HSS2342 - Nutritional Determinants of Health

Lecture 1

What is nutrition?
- the science of food
- how food nourishes our bodies
  - how we consume, digest, metabolize, store nutrients
  - how nutrients affect our bodies
  - eating patterns, amount of food we eat
    - food safety
    - food supply
- how food influences our health

Why is nutrition important to our health
- one of several factors contributing to our health
- nutritious diet can:
  - prevent diseases or reduce risk for chronic diseases
    - obesity, diabetes, heart disease
- **Over-nutrition**
  - a diet that has an imbalance of fats, carbohydrates, proteins or too much energy
- Obesity rates have increased significantly since the 1960's for adults AND children
- **Under-nutrition**
  - a diet that lacks energy or specified essential nutrients
- **Malnutrition**
  - under or over nutrition
- Nutrient deficiencies or toxicities can lead to disease
  - **Scurvy** (vitamin C deficiency); cured on boats
  - **Pellagra** - (niacin, B vitamin or tryptaphan deficiency); - delusion/scaly skin
  - **Goiter** - iodine deficiency (supplemented by table salt)
  - **Rickets** (vitamin D deficiency); weak/soft bones

Types of Health
- many factors contribute to an individuals health
  - **Physical Health:** nutrition and physical activity
  - **Spiritual Health:** spiritual values and beliefs
  - **Emotional Health:** includes positive feelings about oneself and life
  - **Social Health:** includes family community and environment
  - **Occupational Health**: meaningful work and vocation
- nutrition fits in to physical health but also social, emotional, spiritual, and occupational health

Factors Contributing to Nutritional Status

- many different factors contribute to nutritional status
  - **Individual factors**
    - education & income
  - **Family level factors**
    - **breast-feeding & family meal environment**
  - **Community/School Level Factors**
    - food availability & school environment
  - **Societal Factors**
    - taxation policies, marketing policies, subsidies

Six Essential Nutrients

Carbohydrates		
Lipids	provide energy	
Proteins	macronutrients	
Vitamins		critical to growth
Minerals	micronutrients	and function
Water		

Calorie

- we derive energy from carbs, lipids, protein
- calorie = kilocalorie
- amount of heat req. to increase the temp of 1kg of water by 1 C
- measurement to quantify the amount of energy to be supplied to the body

Carbohydrates

- primary fuel source
- composed of carbon, hydrogen and oxygen
- provide **4 calories per gram**
- **sources:** fruits, vegetables, grains, pretty much anything

Protein

- composed of carbon, hydrogen, oxygen and **nitrogen**
- can provide energy but is not a primary source, **4 calories per gram**
- supports tissue growth, structural repair and maintenance, and fluid balance
- **sources:** meat, dairy, nuts, grains, legumes, seeds

Lipids

- provide energy and other essential nutrients including
  - fat-soluble vitamins
  - essential fatty acids
- Composed of carbon, hydrogen and oxygen
- Contain less oxygen and water than carbohydrates
  - higher energy yield per gram, **9 calories per gram**
- an important energy source for our bodies at rest/during low-intensity exercise.
- **Solid fats:** butter, lard, margarine
- **Liquid fats:** vegetable oils

Calculating the Energy Contributions

- simple calculation
- multiply the amount in grams of macromolecule by the amount of calories each gram provides
- divide this by the total amount of calories
- ex.

Fat: $\frac{2.5\text{g} \times 9\text{calories per gram of fat}}{160 \text{ total calories}}$

Vitamins

- Micronutrients
- Organic compounds needed in small quantities that we consume in our diets
- Assist in the regulation of biological processes
  - building bones and muscles
  - immune
  - blood
  - healthy vision
- Two types:
  - Fat-soluble vitamins
  - Water-soluble vitamins

Fat Soluble Vitamins

- Vitamins A, D, E and K
- stored in the body
- recommended intakes are NOT required on a daily or weekly basis
- in fat containing food (meats, dairy, oils, avocados, nuts, seeds)
- large amounts can result in toxic levels and can damage nervous system, hair skin and bones
- low fat diets can lead to deficiencies (uncommon)

Water Soluble Vitamins

- should be consumed daily or weekly
- Vitamin C and B
- found in whole grains, fruits, vegetables, meat, and dairy
- deficiencies can result fairly quickly quickly if required amounts are not consumed regularly
- cannot store large quantities

Minerals

- Micronutrients
- Inorganic compounds
- Help regulate many body functions
  - regulate fluids
  - produce energy
  - important for bone and blood health
  - get rid of metabolic by-products
- i.e. sodium, potassium, calcium, magnesium
- maintain their structure regardless of environment, not broken down by digestion. Food sources: meats, dairy, fruits, vegetables, nuts
- Two types of minerals

Major Minerals
- require more than 100 mg/day
- Fluid balance : sodium, potassium, chloride
- formation/maintenance of the skeleton: calcium, phosphorus, magnesium

Trace Minerals
- required in amounts less than 100 mg/day
- i.e. iron, zinc, copper, manganese, fluoride, chromium, selenium, iodine

Water
- an inorganic nutrient
- supports all body functions.
  - proper fluid balance in and out of cells
  - regulation of nerve impulses, nutrient transport, muscle contractions, exercise of waste
- Sources of water: fluids, solid foods (fruits and vegetables)

Goals of Nutritious Diet
- Avoid deficiencies (uncommon in developed countries)
- **Prevent chronic disease**

Dietary Reference Intakes
- reference standards for nutrient intakes for healthy individuals
- Used in Canada and U.S. for dietary planning
- DRIs for most nutrients consist of four values:
  1. **Estimated Average Requirement (EAR)**
  2. **Recommended Dietary Allowance (RDA)**
  3. **Adequate Intake (AI)**
  4. **Tolerable Upper Intake Level (UL)**

Estimated Average Requirement (EAR)
- average daily nutrient intake level estimated
- to meet the requirements of half of the healthy individuals in a life stage/sex group

Recommended Dietary Allowance (RDA)
- average daily nutrient intake level that meets the nutrient requirements of 97-98% of healthy individuals in a life stage/sex group
  - ie RDA for phosphorus for women and men is 19-30yrs = 700mg/day
- The EAR is used to determine the RDA

Adequate Intake (AI)
- recommended average daily nutrient intake level based on observed or experimentally determined estimates of nutrient intake by a group of healthy individuals
- Used when an RDA cannot be determined because there is less evidence
  - i.e. calcium, vitamin D, vitamin K, fluoride

Tolerable Upper Intake Level (UL)

- the highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in a particular life stage/ sex group
- Intake above the UL = increase in potential for toxicity
- ex. Vit. C; UL = 2000mg

DRI's for Energy and Macromolecules

1. **Estimated Energy Requirements (EER)**
   - Average dietary energy intake predicted to maintain energy balance in healthy reference adults
   - According to age, sex, weight, height, level of physical activity

2. **Acceptable Macronutrient Distribution Range (AMDR)**
   - Ranges of intakes for sources of energy that are related to reduced risk of chronic disease and adequate essential nutrients
     - Has a lower and upper boundary
     - **Carbohydrate — 45% - 65%**
     - **Fat — 20% - 35%**
     - **Protein — 10% - 35%**

Lecture 2

Determinants of Nutrition

- four factors surrounding food intake
  - individual factors
  - soceital factors
  - family level factors/peers
  - community/school level factors
- someones food intake may not be fully controlled by the individual, their circumstance (culture, family, geography, societal resources, work schedule, education, etc.) may dictate what kind of foods are accessible to them.

Individual Factors

- Most of the research have focused on individual factors
  - **Personal preference** - may be a genetic component - some people grow up hating broccoli because of their parents hating broccoli
  - **Habit** - you form food habits at a young age; when you're used to eating something you'll continue, foods you are comfortable with
  - **Food preparation skills** - convenience foods vs. being able to cook
  - **Ethnic heritage /culture/ tradition** - for example if you grow up in the southern united states you would be surrounded by fast foods
  - **Positive/negative associations** - you tend to lean towards foods you have positive associations with, ex. if tequila makes you yack you'll quit
  - **Emotional comfort** - people eat certain foods because it makes them feel better
  - **Body image -** people will eat certain food because they'll feel it makes them look better
  - **Convenience -** foods that take less time to prepare attack the busy worker
  - **Health benefit -** some people eat foods that are known to contribute to health
  - **Education -** wether or not you know HOW to eat healthy
  - **Income -** wether or not you have access to healthy foods or unhealthy ones
  - **Certain behaviours (i.e. TV watching) -** what you are exposed to

Education: What Do Most Know About Nurtition?

- Very little information on the nutritional knowledge of Canadians
- International Food Information Council Foundation (2006)
  - Survey of 1000 representative (age, sex, education) U.S. adults 18 yrs +
  - 9 0f 10 are unable to provide a proper estimate of their recommended daily caloric intake
- by cutting calories you will lose weight no matter what types of food you eat: whether it be healthy or bad
- for americans determining factors in order for picking food: taste > price > healthfulness

Relationship Between Diet and Nutrition Model

- **Eades et al. (2005)**
  - n = 5765 20 yrs + in U.S.
  - Completed Diet and Health Knowledge Survey (DHKS) and a food intake survey
  - Nutrition beliefs influence diet quality
- **Kolodinsky et al. (2007)**
  - n = 200 convenience sample of college students on a university meal plan (18-20 yrs)
  - completed an Internet based survey
  - Nutrition knowledge associated with making more healthful selections

Amount of TV Watching

- Evidence that diets of children/teens that watch large amount of TV are less healthy than those who watch less (Coon et al., 2001)
- Evidence that children who watched >5 hrs TV per day as have less healthy diets as teens (Bar-Anderson et al., 2009)
- Turning off the TV during dinner is related to better diet quality for parents, children and teens (Boutelle et al., 2003; Coon et al., 2001; Feldman et al., 2007)
- Kids who watch TV eat less fruits and vegetables, more processes meats/ less chicken & fish
- Heavy TV watchers have a much less healthy diet as teens
- Those that turn TV off during Dinner have a better diet quality

How Does TV Influence Diet

1. **Amount and power of food/beverage marketing**
   1. Advertisements: how nutritional the adverts are
   2. Product placement
      - Visual, auditory, as part of background
      - ex. ET and Reese's Pieces
2. **Food references**
   - 5 x in 30 minute primetime program (Story & Faulkner, 1990)
   - this is because of our culture's high appreciation of food
   - this may trigger your appetite
3. **Number of shows that are food focused**
   - Programs have nothing to do with actual food prep or responsible consumption
4. **Mindless eating**
   - Hypothesis is that internal hunger and satiety cues are disrupted when you're watching TV because you aren't really paying attention to it

Amount of Food/Beverage Marketing on TV

- 4-7 food beverage ads/hour/station in Canada
- Rated third in 11 countries (Kelly et al., 2010)
- $1.75 billion in U.S. spent at ads directed at children on cable TV

Relationship Between Food Intake and Food Marketing in Children

- Commercial food advertising aimed at children directly affects:
  - Food preferences
  - Short term consumption patterns
  - Food purchase requests
  - Associated with obesity
- the industry is marketing heavily to children while claiming they are in their best interest
- marketing has an impact on children's food preferences, food consumption patterns, food purchase requests
- a product wrapped in McDonalds paper will perceived as better tasting by kids, wether it be a hamburger or carrots

Power of Marketing: Repetition

- in a 99.5 hrs of children's favorite programming on English language TV in Ontario and Quebec (Potvin Kent et al., 2011)
  - **Kraft Dinner mentioned 33 Times**
  - **Happy Meal mentioned 32 Times**
  - **Spongebob Fruit Snakcs mentioned 28 times**
- since 2006, food and beverage advertising has increased by 38%
- in children's station, they have decreased food and beverage advertising by 4.5%
- fast food and cereal are the most advertised
- while there have been less kid station advertising, there has been a general increase of kids being exposed to food and beverage adverts (kids watch all stations not just kids ones)
- spokes characters are an effective means to market towards kids

Family Environment

- Parents have a central role in shaping food habits
  - Food availability in the home and quantity of food stored
  - They are models for eating behaviour
  - Transmit attitudes about foods
  - Feeding practices
  - Structure of the meal
- The food consumption patterns you obtain as a child endure throughout your adult life

Food Availability in the Home

- Direct relationship between availability of fruits and vegetables and their consumption (Jago et al., 2007; Kratt et. Al, 2000)
- Vegetables and milk served at dinner is associated with higher consumption of these items (Arcan et al., 2007; Fisher et al., 2004)
- Bulk purchases lead to increased consumption and more frequent consumption of convenience foods (granola bars, cookies, chips) (Chandon & Wansink, 2002)

Food Security

- Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Food Security in Canada

- ability consistently access safe and nutritious food is a challenge for many Canadians
- CCHS 2.2 (2004)- over 35,000 participated in survey (2.2 is significant because that was the year they did a 24h food recall)
  - Household Food Security Survey Model (18 questions)
  - Self-report questionnaire
    - Food Insecurity: Uncertain, insufficient or inadequate food access, food availability and food utilization due to limited financial resources
    - Compromised eating patterns that result

CHS 2.2 (2004) Results

- 9.2% households are food insecure in Canada
- ranged from 8.1% in Saskatchewan to 14.6% in Nova Scotia
- 5.2% of households with children experienced food insecurity
- Prevalence was highest in
  - Low income households
  - Off reserve aboriginal households
  - Lone parent families
  - Families with 3+ children

The Key Role of Parents

- **Model the consumption of healthy foods**
  - parental modelling influences children and teens
  - continues into young adulthood
- **Type of feeding practices**
  - Attempts to control food intake (i.e. by rewarding the intake of healthy foods with dessert, forcing to finish food on plate)
    - Linked to disliking healthy foods
    - Poor self-regulation of energy intake - not knowing when to stop eating, even eat after your full. not listening to what your body is telling you
- **Overeating**
  - Family meals associated with
    - Higher intake of fruit, vegetables, fibre, diary and protein
    - Lower intake of soft drinks, fried foods and saturated fat

The Size of Dinner Plates

- Experiments have been conducted that manipulate the size of plates, individuals eat more food when larger plates are used

Influence of Peers

- Attitudes and norms of your peers can also influence you food intake
- Children, teens and adults consume larger quantities of foods in group situations and less when alone
- OW eat less in presence of normal weight and more when eating with others who are OW
- people in group situations will always eat more rather than eating by themselves, either through pressure or mindless eating
- overweight people eat less around normal weight people

Food Deserts

- **Food Desert**
  - "socially-distressed neighbourhoods with relatively low average household incomes and poor access to healthy food" (Reisig & Hobbiss, 2000)
- **The process:**
  - Supermarkets move to the suburbs- superstores with more than 25000 square feet and lots of parking
  - Smaller supermarkets in the city core close creating a food desert
  - Result: only convenience stores which typically sell fewer healthy foods are left in the core
  - Those in the core without access to a private vehicle have poor access to healthy foods
- many U.S. studies have identified food deserts in older inner city neighbourhoods of low income residents (typically with Hispanic or African-American populations)
- Results in Canada and the U.K. have been mixed
- Researchers have concluded that Edmonton (Smoyer-Tomic et al., 2006) and Montreal (Apparicio et al., 2007) do not have food deserts
- London, ON- have found presence of food deserts (Larsen & Gilliland, 2008)

School Environment

- School cafeterias
- Vending machines
- Fundraisers
- Special days
- Rewards
- Many studies have shown that the availability of unhealthy foods in schools is associated with
  - higher energy intake, soft drink consumption and fat intake
  - Lower fruit /vegetable consumption and milk

Ontario School Food and Beverage Policy (2011)

- **Sell Most (≥ 80%).** Products in this category are the healthiest options and generally have higher levels of essential nutrients and lower amounts of fat, sugar, and/or sodium. They must make up at least 80 per cent of all food choices7 that are available for sale in all venues, through all programs, and at all events. The same requirement applies to beverage choices.8
- **Sell Less (≤ 20%).** Products in this category may have slightly higher amounts of fat, sugar, and/or sodium than food and beverages in the "Sell Most" category. They must make up no more than 20 per cent of all food choices that are available for sale in all venues, through all programs, and at all events. The same requirement applies to beverage choices.
- **Not Permitted for Sale.** Products in this category generally contain few or no essential nutrients and/or contain high amounts of fat, sugar, and/or sodium (e.g., deep-fried and other fried foods, confectionery). Food and beverages in this category may not be sold in schools.

