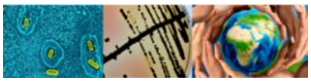

Dietary Guidelines for American I/II

Evidence-based Policies for Creating a Healthy Eating Pattern

AGSC 5540: Food Policies and Regulations

9-2-2021

Tennessee State University, Nashville, TN

A. Fouladkhah: Faculty Director, Public Health Microbiology Laboratory

Photos Courtesy: Adobe Professional, Standard License Purchased by Public Health Microbiology

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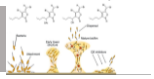
Today's content

- **Summary** of Last Session and Overview of Food Safety Modernization Act
- **Basics of Nutrition**
- *Exercise 1*
- **National Nutrition Monitoring and Related Research Act**
- **USDA Dietary Guideline, Part I/II**
- *Class Exercise 2*
- *Class Exercise 3*
- Discussions on **term paper topics** that is due next week
- Discussions on assignment that was due today

2

Infectious Diseases in Animals and Human is a Moving Target…



- It is estimated only 1% of microbial community has been identified.
- Currently **etiological agent** of 80.3% of foodborne illnesses, **56.2% of hospitalization**, and 55.5% of deaths remain unknown.

"Emerging" Pathogens:

- Vertical and horizontal gene transfer spores and biofilm formation
- Quorum sensing and cell to cell communication

"*It is the microbes who will have the last word.*"
-Louis Pasteur

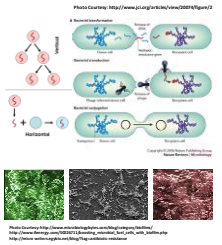


Photo Courtesy: http://www.pnl.gov/article/view/2007#/figure/2

3

Epidemiology of Foodborne Diseases

- **Based on data from 1990s:** *(Mead et al., 1999)*

76 million illnesses, 323,000 hospitalizations, **5,200 deaths** in the United States.

- **More recent estimates show:** *(Scallan et al., 2011)*

47.8 million illnesses, 127,839 hospitalizations, and more than **3,037** deaths in the United States.

- 9.4 million illnesses, 55,961 hospitalizations, and 1,351 deaths are cause by 31 known foodborne agents.
- In addition to consumer insecurity, foodborne diseases cause around $**77.7 billion** for losses in productivity and economical losses.
- Approximately 30% of population are especially "at risk" for foodborne diseases (The **YOPI**'s: The young, the old, Pregnant, and Immunocompromised)

4

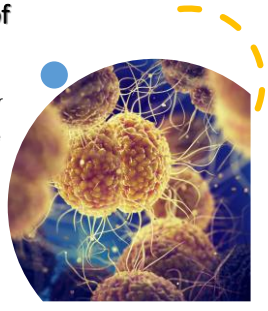
Significant foodborne pathogens…
based on Mead et al., 1999 and Scallan et al., 2011 studies

- **Leading etiological agents for illnesses**: *Norovirus* (58%), Nontyphoidal *Salmonella* serovars (11%), *Clostridium perfringens* (10%), and *Campylobacter* spp (9%).
- **Leading etiological agents for hospitalization:** Nontyphoidal *Salmonella* serovars (35%), *Norovirus (26%), Campylobacter* spp (15%), and *Toxoplasma gondii* (8%).
- **Leading etiological agents for death:** Nontyphoidal *Salmonella* serovars (28%), *T. gondii* (24*%), Listeria monocytogenes* (19%), and *Norovirus (11%).*

5

Signs and Symptoms of Foodborne Diseases

- Mild illness (no medical care sought)
- **Guillain–Barré syndrome** (*Campylobacter* and *Salmonella*)
- **Post-infectious irritable bowel syndrome** (*Campylobacter* and *Salmonella*)
- **Reactive arthritis** (*Campylobacter* and *Salmonella*)
- **Haemolytic uraemic syndrome** (*E. coli* O157)
- **End-stage renal disease** (*E. coli* O157)
- Death



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Significant Foodborne Pathogens of Public Health Concern: Considering DALY and QALY *(Scallan et al., 2015)*

- **Disability Adjusted Life Year *(DALY)***. *Loss of life and health due to illness compared with 'perfect' health*

- Non-typhoidal *Salmonella* (329000)
- Toxoplasma (32700)
- *Campylobacter* (22500)
- Norovirus (9900)
- *Listeria monocytogenes* (8800)
- *Clostridium perfringens* (4000)
- *Escherichia coli* O157 (1200)

62% bacterial agents; 29% parasitic agents; 9% viral agents

- Mild illness (no medical care sought)
- **Guillain–Barré syndrome** (*Campylobacter* and *Salmonella*)
- **Post-infectious irritable bowel syndrome** (*Campylobacter* and *Salmonella*)
- **Reactive arthritis** (*Campylobacter* and *Salmonella*)
- **Haemolytic uraemic syndrome** (*E. coli* O157)
- **End-stage renal disease** (*E. coli* O157)
- Death

7

CDC Estimates of Food Safety Burden

http://www.cdc.gov/foodborneburden/attribution-image.html#foodborne-illnesses

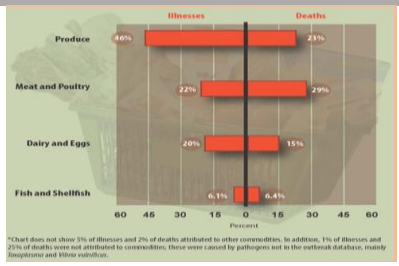

*Chart does not show 3% of illnesses and 2% of deaths attributed to other commodities. In addition, 1% of illnesses and 25% of deaths were not attributed to commodities; these were caused by pathogens not in the outbreak database, mainly *Toxoplasma* and *Vibrio vulnificus*.

