UNIVERSITY OF TORONTO

NFS 284: BASIC HUMAN NUTRITION

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Introduction to Nutrition

Learning Objectives

1. Discuss the diets of Canadians with reference to the CFG (Canada Food Guide)-2007 & 2019, CHEI (Canada Healthy Eating Index) and HEFI (Healthy Eating Food Index)-2019
2. Identify and differentiate between the macronutrients and micronutrients and their relationship with malnutrition (overnutrition and undernutrition)
3. List and discuss the limitations and strengths of nutrition assessment tools.

What is the science that studies the interaction between human health, food, and nutrients?

HUMAN NUTRITION

1.1 Nutrition and the Canadian Diet: How healthy is the Canadian diet?

- Canadian Community Health Survey (CCHS)
  - Survey of health information including food intake
    - 2007-Canada's Food Guide:
    - Recommends food from four groups:
      - Grain products
      - Milk and alternatives
      - Vegetables & Fruit
      - Meat and alternatives
    - Canadian Healthy Eating Index (CHEI):
      - Measures adherence to 2007-CFG

Two nutrition-focused surveys:
2004-CCHS-Nutrition
2015-CCHS-Nutrition

How are Canadians doing with respect to diet quality?

- CHEI: Perfect adherence to 2007-CFG = 100

Taller the bar the poorer the diet

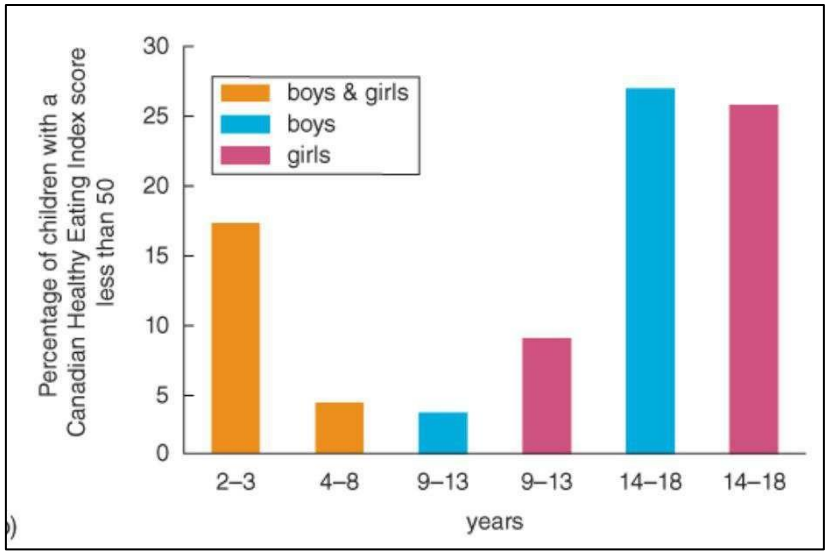
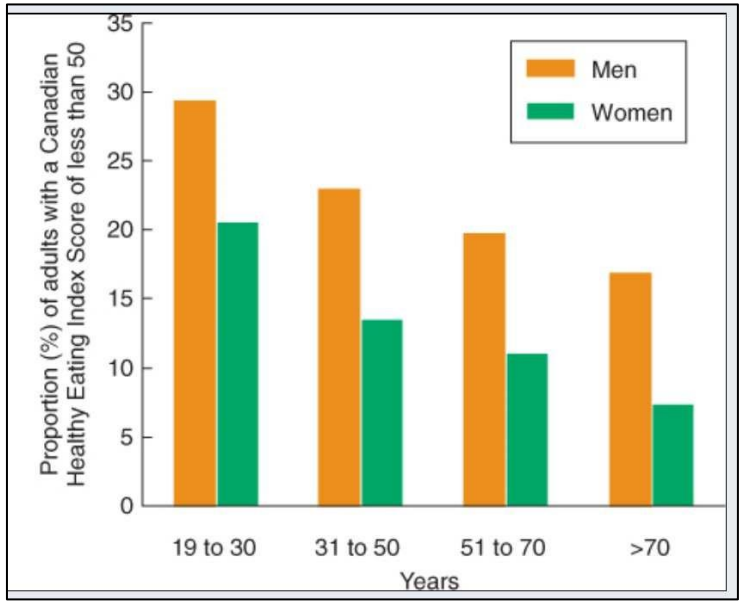


