The Biology of Aging
Week 4

DIGESTIVE HEALTH
& NUTRITION

PRESENTED BY:
DR. SARAH VADEBONCOEUR
NATUROPATHIC DOCTOR
Week 4

Overview of digestive system

Nutrition Changes with Aging

Nutrient Deficiencies & Aging

Nutritional Supplements
Digestive System

- Starts at the mouth
- Ends at the anus
- Consists of:
  - Series of muscles that coordinate the movement of food
  - Other cells that produce enzymes and hormones to aid in the breakdown of food

- What is Digestion?
  - The process of turning food into nutrients
  - Also involves creating waste to be eliminated
STOP 1: Mouth

- Digestion begins in your mouth
- Begins before you even take your first bite
- The smell of food triggers the salivary glands in your mouth to secrete saliva -> mouth waters
- When you actually taste the food -> saliva increases
- Salivary enzymes
  - Salivary amylase: starts to break down carbohydrates
Stop 2: The Pharynx & Esophagus

- Mouth -> throat (pharynx)
- Branching off the pharynx is the esophagus, which carries food to the stomach
- Food is pushed through the esophagus and into the stomach by means of a series of contractions called peristalsis.
- Lower esophageal sphincter (LES)
  - Just before the opening to the stomach
  - Opens to let food pass into the stomach and closes to keep it there
  - If your LES doesn't work properly -> GERD, reflux, heartburn and regurgitation
Stop 3: The Stomach

- Stomach is a sac-like organ with strong muscular walls
- Holding, mixer and grinder of food
- Stomach secretes hydrochloric acid and powerful enzymes
  - Hydrochloric acid helps to digest food chemically and protects the body by killing bacteria present in our food
  - Enzymes help to breakdown proteins, carbs, and fats into smaller components
- Continue the process of breaking the food down and changing it to a consistency of liquid or paste
- Stomach digests proteins
Stop 4: Small Intestine

- 10 feet long
- Surface is coiled like a hose and the inside surface is full of many ridges and folds
- Digestion of starches, protein, and carbohydrates continues
- Folds are used to maximize the digestion of food and absorption of nutrients
- 90% of nutrients are absorbed in the small intestine
  - What's leftover (the waste) moves into the large intestine
Accessory Digestive Organs

Pancreas

- Main factory for digestive enzymes
- Enzymes secreted into the duodenum, the first segment of the small intestine
- Enzymes break down protein, fats, and carbs
Accessory Digestive Organs

Liver

- Main digestive function is to make and secrete bile
- Bile is important for fat digestion and emulsification
- Process the blood coming from the small intestine containing the nutrients just absorbed
- The liver purifies this blood of many impurities before traveling to the rest of the body
Accessory Digestive Organs

Gallbladder

- Storage sac for excess bile
- Bile made in the liver travels to the small intestine via the bile ducts
- If the intestine doesn't need it, the bile travels into the gallbladder, where it awaits the signal from the intestines that food is present.
- Bile serves two main purposes
  - Helps absorb fats in the diet
  - Carries waste from the liver to the stool
Stop 5: The Colon, Rectum, and Anus

- The colon (large intestine) is a five- to seven-foot-long muscular tube that connects the small intestine to the rectum.
- As stool passes through the colon, any remaining water is absorbed.
- Stool is stored in the sigmoid colon until a "mass movement" empties it into the rectum, usually once or twice a day.
- It normally takes about 36 hours for stool to get through the colon.
  - Stool is mostly food debris and bacteria.
Microbiota

- Microbiota = community of cells in human body
- Human body is host to 100 trillion bacterial cells
  - We also carry a large number of other organisms such as archaea, viruses, parasites, or fungi
- Microbiota weighs 2-3 lbs
- Bacterial cells outnumber human cells 10 to 1
- Bacteria account for 99% of genetic material in the body
Microbiota

• Bacteria perform several useful functions
  o Synthesizing various vitamins
  o Processing waste products and food particles
  o Protecting against harmful bacteria
  o Hormone Balance
  o Affect weight management
  o Balance the immune system
Microbiota