8

Climate Change and Public Health Microbiology

Non-typhoidal *Salmonella enterica* serovars

- **Global death:** 50,000 global death in 2010 (WHO, 2020)
- **Public Health Burden in the U.S.:** >1 million annual cases in 2011 (CDC, 2011)

Climate Change:

- **1 °C increase : 5 to 10% increases in Salmonellosis (WHO, 2010)**
- 2500 to 5000 additional global death
- 50,000 to 100,000 U.S. morbidity

At our current rate:

- >1.5 °C by 2040
- >4.8 °C by 2100

9

Food Safety Modernization Act (FSMA)

- Signed to law in January of 2011, FSMA is the largest expansion of U.S. food safety authorities since the 1930s.
- Many **sectors of agriculture and manufacturing** will undergo strict regulations for the **first time in the history of the country**.
- Shifting responses from food safety problems from **reaction** to **proactively prevent** the episodes
- FSMA, a large and comprehensive legislation **broaden FDA's ability** to:
  - **Mandatory recall** of contaminated food products
  - **Enhanced surveillance** to investigate foodborne illness outbreaks [PFGE and WGS]
  - Established **new preventive controls** and **food safety plans** at some food processing facilities and farms
  - Enhanced FDA's **traceability capacity**
  - **Increased inspection** frequencies of high-risk food facilities (both domestic and foreign facilities)
  - Expanded authority and oversight capabilities with regard to **foreign companies**

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Regulatory Landscape of Food Industry Before FSMA

Very small companies:

Exemption from federal requirements, need to follow state policies

Restaurant operations:

*Exemption from **federal requirements**, need to follow **state policies** (food code)*

Food Safety Inspection Service (FSIS) of USDA:

Meat, Poultry and Egg products, HACCP requirements

Food and Drug Administration:

High-risk Foods: Juices, seafood, and shell egg, *HACCP requirements*

Farmers and other food products:

No federal regulation

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Mandated by FSMA

- Food manufacturing (processors)
- Farmers and growers (producers)
- Transportation, retailers
- Imported foods
- Third party laboratories
- Local, state, and federal agencies
- Foreign governments

Not mandated by FSMA

- FSMA does not directly address sectors under **pre-existing** jurisdictions. HACCP will remain the dominant regulation for:
- Meat, poultry, and egg products (USDA-FSIS)
- Juices, seafood, and shell eggs (DHHS-FDA)
- Very small producers and processors could receive exception from FSMA requirements (**cottage industry**).
- FSMA does not mandate **GM** products, **antibiotic resistant** organisms, **organic production, and pesticide and fertilizer use.**

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FSMA Implementation Schedule

FSMA was signed into law on **January, 2011**
Regulations were supposed to be finalized within one to two years of enactment (roughly **January 2012 and January 2013**)

Revised implementation dates: (all drafts are currently publically available)

- **Preventative controls** FSMA §103(a) and(c): August 30, 2015 [Human Food and Animal Food]
- **Produce safety Rule:** FSMA §105(a): October 31, 2015 [Water requirement in 2021]
- **Accreditation of third-party auditors**: FSMA §307): October 31, 2015
- **Sanitary transportation practices for food and feed**: FSMA §111: March 31, 2016
- **Foreign supplier verification program**: FSMA §301(a): October 31, 2015
- **Intentional adulteration of food**: FSMA §106(b): May 31, 2016. [15% of country food]

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Produce and Preventive Rules and Land-grant Institutions

- Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption (**Produce Rule**): **Producers**
- Current Good Manufacturing Practice and Hazard Analysis and Risk-Based Preventive Controls for Human Food (**Preventive Control for Human Food Rule**): **Processors**

- Large producers and processors
- Small and medium size producers and processors
- Very small (hobbyists) producers and processors (local and cottage industry)

- Many of small and medium size entrepreneur will require assistance from the nations 75 land-grant institution for **safe and economical access to market**.

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Produce Rule: Overview

- Regulate "**farms**," and "**farm-type facilities**"
- Emphasizes on regulating fruits or vegetable to be consumed raw (**high-risk produce**) *e.g. berries, celeries, most leafy greens, tomatoes, peppers, etc.*
- Certain vegetables and fruit (**low-risk produce**) are except, those requiring preparation as "kill step," before consumption *e.g. pumpkins, potatoes, squash, green beans etc.*
- **Sprouts** are subjected to "special rule," requiring seed treatment, and a frequent pathogen testing
- Low and high-risk categories have been **subject of criticism**, and had been a **moving target** throughout the revisions.

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Requirements of Produce Rule

- Worker's training (similar to HACCP pre-requisite program, supervisor and workers)
- Health and hygiene training (similar to HACCP GMP's)
- Agricultural water (monthly test of sub-surface and weekly test of surface water; treatment and monitoring of water source)
- Biological soil amendment of animal origin (**validated treatment**, no visible contamination, harvest time)
- Domesticated and wild animals (waiting period for grazing during harvest time, required fence)
- Equipment, tools, buildings, and facilities (storage, pathogens, and extensive documentation)
- Sprout rule (seed treatment and enhanced pathogen testing for **irrigation water**)

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Produce Rule: Implementation and compliance dates

- **Implementation date:** October 31, 2015
- **Compliance date:**
  - Very small farms ($25*k and below): Exempt
  - Small farms ($25k-250K): 4 years (December 2019)
  - Medium farms ($250-500K): 3 years
  - Large farms ($500k and above): 2 years

Water testing requirements will be effective after additional 3 years. [now until 2022]

Effective dates are 60 days after implementation dates

*three-year average revenue; categories are no longer based on number of employee, the categories differ in preventive and produce rules.