EXEMPTION FOR SPECIAL-EVENT DAYS

- The school principal may designate up to ten days (or fewer, as determined by the school board) during the school year as special-event days on which food and beverages sold in schools would be exempt from the nutrition standards outlined in this memorandum.

Every Type of Food is Scrutinized

Societal Factors

- Government policies/legislation
  - Marketing
  - Taxation policies - ex. taxing healthy foods the same way we taxed cigarettes
  - Nutrient composition of foods
  - Limiting food/beverage sizes
  - Fruit/vegetable subsidies - federal government subsidizing healthier foods to make them more economically available
- Industry Initiatives
  - Portion size of food/beverages
  - Pricing - encouraging us to buy bigger sizes
  - Marketing policies

Policy Context

Canada:

- **Broadcast Code for Advertising to Children and its Code Interpretation Guidelines**
  - Station-specific policies
  - Children's Food and Beverage Advertising Initiative

Quebec:

- **Consumer Protection Act**
  - Bans commercial advertising of products exclusively designed for children or that appeal to children under 13 years
  - Applies when children consist of 15% of audience
  - you couldn't use subliminal messaging towards children
  - you couldn't show children eating a bigger than normal sized portion
  - you couldn't show a child saying their food was better than another kids
  - • Quebec banned products aimed at children

Children's Food and Beverage Advertising Initiative

- Initiated in 2007
- Half of companies have pledged to not advertise to children under 12 years
- Half of companies have pledged to only advertise "healthier for you" foods
- because the big companies decided what advertising meant, they defined it in the narrowest terms so that they could potentially avoid the regulation
- they decided what "healthier for you"

Taxation Policies

- "junk food" taxes are the most common
- **These exist in 47 American states**
  - fast food restaurant (5.6%)
  - soft drink taxes (5.2%)
  - chips, candy, pretzels
- Some evidence that imposing taxes on sugar sweetened beverages has a modest impact on the consumption of children and adolescents
  - Effect likely larger for low SES children and teens
- These taxes are considered too low and therefore wont have an actual impact

Sodium Reduction Legistlation

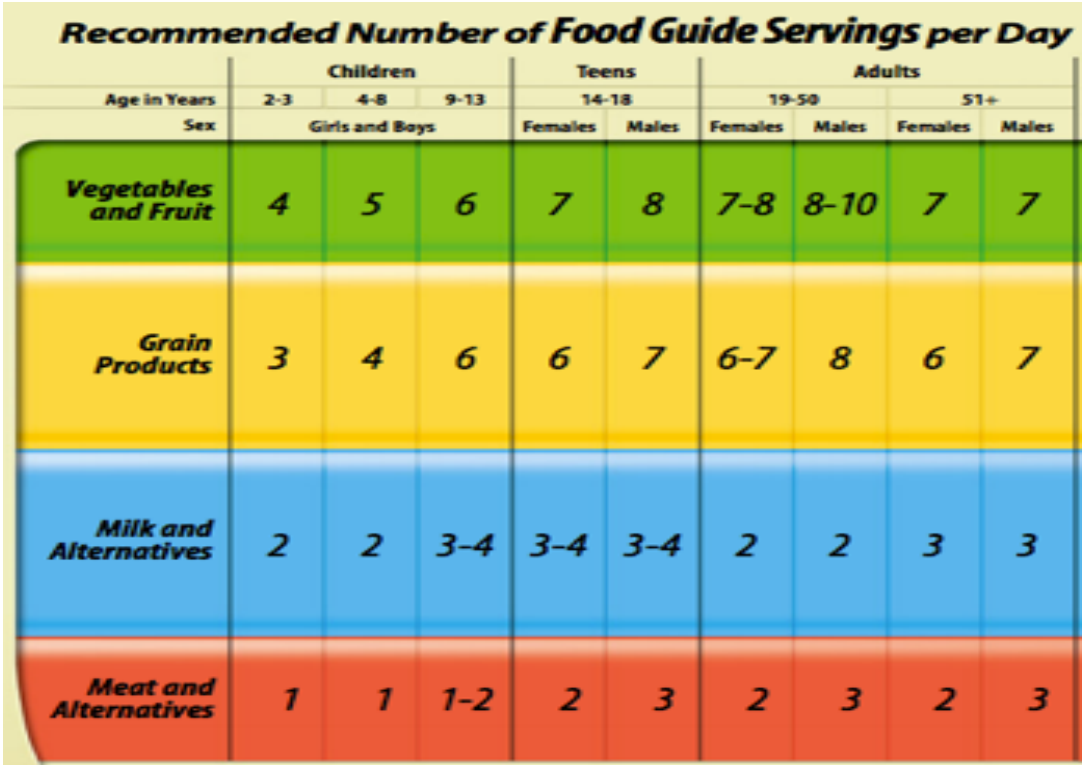
- mean intake of sodium by Canadians is about 3,400 mg per day
- Sodium Working Group 2007-2010
- Proposed Sodium Reduction Strategy in Canada
- Estimated that a decrease in the average sodium intake of about 1,800 mg would lead to 13% fewer CVD events/year
- Group then disbanded
- Bill C-460- First reading in House of Commons was November 5, 2012
- Purpose is to implement the Sodium Reduction Strategy in Canada
  - Requires food manufacturers
    - To lower sodium levels
    - Let consumers know if they have not "This food does not meet Health Canada's sodium reduction targets"

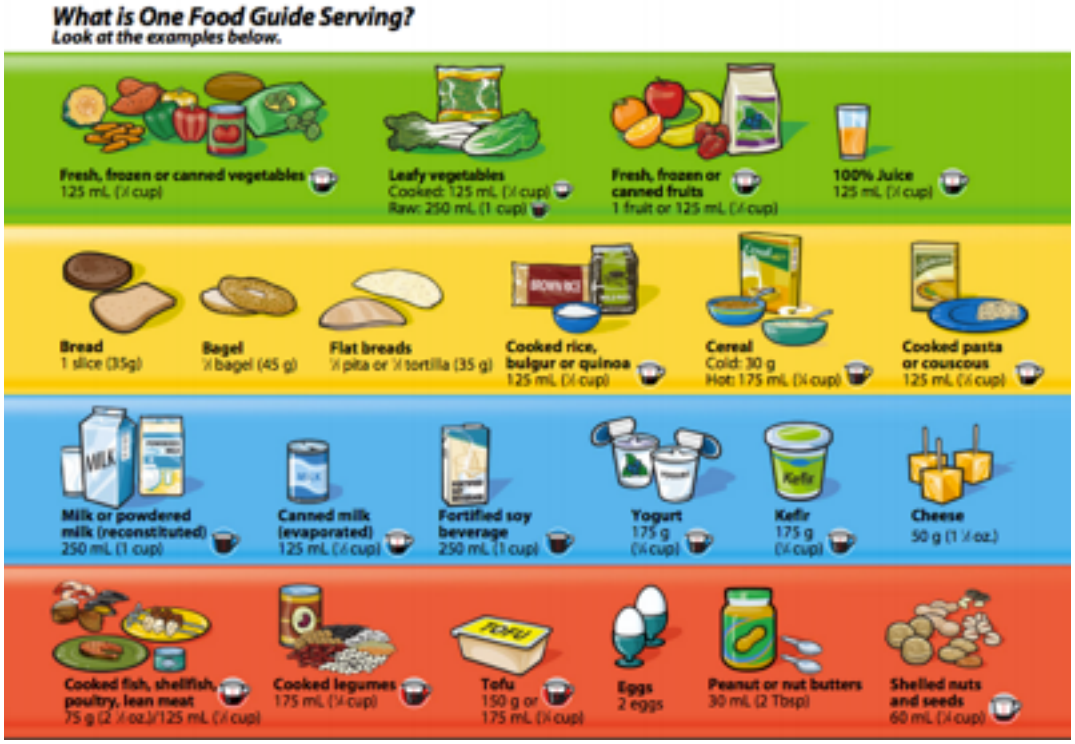
Nutritious Diet

- Adequate
  - energy, nutrients, fibre
- Moderate
  - eating the right amounts of food to maintain a healthy weight
- Balanced
  - contains a combination of foods that provide the proper balance of nutritionist
- Varied
  - includes many different foods
- Choose foods high in nutrient density
  - highest amounts of nutrients for least amount of energy
  - ex. a 450 calorie KD meal vs. 450 calorie salmon and quinoa

Eating Well With Canada's Food Guide (2007)

- First guide published in 1942: Canada's Official Food Rules
- is the major tool for consumers to plan nutritious diets
- consistent with the DRIs
- contains the recommended number of servings for the four food group for children 2yrs. +by sex
- fruit and vegetables, grains, milk and alternatives, meat and alternatives. left to right importance.
- many different languages, even cater to first nation including their traditional foods





Snacking

- a meal: no real definition; ~ food from 3 food groups
- " look for snacks that count towards your recommended number of food guide servings. the best choices are foods from the four food groups"
- avoid snacks that may be high in calories, at, sugar, or sodium. this includes buttered popcorn, cakes, chips, cookies, french fries, ice cream, and sugary drinks such as sport drinks, energy drinks, and soft drinks.
- these foods can add extra calories to your day

Criticism of Canada's Food Guide

- Membership of panel: Food Guide Advisory Committee
  - four of 12 members are from the food industry, whereas the rest have political motivations
- **No guidance on:**
  - calories
  - dangers of overeating
  - numbers of meals/snacks
- **Lacks strong advice regarding:**
  - Use of salt
    - guide says choose products that contain less sodium
  - Eliminating trans fat
    - guide says choose products that contain less fats - they accumulate in arteries
  - Whole grains
    - make at least half of your grain products whole grain each day" - why not all?
  - Processed meats
    - if you eat luncheon meats, sausages, or packaged meats choose those slower in salt/fat
- No call to minimize red meat consumption - probably because of lobbying
- Juice - have vegetable and fruit more often than juice

Harvard Food Plate

- veggies/fruit take up half of the plate
- whole grains and healthy protein take a quarter
- healthy oils have a little section
- LIMIT RED MEAT - not leveraged by meat industry
- drink water, tea or coffee with no sugar
- limit milk and dairy to one to two servings

What's a Healthy Food

- high nutrient density food
- not a high fat foot, not a high sodium food
- Can all foods be part of a healthy diet?
  - yes, in moderation
- grams/4.2 = x tsp of sugar

Purpose of Food Labels

- Basic product information
  - best before date, country of origin, name and contact info of manufacturer
- Health, safety and nutrition information
  - nutrients
  - safe storage and handling
- Marketing (nutrient content claims)
  - "low fat"
  - "cholesterol free"
  - high source of fibre
  - no preservatives added

Components of Food Lables

- nutrition labelling became mandatory for most prepackaged foods in December 2005

1. **Ingredient list**
   - all ingredients in descending order by weight
2. **The Nutrition Facts table**
   - Energy and 13 core nutrients for one serving
   - Required on most packaged foods
   - can provide info for additional nutrients
   - for products under 2yrd
     - energy and 10 nutrients only (saturated, trans fat and cholesterol not required)
3. **Nutrient content claims**
   - claims about the amount of a nutrient in a food
   - based on standardized serving sizes for similar foods
4. **Health Claims**
   - Link a food to a reduced risk of disease

Products Exempt from Carrying Nutritional Information

- Coffee, spices
- Alcoholic drinks
- Fresh meats, fruits, vegetables
- foods that are meant for immediate consumption

Reading The Nutrition Facts Table

- Serving size and servings per container
- Nutrients
- Percent daily values (%DV) information tells you how much a serving of food contributes to your overall intake of a nutrient
  - %DV based on a 2000 Calorie diet
  - foods with <5% DV of nutrients are low in nutrient
  - foods with >20% DV are high in nutrient

Nutrient Content Claims

- claims about the amount of a nutrient in a food
- **"Free"**
  - Amount of nutrient is insignificant
  - i.e. sodium free <5mg sodium/serving
- **"Low"**
  - Amount of nutrient is low
  - i.e low fat <3g fat/serving
- **"Reduced"**
  - 25% less of a nutrient in a serving compared to the original
  - i.e reduced sugar
- **"Source"**
  - Significant amount of the nutrient in one serving
  - i.e > 2g of fibre
- terms such as "low carb" and low glycemic index are not allowed
- term "light" only allowed on products that are either reduced in fat or in calories
  - can also be used to describe taste and colour

Health Claims

- Statements that link a food or food component with reduced disease risk
  - Only seven are allowed
  - " A healthy diet low in saturated and trans fat may reduce the risk of heart disease."
  - "A healthy diet rich in a variety of vegetables and fruit may help reduce the risk of some types of cancers."
  - a healthy diet low in sodium and high in potassium may reduce the risk of high blood pressure, a risk factor for stroke and heart disease

Logo Programs

- President's Choice Blue Menu
  - each product has at least one primary benefit: lower fat, lower calories, less sugar, less sodium, more fibre, omega-3, soy protein, vitamins and minerals, etc.
- Health and Stroke Foundation Criteria
  - Nutrient Criteria
  - Restaurant Nutrient Criteria

Lecture 4 - Source of Nutritional Information

The Government

- Health Canada
  - Health Products and Food Branch
    - **Food Directorate**
      - safety and nutritional value of food
    - **Office of Nutrition Policy and Promotion**
      - source of nutrition and healthy eating policy and promotion
      - conducts reviews of nutrition policies and make recommendations
      - food guides, DRI's, labelling
    - **Natural Health Products Directorate**
      - examines the safety and efficacy of natural products
    - **Canadian Community Health Survey (CCHS, 2004)**
      - joint effort of Health Canada, the public health agency of Canada, Statistics Canada, the Canadian Institute of Health Information
- Public Health Agency of Canada
  - role is to prevent chronic and infectious disease
  - promote health through monitoring and research
- Canadian Food Inspection Agency
  - oversees the safety of the Canadian Food Supply
  - CFIA enforces Canadian Labelling laws
  - Us Sources:
    - the national institutes for Healthy (NIH)
    - centers for disease control and prevention (CDC)

Dieticians

- Registered Dietitian (RD)
  - bachelor's degree in foods and nutrition from a university program accredited by the Dieticians of Canada (DC)
  - completed a dietetic internship
  - title dietitian is legally protected in each province
  - credentials include RD, PDt, RDt or Dt.P.