Fig 15.2 2e & 3e



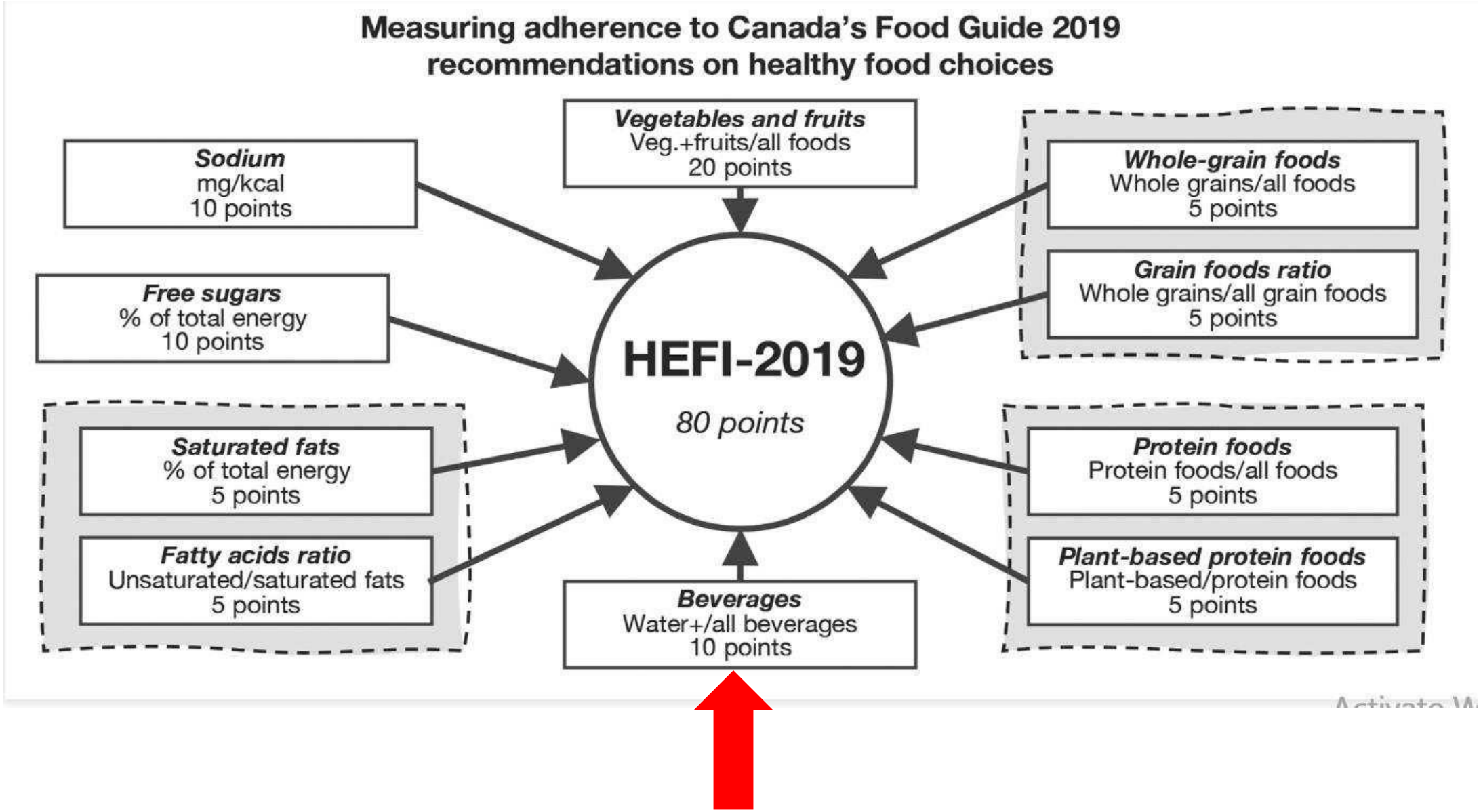
2e pg 666; 3e pg 748

How are Canadians doing with respect to diet quality? (CFG 2019 & HEFI)

- HEFI: Healthy Eating Food Index

- The Healthy Eating Food Index 2019 (**HEFI-2019**) assesses the extent to which food choices align with 2019 Canada's Food Guide (CFG)

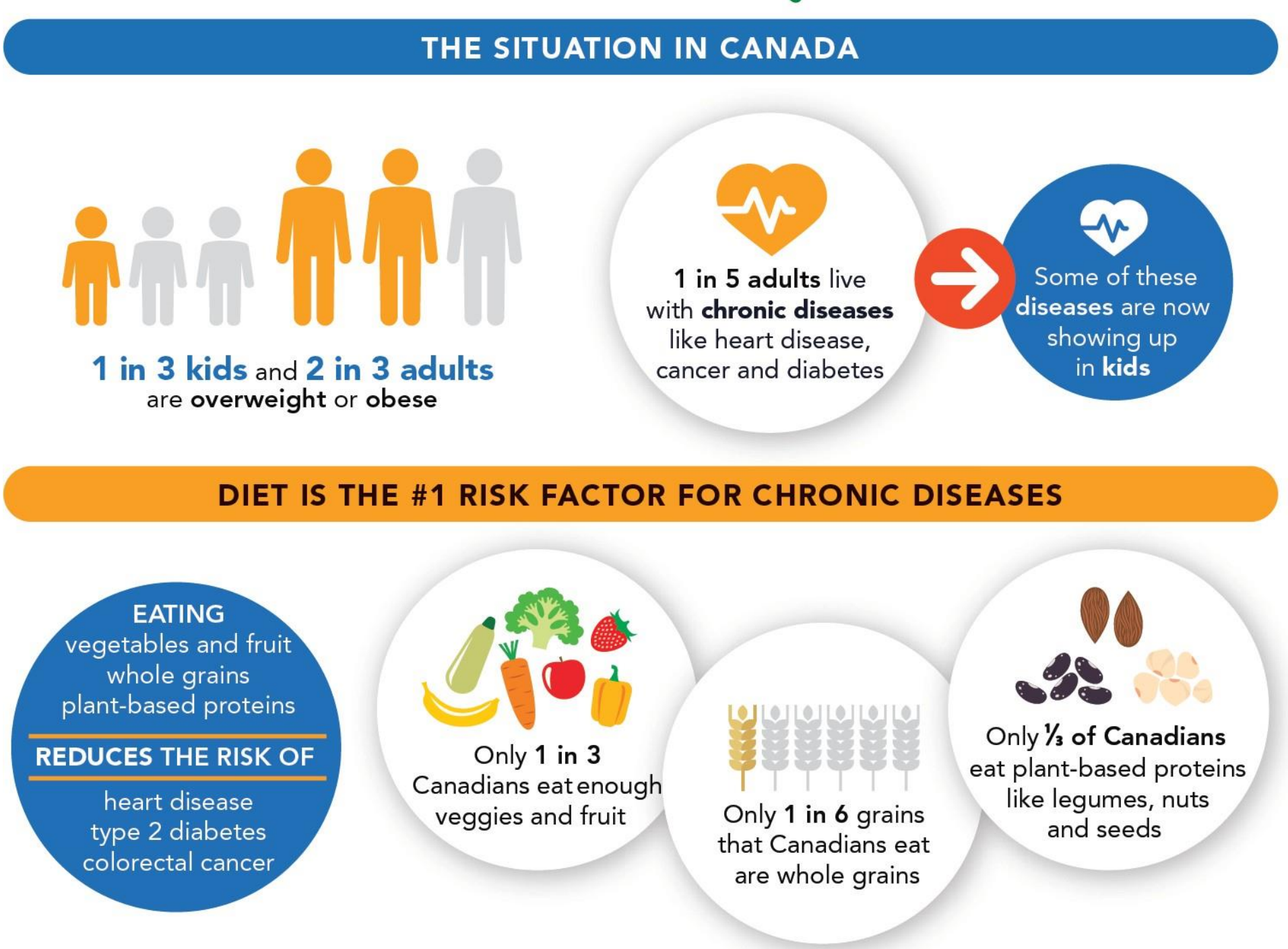
- Maximum points for the beverage component (10 points) are given when the ratio = 1.0, and minimum points (0 points) are given when all beverages consumed are sugary drinks, artificially sweetened beverages and alcohol.


