**Nutrition Information Credibility**

T-Talk 6.1

By Jennifer Turley and Joan Thompson

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**Presentation Overview**

Determining fact from fallacy requires an understanding of:

- Scientific Methodology
- Credentials of the author & reviewers
- Affiliation of the author (public or private)
- The information source (type & peer-review)
- References (evidence used to support the information)
- The Purpose (sell or inform)

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**Judging Nutrition Information**

Tools to decipher credibility

- **Author’s credentials:**
  - Does the author have an advanced degree in Nutrition (M.S., Ph.D)?
  - Does the author have an R.D. or M.D?
- **Author’s affiliation:**
  - Is the author affiliated with public or private sector?
- **Information source:**
  - Is the information from a credible book, peer-reviewed journal, professional organization, accredited educational institution, newsletter, government agency, consumer advocacy group OR from a magazine, newspaper, advertisement or news-story.
- **Quoted sources:**
  - Are quotes from reliable-credible-knowledgeable people or are they testimonials?

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**Judging Nutrition Information**

Tools to decipher credibility

- **Editorial board expertise**
  - Do the individuals have good credentials?
- **References**
  - Are references from peer-reviewed (refereed) journals?
- **Purpose of the information**
  - Is the purpose to inform (raise health awareness) or to make a sale?

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**References**

- Credible information will provide a list of supporting references. These are other studies that demonstrate a similar outcome as well as studies that may not.
- Literature published in peer reviewed journals is always supported by references.
- References typically do not contain the credentials of the author.
- If a reference is cited and is from a credible journal, then credibility is increased.

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**Sample References**

<table>
<thead>
<tr>
<th>Author’s Last Name, Initials</th>
<th>Title, Journal, Volume(Issue), Page Numbers</th>
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<tbody>
<tr>
<td>Bart, K. (2009)</td>
<td>Vegetable diets and buying locally: Ways to increase environmental sustainability, support the local economy and contribute to individual health. Vegetarian Nutrition (Dfpsc 775.4 A 11 16 16 26)</td>
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</tbody>
</table>

References never contain author credentials, look for journal credibility and publication date.
Public Recommends

• Public dietary recommendations from any agency are based on the interpretation of multiple studies with consistent results.
• A whole body of evidence, collected over many years of experimentation needs to be consistently accepted by the scientific community before a public recommendation can be made.
• Examples of public recommends are DRIs, dietary guidelines, heart association & cancer society guidelines.

Nutrition Resources

see appendix

Reliable Web Sites:
• American Cancer Society (www.cancer.org/)
• American Heart Association (www.amhrt.org)
• Food and Drug Administration (www.fda.gov/)
• National Institutes of Health (www.nih.gov/)
• Center for Disease Control (www.cdc.gov/)
• World Health Organization (www.who.ch/)
• U.S. Department of Agriculture (www.usda.gov/)

Surfing the Web

.com for commercial
.org for organizations
.gov for government
.net for information of any sort
.edu from educational institutions

Bob’s Website on Nutrition

If you find yourself at Bob’s Web site, ask yourself:

Who’s Bob?
What are his credentials?
Who is he affiliated with?
Is he a good source of information?

When was his information published (is it current)?
Is his information based on well controlled and conducted scientific studies or does he use testimonials?

Does he provide references?
What is the purpose of his information?

If you can’t answer these questions, check out Bob’s Web site and look for more credible information.

Summary

• Think before you believe.
• Just because the information is published doesn’t mean that it is accurate or true.
• Use your fact/fallacy skills to decipher the overall credibility of nutrition information
  – Consider author (credentials & affiliation)
  – Publication (source, purpose & date)
  – Scientific methodology
  – Apply to all aspects of nutritional science including foods, diets, & supplements.
• Seek credible information to credit or discredit interest in non credible information.

