

Health Effects of FOOD

Mercer University
EVE 486

Question: How much control do you have over the food you eat?

Consider:

- **PRODUCTION:** genetic mods, organic
- **PREPARATION:** do you cook? Go to restaurants (ratings)?
- **HANDLING:** your refrigerator, transit (refrigerated trucks)

In the US (annually), food consumption leads to:

- **ILLNESS** for 76 million people
- **HOSPITALIZATIONS** for 325,000
- **DEATH** for 5000

We'll focus on:

- Biological agents – bacteria/viruses/protozoa (97% of all cases)
- Chemicals – Pb, Hg, organics
- Effects on health – acute and chronic

Health and Nutrition: A little background info

1920s Europe: studies indicated that most of the “poor” were short, thin, and suffered from ill health

- Health improved and children grew taller if provided a diet rich in protein and vitamins
- Term *balanced diet* entered vocabulary
 - Protein from animal products and soybeans
 - Carbohydrates from bread and pasta
 - Vitamins and minerals from fruits and vegetables

In a balanced diet, intake of protein, carbs, vitamins, and minerals meets energy requirements for maintaining health, growth, and activity

Imbalance and Health: More background info

- **Iodine deficiency:** delayed mental development, goiter (enlarged thyroid), diminished work capacity
- **Vitamin A deficiency:** serious eye disease, ↓ resistance to disease, ↑ child mortality
- **Iron deficiency:** anemia, ↑ Cd and Pb absorption
- **Calcium deficiency:** ↓ bone mass, osteoporosis (brittle bones)
- **Obesity** (excess body fat): ↑ hypertension, ↑ diabetes, ↑ breast cancer

Foodborne diseases

- Biological contaminants
 - **Bacterial:** bacteria either produce toxins that may destroy protein and tissues, or viable organisms are ingested that infect the host and produce pathological response
 - Examples: cholera, typhoid, salmonella, staphylococcus
 - **Viral and parasitic:** difficult to investigate due to long incubation periods; little known about infective dose; also produce toxins
 - Examples: Hepatitis A (virus), giardiasis (parasite), trichinosis (parasite), norovirus

Foodborne diseases: More about those toxins

Some result from improper handling (that is, the viruses, bacteria, etc that *produce* toxin are introduced through improper handling)

- EXAMPLES
 - **ENTEROTOXINS:** produced by staph bacteria
 - **BOTULISM:** produced by *clostridium botulinum*
 - **TOXINS PRODUCED BY E. COLI**

Others are naturally-occurring

- EXAMPLES
 - **CAROTATOXINS:** a nerve poison in carrots (a pesticide)
 - **AFLATOXINS:** carcinogens in peanuts, corn, and other staple commodities
 - **BREVETOXINS:** neurotoxins in shellfish

Foodborne diseases: Chemical contaminants

There are MANY sources and inter-relationships

- **EXAMPLES**
 - **PCBs** (polychlorinated biphenyls)
 - Fluids added to many things to increase flexibility
 - Commonly found in pesticides, herbicides before ban in 1979
 - EFFECT: known to suppress immune system and increase developmental disorders (also a suspected carcinogen)
 - HIGHEST LEVELS in fish
 - **Pb**: introduced to food through environmental contamination
 - EFFECT: kidneys, digestive system, nervous system damage
 - HIGHEST LEVELS in fish and shellfish
 - **Cd**: same sources as Pb (cumulative)
 - EFFECT: kidneys, liver, placental function
 - HIGHEST LEVELS in mollusks and crustaceans
 - **Hg**: bioaccumulation
 - EFFECT: central nervous system damage
 - HIGHEST LEVELS in fish (Mediterranean fish particularly contaminated)

Other food contaminants

Food additives: used to modify texture, flavor, appearance, or storage properties

- Some additives improve quality (e.g., vitamins and iodine)
- Some act as stabilizers/thickeners (bean gum, pectin, and gelatin)
- Some *remove* color (benzoyl peroxide); some *add* color (carotenes)
- As for flavor...MSG is an amino acid linked to nausea, numbness, and chest pain

Other food contaminants: Continued

Hormones: given to beef cattle and dairy cows to accelerate weight gain and milk production

- Estradiol and zeranol (estrogens), testosterone, trenbolone, progesterone (steroids) are FDA approved
- We worry about animal excrement in the context of *runoff*: How much of the hormone remains?

Antibiotics: given to promote health in crowded farm environments

- **Concerns**: growth of antibiotic-resistant germs that can be passed on to humans; consumers may be allergic to antibiotics

Other food contaminants: Continued

Genetically engineered foods: the goal is to produce plants that are easier to grow and less susceptible to pests

- How? Introduction of one plant's DNA to another
- How often? **70-75% of all processed food in US** contains genetically engineered ingredients
- Is it safe? The constituent products are considered "safe"; the foods themselves are being sold without extensive research
- Regulated by FDA, Dept of Agriculture, and EPA

Other food contaminants: Continued

Miscellaneous: unwanted substances that accidentally get into food

- There are FDA/EPA "tolerance levels" for dirt, hairs, rodent feces, insect parts, and pesticide residue
- We have a monitoring system, but it has been criticized...
 - Only a small fraction of the food supply is tested
 - Tests available for only a subset of pesticides
 - Often, when contaminants are detected, it's too late

Food safety

- Bacterial growth affected by temperature, moisture, and acidity
- Handling
 - Thaw frozen foods in the fridge ($\leq 40^\circ$ F), cold water OK, too; use immediately after thaw
- Preparation
 - Cooking foods to safe temps usually kills everything except staph toxins

Food safety: Continued

- Safe cooking temperatures

145° F	Beef, lamb
160° F	Pork, egg dishes
165° F	Ground turkey/chicken; leftovers
180° F	Whole birds; bone-in parts

- Food storage: refrigeration and freezing inhibit microbial growth (they don't kill)
 - **Meat:** refrigerate immediately (1-5 days); can be kept in freezer for up to 3 months
 - **Milk:** ~1 week in fridge; ~3 months in freezer

Back to Genetic Engineering: Video

Genetically modified foods discussion
<https://www.c-span.org/video/?316670-5/genetically-modified-foods>