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Preventive Control for Human Food Rule: Overview

- Regulate "**processors**"
- Under the regulation all "**facilities**" have to be registered with FDA
- The rule has **two sections: HARPC and GMP**, facilities obligated to have one or both.
- **Exemptions:** Juice, seafood, and shell egg sectors and businesses that store agricultural comities. (differs with preventive rule)

Modified Requirements:

- Three-year average sales less than $500K, AND
  - Direct sales to restaurants and consumers within 275 mile radius, or
  - Within states sales in 275 mile radius. ***Reason=?***

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Requirements of Preventive Rule
cGMP-*Current Good Manufacturing Practices*

- Similar to prerequisite program in HACCP
- Nearly all facilities are required to follow this section of the rule

Exemption:

(1) Businesses that store agricultural commodities

(2) Businesses that selling directly to a manufacturing facility like canning operation (vertically integrated farms)

- **Main GMP Requirements:**
- Sanitation
- Employee training *by PC QI*
- Environmental control and training
- Recall contingency plan
- Allergen control
- Supplier verifications
- Sanitary transportation

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Requirements of Preventive Rule
Hazard Analysis and Risk-Based Preventative Controls (HARPC)

- Previous a **7-step** plan for FSIS HACCP, **12-step** plan for Codex HACCP, and currently 5-step plan for HARPC:

- **Hazard analysis**
- Identification and implementation **preventive controls**.
- **Monitoring** the performance of controls.
- Developing **corrective actions** for preventative deviation.
- **Verification and recordkeeping** of preventative controls effectiveness

- 2.5 day workshop Preventive Control Qualified Individuals (PC QI)

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Preventive Rule: Implementation and compliance dates

- **Implementation date:** August 30, 2015
- **Compliance date:**
  - **Very small** facility ($2.5*m and below): 3 year
  - **Small** facility (less than 500 employee and does not qualified for exception): 2 years
  - **"Other" facilities**: 1 years

Modified Requirements:

- Three-year average sales less than $500K, AND
  - Direct sales to restaurants and consumers within 275 mile radius, or
  - Within states sales in 275 mile radius.

*Total annual sale; the categories differ in preventive and produce rules.

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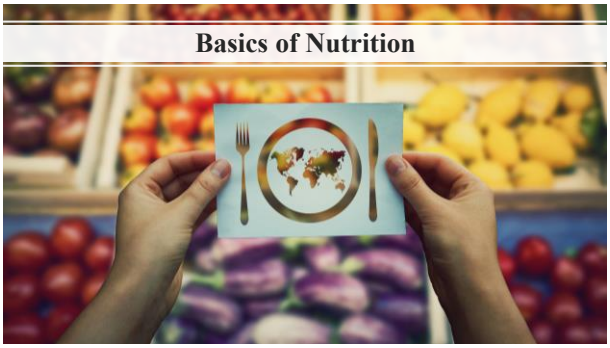

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Building Blocks of Food

Macronutrients
- Carbohydrates ~4 Calories*/gram
- Proteins ~4 Calories/gram
- Fats ~9 Calories/gram

Micronutrients
[Hidden Hunger]

(Alcohol) ~7 Calories/gram

1.5 oz *i.e.* ~45 mL

Water Soluble Vitamins	Fat Soluble Vitamins	Minerals	Water
Vitamin B1	Vitamin A	Calcium	Water
Vitamin B2	Vitamin D	Potassium	
Vitamin B6	Vitamin E	Sodium	
Vitamin B12	Vitamin K	Iron	
Vitamin C		Zin	
Folic Acid			

**The energy needed to raise the temperature of 1 gram of water through 1 °C*
The "calorie" we refer to in food is actually kilocalorie

Source DGA and WAS Extension, Accessed 2021.

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Macronutrients- Fats

- **Building blocks** are fatty acids
- Many **unsaturated fatty acids** are essential
- Energy reserve
- Protects vital organs
- Insulation
- Transport fat soluble vitamins
- Recommended Allowance: 20-35% of your **total** daily calories from fat
- Recommended Allowance: less than 10% of total daily calories from **saturated fat**
- Recommended Allowance: 1% or less from ***Trans* fatty acids** (excluding the CLA)

Source DGA and WAS Extension, Accessed 2021.

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Macronutrients- Carbohydrates

- **Primary source of energy** for our bodies
- Primary fuel source for **high-intensity exercise**
- **Preserves muscle** mass during workout
- Is the primary fuel for the **central nervous system** including **brain**
- Stored primarily in **liver** and in smaller amount in **muscles** as **glycogen**
- Ideally, **45-65% of our calorie intake** should come from carbohydrate sources
- Grains and some starchy vegetables (**complex carbohydrates**)
- Fruits, dairy, sugar (**simple carbohydrates**)

Source DGA and WAS Extension, Accessed 2021.

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Macronutrients- Proteins

- Part of **various tissue** (part of organ tissues, muscle, hair, skin, nails, bones, tendons, ligaments and blood plasma)
- **Various part of cell** plasma membranes
- Involved in **various metabolic, transport, and hormone systems**
- All **enzymes** that regulate metabolism are protein based
- Many individuals do not consume sufficient amount:
- **Legumes** (beans, peas, lentils, chickpeas, peanuts); **Soy products**; **Nuts and Seeds**; **Whole grains** (brown rice, whole wheat, oats, corn, quinoa, sorghum, millet); **Meat alternative products** (often made with pea protein, soy protein, and/or wheat gluten); **Animal sources** (Meat, Dairy, and egg).

Source DGA and WAS Extension, Accessed 2021.

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Building Block of Proteins

Building blocks: Amino Acids

- ~500 amino acids in nature
- 20 (21) amino acids found in human body
- 9 (10) amino acids are essential
- Most plan-based proteins are not "*perfect*" proteins *i.e.* missing one or more essential amino acids.
- Both **Quality** and **Quantity** of protein is important in Diet

Source DGA and WAS Extension, Accessed 2021.

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Amount of Proteins Needed

Recommended Daily Allowance

- **Sedentary Individuals:** 0.36 grams of protein per pound of body weight
- **Recreationally Active:** Up to 0.68 grams of protein per pound of body weight
- **Competitive Athlete and During Pregnancy:** Up to 0.82 grams of protein per pound of body weight
- **Teenage Athlete:** Up to 0.91 grams of protein per pound of body weight
- **When Restricting Calories:** Up to 0.91 grams of protein per pound of body weight

Common Foods	Amount of Protein (gram)
3 ounces tuna, salmon, haddock, or trout	21
3 ounces cooked turkey or chicken	19
6 ounces plain Greek yogurt	17
½ cup cottage cheese	14
½ cup cooked beans	8
1 cup of milk	8
1 cup cooked pasta	8
¼ cup or 1 ounce of nuts (all types)	7
1 egg	6

Source: HARVARD HEALTH BLOG and WAG Extension, Accessed 2021.

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Exercise 1

Based on information provided in the class, how much protein an individual who is "recreationally active," and is 140 pounds needs to maintain health in one day?