Measuring adherence to Canada's Food Guide 2019 recommendations on healthy food choices
Vegetables and fruits
Veg.+fruits/all foods
20 points
Sodium
mg/kcal
10 points
Whole-grain foods
Whole grains/all foods
5 points
Free sugars
% of total energy
10 points
Grain foods ratio
Whole grains/all grain foods
5 points
HEFI-2019
80 points
Saturated fats
% of total energy
5 points
Protein foods
Protein foods/all foods
5 points
Fatty acids ratio
Unsaturated/saturated fats
5 points
Plant-based protein foods
Plant-based/protein foods
5 points
Beverages
Water+/all beverages
10 points

HEFI-2019 Components

#	Component name	Measurement	Maximum Points	Unit	Standard for minimum score	Standard for maximum score
1	***Vegetables and fruits***	*Ratio:* Total vegetables and fruits [a] / Total foods [b]	20	RA/RA	No vegetables and no fruits	≥ 0.50
2	***Whole-grain foods***	*Ratio:* Total whole-grain foods [c] / Total foods [b]	5	RA/RA	No whole-grain foods	≥ 0.25
3	***Grain foods ratio***	*Ratio:* Total whole-grain foods [c] / Total grain foods [d]	5	RA/RA	No whole-grain foods	= 1.0
4	***Protein foods***	*Ratio:* Total protein foods [e] / Total foods [b]	5	RA/RA	No protein foods	≥ 0.25
5	***Plant-based protein foods***	*Ratio:* Plant-based protein foods [f] / Total protein foods [e]	5	RA/RA	No plant-based protein foods	> 0.50
6	***Beverages***	*Ratio:* (Plain water including carbonated + unsweetened beverages) [g] / Total beverages [h]	10	g/g	No water and no unsweetened beverages	= 1.0
7	***Fatty acids ratio***	*Ratio:* (Mono- + polyunsaturated fat) / Total saturated fat	5	g/g	≤ 1.1 [i]	≥ 2.6 [i]
8	***Saturated fats***	*Ratio:* Total saturated fat / energy	5	%E (kcal/kcal)	≥ 15%E [k]	< 10%E
9	***Free sugars***	*Ratio:* Total free sugars / energy	10	%E (kcal/kcal)	≥ 20%E [k]	< 10%E
10	***Sodium***	*Ratio*: Total sodium / energy	10	mg / kcal	≥ 2.0 [k]	< 0.9 [l]

Fig 1.2 3e only



Minister of Health, 2017 Cat.: H164-209/2017E-PDF | ISBN: 978-0-660-08733-7 | Pub.: 170102

Table 1. Estimated proportion of Canadians meeting the recommendations of Canada's Food Guide (CFG) for the intake of fruits and vegetables.

Age–sex category	(*n*)	CFG 2007 recommendation (no. of servings)	Minimum 2007 recommendation met (%)	CFG 1992 recommendation (no. of servings)	Minimum 1992 recommendation met (%)
Children					
2–3 y	564	4	54.2	Not applicable*	Not applicable*
4–8 y	1 257	5	31.2a	5–10	31.2
9–13 y	2 171	6	—†	5–10	44.8a
Teens					
Males 14–18 y	1 285	8	—†	5–10	53.9a
Females 14–18 y	1 260	7	22.3	5–10	47.2
Younger adults					
Males 19–50 y	2 658	8–10	18.5	5–10	60.0
Females 19–50 y	2 485	7–8	—†	5–10	53.9
Older adults					
Males 51+ y	2 426	7	41.2a	5–10	65.3
Females 51+ y	3 403	7	23.8b	5–10	60.3
All respondents	17 509		26.3		56.1

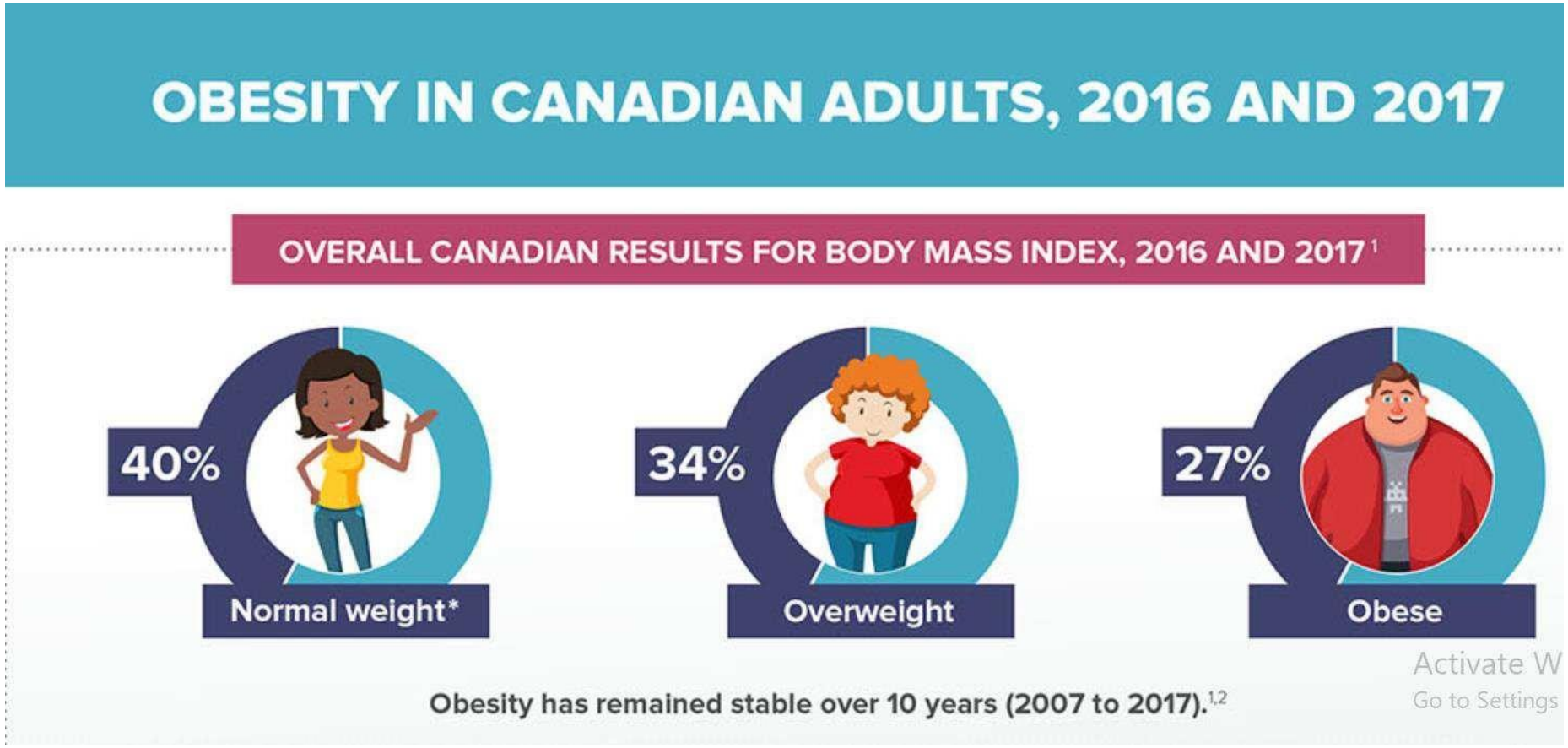
Note: *n* represents sample size of plausible respondents only (with at least 1 plausible 24-h recall). a, Statistically significant difference ($p < 0.05$), compared with preceding age group of the same sex. b, Statistically significant difference ($p < 0.05$), compared with age-matched group of males.