Nutritionist

The title nutritionist (e.g., public health nutritionist) is protected in some provinces but not in most

some people use the terms registered or certified nutritionist but this does not indicate specific credentials

Various Professional Organizations

- Dietitians of Canada (DC) is the national professional organization for dieticians in Canada
- **Canadian Society for Nutritional Sciences (CSNS)**
  - represents nutritional scientists in academia, government, industry, hospitals, research institutes
- **Canadian Society of Nutrition Management (CSNM)**
  - the professional association for nutrition managers (2yr. accredited program in food and nutrition management).
- **International Society for Behavioural Nutrition and Physical Activity (ISBNPA)**
  - researchers interested in nutrition and physical activity
- American Dietetic Association (ADA); organization fo food and nutrition professionals in the US States
- American Society for Nutrition (ASN); goal to improve the qua pity of life through nutrition science
- Society for Nutrition Education (SNE); nutrition research and education

MD's

- Typically have limited experience/training in nutrition
  - Only 25% of medical schools in U.S. and Canada had a nutrition course in 1992-1993
  - Survey to primary care physicians in AB re: nutritional training (Temple, 1999)
    - 43% = less than 5 hrs
    - 28% = 5-10 hrs
    - 23% = 10-20 hrs
    - 6% = more than 20 hrs
  - 82.3% of family physicians in B.C. reported their formal nutrition training in medical school to be inadequate (Wynn et al., 2010)
- Knowledge is insufficient
  - Nutrition quiz to primary care physicians in AB (Temple, 1999)
    - Average mark was 63%
  - U.S. physicians (Internal Medicine and Cardiology) do not possess sufficient nutritional knowledge to implement dietary and cholesterol management guidelines (Flynn et al., 2003)

Academia

- Typically conduct nutritional research educated and experienced in nutrition and hold advanced degree (master's or PhD) in nutrition

Research Articles - Be Critical

- Is the sample representative?
- How big is the sample?
- What was the study design?
  - Meta analysis = the golden standard
  - Systematic review
  - Randomized controlled trial > ….. Cohort study > …. Cross sectional study
- Is the exposure similar to real world exposure?
- **Who funded the research? Be very wary of industry sponsored research.**
- What about other evidence?
- Do the conclusions fit the data?

Non-Governmental Organizations

- The Heart and Stroke Foundation
- Canadian Cancer Society
- The Centre for Science in the Public Interest
  - nutrition action
- Always ask who is funding these organizations?
  - Who are they partnering with?

The Media

- Be wary of articles that report scientific findings
- Often, only results of a single study are presented
- Study findings can be exaggerated, simplified
- example green coffee been extract

Beverage and Food Corporations

- They have a fiduciary responsibility to their shareholders to make a profit
- Their goal conflicts with the goals of public health
- Their playbook:
  - extensive marketing
  - “all foods can be part of a healthy diet”
  - role of personal responsibility
  - blaming obesity on low levels of physical activity
  - trying to discredit good science
  - being part of the solution
  - nanny state argument

Canadian Community Health Survey 2.2

- 2004
- 24 hour food recall by trained interviewers who used an automated system
- what they ate and where the food was prepared
- 5 step process
  - quick enumeration of foods
  - specific food categories and frequently forgotten foods
  - time and kind of meat
  - precise description and quantities eaten
  - final review
- 35,107 completed the interview
- 10,786 completed a second recall 3-10 days later
- Data from both was used to estimate usual intake

Calorie Intake in Canada

- Highest for adolescents
  - **12-19 yrs**
    - males: 2800 cal/day
    - females: just over 2000 cal/day
  - **Declines with age**
  - **65+**
    - males: 1950 cal/day
    - females: 1550 cal/day
- **1/5 children exceeded their energy needs**
- **3/10 adolescents exceeded their energy needs**
- sources of calories:
  - ages 4-18: Other foods > grain > meat > dairy..
- Comparison with 1971-1972 data
  - avg. Calorie intake has not increased
  - decreased for males (12-64)
  - stable for women and men +65

Fruit and Vegetable Consumption

- 1992 Recommendation: min. of 5 servings/day
- Children and teens: 4.5 servings/day on average
- Percentage that do NOT eat 5 servings/day
  - **4-8 yrs: 70%**
  - **9-13 yrs: 62% for females, 68% for males**
- Adults: 5.2 servings/day
  - Half do not eat 5 servings per day
  - males less likely to eat less than 5 servings per day

Milk and Milk Products Consumption

- Children and young teens
- On Average, consume recommended amounts
  - 4-9 yrs
    - 30% plus not eating 2 servings/day
  - 10-16 yrs
    - 61% boys not eating 3 servings/day
  - Late teens
    - On average, consumption falls below recommended levels
  - Seniors 71 and over
    - 80% males/females not eating 2 servings/day

Meats and Alternatives

- Recommendation in 1992: 100-300 g/day (2-3 serving)
- Average intake is at least 100 g for all sex/age groups
- males 14-70 years: avg. 200g/day
- 25% of males eat more than 300g/day (no females fall into this category)
- Males consume more than females in every age group

Grain Products

- 1992 Recommendation: 5-12 servings/day
- Our principal source of Calories
- 25% plus of children 4-8 yrs do not meet 1992 recommendations
- % not meeting increases with age
- Females more likely to not meet recommendation
  - 14-18yrs
    - 33% females not eating 5 servings a day
    - 6% males not eating 5 servings a day

"Other Foods"

- 1992 recommendation: moderate amounts of "other foods"
- 22% of Calories consumed
- 14-18 yr olds: 25% of all calories

AMDR

- Carbs 45-65%
- Fat 20-35% (25-35% for children and teens)
- Protein 10-35%

- On average, Canadians fall within these ranges
- many fall outside these ranges

Calories from Fat

- 31% of calories from fat on average
- **children 4-8yrs: 7% exceed range**
- **adults 31-50 yrs: + 25% exceed range**
- Main food items that contribute:
  - Sandwiches (hamburgers, hot dogs, subs, pizza)
    - 15.9% of fat intake
  - Baked goods (cookies, cake, doughnuts)
    - 8.5% of fat intake

Calories from Protein

- Ave intake is within these ranges and very few fall below or above
  - **children and teens: 14.7%**
  - **adults 16.8%**

Calories from Carbohydrates

- Within the range
  - **Children/teens: 55.4% of calories**
  - **Adults: 50.1% of calories**
- In all age groups, women consume more than men

Meal Breakdown

- 10% do not eat breakfast
- Breakfast accounts for 18% of Calories/day
- Lunch accounts for 24% of Calories per day
- Dinner accounts
  - for 31% of Calories per day for children/teens
  - For 36% of Calories per day for adults

Snacks

- Snacks account for
  - **27% of Calories for children**
  - **23% of Calories for adults**
  - **18-30 yr olds: males 30% , females 28%**
- 41% of snack Calories come from “other foods”

Fast Food Consumption

- 25% had consumed fast food
- 14-18 yr olds: 33.5%
- Males 19-30 yrs: 39%

Beverage Consumption in Children
percentage of daily calories from beverages

Age	Males %	Females %
1-3 yrs	28.2	27.3
4-8 yrs	20.8*	18.1*
9-13 yrs	18.1*	18.0
14-18 yrs	20.0*	19.0

* Significantly different than same sex younger age group

Children's Beverage Consumption
- Milk consumption highest from 1-3 yrs then decreases
  - declines are due to fewer drinking milk
- Fruit juice consumption also highest rom 1-3 yrs
- Soft drink consumption increases with age
  - 14 - 18 yrs old, 53% males and 35% females consumed on the previous day
  - Quantity of soft drinks consumed also increases with age
  - 14-18 yr olds: 376g (males) and 179 (females)

Beverage Consumption of Adults
- percentage of daily calories from beverages

Age	Males %	Females %
19-30 yrs	20.4	17.9
31-50 yrs	16.0	14.3
51-70 yrs	14.7	12.2
71+	12.0	11.3

- Water is consumed in the greatest amount by the highest %
- Soft drink consumption
  - % drinking and quantities consumed declines with age
- Highest consumers: 19-30 yrs
  - 47% males consumed on previous day (649g)
  - 27% females (534g)

Sugar Consumption

- WHO recommends 10% of daily Cals. from sugar
- IOM recommends 25% of daily Cals. from added sugars
- On average 110 g/day (26 teaspoons)
  - 21.4% of daily Cal.
- 35% of sugar from the “other foods” category

SOURCE OF SUGAR	% OF TOTAL SUGAR INTAKE
Fruit	17.4
Soft drinks	13.0
Sugars	11.4
Milk	10.7
Fruit Juice	7.6
Vegetables	6.8
Confectionary	5.3
Other sugars (honey, molasses, syrups)	4.5
Fruit drinks	3.7
Cereals, grains, pasta	3.3

Age group	Sugar Intake from “Other Foods”
9-13 yrs	
Males	37.5%
Females	34.4%
14-18 yrs	
Males	45.8%
Females	41.8%
19-30 yrs	
Males	43.2%
Females	37.8%

Micronutrients

- Children:
  - Adequate amounts of most vitamins and minerals in their diets
  - May not be meeting for potassium, fibre
  - Sodium intake for 77% of children 1-3 yrs (UL = 1500 mg/day) and 93% of 4- 8 yr olds (UL = 1900 mg/day)is above UL
- Teens:
  - Many have inadequate intake of magnesium, vitamin A, phospherous
  - May not be meeting for fibre, potassium
  - Sodium intake above UL (UL = 2300 mg/day) for 80% females and 97% males

Diet and Income

- The diet of adults is tied to income
  - High income adults more likely to
    - Eat more fat
    - Eat in fast food restaurants
    - Eat 5 servings of fruits/vegetables
- Diet of children/adolescents less closely associated with income
  - No patterns with regard to
    - Fat
    - Fruit /vegetable consumption
    - Milk consumption
    - Exception: fast food- high income more likely to consume

Lecture 6 - Global Nutrition Status

What The World Eats - Photoessay

- Photo essay by Menzel & D'Aluisio
- Visited 25 families around the world in 21 countries to see what they eat in a given week

Undernourishment 2010-2012

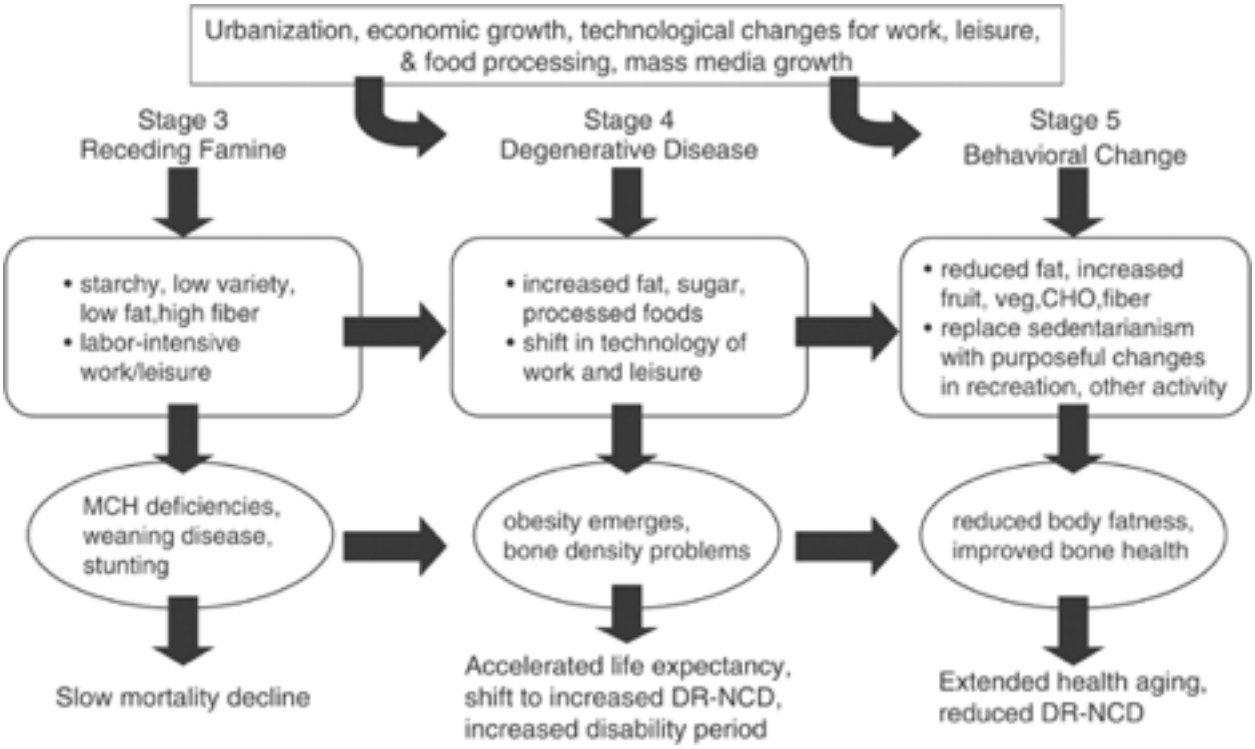
- prevalence of undernourishment has gone down in developing countries
- but the volume of the number of people that are undernourished has increased in some areas even though the overall has decreased
  - this is because the overall population of the world has gone up
  - biggest problem in southern asia, subsaharan africa, and eastern asia
- Food insecurity 12.5% of the world
  - 14.9% of those living in developing countries
- Significant differences among countries since 1990's
  - Significant improvements in South-Eastern Asia (Cambodia, Thailand), Eastern Asia (China, Korea), Latin America
  - Increases in Western Asia (Jordan, Kuwait, Lebanon), sub-Saharan Africa, Northern Africa

Micronutrient Deficiencies in Developing World

- Iron deficiency and anemia: 3.5 Billion
- Goitre (iodine deficiency): 740 Million
- Vitamin A deficiency: 78-254 Million

The Nutrition Transition

- Model first proposed by Drewnovski & Popner (1997)
- Explains dietary changes in developing countries
- overweight and underweight according to levels of development
- developing countries underweight is the problem, but as a country becomes more developed overweight becomes the issue
- **5 step model**
- Step 1: collecting foods, diets are high in carbs, fibre, low in fat (especially saturated fat), activity patters are high
- Step 2: famine, acute scarcity of food, diet becomes less varied



