LECTURE 1 – INTRODUCTION

1. Registered Dietician
   - Protected title (RD) under Health Professions Act (only qualified health professionals can legally use them)
   - Nutritionist: not provincially regulated profession; not necessarily trained in medical nutrition

   a. Required education to practice
      - 4 years of recognized university level education in dietetics + one-year dietetic practicum
      - Registered with CDBC (BC College of Dietitians) and have passed national competence examination

   b. Scope of practice
      - Science of food and human nutrition
      - Assessment of nutritional needs
      - Design, implementation and evaluation of nutritional care plans and therapeutic diets
      - Dissemination of information about food & human nutrition for attaining, maintaining and promoting health

   c. Standards of practice

Professional & ethical practice	• Practice is within scope, with consent, and compliant with legislation • In the public's interest
Communication & Collaboration	• Quality services as a member of the client's interprofessional team • Concurrent (complementary) care to that of other healthcare professionals
Client-centered services	• Services provided reflect the unique client needs, goals, values and circumstances • Grounded in an evidence-informed approach • Underpinned by critical thinking
Leadership, organization & service delivery	• Organizes effective and timely delivery of services • Media promotion is professional and accurate

   d. Areas of practice
      - Hospitals, rehab, long-term care, home care
      - Community health centres
      - Telepractice
      - Recreation facilities
      - Academic & research setting
      - Government offices
      - Food service
      - Private practice
      - Food, food marketing
      - Pharmaceutical industries

2. The Nutrition Care Process (NCP)
   - Systematic approach to providing quality nutrition care
   - NCP steps: nutrition assessment → diagnosis → intervention → monitoring/evaluation
   - Provides a framework for dietician to: individualize care, account for client needs/values, use best available evidence

3. Challenges in nutrition education
   - Understanding patient's beliefs and previous knowledge helps with counseling experience
   - Nutrition behaviors can be influenced by many factors
   - Looking at evidence quoted in articles helps to guide patients with their questions
   - Keep up to date with what's in the news on nutrition & food and know your trusted sources of nutrition information

4. Barriers to health literacy
   a. Individual: social stigma, early childhood experiences, limited formal education, older age, ESL
   b. Systemic: conflicting info and messaging in media (incl. internet), complexity of healthcare system, increasing demand for self-management, challenges to implementing health education into curriculum, lack of English literacy programs, limited workplace education

5. Principles of interprofessional collaboration
   - Client engagement, population-health approach, best possible care/services, access, trust & respect, effective communication

LECTURE 2 – MACRONUTRIENTS PART 1

1. Explain Calorie vs. calorie.
   - calorie = amount of energy needed to raise the temperature of 1 g of water by 1°C from 15-16°C at one atmosphere
   - Calorie = 1000 calories (1 kcal) = amount of energy needed to raise the temperature of 1 kg of water by 1°C ...

2. Compare and contrast BMR (BEE) vs. RMR.

Basal Metabolic Rate (Basal Energy Expenditure)	Resting Metabolic Rate
• = the metabolic activity necessary to sustain life = 25 kcal/kg in healthy individuals • Determined by body size, body composition, gender, and age	

• Measured in a fasting state (min. 12 h)
  o Immediately upon awakening
  o Before any physical activity
	• Measured in a fasting state (min 5 h)
	  o Some movement allowed (dressing, walking) prior to testing
	  o 20 min rest time prior to testing

• Harris-Benedict Equation
  o Overestimates especially in obese patients
• Mifflin-St. Jeor
  o Valid in both obese & non-obese patients
	• With rest time before RMR test, usually only a small difference between RMR and BMR

3. Calculate an estimation of the daily calorie requirements for a given patient as well as appropriate macronutrient ranges (in calories and grams).
   - **TEE = BEE x activity factor + stress factor + TEF + EPOC**
     - TEF: thermic effect of food   EPOC: excess post-exercise oxygen consumption
   - **Macronutrient AMDRs:** carbs 45 – 65%   proteins: 10 – 35% (0.8 g/kg)   fats: 20 – 35%

4. Define EAR, RDA, AI, UL, AMDR.

Estimated Average Requirement (EAR)	• Median daily intake that meets requirement of 50% of healthy individuals in a life-stage or gender group
Recommended Dietary Allowance (RDA)	• Average daily intake sufficient to meet nutrient requirements of nearly all individuals in a particular life-stage or gender group • **Goal for usual intake by an individual**
Adequate Intake (AI)	• Recommended average daily nutrient intake level based on observation or experiments of healthy individuals • Not equivalent to RDA but is goal for usual intake when RDA is not available
Tolerable Upper Intake Level (UL)	• Highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in a given life-stage or gender group • NOT a recommended level of intake
Acceptable Macronutrient Distribution Range (AMDR)	• Range of intake for an energy source (protein, fat, carb) expressed as a % of total energy (kcal) • Associated with reduced risk of chronic disease while providing adequate intakes of essential nutrients

5. List the roles of each macronutrient and their energy content.

Macronutrients	Roles	Energy Content
Carbohydrates	• Turned into glucose → major source of energy for the body • Supply glucose for CNS • Role in metabolism, cell component structure	4 Calories in a gram of carbs
Proteins	NEXT LECTURE	4 Calories in a gram of protein
Fats		9 Calories in a gram of fats

6. Compare and contrast simple vs. complex carbohydrates and identify examples of each. Identify specific mono- and di-saccharides.

Simple carbohydrates	Complex carbohydrates
• <u>Monosaccharides:</u> fructose, galactose, glucose, ribose • <u>Disaccharides:</u> lactose (glucose + galactose), maltose (glucose + glucose), sucrose (glucose + fructose)	• <u>Polysaccharides</u>: multiple units of glucose mono and di saccharides • <u>Oligosaccharides</u>: polysaccharides containing < 10 glucose units • <u>Starches, glycogen, fibers</u>: polysaccharides containing 100 – 1000s of monosaccharides
• Found in healthy foods such as fruits, milk, milk products, vegetables • Also in processed, refined foods (candy, pop, syrups, table sugar)	• Found in healthy foods such as legumes, starchy vegetables, whole grain breads and cereals • Also in processed, refined foods (white flour, sugar, white rice)

7. Describe suggested maximum sugar intake and describe what is meant by "added sugar." Identify sources of natural vs. added sugar.
   - Naturally occurring sugars: fruits, milk   Added sugar: pop, candy
   - ≤ 25% of total daily calories should come from added sugars (< 5% to prevent dental caries)
     o Diabetics: < 10%

8. List the 5 commonly used sugar substitutes and identify which ones are considered safe for use in pregnancy.
   - Safe in pregnancy: aspartame, sucralose, acesulfame K
   - Other: saccharin, cyclamate

9. Explain why sugar substitutes are useful for diabetic patients.
   - Sugar substitutes are thought to have less effect (than sugar) on blood sugars

10. Compare and contrast soluble vs. insoluble fibres and identify examples of each.

Soluble Fiber	Insoluble fiber
Dissolves in water, turns into gel → slows digestion	Does not dissolve in water but becomes bulkier → increases fecal bulk, speeds food transit through stomach, intestines
Oats, barley, flax seeds, beans, lentils, peas, some fruits (apples, oranges, pears, strawberries, blueberries), psyllium, some vegetables (celery, carrots)	Whole wheat, whole grains, wheat bran, corn bran, seeds, nuts, brown rice, fruits, vegetables (cabbage, broccoli), root vegetable skins

11. List four foods that have 6 or greater grams of fibre/serving.
   - 100% whole wheat bread (1 slice), shredded wheat (2 biscuits), lentils (1 cup cooked), all bran cereal (1/2 cup)
   - Recommendations: 1-3 yo: 19 g/d   4-8 yo: 25 g/d   >8y: 25 (female) – 35 (male) g/d   diabetics: 25-50 g/d

12. Describe the glycemic index and identify foods considered to have a low, medium, or high GI.

	Low GI (≤ 55)	Medium GI (56 – 69)	High GI (≥ 70)
Glycemic Index: a scale that ranks carb-rich food by how much (and how quickly) they raise blood glucose levels compared to a standard food (glucose or white bread)			
Breads	• 100% stone ground whole wheat • Heavy mixed grain • Pumpernickel	• Whole wheat • Rye • Pita	• White bread • Kaiser roll • White bagal
Cereal	• All bran • Bran Buds with Psyllium • Oat bran	• Grapenuts • Puffed wheat • Oatmeal • Quick oats	• Bran flakes • Corn flakes • Rice Krispies
Grains	• Barley • Bulgar • Pasta/noddle • Parboiled or converted rice	• Basmati rice • Brown rice • Couscous	• Short-grain rice
Other	• Sweet potato • Yam • Legumes (lentils, chickpeas, kidney beans, split peas)	• New or white potato • Sweet corn • Popcorn • Stoned Wheat Thins • Ryvita (rye crisps) • Black bean soup • Green pea soup	• Baking (Russet) potato • French fries • Pretzels • Rice cakes • Soda crackers

