Nutrition Tools – Standards

TextbookChapter 2

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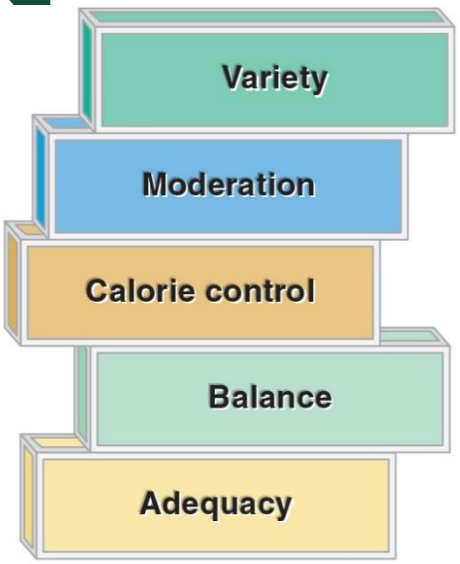
Learning Objectives

- Describe the concepts of nutrient density
- Explain how RDI, AI, UL, DV, and EAR serve different functions in describing nutrient values, and discuss how each is used.
- Describe some tools Canadians can use to assess the quality of their diet.

Characteristics of a Nutritious Diet



These factors are the building blocks of a nutritious diet.

A,B,C,M,V Principles:

1. Adequacy
2. Balance
3. Calorie Balance
4. Moderation
5. Variety

Plus:

Nutrient Density….

Energy Density

- Measure of food kcal relative to its weight :

  kcal/ 100g

- Water 0 kcal/ 100 g= 0 kcal/g
- Pure CHO and Protein: 400 kcal/ 100 g = 4 kcal/g
- Pure Fat: ??

- High energy dense foods: Nuts, avocado, oils, highly processed snacks, desserts, fast foods

Nutrient Density

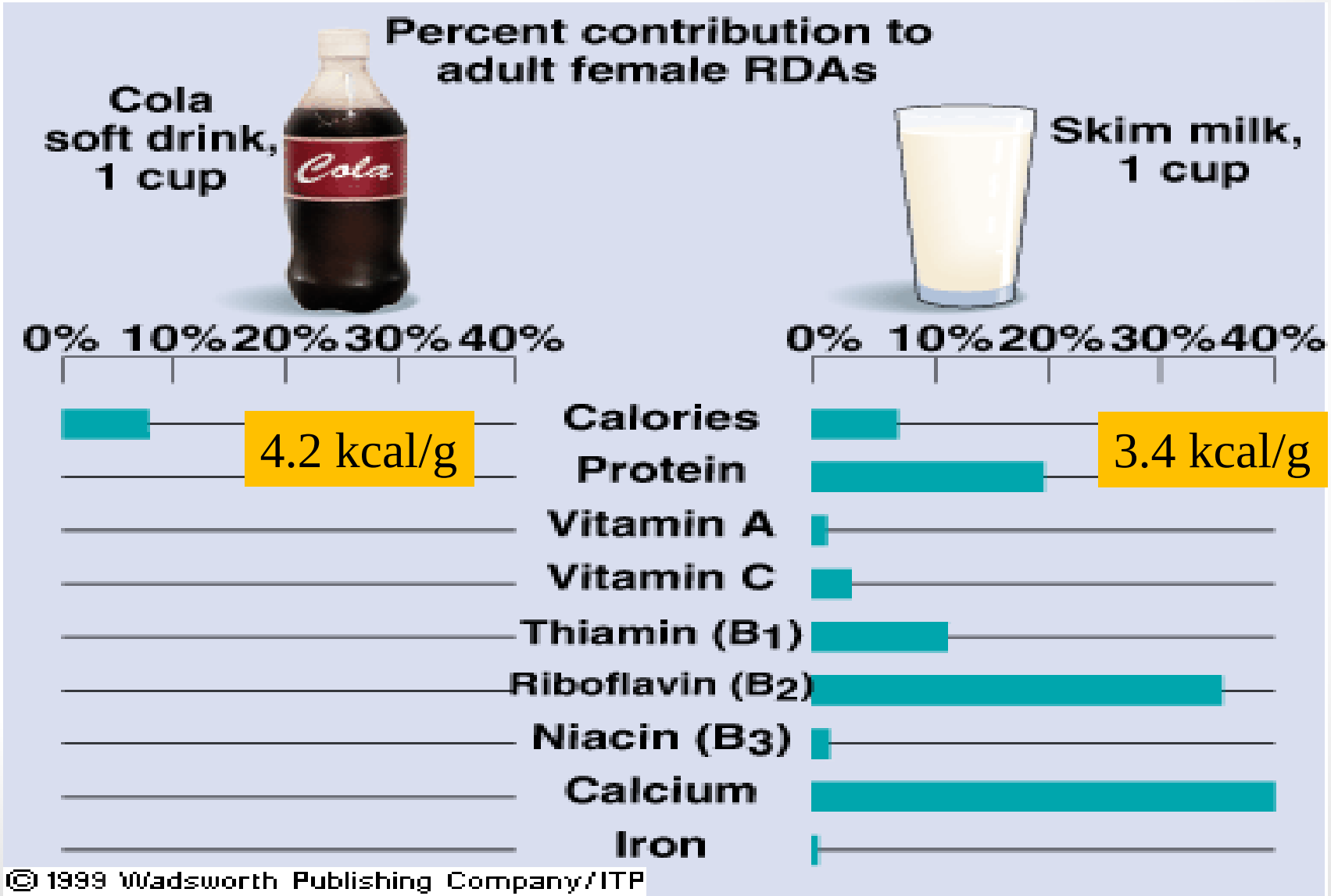
- Measure of nutrient value of food (quantity, energy, nutrients)
- The most nutrients for the least food energy