*In the 1992 CFG, there was no specific recommendation for daily fruit and vegetable intake for children younger than age 4 years.

†Estimates were suppressed because of high coefficients of variation (>33.3%).

https://cdnsciencepub.com/doi/10.1139/apnm-2012-0166#

Burden of Obesity in Canada



Sources

[1] Statistics Canada, 2016 and 2017. **Canadian Health Measures Survey**. Ottawa.

[2] Statistics Canada, 2007 to 2009. **Canadian Health Measures Survey**. Ottawa.

[3] Statistics Canada, 2017. **Canadian Community Health Survey**. Ottawa.

Notes

* Underweight and normal weight categories were combined.

Too many **processed or prepared foods** high in sodium, sugars, or saturated fat

INCREASE THE RISK OF

heart disease
obesity

Over **⅓ of the calories** Canadians eat come from these types of foods

Meals eaten away from home

ARE OFTEN HIGHER IN

calories
sodium
sugars
saturated fat

Canadians spend **30% of their food budget** in places like restaurants, cafeterias and vending machines

Too many **sugary drinks**

LEAD TO A HIGHER RISK OF

obesity
type 2 diabetes
cavities

⅓ of sugar consumed by teens is from sugary drinks

Too much **sodium**

LEADS TO

high blood pressure
heart disease
stroke

Canadians eat about **3,400 mg of sodium** each day—more than **double** the amount needed

Fig 1.2 3e only

CANADA—LET'S MAKE THE *healthy* CHOICE THE *easy* CHOICE!
#EatHealthyCanada

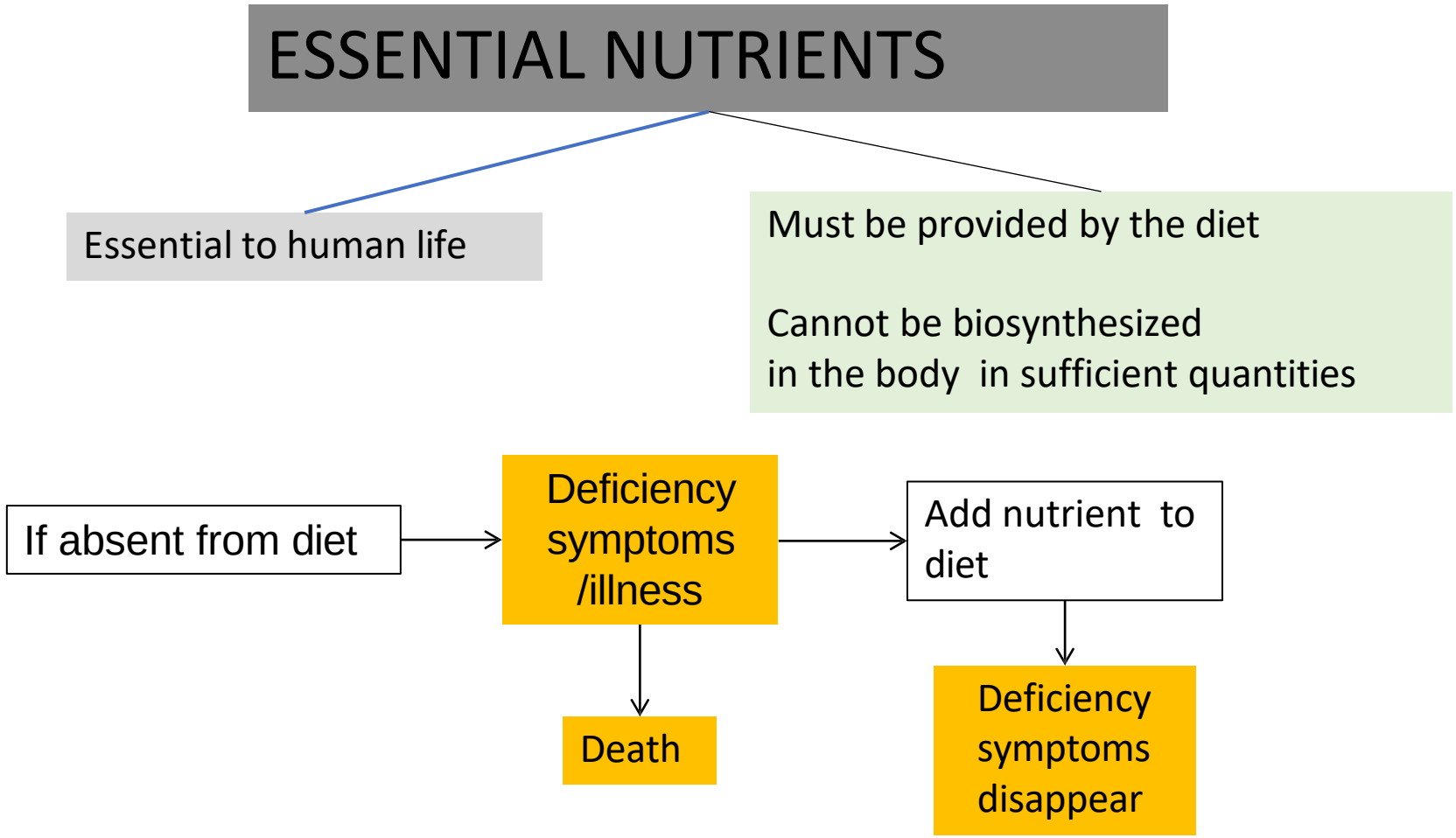
Nutrients: An Overview

Nutrition and Health:

- Good nutrition can reduce your risk of chronic disease

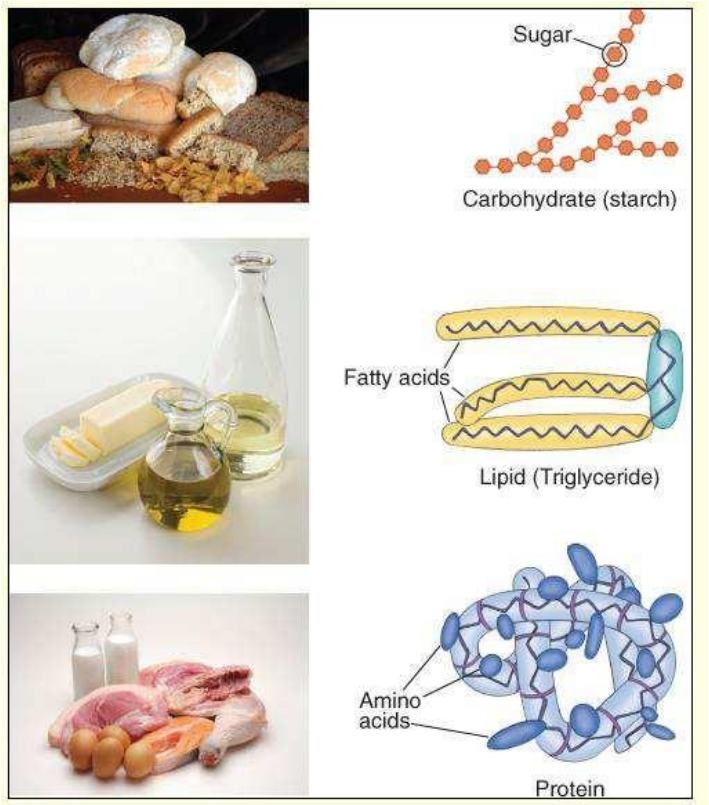
- Diabetes
- Heart disease
- Hypertension
- Obesity
- Cancer
- Stroke
- Osteoporosis
- Neurodegenerative disease

1.2 Food provides nutrients



1.2 Food provides nutrients

MACRONUTRIENTS



- Carbohydrates
- Lipids (Dietary fat/fat)
- Protein

Fig 1.5

1.2 Food provides nutrients

Carbohydrates and

Lipids: Provide energy:

- To support basal metabolism* and physical activity

Protein:

- When present in excess in the diet, protein is also a source of energy .

***Basal metabolism**: metabolic activity needed to maintain life at rest such as maintaining the function of internal organs

- **Units of energy:**
- Energy required by the human body and energy content of foods:

- Kcalories
- Calories or calories
- Kilojoules

1.2 Food provides nutrients

Atwater Numbers:

4 kcal/g carbohydrates

9 kcal/g fat or lipids Know these numbers

4 kcal/g protein

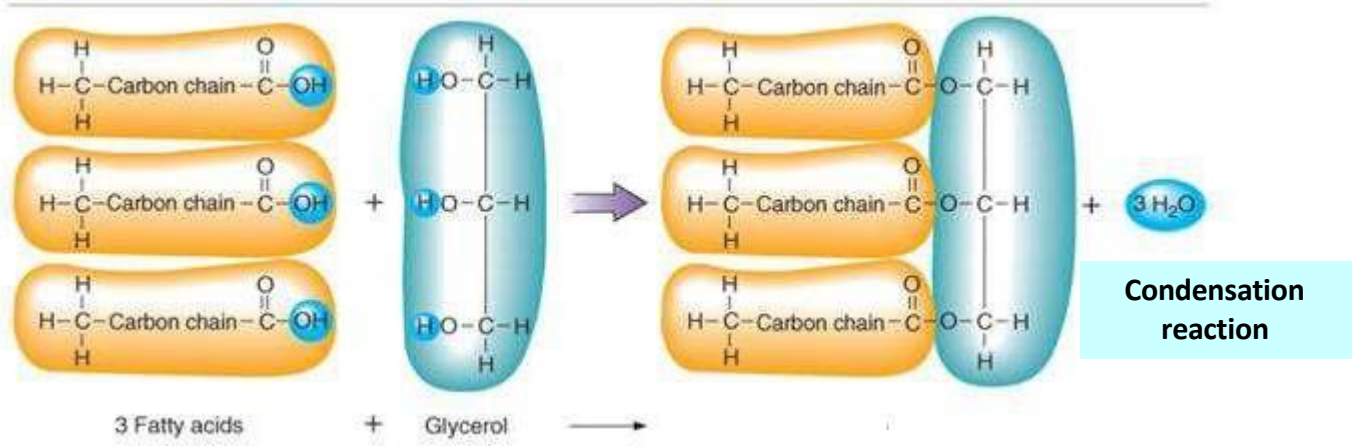
Also:

7 kcal/g alcohol

1.2 Food provides nutrients
Lipids or Dietary Fats:

Triglycerides:

- The major chemical form of lipids in food
- An ester of glycerol and three fatty acids



1.2 Food provides nutrients
Lipids or Dietary Fats:

- Unsaturated fatty acids:
  - Fatty acids that contain double bonds
  - Considered to be beneficial to health- reducing the risk of cardiovascular disease
- Common in plant oils such as
  - canola oil
  - soybean oil
  - olive oil

- Monounsaturated fatty acids (MUFA)
  - Contain one double bond
  - e.g. fatty acid: oleic acid found in olive oil
- Polyunsaturated fatty acids
- (PUFA)
  - Contain at least two double bonds
  - e.g. found in canola oil & soybean oil