Please use the information in the previous table and calculate amount of food items needed to reach this protein intake requirement. Please do the calculations to have approximately 40% protein need in breakfast, 40% protein need in lunch, and 20% protein need in dinner

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National Nutrition Monitoring and Related Research Act of 1990

An evidence-based legislation

DGA Dietary Guidelines for Americans

nhanes National Health and Nutrition Examination Survey

conducted in 1971, and in 1999 the surveys became an annual even

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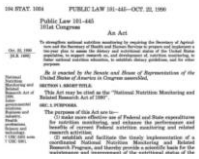
National Nutrition Monitoring and Related Research Act of 1990

- Poor diet and physical inactivity
- Epidemic of overweigh and obesity
  - Men, women and children
  - All segments of the society
- **Poor diet and physical inactivity**: a leading cause of premature morbidity and mortality
- Absence of harmonized national policy and guidelines for food, nutrition and health
- Lead to enactment of:

National Nutrition Monitoring and Related Research Act of 1990

(Public Law 101-445, Title III, 7 U.S.C. 5301 et seq.)


104 STAT. 1034 PUBLIC LAW 101-445—OCT. 23, 1990

Public Law 101-445
101st Congress

An Act

https://www.gpo.gov/fdsys/pkg/STATUTE-104/pdf/STATUTE-104-Pg1034.pdf

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What is USDA Dietary Guideline?

- National Nutrition Monitoring and Related Research Act of 1990 **Requires**:
  - *United States Department of Agriculture (USDA)*
  - *Department of Health and Human Services (DHHS)*
- Review and Update Dietary Guidelines for Americans (**DGA**) every **five years**
- **Prior to NNMRR** Act of 1990, DGA existed in less volumous editions:
  - *Earliest revision, Wilbur Olin Atwater, 1894* [Terms like vitamins were not even developed]
  - *The revisions of 1980 and 1985, less extensive than post NNMRR Act*
- Current DGA has two **main concepts** of:
  - *Maintain calorie balance over time to achieve and sustain a healthy weight* ***(quantity of diet)*** to avoid positive energy balance
  - *Consuming nutrient-dense foods and beverages* ***(quality of diet)***
- Current DGA promotes two **eating patterns** of:
  - USDA Food Patterns
  - DASH (Dietary Approaches to Stop Hypertension) Eating Plan

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DGA main concepts

- **(1) Maintain calorie balance over time to achieve and sustain a healthy weight** (quantity of diet)
  - *Decrease the calories consumption*
  - *Increase the calories expenditure through physical activity*
- **(2) Consuming nutrient-dense foods and beverages** (quantity of diet)
  - *Reduction in consumption of:*
    - *Sodium,*
    - *Calories from solid fats, **(Trans fatty acids, another great topic for the paper)***
    - *Added sugars,*
    - *Refined grains.*
  - *Increase in consumption of:*
    - *Vegetables, fruits, and whole grains,*
    - *Fat-free or low-fat milk and milk products,*
    - *Seafood, lean meats and poultry, eggs,*
    - *Beans and peas, and nuts and seeds.*

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(1) Balancing calories to manage weight
Negative and positive energy balance

- Prevent and/or reduce overweight and obesity through **improved eating and physical activity behaviors**.
- **Control total calorie intake to manage body weight**. For people who are overweight or obese, this will mean consuming fewer calories from foods and beverages.
- **Increase physical activity** and reduce time spent in sedentary behaviors.
- **Maintain appropriate calorie balance during each stage of life**—childhood, adolescence, adulthood, pregnancy and breastfeeding, and older age.

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(2) Foods and food component to reduce

- Sodium Intake:
  - *General recommendation:* ***< 2,300 milligrams (mg) /day*** ***(Salt Vs. Sodium)***
  - *For 51+& those with hypertension, diabetes, or chronic kidney disease, and healthy African Americans:* ***< 1,500 mg /day*** *(51% of population)*
- Saturated Fats:
  - *<10% percent of calories from saturated fatty acids*
  - *Replacing them with monounsaturated and polyunsaturated fatty acids.*
- Dietary cholesterol:
  - *<300 mg per day of dietary cholesterol per day*
- *Trans* fatty acid consumption:
  - As low as possible (<1% energy intake)
  - *Limiting foods that contain synthetic sources of trans fats, such as partially hydrogenated oils, and by limiting other solid fats.*

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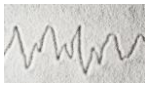
(2) Foods and food component to reduce

- Calorie reduction:
- *Reduce the intake of calories from* ***solid fats*** *and* ***added sugars****. [Subsidized, HFCS?]*
- Refined grains:
- *Limit the consumption of foods that contain* ***refined grains****, especially refined grain foods that contain* ***solid fats****,* ***added sugars****, and* ***sodium****.*
- Alcoholic beverages
- *Consumed in moderation*
  - *Up to one drink per day for women*
  - *Two drinks per day for men*



One study instead of evidence-based decision making

nhanes

National Health and Nutrition Examination Survey

38

(3) Food and nutrients to increase

- Increase **vegetable and fruit** intake.
- Eat a **variety of vegetables**, especially dark-green and red and orange vegetables and beans and peas.
- Consume at least half of all **grains as whole grains**. Increase whole-grain intake by **replacing refined grains with whole grains**.
- Increase intake of **fat-free or low-fat milk** and milk products, such as **milk, yogurt, cheese, or fortified soy beverages**.
- Choose a variety of **protein foods**, which include **seafood**, **lean meat** and **poultry**, **eggs**, beans and peas, soy products, and unsalted nuts and seeds.

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(3) Food and nutrients to increase (continued)

- Increase the **amount and variety of seafood** consumed by choosing seafood in place of some meat and poultry.
- Replace **protein foods that are higher in solid fats** with choices that are lower in solid fats and calories and/or are sources of oils.
- Use **oils to replace solid** fats where possible.
- **Choose foods that provide more:**

Potassium, dietary fiber, calcium, and vitamin D, (**Nutrients of Concern in American Diets**). These **Sources:** vegetables, fruits, whole grains, and milk and milk products.

