, walnuts, canola oil, spinach, broccoli, cauliflower, and leafy greens.

Processed Meats

Many types of meats, or combinations of meats, are made into processed meat products. These are often cured, which gives a distinctive flavor to the food and extends the shelf life. Bacon and ham are often cured and smoked.

Sausages are made of ground meat, flavorings, and preservatives. Cold cuts (or "lunch meat") are also precooked and sliced, making them convenient and ready to eat. Processed meats make up about 35 percent of the meat sold in the United States.

Cooking Meat with Dry Heat

Roasting cooks meat slowly and evenly in an open pan without added moisture.

- Meat is placed on a rack in a shallow roasting pan, fat side up. Meat may be seasoned before cooking, at the end of cooking, or after cooking. Flavorings do not penetrate deeper than 1 inch and salt may draw juices out of meat. It may be preferable to use a marinade or rub a few hours before cooking, season after cooking, or only season the gravy or juices that will be served with the roasted meat. Whole poultry should have the legs tied and the wing tips tucked under the neck.
- Meat is roasted uncovered and without water at a constant low temperature between 250° to 325°F. The larger the cut of meat, the lower the temperature should be to allow for even cooking.
- The meat is done when the internal temperature, measured with a meat thermometer is 5° to 10° below the desired level. (145°F = medium rare, 160°F = medium).
- Lower roasting temperatures are appropriate for large beef roasts. Poultry, however, should be roasted in a 325°F oven.
- Remove the roasted meat from the oven, cover and allow it to stand in a warm place for 15 minutes. The internal temperature will continue to rise to the desired doneness and the roast will be juicier and easier to cut.

Safe Minimum Cooking Temperatures

Catagory	Food	Temperature (°F)	Rest Time
Ground meat and meat mixtures	Beef, pork, veal, lamb	160	None
	Turkey, chicken	165	None
Fresh beef, veal, lamb	Steaks, roasts, chops	145	3 minutes
Poultry	Chicken and turkey, whole	165	None
	Poultry breasts, roasts	165	None
	Poultry thighs, legs, wings	165	None
	Duck and goose	165	None
	Stuffing (cooked alone or in bird)	165	None
Pork and ham	Fresh pork	145	3 minutes
	Fresh ham (raw)	145	3 minutes
	Precooked ham (to reheat)	140	None
Eggs and egg dishes	Eggs	Cook until yolk and white are firm	None
	Egg dishes	160	None
Leftovers and casseroles	Leftovers	165	None
	Casseroles	165	None
Seafood	Fin fish	145 or cook until flesh is opaque and separates easily with a fork.	None
	Shrimp, lobster, and crabs	Cook until flesh is pearly and opaque.	None
	Clams, oysters, and mussels	Cook until shells open during cooking.	None
	Scallops	Cook until flesh is milky white or opaque and firm.	None

Broiling is a quick cooking method that creates a crisp outside on the tender cut of meat while cooking the inside to the desired doneness.

- Broiling may be done in the oven. Read the owner's manual from the oven manufacturer to determine if the oven should be preheated and if the oven door should be left ajar during broiling.
- Meat is placed on a broiler rack; thin meat is placed 2 to 3 inches from the heat source, thicker meat should be 3 to 6 inches from the heat. If there is a fat layer around the edge, such as on steaks, it is helpful to slash the fat to prevent curling. Chicken should be broiled with the skin on and then, if desired, the skin can be removed before eating. This will help prevent drying. Fish may be brushed with butter or a sauce to keep it moist.
- Broil the meat until it is almost half cooked through and the surface has the desired brownness. Turn the meat with tongs and broil the other side.
- The meat may be marinated before broiling or seasoned after broiling.

Grilling is similar to broiling but is done on a grill with the heat source below the meat.

- The grill may be an outdoor gas or charcoal grill or part of a kitchen range.
- Grill one side of the meat at a time, turning when meat is about halfway to desired doneness. Meat should be turned with tongs to avoid piercing and allowing juices to escape.
- The temperature of the coals may be checked by holding a hand at cooking height. When the hand can be held over the coals for 4 seconds, they are medium hot.
- Larger cuts that take longer to cook may be placed in a pan on the grill with coals on each side.

Panbroiling is similar to broiling but is done in a preheated heavy pan on the top of the range.

- The pan is not greased and fat is drained as it accumulates in the bottom of the pan.
- The meat is browned for about 5 minutes first on one side, then turned with tongs and browned on the other side. For larger cuts, the meat may need to be turned more than once.

Frying, stir-frying and sautéing are all ways of cooking tender cuts of meat in fat. The size of the piece of meat, amount of fat used, and the temperature will vary.

- Frying cooks thin or breaded cuts of meat uncovered with a small amount of fat. Meat is turned to cook evenly.
- Stir-frying is done quickly with bite-sized pieces of food in a small amount of fat. The pieces are stirred as they cook.
  The meat may be cut into strips or slices and will cut easier when it is partially frozen. The meat may be marinated and is cooked at a high temperature.
- Sautéing cooks small meat pieces in a small amount of oil while the pieces are stirred to move them around while they cook quickly, browning the meat and adding flavor. Sautéing is usually done with a high temperature.

Cooking Meats with Moist Heat

Braising is a slow cooking method that works well with less tender cuts of meat.

- The meat is slowly browned with oil added if necessary, usually on top of the range in a heavy pan.
- Fat drippings are removed and seasonings may be added. The amount of liquid added may vary. Too much liquid could dilute the flavor of the meat. Water, juice, or broth may be used for the liquid.
- The pan is covered and the meat simmered at 300˚ to 325˚F until the meat is fork tender. This may be done in the oven or on top of the range; the oven will provide more uniform heat.
- Vegetables may be added toward the end of the cooking time, as for a pot roast that will be served with vegetables. Liquid may be saved and thickened to make a sauce or gravy.

Stewing is similar to braising; however, the meat may or may not be browned and more liquid is usually used.

- Meat is added to boiling liquid and reduced to a simmer. Add enough liquid to cover the meat. The pan is usually covered.
- Vegetables may be added toward the end of the cooking time. Meat is done when it is fork tender. Often this is used for a stew and the liquid is served with the meat and vegetables.

Poaching is often used with delicate foods such as eggs or fish.

- Whole foods are simmered in a small amount of liquid. The meat may be wrapped or tied to help retain its shape. It may or may not be browned first.
- Place meat in pan, cover or partly cover with liquid. Liquid may be seasoned with herbs and flavorings.
- Liquid is brought to a boil, then heat is reduced to allow liquid to simmer until done.

Steaming may be done on the range top or microwave and is mostly used with fish.

- Fish is placed in a perforated pan or basket above simmering liquid, covered, and simmered until done.
- In the microwave, the fish is placed in a dish with a small amount of liquid, covered with plastic wrap, and cooked until done.

Dried Beans, Legumes, Nuts, and Seeds

Although not meat from an animal source, dried beans, legumes, nuts, and seeds are good sources of protein. As plant sources of protein, these low-cost foods are often favored for vegetarian diets or by those looking for lower fat and higher fiber choices. Generally, ½ cup of cooked legumes counts as 1 ounce of meat.

Legumes are beans, peas, and lentils. While beans and peas are classified as vegetables when young and green, the protein and other nutrients develop as the plant matures and they are then classified with protein foods. Dried beans are usually a variety of kidney beans but may also include chickpeas or garbanzos, fava beans, and lima beans. Dried peas are usually husked and split to speed cooking time. Lentils are small, lens-shaped legumes and have shorter cooking times.

Soaking will reduce the cooking time required for dried beans. Cooking time is generally 1 to 3 hours. Dry peas and lentils do not need to be soaked but are cooked in liquid to soften. These foods will expand about two times in volume so a large pot

is needed. After cooking, they should be stored in the refrigerator.

Cooked beans may be used in casseroles, soups, salads, or side dishes. Dried peas are often used in soups. Lentils are used in many of the same preparations.

Dried beans and peas, such as garbanzo beans, can be ground in a food processor and used in place of processed grain flour in baking for added fiber, protein, and nutrients. Often, ½ to ¾ of grain flour in recipes can be replaced with bean flour. Baked goods made with bean flour may rise less than goods baked with grain flour.

Nuts and seeds are high in protein but also high in fat. They may be chopped or ground and added to meatless dishes or used in salads, baked products, and cereals. Popular seeds are pumpkin, squash, sunflower, and sesame. Nuts include almonds, filberts, cashews, pecans, and walnuts.

Terms

Bake: to cook in an oven or similar appliance.

Barbecue: to roast over coals, flame, or electric unit, often adding a sauce to food as it cooks.

Baste: to add moisture such as a sauce to food during cooking to prevent it from drying out.

Bread: to coat with bread or cracker crumbs.

Braise: to cook meat in a covered container over low heat with a small amount of liquid or steam.

Coagulation: the thickening of a fluid to a curd or clot because of the denaturation of protein.

Curdle: to form curds or clots by heating of the protein.

Cure: to preserve meat with chemicals and/or smoking.

Flake: to break into small pieces with a fork.

Fry: to cook in fat.

Grill: to cook on a rack over direct heat.

Homogenize: to break up into tiny particles which are the same size, as fat in milk is homogenized.

Marinate: to add flavor and soften the tissue of meat with a mixture of oil and vinegar or lemon juice by letting the meat sit in the liquid for a period of time.

Meringue: a foamy mixture of egg whites and sugar that is baked as a pie topping or a shell for desserts.

Pan-broil: to cook over high heat, removing fat as it accumulates.

Parboil: to cook by boiling until partially cooked.

Pasteurization: to destroy harmful microorganisms by heating to a specific temperature and holding at that temperature for a period of time.

Poach: to cook in hot liquid, retaining the shape of the food.

Rennet: substance containing the enzyme rennin, which is used in cheesemaking. Chymosin is the same enzyme produced by a process or genetic engineering.

Roast: to cook uncovered in an oven.

Sauté: to brown in a small amount of fat.

Score: to make shallow cuts on the surface or edge of a food to increase tenderness of meat or keep the edges from curling during cooking.

Sear: to brown the surface quickly with high heat.

Frequently Asked Questions

Q. Are brown eggs different from white eggs?

A. No, the color of the shell varies by the breed of the hen. All eggs have the same nutrition and cooking characteristics.

Q. Is it dangerous to eat the mold on cheese?

A. Not usually; cut off and discard 1 inch of the side where the mold is and recover with a clean wrapping. Soft cheeses with mold should be discarded. Mold ripened cheeses (blue, Roquefort) are fine unless the mold is of a different pattern than usual.

Q. Is it safe to bake a chicken in a brown paper bag?

A. No, it is not sanitary. It may cause a fire and emit toxic fumes from ink, glue, and recycled materials. Use food-safe oven cooking bags for this purpose.

Q. What is buttermilk?

A. Buttermilk got its name from how the product was first made, from the liquid left after butter was churned from the cream. Now buttermilk is made from skim or low-fat milk with an added culture.

Q. How do you "de-gas" beans?

A. Beans can give people a gassy or bloated feeling. Some techniques to lessen these effects would be to soak the dry beans overnight and discard the soaking water and cook in fresh water. It is helpful to cook beans thoroughly to make them easier to digest. Commercial products are available that may be added to the cooking beans also.

Q. How do you roast sunflower or pumpkin seeds?

A. Clean and air dry seeds if damp, toss with a small amount of vegetable oil, and spread in a single layer on a cookie sheet. Bake at 350°F for about 30 minutes, stirring frequently, until golden brown. Salt to taste.

Resources

International Dairy Foods Association
idfa.org

Wisconsin Cheese
wisconsincheese.com

Midwest Dairy Association
midwestdairy.com

Food for Fifty. Mary Molt, PhD, RD. 14th Edition, 2017. Published by Merrill - Prentice Hall.

Professional Cooking. Wayne Gisslen. 10th edition, 2025. Published by Wiley.

Other Resources

incredibleegg.org

beefitswhatsfordinner.com

fsis.usda.gov

Cutting Up a Chicken at Home, University of Nebraska-Lincoln
mediahub.unl.edu/media/16570

Meat Cuts Identification, University of Nebraska-Lincoln
animalscience.unl.edu/meat-cut-identification

Pulses: Dry Peas, Beans, Lentils & Chickpeas
pulses.org

Additional Publications

Turkey: Farm to Table

Vary Your Protein

Omega-3 for Health

Meat Product Labeling and Marketing: What Do All Those Words Really Mean?

Build Strength with Protein

Check Yourself Questions

1. What vitamins are usually added to fortified milk?
2. Bacteria is not always harmful in food. What are some products made with bacteria?
3. What are some examples of uncured or soft cheeses?
4. What is one of the dangers of overcooking foods that have protein in them?
5. What purpose does the coagulation of eggs have in recipes?
6. What may be used to stabilize meringues?
7. Generally, what parts of the red meat animal will be the most tender?
8. For a safe and medium degree of doneness in meat, what is a recommended internal temperature?
9. What is the main difference between fin fish and shellfish?
10. Why is it recommended to turn meat with tongs when cooking?

Answers

1. Vitamins A and D are added to most liquid fortified milk.
2. Yogurt and sour cream are fermented with special bacteria to create their flavor and consistency. Some cheeses — such as brie, camembert, limburger, and muenster — are ripened with bacteria.
3. Uncured cheeses include cottage cheese, farmer cheese, cream cheese, Neufchatel, and ricotta.
4. Protein foods — milk, eggs, meat products — can become tough and stringy when overcooked at too high a temperature for too long a time.
5. As eggs in food combinations cook, the egg coagulates and the food thickens.
6. Cream of tartar may be added to egg whites before beating to help stabilize the foamy mixture.
7. For beef, pork, and lamb, meat that comes from the muscles that get less exercise, such as those along the back, will be more tender. Often these cuts have "loin" in their name. Also, meat from younger animals will be more tender as will meat that is well marbled with fat.
8. Steaks and roasts are medium done at 160˚F; that is also a safe temperature for cooking ground beef.
9. Fin fish are those with fins and internal skeletons. Shellfish have external shells but no fins or internal bones.
10. Meat needs to be turned during some cooking preparations to cook evenly. Turning with tongs will not pierce the meat as using a fork might, thus reducing the loss of juices.

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Chapter 8

Preparing Combination Foods

Preparing Combination Foods

Upon completion of this lesson, the Master Food Volunteer will be able to:

1. Plan meals to include combination foods.
2. Increase skills in preparing combination foods.
3. Be able to alter recipes or learn ideas to make new combination foods.
4. Understand the convenience of combination foods.

Key Concepts

- Combination foods can be as varied, nutritious, and hearty as the ingredients that go into them.
- Casseroles are one-dish combinations that include many components of a meal.
- Salads can be simple or elaborate and can be served in many ways.
- Sandwiches make a package of foods that may be eaten conveniently.
- Soups can make a varied meal, side dish, or appetizer and can include a variety of ingredients.

Casseroles

Casseroles can include a wide range of food combinations. Generally, casseroles are one-dish meals containing a protein food such as meat or beans, a carbohydrate food such as potatoes or rice, vegetables, and a sauce. A wide variety of combinations allows for great creativity in casseroles. The ingredients may be precooked and heated together to blend flavors or cooked in the casserole. The casserole is usually cooked in the oven at a low to moderate temperature and may be covered or uncovered. Casseroles may also be cooked in a slow cooker, microwave oven, electric skillet, or on the range top. Cooking methods will vary the cooking times. Often the food is served in the baking dish.

The base of the casserole combination is often a protein food, such as meat, eggs, cheese, fish, or beans. When meat is used, it is often precooked and in cubed pieces or crumbled hamburger. Potatoes, rice, or pasta are used to extend and thicken the casserole. Bread or cracker crumbs may also be used. Canned, frozen, or cooked vegetables are added for flavor, color, and nutrition. Aromatic vegetables such as onions, chives, parsley, celery, or mushrooms may be sautéed and added to the mixture. Seasonings include a wide variety of fresh or dried herbs and flavorful spices. A binder or sauce is the thick liquid that holds the ingredients together. It may be a cream soup, white sauce, milk, or juice. The casserole may be topped with cheese, bread crumbs, or other crumbled foods to add texture and browned appearance to the dish.

Pizza is a popular combination food. Pizza can be made at home in a shallow pan and baked at a high temperature of 425°F. A yeast bread crust is traditional, but many convenience products including refrigerator biscuits or pre-made crust may be used. The

sauce is usually tomato-based and seasonings are often Italian-type, such as oregano, basil, and garlic. Toppings can include a wide variety of chopped vegetables such as green peppers, mushrooms, and onions and chopped or crumbled meat such as poultry, sausage, ground beef, or ham. Pizza is usually topped with grated cheese, often mozzarella, cheddar or parmesan.

Stews may be considered with casseroles or compared to soups. Stews usually contain less tender cuts of meat cut into cubes, cooked slowly with vegetables in a thick sauce.

Tips for Casseroles

- For a crisp top, the casserole should be left uncovered during baking.
- Casseroles may be frozen in the pan before or after cooking. If the pan is lined with foil, the frozen casserole may be removed and kept in the freezer so the pan can be reused. The frozen casserole can be placed in the pan again and thawed in the refrigerator before baking or reheating. Freeze the casserole before baking for a fresher tasting product.
- Leftover vegetables are well-suited for use in casseroles.
- Foods that will be precooked should not be overcooked before adding to the casserole or they may become mushy during the casserole baking time.
- Vegetables should be in identifiable bite-size pieces.
- Tomatoes and tomato juice add flavor as well as contain acid, which helps tenderize less tender cuts of meat.

Salads and Salad Dressings

Salads are combinations of foods in bite-sized pieces and are usually served cold. Fruits and vegetables are the most common salad ingredients, but cooked grains, pasta, legumes, meat, eggs, and cheese may also be used. Salads may be served as a side dish, a lighter main dish or as a dessert. Ingredients should be fresh and of good quality.

Salads often have ingredients mixed, tossed, or layered. Tossed salads may contain lettuce or other salad greens. To prevent greens from wilting, dressing may be added to tossed green salads just before serving or at the table. Salads such as potato or other vegetable or fruit salads may be mixed, or layered for an attractive effect. An arranged salad will have the ingredients, often larger pieces, placed in an attractive arrangement on the serving plate. Molded salads are those that hold their shape when removed from the container in which they have been allowed to set up. They often contain gelatin.

Salad dressings are traditionally high in fat and calories, but low-fat versions are available. French, Italian, or vinaigrette dressings have an oil and vinegar base with seasonings. Mayonnaise may be used as a dressing for mixed salads. Mayonnaise is made of oil, vinegar, eggs, seasonings, and lemon juice. Cooked dressings are made with a white sauce. Dairy dressings are made with buttermilk, yogurt, sour cream or cottage cheese, and seasonings. The salad dressing should enhance the flavors of the salad ingredients, not mask or overwhelm them.

Tips for Salads

- Ingredients that have a contrast of flavors, textures, and colors will make good salad combinations.
- When adding ingredients that have been cooked, such as rice or pasta, to fresh ingredients, the cooked foods should be allowed to cool before mixing.
- Pasta should be cooked only to the al dente stage so it may absorb some of the dressing.
- Potatoes for potato salad will absorb the flavor of the dressing if combined while the potatoes are warm. The salad should be refrigerated after mixing.
- Chilled salad plates will keep salads crisp longer.
- Iceberg lettuce may be cut or torn; most other salad greens will stay crisper if they are torn.
- Salad greens should be carefully rinsed in cold running water and should be crisp, chilled, and dry when added to the salad.

Sandwiches

Sandwiches have become popular choices for easy to prepare meals. They are also convenient for quick meals or packed for meals eaten away from home. Sandwiches consist of a bread covering, a filling, and a flavoring in a variety of combinations. Flavors of the different components of a sandwich should be compatible. It is best to limit the use of strong flavors to one or two that complement each other. Sandwiches may be served hot or cold. Cheese or ham fillings make good sandwiches for grilling. Most sandwiches, except hamburgers and hot dogs, are cut before serving.

Sandwich bread is often commercially baked sliced bread, but could be home-made, white or whole grain, and toasted. Other forms of bread such as rolls, pita bread, taco shells, bagels, and tortillas can be used to make sandwiches as well. The traditional sandwich has two slices of bread. A club sandwich has three slices of bread with two fillings. Pita bread, buns, and shells make filled sandwiches. Open-faced sandwiches are made with one slice of bread on which meat or other filling is placed and topped with cheese, sauce, or gravy. This sandwich is eaten with a knife and fork. Tea or fancy sandwiches are made from bread from which crusts have been removed and contain lighter fillings. Canapés are small open-faced tea sandwiches. They are often decorated with a garnish and served as appetizers.

Fillings may be sliced meats or meat salad mixtures, egg salad, or cheeses. Additional ingredients such as lettuce, sliced tomatoes, shredded carrots, sliced green peppers, sliced cucumbers, pickles, or other fruits or vegetables may be added.

A spread adds flavor as well as keeps the filling from making the bread soggy. Mayonnaise, butter, or mustard are common spreads. Salsa, ketchup, cream cheese, or fruit spreads may be used.

Tips for Sandwiches

- Bread used should be fresh and stored at room temperature or frozen for later use. Refrigerating bread will slow the chance of mold developing, but will increase staling. Reheat bread, such as by toasting, to reverse staling.
- Sandwiches should be wrapped carefully to prevent drying. If perishable ingredients are used, the sandwich should be placed in the refrigerator or a cooler until served.
- Mayonnaise or butter should be spread to the edge of the bread to keep moist fillings from making the bread soggy.
- When sandwiches are packed to be eaten later, tomato, pickles and lettuce can be packed separately to be added just before eating.
- Filled sandwiches (pita bread, buns) can be lined with lettuce or alfalfa sprouts to keep the filling from soaking into the bread.
- The type of bread should match the filling being used for easier handling. For example, softer breads are best for soft fillings. Firmer breads should be used for hardier fillings.