- Amount of a nutrient provided by 100g food relative to the amount of energy provided

= % of Nutrient RDA provided/ % of Energy provided

  - e.g. potatoes – baked, boiled or fried

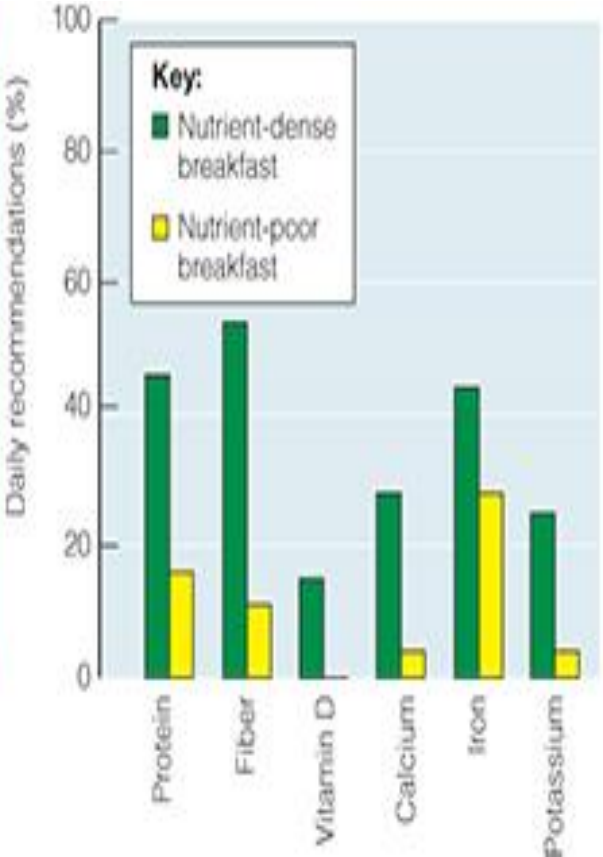
Compare Energy density vs Nutrient Density….. Empty Calories



Nutrient Density of Two Breakfasts

- Using the graph, compare the nutrient density of these two breakfasts- 500 kcal each:

NUTRIENT-DENSE BREAKFAST



NUTRIENT-POOR BREAKFAST

Nutrient profiling

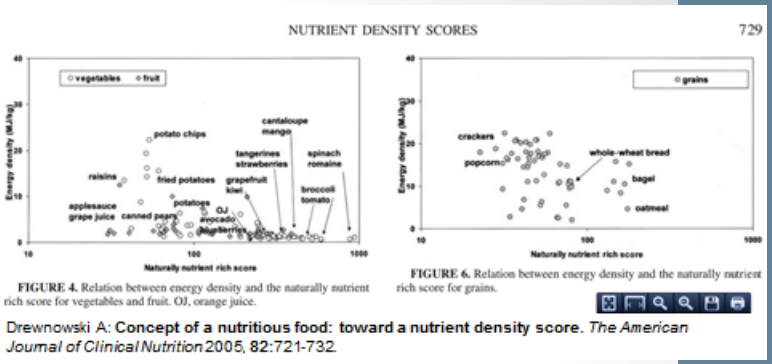


FIGURE 4. Relation between energy density and the naturally nutrient rich score for vegetables and fruit. OJ, orange juice.