Globally: Iron and Vitamin A deficiency (1/3 of world population), Muscle foods

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(4) Building healthy eating patterns

- Select an **eating pattern** that meets **nutrient needs** over time at an **appropriate calorie level**.
- Account for **all foods and beverages consumed** and measures how they fit within a total healthy eating pattern.
- Follow **food safety recommendations** when preparing and eating foods to reduce the risk of **foodborne illnesses**.

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(5) Three recommendations for specific group populations

- **Women capable of becoming pregnant**
- ***Heme iron*** *(which is more readily absorbed by the body),*
- ***Enhancers of iron absorption*** *such as vitamin C-rich foods.*
- ***400 micrograms/per day*** *of* ***synthetic folic acid*** *(from fortified foods and/or supplements)* ***in addition to*** *food forms of folate from a varied diet. [Childhood mortality?]*
- **Women who are pregnant or breastfeeding**
- *Consume 8 to 12 ounces of seafood per week from a variety of seafood types.*
- *Seafood to limit: high methyl mercury content, limit white (albacore) tuna to 6 oz per Seafood to avoid: four types of fish: tilefish, shark, swordfish, and king mackerel.*
- *Iron supplement, as recommended by an obstetrician or other health care provider.*
- **Individuals ages 50 years and older**
- *Consume foods fortified with vitamin B12, such as fortified cereals, or dietary supplements.*

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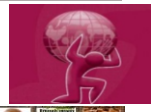
Public Health Burden of Food and Diet-related Chronic Diseases

- **Hypertension**
- 74.5 million **Americans—34 percent** of U.S. adults—have hypertension (another 36% prehypertension).
- **36 percent** of American adults have prehypertension—blood pressure numbers that are higher than normal, but not yet in the hypertension range.
- Hypertension is a major risk factor for **heart disease, stroke, congestive heart failure, and kidney disease**.
- Dietary factors that increase **blood pressure** include **excessive sodium and insufficient potassium intake, overweight and obesity, and excess alcohol consumption**.

(<1% of American adults meet the joint sodium and potassium guideline)



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Public Health Burden of food and diet-related chronic diseases (continued)

Cardiovascular Diseases

- 81.1 million Americans—**37 percent** of the population—have cardiovascular disease.
- **Major risk factors** include high levels of **blood cholesterol** and other **lipids**, **type 2 diabetes**, **hypertension** (high blood pressure), **metabolic syndrome**, **overweight and obesity**, **physical inactivity, and tobacco use**.
- **16 percent** of the U.S. adult population has high total **blood cholesterol**.

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Public Health Burden of food and diet-related chronic diseases (continued)

- **Diabetes**
- Nearly 24 million people—almost **11 percent** of the population—**ages 20 years and older** have diabetes.
- The **vast majority of cases are type 2 diabetes**, which is heavily influenced by diet and physical activity.
- About 78 million Americans—**35 percent** of the U.S. adult population ages 20 years or older—have **pre-diabetes**.
- **Pre-diabetes** (also called impaired glucose tolerance or impaired fasting glucose) means that **blood glucose levels are higher than normal, but not high enough to be called diabetes**.

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Public Health Burden of food and diet-related chronic diseases (continued)

- **Cancer**
- Almost one in two men and women—approximately **41 percent** of the population—**will be diagnosed** with cancer during their lifetime.

Osteoporosis

- **One out of every two** women and **one in four men ages 50** years and older will have an osteoporosis-related fracture in their lifetime.
- About **85 to 90 percent of adult bone mass** is acquired by the age of **18 in girls** and the age of **20 in boys**.
- Adequate **nutrition** and regular participation in **physical activity** are important factors in **achieving and maintaining optimal bone mass**.

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Exercise 2

-What is the main reason for enactment of *National Nutrition Monitoring and Related Research Act* and what year it was enacted?
-What are the two main concepts and two eating pattern associated with Dietary Guidelines for Americans?
-What are the four key recommendation of DGA and three recommendation for specific age groups?

-According to DGA, what are the *Nutrients of Concern in American Diet* and what are their main dietary sources?
-According to the DGA, what percent of American adults:
Currently suffer from hypertension?
Currently suffer from pre-hypertension?
Currently have symptoms of cardiovascular diseases?
Have high total blood cholesterol?
Are suffering from diabetes?
Have symptoms of pre-diabetes?
Will be diagnosed with one type of cancer during life time?
Meet the DGA joint sodium and potassium guideline?

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Foods and food component to reduce

- **Sodium Intake**
- **Saturated Fats**
- **Dietary cholesterol**
  - ***Trans* fatty acid consumption**
- **Calorie reduction**
- **Refined grains**
- **Alcoholic beverages**

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Foods and food component to reduce Sodium Intake

- **Sodium is an essential nutrient**, needed in relatively small quantities
- **Substantial sweating** increased the need for the nutrient
- **Excess dietary sodium** linked to elevated **blood pressure**.
- **Reduction in dietary sodium** also associated with **reduced BP** in adults and children
- Keeping blood pressure in the **normal range** reduces risk of:
  - *Cardiovascular disease,*
  - *Congestive heart failure,*
  - *Kidney disease.*
- Therefore, **adults and children should limit their intake of sodium**.