13. Explain how the glycemic load differs from the glycemic index and why GL may better represent the effect of a food or meal on blood glycose levels.
- Glycemic Load (GL) takes into account the quality (GI) and quantity (amount) of carbohydrates
  - GL < 10 = low   GL 10-20 = moderate   GL > 20 = high

LECTURE 3 – MACRONUTRIENTS PT 2

1. Describe the functions of the macronutrients proteins and fats.

Proteins	Fats

• Growth, maintenance, and movement
    o Integral parts of body structures
    o Support growth & repair of body tissues
• Immunity: Ab, cytokines, chemokines
• Enzymes: facilitate chemical reactions
• Hormones
• Regulate gene transcription & translation
• Fluid & electrolyte balance
• Acid-base balance
• Transportation: lipids, vitamins, minerals
• Storage of macronutrients
	• Source of energy
	• Provide critical structural and metabolically functional components of all biological membranes
	• Aids in absorption of fat-soluble vitamins: ADEK

2. Calculate suggested macronutritional ranges (in grams) for adults based on the AMDRs and a given daily Calorie goal.
Macronutrient AMDRs: carbs 45 – 65%   proteins: 10 – 35%   fats: 20 – 35%

3. Identify the differences between essential, non-essential, and conditionally-essential amino acids.

Essential	Non-essential	Conditional
• Cannot be physiologically synthesized in human body • Rich sources: food of animal sources (dairy, poultry, eggs)	• Can be physiologically synthesized in the human body • NOT required from diet	• Usually non-essential except in times of stress or illness

4. Identify proteins that are considered to be of higher quality compared to other proteins.

Protein Efficiency Ratio	Biological Value	Net Protein Utilization	Protein Digestibility Corrected Amino Acids Score
Determines effectiveness of a protein through measurement of animal growth	Provides measurement of how efficient the body utilizes protein consumed in the diet		Based on essential amino acid requirements and corrected for true fecal digestibility of the test protein
PDCAAS is preferred method for measurement of protein value in human nutrition: • Casein, egg, milk, whey protein = scores of 1.00			

5. Define the three types of vegetarianism discussed.

Lacto: milk allowed   Lacto-ovo: milk & eggs allowed   Vegan: no animal products (milk, egg, honey)

6. Explain the difference between complete and incomplete proteins. Describe how a non-meat/dairy eater can ingest adequate complete proteins.
    * Plant sources are often deficient in at least one of the essential amino acids
    * Strict vegetarians must ensure a proper mixture of amino acids by mixing different plant proteins <u>throughout the day</u>

7. Describe the two key ways in which fatty acids are characterized.
    * **Chain length:** # of carbon atoms
    * **Degree of saturation:** # of double bonds

8. Describe how unsaturated and saturated fats differ in structure
    * Answered in LO # 9

9. Describe key features of the four types of fatty acids and identify food sources of each type.

	Unsaturated		Saturated	Trans-Fats
	Monounsatured	**Polyunsaturated**		
Structure	One double bond between two carbon atoms	Two or more double bonds within the hydrocarbon chain	No double bonds	
Daily Intake	Most of total daily fat should come from this		• < 10% of total daily calories • ≤ 7% if dyslipidemia	Limit intake to < 1% of total daily calories
Sources	• Vegetable oils (olive, canola, peanut) • Avocados • Natural peanut butter • Nuts, seeds	• Omega-3 • Omega-6	• Animal meat • Dairy • Coconut	• Commercially baked pastries, cookies, crackers • Foods deep-friend in partially-hydrogenated oils, stick margarines, shortenings (other than pure lard)

10. Describe trans-fats and why their intake should be limited.
    - Associated with a variety of health conditions
    - Limit intake to < 1% of total daily calories
        - Probably achieved from naturally-occurring trans-fats in milk, meats (which aren't implicated in health issues)
        - Suggested to avoid manufactured products containing trans-fats

11. List the omega-3 and omega-6 fatty acids, their role, and explain how a person can achieve the recommended intake.

Omega-3	Omega-6
Alpha-linolenic acid (ALA): 1.1 – 1.6 g daily • Walnuts, omega-3 eggs, flaxseed, soybean & canola oil	Linoleic acid • Soybean, safflower or corn oil
Docosahexaneoic acid (DHA) & Eicosapentaenoic acid (EPA) • 2 services of fatty fish weekly • Salmon, anchovies, herring, sardines, Pacific oysters, trout, mackerel	

12. Discuss the evidence for daily water intake recommendations.
    - "Adequate Intake" suggestions (Health Canada)
        - Total water (from foods, water, other beverages):   3.7 L/day (males)   2.7 L/day (females)
    - No scientific proof to "drink at least eight glasses of water a day"
        - In the exception of some diseases and special circumstances, we are probably drinking enough!

13. Recommend appropriate caffeine limits for a given patient.
    - Adults: 400 mg/day
    - Children: 4-6 y: 45 mg   7-9 y: 62.5 mg   10-12 y: 85 mg

14. List the suggested guidelines for alcohol intake.

Reduce risks	Women	Men
Long-term	• 0 – 2 standard drinks per day • ≤ 10 standard drinks per week	• 0 – 3 standard drinks per day • ≤ 15 standard drinks per week
	• Have some non-drinking days per week	
Short-term	3 standard drinks per day	4 standard drinks per day
	This UL should happen only occasionally & keep consistent with weekly guidelines: • Drink with meals (not on an empty stomach) • ≤ 2 standard drinks in any 3-hour period • Alternate with caffeine-free, non-alcoholic drinks • Avoid risky situations and activities	
Standard drinks	• 13.6 grams of alcohol ○ Wine: 142 mL (5 oz) Spirits: 43 mL (1.5 oz) Beer: 341 mL (12 oz)	

15. Describe the purpose of the Canada Food Guide.
    - Communicates amounts and types of food to help:
        - Meet nutrient needs & promote health   (NOTE: might not necessarily meet calorie needs)
        - Minimize risk of obesity, T2DM, heart disease, certain types of cancer, osteoporosis

16. Describe key differences between the Canada and Brazil Nutrition Guide.
    - Canadian: milk, egg, grains
    - Brazilian: social eating, focusing on not eating processed foods
    - Both: whole foods, less trans fats

17. Interpret a nutritional value label.

LECTURE 4 – DIGESTION, ABSORPTION AND TRANSPORT OF NUTRIENTS (PT 1)
<< All pictures??? >>>

1. Describe the mechanical and biochemical processes involved in the digestion of food and absorption of nutrients in the digestive tract.
   - **Mechanical digestion:**
     - Peristalsis: bolus of food can move along GIT through controlled and rhythmic action of the circular movements (squeezing) and longitudinal muscles (propelling)
     - Segmentation: circular muscles alternate contracting and relaxing, creating "segmentation," which moves the bolus/chyme back and forth (allowing it to mix with digestive juices)
   - **Chemical digestion:** enzymes

2. List and identify the major functions of key regulatory hormones and peptides involved in the digestion and absorption of nutrients.

Nervous system	Parasympathetic	• Stimulates activity • Increases muscle contraction, secretions and GI reflexes
	Sympathetic	• Inhibits activity • Decreases smooth muscle contraction, constricts sphincters
Enteric nervous system	Myenteric plexus	• Controls peristalsis
	Submucosal plexus	• Controls secretions and blood flow

	• Linked to CNS via vagus nerve
	• Controls reflexes (gastroileal, ileogastric, colonoileal)
	   ○ Gastroileal: when stomach is stimulated, ileum is stimulated
	   ○ Ileogastric: when ileum is stimulated, stomach is inhibited	

   - Also, RE: LO #3

3. List and describe the sources, roles and products of major digestive enzymes secreted into the digestive tract.

Hormone	Origin	Target	Response	Enzymes	Action
Gastrin	Stomach	Stomach	Secretion of gastric juices	Pepsin	Protein digestion
Secretin	Small intestine	Pancreas	Secretion of pancreatic juices	Pancreatic amylase	Carbohydrate digestion
				Pancreatic lipase	Lipid digestion
				Trypsin	Protein digestion
CCK					
	Small intestine	Gall bladder	Secretion of bile	No enzymes	Emulsification of dietary fat
GIP	Small intestine	Stomach			Slows gastric motility

4. List and describe the roles of major enzymes involved in carbohydrate digestion.

Saliva	• Amylose & amylopectin → dextrins via **salivary α amylase**
Stomach	• No further digestion
Small Intestine	• Dextrins → maltose, maltotriose, limit dextrins via **pancreatic α amylase**
Enterocytes	• Maltose → glucose via **maltase** • Limit dextrins → glucose via α **dextrinase (isomaltase)**