Stage 4: The Nutrition Transition

- Has been ongoing in industrialized countries since the industrial revolution
  - ie. UK over the last 200 years
    - 5-10x increase in fat and refined carbs
    - consumption of fibre rich grains has decline
- In mid and low income countries
  - Seeing the same shift but much more quickly
  - Shift begins with large increase in domestic production and import of oilseeds and vegetable oils
  - Increases in consumption of animal sources, processed foods
  - Increases in consumption away from home (street food, fast food)
  - does not affect everyone the same way
    - some diversity within and between groups

Nutrition Transition Trends

- OW starts as a “rich man’s problem” in developing countries
  - As GDP increases
    - Obesity becomes the problem of lower SES groups
- OW typically higher in urban areas in developing countries
  - exceptions: latin america, middle east and south africa
    - ow higher than underweight in rural areas
- Under and over nutrition can co-exist in the same household (a dual burden)
  - reported in brazil, china, russia, india, bolivia, egypt

Globalization Processes Linked to Nutrition Transition

- Growth of transnational food companies
  - affects food availablity,marketing, # of fast food restaurants
- International food trade liberalization
  - more food imports
- Food marketing
  - shapes food wants and preferences
- Supermarket development
- Domestic agricultural markets are commercialized
- Changes to foreign direct investment
- Technological developments
  - affects transportation, storing, and processing foods

Strategies Used to Encourage Children's Consumption

- Sell smaller/cheaper items in markets that are new and/or poor
- Adapt their product to local taste
- TV advertising, premiums, sales promotions (kid's clubs)
- Sponsorship of music, sports teams, TV shows
- philanthropy
- in most countries besides the US, soft drink consumption is up

Lecture 7 - Carbohydrates

Carbohydrates

- one of the three macronutrients that provide energy
- contain carbon, hydrogen, and oxygen
- Carbohydrates can either be
  - Simple
  - Complex

Simple Carbohydrates: Monosaccharides

- Simple carbohydrates (or sugars) include monosaccharides and disaccharides - 6 carbon atoms, 12 hydrogens, 6 oxygen atoms
- Monosaccharides: Consist of a single sugar molecule
  - **Glucose**
    - preferred source of energy for the brain
    - a very important energy source for all cells
    - most abundant sugar molecule in our foods
    - does not generally occur by itself
  - **Fructose**
    - sweetest natural sugar
    - occurs naturally in fruits and vegetables
  - **Galactose**
    - does not occur naturally
    - occurs as part of the disaccharide lactose
- Each monosaccharide contains six carbon atoms, 12 hydrogen atoms, and six oxygen atoms.

Simple Carbohydrates: Disaccharides

- Disaccharides: consist of two monosaccharide molecules joined together
  - **Lactose**
    - found in milk, glucose + galactose
  - **Maltose**
    - glucose + glucose, does not occur by itself
    - is a by-product of the breakdown of larger carbohydrates
    - is fermented during the production of beer and alcohol
  - **Sucrose**
    - glucose + fructose molecule
    - the sweetest disaccharide
    - table sugar
    - provides the sweetness in fruits and veggies

Complex Carbohydrates

- Complex carbohydrates are polysaccharides
- Consist of long chains of glucose molecules
- Polysaccharides
  - **Starch**
    - a polysaccharide stored in plants, i.e grains and tubers and legumes
  - **Glycogen**
    - storage form of glucose in animals
    - very little exists in foods
    - stored in muscle and liver cells
    - break it down easily when we need glucose
  - **Fibre**
    - includes a number of polysaccharides that give plants their structure
    - not digested or absorbed as it passes through the digestive tract

Types of Fibre

- **Dietary fibre:** the non-digestible parts of plants
- **Functional fibre:** non-digestible forms of carbohydrates that are extracted from plants or manufactured in the laboratory
  - have known health benefits
  - are added to foods
  - i.e cellulose, guar gum, pectin, psylium
- Dietary fibre + functional fibre = **Total fibre**

Other Definitions of Fibres

- **Soluble fibres :** are dietary and functional fibres that absorb water and swell to form gels
  - ie. natural pectins, mucilages, and gums
  - they slow down nutrient absorption and passage through the small intestine
- **Insoluble fibres:** components of plants that attract and cling to water
  - i.e cellulose (in wheat), and hemicullulose (in vegetable grains)
  - these substances give structure to the plant
  - they speed up the movement of material through the large intestine
  - increase bulk of stool and absorb water for easier passage

Glucose Metabolism

- **cell respiration.**
  - anaerobic: glycolysis
  - aerobic: krebs cycle, ETC, oxidative phosphorylation
- **lactic acid fermentation**
  - anareobic
  - produces lactic acid and 2 ATP

Glycogen Storage

- **Liver can store 70g glycogen (280 cal.)**
  - between meals, glycogen in liver
    - maintains blood glucose levels
    - supports cell needs
- **Muscles can store 120g glycogen (480 cal.)**
  - provides energy to muscles during intense exercise
  - carbohydrate loading
    - can increase energy to muscles 2-4X

Blood Glucose Level Regulation

- Blood glucose levels are maintained in a fairly narrow range
- fasting glucose level is 3.3-3.5 mmol/L
- two hormones released by pancreas
  - **insulin:** decrease blood glucose
    - promote **glycogensis**
  - **Glucagon:** increase blood glucose
    - promote **glycogenolysis and gluconeogensis** (synthesize glucose)

Glycemic Index

- The potential of food to raise blood glucose and insulin levels
- Pure glucose has a reference of 100
- Foods with a high GI cause sudden and high increases in blood glucose and insulin
- low GI <55: slow glucose absorption
- Affected by
  - the type of carb
  - way food is prepared
  - fat and fibre content
- Important information for diabetics

Why Do We Need Carbohydrates

1. **Carbohydrates provide 4 Calories of energy per gram**
   - **Fuel daily activity, fuel exercise**
     - our red blood cells can only use glucose for energy
     - our brains and nervous tissues rely on glucose primarily
     - fat is the source of energy for low intensity exercise
     - when intensity of exercise increase, the percentage of carbohydrate used increase
   - **Low carbohydrate intake can lead to ketoacidosis**
     - when carbohydrate intake is not adequate, ketones are an alternative fuel produces from stored fat
     - presence of high levels of ketone int he blood leaks to ketoacidosis
   - **Carbohydrates spare protein**
     - if not enough carbs, body manufactures glucose from protein
     - gluconeogensis is the generation of glucose from the breakdown of protein into amino acids
     - can cause serious damage to organs

2. **Complex carbohydrates have health benefits.**
   - reduces the risk for obesity, heart disease, diabetes
3. **Fibre has many benefits for our health**
   - promotes regular bowel movement
   - may reduce the risk of colon cancer, heart disease, type 2 diabetes
   - prevention of hemmorhoids and constipation
   - reduce risk of divertulosis
   - can enhance weight loss

How Much Carbohydrates Should We Eat?

- Recommended Dietary Allowance = 130 grams/day
- Acceptable Macronutrient Distribution Range = 45 to 65% of total energy intake
- Majority of carbs should be **complex**
- Added sugar:
  - sugars and syrups that are added to food during processing
    - ie. white and brown sugar, honey, maple syrups
  - 25% or less of our total daily energy acc. to IOM
  - WHO says 10%
  - American Heart Association
    - No more than 100 calories rom sugar for women
      - 150 calories from sugar for men

Added Sugar and Health

- **High fructose corn syrup:** 55% fructose, 45% glucose
- **Table Sugar:** 100% Sucrose
- **Brown Sugar:** 1% Fructose, 1% Glucose, 98% Sucrose
- **Honey:** 50% fructose, 45% sucrose
- many health problems associated with added sugar intake
  - tooth decay, gum disease
  - hypertension
  - link to cancer
  - unhealthful levels of blood lipids
    - increases LDL, decreases the HDL
- a contributor to obesity
- fructose cant enter brain cells and cant stimulate satiety signals.. you don't feel full

Recommendations

- 6.5 tsp added sugar for women/day (9.5 tsp for men)
  - Includes table sugar, brown sugar, honey, agave, maple syrup, high fructose corn syrup etc.
- Do not drink sugar sweetened beverages
- Fruit juice should be limited to less than 1 cup/day
- Do not be concerned about natural y occurring sugar in milk, plain yogurt and fruit

How Much Added Fibre

- Canadians eat too few complex carbohydrates
- At least
  - 25 grams of fibre/day are required for women
  - 38 grams of fibre/day for men
- **Tips to increase**
  - select whole grain breads and cereals
  - choose foods that have at least 2 or 3 grams of fibre per serving
  - buy fresh fruits veggies
  - canned fruits can be high in added salt/sugar
  - eat legumes frequently
  - drink more water as you increase your fibre

Disorders Related to the Metabolism of Carbohydrates

- Type 1 and 2 Diabetes
- Hypoglycaemia
- Lactose interolerance

Type 1 Diabetes

- Diabetes –
  - a chronic disease in which the body can no longer regulate glucose
  - Blood glucose levels become dangerously high which can cause tissue damage
  - can lead to heart disease, stroke, blindness, kidney disease, and amputations
- Type 1 diabetes (10%)
  - body does not produce enough insulin
  - Uncontrolled diabetes can lead to ketoacidosis
  - only treatment is daily insulin injections or the use of an insulin pump

Type 2 Diabetes

- cells become less responsive to insulin
- Pancreas produces more insulin
- Pancreas stops producing
- accounts for 90% of the diabetes in the general population
- obesity is the trigger for type 2 diabetes
- **Treatment:**
  - weight loss
  - healthy eating
  - regular exercise
  - oral medications to improve sensitivity to insulin, reduce the amount fo glucose the liver produces
- **Prevention for diabetes:**
  - a balanced diet
  - moderate daily exercise
  - a healthy body weight

Symptoms of Diabetes

- frequent urination
- unusual thirst
- frequent appetite
- blurred vision
- frequent infection

Hypoglycaemia

- Hypoglycemia refers to lower-than-normal blood glucose levels
  - **Reactive hypoglycemia**
    - the pancreas secretes too much insulin after a high-carbohydrate meal
      - 1-3hrs post meal
    - nervousness, shaking, anxiety, sweating, weakness
    - treatment, small frequent meals
  - **Fasting hypoglycemia**
    - Too much insulin is produced even when someone has not eaten

Lactose Intolerance

- an inability to digest lactose
- 70% of world population as they age
- Most common among non-Caucasian populations
- Symptoms:
  - intestinal gas, bloating, cramping, diarrhea, nausea and discomfort

Lecture 8 - Lipids

Liver Metabolism

- liver: produces bile
- bile: **emulsifies** lipid; breaking/dissolving them
- Gallbladder: stores the bile; enters small intestine from here
- pancreas: lipase; breakdown triglycerides
- absorption of the lipids occurs mostly in the small intestine

Lipid Metabolism

- fate of triglycerides
  - used as source for cels
  - used to make lipid containing compounds
  - stored in muscle or adipose tissue for later use
- if carbs are available, we produce ATP in the krebs cycle
- if carbs are not, we produced ketones
  - ketones can be used for energy
  - they can accumulate in your blood and harm you

Why Do We Need Lipids

- **Provide energy**
  - a major source of fuel when resting
  - fuel physical activity- especially endurance activities
- **Extra energy stored as body fat and this is energy for later use**
  - can be used for energy:
    - at rest
    - during excersie
  - during periods of low energy intake (between meals)
- **Enable the transport of fat soluble vitamins**
- **Lipids provide essential fatty acids**
  - linoleic acid (omega 6 fatty acid)
  - alpha-linoleic acid (omega 3 fatty acid)
- **Help maintain cell function**
  - i.e maintain membrane integrity, determine substances can transported in/out of cell
  - main components of the brain and spinal cord
- **Protect the body, particularly the organs**
- **Influences the flavour and texture of foods**
- **Help us feel satiated**
  - higher density (9 calories per gram)
  - energy being released slowly therefore we feel full for longer

Types of Lipids in Foods

- Triglycerides
  - major form of lipid found in food
- Phospholipids
  - lipids containing phosphorus
  - water soluble
- Sterols
  - lipid with multiple rings
  - produced by the body
  - found in animal and plant sources of food

Phospholipids

- Phosphoglycerides
  - glycerol backbone + 2 fatty acids + phosphate group
  - fatty acid: fat soluble
  - phosphate head: water soluble
- **function:**
  - food: emulsifiers, e.g. egg yolk in cake batter
  - body: phospholipid bilayer, acetylcholine synthesis

Triglycerides

- Consists of 95% of the fat we eat
- Triglycerides consist of three fatty acids attached to a three carbon glycerol backbone
- Triglycerides are classified by their length, saturation, and shape
- Fatty acids: long chains of carbon atoms bound to eachother as well as to hydrogen atoms
- glycerol: an alcohol composed of 3 carbon atoms

Triglyceride Length

- fatty acids vary in the number of carbons they have
- chain length determines
  - method of digestion and absorption
  - affects how fats function in the body
- short chain: fewer than 6 carbon
  - e.g milk, liquid in the fridge
- medium chain: 6-12 carbons
  - e.g. coconut oil
- liquid in friedge, solid at RT, low melting point
  - long chain: 14+ carbons
    - ex. beef fat

Triglyceride Saturation

- Triglycerides vary by the types of bonds found in fatty acids
- **Saturated fatty acids (SFA's):**
  - no double bonds between carbons
  - every carbon atom is saturated with hydrogen
  - i.e butter, cream, beef fat
  - solid at room temp
  - increase risk for cardiovascular disease
- **Monounsaturated fatty acids (MUFA's):**
  - one double bond in the carbon chain
  - usually liquid at room temp
  - i.e. olive oil, canola oil, cashews
- **Polyunsaturated fatty acids (PUFA's):**
  - more than one double bond in the carbon chain
  - liquid at room temp
  - corn oils, sunflower oil, soybean oil

Fatty Acid Shapes

- Fatty acids have different shapes
- **Saturated fatty acids:**
  - always form straight, rigid chains that pack tightly together
  - they are solid at room temp
- **Unsaturated fatty acids:**
  - the double bond in carbon chain gives them a kink that makes them unable to pack together tightly
  - they are liquid at room temperature
  - unsaturated fats may be cis or trans

Cis and Trans Unsaturated Fatty Acids

- **Cis Arrangement**
  - Both hydrogen atoms located at the same side of the double bond
  - Gives the cis molecule a kink at double carbon bond
  - i.e olive oil
- **Trans Arrangement**
  - Hydrogen atoms attached on diagonally opposite sides of double carbon bond
  - Result: straighter and more rigid(like SFA's)

Trans Fatty Acid

- 6% are naturally occurring in beef, cow's milk, lamb
- Majority are manufactured
  - hydrogenation: hydrogen added to MUFAs, PUFAs
  - some of the double bonds are broken
  - makes the liquid ft more solid at room temperature
  - when trans fats are added to foods
    - they resist spoilage from oxygen
    - crispier

Essential Fatty Acids (EFA)

- Essential fatty acids:
- Must be consumed in diet
- Are not made in our bodies
  - **Linoleic acid (omega 6 fatty acid)**
    - Required in regulation of blood pressure, blood clotting
    - found in vegetable and nut oils
    - i.e. sunflower, corn, soy, peanut oil
  - **Alpha-linoleic acid (omega 3 fatty acid)**
    - Reduce inflammation in body and blood clotting
    - Increase HDL "good" cholesterol in blood
    - Associated with slower levels of cognitive decline
    - found in leafy green vegetables
    - flaxseed, soy, canola, fish oils, seafood, walnuts