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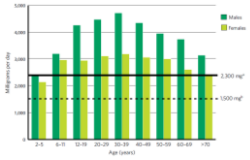
Foods and food component to reduce Sodium Intake

- Virtually *all Americans consume more sodium than they need*.
- The estimated **average intake (Americans ages 2 years and older)**: approximately **3,400 mg** per day.
- 34% adult hypertension; 36% prehypertension
- Life-time probability of developing hypertension: approximately 90%



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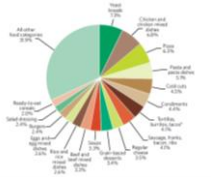
Foods and food component to reduce Sodium Intake

National Health and Nutrition Examination Survey

- Sodium is primarily consumed as salt:
  - *Processed foods: around **75% of dietary diets***
  - *Food prepared in **restaurants***
  - *Salt **added at table** and cooking only a very small portion*
- **Reason for using salt** in processed foods:
  - *Curing meat*
  - *Baking*
  - *Masking off-flavors*
  - *Retaining moisture*
  - *Enhancing flavor*
  - *Increasing shelf-life*
  - *Economical purposes (one of the cheapest ingredients: around 30 c/lb)*



Source **NHANES** data 2005-2006

NHANES: An ongoing epidemiological study since 1969 on Health and Nutrition

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Foods and food component to reduce Sodium Intake

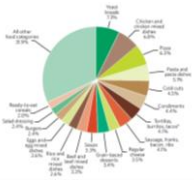
- **Two types of food are of concern:**

(1) **Very high sodium food**:

- *Processed meats,*
- *Prepared soups,*
- *Sauces and snacks*
- *RTE foods*

(2) Foods with **moderate amount** of sodium that are consumed in **large quantities**:

- *Yeast bread*
- *RTE cereals*
- *Cheese and processed dairy*



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Foods and food component to reduce Sodium Intake

- General Recommendation:
- (1) Read the **Nutrition Facts label** for information on the sodium content of foods and purchase foods that are **low in sodium**. ***[Front of package labeling]***

Sodium content ≠ salt content

based on the molar mass: ***sodium content multiplied by 2.5= salt content****.*

e.g., sodium content of a diet is 40% of the total salt intake (1 gram of salt has 400 mg of sodium)

- (2) Consume more **fresh foods** and fewer processed foods that are high in sodium.

beef (topside roast) and raw salmon: 48 and 110 mg/100 g, respectively

canned corned beef and smoked salmon: 950 and 1880 mg/100 g, respectively

- (3) Eat more **home-prepared foods**, where you have more **control over sodium**, and use little or no salt or salt-containing seasonings when cooking or eating foods.
- (4) When eating at **restaurants,** ask that **salt not be added** to your food or order **lower sodium options**, if available.

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Foods and food component to reduce Sodium Intake

- Sodium Reduction would be beneficial for:
  - ***All age groups*** *to prevent hypertension or prehypertension*
  - ***Those with hypertension*** *to avoid further health complications*
- Currently less than **15% of American** adults consume recommended amount of **salt**
- ***(<1% of American*** *adults meet the joint sodium and potassium guideline)*

Recommendations:

- Reducing consumption of High Calorie food

(High calorie food typically contain high level of salt)

- **DASH (Dietary Approaches to Stop Hypertension)** diet

(will be discussed next class)

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Foods and food component to reduce Dietary Fats

- Dietary fats are found in both **plant and animal foods**.
- Essential roles in diet:
  - *Fats supply calories and essential fatty acids, and*
  - *Help in the absorption of the fat-soluble vitamins A, D, E, and K*
- Acceptable ranges for total fat intake (**IOM**):
  - *children ages 1 to 3 years: 30–40% of calories*
  - *children and adolescents ages 4 to 18 years: 25–35%*
  - *adults ages 19 years and older: 20–35%*
- These ranges are associated with:
  - ***Reduced risk of chronic diseases**, such as cardiovascular disease*
  - *Providing for **adequate intake of essential nutrients***

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Foods and food component to reduce Dietary Fats

DGA categorizes Fatty acids as:

- ***Saturated** (mostly un-essential)*
- *Monounsaturated, or polyunsaturated (mostly essential)*
- *Trans fatty acids are unsaturated fatty acids, occurs during food processing*

- **Animal fats:** higher proportion of saturated fatty acids
- *major exception: seafood very high with polyunsaturated fatty acids*
- **Plant foods**: higher proportion of monounsaturated and/or polyunsaturated fatty acids
- *major exceptions: coconut oil, palm oil, pal kernel oil*
- Those "**solid" at room temperature**: Recommended to limit/avoid
  - *Animal sources*
  - *Or industrially produced by hydrogenation*
  - *High in saturated and/or trans fatty acids*
- Those "**liquid**" at room temperature (vegetable oils): Recommended to increase

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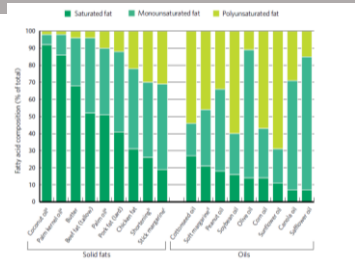
Foods and food component to reduce Dietary Fats



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Foods and food component to reduce
Dietary Fats- Saturated Fatty Acids

- **Saturated fatty acids** have important physiological and structural functions
- But considered as **unessential** (our bodies can synthesize)
- There for **no dietary requirement** for saturated fatty acids
- High intake of saturated fats:
  - *Elevated blood total cholesterol*
  - *Elevation of low-density lipoprotein (LDL) cholesterol*
  - *Increased risk of cardiovascular diseases*

Recommendation:
- *Consuming **less than 10 percent** of calories from saturated fatty acids*
- *Replacing them with monounsaturated and/or polyunsaturated fatty acids*
- *Consuming **less than 7 percent** of calories: further reduce the risk of cardiovascular diseases*

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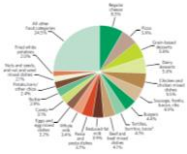
Foods and food component to reduce
Dietary Fats- Saturated Fatty Acids

NHANES data:

Around 11% calorie of Americans diet comes from saturated fatty acids

Major sources of saturated fatty acids in the American diet include:
- *Regular (full-fat) cheese (9% of total saturated fat intake)*
- *Pizza (6%)*
- *Grain-based desserts (6%)*
- *Dairy-based desserts (6%)*
- *Chicken and chicken mixed dishes (6%)*
- *Sausage, franks, bacon, and ribs (5%)*



Recommendation:
- *Preparing foods at home*
- *Replacing solids fats (butter, lard, and coconut oil) with vegetable oils*

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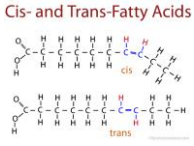
Foods and food component to reduce
Dietary Fats- Trans Fatty Acids