5. Describe how monosaccharides are absorbed and transported to body tissue.

Sodium/glucose co-transporter protein	• Transports glucose/galactose with sodium into enterocyte (ATP) 　○ Glucose then passively diffuses into bloodstream 　○ NaK ATPase pump releases sodium into blood in exchange for K
GLUT 2	• High affinity for glucose and galactose; can also transport fructose • Highly active when [glucose] high in lumen and low in blood 　○ GLUT2 facilitates transport of glucose from lumen into enterocyte AND from enterocyte into bloodstream • Once some glucose is released into the blood, insulin is released which downregulates the function of GLUT2
GLUT 5	• Fructose transporter
GLUT 1, 3	• Glucose and galactose transporter
GLUT 4	• Glucose transporter • Activity dependent on insulin

6. Identify the roles of the large intestine in nutrient production and absorption.
   - Absorbs majority of water, along with electrolytes
   - Transmits feces (dietary fibers, sloughed cells, some water, few unabsorbed nutrients)

7. Describe how dietary fibre is classified and processed in the digestive tract.

	Soluble fibers	Insoluble fibers
Properties	• Dissolve in hot water • Very high water holding capacity • Fementable	• Do not dissolve in water • Water holding capacity • Non-fermentable
Include	Gums, pectins, beta-glucans, fructans, some hemicelluloses	Cellulose, lignin **(not a carb)**, some hemicellulose
Sources	Oats, barley, legumes, some fruits (pears, apples)	Wheat, corn, nuts, seeds

8. Describe ways in which adequate dietary intakes support the integrity of the gastrointestinal mucosa.
   - RE: LO # 9 (?) and picture of flowchart on slide 39 and 40

9. Describe several ways in which dietary fibre affects intestinal flora and contributes to disease prevention.
   - Dietary fibers can bind water leading to increased fecal volume, which allows good bacteria to flourish in the intestine
   - Soluble fibers (and to some extent insoluble fibers) can be degraded/fermented
     - Promotes growth of good bacteria in the colon
     - Generates lactate and short chain fatty acids → support health of the colon with long-term metabolic effects

10. List and describe examples of how disease/healthy conditions can compromise nutrient intakes, digestion and absorption.

LECTURE 5 – DIGESTION, ABSOPRTION AND TRANSPORT OF NUTRIENTS (PT 2)

1. Describe the different nutrient absorption process.
   - **Diffusion**: passive, no energy required
   - **Facilitated diffusion:** no energy required but needs a protein carrier
   - **Active transport:** requires energy and a protein carrier
   - **Endocytosis:** energy is used to bring molecules across

a. Protein digestion and absorption:
   i. Describe where and how protein is digested
   ii. Explain what hormones are released in protein digestion
   iii. List the proenzymes that are stimulated for protein digestion

Answer to all 3:

Area	Hormones	Enzymes	End Products
Mouth	No digestion		
Stomach	Gastrin + gastrin-releasing peptide + acetylcholine + histamine → **HCl release**	HCl converts **pepsinogen → pepsin** • Pepsin (functions at pH <3.5) hydrolyzes peptide bonds	• Large polypeptides • Oligopeptides • Small peptides • Free amino acids
Small Intestine	**Secretin + cholecystokinin (CCK)** from mucosal endocrine cells → pancreas → release pancreatic enzymes	Pancreatic (pro)enzymes: • Trypsinogen • Chymotrypsinogen • Procarboxypeptidases A & B • Proelastase • Collagenase	• Free amino acids • Di and tri peptides
Small Intestine Brush Border		• Aminopeptidases • Tripeptidases • Dipeptidases	• Free amino acids • Peptides

   iv. Describe the brush border absorption of amino acids versus absorption of peptides

Brush border absorption of amino acids	Peptide absorption into enterocyte
• Most AA absorbed in proximal (upper) SI • Sodium dependent & sodium independent transport systems exist • Competition between AA for transport by common carriers • Branched chain AA and essential AA are absorbed quickly	• 67% of AA absorbed in form of small peptides o Peptides absorbed more rapidly • Inside enterocyte peptides are hydrolyzed by **cytoplasmic peptidases** → amino acids

Within the intestinal cell, amino acids may be used for:
- Energy (glutamine extensively used)
- Synthesize compounds: apoproteins, enzymes, hormones, nitrogen-containing compounds
- Transport to liver

b. Lipid digestion and absorption

    i. Describe where and how lipids are digested

    ii. Explain what hormones are released in lipid digestion

    iii. Describe the function of bile and micelles in lipid digestion and absorption

Answer to all 3:

Mouth	• Lingual lipase released
Stomach	Limited digestion by lingual lipase • Can penetrate milk fat globules (important in infant digestion) • Acts on triacylglycerols containing medium (MCT) or short chain (SCT) TGs o MCT & SCT metabolized more directly than long chain TGs (LCT) • Stomach muscle contractions → emulsification

Small Intestine	• CCK released and stimulates:
	   o **Bile** release from gall bladder
	     ▪ Helps with emulsification of fats
	     ▪ Bile salts travel along GIT to ileum → absorbed & recycled through liver → back to gallbladder for storage
	   o Pancreatic juice release from pancreas containing **pancreatic lipase**

    iv. Describe the difference for absorption between smaller lipid particles (water soluble) versus larger lipid particles (non-water soluble)

Smaller lipid particles	Larger lipid particles

• Diffuse into intestinal cells and out into bloodstream to liver	• TG and phospholipids are reformed inside the intestinal cell → **chylomicron (lipoprotein)**
	   o Composition:
	     ▪ Protein and phospholipid shell (hydrophilic)
	     ▪ Fats tucked inside (hydrophobic)
	   o Features
	     ▪ Transports endogenous lipids
	     ▪ Processed through other tissues
	     ▪ Carry lipids from tissue to tissue

2. Describe the nutrient transport systems: blood stream and lymph

Bloodstream (water-soluble products)	Lymph (dietary fats)

1. Water-soluble products of digestion (monosaccharides, small lipids, glycerol, amino acids, water soluble vitamins & minerals) leave the intestinal cells and enter **villi capillary beds**
2. Blood leaves the capillaries and collects in the **portal vein** which leads directly into the **LIVER**
  a. Overall liver functions:
    • 1st opportunity for water soluble nutrients
    • Gatekeeper for foreign or toxic substances
    • Drug metabolization
  b. Fate of AAs in the liver:
    • Used to synthesize new proteins
    • Used as immediate energy source by liver
    • Released into blood for use by other cells
    • Converted to non-protein molecules (glucose, fat)
3. Blood leaves liver via **hepatic vein** to nourish **cells**
	1. One-way route for fluid from tissue spaces to enter the blood (has no pump – unlike vascular system)
	2. Collects in **thoracic duct** behind the heart
	3. Thoracic duct opens into **subclavian vein** → enters blood
	4. Once circulating in bloodstream, **chylomicrons** are acted upon by **lipoprotein lipase (LPL)**
	  a. LPL found on endothelial cells of blood vessels and outside of adipose & muscle cells
	  b. LPL hydrolyzes TGs into:
	    i. Fatty acids → adipose (storage) or muscle (fuel)
	    ii. Glycerol → bloodstream → liver (glucose)
	5. As TGs are removed from chylomicrons, chylomicrons shrink in size → **chylomicron remnant (CR)**
	6. Liver removes CR from circulation
	  a. Uses CR remnant (cholesterol, protein) to make other compounds needed (bile, glucose, vitamin D)
	  b. Although **body cells gain access to dietary fats** before liver does, it is not an issue because liver is able to synthesize all the fats the body needs

4. Vitamin D:
   a. List two major forms of vitamin D and where they are found in nature.
      - **Plants:** ergosterol → ergocalciferol (vitamin D)
      - **Animals:** 5,7 cholestradienol (aka 7-dehydrocholesterol) synthesized in sebaceous glands of skin

   b. Describe two major ways vitamin D is absorbed and transported.