1.2 Food provides nutrients
Lipids or Dietary Fats:

- Two PUFAs, found in oils like canola oil and soybean oil, are essential fatty acids:
  - Linoleic acid
    - (omega-6 fatty acid)
  - Alpha-linolenic acid
    - (omega-3 fatty acid)
  - Must be obtained from the diet

1.2 Food provides nutrients
Lipids or Dietary Fats:

- Other important omega-3 fatty acids
  - EPA-eicosapentaenoic acid
  - DHA-docosahexaenoic acid
    - also known as long-chain (LC) omega-3 fatty acids

- EPA and DHA are omega-3 fatty acids synthesized in the body from alpha-linolenic acid
- Also obtained from the consumption of fatty fish or fish oil supplements
- Also linked to health benefits especially cardiovascular disease

1.2 Food provides nutrients
Lipids or Dietary Fats:

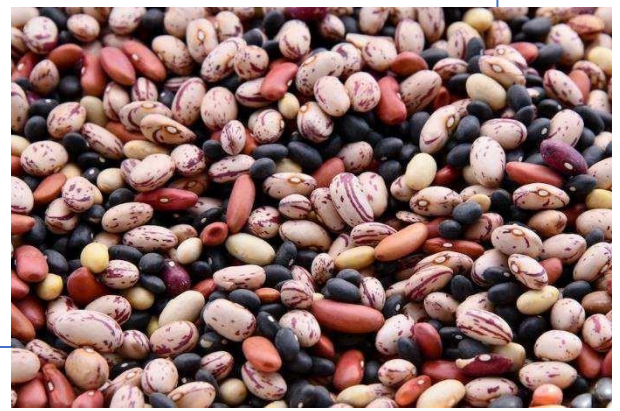
- Saturated fatty acids
  - found in high amounts in fats from animal sources
- Trans fatty acids
  - found in partially hydrogenated vegetable oils, margarines, and shortening
  - These fats were banned from the Canadian food supply in 2018

- These fatty acids are associated with increased risk of disease
  - Dietary recommendations are that foods high in saturated fats should be replaced with foods high in unsaturated fats

1,2 Food provides nutrients Carbohydrates:

- **Digestible**
  - **Starch** –from rice, wheat, corn, potatoes, cassava, etc.
    - Major sources of kcalories that feed humanity
  - Digestion → breakdown to glucose
  - Glucose-main carbohydrate that circulates in the blood
    - Source of energy for cells, especially the brain
  - **Sugars**
    - Sucrose – disaccharide of glucose & fructose
    - High fructose corn syrup- mixture of glucose & fructose (1:1)
      - Sweeteners for sugar-sweetened beverages (SSB)
        - Linked to obesity

- **Indigestible**
  - **Dietary fibre**
    - Whole grains, legumes, beans, peas, lentils
    - Vegetables and fruit.
  - High-fibre diets may reduce risk of CVD and colon cancer



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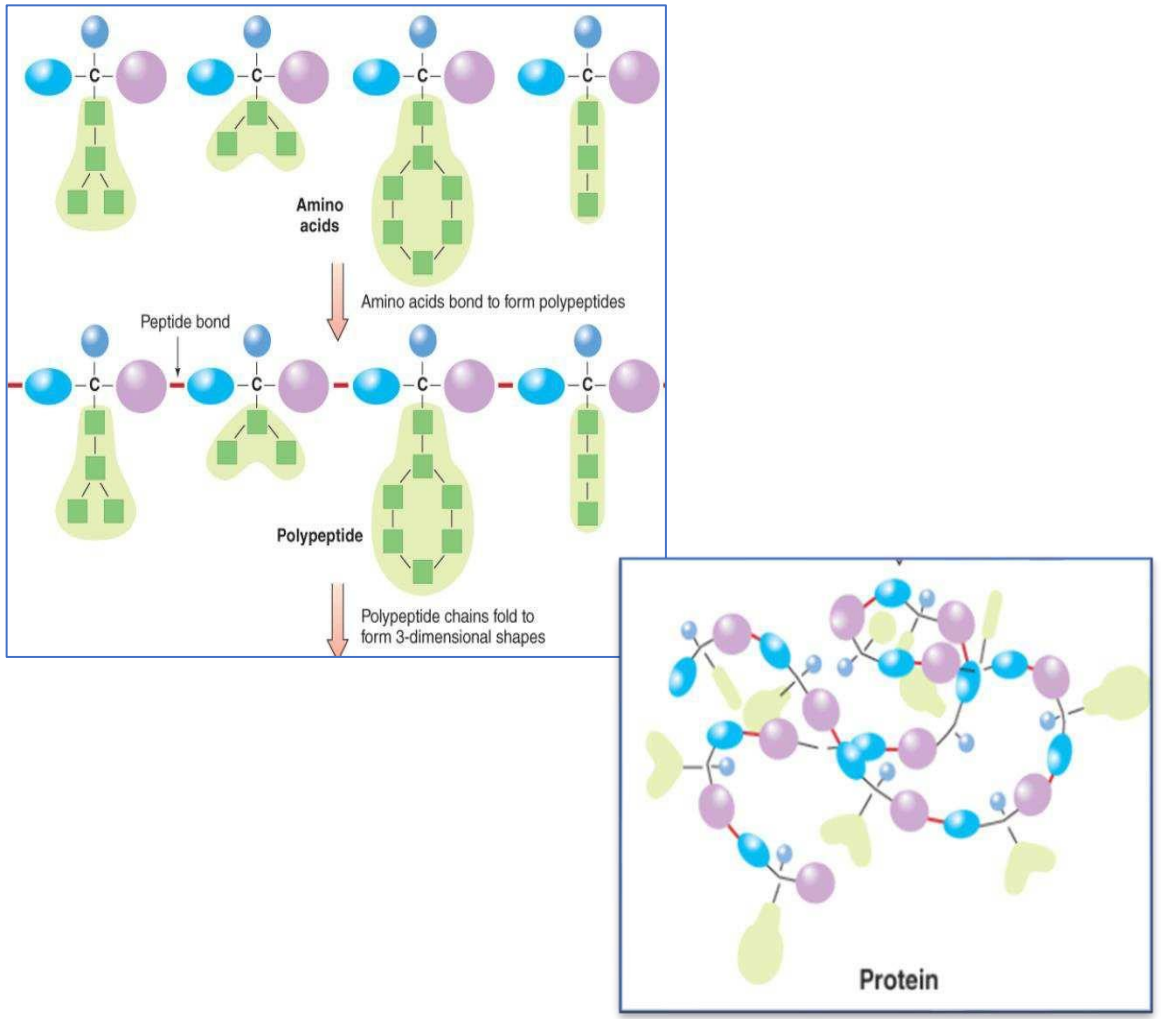
1.2 Food provides nutrients
Proteins