- *Trans* fatty acids:
  - ***Synthetic**: produced during manufacturing*
  - ***Natural**: very small amount in meat and dairy*
- ***Synthetic Trans* fatty acids:**
- Strongly **associated with negative health effects**
- They are **not essential** in the diet.
- Increase **LDL cholesterol**
- Increased **risk of cardiovascular disease**.
- Since **2006, mandatory labeling**
- **Earlier DGA**, less than **1% of calorie intake**
- **Current DGA**, as low as possible in diet



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Foods and food component to reduce Dietary Fats- Trans Fatty Acids

- **Synthetic *trans* fatty acids:**
  - *Produced by a process referred to as hydrogenation*
  - ***Hydrogenation**: make products containing unsaturated fatty acids solid at room temperature therefore **more resistant to becoming spoiled or rancid**.*
- **Sources in past** (before 2006): Hydrogenated oils used be very popular in **fried products and deserts**.
- **Currently** exists in in less quantities in some **margarines, snack foods, and prepared desserts** as a replacement for saturated fatty acids
- Could also be produced during **fried foods** preparation

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Foods and food component to reduce Dietary Fats- Trans Fatty Acids

- **Natural *trans* fatty acids:**
  - *Trans* fatty acids also are produced by **grazing animals**, and **small quantities** are therefore found in **meat** and **milk** products.
  - These are called "natural" or "ruminant" *trans* fatty acids.
  - Some studies indicate natural *Trans* fatty acids (typically short change fatty acids) do not have negative health effects.
  - Some also indicate *Trans* fatty acids such as **Conjugated Linolenic Acid (CLA)** could improve cardiovascular health by reducing LDL Cholesterol.
  - **Supplements of CLA** available in market **without approval of regulatory agencies**.
  - **Evidence** of health claims associated with natural *Trans* fatty acids are very **limited and evolving**.

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Foods and food component to reduce Dietary Fats- Cholesterol

- **Dietary Cholesterol:**
  - *The body uses cholesterol for **physiological and structural functions***
  - *The nutrient **could synthesized by body** i.e. **non-essential***
  - *In blood it exists in **Low and High Density level.***
  - *Cholesterol is found only in animal foods.*
  - *Plant foods consumption could alter the composition of LDH/HDL in blood*
  - *For example coconut oil could increase the LDL*
- **The major sources of cholesterol in the American diet include:**
  - *Eggs and egg mixed dishes (25% of total cholesterol intake)*
  - *Chicken and chicken mixed dishes (12%)*
  - *Beef and beef mixed dishes (6%)*
  - *All types of beef burgers (5%)*

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Foods and food component to reduce Dietary Fats- Cholesterol

- **Current recommendation:**
  - *Less than 300 mg per day*
  - *Reduction below 200 mg cholesterol per day could further improve health*
  - *Average men consumption:* ***350 mg per day***
  - *Average women consumption:* ***240 mg per day***
- **Reduction of Dietary cholesterol:**
  - ***Avoiding animal foods*** *containing cholesterol* ***(eggs and muscle foods)***
  - ***Avoiding dietary component that raise the blood cholesterol*** *(Trans and saturated fatty acids)*
- **By definition, Cholesterol only exist in animal foods** ("Chole" refers to food from animal origin):
- Plant product advertised as cholesterol free is misleading

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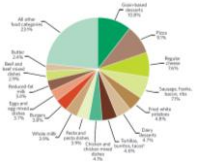
Foods and food component to reduce Dietary Fats- Solids Fats

- Recent DGA created a new category as "Solid Fats" in addition to saturated and trans fats
- Although saturated and *trans* fatty acids are components of many foods, **solid fats are foods themselves or ingredients**
- Solid fats contribute an average of **19 percent** of the total calories in American diets.
- **Some major food sources of solid fats in the American diet:**
  - Grain-based desserts (11% of all solid fat intake)
  - Pizza (9%)
  - Regular (full-fat) cheese (8%)
  - Sausage, franks, bacon, and ribs (7%)
  - Fried regular potatoes (5%)



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Foods and food component to reduce Dietary Fats- Solids Fats

- Among all "solid fats:"
  - ***processed meats*** *(e.g., franks, sausage, and bacon) and increased risk of* ***colorectal cancer and cardiovascular disease****.*
- Recommendation:
  - *Moderation and balance*
  - *Limiting solids fats and processed meats*
  - *Replace them with alternatives that are low in solid fats (e.g., fat-free milk).*
- Reducing solid fats also lead to reductions in: (**co-benefits**)
  - *Saturated fatty acids*
  - *trans fatty acids*
  - *Calories*

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Foods and food component to reduce
Dietary Fats- Natural Sugar and Added Sugar

- DGA **categorize** sugars:
  - *Natural sugar: e.g. in fruits (fructose) and fluid milk and milk products (lactose)*
  - *Added sugar: added to foods during processing, preparation, or at the table*
- **Added sugar are typically provide:**
  - *To improve flavor*
  - *Preserve the product (reducing water activity)*
  - *Improve viscosity, texture, and product body*
- Both natural and added sugar have similar nutritional properties (**high fructose corn syrup and honey**)
- Added sugars contribute an average of **16 percent** of the **total calories** in American diets.
- Leading cause of **dental health** issues and **type 2 diabetes**

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Foods and food component to reduce
Dietary Fats- Natural Sugar and Added Sugar

- **Main sources of "added sugar" to limit**
  - Added sugars include high fructose corn syrup
  - Solid cane/beet sugar
  - Corn syrup and corn syrup solids
  - Malt syrup
  - Maple syrup
  - Pancake syrup
  - Fructose sweetener
  - Liquid fructose
  - Honey
  - Molasses
- **Main Foods containing "added sugar" to limit**
  - Soda, energy drinks, and sports drinks (36% of added sugar intake)
  - Grain-based desserts (13%)
  - Sugar-sweetened fruit drinks (10%)
  - Dairy-based desserts (6%)
  - Candy (6%)

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Foods and food component to reduce
The leading Problem

The leading cause of dietary concern in American adults:
Extra "Solid Fats" and "Added Sugar:"

- **35% of calorie typical American diet**
- Major cause of **weight management**
- Cause of "**hidden hunger**" since solid fats and added sugars are low in micronutrients
- **Only 5-15% in total calories** intake recommended
- **USDA Food Pattern** diet suggested to reduce this nutrient