FIGURE 6. Relation between energy density and the naturally nutrient rich score for grains.

Drewnowski A: **Concept of a nutritious food: toward a nutrient density score.** *The American Journal of Clinical Nutrition* 2005, 82:721-732.

Dr. Dewnowski's research

- **Nutrient profiling of foods**: science of ranking foods based on their nutrient content

- Becoming the basis for regulating nutrition labels, health claims, and marketing and advertising to children around the world. Cost and sustainability can be added to the algorithms.

- Helps guide nutrition quality and public health policies

- Need DRI's to do this…

https://pubmed.ncbi.nlm.nih.gov/20515553/
https://www.frontiersin.org/articles/10.3389/fnut.2020.00107/full

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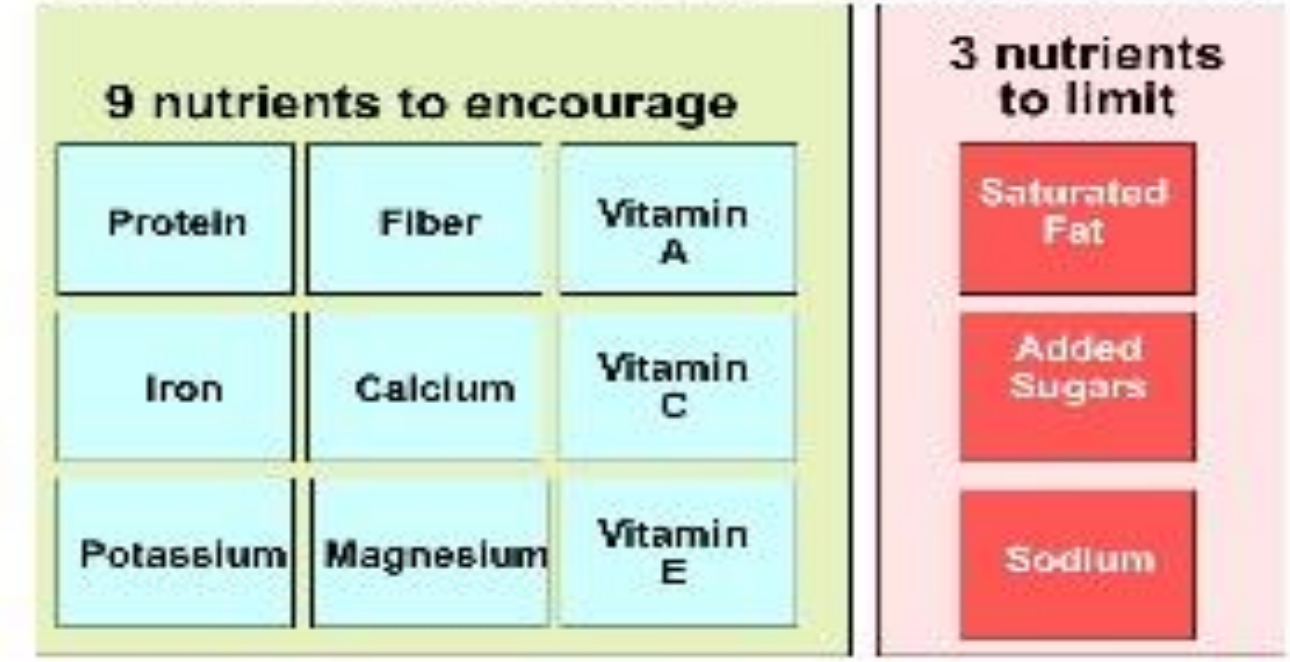
The Nutrient Rich Foods (NRF9.3) index

$$NRF9.3 = \Sigma_{i=9}\ (\%DV/100kcal) - \Sigma_{i=3}\ (\%DV100kcal)$$



Drewnowski, Fulgoni. Nutr Rev 2009

Fulgoni, V. L., 3rd, Keast, D. R., & Drewnowski, A. (2009). Development and validation of the nutrient-rich foods index: a tool to measure nutritional quality of foods. *J Nutr, 139*(8), 1549-1554. doi:10.3945/jn.108.101360

Nutrient Recommendations

- Standards in Canada and the United States are derived from the **dietary reference intakes (DRI)**
- Rec's for **healthy** people
- DRI committee has set recommended intakes for:

Vitamins
Minerals
Carbohydrate
Fibre
Lipid
Protein
Water
Energy

Goals of the DRI Committee

The DRI establishes a number of values for each nutrient, each serving a different purpose

Goals of the DRI Committee

- **Goal #1: Setting Recommended Intake Values**
  - Recommended Daily Allowances (**RDA**): Based on solid experimental evidence and reliable observations
  - Adequate Intake (**AI**): Scientifically based, but requires some educated guesses

Goals of the DRI Committee

- **Goal #2: Facilitating Nutrition Research and Policy**
  - Estimated average requirements **(EAR):** Nutrient requirements for given life stages/gender groups used by researchers and nutrition policymakers
- **Goal #3: Establishing Safety Guidelines**
  - Tolerable Upper intake Levels (**UL**): Identifying potentially hazardous levels of nutrient intake; used to set safe upper limits for food/water supply
- **Goal #4: Preventing Chronic Diseases**
  - Acceptable Macronutrient Distribution Ranges (**AMDR**)
  - Estimated Energy Requirements **(EER)**

DRI Tables

- Each DRI category serves a **unique** purpose

- Go to text book pages A-C
- Or https://www.nap.edu/read/25353/chapter/28#571

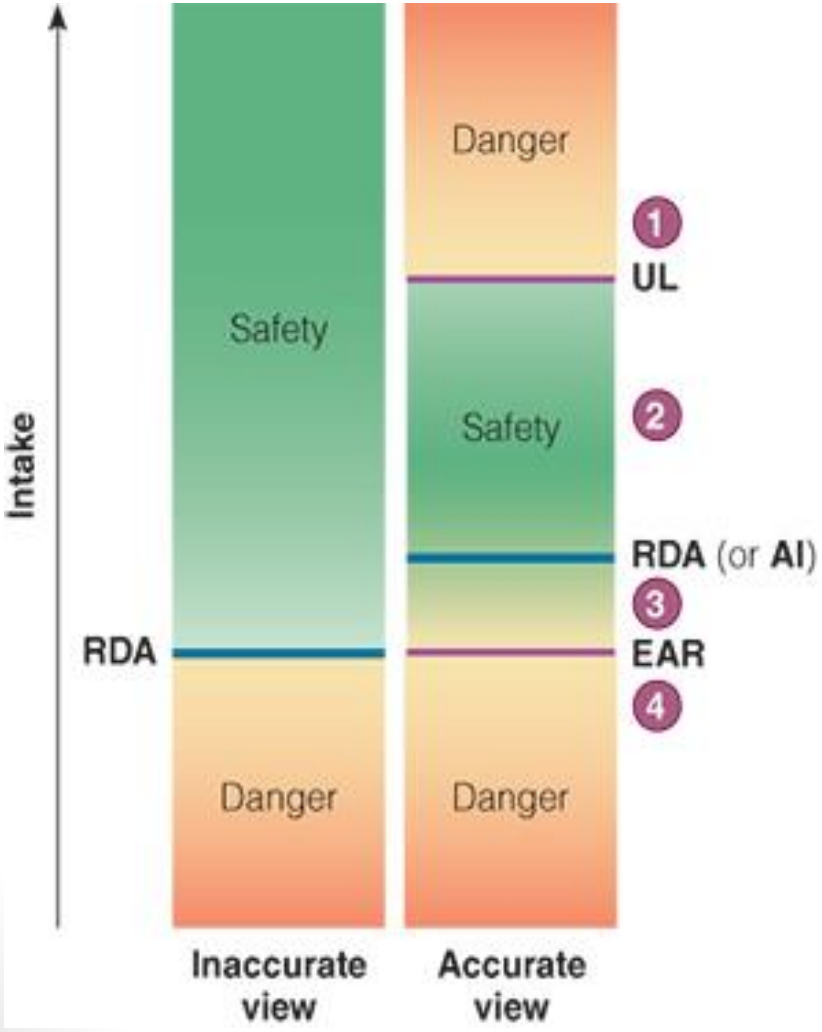
Understanding the DRI Recommendations

- Separate recommendations for specific sets of people, based on available scientific research and updated periodically
  - You should try to get 100% of DRI recommended intake for every nutrient, ensuring an adequate intake over time

Understanding the DRI Recommendations

- Values are based on probability and risk
- DRI recommended intakes are associated with a low probability of deficiency for people of a life stage and gender group
- Not minimum requirements …. linked to prevent development of chronic diseases

Inaccurate versus Accurate View of Nutrient Intakes



1. If a person's usual intake regularly falls above the UL, the intake is probably excessive and the possibility of toxicity likely.
2. If a person's usual intake falls above the RDA, the intake is probably adequate because the RDA meets the needs of almost all people.
3. A usual intake that falls between the RDA and the EAR is more difficult to assess; the intake may be adequate, but the chances are greater or equal that it is inadequate.
4. If a person's usual intake falls below the EAR, the intake is probably inadequate and the possibility of deficiency likely.