Soups

Soups are another combination of foods that can be served as a side dish, appetizer, or main course. Soups are a liquid food usually made with meat and/or vegetables. Clear soups (broth, consommé, and bouillon) are without solid ingredients. They are usually made from the liquid of cooking meat or poultry. These may be served plain or with vegetables and meats or used in other food preparations. Vegetable soups have a clear seasoned soup base with vegetables and sometimes meat pieces added. They may be thickened with grain foods, legumes or pureed vegetables. Cream soups are made with a white sauce base and have vegetables and/or meat added. Meat is usually fish or poultry. Chowders are hearty soups with fish and/or vegetables and typically contain potatoes or milk.

Most soups are served hot and are popular during cold weather seasons. Soups should be served very hot, at least 180˚F, because the mixture will cool quickly in serving bowls.

Some soups (fruit soups and some specialty soups) are served cold and should be served in chilled bowls.

Soups are easy to prepare and ingredients left from previous preparations may be used. Traditionally soups simmer for a long period of time before serving, but many can be made more quickly with precooked ingredients and commercially prepared bases. Simmering will allow the flavors to blend. Soups may be garnished with croutons, grated cheese, fresh chopped herbs or crumbled bacon. Soup is usually served with crackers but other crisp foods such as corn chips, breadsticks, or melba toast may be served.

Tips for Soup

- When adding vegetables, those that will take the longest to cook should be added first.
- Soups may be made the day before and refrigerated to allow flavors to blend.
- When refrigerated, the fat in a soup will solidify and rise to the top and may be removed easily before reheating.
- Soup can be de-fatted by adding a few ice cubes to the hot soup. Fat will congeal around the ice cubes, which can be removed with a slotted spoon. Paper towels may also be used to soak the fat from the surface.
- Leftover pieces of meat, meat bones, and vegetables and broth from cooking meat and vegetables may be frozen and saved for soup preparation.
- Tomato juice or vegetable juice may be used for part of the liquid in vegetable soups.
- Care should be taken not to overheat soups after the addition of foods containing milk products to prevent curdling.
- Soups may be thickened with leftover rice or potatoes, vegetable puree, soft bread crumbs, or instant mashed potato flakes.
- Cream soups made with pureed cooked vegetables and nonfat dry milk will be lower in fat and calories.
- Sauté chopped onion, celery, green peppers, and garlic before adding to develop the flavors.

Terms

Aromatic vegetables: Vegetables such as onions, green peppers, celery, and garlic, which are often sautéed to add flavor to other foods.

Bagels: A doughnut shaped roll that is cooked in water before it is baked.

Bouillon: Broth or clear soup.

Broth: Seasoned liquid from cooking meat or vegetables.

Combination foods: Prepared foods which combine various ingredients to make a food product.

Consommé: Similar to broth or bouillon, but stronger in flavor and concentration.

Crumbled hamburger: Ground beef that has been cooked and browned and broken apart with the fat drained off.

Gelatin: The ingredient that turns a liquid to solid, often used in a powdered form for salads (brand name — Jell-O®).

Pita bread: A small round flat bread that when cut in half forms a pocket for filling ingredients.

Salad greens: Fresh leafy vegetables often used in tossed salads.

Tortillas: Flat round bread from Mexico.

Frequently Asked Questions

Q. The soup is too salty. What can be done?

A. Save oversalted soup by adding a sliced raw potato to the mixture and simmering for 10 to 15 minutes. Remove the potato before serving. Another option is to divide the oversalted soup and add more unsalted ingredients to help dilute the salty flavor.

Q. Can soup be reheated in the microwave oven?

A. Soups reheat in the microwave oven quickly. All foods should be reheated to 165°F. Stir before checking the temperature with a food thermometer.

Q. How do you get a gelatin salad out of the mold?

A. Molded gelatin salads will release easier if the mold is rinsed with cold water or if the mold is sprayed with nonstick vegetable oil spray before pouring the mixture in the mold. (This could slightly cloud the surface of a clear gelatin salad, but will not affect the flavor.) After the gelatin salad is set, insert a knife between the edge of the mold and the food in several places to release the vacuum. Dip the mold in hot water for 5 seconds or less, hold a plate tightly over the mold, and turn both over with a firm shake. If needed, dip in hot water and flip with the plate a second time. If the second try doesn't work, return the mold and salad to the refrigerator for about 20 minutes and try again.

Resources

Food Preparation
food.unl.edu/tags/meal-preparation

Additional Publications

Cook Once, Eat for a Month! (MF3049)

Cooking for One or Two (MF3659)

Spend Smart. Eat Smart.

Check Yourself Questions

1. What is the binder in a casserole and what does it do?
2. Why are tomato sauce, juice or crushed tomatoes often used with less tender cuts of meat in combination food dishes?
3. How should salad greens be prepared to remain crisp?
4. What may be done to prevent sandwiches from getting soggy?
5. How is chowder different from stew?
6. What are some ways to remove the fat from soups?
7. What are some advantages of combination foods?
8. What are some combination foods that can be frozen successfully?
9. What size are the pieces of vegetables and meat in most combination foods?
10. What breads may be used to make filled sandwiches?

Answers

1. The binder in a casserole is the sauce that holds the other ingredients together. It may be cream soup, white sauce, milk or juice.
2. Tomatoes contain acid that helps tenderize less tender cuts of meat as they cook.
3. Salad greens should usually be torn to remain crisp. They should also be gently rinsed in water, chilled, and dried.
4. Spreading butter or mayonnaise to the edge of the bread and not adding tomatoes, pickles, or lettuce until serving time are two ways to help prevent sandwiches from becoming soggy.
5. Stew is a combination of meat and vegetables cooked in a thick sauce; chowder is often made with fish and contains potatoes or milk.
6. Fat can be removed from soup by using paper towels to soak it from the surface, by adding ice cubes and removing after fat has congealed around them, or by placing in the refrigerator until the fat rises to the top and congeals; it may then be skimmed off.
7. Combination foods are often quick to prepare, nutritious, offer a variety of combinations, make one-dish meals, and many can be prepared ahead of time.
8. Sandwiches (use day-old bread, spread butter to edge of bread, omit crisp vegetables, hard cooked egg whites, tomatoes, and mayonnaise) and most casseroles and soups (omit potatoes, slightly undercook vegetables) freeze well. Most salads, unless it is a frozen fruit salad, do not freeze well.
9. Salads, soups, and casseroles usually contain bite-sized pieces of food.
10. Pita bread, buns, and shells may be used to make filled sandwiches in which the filling is placed inside the bread.

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Chapter 9

Preparing Baked Products and Desserts

Preparing Baked Products and Desserts

Upon completion of this lesson, the Master Food Volunteer will be able to:

1. Explain the general principles of baking grain foods.
2. Understand the various techniques for different baked products.
3. Determine causes of problems in baked products.

Key Concepts

- Yeast bread can be made using the "straight dough" method, the "sponge dough" method, or the "no knead" method.
- Each ingredient in baked goods has a specific function.
- Quick breads are easy and convenient. They are in the form of a pour batter, a drop batter, or slightly kneaded and stiff.
- Cakes are shortened or unshortened.
- Cookies are "little cakes," having less flour and liquid but more fat and sugar.
- Pastries are a delicate balance of ingredients and can be the most difficult to prepare.

Types of Ingredients in Baking

Flour

Wheat flour is the most common type of flour used for baked products, but flours from other types of grains may be used as well. All grains are plant seeds and have three main parts that may be used for flour. The germ is the tiny part in the center of the seed that can grow into a new plant. This contains B vitamins, vitamin E, iron, zinc, and some fat. The endosperm surrounds the germ and makes up the greatest part of the grain. It is a good source of complex carbohydrates and proteins. The bran is the protective outer layer. It provides fiber, B vitamins, and some minerals.

Grains are processed for food use. When the entire kernel is used, a whole-grain product is the result. Often the bran and the germ are removed in processing. The nutrients that are lost in that processing may be replaced, and the product is called "enriched." When nutrients that were not present before processing are added, the food is "fortified."

Various types of wheat flour are available from different varieties of wheat. Hard-wheat flours have a higher protein and will develop a stronger gluten structure. This is good for yeast breads. Soft varieties of wheat produce flour that works well in biscuits, cakes, crackers, cookies, and pastries. This is often used in commercial bakeries.

All-purpose flour is made from the endosperm part of the wheat kernel of hard wheat or a combination of soft and hard wheat and is good for a wide range of baked products. This type of flour is usually used by the home baker. It is good for making quick breads, and is often used

in yeast breads, cakes, pastries, and cookies. All-purpose flour may be bleached or unbleached. Both are nutritionally equal. Bleached flour will be a whiter flour and may be more stable with less spoilage.

Bread flour is made from the ground endosperm of hard wheat. Its higher gluten content makes it a good choice for yeast breads. When using bread flour in a bread recipe that calls for all-purpose flour, substitute with a little less bread flour (about 1 to 2 tablespoons less per cup) and increase kneading time to about 12 to 15 minutes.

Cake flour is better for cakes, cookies, and crackers, and is made from the endosperm of soft wheat. It is low in gluten and is usually bleached. It gives a softer crumb.

Enriched flour is white flour to which minerals and vitamins have been added.

Self-rising flour is all-purpose flour with 1½ teaspoons baking powder and ½ teaspoon salt added per cup, the standard proportions for most baked products. When using self-rising flour, the recipe should be adjusted to reduce the baking powder and salt.

Whole-wheat flour is sometimes called graham flour and is made from the entire wheat kernel. It has reduced gluten and absorbs less water, therefore giving a heavier and denser baked product. The rising time will also increase. Mixing whole-wheat flour with white flour in a recipe will increase the fiber and produce a light product.

White whole-wheat flour is becoming more popular and available. It makes an excellent baked product with the fiber and nutritional content of the darker whole-wheat flour.

Because of the fat in flour made with whole grains, it will spoil more quickly and should be stored in the refrigerator or freezer. Products made with whole grains should be used quickly or stored in the refrigerator.

Some flours are not readily available to the home baker but are used by commercial food producers. Semolina is a term often seen on pasta labels. This flour is made from the finely ground endosperm of durum wheat. Pastry flour from the endosperm of soft wheat is used in pastries.

Cornmeal is made from corn and is similar to flour; however, it is lower in gluten. Products made with cornmeal will be coarser and not rise as well. It is often combined with wheat flour to produce a quality product. Cornmeal is available in white or yellow varieties and in a range from coarse to fine grind. Finely ground cornmeal will absorb more liquid. Cornmeal is also enriched to replace vitamins and minerals lost in milling.

Leavening

Leavenings include baking powder, baking soda, or yeast. Eggs also function as a leavening agent, such as an egg white foam. All of these ingredients expand with the steam from heated moisture as the product bakes. Rising also comes from the steam itself as it is formed. Preheating the oven will produce a lighter product. Types of baked products differ according to their leavening agent.

Baking soda releases carbon dioxide (CO_2) when moisture and acid are present. It takes up to ¼ teaspoon per cup of flour. It is usually not used by itself because so much would have to be used for proper leavening that the flavor and appearance would suffer. It is used when acidic ingredients are present such as lemon, vinegar, buttermilk, yogurt, molasses, brown sugar, cocoa, chocolate, citrus fruits, cream of tartar, or sour milk. There is an immediate leavening reaction, so products should be baked immediately. There is no substitute for baking soda.

Baking powder does not need an acidic ingredient because that ingredient is in baking powder as cream of tartar. It is a compound called sodium aluminum phosphate. This already contains acid. Baking powder must produce 12 percent CO_2 when water and heat are applied. Most actually contain 14 percent. Test baking powder by mixing 1 teaspoon in ⅓ cup hot water and check for bubbles. A substitution for 1 teaspoon baking powder is ¼ teaspoon baking soda and ½ teaspoon cream of tartar.

There is single-acting and double-acting baking powder. Single-acting is only used commercially. It must be used quickly because as soon as it is combined with water, CO_2 develops and can escape before the mixture rises.

Double acting-reacts twice, once when moistened, and a second time when heated. Use about 1 to 1½ teaspoons per cup of flour.

Yeast is a one-celled organism in the fungus family and helps dough to rise. It needs flour and/or sugar, moisture, and warmth to grow. Cold temperatures slow growth; hot temperatures kill it.

Yeast makes dough rise, strengthens the dough, and gives flavor to the bread.

Carbon dioxide and alcohol are produced when yeast consumes sugars. This makes dough expand because the CO_2 and alcohol are trapped inside air bubbles. The air bubbles are made of gluten, which will stretch like a balloon, allowing the dough to rise.

Gluten forms when water and flour are combined. Gluten is made from two proteins, glutenin and gliadin. For bread, the more gluten development, the better. It forms by kneading and mixing. Yeast also helps develop gluten. With each burst of CO_2, protein and water molecules move about and have another chance to connect and form more gluten.

When proteins break down to amino acids, starches to sugars, and fats to free fatty acids, these components give flavor to bread. As fermentation continues, the dough becomes more acidic, which breaks down more molecules. Eventually, the alcohol content will stop the yeast fermentation.

Bacteria also gives bread flavor. But as long as the yeast is active, it consumes the sugars quickly, leaving no food for the bacteria to grow. When dough is refrigerated, the yeast activity slows. This allows the bacteria, which can function in cold temperatures, to thrive, giving the dough other flavors.

Yeast comes in several forms:

- **Compressed and active dry yeast** is dissolved in lukewarm water, 105° to 115°F.
- **Rapid-rise yeast** is mixed with flour, sugar, and salt. Then the liquid is added at a warmer temperature, 120° to 130°F.
- **Bread machine yeast** is best for making bread in bread machines. It is highly active and a finer granulation. It also has ascorbic acid (vitamin C), a dough enhancer, to promote good loaf volume and structure.
- **Sourdough** is a yeast started from yeast, flour, and water. It is allowed to "sour" through fermentation. A starter is used and a portion is saved and replenished. Never let the starter go below 1 cup. Then add 1 cup flour and 1 cup water. Replenish once every 2 weeks. It can be refrigerated to slow fermentation. It can also be frozen for up to 3 months. Thaw in refrigerator, then warm to room temperature. Sudden temperature changes ruin a starter. Use 2 cups of starter

for 1 package of yeast. When using sourdough starter, decrease liquids by 1¾ cup and flour by 1 cup in the recipe.

Keep the following tips in mind when working with yeast:

- Yeast is killed when liquids are too hot, above 135°F.
- Always use a thermometer.
- Store unopened yeast in cool, dry place.
- Store opened yeast in refrigerator.
- Don't allow dough to over-rise.
- 1 envelope = about 2¼ teaspoons or 1 small (.6 ounce) cake of yeast.

Liquids

Water makes bread crusty, and the bread is best eaten the day it's made. Potato water adds flavor and gives a smooth crumb.

Milk gives bread a soft crust, adds nutritional value, and aids in browning. In breads, it is usually scalded to begin protein breakdown.

Dry milk is economical and easy to store. It is also nonfat. It functions the same as liquid milk.

Sweetened condensed milk is used in sweets such as cookies, candy, fudge, and sometimes cheesecake and pies.

Evaporated milk can be used by adding equal amounts of water and evaporated milk to make whole milk. It gives a sweeter taste due to the lactose sugar. Yeast doesn't consume lactose so the bread will be sweeter. Do not substitute sweetened condensed milk for evaporated milk.

Evaporated milk and sweetened condensed milk are both made from milk that undergoes a vacuum process to remove half the volume of water. Sweetened condensed milk has a lot of sugar added (up to 2⅓ cups per 14-ounce can). Evaporated milk is heat sterilized at ultra-high temperatures to kill bacteria. It also caramelizes the milk and gives it an ivory to pale amber color. Sweetened condensed milk is not heat sterilized because of high sugar, which prevents bacteria growth.

Filled milk has the milkfat removed and is replaced usually with soybean oil to reduce saturated fat. Filled milk is used like evaporated milk.

Sweeteners – Caloric and Non-Caloric

Caloric sweeteners include white granulated sugar, brown sugar, molasses, honey, corn syrup, agave nectar, and fruit juice concentrates. All add flavor, texture, and color. They also add sweetness and help crust to brown. Sugar is food for yeast to help dough rise, but too much sugar will stop yeast growth.

- **Ultra-fine baker's sugar** is used like regular granulated sugar. It also blends more quickly and smoothly than regular sugar, resulting in a finer texture.
- **Honey and molasses** help hold moisture in the bread and add flavor.

Breads without sugar have a shorter shelf life.

Non-caloric sweeteners or low calorie sweeteners are sugar substitutes. They only add sweetness and little to no functionality in a baked product. Examples include:

- **Saccharin (Sweet n Low)** is a heat stable sweetener that can have an aftertaste, works in baked products, and is 300 times sweeter than sugar.
- **Aspartame (NutraSweet, Equal)** is not good for baking, breaks down above 85°F, and loses sweetening ability. It is 180 times sweeter than sugar.

- **Advantame®** is heat stable and does not breakdown in cooking, making it a good sugar substitute for baked goods. It is 20,000 times sweeter than table sugar.
- **Neotame (Newtame®)** is heat stable and does not break down in cooking. It is 7,000-13,000 times sweeter than table sugar.
- **Acesulfame K (Sunett® and Sweet One®)** is very heat stable, is good for baking, and is 200 times sweeter than sugar.
- **Sucralose (Splenda®)** is made from sugar, is good for baked goods, is 600 times sweeter than sugar, and tastes similar to sugar.
- **Stevia (Stevia In The Raw®, Truvia®, SweetLeaf®, Pure Via®)** is the common name for the natural sweeteners (steviol glycosides) derived from the leaves of the native South American, *Stevia rebaudiana* plant (also known as the Bertoni plant). Stevia is a plant-based sweetener and is 300 times sweeter than table sugar.
- **Monk Fruit (Nectresse®, Monk Fruit in the Raw®, PureLo®)**, also known as Swingle fruit or Luo Han Guo, is a plant native to Southern China; the extract can be used as a general-purpose sweetener. Its extracts are 100 to 250 times sweeter than table sugar.

Sugar alcohols/polyols includes sorbitol, erythritol, xylitol, and others. Sugar alcohols are neither sugar nor alcohol. They are not absorbed in the body and contribute fewer calories than sugar. They occur naturally in many fruits and vegetables, but are also commercially made. They provide sweetness, add bulk and texture, inhibit browning during baking, and help retain moisture in foods.

Eggs

Eggs add richness, flavor, and nutrition. Eggs improve texture, provide color, and help produce a fine crumb and a tender crust. Egg yolks aid gluten development, help crusts to brown, and lengthen shelf life. Egg fats carry and meld flavors within a food product. Egg whites toughen yeast breads and should not be used alone. Here are some of the many functions of eggs.

Thickening and coagulation: Whipping or heating allows products that contain eggs to thicken and/or coagulate, converting the mixture from a liquid state to a solid or semi-solid state. Eggs bind ingredients naturally and suspend other ingredients. Thickening can occur with both yolks and whites. Eggs help custards to gel when making soft pie fillings that are heated.

Coating and binding: With heat, eggs coagulate and give rigidity, causing mixtures to gel and ingredients to adhere. Egg whites are excellent binding ingredients.

Emulsification: Egg yolks contain lipids and proteins that enable the formation of emulsions of immiscible liquids such as fat and water.

Aeration: Beating eggs incorporates air to help create a lighter, more airy product. This action makes eggs a leavening agent. The structural framework that is formed helps hold the product together. It also increases the volume, gives an airy texture, and smooth mouth-feel. Factors that affect egg foams include:

- Degree of beating
- Blending
- Homogenizing
- Temperature
- pH
- Fat
- Salt
- Water
- Manipulation
- Heat
- Copper
- Sugar
- Acid

Egg Replacers

No type of egg replacer can equal the performance and function of real eggs. But there are some options:

- For recipes that use eggs primarily as a binder (such as drop cookies), possible substitutions for one egg include:
  - ½ of a medium banana, mashed
  - ¼ cup of applesauce (or other pureed fruit)
  - 3½ tablespoons gelatin blend (mix 1 cup boiling water and 2 teaspoons unflavored gelatin, and then use 3½ tablespoons of that mixture per egg)
  - 1 tablespoon ground flax seed mixed with 3 tablespoons warm water; let stand 1 minute before using
  - Commercial egg replacement products
- Xanthan gum can be added to egg-free cakes and cookies to bind and add texture. Use about 1 teaspoon per recipe.

- For recipes that use eggs primarily as a leavening agent, you can try a commercial egg replacement product or the following mixture:
  - 1½ tablespoons vegetable oil mixed with 1½ tablespoons water and 1 teaspoon baking powder to equal one egg.

Fat

Fat helps slow gluten development and makes baked goods tender. It increases keeping quality and helps prevent sticking to baking pans. The choice of fat can greatly affect the final volume, texture, and flavor of baked goods.

- Fat such as shortening, butter, or margarine can be used interchangeably. For most recipes, it should be at room temperature.
- Do not use whipped spreads.
- Do not use low-fat margarine in baked goods because it contains too much water.
- Do not substitute oils for solids unless the recipe specifically calls for it.

Fats are also present in other foods such as dairy products, eggs, and chocolate.