Proteins

- amino acids, joined by peptide bonds
- Some amino acids are essential/ indispensable and some are non-essential/ dispensable
  - essential amino acids must be obtained from the diet:

histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine



Micronutrients: Vitamins and Minerals

- Vitamins
  - Organic compounds
    - Fat-soluble vitamins
    - Water-soluble vitamins

- Minerals
  - Inorganic compounds
    - Iron-prevents iron deficiency anemia
    - Iodine-prevents goitre
    - Calcium-maintains bone health

Vitamins

- **Fat-Soluble Vitamins:**
  - Vitamin A, D, E & K
  - Can be stored in the liver and adipose tissue
  - are NOT rapidly depleted from the body
  - If intake is extremely high can have toxic effects

- **Water-Soluble Vitamins**
  - B vitamins and vitamin C
  - Not stored in the body
  - Are rapidly depleted so need to be consumed regularly
    - except vitamin B12 which is efficiently conserved
  - When consumed in excess excreted in the urine

Required Reading: Focus on Phytochemicals (after chapter 9) pg 443-449 3e.

- Substances not made by the body
  - Phytochemicals-sources: plants
- Not essential but may be beneficial to health
  - Many phytochemicals are antioxidants that may reduce the risk of diseases such as cardiovascular disease and cancer
- See the next slide for information on what you need to know about phytochemicals.

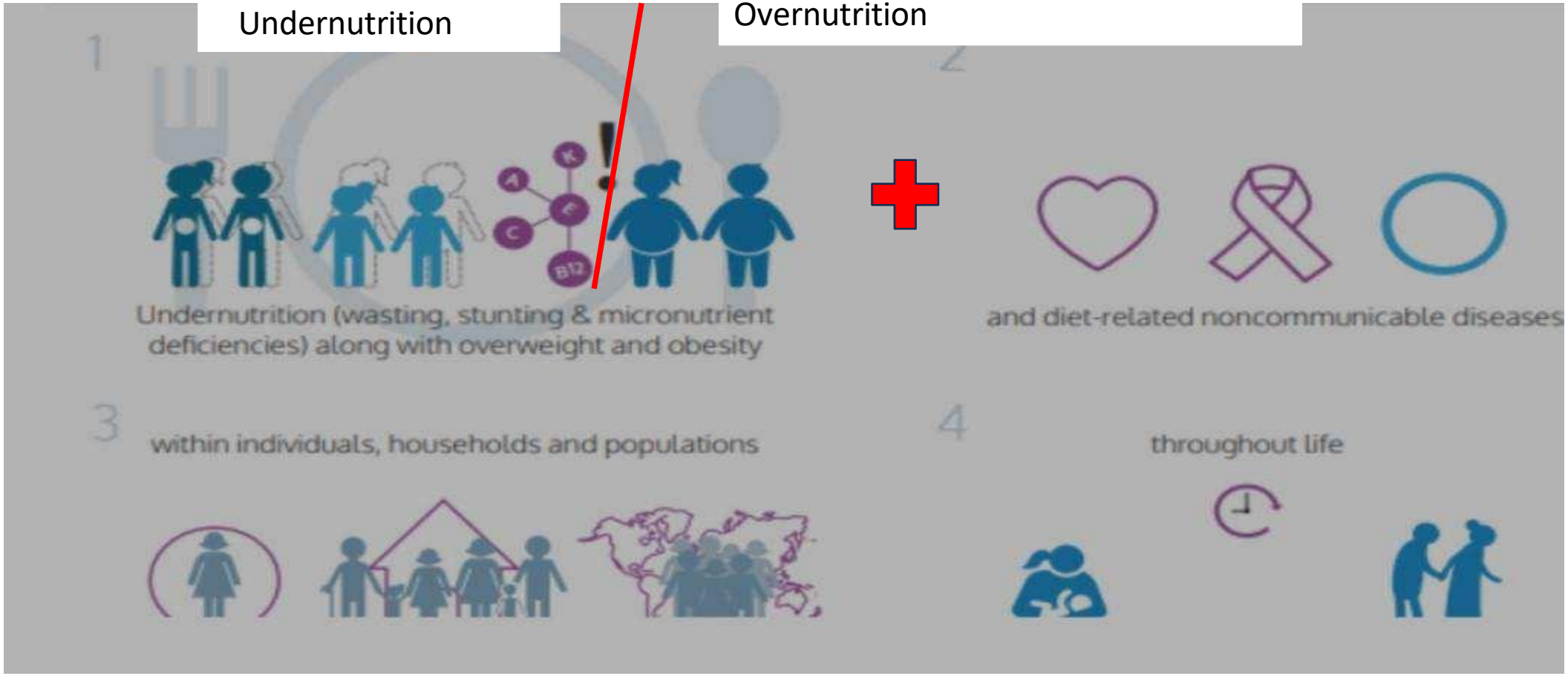
Questions: Required Reading: Focus on Phytochemicals – Nutrition: Science & Application pg 443-449 3e

- After reading about phytochemicals you will be able to:
  - Define:
    - functional food
    - antioxidant
  - Identify:
    - The two carotenoids that may reduce the risk of macular degeneration
    - The carotenoid that gives tomatoes their red colour.
    - The family of vegetables that include broccoli, cauliflower, bok choy and cabbage, two phytochemicals they contain, and how these phytochemicals are beneficial.
    - The sulfur compounds found in garlic and onions and their health benefits
    - The phytochemicals found in green tea and their health benefits
    - The polyphenolic compound associated with longevity
  - Explain briefly how phytoestrogens reduce the risk of disease.
  - Explain briefly how dark chocolate and white chocolate differ with respect to phytochemical content.
  - Explain briefly why bread made with whole grain flour contains more phytochemicals than grain made from white flour