References for this presentation are the same as those for this topic found in module 6 of the textbook.
Presentation Overview
- Legislation and Agencies
- The Role of the FDA
- Drugs versus Food
- Supplements
- Herbs
- DSHEA act
- Examples of Supplements

Legislation History
- **1906**: Food & Drug Act of 1906. The first law, aka Pure Food Law.
- **1938**: The Food, Drug & Cosmetic Act (FD&C). Safely/honestly packaged, the FDA had the right to remove unsafe product from the shelf.
- **1958**: The Food, Drug & Cosmetic Act was amended, food companies prove the safety of food additives.
- **1960**: The 1960 Color Additives Amendment to the FD&C Act. The Delaney Clause & GRAS List. Any substance known to cause cancer in man or animal at any level is not safe.
  - The Delaney Clause: no additive is given FDA approval if found to cause cancer in man or animals.
  - GRAS List: a list of additives that abide by the Delaney Clause. Additive must be detectable and at 1/100 of determined safety level.
- **1976**: Vitamins and Minerals Amendments.
- **1994**: The Dietary Supplement, Health & Education Act (DSHEA), The Supplements Facts Panel.

Governmental Agencies
- **Local Health Departments**: Food borne illness in the community, food handlers permits, food service inspections.
- **The USDA (U.S. Department of Agriculture)**: Food grading and wholesomeness for meat, poultry and egg quality.
- **The CDC (Centers for Disease Control)**: Monitors and investigates food-borne diseases (tracks incidence of diseases).
**Governmental Agencies**

- NMFS (National Marine Fisheries): Seafood safety, stewardship of the nation’s living marine resources and their habitat.
- EPA (Environmental Protection Agency): Protects human health and the environment, regulates pesticide use & residues & monitors water quality.
- The FDA: Monitors general food safety, regulates food additives & biotechnology, labeling, information, & HACCP.

**The FDA**

- Food & Drug Administration (FDA).
- The FDA is a government agency controlling most of the food industry & all of the drug marketing in America.

**Drugs & FDA Regulation**

- Requires substantial research & is tightly regulated by the FDA.
- Evidence is presented to the FDA by the drug company.
- New drug approval requires research demonstrating safety & efficacy.

**Food & FDA Regulation**

- Oversees all food except for meat, poultry, eggs & seafood.
- Food requires comparatively little research & is loosely regulated.
- FDA defines food as: food, supplements, herbs, enzymes, glandulars, vitamins, minerals & fiber.
- All nutritional supplements are considered a food by the FDA. Rigorous testing is not required by the FDA.

**Supplemental Industry**

- The supplement Industry is a multi-billion dollar business in America.
- The deficiency symptoms of the nutrients are exploited to make sales.
- Advertising of supplements may not be ethical and may not tell the whole truth.
- Positive results may be enhanced to increase sales.

**Supplement Considerations**

- Consumers should learn to recognize sales ploys.
- Supplement purposefully & knowledgeably, otherwise, physiological failure may occur.
- Look for products with a Certification Insignia.
  - USP, NF, Biofit, PharmaPrint
Supplement Considerations

Pay attention to:
• Units of the DRIs & ULs
• Basis or criteria of the DRI
• Function of the nutrient in the body
• Deficiency symptoms
• Toxicity symptoms
• Stability of the nutrient
• Good food sources of the nutrient

Herbal Supplements

• All herbal preparations are also recognized as a food.
• Herbs have obvious drug effects, and are used for medicinal purposes.
• If you use herbs, understand in detail the qualities & effects of the herbs.
• Use the PDR for Herbal Medicines for guidance.

Herbal Concerns

• The amount of the drug present in the preparation.
• The toxic effects that can be experienced from potential contaminants.
• A high presence of the pharmacologically active ingredient is undesirable.
• Varying ingredients, nutritional qualities.

DSHEA of 1994

• Legislation pertaining to the sales, marketing, labeling, safety, and support statements made on nutritional supplements.
• Defines the Supplement Facts Panel.