Absorption	Transport

- Absorbed by passive diffusion from a micelle in association with lipid absorption (50% of dietary vitamin D absorbed)
- Absorbed rapidly in duodenum but largest amount from distal small intestine
- Incorporated into chylomicron → lymphatic system → blood
	- Both chylomicrons and DBP (binding protein) delivers to the liver
	   ○ In the liver, vitamin D is converted by 1<u>st</u> hydroxylation with **25-hydroxylase** to **vitamin D3** (*cholecalciferol* or 25-OH D3)
	- Vitamin D3 is transported by DBP to the **kidney**
	   ○ In the kidney, vitamin D3 is converted by a 2<u>nd</u> hydroxylation with **1-hydroxylase** to *calcitriol* (1,25-$(OH)_2$ D3)
	   ○ Activity of 1-hydroxylase influenced by: PTH, ↓Ca^{2+}, ↑ calcitriol
	- Once synthesized in the kidneys, **calcitriol** is released and bound with DBP → target tissues
	   ○ Bone, intestines, kidney, cardiac, muscle, brain, skin, immune system tissue

   c. Know the active form of vitamin D.
      - **Calcitriol** (1,25 (OH_2 D3)

5. Calcium:
   a. Describe how and where calcium is absorbed and the link between vitamin D and calcium absorption.

Two main transport processes for absorption (only absorbed in ionized Ca^{2+} form)	

Saturable	- Requires energy and calcium binding protein (CBP)
	- Stimulated by low calcium diet, conditions of growth, pregnancy and lactation
	   ○ <u>**Regulated by *calcitriol***</u>: low ionized calcium → increased PTH → calcitriol release
	- Steps for calcium absorption:
	   1. Entry at brush border
	   2. Intracellular movement
	   3. Extrusion at basolateral membrane

Non-saturable	- Small intestine (mostly jejunum, ileum): passive, paracellular (depending on supply of calcium) - Large intestine (colon): may release calcium bound to fermentable fibres such as pectins ○ Up to 4% (8 mg) of dietary calcium absorbed this way

   b. Describe how calcium is transported in the blood in three forms.
      - 40% bound to proteins (albumin, prealbumin)
      - 10% complexed with sulfate, phosphate, citrate
      - 50% free (ionized) in blood

   c. Understand the relation between albumin levels and calcium levels and correcting blood calcium levels for albumin.
      Corrected Ca (mmol/L) = **Ca** measured (mmol/L) + 0.020 or 0.025 (40 – **albumin** (g/L))

6. Thiamin:
   a. Describe the key points of absorption and transport.

Absorption	Transport
• Intestinal phosphatases hydrolyze the phosphates from thiamin diphosphate • Free thiamin is absorbed by active and passive transport • Within mucosal cells, thiamin is phosphorylated	• Thiamin transport across basolateral membrane is sodium and energy dependent • Thiamin in the blood is typically in its free form bound to albumin • 90% of thiamin transfers into RBCs via facilitated diffusion • Transport of thiamin into other tissues requires energy o 50% of thiamin contained in skeletal muscle

   b. Describe what can interfere with thiamin absorption.
   • Antithiamin factors can be present in diet hindering absorption
     o **Thiaminases** in raw fish (thermolabile)
     o **Polyhydroxyphenols** in tannic & caffeic acids (thermostable)
     o **Other polyhydroxyphenols** in fruits & vegs (black currents, blueberries, Brussel sprouts, red cabbage)
   • Thiamin destruction may be prevented by reducing compounds such as vitamin C and citric acid
   • Conditions that may cause thiamin deficiency:
     o Malnutrition; diets made up of primarily **un**enriched grain products; excess glucose IV infusion
     o Elderly population; cancer; biliary disease; inflammatory bowel disease
     o Alcoholism (Wernicke's encephalopathy or Wernicke-Korsakoff syndrome): ethanol interferes with active transport of thiamin from mucosal cells across basolateral membrane
     o Folate and protein deficiencies: impair enterocyte turnover, can diminish thiamin absorption

7. Understand an overview of where different minerals and micronutrients are absorbed.

Fat soluble vitamins: ADEK	Water-soluble vits: C & B	Minerals: Ca, Zn, Fe, Mg, etc
• All: jejunum and duodenum • Vitamin D: duodenum → ileum • Vitamin K: duodenum → colon	• Duodenum → ileum	• Predominantly duodenum and jejunum • Copper, molybdenum: stomach & duodenum • Fluoride, iodide: stomach

LECTURE 6 – BRIEF INTERVENTION AND MOTIVATIONAL INTERVIEWING

1. Describe the key elements of motivational interviewing (MI) practice.

Express empathy		
Develop dissonance (discrepancy)	• Change is motivated by a perceived discrepancy between present behavior and important personal goals or values	Decisional balance: • Patient's "pros" and "cons" of change need to be explored • Balance needs to be tipped for change to occur • Explaining pros to a patient who is not ready forces the patient to explain the barriers and cons (want to EXPLORE not EXPLAIN)
Roll with resistance	• <u>Issue resistance:</u> empathize and explore • <u>Relational resistance:</u> respect and roll with it, apologize, when appropriate shift	How to roll with resistance: • Repeat back your understanding: empathy, paraphrase, summarize • Explore pros and cons for change • Ask permission to give advise • Shift (ex// from informational → empathetic) • Avoid argumentation
Support self-efficacy (confidence)	• Communicate that patient is capable of change • Notice (and let person know) the positive behaviors and statements • Suggest alternatives, solicit suggestions • Offer options for achievable small steps toward change	

2. Discuss how MI can be used to support adherence in nutrition and other areas of pharmacy practice.
   - Of those needing to change behavior, 50 – 70 % are not ready

3. Understand the impact of MI and how it is applied to encourage behavioral change.
   - Dissonance/discrepancy: from weighing pros & cons of change
   - Explore importance of changing to the patient and patient's confidence to change
   - Autonomy and respect: choice to change must be the patient's; must feel respected for where they're at
   - Decisional balance: balance of pros and cons needs to be tipped for change to occur

4. Understand the spirit and principles of MI.

Autonomy	• Respect the client's perspective, decisions and choice • Ask "permission" to provide support and information
Collaboration	• Work in partnership with the patient • Remain non-judgmental and non-confrontational
Evocation	• Explore what motivates the patient • Respect patient values, concerns, expertise
Empathy/ Compassion	• Keep the patient's best interest at heart • Change can be quite challenging!

5. Describe the basic steps, skills, and communication methods (conversation flow) used in the brief intervention/motivational interviewing (5 A's and 5 R's).

5 A's		
ASK	• Ask patient to describe their status with behavior • Open-ended questions preferred	
ADVISE	• Support patient autonomy • Ask permission to discuss health behavior issue further	

ASSESS	• Determine readiness to change behavior
	• Ask 3 questions in relation to readiness, importance, and self-efficacy (USE A SCALE from 1 – 10)
		• If willing to change behavior:
		  o Give praise
		  o Offer assistance with changing behavior
		• If unwilling: use 5 R's

ASSIST	• Help the (ready) patient develop a plan • Provide counseling and identify social support(s) • Recommend pharmacotherapy options (if applicable) • Provide info and advise to patient to support behavior change • Ask permission to give advise, materials, or resources	Create a plan using STAR approach: **S**et a change date (ideally w/in 2 wk) **T**ell family/friends/coworkers about change (ask for understanding and support) **A**nticipate challenges **R**emove barriers
ARRANGE	• Arrange a follow-up contact with patient • Refer patient to specialist support (if needed)	

5 R's	
RELEVANCE	• Ask patient about how changing the behavior may be personally relevant
RISKS	• Ask about pros and cons (decisional balance) → develop discrepancy
REWARDS	• Ask patients to identify pros/cons that are personally relevant • Paraphrase/summarize benefits and risks stated by patient o TIP: start with pros, end with cons • Restate the discrepancies heard
ROADBLOCKS	• Encourage the patient to identify barriers to changing the behavior • Note elements of treatment (problem-solving, pharmacotherapy) that could address barriers

REPITITION	• Repeat assessment of readiness to change
	    o If still not ready, end intervention positively and repeat 5 R's intervention at a later date
	        ▪ 5 R's should be repeated every time an unmotivated patient visits pharmacy
	    o If ready to change, proceed with the 5 A's

LECTURE 7 – ASSESSMENT OF NUTRITION STATUS (PT 1)

1. Be able to define nutrition status.
   - Degree to which physiological nutrient needs are met; the balance between nutrient intakes & nutrient requirements
   - Depends on multiple factors:
     o Socioeconomic factors, culture
     o Geography & environment
     o Age & gender
     o Mental health & emotional well-being
     o Disease/stage, illness & health conditions

2. Be able to define assessment of nutrition status.
   - Systematic methods for obtaining, verifying & interpreting data needed to identify nutrition related problems, their causes and significant

   a. Be able to describe the domains of assessment of nutrition status.

	Data	Indicators	Criteria
Food/nutrition-related history	• Food intake • Current therapeutic diets • Rx, NHPs, CAM • Knowledge, beliefs, attitudes, behaviors • Nutrition-related pt-centered measures • Factors affecting intake/access • Physical activity and function	• Energy • Carbs • Protein • Fat • Dietary fibre • Water • Ethanol • Micronutrients • Electrolytes	• DRIs • Eating guides • Consensus guidelines and references
Client history	• <u>Patient hx:</u> age; gender; ancestry, culture, language • <u>Social hx:</u> socio-economic status (occupation, education, role); home situation; social supports • <u>Medical hx:</u> diseases (incl. stage); illnesses & conditions having nutritional impact		

Continued...	Data	Indicators	Criteria
Anthropometric measurements	• Height • Weight • Body ht/wt changes • Body composition	• BMI • Weight hx (changes) • Waist circumference • Growth patterns • Skin fold thickness • Bioelectric impedance analysis (BIA) • Underwater weighing • Dilution methods • Air displacement plethysmography	• Guidelines for goals (BMI, waist circumference, weight) • Growth patterns
Biochemical data, medical tests, procedures	• <u>Lab data:</u> blood chemistry (electrolytes, creatinine, urea, glucose, Hb A1c); lipid panel; hematology; iron studies; specific nutrients; urine analysis; absorption studies • <u>Diagnostic interventions:</u> biopsy or endoscopy results • <u>Imaging:</u> video fluoroscopy; gastric emptying time; feeding tube or central line placement; bone density	• Normal values and reference ranges • Reference ranges for specific disease state • Best practice guidelines or goals	
Nutrition focused physical findings	• Level of consciousness • Cognition • Ability to self feed • Respiratory function • Hydration status • Appetite, satiety • Oral healthy, swallow function, GI symptoms • Adipose and muscle bulk • Skin appearance		

b. Be able to describe the components of assessment of nutrition status.