There are many ways to substitute for fat to reduce fat content and calories. For example, instead of full-fat milk, use a low-fat or skim milk. In many cases, these simple substitutions will have little affect on the final product. Fruit or vegetable purees can replace cooking oil. Use low-fat or nonfat yogurt, buttermilk, or pureed cottage cheese in place of sour cream.

Salt

Salt has several functions in baked goods:

- It contributes to overall flavor.
- In bread, it controls the fermentation rate of yeast.
- It has a strengthening effect on the gluten protein in the dough.
- It influences crust color in baked foods.

Salt controls yeast action and strengthens gluten in yeast bread. It should not be omitted. Leaving out the salt causes over-rising, bland flavor, and poor texture in yeast breads.

Salt substitutes containing only potassium chloride and no sodium chloride are not recommended for use in baking. The flavor and texture of baked goods will not be the same quality.

Salt substitute mixtures containing part sodium chloride, such as Morton Lite Salt®, can be used successfully in baking. For most recipes, a potassium chloride/sodium chloride blend can replace table salt in the same quantities, as directed. Recipes using an automatic bread-making machine may not perform as well.

Baked Products

When deciding to bake, be sure to have enough time to avoid rushing and help increase the chances of success. Some general tips include:

- Remove or reduce distractions.
- Read the recipe from top to bottom.
- Have ingredients available and ready.
- Measure ingredients correctly.
- Use appropriate equipment for best results.
- Check your oven temperature with an oven thermometer.
- Clean as you go.

Baked products are generally made of the same few ingredients: flour, shortening, eggs, water or milk, and leavening. With flour as the main ingredient, these foods are often placed in the breads and grains food group of the dietary guidelines.

Yeast Breads

Yeast gives yeast breads the rising effect as well as enhancing the flavor and texture. Yeast is actually a unicellular organism that causes the sugar to change to alcohol and carbon dioxide as it grows, creating the rising action of the dough.

Yeast may be purchased in pre-measured packets or larger quantities. It is usually dated for freshness and should be stored in the refrigerator and used before that date.

- **Rapid-rise yeast** or quick-rise yeast is a highly active strain that will decrease the rising time of yeast bread by 50 percent. It can be used to replace regular yeast of equal amount and is usually added directly to the dry ingredients.
- **Bread machine yeast** has been developed for best results in home bread machines.
- **Pizza crust yeast** is formulated specifically for homemade pizza dough. The yeast makes the dough easy to roll with no snapback. It is not recommended for standard yeast bread recipes.

Follow the instructions on the packages for best results. Temperature is important in using any yeast. Too low of a temperature slows and lessens the growth and rising of the bread. Too high a temperature may kill the yeast. The ideal temperature of liquid for dissolving active dry yeast is between 105° and 115°F. Rapid-rise yeast is added to dry ingredients and dissolves best when the liquid temperature is between 120° and 130°F.

Three methods of preparing yeast breads produce different types of breads.

- The most commonly used method is the **straight dough** method in which the ingredients are combined, the dough is kneaded, and allowed to rise before baking.
- The **sponge dough** method is mixed as a batter using a portion of the ingredients. This is allowed to rise to a sponge stage, and ingredients are added to make a stiff dough. The dough is then kneaded and rises.
- The **no-knead** method mixes the dough, usually not as stiff as a kneaded dough, with a spoon and the dough is spooned into muffin cups to make rolls or formed in a ball for a loaf. Often this method is used for coffee cakes or sweet rolls. This bread will have an uneven surface and not be as light as kneaded dough.

Kneading is the process of manipulating the dough with your hands or by machine. Kneading develops gluten networks, which form small pockets that expand as the gas from yeast is released. Kneading by hand may take 5 to 20 minutes until the dough is smooth and elastic. The time required for kneading will vary with the temperature, humidity, yeast characteristics, flour characteristics, and the baker's kneading style. The motions for kneading are to press the dough with the heels of the hands and push the dough away from the body. Then the dough is folded in half and rotated a quarter turn. This series of actions is repeated until the dough is satiny. If the dough is not kneaded enough, the finished bread will be small and heavy.

Quick Breads

Quick breads get their name from the preparation method. They are quick to mix and bake. They can also be made ahead of time and are good choices for breakfast. Examples of quick breads include loaf quick breads (banana bread, nut bread), muffins, biscuits (drop or rolled), and others such as scones, cornbread, and popovers.

Quick breads depend on baking powder or baking soda to rise and are baked immediately after mixing. These leavenings produce gas bubbles that increase the volume, causing the product to rise. Because these bubbles are activated by the mixing, the product needs to be baked soon after mixing. **Double acting baking powder** produces bubbles during mixing and during baking. **Single acting baking**

powder produces bubbles only during mixing. **Baking soda** is used when the mixture contains acid ingredients such as buttermilk, chocolate, or fruit. In popovers, air beaten into the batter creates steam during baking to cause rising. Besides flour as their base, quick breads also contain fat to make the product softer,moist and tender and usually contain eggs for flavor and liquid. A batter bread is thoroughly baked when its internal temperature reaches 190˚F.

Quick breads include a wide range of products from different consistencies of mixtures. As the proportion of flour to liquid changes, so does the product. Pour batters are the most liquid and include pancakes, waffles, popovers, and crepes. In these recipes, the liquids are blended together and poured into the flour mixtures. The batter is then stirred rapidly to moisten. This is called the muffin method of mixing because it is often used for muffins, and should not be overmixed. Pancakes and waffles are mixed in a similar way but have a more liquid, pourable batter. Drop batters — such as muffins, pan breads, and drop biscuits — are stiffer and may be dropped into a pan.

Those that have more flour and are drier are soft dough products such as rolled and cut biscuits. With the biscuit method of mixing, the fat is cut into the dry ingredients with a pastry blender or forks, and liquid is added. The dough is then kneaded lightly and quickly, then cut or shaped.

It is important not to overmix the ingredients of a quick bread. This could result in a tough product, especially those that are lower in fat and sugar. Quick breads require little handling. Overbeating or overstirring can cause tunnels, uneven tops, and a tough product. For best results when baking these products, grease only the bottom of pans.

Cakes

There are two general types of cakes, shortened cakes and unshortened cakes. Shortened cakes are those with fat (oil, butter, or shortening) added. These are usually leavened with baking powder or baking soda and an acid. Examples are yellow cakes, white cakes, and bundt cakes, often called butter cakes. Nuts and fruit may be added.

Shortened cakes can be baked in a variety of shapes: square, oblong, round, or cupcakes. The recipe will usually give suggestions with different baking times for each shape. Pans should be greased and floured lightly. To check for doneness, insert a wooden pick, such as a toothpick, into the center of the cake. It should be dry without any wet batter clinging to it when the cake is done.

Unshortened cakes or foam cakes are those made with an egg foam. They are leavened with beaten egg whites and air that is beaten into the mixture. Examples are angel food cake, chiffon cake, and sponge cake. These cakes are very light and more fragile than shortened cakes. The egg whites are beaten to the soft peak stage. Cream of tartar may be used to stabilize the beaten egg white and give a whiter, finer grain. Angel food cake contains only egg whites but sponge cakes may contain both whites and yolks, that are beatenep-arately and then combined. Some foam cakes may also include baking powder for leavening. Chiffon cakes have added vegetable oil for a more tender texture. Foam cakes are baked in ungreased pans to allow the batter to cling to the side of the pan as it rises. A tube pan is often used. This cake is done when it springs back after being touched lightly. They should be cooled in the pan upside down to help maintain the volume of the cake.

Accurate measurements and correct mixing methods are important for cakes. Cake flour may be called for in the recipe, and it will make a more tender, fine-textured cake with greater volume. Cake flour can be substituted for all-purpose flour by increasing the flour measurement by 2

tablespoons per cup. All-purpose flour can be substituted for cake flour by decreasing the amount of flour by 2 tablespoons per cup.

Cake mixes are convenient and allow variation in preparation. Most cake mixes require the addition of oil, water, and eggs. Follow the package instructions for preparing the recipe and baking.

Cookies

Cookies are quick and easy to prepare. There are a great variety of cookie recipes for all occasions. Cookie recipes have more fat and sugar and less flour and liquid than cakes.

The six basic types of cookies are made from two general types of dough. Doughs may be soft or stiff. Soft dough is used for drop or bar cookies.

- **Drop cookies** are dropped on the cookie sheet with a spoon or cookie scoop. They will spread during baking and should bake to a uniform mound shape.
- The dough for **bar cookies** is spread in a shallow pan before baking. They are cut into square or rectangular bars for serving.

Stiff doughs contain more sugar and shortening and are used for refrigerator cookies, rolled cookies, molded cookies, and pressed cookies.

- **Refrigerator cookies** are also called sliced cookies. The dough is shaped into a long roll, refrigerated, then sliced and baked.
- **Rolled cookies** are sometimes called cut-out cookies. The stiff dough is rolled out and cut with cookie cutters.

- **Molded cookies** are shaped into balls by hand and may be dipped in sugar and flattened with a fork or spoon before baking.
- **Pressed cookies** are made with a cookie press, a tube with open shapes at one end through which the dough is pressed. Spritz cookies are one type of pressed cookies.

Some tips for better cookies are:

- Dry ingredients such as flour, baking powder, baking soda, and spices tend to pack down during storage; stir these ingredients before measuring.
- Sugar enhances the flavor and tenderness of cookies. It also influences how much the cookie will spread. More sugar will increase dough spread.
- If brown sugar is substituted for white sugar, the cookie will be more moist.
- Margarine or butter imparts a richer taste and makes a cookie with a flatter shape and spread than shortening.
- Softening the margarine or butter before creaming aids in creaming with the sugar. The stick of butter or margarine should be "bendable" or "pliable" but not "gooey" soft. Using a food thermometer, it should register 65°F or colder. Melted margarine will result in a sticky dough.
- Milk and water can be interchanged in most cookie recipes. Milk gives a richer flavor, but using water will extend the shelf life.
- Quick-cooking or regular oats can be used in most recipes that call for oats or oatmeal.
- Sugar and fat should be creamed until fluffy. If over mixed, the sugar granules will be smaller and result in a more compact cookie.
- Chilled dough will be stiffer and is recommended for rolled cookies. Drop cookies from chilled dough will spread less.
- A small amount of flour (1 to 2 tablespoons) may be added to a dough that is too soft. A small amount of milk or water may be added to dough that is too dry and crumbly.
- Cookies will brown more evenly on shiny cookie sheets. Dough should be placed on cooled baking sheets to prevent excess spread.
- Bake cookies for the minimum baking time suggested and check for doneness. When done, cookies should be transferred to a wire cooling rack with a wide spatula.

Pastries

Pastries are made from a basic dough containing four ingredients: flour, fat, salt, and water. Ingredients can be combined in different amounts with different methods to make a variety of baked shapes. The flexible dough can become pie crusts, tarts, turnovers, meat pies, and many other delicate baked products. Many cultures have their own special pastry such as the strudel from Hungary and phyllo (FEE-low) from the Near East. The ingredients must be handled carefully and not mixed too much or too little.

Because of the balance of ingredients and handling, pastries are often thought to be difficult to prepare. The pastry should be flaky and tender. All pastries achieve this by how the fat (butter, margarine, solid vegetable shortening, or vegetable oil) is mixed with the dry ingredients.

The fat is evenly distributed by rolling, cutting, creaming, or melting, depending on the type of pastry. The dough should be handled as little as possible so that

the gluten does not begin to develop. A minimum amount of water will add to the tenderness.

For a two-crust pie, the bottom crust is trimmed even with the pan and a slightly larger crust is laid over the filling. The top pastry is tucked under the bottom and the edges are pinched together and shaped. The top crust is slit to allow steam to escape.

Custard pies are made with one pie crust that is baked before filling. This crust is fitted to the pan, leaving a 1-inch overhang that is turned under to form a double thickness. Before baking, the crust is pricked with a fork (docking) on the bottom and sides to prevent bubbling while baking.

Frostings and Icings

Frostings and icings are sweet sugar spreads added to cakes and other baked goods' surfaces. They add flavor and richness and help keep the product moist. They also give the cake a more attractive look. Most are made of a sugar and liquid mixture, but are not cooked to the higher temperatures that candies and syrups are. Frostings are of several types and may be cooked or not cooked.

Common cooked frosting types include seven-minute frosting, fluffy frosting, and fudge frosting.

- The **seven-minute frosting** is made in a double boiler. The ingredients of sugar, egg whites, cold water, and light corn syrup or cream of tartar are beaten and then heated similar to candy cookery. As the frosting cooks, it is beaten about seven minutes to form stiff peaks, then removed from the heat and beaten more.
- The **fluffy frosting** is similar; however, the sugar, water, and cream of tartar are heated, forming a hot syrup, which is poured over the unbeaten egg whites. The mixture is then beaten to form soft peaks. The hot syrup mixture will cook the egg whites and should be added slowly. This frosting is less stable than the seven-minute frosting.
- **Fudge frosting** is also cooked. Ingredients are cooked to 234°F, butter is added, and the mixture cooled to 110°F and beaten to spreading consistency.

In all of these cooked frostings, the sugar crystals should be crystallized into fine crystals for a smoother texture. Care should be taken not to allow seeding with larger crystals on the pan sides or spoon.

- **Butter frosting** is an uncooked version. It includes butter for a rich flavor, powdered sugar, milk, and vanilla. After the butter is creamed, portions of the powdered sugar, then milk, and vanilla are added and beaten. More sugar and milk are added and beaten until the desired consistency is reached. The additions need to be in small amounts and consistency checked during beating to produce the correct consistency and amount of frosting at the same time. A thinner blend of butter frosting can be used as a glaze to drizzle over breads, bundt cakes, and other baked foods.

Powdered sugar may also be sprinkled on cakes as a topping. Fillings made of fruit mixtures, cream fillings, or whipped cream may be placed between the layers of a cake instead of frosting.

Cakes are usually frosted on the serving plate, and a piece of waxed paper can be used under the edge to keep the frosting from smearing on the plate. Cakes are best frosted with uncooked frostings before they cool completely. If a cake is soft and crumbs are falling off as the frosting is applied, the cake can be sealed with a thin layer of frosting (crumb coat) and frosted after this has set. The cake may also be

frozen and frosted while frozen to make a delicate cake more firm. Dipping the spatula used for frosting in cold water frequently will help keep the frosting from sticking to the spatula.

Other Desserts

Many other desserts are possible for the end of the meal. Most desserts are sweet, and some contain a higher amount of sugar than others. Pies are often filled with sweet mixtures of fruit or custard. Custards, cheesecake, puddings, and meringues are prepared with eggs and dairy products. Fresh fruit is naturally sweet and may be served for dessert as well. Fruit may be baked or poached and may be glazed with a thin sugar syrup.

Elegant-sounding desserts are often found in cookbooks and at fine restaurants. These are made of basic ingredients with techniques appropriate for their type of ingredient. Principles of egg cookery, dairy foods cookery, and sugars will help in the preparations of many desserts. A Bavarian creamis a custard sauce with gelatin and whipped cream. Chiffons are a custard base with gelatin and beaten egg whites. Mousses are a creamy soft dessert. Whipped cream and/or beaten egg whites give the dessert lightness and fluff. Dessert soufflés are made from a base with beaten egg whites to add lightness.

Frozen desserts can be varied, but ice cream is the most popular in the United States. Ice milk and sherbets are similar but usually contain less fat. Sherbet may or may not contain milk and egg whites. Ices are made with water, fruit juice, and sugar. They are sometimes called sorbets.

Dessert sauces can be served over fruit, cakes, or other baked desserts. Sauces may be made as a custard sauce, fruit, or syrup. Fruit sauces are pureed and sweetened fruit mixtures. Syrup sauces are similar to those

discussed in this chapter, varying in thickness according to the amount of crystallization.

Chocolate is a popular flavor for many desserts. Chocolate is made from cocoa beans that have been roasted, shelled, and ground. It comes to the market in many forms. Sweet chocolate may be called chocolate coating and is mixed with sugar and may contain cocoa butter and other flavorings. It is often used for dipping candies. Chocolate used for dipping should be tempered to avoid white or gray streaks (chocolate bloom) through the product. Semisweet chocolate is available as chocolate chips or squares. It is made from slightly sweetened chocolate and is used in cookies and other products. Unsweetened chocolate is the original baking chocolate and has no sweeteners or flavorings added. White chocolate is a mild flavored milk chocolate used for baking or candy making. Some recipes call for unsweetened cocoa, the powdered chocolate from which some of the cocoa butter has been removed. Other powdered cocoa mixtures may be made to addto milk or water as a beverage.

Terms

Bran: The ground outer coating of the oat, rice or wheat grain. Usually added to cereal or baked products, very high in fiber.

Bulgur: Wheat kernels processed by steaming, drying, and crushing.

Cornmeal: The flour-like product of coarsely ground corn, used in cornbread, cereal, and other baked goods.

Crumb: The interior portion of baked product.

Emulsifier: The binder that keeps products from separating into separate ingredients.

Enriched: The process of replacing nutrients which have been lost in processing.

Fermented: The process of yeast acting on the sugars and starches in the bread dough to produce carbon dioxide gas and alcohol.

Fortified: The process of adding nutrients which were not present before processing.

Gluten: The elastic network formed by kneading flour with liquid.

Grits: The coarsely ground endosperm part of corn grain.

Leavening: The formation of gases in a baked product to give it greater volume and create an even texture.

Mouth feel: The degree of firmness, density, and fluidity felt when tasting a product.

Wheat berries: Whole, unprocessed wheat kernels.

Bavarians: A cold dessert set with gelatin and whipped cream.

Chiffons: Light fluffy desserts made with gelatin and beaten egg whites.

Glaze: A shiny coating added to a food.

Ices: Frozen desserts made from fruit juice, water, and sugar.

Mousse: A light dessert made with whipped cream and/or egg white.

Poached: Cooked gently in simmering water, carefully holding the shape of the fruit.

Seed: The formation of larger, coarse sugar crystals from cooled crystals.

Sherbet: Frozen dessert, usually made with fruit juice, sugar, and milk.

Sorbet: Frozen dessert made with fruit juice, sugar, and water.

Sugar: Sweet ingredient from sugar beets or sugar cane. Granulated sugar is the standard product for food preparation; the sugar is in small granules. Powdered or confectioner's sugar is granulated sugar crushed and sifted to a desired fineness.

Frequently Asked Questions

Q. *Can you test baking powder to see if it is still good?*

A. Yes, put a little in hot water. If it fizzes, it is still good.

Q. *Can I substitute whole wheat flour for white flour in recipes for baked products?*

A. Whole wheat flour is heavier, it works best to mix whole wheat flour and all-purpose flour in regular recipes.

Q. *How do I use self-rising flour?*

A. Self-rising flour can be used in baked products by reducing the baking powder by 1½ teaspoons and the salt by ½ teaspoon per cup of flour.

Q. *Can I bake in a flowerpot?*

A. Breads or quick breads can be baked in a lined flowerpot. Use a new, never used clay pot. Wash the pot well, grease well, and line with foil before putting dough or batter in the pot. You may also use clay pots with a foodsafe glaze.

Q. *Can I use egg whites in unbaked whipped desserts?*

A. No, all eggs and egg parts should be cooked to kill possible *Salmonella* bacteria. In fluffy frostings, the egg white is cooked as the hot syrup mixture is added to it.

Resources

Joy of Cooking. Irma Rombauer, Marion Rombauer Becker, Ethan Becker. Scribner. 75th Anniversary Edition, 2006

Home Baking Association
homebaking.org

International Food Information Council Foundation
foodinsight.org

American Egg Board
incredibleegg.org

Kids with Food Allergies
kidswithfoodallergies.org

Additional Resources

Kansas Wheat

Wheat Foods Council

National Festival of Breads FACS Labs

The Art of Pie Making

Judge's Guide for Foods and Nutrition Exhibits (4H488)

Sweeteners: nutritive and non-nutritive | OSU Extension Service

Check Yourself Questions

1. What does enriching a product do?
2. What is it called when nutrients not naturally present are added to a food?
3. What are three methods for making yeast breads?
4. How do you tell if yeast bread has risen enough before baking?
5. What is "proofing" bread?
6. What leavening products are usually used in quick breads?
7. A chocolate layer cake is an example of what type of cake?
8. Cookies were once called "small cakes," but they contain more of what two ingredients than cakes?
9. What is the ideal temperature for dissolving active dry yeast?
10. What is the function of fat in baked products?
11. Smooth frostings are the result of what process?
12. What is the difference between a sherbet and sorbet?
13. At what temperature does water boil?
14. When a recipe calls for baking chocolate, what type of product should you use?

Answers

1. Enriching a food product adds nutrients that may have been removed in processing.
2. Foods are fortified to add nutrients not naturally present in the food.
3. Three methods for making yeast breads are the straight dough, no-knead, and sponge methods.
4. The finger poke test, lightly inserting a finger in the side of the unbaked loaf of bread, will leave a slight indentation, indicating it is ready to bake.
5. Proofing is the final resting time for yeast bread after kneading, before it is shaped and baked.
6. Quick breads usually depend on baking powder or baking soda to rise.
7. A chocolate layer cake is a shortened cake.
8. Cookies contain more fat and sugar than cakes, and less flour and liquid.
9. Active dry yeast is best dissolved in liquid that is between 105° to 115°F. Rapid rise yeast is added to the dry ingredients and dissolves best when the liquid added is between 120° to 130°F.
10. Fat in will make the baked product more tender, soft, and moist.
11. Smooth frostings are made with mixtures that have the sugar crystallized by cooking and beaten into small crystals.
12. Both sherbets and sorbets are frozen desserts, but the sherbet may contain milk and egg whites. The sorbet is made with fruit juice, sugar, and water.
13. Water boils at 212°F. A thermometer may be tested by placing in boiling water and checking the reading, which should be 212°F at sea level.
14. Baking chocolate is an unsweetened chocolate with no flavorings added. It is often packaged in bars or squares.