DSHEA of 1994

• FDA defined nutritional categories
  – essential and nonessential vitamins
  – essential and nonessential minerals
  – nutritional substances (HMB, glucosamine)
  – glandulars (DHEA and melatonin)
  – fiber types
  – enzymes (mostly digestive)
  – herbs

• Labels must include the name and quantity of the nutritional present per unit.
• A disclaimer that the FDA has not evaluated the product.
• Products may include structure and function claims.
• Products cannot claim to cure or prevent diseases.
DSHEA of 1994
Supplement Facts panel, Implemented 1999

<table>
<thead>
<tr>
<th>Like Nutrition Facts panel</th>
<th>Coenzyme Q10 Supplement Facts</th>
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<tbody>
<tr>
<td>Serving sizes 1 softgel</td>
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<tr>
<td>Amount per serving</td>
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</tr>
<tr>
<td>% Daily Value</td>
<td>Symbols</td>
</tr>
<tr>
<td>Vitamin E (as d-alpha-tocopheryl acetate) 150 IU</td>
<td>150%</td>
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<tr>
<td>Other nutrients</td>
<td>Coenzyme Q10 (ubiquinone) 100 mg</td>
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<tr>
<td>Ingredients</td>
<td>Other Ingredients: Gelatin, sorbitol, glycerin and purified water, polyethylene 80, hydroxylated soy lecithin, medium-chain triglycerides, annatto seed extract, and soybean oil.</td>
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Permissible & Prohibited Claims

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>• Reduces pain and stiffness associated with arthritis</td>
<td>• Promotes relaxation</td>
</tr>
<tr>
<td>• Laxative</td>
<td>• Promotes regularity</td>
</tr>
<tr>
<td>• Prevents Alzheimer’s Disease</td>
<td>• Reduces absentmindedness</td>
</tr>
<tr>
<td>• Antiviral</td>
<td>• Supports the immune system</td>
</tr>
<tr>
<td>• Antidepressant</td>
<td>• Reduces frustration or rejuvenates</td>
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DSHEA of 1994
Herbs

• Herbal dietary supplements are ground-up plant material or extracts that can be prepared and sold encapsulated, as tinctures, and as teas

• Examples include echinacea, ginkgo biloba, ginseng, and St. John’s Wort.

DSHEA of 1994
Essential and Nonessential Vitamins

• Organic compounds that are integral structural components of enzymes or coenzymes in the body.
• See module 5 for the essential vitamins.
• Most standard vitamin pills contains the essential vitamins.
• Non-essential vitamin compounds are made in the body.
  • Healthy people usually do not benefit from taking additional non-essential vitamins
  • Some individuals may improve function by supplementing with additional non-essential vitamins such as L-Carnitine, Coenzyme Q10 or Lipoic Acid

DSHEA of 1994
Essential and Nonessential Minerals

• Inorganic elements naturally found in earth.
• See module 5 for the essential minerals.
• Most standard mineral pills contains essential minerals.
• Some non-essential minerals have been marketed to improve health or function such as boron and vanadium.
DSHEA of 1994

Nutritional Substances

- Nutritional substances are chemical compounds extracted from food sources, concentrated and commonly encapsulated.
- Variety of effects from improving many discomforts of medical conditions to enhancing sport performance.
- A few examples include glucosamine, chondroitin, creatine, and fish oil.

DSHEA of 1994

Glandulars

- Supplement that contains hormones.
- Very few glandulars can be sold over the counter.
- Popular examples include melatonin and dehydroepiandrosterone (DHEA).

DSHEA of 1994

Fiber

- Indigestible molecules normally consumed in foods.
- Functional fiber can provide a beneficial GI effect and promote health.
- Examples of functional fibers include fructooligosaccharides (FOS), flaxseed lignins, and psyllium.

DSHEA of 1994

Enzymes/Digestive Aids

- May improve many complications of poor digestion seen commonly in the elderly and in stressed individuals.
  - Signs and symptoms of poor digestion include gas, bloating, malnutrition and other gastrointestinal discomforts resulting from indigestion.
  - Examples of digestive aids include betaine hydrochloride, pepsin, bromelain, papain, bile extract, and pancreatin.