Fatty Acid Food Content

- Foods vary in their fatty acid food content
  - animal fats: 40-60% of energy from unsaturated fat
  - plant fats: 80-90% energy from unsaturated fats
  - most oils are a good source of multiple fat types

	% total cal from fat	% total fat cal. from EFA	% total fat cal. from SFA	% total fat cal. from MUFA	% total fat cal. from PUFA
butter	100%	4%	65%	31%	4%
olive oil	100%	10%	14%	74%	10%
egg	62%	13%	37%	46%	16%
cashew	72%	17%	20%	59%	17%

Sterols

- Type of lipid produced by the body and found in animal and plant sources of food
- **Plant sterols** block the absorption of dietary cholesterol in small intestine
- **Cholesterol** is the most common sterol in the diet
  - found only in animals (not in plants)
  - i.e in fatty parts of meat, in milk fat, butter, cheese

Cholesterol

- Liver synthesizes cholesterol
  - Adjusts its production according to the amount consumed
  - This mechanism fails in some individuals
- It is essential for health
  - part of every cell membrane
  - helps maintain cell membrane integrity
  - used to synthesized sex hormones, adrenal hormones and vitamin D

The Metabolism of Lipids

- Gallbladder, liver and pancreas assist in lipid digestion
- Absorption of the lipids occurs mostly in the small intestine
- The fate of triglycerides:
  - Used as a source of energy for cells- especially muscle cells
  - Used to make lipid containing compounds
  - Stored in muscle or adipose tissue for later use
- (P. 155-160)

How Much Fat Should We Eat

- Total fat:
  - Acceptable Macronutrient Distribution Range (AMDR) = **20-35%** of total energy from fat
  - **45-75 g/day for women and 60-105 g/day for men**
    - recommendation for athletes:
      - 20-25% of total energy from fat
- **Essential fatty acids**
  - **Adequate intake for linoleic acid (omega 6)**
    - =14-17 g/day for males and 11-12 g/day for females
  - **Adequate intake for alpha-linoleic acid (omega 3)**
    - 1.6g/day for males and 1.1 g/day for females
- **Saturated and Trans Fats**
  - Keep as low as possible
  - limit intake of animal products/select low fat animal products

Sources of Good Fats

- Eat 2 Food Guide servings/week (75 g each) of fish (Omega 3 fatty acids)
  - Higher fat fish (rainbow trout, salmon, sardines, herring)
  - Mercury levels in fish
    - eat predatory fish less often (i.e tuna, swordfish, shark)
    - canned tuna: eat smaller species such as skipjack, yellowfin, and tongol - avoid albacore
- Choose olive or canola oil (rather than butter or margarine)
- Margarine? No trans fats, low in saturated fat (soft)
- Avoid deep fried foods
  - they are often fried is vegetable shortening

Visible and Invisible Fats

- **Visible fats**
  - Fat that we can see in our food
  - i.e. salad dressing, chicken skin, butter
- **Invisible fats**
  - Fats that are added to foods in cooking process and are hidden in our foods
  - i.e. muffins, dairy products, marbling in meat
- in our diets most fats are invisible

Saturated Fats and Disease

- Saturated fats highly correlated with CVD disease
- A diet high in saturated fats:
  - Increase total blood cholesterol levels
  - Increase low density lipoproteins LDL “bad” cholesterol
    - they change the way cholesterol is removed from the blood
- Contribute s to heart disease and cancer
- **CVD**
  - Any abnormal condition involving dysfunction of heart and blood vessels
  - cause of death of 30% of Canadians

Trans Fat and Disease

- High density lipoproteins (HDL’s/good cholesterol) pick up cholesterol in blood and return it to the liver
- Liver uses it to make bile to digest fats
- High levels of HDL’s = lower risk of CVD
- Trans fatty acids
  - **Increase LDL cholesterol level**
  - **Decrease HDL cholesterol level**
- Effect of trans fats 5-10 X worse than saturated fats

Trans Fat Composition

- Average 2004 consumption:
  - 8.4g/day (10% of fat intake)
    - Level of trans fats in breast milk is directly proportional to level in mother's diet
    - 7-10% of the fat in breast milk
- baked products like doughnuts, croissants, puddings, microwave, fresh fries
  - 25-50% of fat from trans fats

Trans Fat Regulation in Canada

- 1970's industry introduced trans fat into food supply
- 2007 Trans Fat Task Force
  - Limit trans fat content
    - 2% of total fat content of vegetable oils and margarines
    - 5% of total fat content for all other foods
- New labelling regulations in 2003
  - Trans fats indicated in Nutrition Facts table
    - Trans fat free = less than 0.2g/serving
    - Exception:
      - foods for children under 2 years

Coconut Oil

- 90% saturated fat
- half of the fat is lauric acid is HDL cholesterol
- Walter Willett (Harvard)
  - use coconut oil sparingly
    - short term studies show good increase in HDL cholesterol
    - no info on heart disease, might likely have an impact because of the saturated fats
    - olive oils > because low LDL and increase LDL

Olive Oil and Hydrogenation

- all oils will hydrogenate to a small degree if heated to a high temperature i.e. in large commercial flying operations
- home cooks will not experience this
- to hydrogenate oil;
  - bubble hydrogen gas through 250-400 degree C cooking oil in presence of metal catalyst

- Saturday April 12 2-5 pm

- 100 multiple choice
- Cumulative (80/20 split)

- Vitamins/Minerals
  - Sodium, Potassium, Chloride, Phosphorus
  - Calcium, Magnesium, Fluoride, Vitamin D
  - Thiamin, Riboflavin, Niacin, Folate, Iodine

- RDA? Sources? Too much? Too little?

- Chapters 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12

Lecture 9 - Protein

What is Protein

- large, complex molecules
- found in cells of all living things
- Components of all tissues in body
  - bones, blood, hormones, enzymes, antibodies
- How are they different from carbohydrates and lipids?
  - Formed of carbon, hydrogen, oxygen and nitrogen
  - nitrogen in amino acids
  - structure of each protein molecule is dictated by genetic material
    - genes regulate sequence of amino acids
- Function of protein is determined by its shape

Protein Composition

- 20 total amino acids
- 11 nones**sential amino acids**
  - **can be made by the body**
- **9 essential amino acids**
  - body cannot produce them in large enough quantities, we obtain from foods
- For protein synthesis to occur
  - all **essential amino acids** must be available
  - the proper amount of essential amino acids must be available

Why Do We Need Protein

- They contribute to cell growth, repair, and maintenance
- They act as enzymes and hormones
  - **enzymes**
    - proteins that speed up chemical reactions without being changed by the reaction
  - **hormones**
    - substances that act as chemical messenger
    - some made of amino acids i.e. insulin
- They help maintain fluid and electrolyte balance
  - **electrolytes:** electrically charged particles that help maintain fluid balance inside and outside cells and within blood vessels
  - proteins in the cell membranes called transport proteins helping maintain the proper balance of sodium and potassium inside and outside the cell

Why Do We Need Protein

- help maintain acid-base balance (i.e. constant blood pH)
  - **acidosis: blood to acidic**
  - **alkalosis: blood becomes to basic**
- help maintain a strong immune system
  - antibodies: proteins that defend the body against specific foreign invaders
- serve as an energy source
  - our body does not store extra protein
  - taken from the blood and body's tissues like liver skeleton and muscle
  - very important to eat adequate amounts of carb and fat
    - energy for carbs: glycogen
      - energy from fat: trigylcerides
  - with healthy people, protein contributes little to energy

Complete and Incomplete Proteins

- **Complete protein (or high quality protein)**
  - contains all 9 essential amino acids
  - i.e egg whites, beef, chicken, fish, milk, soybeans
- **Incomplete protein (or low-quality protein)**
  - does not contain all of the essential amino acids in sufficient amounts to support growth and health
  - i.e legumes, grains veggies
- **Limiting amino acid**
  - amino acid that is missing or in the smallest supply
- **Mutual supplementation**
  - Combine two or more incomplete proteins
  - **these foods provide complementary proteins**

Protein Supplementation

- Stomach : acids and enzymes break proteins into short polypeptides and single amino acids
- Small intestine : enzymes break polypeptides into single amino acids and smaller polypeptides
  - cells of small intestine break peptide fragments into single amino acids
  - Amino acids are transported through the intestinal wall into the bloodstream to the liver for distribution

Protein Digestibility and Protein Quality

- Protein digestibility affects protein quality
- Protein from animal sources and soy are highly digestible
  - can absorb 90% of these proteins
  - legumes 80% digestible
  - grains and veggies 60-90% digestible
- **Protein digestibility-corrected amino acid score (PDCAAS)**
  - A measurement of protein quality
  - takes into account balance of amino acids and digestibility
  - i.e beef = 92, soy= 91, wheat = 42

Protein Need Calculation

- Weight 150 lbs. male
- Convert weight to Kg: 150 lbs
- 2.2 lbs/kg
- = 68.2 kg
- Figure out protein requirement:
- 68.2 kg X **0.8 g/kg**
- = 55 g of protein/day

Eating Meat

- Serving size is 3.5 0z or 100g cooked
- restaurant serving sizes: 150-340g
- Extra lean cut
  - Select AA- it's the leanest
    - prime is the fattiest, AAA is in the middle
  - minimize mutagens = the more heterocyclic amines (HCA's) which may raise the risk of cancer
  - grilling, barbecuing, broling, and pan frying create most HCA's

Processed Meats

- good evidence that eating processed meats (ham, bacon, deli meats, hot dogs) increases the risk of colorectal cancer
- Salt preserved and pickled meat consumption is associated with stomach cancer
- limit your consumption of these foods

Health and Too Much Protein

- Associated with high cholesterol
- Can cause you to excrete calcium
  - animal products contain acidic amino acids
  - calcium pulled form bone to buffer acids
  - unclear wether high protein leads to bone loss
- Kidney disease in those who are susceptible to kidney disease (i.e. those suffering from diabetes)

PKU or Phenylketonuria

- Cannot metabolize phenylalanine (essential amino acid)
- Phenylalanine used to produce the non-essential amino acid tyrosine
- for those with PKU
  - tyrosine must be consumed in the diet
- PKU can lead to irreversible brain damage if not diagnosed right at birth
- follow special diet
  - avoid phenylalanine
  - eat foods with tyrosine

Health and Too Little Protein

- Leads to bone loss
- **Protein-Energy Malnutrition**
  - When too little protein and energy are consumed
  - Particularly serious when combined with an infection or a parasite that causes diarrhea
    - 49% of the 10.4 million deaths occurring in children younger than 5 years in developing countries are associated with PEM
    - in developed countries, it affects the poorest
      - eating disorders, drug alcohol addicts, AIDS
  - particularly serious when combined with an infection or a parasite that causes diarrhea
    - leads to
    - stunting
    - underweight
    - vitamin and mineral deficiencies
    - electrolyte imbalances
    - more susceptible to disease

Marasmus

- results from grossly inadequate intakes of protein, energy, and other nutrients
- most common in young children living in impoverished conditions
  - **consequences**
    - wasting and weak muscles
    - stunted brain dev. and learning impairment
    - dangerously low internal temp
    - stunted physical growth
    - deterioration of intestinal lining
      - inhibits absorption of nutrients
    - severe weak immune system
    - iron deficiency
- If untreated
  - Death will result from dehydration, heart failure or infection
- **Treatment**
  - IV treatment to correct electrolyte imbalances
    - increase levels of K, Ca, P, and Mg
- once stabilized, intro proteins and carbs

Kwashiorkor

- Form of **PEM (protein energy malnutrition)**
- Severe protein deficiency
- seen in young children who no longer drink breast milk
  - consequences
    - weight loss and muscle wasting but retains fat
    - retarded growth and development
    - Edema (extreme distention of belly)
    - fatty degeneration of the liver
    - loss of appetite, sadness, irratability, apathy
    - development of skin sores, skin pigmentation changes
    - dry, brittle hair
  - can be reversed if
    - adequate protein and energy are given in time
    - underlying infections treated

Types of Vegetarian

- 4% of Canadians are vegetarians (2002)
- vegetarianism is restricted to foods of plant origin

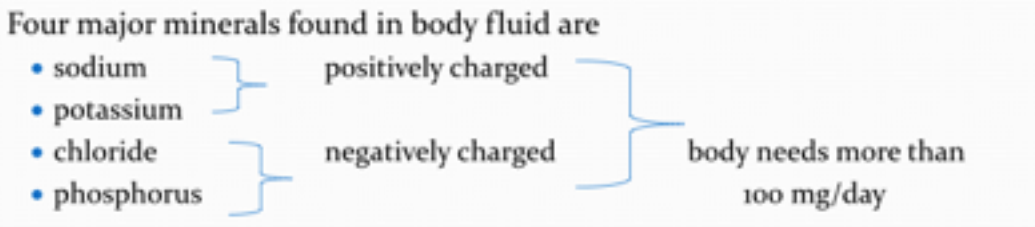
Diet Type	Food Intake
Lacto-ovo-pesco vegetarian	Vegetables, fruit, grains, nuts, legumes, eggs, dairy, seafood, fish
Lacto-ovo vegetarian	Vegetables, fruit, grains, nuts, legumes, eggs, dairy
Lacto-vegetarian	Vegetables, fruit, grains, nuts, legumes, dairy
Ovo-vegetarian	Vegetables, fruit, grains, nuts, legumes, eggs
Vegan	Vegetables, fruit, grains, nuts, legumes

- Religious or spiritual reasons (i.e. Hindus, Buddhists)
- Ethical reasons
  - feel modern farming practices are inhumane
    - large numbers of animals in close quarters
    - use of antibiotics
- The effect of the meat industry on global environment
  - large use of water
  - destruction of rainforest to provide land for livestock
  - waste produced from livestock operations
  - 10% of global greenhouse gases in Canada are from agricultural sector
- Concerns about the safety of animal foods
- Sign of disordered eating
- **Health benefits**
  - Vegetarians have a reduced risk for
    - Obesity
    - heart disease
    - some cancers (colon)
    - kidney disease, kidney stones, and gallstones
    - Vegetarians have
    - lower blood pressure
    - fewer digestive problems

Lecture 10 - Nutrients in Fluid and Electrolyte Balance

Body Fluids

- 50-70% of adult's body weight is fluids
  - 2/3 intracellular fluid
  - 1/3 extracellular fluid (i.e plasma, digestive juices from pancreas)
- fat = 10-20% fluid
- lean tissue = 70% fluid
- men have less body fat than females
- total amount of body fluid decreases with age because of loss of lean tissue Body fluid composed of
  - water
  - electrolytes (variety of dissolved substances)
    - mineral salts
    - when dissolve in water, two component minerals separate and form irons which can carry an electrical current