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Chapter 10

Seasonings and Flavors

Seasoning and Flavors

Upon completion of this lesson, the Master Food Volunteer will be able to:

1. Choose seasonings that complement the food and enhance the flavor.
2. Prepare smooth and flavorful gravies and sauces.
3. Know the basic types of sauces and general uses of them.
4. Use marinades to flavor and tenderize meat safely.

Key Concepts

- Gravies and sauces must be compatible with a food to complement that food.
- Marinades can be reused only if heated to boiling.
- Herbs and spices enhance foods and may have some medicinal qualities.

Herbs and Spices

Herbs and spices enhance the flavors of foods. Often, those who are on low-sodium or low-calorie diets can use herbs and spices to make their food more flavorful. Herbs and spices differ by their growing origins. Herbs are from the leaves and stems of plants grown in the temperate zone of the world. They may be used fresh or dry. Spices are from tropical climates and may come from the seeds, buds, bark, stems, or roots of aromatic plants and trees. They are usually used dry and may be purchased whole or ground.

Air, heat, and light destroy the flavors of herbs and spices. They should be stored in a dark, cool cabinet away from heat and moisture and used in a short time. Ground spices should be used within a year, and whole spices within three years. Dried herbs should be used within six months after opening the package. Dried herbs will have a stronger flavor than fresh. When substituting dried herbs for fresh herbs, a general recommendation is to use ¼ to ⅓ less dried herbs compared to fresh herbs. For example, 1 tablespoon fresh herbs = 1 teaspoon dried herbs = ¼ teaspoon powdered herbs. Add herbs and spices to cooking foods at least 10 minutes

before serving to allow the flavor to be released. If added too early, some will lose flavor after 45 minutes. Cold foods may have seasonings added 30 minutes to several hours before serving.

As a general rule, certain spices are widely used in certain cuisines. For example, basil, cumin, and garlic are associated with Thai cuisine. Most spice companies maintain a website of detailed spice information. If you want to try new spices in your cooking, start with common spices in your favorite cuisine.

Gravies and Sauces

Gravies and sauces add flavor to foods, usually meat or vegetables. They may be served as toppings to foods, as binding agents to hold ingredients together, or as complements to food. Gravies and sauces can vary the basic flavors of food for more special meals. They will add moistness and richness to food and improve the appearance and appeal to the appetite.

The basic ingredients of all gravies and sauces are liquid, thickening agent, and flavorings. Liquids may be milk, as for a white sauce, or meat stock, as in a pan gravy. Thickenings are usually flour or cornstarch. Flavorings vary according to the food the sauce will be served with. It should complement and be compatible with the food's flavor.

Most sauces and gravies are based on a roux, which is an equal mixture of flour and fat cooked over low heat. By cooking slowly and stirring, the starch granules of the flour are coated with fat, which prevents clumping and lumps. For a simple gravy, the fat is melted, or may be left in the pan from cooking meat, and flour is added to cook until smooth and bubbly. Then milk is stirred in and the mixture is cooked until thickened. The color and flavor are determined by how long the mixture is cooked and by the added ingredients.

Some sauces are made by a process called deglazing, in which the food is removed from the pan, leaving some fat and food

particles in the bottom of the pan. A small amount of liquid is added and stirred to loosen the food bits stuck to the pan. It is then cooked to thicken and reduce. It may be drizzled over the food.

Recipes for sauces may instruct for the reduction of the mixture. This is the process of reducing a liquid by boiling until it is half the original volume. This will thicken the sauce and intensify the flavors.

Another method may be used to make sauces or gravies without fat. Flour or cornstarch is used as the thickening agent and is mixed with a small amount of liquid to make a paste. It is then whisked into the hot liquid and cooked until thick.

There are many types of sauces and varieties of each.

- The basic **white sauce**, also called Bechamel, is the most familiar. It may have ingredients added to become cheese sauce, curry sauce, or Parmesan sauce.
- **Blond sauce** is similar to a white sauce but cooks a little longer, until the roux begins to brown.
- **Brown sauce or gravy** is sometimes called pan gravy and is usually made with meat stock and served with meat.
- **Red sauces** will include tomatoes or tomato products; examples are spaghetti sauce and salsa.
- **Butter sauces** are made with clarified butter and spooned over vegetables, fish, and meat dishes.

White sauce may be made in varying consistencies. Basic proportions of ingredients are, for 1 cup of milk:

- **Thin sauce:** 1 tablespoon butter and 1 tablespoon flour

- **Medium sauce:** 2 tablespoons butter and 2 tablespoons flour
- **Thick sauce:** 3 tablespoons butter and 3 tablespoons flour

Pan Sauces and Relishes

Pan sauces and relishes are an option for those wanting an accompaniment with less fat. They are especially flavorful for lower-fat cuts of meat, such as chicken breast.

To make a pan sauce to serve four people, start with ½ cup of liquid (broth, fruit juice, alcohol) then cook to reduce to ¼ cup. Add flavorings, such as mustard, dried fruits, and 1 tablespoon of fat. This should allow about 1 tablespoon of sauce per person.

To make a relish, start with about 1½ cups of fruit, ¼ of a medium red onion or 2 green onions, ¼ of a red, yellow or orange pepper, 1 tablespoon of minced parsley or cilantro, 2 tablespoons of acids, such as lime juice, lemon juice or vinegar, and ½ teaspoon cumin or chili powder.

Marinades

Marinades are liquids that meat or vegetables are placed in before cooking to add flavor. A marinade is made of oil, acid, and seasoning. Less tender cuts of meat will be more tender after marinating. Meat should be marinated at least 2 hours to have a tenderizing effect. The extra moisture helps prevent meat for grilling from drying out.

Marinades are simple to make and low-fat salad dressings can even be used. The marinade should be mixed well and combined with the food in a plastic or glass covered container and placed in the refrigerator. The food should be turned during the marinating time to be evenly marinated. The marinade mixture should not be reused after contact with raw meat unless it is heated to boiling to destroy bacteria that may be present.

Condiments

Condiments add flavors to foods. They are often added after the food is cooked and may be salty, sweet, or spicy. Examples

are mustard, ketchup, salsa, soy sauce, hot pepper sauce, and Worcestershire sauce. Some recipes call for the addition of condiments in the preparation.

Terms

Aromatic plants: Those plants that produce natural aromas and flavors from parts of their plant which are used as spices.

Bechamel: A French sauce made by thickening milk with a white roux; also referred to as a cream sauce and a white sauce.

Clarified butter: Melted butter with the sediment (milk solids) removed.

Deglazing: The process of removing bits of food from the pan it was cooked in as a gravy or sauce is made.

Glaze: To coat with a glossy mixture that adds flavor and appearance to the food.

Hollandaise sauce: A thick sauce made of egg yolks, butter and lemon juice.

Reduction: The process of cooking a liquid until it is reduced in volume to about half of the original.

Roux: A mixture of fat and flour used to thicken soups, sauces, and gravies.

Stock: The liquid in which meat or vegetables have been cooked.

Frequently Asked Questions

Q. ***What is poultry seasoning?***

A. Poultry seasoning is a blend of dried sage, thyme, and marjoram or oregano.

Q. ***Is "Mexican vanilla" safe?***

A. "Mexican vanilla," is frequently manufactured with a substance that is not approved by the Food, Drug and Cosmetic Act. This substance, coumarin, can damage the liver and other organs and interfere with blood clotting. Look for Mexican vanilla manufactured in Mexico to be properly labeled as "coumarin free." Vanilla

flavoring or extract manufactured in the United States will meet the FDA standard and is safe. United States products that don't meet the government standard for pure vanilla must be labeled "imitation" vanilla, but will also be made from safe substances. Vanilla cannot be made at home, because it requires a complex distillation process.

Q. *What is a garlic clove?*

A. The garlic clove is the part of the bulb that breaks off. The whole product is the bulb.

Q. *How can lumpy gravy be saved?*

A. Strain or blend the mixture, reheat while stirring constantly.

Resources

Professional Cooking. Wayne Gisslen. 10th edition. 2025. Published by Wiley.

The Food Lover's Tiptionary. Sharon Tyler Herbst. 2002. William Morrow Cookbooks.

The American Dietetic Association's Complete Food and Nutrition Guide, 5th, Revised and Updated Edition. Duyff, R.L. 2017. Wiley Publishing.

How to Cook without a Book. Pam Anderson. 2018. Broadway Cookbooks.

Seasoning with Herbs and Spices, MF 3539. Kansas State University. *MF3539 Seasoning with Herbs and Spices*

Additional Publications

Herbs and Spices

Spices of India, Leader's Guide

Spices of India, Handout

Get Sauced: Five Mothers and Others

Kansas Herbs Fact Sheets

Check Yourself Questions

1. How much dry herbs should be used compared to fresh?
2. What is the difference between white sauce and pan gravy?
3. What are two methods for adding flour to liquids for gravies or sauces?
4. What is a roux?
5. What do red sauces include to make them unique?
6. What type of sauce is a Bechamel sauce?
7. How long should meat be marinated?
8. What are some ways to add flavoring to foods?
9. Where are the plants for spices grown?
10. When adding herbs to cooked foods, when should they be added?

Answers

1. Generally, 1teaspoon of dried herbs will substitute for 1 tablespoon of fresh.
2. White sauce is made with milk, pan gravy is made with meat juices.
3. Flour may be mixed with the fat to form a roux, or flour may be blended with a small amount of liquid and added to the hot liquid.
4. A roux is the mixture of flour and fat cooked over a low heat, usually used as a base for gravy and sauces.
5. Red sauces include tomatoes or tomato products such as tomato sauce, chopped tomatoes, etc.
6. Bechamel sauce is a white sauce, made with milk.
7. Meat should be marinated at least 2 hours in the refrigerator.
8. Sauces, gravies, marinades, condiments, herbs and spices all add flavor to foods.
9. Spices are from plants grown in the tropical climates.
10. Herbs should be added to cooked foods at least 10 minutes before the end of the cooking period and should not be cooked with foods more than 45 minutes.

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Chapter 11

Food Preservation: Canning, Freezing and Drying

Food Preservation: Canning, Freezing and Drying

Upon completion of this lesson, the Master Food volunteer will be able to:

1. Understand canning, freezing, and drying principles.
2. Know the proper equipment needed for canning, freezing, and drying.
3. Understand reasons to properly can low-acid and high-acid foods.
4. Understand processing times and pressures.
5. Understand the process of making jams and jellies.
6. Explain the function of various ingredients in food preservation.
7. Explain why products fail in canning and how to correct them.
8. Explain why blanching is important in freezing foods.
9. Explain what to do when a freezer stops working.
10. Understand and explain differences between fermented and fresh-pack pickles.
11. Compare time and energy differences between drying and other methods of food preservation.

Key Concepts

- Heat processing canned foods destroys spoilage organisms such as bacteria, yeasts, molds, and harmful bacteria such as *Clostridium botulinum.*
- Freezing stops the growth of microorganisms, but does not kill them.
- It is important to start with fresh, top-quality food products.
- Dried foods are low in moisture, which prevents microorganism growth.
- Understand the difference between spoilage microorganisms and pathogens.

Canning

General Guidelines

Canning homegrown food is an economical way of enjoying garden produce. In most cases, it can save you half the cost of commercially canned foods because people usually do not consider their labor costs.

The **boiling water bath** method is for processing high-acid foods with pH measurement of 4.6 or less. High-acid foods prevent the growth of *Clostridium botulinum*. Therefore, these foods are safely preserved in boiling water temperature of 212˚F, for a specific time, to kill vegetative bacteria. Examples include jams and jellies, fruits, and pickles. For details, see the *How-to Guide to Water Bath Canning and Steam Canning* at bookstore.ksre.ksu.edu/pubs/MF3241.pdf.

The **pressure canning** method is for processing low-acid foods with pH measurement of 4.6 or more. These foods can support the growth of *Clostridium botulinum*. Therefore, these foods are safely preserved under pressure to achieve a temperature of 240˚ to 250˚F to kill

botulinum spores. Examples include meats and plain vegetables. For details, see the *How-to Guide to Pressure Canning* at *bookstore.ksre.ksu.edu/pubs/MF3242.pdf*.

In both methods, other factors important to the safety of the food include how the food is packed into the jars, the size of jar, the water activity, the density of the food, and more.

To properly can foods, follow these tips for best safety and quality:

- Select recipes from reliable sources that have been tested to ensure the safest end products.
- Use top quality, fresh food.
- Peel foods as recommended.
- Use the hot-pack method.
- Add acid, such as citric acid, bottled lemon juice, or vinegar with 5% acidity.
- Use proper jars and new, self-sealing lids with metal ring closure.
- Heat process at proper time, temperature, and method.

All of these steps will help reduce the following problems:

- Growth of spoilage and pathogenic microorganisms
- Activity of food enzymes
- Reactions with oxygen
- Moisture loss

Microorganisms are divided into two groups: spoilage microorganisms and pathogens. Spoilage microorganisms will cause unpleasant odors, appearance, and tastes. These organisms seldom cause illness. Examples of spoilage microorganisms are mold and yeast. Pathogens cannot be seen, tasted, or smelled. However, pathogens will cause some form of illness when ingested. Examples of pathogens include *Clostridium botulinum*, *Salmonella*, and *E. coli* O157:H7.

One of the most deadly microorganisms in home canned foods is the pathogen *Clostridium botulinum*. This bacterium exists as spores or vegetative cells. In ideal growing conditions, the spores will produce vegetative cells, which can multiply rapidly. A deadly toxin is produced within 3 to 4 days. Learn more about botulism and home canned foods from the *Centers for Disease Control and Prevention*.

Temperature Control

A key control point in home food preservation is temperature. From below freezing to above boiling, temperature affects quality, microbial growth, and shelf life. Here are key temperatures to remember and what can happen at each level.

- **-10° to 0°F:** Best storage temperatures for frozen foods.
- **32°F:** Water freezes; some cold-loving microorganisms can grow, including yeast and mold.
- **40° to 50°F:** Best storage temperature for dried and canned foods.
- **60° to 80°F:** Average room temperature.
- **40° to 140°F:** Temperature Danger Zone! This range allows rapid growth of microorganisms.
- **140°F:** Optimum temperature to dry food.
- **140° to 165°F:** Warming temperatures prevent some microbial growth, but may allow survival of some microorganisms.
- **180 to 250°F:** Canning temperature to destroy most bacteria, yeasts, and molds in acid foods. Time required to kill these decreases as the temperature increases.
- **212°F:** Boiling temperature at sea level. Effective temperature for water bath canning high-acid foods such as fruit, tomatoes, pickles, and jellied products. Time adjustments are made with increasing altitudes where water boils at temperatures lower than 212˚F.
- **240° to 250°F:** Canning temperature for low-acid foods such as vegetables, meat, and poultry. Must be done in a pressure canner to achieve temperatures above boiling. Pressure adjustments must be made with increasing altitudes.

Acidity

The acidity of foods dictates which processing method is used, the water bath method or pressure canner method. Researchers test the acidity by measuring the "pH" level. The pH scale ranges from 1.0 to 14.0 with 7.0 being neutral. Foods with a pH lower than 4.6 are high-acid foods. These foods can be water-bath canned. These foods contain enough acid to prevent growth of *C. botulinum.* High-acid foods include most acidified tomatoes, most fruits, pickles, sauerkraut, jams, jellies, marmalades, and fruit butters.

Foods with a pH higher than 4.6 are low-acid foods. These foods must be pressure-canned. Low-acid foods include red meats, seafood, poultry, milk, and all fresh vegetables including some tomatoes.

Tomatoes have pH values close to a pH of 4.6, including some varieties that are above a pH of 4.6. The pH varies with soil types, growing conditions, and other factors. Therefore, it is recommended to acidify tomatoes to make them a high-acid food. See the publication *Preserving Tomatoes*, MF1185, for details.

Methods of Packing Jars

Two methods are used to fill, or pack, jars. They are:

- Raw pack method
- Hot pack method

Always follow the method the recipe recommends. The hot pack method yields better color and flavor in the food. It also reduces oxygen in food and allows more food to fit into the jar. For both methods, jars should be filled with enough liquid to completely cover the food.

The **raw pack method** is defined as putting raw, unheated food directly into the jar. Boiling hot liquids are then added. Pack the jar as tightly as possible because air will be lost as food shrinks during processing. The exceptions are when canning corn, lima beans, potatoes, and peas. Loosely pack these vegetables because they absorb liquid and expand during heating. If a recipe does not specify the raw pack method, it should not be used.

The **hot pack method** is defined as cooking the food for a specific time and then filling the jar with the food and boiling hot liquid. Hot-packed foods should be loosely packed because shrinkage or air loss has already happened.

Before closing the jar, remove any trapped air bubbles from inside the jar by running a plastic or rubber knife into the jar. Gently move the knife to remove trapped bubbles. More liquid and/or food may need to be added. Headspace is important in canning. This is the space between the top of the food or liquid and the underside of the lid. The amount of headspace is specific for each food. Improper headspace can lead to an improper seal, contents boiling out of the jar, or discoloration of the food.

Wipe the rims of the jars clean and place a new, clean lid on the rim. Screw on the metal ring fingertip tight. Overtightening will prevent the air from escaping the jar properly and could cause the lids to buckle.

Processing

Processing times vary from product to product. Factors that affect processing time include:

- Kind of product
- Consistency of the product
- Whether it is hot or raw packed
- Size of jar

For low-acid foods, the time ranges from 20 to 100 minutes. Low-acid foods must be pressure canned between

10 to 15 PSI (pounds per square inch) to reach a temperature of 240˚ to 250˚F. For high-acid foods, the time ranges from 5 to 85 minutes. High-acid foods can be processed in a water bath canner at boiling temperature. Timing starts when water returns to boiling after jars are placed in the canner.

Elevation

Because the United States includes varying elevations, the home canner must know the local elevation to safely can food. As elevation increases, the temperature at which water boils decreases. Therefore, processing times must be increased for water bath processing, or pressure must be increased for pressure canning. Tested canning recipes are written with elevation-adjusted processing times. To determine the elevation in your area, refer to a state map or internet search for your location. For details, see *What's Your Elevation?* at *bookstore.ksre.ksu.edu/pubs/MF3172.pdf*.

Unsafe Canning Methods

Several canning methods should not be used because they do not eliminate the risk of pathogenic bacteria, including:

- Open-kettle canning
- Conventional and microwave ovens
- Dishwashers
- Slow cookers
- Outside in the sun
- Electric multi cookers
- Canning powders
- Old antique, wire bail and glass, or regular storage jars
- One-piece zinc porcelain-lined lids
- Glass lids with separate flat rubber rings

Safe Canning Methods

Steam canners can be used for high-acid foods processed less than 45 minutes, including adjustment for elevation. These are not the same as steam pressure canners.

Pressure canners should not exceed 15 PSI during the canning process. Monitoring the canner while it is processing is necessary.

Proper pressure canner equipment includes:

- A heavy pot and a lid that closes tightly
- A steam vent pipe (petcock)
- A rack for the jars to rest upon
- A dial gauge with a counterweight or weighted pressure gauge
- An overpressure plug. Newer models have an extra coverlock for added protection.
- It may or may not have a gasket, depending on the brand.

Dial pressure gauges must be tested annually for accuracy.

A proper **water bath canner** includes:

- A large cooking pot, a lid, and a wire rack
- It must be deep enough to have at least 1 to 2 inches of boiling water cover the tops of the jars, plus space for the water to boil.

Some boiling-water canners do not have flat bottoms. A flat bottom must be used on a smooth-top electric range safe for canning. Either a flat or ridged bottom can be used on a gas or coil electric burner. To ensure uniform processing of all jars with an electric range, the canner should be no more than 4 inches wider in diameter than the heating element. The range top burner must be large enough to provide enough heat to boil a large volume of water. Many newer ranges do not have large enough burners. Always follow the appliance manufacturer's advice on using smooth cooktops for canning. Also, follow the canner equipment manufacturer's advice for using their canners on smooth cooktops. Canner bottoms may not be entirely smooth, and uneven heating will occur. If the pot is larger than the burner area, the heat may discolor or crack the stove surface. Consumers should consider how much home canning they will do when purchasing a new stove. There are electric canning appliances available that can be used instead of stovetop canners.

The best jars are regular or wide-mouth Mason-type jars that are threaded and use two-piece lids. Jars must be clean and undamaged.

Two-piece lids must be used; these consist of a flat metal lid with a gasket and a metal

screw band. The lids are only used once. Screw bands can be re-used as long as they are free from rust. According to the manufacturer of Ball® and Kerr® canning products, current flat metal lids do not require heating before use. Simply wash with hot, soapy water, dry, and they are ready to use.

A plastic reusable lid is available. When using these lids, follow the manufacturer's instructions for best results. There are other brands of metal lids, but they can be of inferior quality.

After Processing

After heat processing, let the jars cool at room temperature for 12 to 24 hours. Do not retighten the metal rings after processing jars. This could result in breaking the rubber seal on the lid. In raw-packed foods, the food level and liquid volume may be reduced, due to air being exhausted during processing. Do not open the jar and add more liquid.