Summary

- There are many laws & agencies governing food & supplements.
- Supplement purposefully & knowledgeably.
- Remember, rigorous scientific testing is not FDA mandated on nutritional supplements.
- Become familiar with product certification insignias.
- Read the Supplement Facts Panel.
- Look for credible publications supporting the safety & efficacy of the supplement.

References for this presentation are the same as those for the preceding slides & at the back of the textbook.
Food Additives

T-Talk 6.3

By Jennifer Turley and Joan Thompson

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Presentation Overview

- Types & purposes of food additives
- Categories & examples of intentional additives
- Methods for replacing fats & sugars

Food Additives: Types

- Intentional
  - For restoration, enrichment, or fortification of the product
  - For preservation and safety of the product
  - For enhanced appearance, flavor, or texture of the product
- Incidental
  - A substance that comes in contact with food during growth or processing (pesticides)
- Indirect
  - Something present in the food package which may then be present in the food

Purposes of Intentional Food Additives

- Nutritional enrichment of the product
- Preservation and safety of the product
- Enhanced appearance, flavor, or texture of the product

Categories of Intentional Food Additives

- Antimicrobial agents: Salt, sugar, nitrates, nitrites
- Antioxidants: BHA, BHT, vitamin E, vitamin C
- Nutrients: Vitamins and minerals
- Artificial colors/flavors (flavor enhancers): Dyes, MSG, sweeteners
- Bleaching: Peroxides
- Chelating: Citric acid, malic acid, tartaric acid
- Stabilizers: Starch, pectin, dextrins

Intentional Food Additives

- Salt & sugar in processed foods
- Sodium benzoate in margarine
- Sulfur dioxide in apples after dehydrating to retain color
- Calcium propionate in bread
- Sorbic acid in cheese wrappers to control mold
**Intentional Food Additives**

**Fats: Fat Substitutes**
- Food Chemistry providing “mouth feel” with fewer Calories
- Replace fat in the food by acting as
  - Stabilizing agents (complex CHO)
  - Protein stabilizing agents (Simplesse)
  - Fake fats (Olestra, Olean)

**Fats: Stabilizing Agents**
- Carrageenan:
  - From seaweed
  - Retains moisture
  - Found in McD hamburgers, ice-cream, healthy rewards fat free milk, etc.

**Fats: Stabilizing Agents**
- Starches, Gums, and Gels:
  - Complex CHO’s that act as “fillers”
  - Hold water & impart a creamy texture
  - Adds form & structure to food
  - Found in salad dressing, desserts, sauces, yogurt, etc.

**Fats: Stabilizing Agents**
- Simplesse:
  - A mixture of food proteins (egg white, whey, casein) cooked and blended to form tiny particles that trap water
  - Heat causes it to gel
  - Perceived as fat in the mouth, but only provides four calories per gram
  - Found in cheese, ice cream, mayonnaise, etc.

**Fats: Fake Fat**
- Olestra: (Olean trade name)
  - Has a sucrose molecule in the center and eight long chained fatty acids attached
  - Olestra is not digested by the body, thus it is like a fat fiber!
  - May interfere with fat soluble nutrient absorption and cause gastrointestinal distress

**Sugars: Sugar & Honey**
- Sugar:
  - The average American consumes 25% of Calories. Many use artificial sweeteners to control body weight or eat honey because they believe it to be “healthier”

- Honey:
  - Is not nutritious due to the very tiny amounts of nutrients present, but it is sweeter than sucrose
Sugars: Sugar Free

• Sugar Free:
  – Sucrose is not present in the food product
  – Sorbitol, a caloric sugar alcohol can be used as the sweetener such as in sugarless gum

Sugars: Artificial Sweeteners

• Aspartame (NutraSweet, Equal)
  – Is phenylalanine + aspartic acid
  – 160-220 times sweeter than sugar
  – The safe level set by the FDA is 50 mg per kg body weight
  – In over 1500 food products like diet drinks, sweetened cereals, baked goods
  - Is safe for almost all people to use (avoid if you have PKU or side effects)

• Saccharin (Sweet’N Low, Sugar Twin)
  – A controversial artificial sweetener
  – Huge amounts have been shown to cause cancer in rats, but not humans
  – Is approved for use because of consumer demand
  – It is 200-700 times sweeter than sucrose