• Changes to microbiota in recent decades due to:
  ○ Antibiotic Use
    ▪ 75% of antibiotics are used in livestock
  ○ Increases C-section rates
  ○ Breastfeeding
    ▪ 26% of women breastfeed exclusively until 6 months
  ○ Increased use of anti-bacterial products
  ○ Dietary habits
    ▪ Vegetarians have higher levels of certain bacteria compared to meat eaters
Impacts of Changes in Microbiota

- Babies born by caesarean section (compared to babies delivered vaginally)
  - 26 percent more likely to be overweight
  - 22 percent more likely to be obese as adults
- Obese mice have gut bacteria that are better able to extract calories from food
- Increased rates of allergies/food sensitivities
- Increased auto-immune disease
Diseases linked to microbiome imbalance

- Gastrointestinal ailments:
  - Crohn’s disease
  - Ulcerative colitis
  - Celiac disease
- Cardiovascular disease
- Non-alcoholic fatty liver disease
- Digestive disorders
  - chronic reflux
- Autoimmune diseases: MS & rheumatoid arthritis
- Asthma & allergies
- Mood/behaviour disorders: depression, anxiety, autism
Why is the gut so important?

- **Responsible for immune system**
  - Our intestines contain more immune cells than the entire rest of our body
  - Immune system's capacity to fend off attackers relies on its ability to distinguish self cells from foreign cells

- **Production of neurotransmitters**
  - 100 million neurons embedded in the gut wall
  - Gut bacteria manufacture about 95 percent of the body's supply of serotonin
Immune System

- **2 branches:**
  - Innate
  - Adaptive

**Innate**
- Barriers: skin, mucous membranes, cough reflex
- Immune cells
- Inflammation
- Decrease communication between immune cells with aging = reduced defenses against bacteria, and viruses
- With aging, chronic low grade inflammation and reduced ability to mount strong inflammatory response needed for healing
Immune System

Adaptive

- Thymus, spleen, lymphatic system, bone marrow, tonsils, and circulatory system
- T cells attack infected or damaged cells
- Once they’ve attacked a particular pathogen, they develop memory
- Able to respond more quickly in subsequent infections -> immunity
- Reduced production of new T cells with age so reduced ability to deal with new infections
Immune System

• **Immune Balance** is key
  - Weakened immune function = increased susceptibility to infection (e.g. pneumonia)
  - Overactive immune function = auto-immune reactions which can contribute to Alzheimer’s, RA, diabetes, heart disease

• Additional factors that can affect immune system decline:
  - Radiation exposure
  - Chemical exposures
  - Certain diseases
Digestive Changes Associated with Aging
Nutrition Changes with Aging

- Increased constipation
  - Muscle movement (peristalsis) slows down with age
  - Stool spends more time in colon -> increased water absorption
    -> constipation
  - Other Causes:
    - Medication: calcium channel blockers (high blood pressure), narcotics (pain medication)
    - Physical Inactivity
    - Dehydration (diuretics, lack of fluid intake)
Nutrition Changes with Aging

- **Diverticulosis**
  - Small pouches in the lining of the colon bulge out along weak spots in the intestinal wall
  - Can be asymptomatic
  - Symptoms: gas, bloating, cramps, and constipation

- **Diverticulitis**
  - Inflammation of diverticula
  - Can cause abdominal pain, cramping, fever, chills, nausea, and vomiting.
Nutrition Changes with Aging

- **Ulcers**
  - Not due to the normal aging process
  - Increased risk due to chronic NSAID (anti-inflammatories, pain med) use
  - Red flags: black stool, blood in stool, low ferritin (iron)

- **Decreased lactase production**
  - Increased lactose intolerance

- **Bacterial Overgrowth**
  - Decreased absorption of certain nutrients, such as vitamin B12, iron, and calcium.
Nutrient Deficiencies

- Caloric requirements decrease with age

- Nutrient requirements do NOT decrease
  - Important to eat a nutrient dense diet
  - “Toast and tea”

- In fact, some nutrient requirements increase
  - Calcium
  - Vitamin D
Nutrient Deficiencies