Function of Fluids

- dissolve & transport substances through the blood
- account for blood volume: the amount of fluid in blood
  - increase blood volume, = increase blood press
- help maintain body temperature
  - fluids keep us cool as it takes high sustained heat to raise our body temp
  - fluids keep us col as heat released when we sweat and skin and underlying blood is cooled
- Protect from injuries and lubricate tissues (i.e amniotic fluid protects womb and saliva moistens food and helps carry to stomach)

Purpose of Electrolytes

- help regulate fluid balance
  - water moves to areas where electrolytes are highly concentrated until concentration is equal on both sides of membrane
- let our nerves respond to stimuli
  - because changes in the degree of electrical charge
- signal muscles to contract

Maintenance of Fluid Balance

- Gain fluids by
  - Beverages
  - Foods
  - Metabolic water
    - in breakdown of fat, carb, protein
      - ATP (cells basic energy source) and water are formed
      - water contributes to 10-14% of daily needs
- We lose fluids through
- Urine
  - **Insensible water loss is 1 l/day**
    - Sweat
    - During exercise
    - Hot environment
    - during rest
    - Exhalation
- **Feces**
  - 150 -200 ml a day
  - extreme diarrhea = several l a day

Other Avenues for Fluid Loss

- Illness (fever, vomiting, runny nose)
- Traumatic injury that leads to blood loss
- Exercise
- Pregnancy (fluids diverted to fetus and amniotic fluid)
- Breastfeeding
- Diuretics (prescription, caffeinated beverages, alcohol, weight loss products)

Water Needs

- Can only survive 1-2 days without water
- Water need depends on
  - Age
  - Body size
  - Health status
  - Level of physical activity
  - environmental conditions

DRI for women 19-50yrs = 2.7 l/day
DRI for men = 3.7 l/day

Water Needs

- General guideline:
- 8 glasses (240 ml or 8 oz) of fluid/day
- athletes will require more
  - some lose up to 1.8kg of fluid/hour
  - lose sodium, potassium, small amounts of calcium, iron

Dehydration

- Fluid excretion exceeds intake
- **Result of**
  - Heavy exercise
  - Environmental conditions
- Infants at higher risk
  - cannot communicate they are thirsty
  - excrete urine at higher rate
  - respond more dramatically to heat and cold
- **Older adults at higher risk**
  - lower total amount of body water
  - thirst mechanism less effective

Sodium

- Salt = sodium chloride
  - **40% sodium, 60% chloride**
- **AI for sodium = 1.5 g (or 1500 mg)/day (2/3 tsp salt)**
- **Tolerable Upper Limit (UI) = 2.3 g (or 2300 mg)/day (1 tsp table salt)**
- Canadians consume 3092 mg/day of sodium
- 77% of the sodium we consume is from processed foods
  - 90% in form of sodium chloride
  - 10% sodium in containing compounded (sodium bicarbonate, MSG, sodium nitrate)
- 6% added salt at table
- 5% added salt during cooking
- 12% naturally occurring (water, milk, meat, veggies)

Too Much or Too Little Sodium

- **Hypernatremia**
  - Abnormally high blood sodium concentrations
  - caused by rapid intake of sodium
  - individuals with kidney disease and congestive heart failure
  - can lead to abnormally high blood volume
    - edema of tissue
    - high blood pressure
- **Hyponatremia**
  - Abnormally low blood sodium concentrations
  - caused by severe vomiting, diarrhea, much sweat
  - if untreated; coma seizures death

Sodium and Health

- meta- analysis (Strazzullo et al., 2009)
  - 13 cohort studies that included 177,025 men and women
  - followed from 3.5 to 18 yrs
  - **Higher salt intake associated with**
    - **23% increase in stroke**
    - **14% increase in heart disease**
- Evidence linking sodium and stomach cancer
- Evidence linking sodium intake and bone density loss
  - the higher your sodium intake the more calcium is flushed out

Potassium

- AI for potassium is 4.7 g /day (4700 mg/day).
- best sources of potassium: fresh fruits and vegetables
- Processing foods generally
- Increases sodium
- Decreases potassium

Too Much or Too Little Potassium

- **Hyperkalemia**
  - Too much potassium
  - occurs when potassium is not exerted effidiencnyl
  - result in heart attack and bad heart rhythm
  - uncomon in healthy invd.
  - kidney disease rid
- **Hypokalemia**
  - Too little potassium
  - defeicney rare in healthy individuals
  - invididuals with kidney disease
  - those with extreme dehydration, vomiting, diarrhoea
  - those who abuse alcohol ad laxicitives

Chloride

- Obtained from our diets
- Almost exclusively from sodium chloride
- Found in some fruits/vegetables
- **AI for chloride is 2.3 grams/day (2300 mg/day)**
- too much chloride
  - may lead to hypertension
- not enough clothirde
  - only in severe dehydration

Phosphorus

- **RDA for phosphorus = 700 mg/day**
- Phosphorus deficiency is rare
- Too much phosphorus?
  - Rare
- Too little phosphorus?
  - Rare

Lecture 11 - Nutrients in Bone Health

Nutrients Essential to Bone Health

- Major Minerals: Ca, P, Mg
- Trace Minerals: F
- Fat Soluble Vitamins: D, K

Calcium

- **most abundant mineral in body**
  - 99% Calcium in oru bodies found in bone
- provides structure to bones & teeth
  - Calcium and phosphorus crystallize to form hydroxyapatite
  - Crystals pack themselves tightly and form collagen foundation of bone
- assists with acid-base balance
  - Calcium is alkaline (basic)
  - 1% caclcium is in our blood and soft tissues
  - calcium is alkaline
  - body maintains appropriate calcium level in a narrow range at all costs
- required for normal transmission of nerve impulses
  - nerves ability to transmit messages would be inhibited without calcium
- assists in muscle contraction
  - if calcium is low, muscle relaxation and contraction inhibited
- helps to maintain healthy blood pressure
- initiates blood clotting
- regulates some hormones and enzymes

How Much Calcium

- requirements vary with age & sex
  - whether a woman is pregnant or breastfeeding
  - **19-50yrs = 1000mg/day**

Bioavailablity of Calcium

- Bioavailability
  - Degree to which our body can absorb and use a nutrient
- bioavailability of calcium depends on:
  - **Age and calcium need**
    - infants and children absorb most
    - pregnant lactating absorb more than normal
    - healthy young adults absorb less
    - ability to absorb calcium decreased with age
  - **how much calcium consumed at one time**
    - can only absorb 500mg of calcium at a time
    - better to have calcium throughout a day
  - **dietary factors**
    - Vitamin D necessary for absorption of calcium
    - Iron, zinc , magnesium, phosphorus can interfere with calcium absorption
    - Phytates and oxalates (binding factors) in some vegetables, seeds and nuts prevent calcium absorption (i.e. spinach, Swiss Chard)

Milk

- skim milk least calories, no fat
- 2% milk middle, more fat
- 3% most calories, most fat
  - good for kids who need fat for brain dev.
- Chocolate Milk
  - high in carbs, protein, sugars
  - to see added sugar, compare to product with no sugar added. e.g. chocolate milk vs. skim milk
    - difference of 13g/ 4, = 3.25 tsp of added sugar
- not the best recovery drink, you could opt for a better option such as an apple with almonds

Soy Milk

- Natural soy milk is a poor source of calcium
- Many are fortified with calcium and vitamin D
- Some research shows that added **calcium salts settle at bottom of container** (Heney & Rafferty, 2006)
  - examined 8 products
  - 6 of 8 even vigorous shaking did not improve dispersion
  - **what you consume isn't indicated on nutrition facts panel**

Calcium Supplements

- We absorb about 30% of calcium in supplements
- Do not take at same time as multivitamin
  - calcium can interfere with absorption of iron, magnesium, phosphorus, zinc
- Take with meals (calcium will stay in intestinal tract longer and better absorbed)
- Small doses throughout the day -no more than 500 mg

Calcium Toxicity Symptoms

- Toxicity not an issue in healthy individuals
- Much of excess excreted in feces
- Excessive amounts through supplements can lead to:
  - Potential mineral imbalances
    - can interfere with absorption of
      - ioron, zinc, magnesium
  - older adults are most at risk
- **Hypercalcemia- high level of calcium in blood**
  - Fatigue, joint pain
  - Mental confusion
  - Coma
  - Kidney failure
  - Heart failure

Hypocalcemia

- Abnormally low level of calcium in blood
- Caused by disease
- Symptoms
  - Muscle spasms
  - convulsions

Osteoperosis

- disease characterized by low bone mass and deterioration of bone tissue (porous bones)
- Structural change of bone means bones can't bear as much weight
  - increased bone fragility
  - risk of fracture (esp hip, spine, wrist shoulder)
- **CANADA:**
  - 16% of women over 50 have osteoporosis
  - 7% of men
- 70% of hip fractures associated with osteoporosis
- **Prevention**
  - Best defence is building strong bones during childhood and adolescence
  - **Peak bone mass is achieved at**
    - 16-20 yrs in women
    - 20-25 yrs in men
- Women and men begin to lose bone int heir mid 30s
- women lose 2-5% of bone a year during menopause as estrogen decreases
    - caucasian or asians more likely
    - family history
    - failure to menstruate in women
    - low body weight

Physical Activity and Bone Health

- Regular exercise is protective against osteoporosis
- Athletes have better bone density
- Regular weight bearing exercise helps us increase bone mass by stressing our bone tissue
  - This stimulates increases in bone density

Assessment of Bone Health

- Duel energy x-ray absorptiometry (DXA)
  - measures bone mineral density
  - Simple, fast, painless
  - Low level of X-ray
  - 15-30 minutes
  - Result compared to peak bone density of healthy adult of same sex/race
  - **T-score**
    - Between +1 and -1 = normal
    - Between -1 and -2.5 = osteopenia (increased risk for fractures)
    - Lower than -2.5 = osteoporosis
- Recommended for post-menopausal women

Vitamin D

- a fat-soluble vitamin and a hormone
- can be made in the skin when exposed to UV light
- Role:
  - Aids calcium absorption
  - Regulates blood calcium levels
  - Maintains bone health
  - may play a role in decreasing the formation of some cancerous tumours
    - **Iappe et al: randomized control trial**
      - 1200 post menopausal women with calcium and vitamin D supple.
      - 60-80% fewer cancers than placebo group
      - may play a role in cardiovascular disease, multiple sclerosis and rheumatoid arthritis

How Much Vitamin D?

- 19-50y
  - AI 200IU, UL 2000IU
- From Where?
  - Foods contain little vitamin D
  - Fortified milk is primary source
  - Cow's milk has 100 IU added per 1 cup (250 ml)
  - Breakfast cereals are fortified in U.S. but not here

Vitamin D and the Sun

- Canadians cannot rely on sun for vitamin D synthesis between October and April
  - Diet and supplements
  - Canadian Cancer Society recommends 1000 IU/day in Fall/Winter
  - Health Canada recommends 400 IU/day
  - expose arms and legs, or your face, arms and hands to sunlight between 10 a.m. and 3 pm for 5-10 min. 2-3X/week
    - No sunscreen
    - SPF 15 reduces synthesis by 98%
- Individuals with darker skin pigmentation need more sun exposure to synthesize vitamin D
- Older individuals synthesize less than younger
  - i.e 70yr old synthesizes 25% that of 20 year old

Too Much Vitamin D

• Can't get toxic levels of vitamin D from sun exposure
  • Any extra produced by skin stored in body fat
• Too much vitamin D through supplementation
  - Hypercalcemia
    • Mental confusion
    • Coma
    • Heart failure

Age/Sex	RDA (mg)
19-30 yr men	400
19-30 yr women	310
31 + male	420
31 + female	320

T

• When levels are low, our intestines can only absorb 10-15% of calcium we consume
  • **Rickets** in children
    - Bones are soft and poorly mineralized
    - Bones can't support weight
    - Deformities common
    - Pain and difficulty walking
  • **Osteomalacia** in adults
    - Soft bones that lack density
    - Prone to fractures
    - Aching bones
    - Bowed legs are common

Magnesium

• Part of structure of bone
• helps regulate bone and mineral status
• a cofactor (compound needed for enzyme to be active) for over 300 enzymes
• necessary for ATP production
• plays an important role in DNA and protein synthesis
• supports normal vitamin D metabolism
• required for muscle contraction
• necessary for blood clotting

Magnesium Quantities

- Healthy individuals generally consume adequate amounts in their diets
- No UL for food/water sources
- UL for supplements = 350 mg/day

- Too much: Diarrhea, nausea, cramping
- **Hypermagnesium**
  - Can result in :acid-base imbalances, massive dehydration, cardiac arrest, death
- **Hypomagnesium**
  - Result of kidney disease, alcoholism, chronic diarrhea
  - Results in muscle cramps, seizures, weakness, nausea, confusion, irratibility
  - Side effect: low calcium
- *Long-term magnesium deficiency associated with osteoporosis

Fluoride

- Trace mineral (less than 100 mg/day)
- Fluoride contributes to
  - the development and maintenance of bones/teeth
- **AI for fluoride is 4mg/day for men 3 mg/day for women**
- primary sources of fluoride
  - fluoridated dental products
  - fluoridated water
- Too much?
  - **Fluorosis of the teeth**
    - Increased protein content of enamel makes it more porous
    - Teeth become pitted and stained, can lead to tooth pain
  - Higher risk until age 6/7 years
- **Fluorosis of the sketleton**
  - Increased bone mass
  - Pain, stiffness in joints
  - Can be crippling and lead to osteoporosis, wasting of muscles
- Too little?
  - Tooth decay

Lecture 12 - Nutrients in Energy Metabolism and Blood Health

Energy Metabolism

- B-complex vitamins
- Thiamin (B1), riboflavin (B2), vitamin B6, niacin, folate, Vitamin B12, pantothenic acid, biotin
- Choline- a vitamin-like substance
- Trace Minerals
    - Iodine
    - Chromium
    - Manganese
- Sulphur- a major mineral
- role
    - vitamins and minerals are required to produce energy
    - assist with energy metabolism
        - assist with transport of nutrients and production of hormones
        - primary role is to act as coenzymes
            - thiamin part of co-enzyme TPP, which helps breakdown glucose

Thiamin (B1)

- part of co-enzyme TPP
- **TPP**
    - helps breakdown glucose for energy
    - a coenzyme in the metabolism of the branched-chain amino acids (i.e. lucine, valine, primarily metabolized in the muscles and can be used by glucose
    - assists in producing DNA and RNA
    - plays a role in the synthesis of neurotransmitters
- **Thiamin RDA**
    - 1.2mg/day for men
    - 1.1 mg/day for women
- **no known adverse affects for too much**
- **Beri Beri = thiamin deficiency**
    - Anorexia (loss of appetite), Weight loss
    - Apathy, Decreased short-term memory
    - Confusion/irritability, Muscle weakness, Enlarged heart
    - **Wet Beriberi:**
        - cardiovascular system affected
    - **Dry Beriberi:**
        - nervous system affected

Sources of Thiamin

- Enriched cereals
- Grains
- Whole grain products
- Wheat germ
- Ready-to-eat cereals
- Pork products
- Organ meats
- Some green vegetables (peas, asparagus, okra)