• Sucralose (Splenda)
  – Is made from a chemical modification of real sugar
  – Is used in diet soft drinks and desserts
  – Is 600 times sweeter than sucrose
  – May have the fewest safety concerns

• Aceulfame-K (Sunette)
  – Is 200 times sweeter than sucrose
  – Is used in diet soft drinks and desserts
  – Can be combined with Aspartame to make an even sweeter taste (Pepsi One)

Summary

• Food additives are used for many reasons in the food industry.
• Chemicals in food are FDA approved and GRAS though not free of adverse reactions in some individuals.
• Intentional additives: Nutritional value, preservation, appearance, flavor, and/or texture of processed foods.
• Fat substitutes, fake fats & artificial sweeteners are commonly used in processed foods.

References for this presentation are the same as those for this topic found in module 6 of the textbook.
Food Safety
Microbial Growth

T-Talk 6.4
By Jennifer Turley and Joan Thompson
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Presentation Overview
- Microbial growth
- Microbial transmission
- Types of microbes
- Examples of microbes in food

Microbial Growth
- Fission
- Budding
- Rapid, clonal expansion

Clonal Expansion of Microbes

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Classification of Microbes
- Vary in shape, cell arrangement, inclusions, spores and/or capsules, staining, motility, and nutrient and oxygen requirements.
- Aerobe and anaerobe.
- Include parasites, protozoa, bacteria, fungi, viruses, and algae (algae is not implicated in food-borne illness).

Ways to Encounter Microbes
- Air
- Water
- Food
- Feces
- Soil
- Person to person interactions
Food Contamination: Microorganisms & Toxins

- Bacteria, protozoa, parasite & virus related food-borne illness.
- Can cause direct illness or illness from enterotoxins or neurotoxins.
- Be aware of microorganisms that frequently infect foods, the symptoms and their onset time, and prevention methods.

Examples of micro-organisms

- **Trichinella spiralis** parasite
  - Raw, undercooked pork or wild game
  - Onset: 24 hours +
  - Symptoms: Abdominal pain, nausea, vomiting, diarrhea, fever. 1-2 weeks later muscle pain, low-grade fever, edema, skin eruptions, pain on breathing, loss of appetite. Drug therapy can kill the worms.

Examples of micro-organisms

- **Giardia lamblia** parasitic protozoa
  - Contaminated water, undercooked foods
  - 1-6 weeks onset
  - Diarrhea, abdominal pain, nausea, vomiting

- **Clostridium perfringens** bacterium
  - Meats, meat products
  - 8-12 hour onset
  - Diarrhea, abdominal pain, nausea, vomiting

Examples of micro-organisms

- **Salmonella bacteria**
  - Raw, undercooked eggs, meats, dairy, shrimp, etc.
  - 6-48 hours
  - Nausea, chills, fever, vomiting, Diarrhea, abdominal pain, headache
  - Can be fatal

Examples of micro-organisms

- **Escherichia coli** bacteria
  - Contaminated water, undercooked beef, raw food, unpasteurized soft cheese
  - 12-18 hour onset
  - Loose stool, nausea, bloating, abdominal pain
  - E. coli 0157:H7 evolved to be highly pathogenic; causes enterohemorrhagic colitis and bloody diarrhea

Examples of micro-organisms

- **Botulinum toxin**
  - Anaerobic environment of low acidity
  - 4-6 hour onset
  - Nervous system: double vision, inability to talk or swallow, respiratory paralysis, death

- **Staphylococcus aureus** bacterium
  - Toxin in meats, poultry, egg products
  - 0.5-8 hour onset
  - Diarrhea, abdominal pain, nausea, vomiting, fatigue

Fungi

- Includes yeast, molds, mushrooms, and other species similar to plants but lacking chlorophyll.
- Mycotoxins are produced from fungal infection of plant crops and pose a biohazard risk.
  - Aspergillus flavus which produces aflatoxin can grow on fruits, vegetables, grains, nuts and seeds, especially those produced and/or stored in warm and humid climates.
Viruses
- Originate as a virion, encapsulated DNA or RNA.
- Incorporate into host DNA.
  - DNA viruses directly integrate.
  - RNA viruses are reverse transcribed to DNA and then integrate.
- Use the host's metabolism to replicate, make capsids, and infect more cells.