Calcium

- Intestinal absorption of calcium declines with age
- Lack of calcium intake -> calcium drawn from bones
- Increased risk of fracture, bone loss, osteoporosis

- **Foods rich in calcium:** dairy products, almonds, turnip greens, spinach, kale, Yogurt, tofu, sesame seeds, collard greens, sardines

- Will discuss calcium in more detail next week!
Nutrient Deficiencies

Vitamin D

- Reduced capacity to endogenously synthesize vitamin D in the skin
- Roles of vitamin D:
  - Optimal calcium absorption
  - Normal bone growth
  - Maintenance of bone density
  - Maintaining muscle strength
- Very little vitamin D in food
  - Require sun exposure or supplement
  - Reduce vitamin D conversion in kidneys with aging
Nutrient Deficiencies

Vitamin D

- Adequate blood levels of vitamin may help to protect against cancer and neurological diseases
- Supplemental intake of 2,000 IU- 5000 IU of vitamin D may help protect older adults from breast, ovarian, and colon cancers.

- **Food sources of vitamin D:** Wild salmon, sardines, eggs, milk (cow’s/goat), shiitake mushrooms
Nutrient Deficiencies

**Magnesium**
- Most adults do not meet the daily required intake
- Elderly adults at risk for magnesium deficiency
  - Low dietary intakes
  - Reduced intestinal absorption
  - Increased urinary losses of the mineral
- Cofactor for more than 300 metabolic reactions
- Necessary for normal muscle and nerve function
- Bone health
Symptoms of magnesium deficiency:
- Muscle cramping, twitches
- Insomnia
- Constipation
- Anxiety
- Headaches

Food sources of magnesium: pumpkin seeds, spinach, Swiss chard, soybeans, sesame seeds, halibut, black beans, sunflower seeds, cashews, almonds
Nutrient Deficiencies

**Vitamin B₁₂**
- Prevalence of vitamin $B_{12}$ inadequacy increases with age
  - Atrophic gastritis: a chronic inflammation of the lining of the stomach
  - Results in stomach atrophy and decreased stomach acid production
  - Impairs the release of vitamin $B_{12}$ from proteins in food
- Anemia and neurological symptoms can result

- **Foods rich in vitamin B₁₂:** meat, eggs, sardines, salmon, venison, shrimp, halibut, scallops, nutritional yeast
Protein Requirements

Protein

- Protein requirements increase with age
- Adult recommendation = 0.8 gram protein/ kg body weight
- Older adults (65+) = up to 1.6 grams/kg
  - E.g.: 70 kg = up to 112 grams of protein per day

- Protein content of foods:
  - Eggs = 6 grams/egg
  - Chicken breast = ~20 grams
  - Fish (3oz) = ~22 grams
  - Beef (3oz) = 31 grams
BREAK
Healthy Habits

• Eat 3 meals daily and snacks in between, as needed.
• Never go more than 3-4 hours without eating in order to maintain healthy blood sugar levels.
• Have some protein or healthy fat with every meal and snack
• Aim to fill your diet with real food such as whole grains, lean protein, and fresh fruits and vegetables.
Healthy Habits

- Aim to eat healthy foods 80% of the time, allowing room for indulgence (20%)

- Avoid counting calories.
  - Calorie requirements vary depending on activity level, etc.

- Be mindful.
  - Learn to listen to hunger and satiety signals
  - Use those to determine how much food you need
Eating a Healthy Diet

- Macronutrients (determine the *number* of calories)
  - Protein
  - Carbohydrates
  - Fat

- Micronutrients (determine the *quality* of calories)
  - Vitamins
  - Minerals
  - Amino Acids
  - Anti-oxidants
Protein

- Important for satiety
- Help build lean muscle tissue
- Helps to stabilize blood sugar levels
- Aim to eat some protein at every meal and snack
What are good sources of protein?

- Meats: chicken, turkey, beef, pork etc
- Wild game (e.g. Bison)
- Eggs (eat the yolk!)
- Dairy products
  - Avoid fat-free products
- Fish and seafood
  - Choose wild Pacific salmon (Coho, Chinook, sockeye) over Atlantic salmon
  - Tuna: light canned tuna = low in mercury
    - Limit to 2 cans per week
- Beans, legumes, hummus
- Protein powders
Fats

- Don’t eat a low-fat diet!
  - Needed for satiety
  - Important for weight loss
  - Contribute to health (hormone balance, skin health..)