To test the jar seal after cooling:

- Press the middle of the lid with a finger. If the lid springs up when you release your finger, the jar is not sealed.
- Tap the lid with the bottom of a teaspoon. If sealed properly, it will make a ringing, high-pitched sound. A dull sound indicates the jar is too full of food or the lid is not sealed.
- Hold the jar at eye level and look for a concave indentation in the surface of the lid. If the lid is flat or bulging, it is not sealed properly.

Improperly sealed jars may be reprocessed within 24 hours of the original processing time, but you must have followed research-tested recipes on the first attempt. Remove the original lid and empty contents into a large pot. Bring to a boil and refill clean jars. If necessary, use a new jar. Remove air bubbles and apply a new lid. Reprocess using instructions for the hot-pack method. Unsealed jars may also be refrigerated and used within several days or frozen.

To store, remove the metal ring. If left on the jar, it may rust and become difficult to remove later. Clean residue off the jars using a cloth moistened with white vinegar. Label and date the jars. Store in a clean, cool, dark, dry area. Do not store in warm areas such as near hot pipes, a range, furnace, uninsulated attic, or direct sunlight. Damp areas can cause lids to corrode, or seals may be broken. If the jars are stored in an area where they may freeze, wrap them in newspapers or blankets and place them in heavy cartons.

Handling Spoiled Food

Do not taste any food from a jar that is unsealed or shows any signs of spoilage! When ready to use a jar of food, always check the lid for a good seal. Next, look at the food for these spoilage signs:

- Rising air bubbles
- Improper color
- Dried food at the top of the jar

After opening the jar, examine the food for:

- Unnatural odors
- Spurting liquid
- Mold growth

If the jar is unsealed and there are no signs of spoilage, the food may have pathogens present. Unlike spoilage organisms, pathogenic organisms often provide no evidence of their presence.

Spoiled food or unsealed jars of food must be destroyed. If the jar is still sealed, place in a heavy trash bag and seal. Place in a regular trash container or dispose of it in a nearby landfill. If the jars are

unsealed, open, or leaking, they should be detoxified and then discarded in a trash container or buried in soil. To detoxify spoiled products, carefully remove the lid from the jar. Place the jar(s) of food and lids in a large saucepot. Leave the food in the jar to prevent contamination. Add enough hot water to cover the jar(s). Boil for 30 minutes and let cool. Discard the containers, their lids, and food in the trash or dispose in a nearby landfill.

Sugar and Salt Substitutes

Salt substitutes should not be used in canning. For those on low-salt or no-salt diets, simply leave the salt out of canned vegetables, meat, poultry, tomatoes, and seafood, or reduce the amounts of salt added. Salt is added for flavor only, and salt substitutes can become bitter.

When making fermented pickles, salt is critical because salt controls the fermentation process. There are low-sodium, quick-process pickle recipes available.

Sugar is primarily added to canned fruits. Sugar can be eliminated to use water only. Or, the amount may be reduced. To reduce sugar in jams, jellies, and similar products, use low- or no-sugar pectin to use artificial sweeteners or a reduced amount of sugar. Certain sugar substitutes can impart a bitter flavor. Aspartame sweeteners are not heat stable and lose their sweetness when heated. It is best to use artificial sweeteners when ready to serve the canned food.

Pickling Products

General

There are four basic classes of making pickled products. They include:

- Brined or fermented foods
- Fresh pack or quick process pickles
- Fruit pickles
- Relishes

Pickled products contain a specific level of acid. This acid content is important for taste, texture, and safety of the final product. If there is not enough acid, there is a risk of botulism. Use only tested recipes and never alter the ingredient proportions.

Ingredients

Use **cucumbers** designated for pickling. "Table" or "slicing" cucumbers will yield a mushy pickle. The skin is tough, making it difficult for pickling spices and brine to penetrate the skin. Use the freshest cucumbers possible. For dill pickles, a 4-inch cucumber is best. For gherkins, a 1½-inch cucumber is best. Before pickling, rinse and scrub cucumbers well and remove the blossom end. The blossom contains enzymes that cause softening.

Canning or pickling salt is pure granulated salt. Regular table salt contains anti-caking agents that can cloud the liquid. Never alter the salt content to ensure proper fermentation. Pickle recipes designed with lower salt content may be softer and less flavorful than regular pickle recipes.

White or apple cider vinegar with a 5 percent acidity level must be used. Do not dilute the vinegar unless specified in the recipe. For a less sour product, add some sugar to reduce tartness. Vinegar gives the preservative effect in pickles. Do not use homemade vinegar or cleaning vinegar.

White sugar is most commonly used in pickles. Brown sugar can be used if that flavor is preferred. Never use a sugar substitute unless using a recipe specifically for that product. Sugar substitutes can cause bitterness, lose sweetness, will not plump cucumbers, nor keep them firm as sugar does.

Use **fresh spices** for best flavor. Powdered spices can darken pickles and make the brine cloudy. Keep spices stored away from heat and humidity for best quality.

In geographic areas with hard water, pickles may not cure properly. Soften the water

by boiling it for 15 minutes and let stand, covered, for 24 hours. Remove any scum and slowly pour off the water, leaving the sediment in the pan. Distilled water can also be used in place of hard water.

Lime and alum are not needed to make firm pickles in today's recipes. Soak cucumbers in ice water for 4 to 5 hours for a safe, crisp pickle. Fermented pickles may use alum if desired. Alum is not effective in quick process pickles. If lime is used, buy food-grade pickling lime. Rinse the pickles thoroughly to remove excess lime before canning. Failure to remove excess lime can lead to a risk of botulism. Lime increases the pH of the product, making it less acidic. Pickles must have a pH below 4.6 to prevent growth of *C. botulinum*.

Fermentation Equipment

Ferment foods in a large stone crock, glass container, or food-grade plastic container. A 5-gallon size will hold 25 pounds of product. Never use non-food-grade plastic such as garbage bags or trash liners. Wash the container and all utensils with hot water and soap before using. Allow to air dry.

To keep the product submerged in brine, fill a large food-grade plastic bag with brine and place on top of the product. It is important to keep all product covered and submerged during fermentation to prevent contamination and spoilage.

Flavored Vinegars and Oils

Flavored vinegars and oils add a new twist to salads, marinades, and sauces. However, they must be prepared and used safely to prevent growth of *C. botulinum* bacteria and *E. coli* O157:H7 bacteria. Both products are best when used immediately or stored in the refrigerator up to three weeks. After that, they should be discarded.

Flavored Vinegar

Only use glass jars or bottles that are clean, free of cracks or nicks, and fitted with a screw-band lid, cap, or cork. Containers must be sterilized and kept warm until filled.

When using herbs, use the freshest leaves and flowers. The herbs can be dipped in a sanitizing solution of 1 teaspoon bleach to 6 cups water, rinsed and patted dry. Allow 3 to 4 fresh sprigs or 3 tablespoons dried herbs per pint of vinegar.

Fruits and vegetables make flavorful vinegars. Fruits commonly used include strawberries, raspberries, pears, peaches, and orange or lemon peel. They can also be combined with herbs or spices. Vegetables used include garlic cloves and hot peppers. All added product should be thoroughly washed and peeled if necessary. Produce can be left whole or cut into smaller pieces.

Use high quality vinegar suitable for the product being added. Apple cider vinegar is best for fruits. Distilled white vinegar is best for herbs. Wine vinegar is best for garlic and tarragon. Wine and rice vinegars do contain some protein. Therefore, they can support bacterial growth.

When properly prepared, flavored vinegars will retain good quality in cool storage for 2 to 3 months. When stored

in the refrigerator, they will keep for 6 to 8 months. If the vinegar is left at room temperature, it is recommended to use them as decoration only.

Flavored Oil

Flavored oils made at home must be refrigerated if not safely acidified. There have been cases of botulism from commercial and homemade garlic-in-oils that were not refrigerated. Flavored oils provide favorable conditions for the growth of *C. botulinum*. These conditions include a low-acid environment, anaerobic conditions, a food and moisture source, and no heat treatment before consumption.

The FDA now requires commercial producers to add microbial inhibitors or acidifying agents to garlic-in-oil products. For homemade oils, the FDA recommends they be made fresh and used immediately. Any leftovers should be refrigerated to use within 3 weeks, frozen, or discarded.

Vegetables and herbs in oil should be handled the same as for garlic. Vegetables have a high moisture content, which encourages microbial growth. Follow these storage recommendations for fresh and dried foods:

- **Raw or cooked garlic and/or raw herbs in oil:** These mixtures MUST be refrigerated and used within 4 days or frozen for long-term storage. (**Note:** Raw garlic MAY be safely stored in vinegar at room temperature.)
- **Dried garlic and/or dried herbs in oil:** If oil is seasoned with dried garlic and/or dried herbs, the mixture MUST be refrigerated and used within 4 days or frozen for long-term storage.
- **Dried tomatoes seasoned with garlic and/or herbs:** Dried tomatoes-in-oil mixtures with garlic and/or herbs MUST be refrigerated and used within 4 days or frozen for long-term storage.
- **Dried tomatoes in oil:** Because of their acidity, unseasoned (i.e., no extra vegetables or herbs), fully dried tomatoes may be safely stored in oil at room temperature. (Refrigeration may delay rancidity, however.)
- **Mushrooms or chilies in oil:** Mushrooms and chilies in oil must be refrigerated unless they have been pickled with vinegar or lemon juice. Mixtures must be refrigerated and used within 4 days or frozen for long-term storage.
- **Pesto:** Pesto (an uncooked seasoning which includes fresh basil, garlic, pine nuts, and oil) must be refrigerated and used within 4 days or frozen for long-term storage.

How to Safely Make Infused Oils, *extension.psu.edu/how-to-safely-make-infused-oils*.

Jams and Jellies

Jellied products are typically made from fruit or fruit juices. They are thickened with pectin and preserved with sugar. There are five types of jellied products. They include jam, jelly, preserves, conserves, and marmalade. Other products preserved with sugar also in this category include fruit butters, fruit honey, and syrups.

Ingredients

Fruit provides flavor, color, some pectin, and some acid to the product. Fresh fruit must be at the peak of ripeness and quality for best results. Commercially canned or frozen fruit products can be used if they have no added sugar.

Pectin helps form a gel. Some fruits that are just-ripe contain a high amount of natural pectin. If the fruit is under-ripe or over-ripe, there is not adequate pectin to form a gel.

Commercial pectin is available in liquid or powdered form. They are NOT interchangeable in recipes. The advantages of using commercial pectin include:

- Using fully ripe fruit
- Cooking time is shorter and specified
- Greater yields from fruit are obtained

One disadvantage is the use of more sugar. This tends to mask the fruit flavor. Commercial pectin should be used within one year for best results. Types of commercial pectin includes:

- **Regular pectin** is for traditional jams and jellies.
- **Low- or no-sugar needed pectin** is for reduced-sugar and reduced-calorie jams and jellies.
- **Instant pectin** is for making quick batches of jam to freeze.
- **Liquid pectin** is for traditional jams and jellies.

Acid improves the formation of gel and flavor. Some fruits vary in acid content so bottled lemon juice or citric acid must be added to obtain a good gel.

Sugar is a key ingredient in forming a gel. It must be properly balanced with the pectin. Sugar, in large amounts, also prevents the growth of microorganisms. Sugar contributes to the flavor of the final product.

Never alter the sugar content of a recipe when using regular, instant, or liquid pectin because the product will not gel. Granulated white sugar is the recommended sugar. Artificial sweeteners cannot be substituted for sugar when using regular, instant, or liquid pectin. A gel will not form.

Artificial sweeteners or lower amounts of sugar can be used with low- or no-sugar needed pectin.

Equipment

To make jellied products, some specific equipment is needed.

- A large 8- to 10-quart pot with a flat bottom to cook the jam or jelly.
- A jelly bag, cheesecloth, or steam juicer to extract juice from fruit and make a clear jelly.
- A candy thermometer for making jellied products without added pectin. This helps to determine the doneness of the product.
- A boiling water bath canner or atmospheric steam canner is needed to process the products.

Preparation

Make only one recipe at a time. Doubled recipes will not gel properly. Because fruits vary in pectin and acid content, each batch may not always turn out the same. Therefore, for jellies with added pectin, the fruit or juice can be adjusted to get the desired product. Be sure to follow the recipe that comes with the pectin product. For jellies without added pectin, the cooking time can be adjusted.

Recommended canning jars for jellied products are half-pint jars. These give the best gelled products. The jars should be washed and sterilized prior to use. Keep the jars hot until ready to fill. Lids should be washed and kept clean. They do not need to be heated prior to use.

When filling the jars, leave a ¼-inch headspace. Wipe the jar edges clean before applying the lid. This helps ensure a good seal. Water bath process the products to help prevent mold or yeast growth. Store cooled jars at room temperature in a cool, dark, dry area. Jellied products not heat processed must be refrigerated or frozen.

Jellies Without Added Pectin

Testing fruit pectin content

The two ways to test fruit for pectin content are the cooking test and the alcohol test.

- **Cooking test:** Measure ⅓ cup juice and ¼ cup sugar into a small saucepan. Heat slowly, stirring constantly to dissolve all sugar. Boil rapidly until the syrup comes off a spoon in one sheet. Pour the syrup into a clean, hot jar or bowl and let cool. If a gel forms, the juice contains proper amounts of pectin.
- **Alcohol test:** Combine 1 teaspoon juice and 1 tablespoon rubbing alcohol in a jar with a lid. Tighten the lid and shake the jar gently to combine the mixture. If the juice has high pectin content, a solid gel mass will form. If it forms several small clumps, the juice has low pectin content. **Do not eat this mixture.**

Testing acid content

Acid content cannot be determined in the home. However, a simple taste test to check tartness works well. Combine 1 teaspoon lemon juice, 3 tablespoons water, and ½ teaspoon sugar. Compare the tartness taste of this mixture with the fruit juice. If the fruit juice does not taste as tart as the lemon juice mixture, it is not tart enough. Therefore, add 1 tablespoon lemon juice or ⅛ teaspoon citric acid to each cup of fruit juice to increase the acidity. This will help form a gel.

Cooking the Jelly

When making jelly without added pectin, care must be taken to not overcook the product. Overcooked product cannot be reversed or saved. Signs of overcooking include a change in color and a taste or odor of caramelized sugar. Therefore, there are three options to test for doneness. The temperature test is the most reliable.

- **Temperature test:** Using a candy thermometer, the temperature of the jelly should reach 220˚F. Adjust for elevation by subtracting 2˚F for each 1,000 feet above sea level. Make sure the bulb of the thermometer does not touch the bottom of the pan.
- **Spoon or sheet test:** Use a cool metal spoon and dip it into the boiling jelly. Lift the spoon. When the jelly reaches the proper thickness, the jelly will come off the spoon in one sheet.
- **Refrigerator/Freezer test:** Place a small amount of jelly on a plate and place in the freezer. After a few minutes, if the jelly becomes a gel, it should be done. During this test, avoid overcooking the jelly by removing the pot from heat.

Jelly With Added Pectin

Jelly made with added powdered or liquid pectin is made differently. As mentioned earlier, powdered and liquid pectin are not interchangeable. Also, pectin, acid, and doneness tests are not performed. Instructions are included in the boxes of pectin or on the manufacturer's website and should be followed precisely for best results. Each brand of pectin has a certain order in which ingredients are mixed together. These products are cooked less, have a larger yield, and fruitier flavor.

Uncooked Jellies — Freezer Products

These products must be stored in the refrigerator or freezer to prevent spoilage. Before storing in the freezer, make sure a gel has formed. Gel formation can take up to 24 hours. Store in the refrigerator, and use within 3 weeks. Store in the freezer for one year.

Freezing Principles

General Guidelines

Freezing is easy, convenient, and consumes very little time. Freezing slows the growth of microorganisms and slows the chemical changes that can spoil food. Freezing does not eliminate or kill microorganisms. Freezing works well for most foods, but may have a lower or undesirable quality when thawed.

Chemical Changes

Fruits and vegetables naturally contain enzymes. These enzymes can cause color, texture, and flavor changes along with a loss in nutrient content.

Vegetables must be blanched to inactivate enzymes. Blanching is the process of briefly boiling or steaming the vegetable. Rapidly cool the vegetable in ice water to stop the cooking process. This helps retain a higher quality vegetable. Blanching also destroys microorganisms and shrinks some produce so it uses less freezer space. Blanching times vary by vegetable and must be followed accurately to ensure a good product.

Fruits are also affected by enzymatic changes. Enzymes will cause fruit to brown and lose vitamin C. Fruit enzymes are controlled by adding ascorbic acid. Citric acid or lemon juice solutions can be used but are not as effective as ascorbic acid.

Meat contains fat, which can become rancid. Wrap meat tightly to remove all air. This reduction of air will reduce the chance of rancidity occurring and extend product shelf life.

Texture Changes

All foods contain a certain amount of water. When the food is frozen, the ice crystals expand, causing the cell walls to rupture. Consequently, when the food thaws, it will be softer in texture. The ruptured cells allow water to flow out. Foods with high amounts of water, such as fruits and vegetables, will see the most change in texture. Examples include tomatoesand celery. Fruits are also high in water and are best served partially thawed. Many frozen foods are cooked before consuming, so most textural changes are not noticed.

To combat textural changes, freeze foods as rapidly as possible. This reduces large ice crystal formation. The home freezer should be set to the lowest setting. Refer to the appliance manual for the recommended amount of food to be stored per cubic foot. Overloading a freezer can slow the freezing process and lower food quality.

Another textural change that can occur is freezer burn. This occurs when moisture evaporates from the product surface. The area becomes grainy, brown, tough, and may develop off-flavors. To prevent this, use heavyweight, moisture-resistant packaging. If freezer burn occurs, it cannot be reversed.

Your Home Freezer

Selecting a freezer depends on the household needs and what types of foods will be frozen. The general rule is to allow 6 cubic feet of freezer space per person. However, if a side of beef is being stored, additional space will be required. What style of freezer to buy depends on where it will be located in the home.

- **Upright freezers** use less floor space but lose more cold air each time the door is opened.
- **Chest freezers** use more space but are more economical.
- **Refrigerator-freezer combinations** are more convenient.

Make sure the freezer space can maintain a 0°F or colder temperature to freeze foods properly. Freezers should be placed in a convenient, cool, dry, and ventilated area. If placed in a warm location, it will be difficult to maintain a low temperature. It should sit level and be placed 2 to 4 inches from the wall if it has exposed coils.

Freezing Containers

Proper packaging will protect flavor, color, moisture content, and nutritive value. The characteristics of packaging for freezing include:

- Moisture-vapor resistant
- Durable and leak-proof
- Withstand low temperatures
- Resist oil, grease, and water
- Resists absorption of off-flavors or odors
- Easy to seal
- Easy to label

Types of packaging material suitable for freezing include:

- **Rigid containers** such as plastic or glass with tight-fitting lids.
- **Glass containers** made for freezing and canning have a wide mouth and straight sides to prevent breakage.
- **Flexible bags or wrapping** include aluminum foil, plastic bags designed for freezing, and laminated paper such as freezer paper. Place foil-wrapped food inside a plastic bag to prevent damage.
- **Seal** with freezer tape for paper and foil. Seal plastic bags with a twist tie or zip-type seal.

Freezing Fruit

Use fruit varieties at the peak of maturity suitable for freezing. The fruit should be free from blemishes and firm. Freeze fruit

as soon as possible after harvest or refrigerate until ready to freeze. Freeze small quantities at a time. Rinse and drain the fruit well. Do not use equipment made of iron, copper, or galvanized metal. These metals can react with acids in fruit to form off-flavors or harmful compounds.

Fruit can be frozen using a syrup pack, sugar pack, dry pack, or unsweetened pack. If sugar is a concern in the diet, it can be reduced or left out. Fruit texture, however, will be affected. Artificial sweeteners are best used when ready to serve the fruit. How the fruit is packed depends on the final use of the fruit.

- **Syrup-packed fruit** can range from a heavy syrup (50 percent sugar) to a very light syrup (10 percent sugar). The choice of syrup used depends on the amount of sweetness and texture desired. A 40 percent syrup is suitable for most fruits.
- **Sugar-packed fruit** has just enough sugar to cover each piece. Stir the sugar with the fruit until juice releases from the fruit and the sugar dissolves. Peaches, strawberries, figs, grapes, plums, and cherries are suitable for sugar pack.
- **Dry-packed fruit** is a simple method for small whole fruits like berries. Simply sort, rinse, and drain the fruit. Place on a tray in a single layer and freeze. Once frozen, transfer the fruit to a freezing package and return to the freezer immediately.
- **Unsweetened packed fruit** is packed in water, unsweetened juice, or pectin syrup. Unsweetened packs generally result in low quality texture and color. The fruit will freeze hard and thaw slowly. Artificial sweeteners can be added in unsweetened packs. They do provide sweetness but do not provide color protection or a syrup. Follow package directions to use proper amountswhen using artificial sweeteners.

Freezing Vegetables

Choose varieties best for freezing. Vegetables should be at peak maturity and freshly

harvested. If they cannot be frozen immediately, refrigerate to maintain freshness. Sort, rinse, and prepare vegetables in small quantities for best results. The freezing process varies according to type of vegetable.

Blanching

Blanching is a necessary step in freezing most vegetables to control enzymatic activity. It also removes dirt and microorganisms. It brightens and sets the color and helps maintain nutrient content. Blanching time varies by vegetable and must be followed precisely. Underblanching causes enzymes to increase in activity. Therefore, it is worse than no blanching. Overblanching results in the loss of color, nutrients, and flavor. The goal is to blanch the product, not to cook it.