Example of viral contamination
- **Hepatitis A virus**
  - From foods handled by non-sanitary hepatitis A carrier (virus replicates in the liver and is released into bile)
  - From contaminated shellfish
  - 15-50 days onset
  - Liver inflammation, nausea, vomiting, jaundice

Prion
- Proteinaceous infectious particle, believed to cause mad cow disease (BSE) and be transmittable to humans.
- Maintains its pathogenicity after 29 months in soil contaminated from excrement of infected animals.
- Human and animal outbreaks occur from consuming contaminated feed.
- Creutzfeldt-Jakob disease (CJD) is a neurological and fatal human form of the disease.

Beneficial Microbes
- Probiotics, live health promoting bacterial cultures.
  - Prevent or manage diarrhea, lactose intolerance, yeast infection, inflammatory bowel disease.
  - Benefits within days of consuming foods or supplements with friendly bacteria.
- Two main bacteria inoculated into yogurt are *Lactobacillus acidophilus* and *Bifidobacterium bifidus*.
- Antibiotic use, chemotherapy, and abdominal radiation alter GI flora.
- Dietary fiber (probiotics) supports the growth of the friendly bacteria.

Summary
- Microbes grow rapidly & are present in food.
- Microbes causing food-borne illness include: parasites, protozoa, bacteria, fungi, viruses, and prion proteins.
- Food-borne illness causes severe GI distress, pH and electrolyte imbalances, and can be life-threatening.
- Some microbes are beneficial.

References for this presentation are the same as those for the topic found in module 6 of the textbook.
**Food Issues**

*Consumer Awareness*

*T-Talk 6.5*

By Jennifer Turley and Joan Thompson

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**Presentation Overview**

- Food contamination, consumer awareness, & safe food handling
- Natural toxicants
- Chemical poisoning
- Other food safety concerns
- Food production and sustainability

**Safe Handling of Food**

*Consumer Awareness*

- Understand microbial growth.
- Know the most common types of bacteria that cause food-borne illness (Salmonella, Clostridium, & Staphylococcus).
- Know food poisoning health complications:
  - Severe GI distress (cramps, diarrhea, nausea & vomiting).
  - Acid/base imbalance, fluid & electrolyte loss.
- Cook & store foods properly. Recognize troublesome foods and eating situations like picnics or buffets.

**Food Handling**

- **Store Foods Properly:** Refrigerate or freeze. Thaw in the refrigerator or microwave. Keep cold foods cold; refrigerator temperature of 40°F and freezer temperature of 0°F.
- **Cook Foods Properly:** Cook thoroughly. Don’t consume raw or undercooked meat or seafood. Cook to a high enough core temperature to kill pathogenic microorganisms.
- **Handle Raw Foods Properly:** Don’t cross contaminate raw fruits and vegetables with raw meats. Wash hands and cutting surfaces. Minimize food infection.
- **Handle Cooked Foods Properly:** Keep hot foods hot. Refrigerate leftovers immediately or discard. Minimize the time foods are held in the danger zone 40°F-140°F.

**Safe Handling of Food**

*Consumer Awareness*

- **Buying food:** reputable grocers, avoid dented cans, crushed boxes, etc.
- **Storing food:** refrigerate/freeze perishable items quickly. Process raw meat within 2 days & store in coldest part of refrigerator.
- **Preparing food:** wash hands, defrost meat properly, marinade foods in refrigerator, avoid cross contamination in grocery bags, on counters, on cutting boards, with hands. Wash tops of cans prior to opening, rinse fresh fruits & vegetables in water.