Review	• Review collected data for factors that affect nutritional and health status • Identify *indicators* of nutrition care that can be used to observe, measure and potentially monitor & evaluate progress towards the resolution of the nutrition problem(s)
Cluster	• Group individual assessment data that define the suspected nutrition problems (example S/S) • Clustering helps validate/confirm suspected findings to support the selection of the correct nutrition problems
Identify	• Select standards (*criteria)* of nutrition care against which assessment data (*indicators*) will be compared • Standards (national, regional, institutional) may be practice guidelines, consensus statements, regulation or safety parameters, goals o Will vary based on practice setting; pt age; disease/illness, stage of care, severity

3. Be able to recognize critical thinking as an inherent underpinning to the validity & reliability of the results obtained from an assessment.
- Nutrition status assessment involves critical thinking at all stages
  a. Appropriate data collection, distinguishing b/w relevant/irrelevant data, validation of data, need for additional data
  b. Selection of tools & procedures relevant to a given situation and use of these resources in a valid & reliable way
  c. Identification of nutrition problems
  d. May prompt re-assessment with additional information, resulting in revision of identified problems

4. For each domain of nutrition assessment, identify and discuss the advantages and limitations for various data sources, collection methods, nutrition care indicators, nutrition care criteria.

Food/nutrition-related history tools/methods	Advantages	Disadvantages
Food Intake Record	• Real time • Intake over time • May include quantity, preparation methods, meal & snack times	• Requires skill, literacy • Subject to bias • Labour intensive
Food Frequency Questionnaire	• Amenable to standardization • Efficient for deriving overall picture or focusing on specific foods	• Requires literacy, knowledge of portion sizes • Does not provide meal pattern data
24-hr recall	• Quick	• Requires ability to recall, knowledge of portion sizes • May not be representative • Requires interviewer skills
Food Intake History (interview)	• May employ a variety of methods • Adaptable to situation, indications	• Requires interviewer skill • Variability between interviewers
General challenges with food history tools	• Observed intake ≠ usual intake • Variables: variety of foods, day of the week, patterns of behavior/activities, season, appetite • May take months of observation to capture usual intakes	

5. Describe the indications, advantages, and limitations of nutrition status screening tools.
   - Screening tools are methods for identifying patients who are at nutritional risk and indicate a full nutritional assessment
   - **Subjective global assessment:** predictor of nutrition status & tool for reassessment
     o Weight & diet changes, GI sx, functional capacity, metabolic demand of disease + quick physical assessment
   - **MUST (Malnutrition Universal Screening Tool):** predictor of nutrition risk
     o BMI, weight change, metabolic demand of disease
   - **Nutri-e-STEP:** for pre-school children that can be utilized by HCP and non-HCP (including parents)
     o Growth, dietary intake patterns, food security, development, physical activity

LECTURE 8 – ASSESSMENT OF NUTRITION STATUS (PT 2)
<< All Cases >>

LECTURE 9 – INFANT NUTRITION

1. List the main components of breast milk.

Carbohydrates (lactose)	• 50% of total calories
Protein (whey & casein)	• < 10% of total calories • 60% whey : 40% casein (whey is easier to digest)
Fat	• 40 – 50% of total calories • Triglycerides (medium – long chain); lipase
Water	• Content higher than in some formulas • Helps prevent constipation
Lactoferrin	• Iron binding protein → helps baby absorb iron • Antibiotic, antifungal, antiviral properties
Motilin & Gastrin	• Stimulates production and release of bile and pancreatic enzymes
Secretory IgA	• Antibody in GIT and lungs → first line defense against ingested pathogens
Lysozymes	• Bactericidal (E. coli, Salmonella, etc)

- Composition of breast milk changes over time:
  - **Colostrum:** 1st few days of life, fewer nutrients, +++ antibodies
  - **Mature milk:** 7 – 10 days of life, thinner, increased water content
    - **Fore milk:** lower fat content   **Hind milk:** increased fat content

2. Explain the advantages of breastfeeding for the infant and for the mother.

Mother	Infant
- Recovery of uterine size & tone - Weight loss - Bonding - Convenient - Inexpensive - No other equipment required	- Provides all the energy & nutrients baby requires in first months of life 6-12 months of age: provides ½ nutritional needs of infant - Optimal whey:casein for better absorption/digestion - Gut microflora: lactobacilli, bifidobacterial - Optimal cholesterol, omega-3 - Protection against infection: - Contains maternal immunoglobulins (Abs) - Phagocytes, lysozymes, lactoferrin

3. List the contraindications to breastfeeding.

Maternal	Infant
- HIV - Tuberculosis: ok if mom has at least 2 wks of effective txt - HSV: if local herpes lesions present	Metabolic diseases (rare, many of them) - Phenylketonuria (PKU): lack enzyme to breakdown phenylalanine → accumulation → seizures, neurodevelopmental delay - Breastmilk contains phenylalanine - Galactosemia: lacks enzyme to break down galactose → galactose accumulation → liver disease, developmental delays - Breastmilk contains lactose (glucose + galactose)

4. Describe the types of infant formulas available.

RECOMMENDED	- Infant with special dietary needs - Infants who are breasted but not growing as expected - When weaning breastmilk (5-6 months of age) - Mom who cannot or choose not to breastfeed
Healthy term infants	- Cow-milk based - Iron fortified
Special products	Formulas for specific medical condition(s) - Premature infants - Allergies/intolerance (lactose free, soy free, etc) - Specific metabolic diseases - Chronic kidney disease (low protein)
Transitional products	- Marked for infants 6-12 months of age - Not necessary
Types of formulas	- Ready to use - Powders: cheaper, need clean water, mixing instructions vary - Concentrates: same dangers as powders, often confused with ready to use

5. Explain which infants require vitamin D, vitamin K, vitamin B12, and iron supplementation.

• Formulas contain adequate iron, vitamin D, vitamin B12 and vitamin K for normal infants	

Vitamin K	• Given to all babies born in BC to prevent vitamin K deficiency bleeding in newborns
	• Causes of vitamin K deficient-bleeding:
	  o Inadequate activity of vitamin K-dependent coagulation factors
	  o Low levels of vitamin K at birth
	• Two options for dosing:
	  o Vitamin K 1 mg IM/SC x 1 dose
	  o Vitamin K 2 mg PO daily with first feeding, then at 2-4 wks & 6-8 wks (x 3 doses total)

Vitamin D	• Vitamin D 400 IU PO daily given until formula or cow's milk added to diet • Improves bone health and prevents Ricketts

Iron	• Added only if baby is anemic or has specific increased needs for iron
	• Consider if mom is strict vegan or was anemic during pregnancy
	• Ferrous sulfate or Ferrous fumarate liquid used (caution re: concentrations, constipation)
	  o Supplement: 1-2 mg elemental Fe/kg/day PO divided q8-24h
	  o Treatment: 1-2 mg elemental Fe/kg/dose PO q8h

Vitamin B12	• Only if mom is strict vegan

6. Explain recommendations for introduction of cow's milk, honey, and potentially allergenic foods.

Birth to 6 m	• Breastfeeding recommended exclusively • Breastfeeding initiated within 1st h after birth for: bonding, skin-to-skin & learning purposes

6-12 m	• Introduction of solid foods and continue breastfeeding
	  o **Iron-rich foods** (minced, mashed, shredded meats & iron fortified infant cereal)
	    ▪ Iron deficiency unlikely in breastfed babies 0-6 m (adequate iron stores)
	    ▪ After 6m iron stores depleted (breastmilk doesn't contain much iron) → needs to be replenished
	• After introducing iron rich foods, **all other groups** (veggies, fruits, gains) can be introduced
	  o Mix up textures and flavors
	• Introduce **potentially allergenic foods** (peanuts, seafood, soy, tree nuts, wheat) <u>early and often</u>
	  o Regular ingestion of foods is important to develop & maintain tolerance
	  o Wait 2 days b/w introduction of each group (if reaction occurs - most likely within 48h)