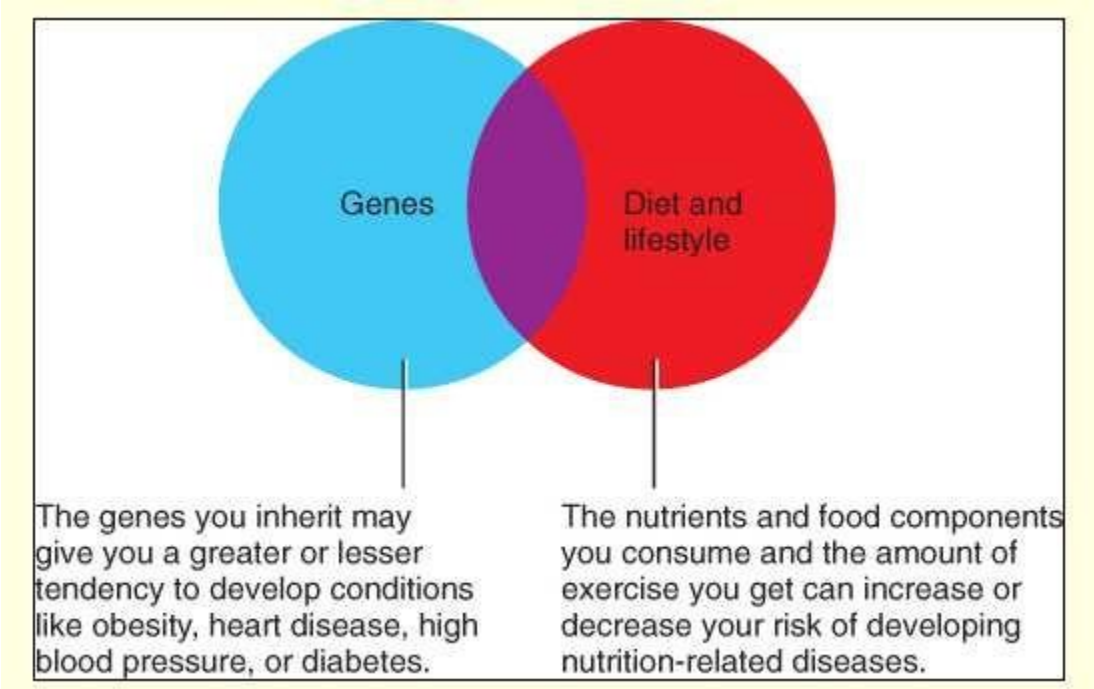
Section 3: Important Nutrition Concepts

1.2 Food provides nutrients: Nutrition and Health

Malnutrition



1.2 Food Provides Nutrients: Diet-Gene Interaction

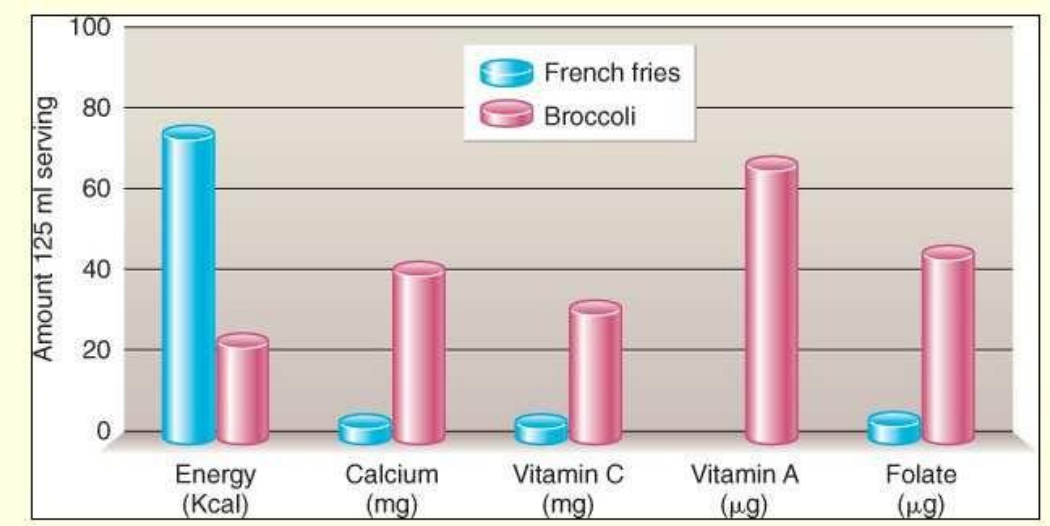


- Nutritional genomics or nutrigenomics
  - Study of the interaction between genetic variation and diet

Personalized nutrition

1.3 Food Choices for a Healthy Diet: Choosing a Healthy Diet

- Adequacy
  - Enough of a nutrient to maintain health
- Choose foods high in **nutrient density**
  - High nutrient levels/kcalorie



1.3 Food Choices for a Healthy Diet: Table 1.3 Choices to Boost Nutrient Density

TABLE 1.3 Choices to Boost Nutrient Density

Lower Nutrient Density Choice Instead of this . . .	Higher Nutrient Density Choice Have this . . .
Soft drink	Low-fat milk
Chocolate candies	Fruit and nut trail mix
Apple pie	Fresh apple
Potato chips and sour cream dip	Baked tortilla chips and salsa
Triple fudge brownie	Oatmeal raisin cookie
Fried chicken	Roasted chicken without skin
French fries	Oven-baked potato wedges

1.3 Food Choices for a Healthy Diet: Choosing a healthy diet

- Eat a **variety** of foods
- Eat a **balanced diet**
- Avoid excess kcalorie intake
  - Everything in moderation

- These principles are applied in Canada's Food Guide (Ch 2)

1.3 Food Choices for a Healthy Diet: Choosing a Healthy Diet

Portion Distortion

Typical portion sizes have increased, over the last forty years, and with it an increase in the consumption of kcalories.

http://www.nhlbi.nih.gov/health/educational/wecan/eat-right/portion-distortion.htm

Subpackaging
-packaging in 100 kcal portions

Luisa Begani

Think-Pair-Share

Note two concepts that you remember from the Nutrition Intro Lecture