Riboflavin (B2)

- important component of coenzymes involved in chemical reactions within the energy producing metabolic pathways
  - coenzymes **flavin mononucleotide (FMN)** and **flavin adenine dinucleotide (FAD)**
    - involved in carbohydrate and fat metabolism
- Assists in fight vs. oxidative damage
  - It is part of the antioxidant enzyme glutathione peroxidase
- Important in metabolism of vitamin B6, folic acid, vitamin K, niacin
- **Riboflavin RDA**
  - 1.3mg/day for men
  - 1.1 mg/day for women

Too Little

- Can have profound effect on energy production
- Fatigue
- Muscle weakness
- Swelling of mucous membranes in the mouth, throat
  - Dry, cracked scaly lips, painful cracks at the corner of the mouth
  - Purple tongue
- **Sources**
  - -milk, yogurt
  - -enriched bread, grain products,
  - ready-to-eat cereals
  - -organ meats
  - -green vegetables (broccoli, asparagus, spinach)

Niacin

- refers to the compounds
  - nicotinamide
  - nicotinic acid
- is a coenzyme that
  - assists in carbohydrate and fat metabolism
  - plays an important role in DNA replication and repair
  - plays a role in cell differentiation
- Our bodies can produce niacin
  - Amino acid triptophan can be converted into niacin
- **Niacin RDA**
  - 16mg/day for men
  - 14 mg/day for women
- **Too Much**
  - From excessive supplementation
    - UL = 35 mg/day
      - Flushing
      - Liver dysfunction and damage
      - Glucose intolerance
      - Blurred vision
- **Too Little**
  - Pellagra
  - Dermatitis, diarrhea, dementia, death
  - Soreness in mouth and raw skin on areas exposed to sun
  - Progresses to digestive and nervous systems
  - Pigmented rash
  - Vomiting, Constipation, Diarrhea
  - Bright red tongue
  - Depression
  - Apathy
- **Sources**
  - Meat, fish, poultry
  - Enriched bread, ready-to-eat cereals
  - Legumes
  - Seeds
  - Milk
  - Leafy vegetable
  - Coffee, tea

Folate

- involved in DNA synthesis
- Involved in amino acid metabolism
- Plays a role in assisting with cell division
  - critical nutrient during the first few weeks of pregnancy
- works with vitamin B12 , B6 in metabolism of **homocysteine**
- **Folate RDA = 400 µg/day**
- **Too Much**
  - **UL = 1000 µg/day**
  - No clear symptoms except it can mask B12 deficiency
- **Too Little**
  - can cause **macrocytic anemia (large cell)**
  - Elevated levels of homocysteine in blood
  - deficiency in pregnant women can cause neural tube defects in fetus
- **Sources**
  - added to wheat flour in Canada
  - fortified cereals , bread products
  - orange juice
  - green leafy vegetables (spinach, Romaine lettuce) , asparagus
  - lentils

Neural Tube Defects

- most common malformations of the central nervous system
- occur during fetal development
  - neural tube is formed during 4th week of pregnancy
- If folate deficiency
  A. Neural tube will fail to fold and close properly
- Neural tube defects can range from protrusion of the spinal cord outside the spinal column to missing brain tissue
  - Some defects can be surgically repaired
  - Others lead to death

B Vitamins

- Sources
  - Whole grains, ready-to-eat cereals
  - Meat, poultry, fish
  - Milk and dairy products
  - Some fruits and vegetables
- If consume a varied diet, consuming adequate amounts is easy

Iodine

• trace mineral
- Form in our food is iodide
- Supports energy regulation
- For synthesis of thyroid hormones
  - **Thyroid hormones**
    - regulate body temperature
    - maintain resting metabolic rate
    - support growth and reproduction
- **Iodine RDA = 150 µg/day**
- **Too Much**
  - **UL = 1100 µg/day**
  - Blocks synthesis of thyroid hormones
  - Thyroid will attempt to produce more hormones
  - goiter
- **Too Little**
  - Suppresses production of thyroid hormones
  - Goiter
  - enlargement of the thyroid gland
  - Hypothyroidism
  - Decreased body temp
  - Weight gain
  - Fatigue/Sluggishness
- **Food Sources**
  - few foods naturally contain iodine
  - saltwater fish, shrimp
  - iodized salt (1/2 tsp meets RDA)
  - products made from iodized salt
  - bread /dairy products

Blood Health

- Vitamin K Fat soluble Vitamin
- Trace Minerals: Iron, Zinc, Copper

Iron

- Trace mineral
- **Iron deficiency = most common nutrient deficiency**
- Functions as component of many proteins in our body
  - close to 2/3 of iron found in hemoglobin
    - acts as a shuttle, picks up O2 in the environment, drops it in tissues
  - Component of **myoglobin**
    - Iron containing protein
    - Similar to hemoglobin but found in muscle cells
  - Component of **cytochromes**
    - Iron is a cofactor in energy production
  - Part of the **antioxidant enzyme system**
    - Helps fight free-radicals

Iron Storage and Bioavailability

- We have little iron stored in our bodies
  - Women > 2 g Men < 4g
- Iron stored as ferritin and hemosiderin
  - Liver, bone marrow, intestinal mucosa, spleen
- Bioavailability depends on type of diet
  - vegan diet: 10%
  - mixed western diet: 18%

Influencing Iron Absorption

- Iron status
  - poor iron status = highest absorption rates
    - i.e. pregnant women, experience blood loss
- **Stomach acid content**
  - adequate stomach acid required for absorption
- Total amount iron in foods
  - Type of iron in foods
    - **Heme iron = best absorbed form**
      - Found only in animal-based foods
      - Meat, fish, poultry also contain meat protein factor (MPF) that increases absorption
    - **Non-heme iron = not absorbed as well**
      - Found in animal-based and plant-based foods
- Presence of dietary factors can inhibit/improve absorption
  - i.e. polyphenols in coffee, tea, red wine, oregano, soybean protein, calcium all inhibit absorption
  - i.e Vitamin C increases absorption of non-heme iron

Iron

- Iron RDA
  - = 8 mg/day for men
  - = 18 mg/day for women

Too Much

- Iron overdose is leading cause of poisoning in U.S. children under 6 yrs.
  - nausea, vomiting, diarrhea, dizziness, confusion, and rapid heartbeat
  - Must be treated quickly or will result in death
- **Hemochromatosis**
  - Hereditary disorder
  - Northern European descent
  - excessive absorption of dietary iron and altered iron storage
  - Cirrhosis of liver, liver cancer, heart attack, heart failure, diabetes, arthritis

Too Little

- Most at risk: infants, young children, girls and pre-menopausal women, pregnant women
- Iron-deficiency anemia is most common nutrient deficiency
  - Stage 1: decrease in iron stores
  - Stage 2: decrease in the transport of iron
  - Stage 3: results in iron-deficiency anemia

Types of Anemia

- Anemia
  - any condition in which hemoglobin levels are low
  - Inherited
  - Deficiency-related anemias
- **Iron-deficiency anemia**
  - iron intake is inadequate
  - Red blood cells are
    - smaller than normal
    - contain insufficient hemoglobin to transport adequate oxygen or to allow the production of energy
  - Symptoms of energy and oxygen deprivation
    - Fatigue, pale skin, reduced exercise tolerance, impaired immune function, impaired memory, cognitive function, nerve function

Types of Anemia

- **Pernicious anemia**
  - caused by inadequate absorption of vitamin B12
- **Macrocytic anemia**
  - results from folate deficiency
  - Deficiency > impaired DNA synthesis > impairs normal production of red blood cells
  - Results in production of larger-than-normal red blood cells with insufficient hemoglobin

Zinc

- a coenzyme for a hundred different enzymes
- assists in hemoglobin production
- Helps fight free radical oxidative damage
- assists in generating energy from carbs, fats, protein
- Helps activate vitamin A in the retina
- helps proteins maintain their biologically active shape
- key for cell replication and normal growth
- critical for proper functioning of the immune system.
- **Zinc RDA**
  - 11 mg/day for men
  - 8 mg/day for women
- **Too Much**
  - UL= 40 mg/day
  - intestinal pain, nausea, vomiting, loss of appetite
  - depress the immune system/decrease HDL
  - interfere with copper absorption
- **Too Little**
  - growth retardation
  - delayed sexual maturation and impotence
  - eye and skin lesions, hair loss

Zinc Sources and Absorption

- Good food sources: red meat, some seafood, and whole and enriched grains/cereals
- Zinc absorption
  - 10-35% (similar to iron)
  - Factors that increase absorption:
    - Poor Zinc status
    - During times of growth (sexual development, pregnancy)
    - Intake of protein
- Factors that inhibit absorption:
  - High intake of non-heme iron (i.e. in supplements)
  - Phytates and fibre in beans and whole grains

Lecture 13 - Nutrition and Obesity

Healthy Body Weight

- appropriate for individual's age/physical development
- can be achieved and sustained without restraining food intake or constantly dieting
- is one that is acceptable to the individual
- based upon genetic background and family history of body shape and weight.
- allows for participation in regular physical activity
- (Source: Manore et al., 2009)

Other Weight Categories

- Underweight: too little body fat to maintain health
- Overweight: moderate amount of excess body fat
- Obesity: excess body fat adversely affecting health

Body mass index(BMI)

$$= \frac{\text{weight (kg)}}{\text{height(m)2}} = \frac{60\ \text{kg}}{1.6\ \text{m}\ 2} = 23.4$$

- normal = 18.5 - 24.9
- overweight = 25.0-29.9
- obese 1 = 30- 34.9
- obese 2 = 35- 39.9
- obese 3 = 40 >
  - These categories apply to adults only
  - BMI is limited value for those with disproportionately high muscle mass
    - No information re: body composition
- 68% percent of Canadian men obese or overweight category

Assessment of Body Weight Composition

- **Underwater weighing**
  - most accurate method
  - used for research purposes with 2-3% error
- **Skinfold measurements**
  - pinch and measure folds of skin and fat at various locations using a calliper
- **Bioelectrical impedance analysis**
  - sends a low level electrical current through the body
  - rate at which electricity is conducted gives indication of lean body mass and fat, as lean body mass is a good indicator of conductor of electricity.

Waist Circumference Measurements

- Measurement at narrowest part of torso as seen from the front
- More useful than BMI for determining health risk
- High risk for chronic disease:
- For males: 102 cm (40 inches)
- For females: 88 cm (35 inches)

Edmonton Obesity Staging System

- different levels to obesity
- stage 0-4, increasing intensity of poor health

What Causes Obesity?

Energy Balance

- Occurs when
  - **energy intake = energy expenditure**
- Energy intake is the food we eat every day
- Energy expenditure:
  - **Basal metabolic rate (BMR)**
    - Energy output at rest
      - needed for respiration, circulation, body temperature, nervous system activity, synthesis of new cells/tissues, hormone secretion
  - **Thermic effect of food**
    - Energy expended to process food
      - to digest, absorb, trasnport, metabolize and store nutrients
      - fat requires little energy,protein and carbs require more
- Physical activity
  - body size, intensity of activity and time spend engaged in activity affect amount of energy expended
- **Excess intake of approximately 3500 calories = gain of approximately 1 lb**

Genetics and Obesity

- 25% of body fat can be accounted for by our genes
- Having one or two OW parents increases risk for OB X2-X4
- **Thrifty gene theory**
  - some possess a gene (or genes) that cause them to be energetically thrifty
  - i.e. at rest and when exercise, they expend less energy
- **Set-point theory**
  - our bodies are designed to maintain weight within a narrow range or “set point”
  - If we restrict, body responds by slowing BMR
  - If we overeat, BMR increases

Physiological Factors

- Low level of thyroid hormone
- Elevated levels of cortisol
- Certain prescription medications
  - Steroids / Seizure medications/ Anti-psychotics/ Anti-depressants

Social Factors

- Poverty/ Lower level of education/ Cost of healthy foods
- Availability of cheap unhealthy foods/ Access to safe places to exercise
- Cost of gym memberships, sports team membership
- Having a spouse, sibling, friend who is obese

Obesity and Fast Foods

- Fast food outlets in the U.S. have increased
  - 30000 in 1970
  - 230000 in 2004
- Food expenditures out-of-home have increased
  - 1970 - 25% of food dollars outside home
  - 2004 - 50% food dollars spent outside of home
- Fast food consumption by children and teens associated with
  - Higher energy intake, fat, servings of soft drinks
  - Lower consumption of milk, fruit and vegetables
- Positive association between fast food consumption and risk for obesity (systematic review by Rosenheck, 2008)

Weight Bias

- Are bullied at school
  - 64% of teens report weight based victimization by peers, friends and gym teachers
  - Children/teens who experience WBV can experience
    - low self-esteem, depressive symptoms, suicidal thoughts and acts
    - poorer academic performance, skipping school
    - may contribute to social isolation
- At work
  - Paid less
  - Discriminated against in hiring and promotion process
- Nurses and doctors have weight biases
- obese patients are seen as lazy, noncompliant, having low will power
- Patients have weight biases (Puhl et al., 2013)
- more mistrust of physicians who are OW/obese
  - less inclined to follow their advice
  - more likely to change doctors

Lecture 14 - Dieting

Dieting

- $40billion/yr industry in U.S.
- diet industry
  - **profit and exploitation** (Foxcroft, 2012)
  - under fire in the 1980s for making unsubstantiated claims re: diet products
  - 1980s: products will help them quickly lose significant weight
  - Now: focus is more on losing weight in a healthy fashion (Bishop, 2000)

Low Fat Diets

- Historically, the main strategy for losing weight
- **1 gram of fat = 9 calories**
- Less filling and flavourful
- Long-term appeal?
- Some fats are good for the heart: MUFA's, PUFA's

Low Carb Diets

- Restricts carbohydrates to 20 to 60 g/day (less than 20 % calories)
- Supposed to prevent the insulin surge
- **Encourages ketosis** (production of ketones from liver and muscle tissue to be used as energy in place of glucose)
- Make you feel full longer

Atkins New Diet Revolution

- First published in 1972
- Very low carbohydrate diet: >20 g/day
- Few limits on amount of food you eat
- Severely restricts the kinds of food allowed
  - **no refined sugar, milk, white rice, white flour**
- Can eat protein and fats including meat, eggs, cheese, butter, mayo, oils
- Claims to reduce your appetite
- After two weeks
  - Can add fruits/vegetables, and whole-grain foods
- Very controversial
  - american heart association
    - warns people against atkins diet
    - too high in saturated fat and protein (bad effect on heart, kidney, and bones)

Wheat Belly Diet

- **Dr. William Davis**
- wheat's modern genetic modifications responsible for the majority of society's ills
- Very extensive list of the foods allowed/not allowed
- Cut most carbs out (50-100 g/day)
- Similar to Atkins
- **Can Eat**
  - Vegetables and pickled vegetables
  - Cheese, Oil, Eggs,Raw nuts and seeds, ground flaxseed, coconut
  - Uncured Meats, Non sugary condiments, Avocado, Olives, Herbs and spices