There are three methods of blanching.

- **Water blanching** is used for most vegetables. Use a basket that fits inside a large pot with a lid. Use 1 gallon water per pound of vegetables. Heat the water to a rolling boil. Lower the basket of vegetables into the water and cover with the lid. Start counting blanching time when the water returns to a full boil. Blanch for the time recommended for the vegetable. Blanching times can be found here: *nchfp.uga.edu/how/freeze/freeze-general-information/blanching-times*.
- **Steam blanching** is best for vegetables such as broccoli, pumpkin, sweet potatoes, and winter squash. In steam blanching, the boiling water does not touch the food. Steaming time is counted as soon as the lid is placed on the pot.
- **Microwave blanching** is the least recommended method of blanching. In research studies, microwave blanching does not always inactivate enzymes because heating is uneven. Therefore, quality will be low. Microwave blanching does not save time or energy.

After blanching, the product must be cooled quickly and completely to stop the cooking process. Use a large bowl filled with cold water and ice. Drain thoroughly to remove excess moisture.

Packing

The prepared vegetables can be packed using two methods.

- The **dry pack method** involves placing the prepared vegetables in freezing containers quickly. Remove as much air as possible and leave headspace. Seal and freeze.
- The **tray pack method** involves placing the prepared vegetables on a shallow tray in a single layer. Place the tray in the freezer and freeze only until firm. Do not expose to the open freezer air for a long time because too much moisture will be removed. After freezing, remove from tray, package leaving no headspace, seal, and return to the freezer.

Freezing Meats

Choose the best fresh meats to freeze. Cured meats can be frozen but for a shorter period of time. Curing salts can induce rancidity during long freezing times. Fresh beef can be aged five to seven days prior to freezing. All freshly slaughtered meats should be cooled to below 40˚F within 24 hours to prevent spoilage.

Meats purchased from the grocery store can be frozen immediately. Divide or cut meat into desired portion size. Package in freezer paper or wrap using the drugstore or butcher wrap method. (*Food Freezing Basics: Methods of Wrapping (FN613)*). Meats purchased in the grocery store should be removed from their store wrap prior to freezing because this packaging is not suitable for freezing.

Game Meats

Large game meat can be frozen the same as above. Small game meats should be skinned and dressed. Chill for 24 to 36 hours. Cut into desired portion sizes, package, and freeze.

Poultry

All poultry should be cleaned, eviscerated, and cooled completely before freezing. Whole birds freeze best for high quality. For short freezing time, pack in a plastic freezer bag. For long freezing time, wrap the bird tightly in plastic freezer film. Then overwrap with freezer paper or foil. Seal, label, and freeze immediately.

Poultry cut into halves, quarters, or pieces should be packed using a layer of freezer wrap or waxed paper in between each piece. Pack like pieces together to minimize space between pieces, then wrap in freezer paper or plastic bags. Package, seal, label, and freeze.

Poultry bought in the grocery store should be removed from original packaging prior to freezing. Debone cooked poultry. Remove as much fat as possible. Pack into plastic freezer bags or boxes, seal, label, and freeze. Do not freeze stuffed poultry. Stuffing should be frozen separately.

Game Birds

All game birds should be field dressed and cooled quickly after shooting. Prior to freezing, remove excess fat to prevent rancidity. Freeze as above for poultry. Do not freeze stuffed game birds.

Fish and Seafood

Use the freshest fish possible for freezing. Wash and remove scales, entrails, head, and dorsal fin. Cut large fish into steaks or fillets. Fish can be pretreated prior to freezing. High-fat fish can be dipped into an ascorbic acid solution to control rancidity and flavor changes. Lean fish can be dipped in a salt brine to firm the fish and decrease drip loss when thawed. Fish can be packed by first dipping in a glaze and then package, label, and freeze.

Glazing fish can be done one of three ways.

- **Lemon-gelatin glaze:** Combine ¼ cup lemon juice and 1¾ cups water. Dissolve one packet of unflavored gelatin in ½ cup of the lemon mixture. Heat the remaining lemon juice mixture to boiling. Stir the gelatin mixture into the hot juice. Cool to room temperature. When cool, dip the cold fish into the gelatin glaze, drain. Wrap the fish in freezer paper, label, and freeze.
- **Ice glaze:** Pre-freeze the fish, unwrapped, in the freezer. As soon as it is frozen, dip the fish in ice water. Freeze the glazed fish a few minutes to harden the glaze. Repeat this glazing procedure until a uniform cover of ice forms. Wrap, label, and freeze.
- **Water method:** Simply place the fish in a shallow metal, foil, or plastic pan. Cover with water and freeze. Wrap the container in freezer paper after it is frozen, label, and freeze.

Clams can be frozen in the shell or shucked. Shucked clams should be cleaned and washed. Drain thoroughly prior to packing and freezing.

Live crab should be boiled for five minutes. Then remove the back, legs, entrails, and gills. Cool quickly after cooking. Wrap or ice glaze the claws and body. Package, seal, label, and freeze.

Lobster should be frozen uncooked for best quality. Freeze whole or just the edible portions.

Oysters still in the shell should only be frozen live. A live oyster will keep its shell tightly closed or will close when tapped. If you have plenty of freezer space and want to freeze the oysters in the shell, simply wash the shells thoroughly and place in moisture- and vapor-resistant bags.

Shuck the oysters to save freezer space. First, wash the oyster shells, discarding any that have died. Shuck oysters into

a strainer, saving the liquor, and remove any pieces of shell or sand. If necessary, the oysters can be rinsed to remove any sand. Place oysters and liquor in a plastic container or freezer bag, leaving ½-inch headspace. Seal and freeze.

Note: Freezing does change the texture and flavor of oysters. These oysters may be best used in casseroles or stews. More information may be found here: *clemson.edu/extension/hgic/food/food_safety/preservation/hgic3064.html*.

Shrimp should be high quality, cooked or raw, in or out of the shell. It is best to freeze shrimp raw, without heads, and in the shell.

Eggs

Eggs can be refrigerated for 1 month. To freeze, use fresh undamaged eggs. Crack the egg and remove any shell pieces.

- For **whole eggs**, mix the white and yolk together. Reduce graininess by adding 1½ tablespoons sugar, 1½ tablespoons corn syrup, or ½ teaspoon salt per cup whole eggs. This addition depends on final use of the eggs. Strain through a sieve to improve uniformity. Package, seal, date, and freeze. The mixture can also be frozen in ice cube trays using 3 tablespoons per cube. Freeze solid, remove from trays, package in bags, seal, date, and store in freezer. Each cube equals one egg.
- To freeze **egg yolks**, separate yolks from the whites. Stir gently. Freeze as for whole eggs. One tablespoon egg yolk mixture equals one egg yolk.
- To freeze **egg whites**, separate whites from the yolks. Mix gently and strain through a sieve. No sugar or salt is needed. Freeze as for whole eggs. Two tablespoons egg white mixture equals one egg white.

Dairy Foods

Butter. Wrap in foil, freezer paper or film, or other moisture-vapor resistant package.

Hard and semi-hard cheese. Cheese can become crumbly and mealy. Pasteurized processed cheese can also be frozen. Soft cheeses such as cream cheese and cottage cheese do not freeze well.

Heavy cream with more than 40 percent butterfat can be frozen. To reduce the oily film effect when used in hot liquids, it can be heated to 170˚ to 180˚F for 15 minutes. The addition of ⅓ cup sugar can extend the freezer storage time. Cool quickly, package with headspace, seal, and freeze.

Ice cream is best when used within one month. After that, it becomes sticky and grainy, and can change in flavor. For longer storage periods, place in extra wrapping or airtight container. Homemade ice cream does not store well and is best used immediately after preparation.

Milk and buttermilk. Use pasteurized, homogenized milk only. Re-package large quantities into smaller, moisture-vapor resistant containers with headspace. Freezing may change the texture and cause separation. Thaw in the refrigerator and stir well before use.

Sour cream should not be frozen. Freezing will cause separation and it will not blend back together.

Yogurt can be frozen. Place in containers in freezer and freeze. When thawed, it may have a more pronounced acidic flavor.

Frozen Prepared Foods

For convenience, foods such as casseroles, main dishes, baked goods, and desserts can be frozen in advance to save time later. Leftovers can also be frozen. Large items can be divided into smaller portions.

Some prepared foods do not freeze well for long periods of time. Therefore, proper planning helps cut down on too much product to freeze.

Cool prepared foods completely before freezing. This can be done by dividing into smaller portions or placing the pan in an ice water bath. After cooling, freeze immediately.

Thawing Frozen Foods

All foods should be thawed in the refrigerator or, for foods that will be heated, in the microwave or as part of the cooking process. Thaw only what is needed for the meal. If a microwave is not available, proper planning is needed to thaw the product before reheating.

If foods have been accidentally thawed due to power outage or other cause, check the packages for ice crystals or that the temperature has remained 40˚F or below. This allows most foods to be refrozen. A good rule to follow for all foods is "when in doubt, throw it out."

Drying Foods

Dried foods are convenient, safe, and simple to use. They are lightweight, use little space, and do not need to be refrigerated. Drying removes moisture from food. This prevents the growth of bacteria, yeasts, and molds. Enzyme action is slowed but is not eliminated. Some dried foods — such as jerky, fruit, and fruit leathers — can be eaten in the dried state. Others only need water to rehydrate the food. Food can be dried in a dehydrator, oven, or in the sun in hot, dry climates.

Sun drying is the oldest method of drying foods. However, some foods are better than others for sun drying. The best foods are fruits because of high sugar and acid content. Care must be taken to prevent contamination from the environment. Temperature fluctuations can cause moisture to reabsorb into the food.

Home food dehydrators are specifically designed to dry foods indoors. It dries food at 140˚F quickly with air circulation. The

main disadvantage to dehydrators is the limited capacity depending on the food being dried. Extra drying trays can be purchased for some brands of dehydrators to dry more food.

Oven drying is another alternative. It is good for those who occasionally dry foods. Oven drying is slower because of low air circulation. It is not as efficient and uses more energy because the oven door must be left open. A fan is needed for air circulation. It is difficult to maintain a low even temperature (130˚ to 140˚F) in many ovens.

Some **air fryer** appliances have the option to dehydrate foods. Follow the manufacturer's instructions for best results.

A food preservation method gaining popularity at home is **freeze drying**. Commercially, it is used for products such as astronaut meals in space and camping meals. This process removes water from food under a vacuum in three steps:

- The food is frozen at very low temperatures, usually below 0˚F.
- The first drying step turns the ice into vapor by raising the temperature under vacuum. This is called sublimation.
- The second drying step removes any remaining moisture at a higher temperature. This is called desorption.

The process of freeze drying helps preserve the original texture, flavor, and nutrients more effectively than traditional drying methods. This method takes more time, a higher investment cost for equipment, and uses more energy than traditional drying methods. The final product has very low moisture levels and is very lightweight.

Food safety is still a key consideration with freeze dried foods. The process of freeze drying does not kill bacteria. Exposure to

moisture or humidity will allow bacteria will be reactivated. Raw meat, poultry, seafood, raw eggs or egg products, or any raw dairy products are high risk foods for freeze drying.

Learn more from Can I Freeze-Dry That? A Practical Guide to Safe and Effective Freeze-Drying, Utah State University Extension (*extension.usu.edu/foodsafety/research/can-i-freeze-dry-that-a-practical-guide-to-safe-and-effective-freeze-drying*) and Let's Preserve: Freeze-Drying, Penn State University (*extension.psu.edu/lets-preserve-freeze-drying*).

Drying Fruit

Slice fruit in thin, uniform pieces. Peels can be left on but this increases drying time. Fruits must be pretreated to prevent darkening. Pretreatments include a sulfite dip (not recommended for asthmatics), ascorbic acid, fruit juice, or honey. Some fruits can be syrup blanched or steam blanched. When drying, place food onto trays in a single layer with no overlapping.

The drying tray may be sprayed with a non-stick spray to prevent fruit from sticking. To determine final dryness, the fruit should have no visible moisture and when squeezed, no moisture should appear. Some fruits may be pliable, but be properly dried. When drying is complete, let the food cool completely. Warm food may cause moisture to develop during storage, leading to mold growth. Loosely pack into airtight plastic bags or glass jars. Store in a cool, dry place.

Drying Vegetables

The critical factor in drying vegetables is drying time. The longer the time, the greater the loss of flavor and quality. It is important to keep the pieces uniform for optimum drying. Vegetables must be blanched as is done for freezing. This stops the enzymes from deteriorating the product during the long, warm drying process. Onions, green peppers, and mushrooms do not need blanching for drying. To improve texture for green beans, place the blanched beans in the freezer for 30 to 40 minutes prior to drying. Vegetables should be brittle or crisp when completely dried.

Fruit Leather

Leathers are an alternative to drying fruit pieces. Pureed fruit is spread in a thin layer on a flat surface. When dry, the leather is rolled into a tube. Leathers can be made from leftover fruit pulp in making jelly and from overripe fruit. Wash, peel and chunk large fruit. Puree until smooth in a blender or food processor. Add sugar if desired. To prevent darkening, add 2 teaspoons lemon juice or ⅛ teaspoon ascorbic acid for 2 cups fruit pureé. Canned fruit may also be used. Add applesauce to other fruits to increase the amount of leather. Spread pureé on a flat tray lined with plastic film to about ⅛-inch thick. Leathers are dry when the middle does not leave an indentation when touched. They should retain enough moisture to be pliable. Leathers can also be made from vegetables such as pumpkin and tomato.

Meat Jerky

Jerky can be made from any lean meat. Raw poultry is not recommended to make jerky because of the texture and flavor of the finished product. The primary concern in making jerky is destroying microorganisms that cause foodborne illness. Always handle the meat with clean hands, utensils, and equipment. Keep the meat refrigerated before use and while marinating the meat. Wild game must be handled carefully so that gut contents and wound locations are eliminated. Meat jerky must be heated to 160°F to destroy microorganisms. This can be done using one of two methods.

If the meat is marinated, heat the meat in the marinade prior to drying.

After drying, heat the dried jerky in the oven at 275˚F for 10 minutes after the dehydration process.

Store jerky in an airtight container. For best results, store in the refrigerator or freezer.

For complete instructions on making meat jerky, see *Dry Meat Safely at Home* (MF3173), *bookstore.ksre.ksu.edu/pubs/MF3173.pdf*.

Drying Herbs

Drying is the easiest method of preserving herbs. Simply expose the leaves, flowers, or seeds to warm, dry air. Leave the herbs in a well-ventilated area until the moisture evaporates. Sun drying is not recommended because the herbs can lose flavor and color.

The best time to harvest most herbs for drying is just before the flowers first open when they are in the bursting bud stage. Gather the herbs in the early morning after the dew has evaporated to minimize wilting. Avoid bruising the leaves. They should not lie in the sun or unattended after harvesting. Rinse herbs in cool water and gently shake to remove excess moisture. Discard all bruised, soiled, or imperfect leaves and stems.

Dehydrator drying is a fast and easy way to dry high-quality herbs because temperature and air circulation can be controlled. Preheat the dehydrator with the thermostat set to 95˚F to 115˚F. In areas with higher humidity, temperatures as high as 125˚F may be needed. After rinsing under cool, running water and shaking to remove excess moisture, place the herbs in a single layer on dehydrator trays. Drying times may vary from 1 to 4 hours. Check periodically. Herbs are dry when they crumble and stems break when bent. Check your dehydrator instruction booklet for specific details.

Less tender herbs: Sturdy herbs such as rosemary, sage, thyme, summer savory, and parsley are easy to dry without a dehydrator. Tie them into small bundles and hang them to air dry. Air drying outdoors is often possible; however, better color and flavor retention usually results from drying indoors.

Tender-leaf herbs: Basil, oregano, tarragon, lemon balm, and the mints have a high moisture content and will mold if not dried quickly. Take a paper bag and tear or punch holes in the sides of the bag. Suspend a small bunch (large amounts will mold) of herbs in a bag and close the top with a rubber band. Place where air currents will circulate through the bag. Any leaves and seeds that fall off will be caught in the bottom of the bag.

Another method, especially nice for mint, sage, or bay leaf, is to dry the leaves separately. In areas of high humidity, it will work better than air drying whole stems. Remove the best leaves from the stems. Lay the leaves on a paper towel, without allowing leaves to touch. Cover with another towel and layer of leaves. Five layers may be dried at one time using this method. Dry in a very cool oven. The oven light of an electric range or the pilot light of a gas range furnishes enough heat for overnight drying. Leaves dry flat and retain a good color.

Microwave ovens are a fast way to dry herbs in small quantities. Follow the directions that come with your microwave oven and watch carefully to prevent burning.

When the leaves are crispy dry and crumble easily between the fingers, they are ready to be packaged and stored. Dried leaves may be left whole and crumbled as used, or coarsely crumbled before storage. Husks can be removed from seeds by rubbing the seeds between the hands and blowing away the chaff. Place herbs in airtight containers

and store in a cool, dry, dark area to protect color and fragrance.

Dried herbs are usually 3 to 4 times stronger than fresh herbs. To substitute dried herbs in a recipe that calls for fresh herbs, use ¼ to ⅓ of the amount listed in the recipe.

Terms

Ascorbic acid: the chemical name for vitamin C. Lemon juice is a good source for preserving foods.

Blanching: Heating food in a boiling water bath or over steam for a designated time period to inactivate enzymes.

Botulism: An illness from the bacteria *Clostridium botulinum*. Grows best in moist, low-acid food under low oxygen conditions and a temperature between 40°F and 140°F. These conditions are found in jars of canned foods such as meats and plain vegetables that have been under-processed.

Canning salt: Also referred to as pickling salt. It is table salt without anticaking or iodine additives.

Citric acid: A form of acid added to canned foods to increase the acidity (decrease the pH) of low-acid foods. This is commonly used in canning tomatoes.

Conserves: Jam-like spreads made with a combination of fruit. May contain nuts, raisins, or coconut.

Enzymes: Proteins in food that accelerate flavor, color, texture, and nutritional changes. Must be inactivated to stop further enzyme action.

Fermentation: Changes in food caused by intentional growth of bacteria, yeast, or mold. Native bacteria ferment natural sugars to lactic acid. This is a major flavoring and preservative in sauerkraut and in naturally fermented dill pickles.

Headspace: The un-filled space above food or liquid and below the lid in jars. It allows room for expansion during heat processing or freezing. It also forms a vacuum when hot jars cool.

High-acid foods: Foods with pH lower than 4.6. Includes fruits, acidified tomatoes, and pickled vegetables.

Jam: Thick, sweet spread with crushed or chopped fruit.

Jelly: Sweet, clear spread made with fruit juice and sugar.

Low-acid foods: Foods with pH higher than 4.6. Includes vegetables, tomato-vegetable mixtures, all meats.

Marmalades: Citrus flavored, clear gels with small fruit pieces or peel.

Moisture-vapor-proof: Packaging for freezing such as rigid plastic or glass jars.

Moisture-vapor-resistant: Packaging for freezing such as heavy aluminum foil or laminated freezer paper.

pH: A measure of acidity or alkalinity. The values range from 0.0 to 14.0 with 7.0 being neutral. Lower numbers are more acidic; higher numbers are more alkaline.

Pectin: A "gum" found in plant cell walls. Used to form a gel. Naturally found in some fruits.

Preserves: A clear, slightly gelled syrup made with small, whole fruit or uniform pieces of fruit.

Rancidity: Flavor changes that occur when fat is exposed to oxygen over a period of time.

Frequently Asked Questions

Q. Can burpless cucumbers be used to make pickles?

A. Not recommended. They can become soft and have a tough skin. They can be used for pickle relish.

Q. Why do canned tomatoes float?

A. The tomatoes were not hot packed. Hot packing will remove air from the food and allow the food to pack better in the jar.

Q. Can you freeze tomatoes without cooking them first?

A. Yes, but not recommended. Enzymes will not be inactivated, therefore quality will be low.

Q. My pressure canner is not working. Can I use my water bath canner for low-acid foods?

A. No. Low-acid foods must be pressure canned. Water bath canning is for high-acid foods only.

Q. What foods can be home-canned for baby food?

A. Fruits only.

Q. Is it safe to can foods in the oven?

A. No. There is too much temperature variation and dry heat is slow in penetrating the jars of food. Jars could also explode. Too much risk of developing botulism toxin.

Q. Why did the garlic in my pickles turn green or blue?

A. This is due to the pigments in the garlic reacting with any metallic component that came in contact with the garlic. This could be a metal knife, iron, tin, or aluminum pans, metal from the water pipes. Garlic

also contains a pigment that reacts with acid to turn blue or purple. Immature garlic, garlic not fully dry, or red-skinned varieties are most prone to these color changes. The garlic is safe to eat.

Q. *What is freezer burn?*

A. A dried or dehydrated area of frozen food that was not properly wrapped. It is safe to eat but has poor quality.

Q. *Can bread wrappers be used as freezer wrap?*

A. No. Bread wrappers are not moisture-vapor resistant.

Resources

USDA Complete Guide to Home Canning, Agriculture Information Bulletin No. 539, 2015 edition, *nchfp.uga.edu/resources/category/usda-guide*

So Easy To Preserve, 6th edition, Elizabeth Andress and Judy Harrison, The University of Georgia Cooperative Extension Service, *setp.uga.edu*

Additional Publications and Videos

Links to additional publications, information, and videos on food preservation can be found at: *rrc.k-state.edu/preservation/index.html/*

Check Yourself Questions

1. What are the four main components to make jams and jellies?
2. What temperature does pressure canning reach for processing low-acid foods?
3. What are tomatoes acidified with to make them safe for water bath canning and pressure canning?
4. What does blanching do when freezing vegetables?
5. To kill microorganisms, what temperature is meat jerky heated to?
6. What is the difference between hot pack and raw pack methods of canning?
7. Can powdered and liquid pectin be used interchangeably?
8. What are some signs of spoiled canned food?
9. Can you reuse canning lids?
10. Is it safe to use preservation recipes handed down through the family?