9 – 12 m	• Introduce cow's milk

After 12 months	• Honey (not pasteurized)
	  o May contain *Clostridium botulinum* spores → produces toxins → botulism
	    ▪ **Botulism:** weakness, paralysis, death
	    ▪ Infants < 12 m have immature immune system & GIT = increased risk

7. Compare and contrast breastmilk, formula and cow's milk in the context of infant nutrition.

	Cow's Milk	Breast Milk	Formula	Comments
Water content	Lower	Higher	May be lower	Cow's milk ↑ risk of dehydration
Whey : casein	20:80	60:40 (ideal)	Depends	Cow's milk more difficult to absorb → diarrhea
Calcium : phosphate	1:1	2:1		Breast milk higher in absorbable calcium
Iron deficiency anemia	Interferes with iron absorption from other foods		Fortified	
Vitamin D	Fortified	Inadequate	Fortified	Breastfed babies require supplementation
Vitamin C	Inadequate	Adequate		
Protein content	Higher	Lower		Cow's milk increase solute load for kidneys

8. Describe the controversies around infant formula marketing.

9. Describe how normal growth in an infant is monitored and the WHO growth charts.

Normal Growth		Assessment of adequate intake
Age	**Weight**	- Weight gain - Linear growth - Wet diapers - Soft, yellow stools - Content, happy baby - Hydration status
10 days	Lose 5-10% of birth weight	
14 days	Back to birth weight, then gain 25-30 g/day	
3 months	Gain ~ 500 g/month (15 g/day)	
4-6 months	2x birth weight	
12 months	3x birth weight	
> 2 years	Gain ~ 2.25 kg per year	

WHO Growth Charts			
Children included	- No health, environmental, economic constraints on growth - Singleton, term-birth (37 wk ≤ 37 wk < 42 wk) - Absences of significant morbidity - Willing to follow health and feeding recommendations - Non-smoking mother - Exclusive or predominant breastfeeding for ≥ 4 m - Introduction of complementary foods between 4 – 6 mo - Partial breastfeeding to be continued ≥ 12 mo - Routine pediatric health care visits and immunizations		
Strengths	Growth *standard* (versus growth *reference*) - Perspective, based on healthy children - Best portrayal of physiological growth - Consistent with current nutrition recommendations - Establish breastfed child as normative model for growth		
Versus CDC Growth Charts		**CDC**	**WHO**
	Longitudinal vs. cross-sectional growth monitoring	- Children sampled once - Measurements at 3 mo intervals	Each infant measured 21 times between birth and 24 months
	Address obesity epidemic	Removed most current weight data for ≥ 6 y (but not < 6 y)	- Excluded points > 99.9th percentile (3 z-scores) for birth – 2 years - Excluded points > 97th percentile (2 z-scores) for 2-5 years
	International sample population	Single country (USA) growth pattern	Similar growth among varied cultural and ethnic backgrounds of 6 developed and developing countries

LECTURE 10 – PREGNANCY AND WELLNESS

1. Discuss the evidence for use of specific vitamins and minerals for pregnancy wellness. Formulate, where appropriate, patient-specific, evidence-based treatment algorithms.

	Indication	Maternal benefits	Infant benefits	Intake
Vitamin A	Supplementation in areas of endemic vit A deficiency	↓ maternal anemia ↓ night blindness ↓ maternal infection		5000 – 10,000 IU daily 200,000 IU weekly

Cont...	Indication	Maternal benefits	Infant benefits	Intake
Calcium	Supplementation during pregnancy to prevent hyperension	• ↓ hypertension • ↓ pre-eclampsia • ↓ maternal morbidity	• ↓ pre-term birth	• 1g calcium • RDA: 1 – 1.3 g
Vitamin D		• No clear benefits • Taken with calcium ↓ pre-eclampsia	• ↓ pre-term birth (however, ↑ if taken with calcium) • ↓ low birthweight	• RDA: 600 IU • UL: 4000 IU
Iron		• ↓ maternal anemia	• ↓ iron deficiency anemia at birth • ↓ low birthweight	• RDA: 27 mg • <u>Heme-rich foods:</u> meats, liver • <u>Non-heme iron foods:</u> beets, spinach, broccoli
Zinc	Low serum zinc levels associated with poor pregnancy outcomes		• ↓ pre-term birth • No evidence of other benefits	• RDA: 15 mg

2. Discuss the role of folic acid in pregnancy and formulate an evidence-based treatment regimen for specific patients.

Folic acid sources	• Broccoli, spinach, peas, Brussel sprouts, corn beans, lentils, oranges • Enriched pasta, enriched cornmeal, white flour		
Folic acid supplementation	• Regular MV: 0.4 – 0.6 mg • OTC prenatal MV: 1 mg • Rx prenatal: 1.1 or 5 mg		
Fetal risks of pregnancy FA deficiency	• Heart defects • Neural tube defects (NTD): spina bifida, anencephaly • Down's Syndrome		
Folic Acid pregnancy recommendations • Diet of folate-rich foods • Daily oral MV supplement containing folic acid (FA)	**Low-risk:** women or their male partners with no personal or family history of health risks for folic-acid sensitive birth defects	• **0.4 mg FA** o Start: 2-3 m pre-conception o End: 4-6 wks post-partum or for duration of breastfeeding	
	Moderate risk: women or their male partners with: • Personal or family hx of folate-sensitive congenital anomalies (non-NTD) • Family hx of NTD in 1st or 2nd degree relatives • Maternal diabetes (T1 or T2) • Teratogenic medications with folate inhibition • Maternal GI malabsorption conditions	• **1 mg FA** o Start: 3 m pre-conception o End: 12 wks gestational age • **0.4 – 1 mg FA** o Start: 12 wks gestational age o End: 4-6 wks post-partum or for duration of breastfeeding	
	High-risk: women or their male partners with personal NTD hx or previous NTD pregnancy	• **4 mg FA** o Start: 3 m pre-conception o End: 12 wks gestational age • **0.4 – 1 mg FA** o Start: 12 wks gestational age o End: 4-6 wks post-partum or for duration of breastfeeding	
Toxicities	• Higher doses than suggested above not recommended • Possible association with increased incidence of twins • Association between 5 mg FA in pregnancy and asthma in children		

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3. Discuss the evidence regarding use of multiple vitamins (e.g. prenatal vitamins) in pregnancy wellness.

	Advantages	Disadvantages
Materna	• Once daily dosing	
Preg Vit	• Numbered for adherence • Beta-carotene allows body to convert it to vit A as needed • Separates iron & calcium to prevent chelation	• Big • Needs prescription
• Prenatal MVs associated with: ↓ risk of pediatric brain tumors, neuroblastoma, leukemia, Wilm's tumor • Low & middle income countries: ↓ low birthweight, ↓ stillbirth (but UK trials show no clear benefts)		

4. Discuss the evidence regarding adverse effects of and suggested limits for caffeine and alcohol intake during pregnancy. Counsel a patient on common caffeine sources.

	Evidence	Recommended intake

Caffeine	• Insufficient evidence to determine whether caffeine has any effect on pregnant outcomes
	• Animal studies: teratogenicity at > 8 cups/day
	• Low quality RCT: decreasing regular coffee drinker's intake had no effect on birthweight or length of gestation
		• **Max 300 mg caffeine/day**
		  o 2 cups of coffee
		• Common sources of caffeine
		  o Coffee (including decaf)
		  o Tea (including green)
		  o Colas (including diet)
		  o Chocolate (candy, milk, hot, baking)
		  o Medications
		  o Energy drinks
		• Herbal tea limited to 3 cups/day

Alcohol	• Alcohol exposure at "high-risk" levels (mother consumes > 0.04 ounces of absolute alcohol daily) may result in characteristics abnormalities of development • **Fetal Alcohol Syndrome (FAS):** growth restriction, facial dysmorphology, CNS dysfunction, <u>prenatal exposure to alcohol</u>	• **Advise abstinence as prudent choice**

5. Identify appropriate weight gain targets for specific patterns at specific stages of pregnancy.

Pre-pregnancy BMI	Total weight gain (lb)	Rate of weight gain in 2nd/3rd trimester (lb/wk)
< 18.5	28 – 40	1.0
18.5 – 24.8	25 – 35	1.0
25 – 29.9	15 – 25	0.6
≥ 30.0	11 – 20	0.5
• Extra 2-3 Canada Food Guide servings per day in 2nd and 3rd trimester		

6. Discuss suggested foods to avoid during pregnancy for fetal health.
- Unwashed fruits and vegetables
- Hot dogs, deli meats (unless steaming hot)
- Soft cheeses (unless made from pasteurized milk): feta, Brie, Camembert, blue-veined, etc
- Ready-to-eat foods from deli: cut fruits, hummus, salads, egg salad, etc
- Refrigerated pates (as opposed to canned pates)
- Smoked seafood

7. Discuss fish intake recommendations during pregnancy.
- Limit consumption of fish with higher mercury levels to **150 g/week**
  - High levels of mercury may damage fetal brain and nervous system
  - Fresh/frozen tuna, canned albacore (white) tuna (300 g/wk), shark, swordfish, marlin, orange roughy

LECTURE 11 – NUTRITION & DIETARY ISSUES IN CHILDHOOD & ADOLESCENCE

1. Outline current recommendations for energy balance and weight management in children and adolescents.
    a. Be able to define aspects of healthy and normal eating.
    b. List internal and external factors that govern appetite, hunger and satiety.