Wheat Belly Criticisms

- Many statement **not backed by scientific evidence**
  - i.e that individuals suffer from withdrawal when remove wheat from their diets
- Cites studies that indicate that wheat has been bred to produce more potentially-allergenic proteins
  - fails to connect this with the problems and he describes that wheat causes
- **Uses testimonials** to show curative link between disease and wheat
- Asserts wheat more easily converted to glucose- true
  - other starches also easily converted to glucose

The 8 Hour Diet

- Author: David Zinczenko
- **Intermittent fasting**
  - Eat whatever you want for 8 hours/day, fast for 16 hrs
  - Follow for 3 days/week
  - At each meal/snack eat 2 of 8 "Powerfoods"
    - lean protein, nuts, yogurt, other dairy, legumes, berries, fruit, green leafy vegetables, and whole grains
  - His 7 day menu: 1,222- 1,805 calories
- His claims:
  - **certain foods as "Fat Busters", or "Health Boosters“**
  - fasting improves every last aspect of your life, weight and metabolism
  - Says Moses, Jesus, Buddha, and Muhammed were fans
- **No references in book**
- Research on fasting not yet very advanced
- **Little scientific evidence**

Fad Diets

- Themes:
- "Easy!" , "Reset metabolism" , "Turbocharge weight loss", "Target muffin top fat", "New", "Improved" "Based on Scientific Evidence"
- 100's on the market
- Goal is to make money
- Short-term popularity
- Rapid weight loss (more than 1 kg or 2.2 lbs per week)
- Special foods and supplements
- Rigid menus
- Elimination of entire food groups

Extreme Dieting, Biggest Loser

- Debut in 2005
- Competition- who can lose the most weight the fastest
- 150lbs plus weight loss and an average pace of 10 lbs/week
- **Pros**
  - Accountability
  - Hope/inspiration
  - Competition
  - Reality of hard work to lose weight
- **Cons**
  - Extreme- 4-6 hrs of daily training
  - Encourages dangerous weight loss practices
  - No relevance to real world
  - Unrealistic weight expectations
  - No focus on long-term maintenance

Healthy Dieting

- **Reduction in energy intake**
- (500-1000 calories/day)
  - Eliminate refined carbohydrates
  - **Reduce fat intake (from 35 to 20% of intake)**
    - No fried foods, Select leaner meats
    - Eliminate liquid calories from your diet
  - Reduce your portion sizes, Eat out less frequently
  - **Reduce your consumption of processed foods**
  - Lots of fruits and vegetables
  - Healthy fats
  - Lean Protein
  - Drink lots of water

Healthy Dieting

• Behavioural changes
  - Listen to your hunger cues
  - Eat slowly
  - Avoid hunger, Plan ahead
  - Don't eat in front of the TV, while reading
  - Keep a food diary
  - Get back on your plan, when you falter
• **Regular/appropriate physical activity**
  - 30 minutes of moderate intensity 3–5 times/wk;
  - eventually ≥ 60 minutes on most days
  - Medical evaluation is advised before starting
• **Set realistic goals (no more than 2 lbs/week- 1 kg)**
  - 5-10% weight loss will substantially improve risk factors for heart disease and diabetes

Commercial Weight Loss Programs

• **program asses and treats co-morbid conditions**
• provides individualized nutritional, exercise and behavioural programs and counselling
• advice by experts, diets are not less then 900 cal/day
• exercise is encouraged at a gradual pace
• reasonable weight loss goals, 1/2 pounds a week
• cost is not contractual no products, supplements, injections
• **does not make unsubstantiated claims**
• program has maintenance program for once you come off the diet

Losing Weight

• **3500 calories = approximately 1 lb**
• Does NOT mean that 100 extra calories every day for about a year will mean 10 extra lbs
• Does NOT mean that removing 100 calories every day for a yr will mean a loss of 10 lbs
• **You need to significantly**
  - Increase your calories to significantly increase your weight
  - Decrease your calories to significantly decrease your weight

Metabolic Adaptation

• Phenomenon whereby an **individual's metabolism slows down** (through hormonal changes) by a large amount when they lose a percentage of body weight
• Body defends against weight loss - Means weight loss slows on same diet
• Must decrease calories further to continue to lose weight
• Explains why vast majority of individuals, who lose weight fail to keep it off
• Process is accelerated with rapid weight loss (Johanssen et al., 2012)
  - exercise did not prevent dramatic slowing of resting metabolism

Successful Maintainers

- Stunkard & McLaran-Hume 1959 study
  - 100 obese individuals
  - 2 yrs post-treatment- 2% maintained weight loss of 20 lbs. +
- **Approximately 20% "successfully maintain"** their weight loss (Wing & Phelan, 2005)
  - 10% loss of body weight
  - at least 1 year
- **National Weight Control Registry (Wing & Hill)**
  - Established in 1994
  - 4000 individuals
  - 18 yrs plus
  - Lost 30 lbs +
  - Kept weight off for 1 yr
  - Average loss of 33 kg (72 lbs.)
  - Have maintained min. loss of 13.6 kg (30 lbs.) for average 5.7 yrs.
    - 13% have maintained for more than 10 yrs
    - 77% women, 82% college educated
    - 95% Caucasian, 64% married

National Weight Loss Registry

- Lost weight
  - 55% had help (commercial program, doctor, dietician)
  - 45% on own
  - 89% diet and physical activity
  - 10% diet only
  - 1% exercise only
- To maintain weight loss
  - Low-calorie diet (approx. 1800 cal./day)
  - Low-fat diet
  - High level of physical activity (1 hr/day)
    - Walking most common
  - Weighing themselves frequently (44% daily, 31% weekly)
  - Eating breakfast
  - Diet consistency (weekdays/weekends; holidays; non-holidays)

Lecture 15 - Eating Disorders and Disordered Eating

Eating Disorders

- psychiatric diagnosis that is diagnosed by a physician or clinical psychologist
  - Anorexia Nervosa
  - Bulimia Nervosa
  - binge eating disorder
  - Eating Disorder Not Otherwise Specified (EDNOS)

Anorexia

- Refusal to maintain body weight at or above a minimally normal weight for age and height
  - less than 85% of expected weight
  - failure to make expected weight gain during period of growth
- Intense fear of gaining weight or becoming fat, even though underweight
- Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight.
- Amenorrhea
  - absence of at least three consecutive menstrual cycles

Subtypes of Anorexia

- Restricting Type
  - Weight loss primarily through
    - Food restriction
    - Fasting
    - Exercising
- Binge-eating/Purging Type
  - binge: eating a very large quantity of food within two hours, and you have to feel after control
  - Either binge and purge
  - Purge only

Anorexia Nervosa

- 90-95% of those diagnosed are female
- Lifetime prevalence:
  - 0.9% in women
  - 0.3% in men
- Mean age of onset 17 yrs
  - Bi-modal peak
    - 14 yrs
    - 18 yrs
- Mortality
  - 5-20% will die within 10 years of diagnosis
  - food rituals
  - total lists of how much food they eat
  - hair looks brittle or over processed, blonde hairs on stomach
  - OCD common, as is substance abuse

Bulimia Nervosa

- Recurrent episodes of binge eating
  - **Binge eating**
    - eating within any 2-hour period, an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances
    - **a sense of lack of control**
    - **at least once a week for 3 months**
- Recurrent inappropriate **compensatory behavior** in order to prevent weight gain
  - Self-induced vomiting - most common
  - Misuse of laxatives, diuretics, enemas, or other medications
  - Fasting
  - **Excessive exercise - less common**
  - **at least once a week for 3 months**
- Self-evaluation is unduly influenced by body shape and weight.

Bulimia Nervosa

- Lifetime prevalence:
  - 1.5% in women , 0.5% in men
- Usually begins in late adolescence/early adulthood
- Mortality rate
  - 1% within 10 years of diagnosis
  - GAD
  - substance abuse, alcohol is typical
  - borderline personality disorder; people who have lots of instability in their lives: in their relationships, in their identity, emotions, impulsive behaviours

Binge Eating Disorder

- Symptoms
  - Recurrent episodes of binge eating
    - At least once per week
  - **Absence of compensatory behaviours**
- Individuals present as OW/obese
- Prevalence
  - 2-3% of general population
  - 8% of those suffering from obesity (20-40% of those in obesity related treatment programs)
  - 1.5 females: 1 male
- Co-morbidity- depression (50-60%), anxiety, substance abuse

Health Impact of BD

- All conditions associated with obesity
- Psychological consequences:
  - Low self-esteem, Social avoidance, Depression, Body image issues

Eating Disorders not Otherwise Specified

- for females, all criteria for AN except for lack of menses
- all criteria for AN but maintain normal weight
- all criteria for BN except bing eating behaviours are less than twice a week and compensatory behaviours have lasted for less than a month
- regular use of compensatory behaviours occurs in individual with normal body wight after eating small amounts of food
- repeated chewing and spitting of food
- binge eating but no compensatory behaviours

Treatment of Eating Disorders

- **Multidisciplinary team approach**
  - Psychiatrist, psychologist, dietician, nurse, social worker, occupational therapist
- **Hospitalization vs. outpatient care**
- **Nutritional therapy- dietary intervention**
  - restore healthy weight
  - restore normal eating practices
- **Cognitive behavioural therapy**
  - looks to change behaviours and faulty cognitions
  - body image issues
  - interpersonal issues/anger/coping
- **Family therapy**
- **Psychopharmacology**
  - anti-depression, aniolytics, anti-psychotics

Disordered Eating

- Term that describes a variety of abnormal eating behaviours
- Enormous time spent
- Thinking about food
  - Engaging in behaviours designed to change shape
  - Behaviours do not significantly interfere with life
- Can put you at higher risk for developing an ED
  - i.e. teen girls who engage in strict dieting practices are 18x more likely to develop an ED within six moths compared to non dieters
  - i.e chornic deiting, fasting, skipping meals, smoking

Prevalence of Body Dissatisfaction

- **Children**
  - 26% boys (mean age 8.5 yrs) and 35% of girls want to lose weight (Robinson et al, 2001)
- **Teens**
  - 19% of normal weight girls in grades 9-10 believe that they are too fat (Boyce et al., 2008)
  - 4% of boys in grades 9-10 report using anabolic steroids
  - 12% of normal weight grade 9-10 girls reported attempting to lose weight (Boyce et al., 2008)
  - 17% of boys and 24% of girls report dieting to lose weight (Robinson et al, 2001)
- **Unhealthy weight control behaviours (Neumark-Sztainer, 2002)**
  - fasted, ate little food, used food substitute, skipped meals, smoked more cigarettes
  - 57% teen girls and 33% boys
- **Extreme weight control behaviours**
  - taking diet pills, laxatives, or diuretics or vomiting
  - 12% teen girls and 5% boys
  - 18% very overweight teen girls and 6% boys

Eating Disorder Prevention

- Model healthy eating and exercise habits to children
- Model positive self- talk regarding body
  - emphasis on functional role of body
- Social marketing campaigns to
  - Reduce peer and family weight-related criticism/teasing
    - 30% of girls and 25% of boys in grades 7-12 reported teasing by peers about their weight
    - girls who sport teasing by family members are 1.5X more likely to bing and engage in extreme weight control behaviours
- education re: changes in body shape and size are part of development
- Public policies
  - Obesity prevention efforts need to be focused on healthy eating and physical activity
  - Restrictions on size of models **(i.e. Quebec Charter Healthy/Diverse body image)**

Lecture 16 - Improve Nutritional Status

Who is Intervening

- Governments
  - Federal
  - Provincial
  - Municipal
- Food industry, NGO's, Schools, Communities
- Individuals (i.e. dieticians, doctors, nurses)

Who is Being Targeted

- Entire population
- Adults
  - **young adults, parents, new mothers**
- Children / Adolescents
- Special populations
  - low income, minorities, those suffering from a special medical condition, immigrants

When The Stages of Prevention

- Primary prevention
  - seeks to prevent onset of specific diseases by
- Secondary prevention
  - seeks to detect and treat early signs of disease
- Tertiary prevention
  - seeks to reduce the impact of disease or help individual manage disease

Where?

- Home, Work, School, Hospital, Community

How? Types of Interventions

- Social marketing campaigns
- Decreasing food costs
  - Nutrition North Program
- Policy changes
  - Marketing to children
    - Toy giveaways and food
    - Policies to limit food/beverage marketing
- Food availability
  - Breakfast programs
  - Farmers markets

Effectiveness of Social Marketing Campaigns

- Social marketing can be effective in nutrition
- Systematic review (Gordon et al., 2006)
  - strong evidence re: increasing fruit/vegetable consumption
  - Moderate evidence re: decreasing fat intake
  - Good evidence that influences attitudes towards healthy eating and self-efficacy for eating healthier diet

Perception of Health Messages

- Puhl et al., 2012
  - 30 messages
  - n= 1014 who each rated 10 messages
  - related like-ability, relevance, helpfulness, motivation
    - **Positive ratings and most motivating messages**
      - messages of empowerment, self-efficacy
      - multiple health messages
      - fruits and vegetable messages
      - no mention of obesity/focused on health
    - **Negative ratings and least motivating messages**
      - personal responsibility

Improving Nutritional Status in Schools

- breakfast programs
- vending machine/selection/availability
- fresh fruit/vegetable programs
- no fundraisers tied to unhealthy foods
- limit ordering of pizza/subway
- birthday celebrations
- rewarding children with food
- significant nutrition curriculum

Nutrition North Program

- Federal retail subsidy program aimed at isolated northern communities
- Goal is to increase access to perishable healthy food
  - i.e. Fruit, vegetables
  - Traditional foods commercially-processed in the North
- Businesses registered with the program pass on subsidy to consumers
  - **Fruit, vegetables, milk, eggs, meat, cheese get highest subsidies**
  - **Lower subsidies for foods like flour, crackers, ice cream and combination foods (e.g., pizza)**

Unintended Consequences

- Healthy eating and weight initiatives
  - Can these lead to eating disorders?
  - What is the impact on mental health?
- **Educators need to be sensitized to children's potential**
  - Unhealthy weight practices
  - Issues with body dissatisfaction
  - Issues with low appearance esteem
- Some may interpret in negative ways
- **Adolescence**
  - Increases in body weight/fat
  - Importance of peer acceptance/peer pressure

Policy Changes: Drink Sizes in NYC

- **Sept 2012**
  - NYC Board of Health passes Mayor Bloomberg's proposal
  - A ban of sugary drinks (sodas, teas, and sports drinks) over 16 ounces in fast-food joints, stadiums, movie theaters, and other restaurants
- American Beverage Association + other business groups sued the city and challenged ban
- **March 2013**
  - Ban is struck down by a judge the day before it was to go into effect
  - judge stated that the ban arbitrarily applied some sugary drinks and some locations
    - board of health didn't have authority to issue the ban
    - city filed an appeal

Toys and Food

- December 2011
  - **Healthy Food Incentive Ordinance** bans toy giveaways with children's meals at fast-food restaurants unless meal meets nutritional standards
- McDonald's is now selling the toy for ten cents proceeds go to Ronald McDonald House charity