Answers

1. Fruit, acid, pectin, and sugar.
2. Pressure canning temperatures should reach 240-250˚F.
3. Lemon juice is recommended to acidify tomatoes. Use at a rate of 2 tablespoons per quart or 1 tablespoon per pint. Other options to acidify tomatoes include citric acid or vinegar with 5% acidity.
4. Blanching inactivates enzymes which can lower the quality of frozen food.
5. Meat jerky should be heated to an internal temperature of 160˚F to reduce risk of microbial contamination.
6. Hot pack method is cooking the food prior to filling the jars. Hot packing removes air and allows more food to be packed into the jars. The raw pack method is putting raw food into the jar, then adding hot liquid.
7. No. Always use what pectin the recipe calls for when making jams and jellies.
8. Look for bulging lids, bubbles in the liquid, spurting liquid when the jar is opened, a foul odor. Do not taste the food when signs of spoilage are present!
9. Never reuse canning lids. Always use a new lid.
10. Old recipes may not be safe. It is recommended to use current, tested recipes for safely preserved food.

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Chapter 12

Food Safety

Food Safety

Upon completion of this lesson, the Master Food Volunteer will be able to:

1. Understand basic food safety concepts of clean, separate, cook, and chill.
2. Learn how food safety affects specific population groups.
3. Learn about specific foodborne illness agents and how they affect foods.

Key Concepts

About Food Safety

- It is the consumer's responsibility to ensure the safety of their food once they purchase it at the grocery store, farmers market, or similar venue.
- Good kitchen habits are important for thawing, storing, dating, and preparing foods.
- Foods should always be cooked to their appropriate temperature.
- Food should not be held in the temperature danger zone for more than two hours.
- One can never be too concerned with food safety in all aspects of food handling, storage, and preparation.

About Foodborne Pathogens

- Microorganisms are found naturally in nature. They live on and in the human body in harmony. They also may be found on plant and animal materials that become food. Occasionally, illness can occur from ingestion of an organism, its toxins, or spores.
- Some microorganisms can survive at refrigerated temperatures while others are heat resistant.
- It is important to follow proper cleaning and food handling procedures to avoid illness.

Introduction

Consumers have a tremendous interest in the foods they eat — and for a good reason. Food nourishes our minds and bodies at all stages of life. Food provides energy, tastes good, smells pleasant, and has eye appeal. Thanks in part to increased availability of food, Americans are living an average of 78.4 years, according to the Centers for Disease Control and Prevention.

So why is there such increased attention to safe food handling practices? If research has advanced towards making food safer, why are we still getting sick? Illness from food is recognized now more than ever, as media sites report foodborne illness outbreaks, and a large number of consumers have been affected by product recalls. But still today, consumers are not convinced to change long-time food handling practices that seem safe. Prevention, stated simply, is the best method of safety.

Now more than ever, food products provide consumers with health benefits, new flavor experiences, and convenience. Foods are

fortified and processed to retain nutrients. Biotechnology allows food to improve health beyond the imagination. Food processing technology has improved the safety of the foods we buy. Growth in the food industry is expected to increase in years to come. So, why are we still getting sick?

Advances in food science and technology have opened our eyes to new sources of foodborne illness. We are able to detect tiny living organisms on the food we eat. If ingested, and conditions are right, some of these organisms can cause illness. Though most microorganisms in food are harmless, some can cause serious harm or even death. The organism *E. coli* O157:H7, in recent years, has been linked to improperly cooked ground beef and other food products. It resulted in the severe illness and death of some that consumed it. Children are especially vulnerable to this organism.

New research leads to new guidelines for food handling. Science works on behalf of the public to investigate ways to prevent foodborne illness. New organisms that cause illness are discovered, and new handling procedures or other interventions are developed to destroy them. Unfortunately, many consumers choose to ignore these safe food-handling practices.

If most illness comes from raw products, aren't all prepackaged ready-to-eat foods safe? This common misconception raises great concern for the food industry. Today's lifestyles promote convenience and speed; two factors that do not always provide safety in our food. Ready-to-eat food products also have potential to cause illness. This can occur because some organisms can survive the heat of cooking, the cold of refrigeration, and may be able to grow without oxygen. Microorganisms such as *Listeria monocytogenes* or *Clostridium botulinum* fall into this category and have been responsible for miscarriage, illness, and death. Proper food processing increases the consumer's reliance on the food manufacturer. But consumers must handle these foods appropriately at home to keep them safe to eat.

The same concerns arise when eating out. Trust is placed in each eating establishment when a consumer bites into the tasty food they selected. Were proper food preparation guidelines followed? Were correct food storage, handling, and preparation techniques used? Is the food that is being eaten safe? Yes, most likely these guidelines have been followed. Thanks to the United States government, regulatory agencies monitor the activities and food safety (HACCP) plans of meat, poultry, seafood, and juice processors. Programs for foodservice establishments, such as ServSafe®, educate foodservice workers on proper food handling techniques. The same safe handling practices that consumers want to see followed at their favorite restaurants are the same practices that should be followed at home.

It is no secret that the elderly American population is growing. This raises awareness for risk of foodborne illness. Most elderly people do not have healthy bodies and immune systems to fight off disease. If small amounts of a harmful organism do not affect a healthy adult, they may make an elderly person extremely sick. Young children are also of concern because of their developing immune systems. People who are already sick from other causes and pregnant women are also more susceptible to foodborne illness. These vulnerable populations provide an even greater reason for foodborne illness prevention.

Because of the many risks involved, it is the role of the consumer to take responsibility for food during all stages. To prevent illness or even death, a wise consumer should choose to always practice proper safe food handling habits. By following the food safety guidelines outlined in this book, it will be easy to ensure safe meals at home. You too can learn to make cooking a safe experience, for you and your family.

Safe Handling of Food

Consumers want to be able to purchase healthy, flavorful, and safe foods. What many people don't realize is that the safety of food following purchase is within their control. We are responsible for the transportation, storage, preparation, and serving of our grocery purchases. By following simple guidelines on how to shop smart and handle food safely from purchase to serving, potential food safety problems can be avoided.

Supermarket Shopping

While at the supermarket, be aware of the products you purchase as well as the cleanliness of the store.

- Shop for refrigerated and frozen foods just before checkout to keep them cold. Keeping them together in the cart will also keep them at a colder temperature.
- When buying refrigerated foods, choose only those that are cold to the touch. Refrigerated foods that are not cold to the touch may have been held in the temperature danger zone too long.
- Pack raw meat and poultry in plastic bags to prevent the meat juices from leaking onto other products.
- Buy only pasteurized dairy products. This includes all milk products and eggs if they will be served without cooking.

- Examine fruits and vegetables carefully for quality and freshness. Be sure to closely examine fruits and vegetables that may be purchased in bulk bags or sacks, for example: apples, oranges, potatoes, etc. Do not choose products with packaging that has been torn, ripped, or damaged in other ways.
- Examine sacks of items such as flour and sugar. Bags should be free of rips, tears, and insects.
- Examine all cans and avoid purchasing those that are dented, leaking, or rusty. Make sure that safety buttons on the lids of jars are intact. When canned foods are badly dented or damaged by rough handling, illness-causing bacteria may grow.
- Think ahead when shopping, and do not buy items that won't be used before their expiration date. Shopping smart at the supermarket saves time, money, and your health.

Checking Dates

Most smart shoppers check dates on all products. We usually think to only check the date on milk. In reality, almost all food packaging contains a sell-by, use-by, or best-by date. Supermarkets may stack the shelves and refrigerator cases with the freshest product in the back. By identifying the date on the package, one can ensure the purchase of the freshest product available.

The following are dates one may find on product packaging:

- **"Sell-by" date** tells the store how long to display the product for sale. Consumers should buy the product before that date, but should still be able to safely consume the product after that date if it is handled properly.
- The **"use-by" date** represents how long a manufacturer indicates its product is of optimal quality. Food may still be eaten after the use-by date, but depending on the product, there may be a noticeable decline in quality.

- The **"best-by"** or **"best if used by" date** indicates when a product will be of best flavor or quality. It is not a purchase or safety date.

Be aware of what types of dates are on the food products you buy. For the best food quality and the longest shelf life, purchase the freshest food items available. Also, purchase cold foods cold and hot foods hot. Improper storage of food at the grocery store can greatly decrease the shelf life of each product.

Transporting Food

Usually, we do not consider the length of time it takes to shop for groceries, stand in checkout lines, drive home, and unpack the food. Often, distractions occur that may lengthen the intended shopping trip. It is important to take groceries directly home after shopping. The reason for this is to keep the products at the appropriate temperature.

- By gathering perishable foods last and going home directly, you reduce the length of time these products are exposed to the temperature danger zone.
- During transport in your car, it is important that refrigerated or frozen foods are not left in warm places, such as below heating vents or in direct sunlight.
- At checkout, make sure frozen and refrigerated products are packed in the same bag. Keeping the colder items together will keep them cooler longer.
- If the drive home is greater than one hour, transport perishable foods in an ice-packed, insulated cooler.
- If transporting a ready-to-eat food that is already warm, it is best to reheat the product to its proper temperature, as measured with a calibrated thermometer, before consumption.

Food Storage

Developing good food storage habits will extend the shelf life of your food and help maintain safety. Kansas State University has publications that provide guidance on the length of time that various foods can be safely stored in the cupboard, refrigerator, or freezer. (*Safe Food Storage: The Cupboard:* bookstore.ksre.ksu.edu/pubs/MF3131.pdf and *Safe Food Storage: The Refrigerator and Freezer:* bookstore.ksre.ksu.edu/pubs/MF3130.pdf).

Follow these guidelines to help ensure safe food storage at home:

- Keeping a clean environment for the storage of all food products is ideal. This includes refrigerators, freezers, cupboards, pantries, or any other food storage location.
- Safe storage begins with the temperature. Refrigerator and freezer temperatures should be monitored regularly and kept within the ranges of: refrigerated storage, 32° to 39°F; frozen storage, –10° to 0°F. Use an appliance thermometer to monitor the temperatures in your refrigerator and freezer.
- To maintain freshness, follow the "first in first out" rule by dating all items and placing newer items behind older ones in storage. This practice will ensure that the oldest product is consumed first.
- Raw meats should be stored on the lowest shelf possible and away from ready-to-eat foods. This prevents meat from dripping on other foods. Also, place a lipped plate or tray under all thawing meats to contain leakage.
- Store food where rodents or pets can't reach it and away from household chemicals.
- Keeping food properly contained in sealed containers may prevent pests from infiltrating the kitchen area.

Keeping the food storage area clean will accomplish the same goal.

- Crumbs or food particles on the floor, countertop, or in the sink are invitations for rodents to enter your house. Monitor the cleanliness of your kitchen and food storage area and remove trash regularly.
- Keep an eye on your leftovers. Date them and consume or discard within four days.

Food Preparation and Serving

After food has been safely and responsibly purchased, transported, and stored, the next steps are preparation and serving. Continue to follow guidelines to prevent foodborne illness. As you may already know, most cases of foodborne illness can be eliminated through proper food handling and storage steps. It is the consumer's responsibility to follow safe preparation and handling procedures for delivering a safe product to the table. Because bacteria can survive on raw foods despite aggressive attempts by the processor and retailer, the consumer should think about food safety at each step of the way. Use these four main steps, recommended by the Food and Drug Administration, during meal preparation. (*fda.gov/food/buy-store-serve-safe-food/safe-food-handling*).

1. **Clean.** Before and after the preparation of food, wash hands, equipment, cooking surfaces, and utensils with hot, soapy water. Proper hand washing involves washing under warm water with soap for 20 seconds. Thorough cleaning is especially important after preparation of raw meat, poultry, fish, and eggs. Raw meats and eggs may contain microorganisms that can cause illness. Cleaning and sanitizing work surfaces, hands, and utensils can eliminate these organisms. A sanitizer made from 1 tablespoon bleach per 1 gallon water or a commercial disinfectant product may be used on surfaces for added cleanliness. To remove soil and any residues from fresh fruits and vegetables, wash under running water. Instead of using wooden utensils, use plastic, glass, or stainless steel utensils. Wooden utensils may act as hosts for tiny microorganisms to hide within the wood's small cracks. Acrylic cutting boards may be easily washed at very hot temperatures in the dishwasher.

2. **Separate.** Keep raw meat, poultry, fish, and eggs away from ready-to-eat foods. To avoid cross-contamination, never place cooked food onto a surface that previously held uncooked meat, poultry, fish, or eggs.

   The USDA Food Safety and Inspection Service (*fsis.usda.gov/food-safety/safe-food-handling-and-preparation/food-safety-basics/washing-food-does-it-promote-food*) recommends that raw meat and poultry should not be rinsed because this creates the danger of cross-contamination and is not necessary. Rinsing these foods can allow most bacteria present on the surface of the meat and poultry to spread to ready-to-eat foods, kitchen utensils, counter surfaces, and the kitchen faucet.

   Handling meat can easily transfer bacteria. It is important to treat all raw meats and eggs with caution. Using separate utensils and equipment for the preparation of raw meat and ready-to-eat foods such as salad ingredients, can avoid cross-contamination. Cooking meat to its appropriate internal temperature may kill microorganisms on meat. On the other hand, microorganisms on fresh salad vegetables will not be killed because the salad is eaten raw. This is the reason for the importance of separating raw meats and eggs from ready-to-eat foods.

3. **Cook.** To kill potential harmful microorganisms, cook food to the proper internal temperature. Use a food thermometer while cooking or to check the end-point internal temperature. Eggs should be cooked until the yolk and white are firm. Hold foods at the appropriate temperature before it is served and eaten. Aim to hold hot foods at or above 140°F. For cold foods, maintain them at 40°F or lower. No perishable food, whether hot or cold, should be held within the range of 40°F to 140°F for greater than two

hours. This range is known as the temperature danger zone, and at these temperatures, microorganism growth is optimal. This range includes normal room or kitchen temperatures. When cooking commercially frozen meals, always follow package directions for time and cooking method to ensure safety. Always check the final internal product temperature with a food thermometer.

4. **Chill and thaw.** Perishables, prepared food, and leftovers should be refrigerated within two hours of preparation at a temperature no greater than 40˚F if refrigerated and 0˚F if frozen. If chilling soups or casseroles, store at 2-inch depths to allow for proper cooling. Problems may occur in large cuts of meat. The meat's surface may be completely chilled while the internal temperature remains high. Cut large meat items into smaller pieces to allow thorough cooling. The internal product temperature of all food items should reach the appropriate chilling temperature within four hours.

   Despite previous thawing practices you may have encountered, meat and poultry should not be thawed on the counter. Proper thawing should take place on the bottom shelf of the refrigerator or under cool running water. Thawing in a refrigerator calls for planning in advance, but it is a much safer practice. Follow the manufacturer's instructions if using microwave ovens to thaw foods. Cook foods immediately after thawing in the microwave. To avoid cross-contamination, clean all utensils, surfaces, hands, or anything that may have come in contact with raw meats. As a precaution, never taste foods containing raw animal products or uncooked flour, such as some salad dressings and raw cookie dough. The FDA has flour handling guidelines as a result of an *E. coli* outbreak related to handling raw dough: *fda.gov/consumers/consumer-updates/flour-raw-food-and-other-safety-facts*.

Considerations for Specific Population Groups

Some people may be at high risk for developing foodborne illness. They include pregnant women and their fetuses, young children, older adults, people with weakened immune systems, and individuals with certain chronic illnesses.

For example, pregnant women, older adults, and those who are immunocompromised are at higher risk of developing listeriosis, a potentially life-threatening illness caused by the bacterium *Listeria monocytogenes*. Some deli meats and frankfurters that have not been reheated to steaming hot and some ready-to-eat foods are associated with listeriosis and pose a high risk to certain individuals. All these foods should be heated to a safe internal temperature.

In addition, these individuals should take special care not to eat or drink raw (unpasteurized) milk or any products made from unpasteurized milk (such as some soft cheeses), raw or partially cooked eggs or foods containing raw eggs, raw or undercooked meat and poultry, unpasteurized juices, and raw sprouts. They should also avoid raw or undercooked fish or shellfish.

Serving

Hands are an excellent way to unintentionally transfer germs and bacteria. For this reason, it is extremely important to wash hands while preparing food and before serving.

Food should be served at proper temperatures — hot food served hot and cold food served cold. Perishable food items should not be kept out of the refrigerator for more

than two hours. When preparing to serve a meal, it is best to remove cold food items from the refrigerator and hot foods from their heat source at the last minute.

Leftovers should be refrigerated within 2 hours of cooking or being taken out of the refrigerator and discarded or frozen within 4 days. This is especially important to remember during the holidays.

Keeping the meal on the table or countertops does not allow for rapid cooling. Foods are at risk of being exposed to the temperature danger zone for an extended amount of time, allowing bacterial contaminants to grow.

After reading through this information, you may wonder why so much attention is focused on food handling. The answer is simple. Advances in scientific research have shown us the conditions and requirements microorganisms need to live and grow. Food is the optimum location for them to do this. Following the food handling recommendations in this section provides microorganisms with the least chance for survival. The prevention of ingesting these organisms is within the control of each consumer. The safety of food depends on the safe handling practices of each member of the household. Think smart. Take precautions. Take part in preventing foodborne illness for the well-being of yourself and your family.

Safe Minimum Internal Temperature Chart

Cook all food to these minimum internal temperatures as measured with a food thermometer before removing food from the heat source. For reasons of personal preference, consumers may choose to cook food to higher temperatures.

Product	Minimum Internal Temperature	Rest Time
Beef, pork, veal and lamb *(steaks, chops, roasts)*	145°F (62.8°C)	At least 3 minutes
Ground meats	160°F (71.1°C)	
Ham, uncooked *(fresh or smoked)*	145°F (62.8°C)	At least 3 minutes
Ham, fully cooked	Reheat cooked hams packaged in USDA-inspected plants to 140°F (60°C) and all others to 165°F (73.9°C).	
All poultry *(breasts, whole bird, legs, thighs, and wings, ground poultry, and stuffing)*	165°F (73.9°C)	
Eggs	160°F (71.1°C)	
Fish and shellfish	145°F (62.8°C)	
Leftovers	165°F (73.9°C)	
Casseroles	165°F (73.9°C)	

Foodborne Pathogens

Foodborne illness is a general term referring to illness caused by microorganisms consumed when eating any type of food. People ill from the "24-hour flu" may be suffering from some type of foodborne illness. Sicknesses from these organisms may be mild, but they can also be very serious and lead to death. Microbes, bacteria, and pathogens are other terms sometimes used to describe the microorganisms that cause foodborne illness. These microorganisms are tiny creatures, much too small to see with the naked eye. In recent years, a number of widely reported outbreaks of foodborne illness caused by microbial contamination have increased public awareness and concern about food safety.

The incidence of foodborne illness is common enough to prompt awareness from government agencies. National food safety programs with prevention strategies include reducing infections and outbreaks caused by key foodborne bacteria. Also, it is the federal government's goal to increase the proportion of consumers who follow key food safety behaviors and practices.

The majority of cases of foodborne illness are not reported because the initial symptoms of most foodborne illnesses are not severe enough to require medical attention. Symptoms mimic the flu, including nausea, vomiting, diarrhea, and minor aches.

Foodborne illness costs billions of dollars annually. Specifically, the *Centers for Disease Control and Prevention (CDC)* has targeted seven microorganisms most commonly identified as causing foodborne illness. These microorganisms are Norovirus, *Salmonella*, *Clostridium perfringens*, *Campylobacter* spp., *Listeria monocytogenes, Shiga toxin producing Escherichia coli, and Toxoplasma gondii.*

Microorganisms live naturally in the environment and are found widely throughout nature. An average person carries more than 150 kinds of bacteria in and on the surface of his body. Under the right conditions, some of these microorganisms can cause human illness; others can cause food to spoil. Generally, bacteria can spread rapidly, requiring only food, moisture, a favorable temperature, and time to multiply. Animal protein foods, such as meat, eggs, poultry, and fish, are common hosts of

foodborne bacteria. However, bacteria can be readily spread from nonfood items — such as a knife, cutting board, plate, or human hand — to food. This is called cross-contamination. Contaminants that lead to foodborne illness can originate within the food, on the food, from unsafe water, or from human or animal feces. Bacteria may be unknowingly spread from sponges, dish towels, aprons, sinks, countertops, and wooden utensils.

Some bacteria may spoil food by souring, developing slime, developing foul odors, and discoloration. Other bacteria may induce sickness when ingested by humans. Since bacteria multiply quickly in the right environment, it is important to keep food in proper conditions that do not encourage microbial growth. Requirements for growth include food, acid/base conditions, time, temperature, air, and moisture. Bacteria require only a minute amount of food. Something as simple as food left in the crack of a cutting board or on the wheel of a can opener is enough to support the diet of a microorganism. Along with food, each organism has an optimum level of pH, or acid/base balance, for survival.

Molds and yeasts prefer acidic conditions while bacteria do not. Temperature, the most important factor for microorganism growth, is a condition that can control food spoilage. The colder the storage temperature of food, the longer the shelf life. Under cold conditions, most microorganism growth is minimal.