Eating attitudes and behavior	Internal regulation of intake	Food acceptance	Eating context
• Relaxed about eating • Comfortable about eating enough • Enjoys food and eating • Comfortable with one's enjoyment of food and eating • Feel it is ok to eat food that one likes	• To trust oneself to eat enough • To eat as much as one is hungry • To eat until one feels satisfied	• Experimenting with new food and learning to like it • Make do with eating food one doesn't care much for • Eating a wide variety of foods	• One tunes into food and pays attention to eating • Making time to eat • Having regular meals • To give consideration to what is good for one to eat • To plan to feed oneself

    c. Define competence, feeding and eating skills.
        i. Describe how these skills develop, are facilitated, and/or hindered.

		Child	Parent
Responsibility	**Infants**	• How much	• What the child eats • Help infants be calm and organized • Pay attention to info about timing, tempo, frequency, amount
	Older infants	• How much • Whether to eat	• What the child eats • When & where • Guide transition to semi-solids, thick and lumpy food, finger food and then family meals • Trusting children to determine how much and whether to eat
Role		• Will eat amount they need • Will learn to eat the food their parents eat • Will grow predictability • Will learn to behave well at mealtime	• Choose and prepare the food • Provide regular meals and snacks • Make eating time pleasant • Role model desired behavior • Be considerate of child's lack of food experience without catering to likes and dislikes • Not letting children have food or beverages (except water) between meal and snack times

        ii. Describe the importance of eating competence in relation to risk of feeding problems and other health concerns.

Children	Parents
• Normal BMI • Higher diet quality • Better sleep quality • Biomarker suggestive of ↓ risk of CVD • Reduced childhood nutrition risk	• Eating with their children • Making healthier foods (role modeling) • Application of the division of responsibility

2. Be able to use the WHO Growth Charts for Canada to interpret the growth pattern of a child.
   - **Data:** accurate, serial measurements (birth, 1, 2, 4, 6, 9, 12, 18, 24, then once annually); precise plotting; parents' heights
   - **Normal growth:** reflected by consistently following along a "channel"
     - Channel "surfing" may be normal when subsequently settling into a channel towards the 50th percentile
       - Unexpected downward, sharp changes or flat-line growth = potential growth failure or malnutrition
     - 50th percentile is the average (not necessarily the goal – compare to genetic potential)
   - **Length and weight:** should be proportional
     - Weight is more sensitive indicator of early under-nutrition
     - Cut off points should prompt further assessment

3. Be able to select the DRIs that represent the dietary nutrient intake goals of children, including: iron, vitamin D, calcium, fluoride, sodium, energy, protein, carbohydrate, sugar, fat, dietary fibre.
   a. Be able to identify recommendations and/or guidelines that support achievements of these DRIs.
      Dietary reference intake tables   Toddler's first steps   Canada's Food Guide

   b. Be able to calculate the macronutrient needs of a child.
      - Select most appropriate equation for use depending on age, health status, illness, etc
      - Know the risk factors associated with under and over estimating needs

4. Describe how Canada's Food Guide & Toddler's First Steps serve as references for healthy food intakes among children.
   - Criteria (references) for adequate nutrient intake

5. Explain the rationale for the Health Canada recommendation to breastfeed to 2 years of age and beyond.
   - Breastfeeding to ≥ 2 years with appropriate complementary foods supports optimal nutrition status, immunity function, and growth and development
     - 12-24 months: about 1/3rd of energy needs from breast milk
   - Breastfeeding beyond 6 months is associated with protection against:
     - Childhood overweight and obesity
     - Childhood gestational and respiratory infections
     - Maternal breast cancer and possibly ovarian cancer
     - Mothers report greater sensitivity and bonding with their child

6. Describe specific nutrient and nutritional issues pertaining to childhood and adolescence.
   a. Iron deficiency

S/S	Risk Factors	RDA
- Changes in cognitive and behavioral performance - Impaired physical growth - Altered immune function	- Pre-term or small for gestational age - Maternal iron deficiency during pregnancy - Early milk introduction - Homemade infant formula substitution - Excess consumption of milk and juice - Limited consumption of solid foods - Special needs - Low socioeconomic status - New immigrant or select ethnic group	11 mg/day 7-12 months of age

b. Dental Health

Impact	Prevention

Infants and children who drink sweetened beverages are susceptible to dental caries:
• From a bottle
• At bedtime
• Frequently throughout the day
	• Water for hydration or quenching thirst
	• Non-regular consumption of sweet foods
	• Oral hygiene practices
	• Sources of fluoride (non-essential): fluoridated drinking water, fluoridated toothpaste, topical dental treatments
	    o Produces more stable fluorapatite crystals in place of hydroxyapatite
	    o Remineralizes early dental enamel lesions
	    o Antibacterial properties in oral cavity
	• Ingestion of high protein foods with fermentable and/or sticky carbs

c. Constipation

Cause	• Commonly precipitated by volitional holding of stool after painful bowel movements	
S/S	• < 3 complete stools per week • Soiling in a child who has been toilet trained • Hard stools • Large infrequent stools that block toilet • Poor appetite • Abdominal pain that improves with bowel movements	• Body position suggesting attempts to hold in stool • Anal pain • Painful bowel movements • Blood mixed with hard stools • Previous constipation • Anal fissure
Types	**Acute (simple):** ≤ 2 wks	• Balanced dietary intake and adequate fluids

	Chronic: < 8 wks	• Laxative to relieve fecal mass from rectum (immediate)
		• Maintenance therapy:
		    o Laxatives
		    o Behavioral interventions: scheduled toilet routine, bowel journal
		    o Balanced dietary intake, adequate fluid intake
		    o Adequate physical activity

	Organic (medical condition): rare	

d. Food allergy
- Prevention: early introduction of potentially allergenic foods
- Management: complete elimination of offending foods
    - Evidence for nutrition risk among children with multiple food allergies

e. Overweight and obesity

Behaviors	Pressuring young children to eat	• Ignoring of internal hunger and satiety cues • More food ingestion and higher BMI (or opposite) • Increase likelihood of emotional eating • Increase likelihood of food dislikes, pickiness & neophobia, less balanced dietary patterns • IS INEFFECTIVE at increasing intake or preference for a food
	Restricting food	• Increased preference for restricted food • Increased eating in absence of hunger • Associated with higher BMI
	Larger serving sizes	• Consumed more food and drink when offered larger-sized portions, packages or tableware
	External cues	• Appetite is triggered or inhibited by external factors • Stimulation can override internal cues, leading to over-eating
Prevention & Intervention	Individual	• Development of eating competence • Family health: parenting style, parenting role modeling • Modifiable nutrition • Lifestyle issues: physical activity, inactivity, screen time
	Broader community	• Supportive inclusive communities
	Government and sectoral	

f. Feeding and eating problems

Definition	Concerns	Risk Factors
A condition that imposes a short-term eating behavior on the child: • Loss of interest in food • Neophobia • Strong food preferences limiting quantity or variety of food intake	• Risk of long-term health consequences: 　o Growth faltering 　o Nutritional deficiencies • Implications for family well-being: 　o Caregiver anxiety 　o Family disharmony	• Improper early feeding practices 　o Little variation & texture variety 　o Too few new foods offered 　o Poorly structured meal time and practice • History of previous significant medical illness • Disturbed sleep patterns in child • Conflict b/w caregiver and child at meal time • Maternal history of anxiety, eating problems and body image concerns

g. Disordered eating

Definitions:
• Unhealthy weight control behaviors　　　　o Self-induced vomiting 　o Fasting ≥ 8 h　　　　　　　　　　　　o Laxatives, diuretics, diet pills 　o Extreme restriction ≤ 500 kcal/d　　　o Smoking for weight control 　o Skipping meals 　o Exercising excessively • Binge Eating