**Safe Handling of Food**

*Consumer Awareness*

- **Temperature** is important for microbial growth.
  - The danger zone is: 40°F to 140°F.
  - The closer to the mid point, the faster the growth!
  - Chilling, freezing, heating (cooking, pasteurizing, canning, sterilizing) can minimize microbial growth.
Safe Handling of Food

Consumer Awareness

- **Cooking food:** Cook meats to appropriate internal temperature, cook eggs so white is firm & yolk begins to harden.
- **Serving food:** Keep hot foods hot (>140°F) & cold food cold (<40°F), refrigerate leftovers, eat leftovers within ~3 days.

Water is important for microbial growth.
- Dehydration is a method of controlling microbial growth.

Protein is important for microbial growth.
- Protein-rich foods are common carriers of pathogenic bacteria.

The pH of a food affects microbial growth.
- Acidic and alkaline foods do not support bacterial growth.

Chemical Processing

**Killing or Minimizing Microorganisms**

Manufacturing methods to extend shelf life

- Sugar and salt, sodium benzoate in margarine, calcium propionate in bread, and sorbic acid in cheese wrappers to control mold are all examples of chemicals that minimize microbial growth.

Irradiation: Controls insects & microbes
- FDA approved
- Irradiated foods are labeled

<table>
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<th>Food Safety Effect</th>
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<td>Wheat</td>
<td>0.025–0.05</td>
<td>Disinfects insects</td>
</tr>
<tr>
<td>Potatoes</td>
<td>0.025–0.15</td>
<td>Extends shelf life</td>
</tr>
<tr>
<td>Fresh fruits</td>
<td>1.0</td>
<td>Disinfects insects</td>
</tr>
<tr>
<td>Pork</td>
<td>0.1–1.0</td>
<td>Delays ripening</td>
</tr>
<tr>
<td>Poultry</td>
<td>3.5</td>
<td>Controls microbes</td>
</tr>
<tr>
<td>Raw beef</td>
<td>6.0</td>
<td>Controls E. coli growth</td>
</tr>
<tr>
<td>Frozen beef</td>
<td>7.0</td>
<td>Controls E. coli growth</td>
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</tbody>
</table>

*One kilogram will increase the temperature of the product 0.43 degrees F.*

Modified Atmosphere Packaging: minimizes the amount of oxygen in the environment.
- Oxygen is usually replaced with carbon dioxide & nitrogen
- Controls oxidative enzymes

Safe Handling of Food

Killing or Minimizing Microorganisms

Food Safety Concerns:

Natural Toxins

- Mold & fungi produce mycotoxins and aflatoxins
- Poisonous mushrooms
- Oxalic acid in Rhubarb leaves
- Solanine in the green part of potatoes
- Goitrogens in cabbage family vegetables
- Cyanogens in raw lima beans & apricot pits
- Red tide toxin in blooming sea algae
- Other toxins in certain herbs such as belladonna, hemlock, & sassafras
Food Safety Concerns:  
**Chemical Poisoning**

- Lead, mercury, cadmium (heavy metals) & organic compounds.
  - **Lead** poisons the nervous system, bone marrow, liver, and kidneys.
  - **Mercury** poisons the nervous system, especially during fetal development.
  - **Cadmium** slowly damages the liver and kidneys.
  - **PCB's** cause skin eruptions, eye irritation, growth retardation, anorexia, and fatigue.

Food Safety Concerns:  
**Incidental Additives**

- Pesticides, hormones, etc.
- Ways to reduce pesticide intake include:
  - trim fat
  - vary meats
  - wash fresh produce (scrub and rinse)
  - discard outer leafy vegetables
  - peel waxed fruit and vegetables

**Antibiotics & Hormones**

- Commonly used when raising animals in conventional food production.
- Used to reduce animal sickness while accelerating growth to meet food production demands.
- Possible health consequences:
  - Antibiotic resistance and multiple drug resistance in animals and humans from antibiotics.
  - Endocrine disruption potentially leading to fertility problems and cancer from hormones.

