**Diet, Nutrition, and Energy Balance**


**DEFINITIONS**

- **BMR** = basal metabolic rate. Rate of energy consumption in resting state
  - BMR = (weight in kg) *100 kJ/kg or (weight in kg) *24 Cal/kg
- **RDA** = recommended daily allowance
  - Going over the RDA of energy intake increases chances for health problems
- **DV** = daily value
  - Based on dietary need in 2,000 cal/day diet
- **Hyponatremia** = excess water intake. Can be deadly
- **Ketosis** = excess production of ketone bodies (acetoacetate, acetate, β-hydroxybutyrate)
  - Results from switch to energy production by fatty acid oxidation
  - Lack of oxoacetate directs acetyl-CoA to ketone bodies
- **Ketonuria** = presence of ketone bodies in the urine
  - Filtered by kidneys and excreted out in urine
- **Ketone body** = made from acetyl-CoA
  - Acetoacetate, acetone, β-hydroxybutyrate
- **Glycemic index** = way of monitoring carb intake in diabetes
  - GI = 100 corresponds to area under curve of measured blood glucose 2 hrs after 50 g glucose intake
- **Glycemic load** = better way of monitoring carb intake than glycemic index
  - = glycemic index * amount of carbohydrate
- **Gluten** = made of the proteins gliadin and gliutanin
  - Celiac disease = immune sensitivity to gluten
- **PUFA** = poly-unsaturated fatty acid. Can’t make these in the body so must get from diet
- **ω-3 (linoleic acid)** = an essential PUFA
  - Contains eicosanoid → an arachidonic acid for leukotriene and prostaglandin synthesis → helps with immune fxn and blood clotting
  - Deficiency causes problems with immunity and blood clotting
  - Ligand for gene regulatory proteins (PPARs)
  - Ligand for inositol containing phospholipids
- **Marasmus** = energy insufficiency
  - Leads to anemia, lethargy, impaired immunity
- **Kwashiorkor** = protein deficiency
  - Leads to edema, abdominal swelling, fatty liver, anemia, lethargy, impaired immunity
**Recommended Daily Intake of Water**

- Infant = 0.7 L/day
- Teen = 2.1-3.3 L/day
- Adult:
  - 2.7 L/day for females
  - 3.7 L/day for males
- Too much water can be detrimental because you can drown your cells and get hyponatremia
  - Hyponatremia = very low sodium due to excessive urine excretion

**Activity Levels**

- Activity levels based on percent BMR
  - Sedentary = 30%
  - Moderate activity = 40%
  - Active = 50%
- Take % BMR, add to the BMR, get total energy expenditure
  - Ex.) 90 kg male who is Active
    - BMR: we use 24 Cal/kg → 24 Cal/kg * 90 kg = 2160 Cal
    - Activity = 2160 Cal * 0.5 (50% activity) = 1080 Cal
      - So this male uses 1080 Cal throughout the day based on his activity level and BMR
    - Total energy expenditure = 2160 Cal + 1080 Cal = 3240 Cal
      - This male uses a total of 3240 Cal throughout the day due to his natural BMR and his high activity level
- Energy in nutrients
  - Protein = 4 cal/g = 17 kJ/g
  - Carb = 4 cal/g = 17 kJ/g
  - Fat = 9 cal/g = 37 kJ/g

**Glycemic Index and Glycemic Load**

- GI = 100 is equivalent to area under blood glucose curve after 2 hours of ingesting 50 g of glucose
  - Represents rise in blood glucose after 2 hours of eating
  - Only takes into account available carbohydrate in the food
    - Low GI < 55
    - Medium GI: 56-69
    - High GI > 70
- Glycemic load is the product of GI and the cab amount
  - Accounts for how much carbohydrate is in the food and how much each gram of carbohydrate in the food raises blood glucose levels
GLUTEN

- Gluten is made of gliadin and glutenin
  - From wheats, barely, and rye
- Celiac disease is immune sensitivity to gluten
  - Can cause diarrhea, inflammation, and malnutrition

PUFAs

- $\omega$-6 (linoleic acid) and $\omega$-3 ($\alpha$-linolenic acid) are essential PUFAs
  - $\omega$-3 deficiency causes neuropathy and loss of visual acuity
  - $\omega$-6 contains eicosanoids $\rightarrow$ arachidonic acid $\rightarrow$ prostaglandins and leukotrienes
    - used as ligand in gene regulatory proteins (PPARs)
    - deficiency causes impaired immunity, blood clotting, loss of membrane integrity. Compromises skin-water barrier
- Food sources = fish oils, flaxseeds, soybean, canola oil

ESSENTIAL AMINO ACIDS

- The following are essential amino acids:
  - Leucine, isoleucine, valine, tryptophan, threonine, lysine, methionine, phenylalanine, histidine
- For children and infants, add tyrosine and arginine
- For premature infants, add tyrosine and cysteine
- These are essential because they cannot be synthesized in the body. Must get from diet

NO CARB DIET

- Can survive on no car diet because the body can use proteins for energy
  - Proteins have a carbon skeleton
- Carbs are NOT essential (except vitamin C). We can synthesize them from glycerol, the carbon skeleton of amino acids
  - Can result in ketoacidosis, calcium loss, and renal dystrophy

KETONE BODIES

- Origins of ketone bodies: Diversion of acetyl-CoA from the citric acid cycle because there is no oxaloacetate due to low carbohydrates in the diet or in diabetes because of the inability for cells to take up carbohydrates
- Ketone bodies can supplement glucose in the diet because they can be converted back to acetyl-CoA in extrahepatic tissue, which goes back into the citric acid cycle
- Signs of ketosis are ketone bodies in the urine
• The liver diverts oxaloacetate to gluconeogenesis. No other cells can do this
• Ketosis is due to high concentrations of ketones in the blood, while ketoacidosis is acidification of blood because of acetoacetic acid and β-hydroxybutyric acid