Risk factors	Complications	Protective Factors
• Body dissatisfaction • Personal weight gain concerns • Subject to teasing • Low self-esteem • Vulnerability to media exposure • Chronic disease where diet therapy is core to self-management	• Poor diet quality • Reduced nutrient intake • Weight gain and obesity • Reduced bone mass • Menstrual dysfunction • Depression • Increased risk of eating disorders	• Family connectedness • Body satisfaction • Regular, healthy meals • Healthy weight control measures

h. Eating disorders

Types	Anorexia nervosa (AN)	• Excessive food intake restriction that leads to severe weight loss • Intense fear of gaining weight or becoming fat • Disordered body image
	Bulimia nervosa (BN)	• Intense urges to overeat followed by inappropriate behaviors to avoid weight gain: o Self-induced vomiting o Laxative abuse o Over-exercising • Binge-purging episodes: 1/wk
	Binge eating disorder (BED)	• Recurrent ingestion of significantly more food in a shorter period of time than normal • Associated with feelings of lack of control, significant guilt, embarrassment, disgust • At least 1 episode/wk over 3 months
Complications	• Isolation and withdrawal • Poor quality of life • Severe malnutrition and multiple associated medical complications • Significant cost to health and social services	
Multi-factorial etiology	• Individual risk factors not necessary OR sufficient • Risks may be correlates or secondary to the eating disorder	
Bio-psycho-social models	• Integrate various factors: cultural, social/family/personal traits, biological	
Treatment	• Multidisciplinary: therapist, physician, dietician and psychiatrist	
Goals of Treatment	• Education • Normalization of eating behaviors • Weight gain • Address psychological needs (poor self-esteem, past trauma, harmful beliefs & attitudes about self)	

i. Poverty: 1 in 5 children in BC (1 in 2 if single-parent)
- Detrimental effects associated with food insecurity and hunger in children
  - o Higher incidence of iron deficiency → delayed cognitive, motor & socio-emotional development
  - o Increased risk of depression and suicidal ideation in adolescence
  - o Increased risk of obesity (more difficulty self-regulating eating behaviors)
  - o Increased risk for stunting, CVD, lung disease, autoimmune disease
    - ▪ Mediated potentially through severe maternal stress

7. Explain the risks and benefits of popular diets in adolescence.
   a. Sports Nutrition: 1.2 – 2.0 g protein/kg/day for adolescents active in sports
      i. High protein diets: add nutrient dense food from all food groups
         - Example: 2 additional servings meat + 1 additional serving from rest of groups = + 50 g protein
      ii. Protein supplements, including BCAA (branch chain amino acids)
         - No evidence to support protein supplementation
         - Excess supplementation can increase need for other nutrients
         - Excess protein intake can facilitate dehydration, hypercalcinuria, and place additional stress on liver and kidneys

      b.   Vegetarianism
- Well-planned vegetarian diet is nutritious: higher intake of iron, vitamin A and dietary fibre
- Important considerations:
  - Fortified food sources of B12 and calcium
  - Emphasis on plant sources of omega-3 fatty acids
  - Supplementation of calcium, vitamin D, zinc and iron may be indicated

LECTURE 12 – NUTRIENT & DIETARY ISSUES IN ADHULTHOOD AND AGING

EARLY ADULTHOOD (19-50 YEARS)

1. Be able to describe factors through this age-period that may affect nutrition and food choices.
   - Further education, entering the workplace, family

2. Understand the importance of continuing to develop healthy lifestyle habits and ways to accomplish this.
   - Food trends and patterns are important – learned behavior over time can be difficult to change
   - Many are aware of what to do, but struggle with how to do so

3. List the chronic diseases that are linked to diet and lifestyle.
   - Heart disease, stroke, cancer, diabetes

4. Be able to describe the precursors of these diseases.
   - Overweight and obesity

5. Understand what metabolic syndrome is.
   - Cluster of health risks (3 of the following):
     - Abdominal obesity: waist circumference > 102 cm for men or > 89 cm for women
     - Triglycerides: $\geq$ 1.7 mmol/L
     - HDL: < 1.03 mmol/L in men or < 1.3 mmol/L in women
     - Blood pressure: $\geq$ 130/85 mmHg
     - Fasting glucose: $\geq$ 6.1 mmol/L

6. Understand nutrition issues for women's health.
   - Perimenopausal and menopausal (late forties)
     - Can increase total cholesterol and LDL, decrease HDL
     - Emphasis diet on plant-based foods for phytoestrogens, soluble fiber and other components
       - Sufficient calcium, vitamin D, vitamin K and magnesium

7. Understand nutrition issues for men's health.
   - Diet that supports reducing risk for health disease is especially important (a leading cause of death)
   - Unless men are diagnosed with iron deficiency, they don't require extra iron
     - Some men carry genetic variant for hemochromatosis and iron overload → problematic because iron is an oxidant

NUTRITION AND AGING (> 50 YEARS)

8. Be able to describe the feeding and eating issues for seniors.

Difficulty swallowing (dysphagia)	• Food and liquid texture modifications may be important to prevent aspiration • Weight loss may be an issue due to eating and drinking less • OT and SLP may be involved
Dentition	• Chewing difficulties • Typically eat less fruits & veggies, fiber, vitamins
Sensory Losses & Physical Issues	• Taste and smell affect enjoyment of eating and preferences
Dehydration	• Total body water decreases • More susceptible to UTIs, pneumonia, pressure ulcers, confusion

9. Understand the gastrointestinal concerns.
   - Intestinal wall loses strength and elasticity with age
   - GI hormone secretions change
   - Slowed motility → constipation
   - Irritable bowel syndrome and malabsorption → diarrhea
   - **Atrophic gastritis**: inflamed stomach, bacterial overgrowth, lack of HCl and intrinsic factor
     - Impairs nutrient digestion & absorption: Vit B12, folate, calcium, iron, zinc → malabsorption

10. Understand what some of the common nutrient deficiencies are and why they occur in this age group.

	Mechanism	Effects
Vitamin B 12 (pernicious anemia)	Atrophic gastritis • Bacterial overgrowth uses up vit B12 • Lower HCl and IF leads to inefficient digestion and absorption	• Poor cognition • Anemia • Neurological effects • Poor energy
Vitamin D	• Limited exposure to light (especially in nursing homes) • Aging reduces skin's capacity to make vit D and kidney's ability to convert it to active form • Higher needs to improve muscle and bone strength	
Calcium	• Canadians are below recommendations usually	• Important for women in particular after menopause to protect against osteoporosis
Zinc	• Commonly low in older people • Many medications impair zinc absorption or enhance its excretion	• Depressed appetite • Blunted sense of taste • Affected food intake
Iron	Deficiency may occur if: • Consume less meat, fish, chicken • Increased blood loss due to disease • Absorption issues due to reduced HCl secretion & antacid use	• Impaired immunity

11. Describe what are the changes in body composition with aging.

Lose bone	• Leads to osteoporosis

Hormones	• Hormones that regulate appetite and metabolism become less active with age
	• Causes of decreased appetite in older adults:
	   ○ Increased cholecystokinin, leptin, cytokines
	   ○ Decreased ghrelin and testosterone

Loss of muscle	• Leads to sarcopenia (lose ability to move & maintain balance → falls) • Optimizing nutrition, eating sufficient protein & regular activity can help with minimizing changes • Risk factors: weight loss, little physical activity, cigarette smoking, obesity

12. Understand the food and nutrition role in gout and rheumatoid arthritis.

	Interventions to decrease inflammation	Interventions to reduce flare
Rheumatoid Arthritis	• Mediterranean diet • Omega-3 fatty acids • Vitamin C and E	
Gout	• Vitamin C • Milk products • Water	• Decreased purines (animal, seafood) • Decreased soft drinks (high fructose corn syrup) • Decreased alcohol

13. Describe what the ecological/environmental influences on food intake are.
   - Depression: lose motivation to cook; mealtime support of family and friends helpful
   - Economic changes: 10% in poverty
   - n: most common in hospitals and nursing homes (social isolation, loneliness)

14. Understand aspects that contribute or take away from the quality of life in the aging population.

15. Be able to use the food guide for an initial food record assessment.
   - Refer to the food guide for what a food group serving equals
   - Compare food record to recommended servings

16. Be able to describe what the plate method is and how it can be used.
   - ONE PLATE: ½ veggies (at least 2 kinds) ¼ grains & starches ¼ meats & alternatives
   - Fruit, milk on the side

17. Understand the importance of meal pattern.

18. Be able to select the Dietary Reference Intakes (DRIs) that represent the dietary nutrient intake goals of adults 19-50 and 50 and older.
   - Energy needs decline an estimated 5% per decade (calorie needs fewer BUT nutrient need remains high)
     - Reduction in physical activity
     - Basal metabolic rate declines 1-2% per decade (decreased lean body mass, reduced thyroid hormones)

19. Understand the following nutrient considerations in the 50+ age group including: iron, vitamin D, calcium, zinc, B12.
   - Re: LO # 11

20. Be able to calculate the macronutrient needs of an adult using the Harris-Benedict calculation and using 25-35 kcal/kg.
   - Harris-Benedict Equation
     - Obese patients: calculate adjusted body weight (ABW) prior to calculating energy needs
   - Prediction equation:
     - 25 – 30 kcal/kg = healthier population, no infection
     - 30 – 35 kcal/kg = underweight, infection, higher needs