Microorganism populations can double in as short as 20 minutes. With just the right amount of time, appropriate temperature and environment, bacteria can grow to alarmingly high levels in food, most of which cannot be seen by the naked eye.

Categories of Foodborne Illness Agents or Contaminants

Bacteria: Many beneficial bacteria are used in the food industry to produce fermented foods and for other beneficial uses. Other types of bacteria combat disease. Unfortunately, other bacteria account for the majority of foodborne illness outbreaks in the United States. These bacteria require the same four factors for foodborne illness to occur:

- A microbial contaminant
- A food vehicle carrier
- Conditions allowing bacteria to survive, reproduce, or form a toxin
- A susceptible food consumer who ingests enough of the bacteria to induce illness

Viruses: Viruses grow and reproduce in living cells. They do not grow in food but may be carried by food. Most often, they are found in untreated or contaminated water, especially water contaminated by human or animal feces. Viruses from feces that may be present on human hands can also be a source of foodborne illness.

Parasites: Tapeworms, roundworms, and protozoa may be carried in food and water or even by human pets. Humans are natural carriers of protozoa in their intestinal tract. Parasites depend on living hosts for nutrients.

Food toxins: Toxins can be formed by microorganisms that are present in food. Foodborne "intoxication" may occur after consuming these toxins. Symptoms of intoxication, otherwise known as food poisoning, can occur rapidly.

Major Causes of Foodborne Illness

Norovirus

Illness: Norovirus is the leading cause of vomiting and diarrhea, and foodborne illness in the United States. People of all ages can get infected with norovirus and become sick. Proper handwashing and other simple steps can help prevent getting and spreading norovirus.

It is sometimes called the "stomach flu" or the "stomach bug." However, norovirus illness is not related to the flu. The flu is caused by the influenza virus. Norovirus causes acute gastroenteritis, an inflammation of the stomach or intestines.

Sources: You can get norovirus by:

- **Having direct contact with someone** with norovirus, like caring for them, sharing food or eating utensils with them, or eating food handled by them.
- **Eating food or drinking liquids** that are contaminated with norovirus.
- **Touching contaminated objects or surfaces** and then putting your unwashed fingers in your mouth.

You can still spread norovirus for 2 weeks or more after you feel better.

Prevention: Norovirus is very contagious, but you can take steps to protect yourself and others, including:

- Wash your hands well and often.
- Cook shellfish thoroughly and wash fruits and vegetables.
- Clean and disinfect contaminated surfaces.
- Wash laundry in hot water.
- Stay home when sick for 2 days (48 hours) after symptoms stop.

Escherichia coli O157:H7 (ESH-err-EEK-e-uh COE-lie)

Illness: Illness generally begins 3 to 4 days following ingestion and may persist for up to 10 days. Hospitalization is often required. The strain O157:H7 produces a highly virulent toxin, which causes hemorrhagic colitis, a severe illness characterized by abdominal cramps and diarrhea. Kidney failure can also occur in children. Some strains of *E. coli* cause urinary tract infections, respiratory illness and pneumonia, and other illnesses. Ingesting only a few cells of this organism can be deadly.

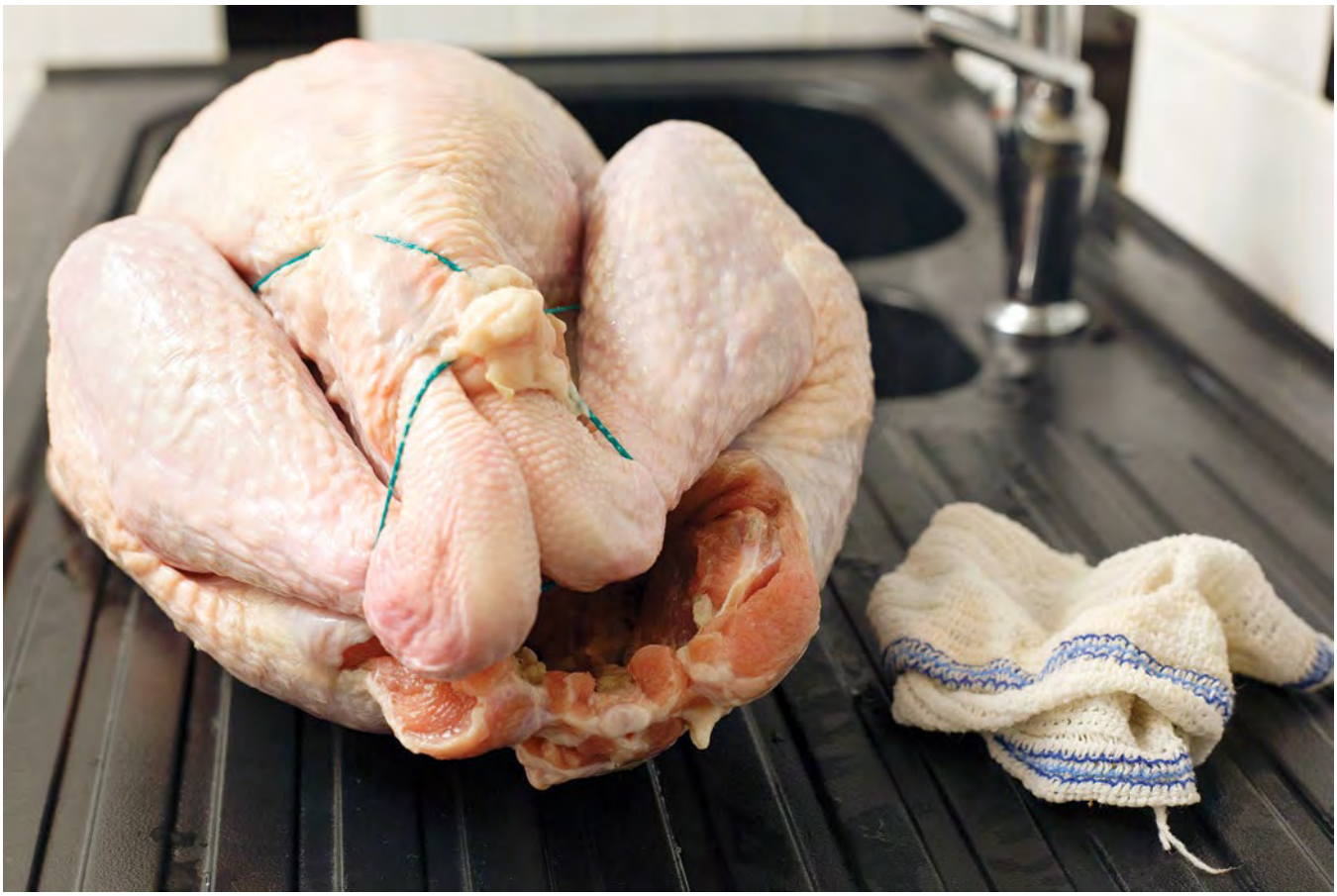
Sources: "Generic" *E.coli* is a normal part of the intestinal tract of humans and animals. This type of *E.coli* does not cause a foodborne illness. Feces and feces-contaminated water are the most likely sources of bacterial contamination. Food sources of *E. coli* O157:H7 have included undercooked ground beef, raw fruits and vegetables, mold-ripened cheeses, raw flour, and unpasteurized milk or apple beverages.

Prevention: Personal hygiene of food producers, food service workers, and consumers is of utmost importance for preventing the spread of these microorganisms. Wash hands thoroughly after handling raw food products and using the restroom. Avoid cross-contamination by preventing contact between cooked foods and raw foods.

Ground meat is commonly associated with foodborne illness from *E. coli* contamination. Ground meat should be cooked thoroughly to an internal temperature of 160°F, as tested using a thermometer.

Salmonella (Sal-mo-NELL-uh)

Illness: Salmonellosis is one of the most common bacterial foodborne infections. Symptoms include nausea, vomiting,



headache, chills, diarrhea, and fever. Illness begins 6 to 72 hours after ingestion of contaminated food. Complications can result in death in infants, chronically ill persons, and the elderly. Serious rheumatoid or cardiac problems may occur after recovery from the acute disease. In most cases, the disease is short, and recovery is favorable.

Sources: *Salmonella* bacteria have the ability to grow in a wide range of temperatures, acid levels, and environments. They are found in the intestinal tracts of humans and animals. Often, *Salmonella* bacteria are found in raw and undercooked foods. Unpasteurized dairy products, contaminated raw fruits and vegetables, raw and undercooked poultry, eggs, and meat have been linked to illness. *Salmonella* are most often associated with egg and poultry products.

Prevention: Normal cooking and pasteurization will kill these microorganisms. They will survive for an extended period of time in dried or frozen foods. Once thawed, these organisms are capable of continuing their growth. Proper handling of meats, poultry, eggs, and other animal foods can prevent salmonellosis. Raw foods should not come in contact with cooked foods. Unpasteurized dairy products should not be consumed. Eggs should be cooked to a firm state or until the whites and yolk are not soft and runny. Use pasteurized eggs or a cooked custard recipe for homemade ice cream. Thaw meat in the refrigerator, not on the counter top. Animal foods should be thoroughly cooked and held at cold temperatures (below 40˚F) or hot (above 140˚F).

Campylobacter jejuni (CAMP-y-lo-BACK-ter je-JU-nie)

Illness: As with many foodborne illnesses, symptoms of *C. jejuni* are primarily gastrointestinal, including nausea, diarrhea, and other gastrointestinal problems. Seek medical treatment when symptoms progress or persist. These conditions may include grossly bloody stools. Other conditions requiring medical treatment not related to gastrointestinal distress include meningitis in infants and urinary tract infections. Onset of illness can vary from 2 to 10 days, and the degree of affliction may depend on the health status of the individual as well as the amount of *C. jejuni* ingested.

Sources: The major source for *C. jejuni* is intestinal contents of animals. Undercooked chicken, raw clams, contaminated drinking water, raw milk, raw hamburger, and even contact with cats have been sources for *C. jejuni*.

Prevention: Food should be cooked to the recommended temperature. Poultry should reach an internal temperature of 165˚F, as detected by a thermometer. Ground beef should reach 160˚F, and leftovers should reach 165˚F. Consume only pasteurized dairy products, and avoid raw shellfish. Avoid drinking water directly from rivers, lakes, or streams. Wash hands after handling pets and, as always, before eating or drinking.

Listeria monocytogenes (Lis-TEER-e-uh MONO-cie-TOG-e-nees)

Illness: Listeriosis is the disease caused by this microorganism. Following ingestion, a person can become ill within 48 hours for gastrointestinal symptoms or up to six weeks for invasive disease. Symptoms may persist for 2 to 7 days. Symptoms in adults include fever, chills, headache, backache, and occasionally diarrhea and abdominal pain. In newborns, symptoms include breathing difficulties, refusal to drink, and vomiting. In severe cases, meningitis, blood poisoning, or meningo-encephalitis (a condition affecting the tissues and fluid around the brain) can occur. In pregnant

females, illness can result in spontaneous abortion or stillbirth. Those most susceptible to illness from infection include pregnant women or people with AIDS, alcoholism, type 1 diabetes, cardiovascular disease, renal transplant, or others with low resistance and susceptibility.

Sources: Outbreaks have been associated with consumption of unpasteurized milk, certain soft cheeses, undercooked meat, poultry, seafood, contaminated water, and raw vegetables fertilized with infected manure. The organism can survive for long periods in soil, feces, silage, and dairy products. *L. monocytogenes* has the ability to grow at refrigerated temperatures and in high salt concentrations. *L. monocytogenes* is sensitive to heat. Of great concern in the future is the presence of this organism in ready-to-eat, refrigerated, and convenience foods.

Prevention: Use pasteurized milk and dairy products. Cook foods of animal origin thoroughly. Follow good hygiene and cooking practices. When gardening, avoid using animal manure or sewage sludge for fertilization unless they have been well-composted, achieving a temperature of 160˚F or greater. Thoroughly reheat frozen or refrigerated processed meat and poultry products before consumption.

Staphylococcus aureus (STAF-e-lo-KOK-es OR-e-us)

Illness: These organisms are capable of producing a heat-resistant enterotoxin that is responsible for illness. Illness begins within 30 minutes to 8 hours after consumption of the contaminated food. Sickness may persist for one to two days. Symptoms include vomiting, diarrhea, cramps, weak pulse, prostration, shock, and lowered body temperature.

Sources: *S. aureus* is found in and on the human body. Locations on the body include skin, infected cuts, acne, the nasal cavity, and hair. Coughing and sneezing by people with infected respiratory tracts are other sources of contamination. Handling of food by an infected individual is the most common source of contamination. Foods that best support growth include high protein sources such as meat, poultry, fish, cream sauces, cream-filled pastries, puddings, custards, and salads such as ham, potato, and chicken. Once the toxin

is formed, it is resistant to heat, refrigeration, and freezing. Reheating cannot make mishandled foods safe.

Prevention: Wash hands and utensils before preparing and serving food. Always follow good personal hygiene and avoid food preparation when ill with a respiratory infection. Never sneeze or cough directly on food or food preparation equipment. Use strict temperature controls to prevent microorganism growth. Keep hot foods at or above 140˚F or store cold foods at 40˚F or below. Store foods in shallow containers and avoid leaving foods at room temperature for more than two hours.

Clostridium botulinum (klos-TRID-e-um boch-u-LINE-um)

C. botulinum is a heat-resistant, spore-forming organism that produces a toxin in its vegetative (growing) state, and grows in the absence of oxygen and at pH levels above 4.6. Places of growth include sealed containers or below the surface of food. At above 38˚F, the spores become active and produce a toxin. The toxin causes severe illness and even death in humans.

Illness: Cases of the disease botulism are rare but very dangerous. Onset occurs within 12 to 72 hours and initial symptoms include nausea, vomiting, fatigue, dizziness, and headache. These symptoms result from a toxin being bound to nerve endings. Later symptoms reveal constipation, double vision, and difficulty speaking and swallowing. Respiratory paralysis, cardiac failure, and ultimately death occur. Today, botulism is fatal in 3 to 5 percent of cases if timely treatment is not obtained.

Infantile botulism can occur in children under 12 months of age. This disease occurs following ingestion of bacterial spores that continue to produce toxin in the child's intestinal tract. Some spores that have been linked to cases of infant botulism have been located in honey and corn syrup. It is important not to feed these products to infants. The processing of these products does not eliminate *C. botulinum* spores. Infants do not digest the spores. However, the intestinal tracts of older children and adults are mature enough to handle the spores. Thus, it is safe for them to eat honey and similar products.

Sources: The bacteria are present in soil and water throughout the environment, but conditions for growth and toxin formation are not always favorable. Optimum conditions for growth of and toxin formation by *C. botulinum* include high moisture, low salt, low acid (pH greater than 4.6), low oxygen such as in canned or vacuum packed foods, and room-temperature stored foods. Illness is most often associated with improper home canning of foods.

Prevention: Prevention begins with consumer awareness. Home canners should follow reliable and current, science-based procedures from extension or reputable home canning commercial sources such as *freshpreserving.com* when canning low-acid vegetables, meat, fish, and poultry.

If using vacuum packaging for food storage, store these foods in the freezer and thaw properly to minimize bacterial growth. Avoid consuming food from dented, swollen cans, from jars with leaky or loose lids, or from containers that expel liquid

when opened. Avoid serving honey or corn syrup to infants. Prompt refrigeration of low-acid foods is necessary. Illness has been reported from food left at room temperature for extended periods of time, especially foil-wrapped or vacuum-packed foods or products such as salad oil infused with garlic cloves.

Clostridium perfringens (klos-TRID-e-um per-FRIN-gens)

Illness: Disease results from ingestion of vegetative cells that produce spores and release toxins when in the intestinal tract. Common symptoms include diarrhea and severe abdominal pain. Death is uncommon but can occur in immunocompromised or elderly individuals. Illness begins 9 to 15 hours following ingestion and may persist for 24 hours.

Sources: *C. perfringens* is present throughout the environment, including soil, human and animal intestines, and in sewage. Growth can occur with or without oxygen. Heat-resistant spores are found in raw foods. Often, this organism is referred to as the "cafeteria germ" because it commonly occurs in food produced in large quantities or food that has been left in a "too cool" steam table or at room temperature too long.

Prevention: Proper handling, preparation, serving, and storage of foods can prevent illness. Cooked meats, gravies, stews, dressings, and casseroles should be cooled rapidly and refrigerated promptly at 40°F or below for storage, or should be maintained at an internal temperature of 140°F. Rapid cooling can be achieved by dividing food products into smaller portions.

Casseroles, gravies, soups, and stews, etc. should be stored in shallow containers at 2-inch depths. Reheat leftovers to an internal temperature of 165°F before serving. Use proper hand-washing procedures.

Terms

Cross-contamination: Microorganisms present on a food that are inadvertently passed to another food usually by human error. For example: using the same knife to cut raw meat and then to cut lettuce or fruit.

Enterotoxin: a toxin affecting the cells of the intestine.

Foodborne illness: generally refers to illnesses caused by microorganisms consumed by eating any type of food.

Foodborne pathogen: A microorganism present in food that, if eaten in large enough quantities, may cause illness or disease.

Low-acid food: Foods with a pH greater than 4.6, thus containing a low amount of acid.

Pasteurization: a heat process that destroys pathogens in foods. In dairy products, every particle of milk or milk product is heated to a specific temperature and time based on the type of pasteurization method used.

Pathogen: an organism capable of causing disease.

Perishable: a food item that is likely to decay, rot or spoil. These food items require refrigeration.

Ready-to-eat (RTE) foods: foods that do not require additional cooking. They are ready for consumption at the time of purchase.

Temperature danger zone: 40°F to 140°F. Perishable food should not be kept in this temperature range for more than two hours. Microorganism growth is optimal at these temperatures.

Toxin: a poison; produced by a pathogenic bacteria that can cause harm to other living things.

Spore: Protective form of bacteria, dormant, not growing or "vegetative," resistant to heat and other treatments.

Frequently Asked Questions

Q. *Why do I need to use a thermometer if I always cook ground beef until it is brown?*

A. Some ground beef may brown "prematurely." It may turn brown before it is hot enough to be safe.

Q. *What's wrong with thawing my turkey on the kitchen countertop? I've been doing it for years.*

A. As the turkey warms, outer portions will thaw and warm up while interior parts are still solid. Bacteria on the carcass may grow to such high numbers that not all may be killed in the cooking process.

Q. *How does rapid chilling protect against C. perfringens? Isn't this organism killed when I cook the food?*

A. *C. perfringens* is a spore-former. Spores survive cooking while any vegetative organisms are killed. Then, if the product cools too slowly, the spores can become active and grow and multiply in the "warm" product.

Q. *Should I stop wrapping baked potatoes in foil to avoid botulism?*

A. No. Foil-wrapped potatoes are fine as long as they are kept hot (above 140˚F) before serving and eating. The botulinum spores can live and grow in small spaces with little or no oxygen between foil and the skin of the potato if potatoes are baked early and allowed to stay warm, but not HOT, for several hours. After baking wrapped potatoes, remove the foil to cool completely.

Check Yourself Questions

1. Which type of food should be purchased last when at the supermarket?
2. Why is it important to check dates on food before purchase at the supermarket?
3. What should you do if you have a two-hour drive home from the supermarket?
4. Why is it important to wash hands?
5. What are the appropriate cold storage temperatures?
6. Are all microorganisms bad?
7. Which organism is of concern to infants that are fed honey or corn syrup?
8. What are considered to be proper cooling procedures?
9. What are proper hand-washing procedures?
10. What is the most common source of microorganisms that can cause foodborne illness?

Answers

1. Perishable food items, such as meat, dairy, and eggs, should be placed in the shopping cart just before checking out. This decreases the amount of time they are exposed to undesirable temperatures.
2. Manufacturers mark their products with a variety of dates. It is possible to select fresher products and extend home shelf life by viewing the product date and purchasing accordingly. Product dating gives the consumers information on date of production, guaranteed freshness and expiration.
3. In order to keep foods at their appropriate temperature, perishable food items should be kept in a cooler. This will allow them to stay cold until they can be properly stored at home.
4. Unclean hands are an excellent way to spread germs. It is important to thoroughly wash hands before, during and after food preparation. Always wash hands immediately after handling raw meat and eggs.
5. Refrigerated: 32˚ to 39˚F. Frozen: -10˚ to 0˚F.
6. No, we live in harmony with millions of microorganisms each day. Some are used in the food processing industry such as making cheese and yogurt, and fermenting pickles, beers, and wines. Occasionally, harmful organisms will be ingested by humans, with the potential to cause illness. Through proper food safety practices, these illnesses can be avoided.
7. *Clostridium botulinum* has the potential to cause the disease infant botulism. This is a potentially fatal condition if not treated immediately by a physician.
8. Microorganism growth can be slowed and sometimes eliminated by proper food cooling and storage. Liquid-type foods or casseroles should be divided into 2-inch depth amounts for cooling. Large sections of meat should be cut apart to allow for cooling in the inner part of the muscle. Ideally, the internal product temperature should be 40˚F or below within four hours of cooking. Discard cooked food that has been at room temperature for more than two hours.
9. Hands should be washed with soap and hot water for at least 20 seconds. Be sure to thoroughly rub hands and clean under fingernails with soap. Avoid touching the faucet or water controls with your clean hands. Instead, use a paper towel to turn them off.
10. Humans are the most likely source of contamination. Improper handling of food and not washing hands after using the restroom are reasons for contamination. Many bacteria are found in the feces of animals and humans.

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