- 3 Types of fat
  - Unsaturated (mono- and poly-unsaturated)
  - Saturated
  - Trans fat
Cooking with Oils

- **Good cooking oils**
  - Coconut oil
  - Butter
  - Sesame oil

- **Eat raw (do not heat)**
  - Olive oil
  - Flaxseed oil
  - Walnut oil
Sources of Carbohydrates

- Fruit
- Vegetables
- Bread
- Cereal
- Crackers
- Pasta/rice
- Desserts (pie, cookies, cakes)
- Donuts & muffins
- Granola bars

- All carbohydrates are digested into sugar
  - Glycemic Index
Carbohydrates

- Good source of energy
- Good source of fiber
- Carbohydrates are essentially sugar
- Body’s first line of fuel
- Excess carbs are stored as body fat

3 Components

- Starch = large sugar molecules
- Fiber (indigestible portion)
- Sugar
1. **Starch**

- Large, dense sugar molecules
- Eventually digested into sugar
- Foods high in starch: grains, white potatoes, corn
- Should be limited in the diet (2-4 servings per day)
Carbohydrates

2. Fiber

- Non-digestible
- Non-absorbable
- Speeds up transit time (i.e. bowel movement frequency)
- Binds to toxins & eliminates them
- Balances blood sugars
- Reduces hunger & cravings
- High fiber diets can help prevent: obesity, heart disease, type 2 diabetes, and colon cancer
Carbohydrates

2 types of fiber

- **Soluble fiber**
  - Absorbs water -> forms a gel in intestines
  - Binds to and eliminates excess cholesterol
  - Foods high in soluble fiber: fruits, vegetables, oats

- **Insoluble fiber**
  - Swells, adding bulk to the stool
  - Reduces hunger (because takes up space & slow to digest)
  - Prevents constipation
  - Naturally detoxifies the body
  - Foods high in insoluble fiber: whole grains, legumes
Carbohydrates

3. Simple Sugars
  - Smallest sugar molecules
  - Rapid-release source of energy (because need little digestion)
  - Taste great- sweetest of all the carbohydrates
  - End in “ose”
    - Sucrose, glucose, lactose, fructose
  - Foods rich in simple sugars
    - Fruit, honey, maple syrup, sugar cane
Carbohydrates

- **Fructose**
  - Most dangerous of all simple sugars
  - Most quickly and readily converted to fat
  - Fructose does not stimulate insulin release so blood sugar levels can stay elevated much longer
  - All sugars contain some fructose

  - **Sugars that contain high levels of fructose:**
    - Glucose-fructose
    - Corn syrup
    - High-fructose corn syrup
    - HFCS
    - Agave nectar
    - Sorbitol (sugar alcohol)
Carbohydrates

• **Added Sugars** (does not include fruit)
  ○ Limit daily intake to 25 grams per day (~6 tsp)
  ○ Sources of added sugars:
    ▪ Cereals
    ▪ Granola bars
    ▪ Bread
    ▪ Cookies, muffins, pastries
    ▪ Fruit juice
    ▪ Specialty coffee
    ▪ Energy/sports drinks
    ▪ Alcohol

• Start reading nutrition labels!
Vitamins & Minerals

Best ways to get adequate vitamins & minerals

- Eat a wide variety of fresh, whole foods
- Eat a “rainbow” every day: 5 different colour of fruit and vegetables
  - Greens
  - Blue
  - Purple
  - White
  - Orange
  - Yellow
  - Red
Hydration

• #1 Beverage = WATER!
  ○ Water should be your beverage of choice
  ○ Your weight (lbs) / 2 = # of ounces of water needed daily
  ○ Add one cup of water for each caffeinated or alcoholic beverage you consume

• Benefits of staying hydrated:
  ○ Glowing skin
  ○ Reduces hunger and cravings
  ○ Reduces headaches
  ○ Increases energy levels
Beverages