**GMO Concerns**

*Why are plants GM?* For insect & viral resistance, herbicide tolerance, delayed ripening, plant sterility, and modified oils. What type of plants are GM? Corn, tomatoes, potatoes, soybean, rice, squash, papaya, flax, cantaloupe, and others.

- Marker gene required for identification of altered cells & antibiotic resistance.
- New plant species & naturally occurring toxicant levels (allergy and sensivity).
- Plants with substances not normally found in species (allergens, vegetarianism).
- Unexpected changes in tissue composition from gene activation or suppression.
- Risk of plants used to make nonfood oils or starch entering the food supply.
- Legal issues of false non-GMO labeling by manufacturers & farmers dealing with unintentional crop migration.
- Threatened biodiversity.
- Not labeled.

**Pesticide Residues in a Food Chain**

**Toxic Chemical Exposure through a Marine Food Web**
Genetic Engineering of Food

1. The PG (pre-germinative) coat gene, which allows seeds to germinate, is isolated and cloned. The resulting PG gene is inserted into a genetically modified organism (GMO).
2. The recombinant PG gene is put into Agrobacterium, which is a bacterium that naturally infects plants and inserts its DNA into the植物的genome. Genes are introduced into other target cells.
3. The Agrobacterium is then placed in a pipeline and then injected into the plant. The modified plant is then harvested and used to improve food production.
4. The soil bacteria aggregate into clusters and can cause disease. The bacteria can be used to produce food products.
5. In the genetically engineered plant, the desired PG gene is expressed. The PG gene is expressed by the plant and the plant can be used to produce food products.

Food System

Levels of organization within a food production system

<table>
<thead>
<tr>
<th>Biosphere</th>
<th>The earth's ecosystems</th>
<th>All farms on earth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystem</td>
<td>A community and their nonliving natural surroundings</td>
<td>The animals, plants, microbes, soil, rocks, water, air, and sunlight on the farm</td>
</tr>
<tr>
<td>Community</td>
<td>Various population living in a defined area together</td>
<td>A farm with cattle, chickens, turkeys, sheep, and goats</td>
</tr>
<tr>
<td>Population</td>
<td>A group of the same organisms living in the same geographical area</td>
<td>The cattle on a farm</td>
</tr>
<tr>
<td>Organism</td>
<td>An individual living thing</td>
<td>One cow</td>
</tr>
<tr>
<td>Groups of Cells</td>
<td>Tissues, organs, and organ systems</td>
<td>The brain and central nervous system of a cow</td>
</tr>
<tr>
<td>Cells</td>
<td>A smallest functional unit of the organism</td>
<td>A single brain cell</td>
</tr>
<tr>
<td>Molecules</td>
<td>Groups of atoms making a chemical compound</td>
<td>A protein made of carbon, oxygen, hydrogen, and nitrogen</td>
</tr>
<tr>
<td>Atom</td>
<td>The smallest component of an element</td>
<td>Hydrogen</td>
</tr>
</tbody>
</table>

Conventional vs. Organic Food Production

- Conventional plant practices commonly use pesticides, nitrogen fertilizers, sewage sludge, genetically modified organisms (GMO), and irradiation.
- Conventional animal practices commonly use hormones, antibiotics, conventionally produced feed, tallow (animal fat), manure can be applied to the land, grazing (70%) and confinement (30%).
- Organic food: farmers use renewable resources and conserve soil and water to enhance environmental quality for the future. Nitrogen in soil is maintained by composting and the action of decomposers. Animals are less confined.
- USDA Certified Organic Foods: Government inspectors and certifies farms as organic. All conventional aspects prohibited. Thus non-GMO.

The Nitrogen Cycle

[Diagram of the nitrogen cycle, showing processes such as nitrogen fixation, ammonification, nitrification, and denitrification]
A Sustainable Food System

Summary

- Food can contain natural toxicants, incidental additives & undesirable chemicals.
- Food industry uses techniques to minimize microbes & pests.
- Consumers need to be aware of how to handled food properly.
- Consumers should make choices to support a sustainable food system

Healthy & Sustainable Me

Summary for this presentation are the same as those for this topic found in module 6 of the textbook.