(will be discussed next session with **DASH Diet***)*

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Foods and food component to reduce
Refined Grains

- Refining of whole grains:
  - *The loss of vitamins, minerals, and dietary fiber.*
  - *Most refined grains are enriched: with iron, thiamin, riboflavin, niacin, and folic acid*
  - ***This returns some, but not all***
- If consumed in **moderation**, refined grains could provide **some nutritive value**
- **Higher than recommended** amount, **leads to weigh management issues**

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Foods and food component to reduce
Refined Grains

- On average, Americans consume 6.3 ounce-equivalents of refined grains per day
- The recommended amount of refined grains is no more than **3 ounce-equivalents** per day
- **Ounce-equivalents**
  - *1 slice of bread*
  - *1 cup of ready-to-eat cereal*
  - *½ cup of cooked rice, cooked pasta, or cooked cereal Further recommendation:*
- At least 50% of grains to be from whole grain sources
- **Whole Grains** (the bran, germ, and endosperm):

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

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Foods and food component to reduce
Refined Grains

- Major sources of refined grains in the diets of Americans:
  - *Yeast breads (26% of total refined grain intake);*
  - *Pizza (11%);*
  - *Grain-based desserts (10%)*
  - *Tortillas, burritos, and tacos (8%)*
- Refined grain products also are **typically high in solid fats** and added sugars:
  - *cakes*
  - *cookies*
  - *donuts*
  - *Other desserts*

Recommended be reduced…

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Foods and food component to reduce Alcohol

- **Based on NHANES data in the United States:**
  - *Approximately **50 percent**: regular drinkers*
  - ***14 percent**: infrequent drinkers.*
  - ***9 percent of men** consume more than two drinks per day*
  - ***4 percent of women** consume more than one drink per day.*

- **DGA drinking categories:**
  - *(1) Moderate alcohol consumption*
    - *1 drink per day for women*
    - *2 drinks per day for men.*
  - *(2) Heavy or high-risk drinking*
    - *>3 drinks on any day or >7 per week for women*
    - *>4 drinks on any day >14 per week for men*
  - *(3) Binge drinking*
    - *Consumption within 2 hours of 4 or more drinks for women and 5 or more drinks for men*

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Foods and food component to reduce Summary

- **Moderate alcohol consumption** is associated with:
  - Lower risk of cardiovascular disease.
  - All-cause mortality among middle-aged and older adults
  - Improved cognitive function for elderly

- **Excessive (i.e., heavy, high-risk, or binge)** is associated with:
  - No health benefits
  - Liver complications
  - Hypertension
  - Stroke
  - Type 2 diabetes
  - Cancer of the upper gastrointestinal tract and colon
  - Weight gain
  - Cognitive impairment

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Exercise 3

- **What are the food and food components that are recommended to be reduced in diet according to USDA DGA?**
- **What is the average dietary sodium intake of American adults? What are the two levels of recommendations for maintaining health?**
- **According to DGA, what age group consumes highest amount of sodium? What gender typically consume higher sodium across all age groups?**
- **What is NHANES?**
- **What are the four general recommendation for reducing dietary sodium intake?**
- **What is the difference between sodium content and salt content of a food? How much sodium exist (in mg) in a food containing 2 grams of salt?**
- **What animal-based food category typically contain high level of unsaturated (mono and polyunsaturated) fatty acids? What are the plant-based foods that are very high in saturated fatty acids?**
- **According to DGA, what are top three common food sources highest in:**
- **Saturated Fatty acids:**
- **Monounsaturated fatty acids:**
- **Polyunsaturated fatty acids:**
- **According to NHANES, what proportion of calories in American diet comes from saturated fats and what are the main contributors to dietary saturated fats? What is the recommended amount saturated fat in diet?**
- **What is the main source of synthetic *trans* fatty acids in diet and what is the current recommendation for consumption of synthetic *trans* fatty acids?**
- **What are the main sources of naturally-occurring *trans* fatty acids in diet?**
- **What is the current recommendation for daily dietary cholesterol? What is the men and women average intake of dietary cholesterol in the United States?**
- **What are the main sources and food categories associated with added sugar in diet of American Adults?**

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Next Session…

- **DGA Key Recommendation**

- *(1) Balancing calories to manage weight*
- *(2) Foods and food component to reduce*
- *(3) Food and nutrients to increase*
- *(4) Building health eating patterns*

- **Three recommendations for specific group populations**
- *(1) Women capable of becoming pregnant*
- *(2) women who are pregnant and breastfeeding*
- *(3) Individuals age 50 years and older*

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Term Paper Example

Papers will be analyzed for similarity index

Option 1: Brief Term Paper

10 pages double Space

Food For Thought: The Complexity of Obesity with the Black Community

Option 2: An Outreach Article

10-20 pages double Space

To be converted to 3-page outreach article

Option 3: Review Paper

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Suggested topics…
For those who are "shopping" for topics

- Recent Advancements in control of ***Listeria monocytogenes*** in processed and ready-to-eat meat products
- Advances in preventing O157 and non-O157 **Shiga toxin producing *Escherichia coli*** using natural antimicrobials and emerging technologies
- Recent advances in **non-thermal pasteurization** of fluid milk
- Fortifying lives from the early days: **folic acid**
- Vegetarian diet and **vitamin B12**
- Reducing the **sodium** content of processed food
- **Hemp seed**: nutritional composition and health benefits

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Additional Resources

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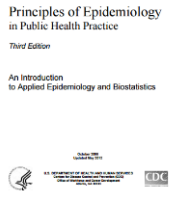
Additional Resources:

Centers for Disease Control and Prevention:
https://www.cdc.gov/ophss/csels/dsepd/ss1978/ss1978.pdf
Center for Food Security and Public Health, Iowa, Zoonotic Diseases:
http://www.cfsph.iastate.edu/Zoonoses/
Food and Agriculture Organization of the United Nation:
http://www.fao.org/emergencies/emergency-types/transboundary-animal-diseases/en/



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Thank you

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