- **Caffeine:**
  - Limit to 2 cups daily
  - Add milk/cream, stevia (if sugar needed)
  - Avoid sugar, artificial sweeteners
  - Green tea: antioxidant, may help with weight loss

- **Avoid drinking juice, pop, sugary drinks**
  - High in sugar and calories
  - Eat fruit, don’t drink it!
Hydration

- Not sure you’re getting enough water...
  - Look at your urine!
  - Urine should be clear to pale yellow
  - Dark yellow = dehydration OR B vitamins/multivitamins
# A Healthy Meal

- Every meal should contain:

<table>
<thead>
<tr>
<th>Group</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>1 palm</td>
<td>2 palms</td>
</tr>
<tr>
<td>Veggies/Fruit</td>
<td>1 fist</td>
<td>1 fist</td>
</tr>
<tr>
<td>Carbs</td>
<td>1 cupped hand</td>
<td>2 cupped hands</td>
</tr>
<tr>
<td>Fat</td>
<td>1 thumb</td>
<td>2 thumbs</td>
</tr>
</tbody>
</table>
A Healthy Meal

- Another way to visualize:

- Protein
- Veggies
- CARBS
How Much Should I Eat?

- Depends on variety of factors:
  - Metabolism
  - Physical activity

- Calorie counting not generally necessary

- Practice mindfulness
  - Reconnect brain and stomach!
Caloric Restriction

- Reducing healthy diet by 30% with balanced carbs/protein and fat
- Excess calories = stress on body
- May increase lifespan
- Lab mice lived up to 40% longer
- When started as young adult:
  - Can increase health span
  - Delay age-associated decline and illness
  - Promising research in primates
Calorie Restriction

- Comprehensive Assessment of Long-term Effects of Reducing Intake of Energy (CALERIE)
  - 1 Year of Reduced Caloric intake reduced:
    - Fasting blood sugar
    - Total cholesterol
    - Core body temperature
    - Body weight
    - Body fat
  - Better functioning mitochondria
  - Reduce DNA damage
Calorie Restriction

- NIA study:
  - Increase BDNF (brain-derived neurotrophic factor)
    - Protects the brain for dysfunction and degeneration
    - Improves blood sugar regulation
    - Increased heart function

- May influence:
  - Hormone balance
  - Cell senescence
  - Gene expression
Sarah’s Healthy Eating Guidelines

- Eat the **healthiest** diet that you can maintain FOREVER & ENJOY

- Start **tracking** everything that you EAT & DRINK

- Start by creating **healthy habits** and a GOOD daily ROUTINE

- Choose 1-2 **strategic** new **habit** to focus on each week
Nutritional Supplements

- Always best to get nutrients from food versus supplements
  - Naturally occurring form so easier to absorb
  - Work in synergy
  - Nutrients are “alive” versus synthetic

- Do we need them?
  - Important to look at nutrient density of diet
  - Known nutrient deficiencies?
  - Use of medications that deplete nutrients
    - E.g. Statins lower CoQ10, heartburn meds increase B12 deficiency
  - Soil depletion
Nutritional Supplements

- **What to look for?**
  - Good quality ingredients
  - Adequate dosage
  - Absorbable form of nutrients
    - E.g. Vitamin B12
  - Lack of additives and preservatives
Nutritional Supplements

• Are they safe?
  o Can cause interactions with medications
  o Some nutrients in synthetic form may cause more harm than good
    ▪ E.g. Vitamin A, Vitamin E
  o Important to take the right dose
    ▪ E.g. women taking excessive calcium supplements

• Bottom Line?
  o Consults with someone knowledgeable about supplements
Next Week

Arthritis

Osteoporosis & Bone Health

Conclusion
References

- [http://lpi.oregonstate.edu/fwo8/olderadults.html](http://lpi.oregonstate.edu/fwo8/olderadults.html)
- [http://well.blogs.nytimes.com/2014/07/14/we-are-our-bacteria/?_r=0](http://well.blogs.nytimes.com/2014/07/14/we-are-our-bacteria/?_r=0)