Establishing DRI Values—RDA Example

- One type of experiment is a **balance study**:
  - A person is fed a controlled diet
  - The intake and excretion of a nutrient is measured
  - For each individual subject, it can determine a **requirement**, or amount of nutrient, that will just prevent the development of specific deficiency signs

Understanding the DRI Recommendations

- Specific indicators of nutrient adequacy:
  - Blood nutrient concentrations
  - Normal growth
  - Reduction of certain chronic diseases
  - Other disorders when appropriate, rather than just prevention of deficiency symptoms

Don't let the "alphabet soup" of DRI recommended nutrient intakes confuse you. Their names make sense when you learn their purposes.

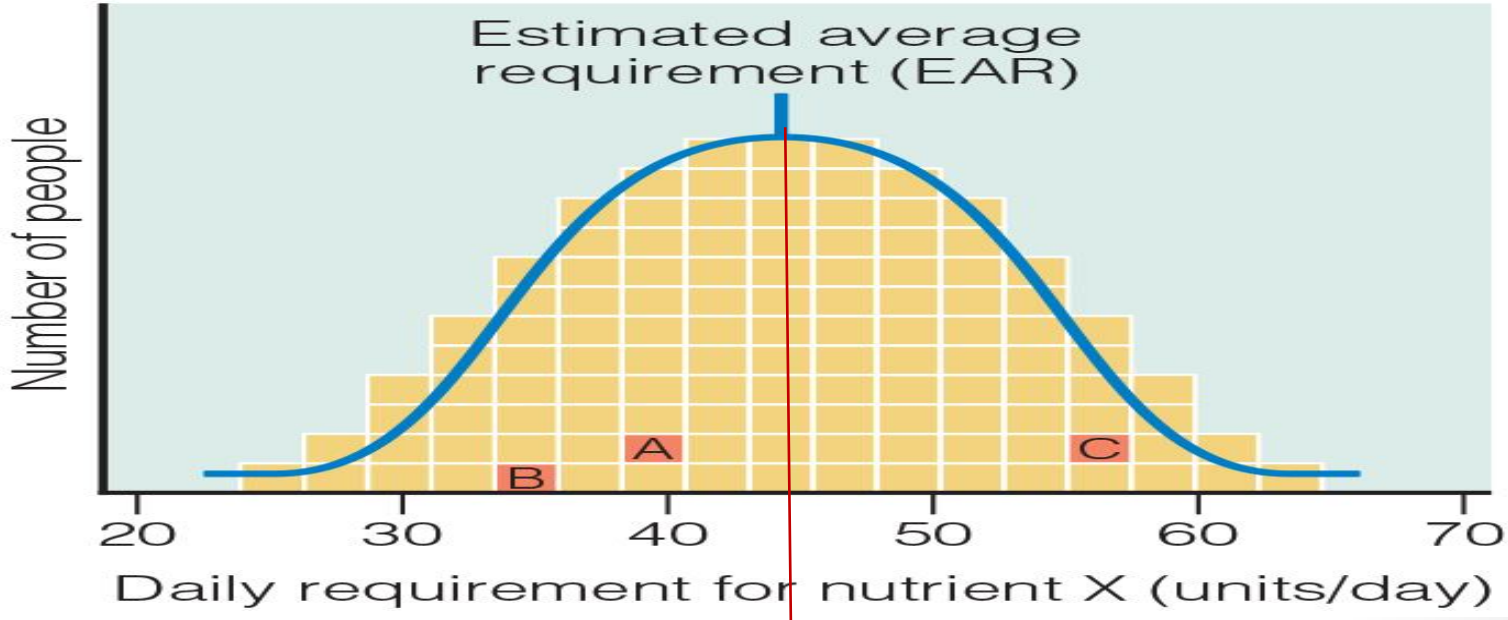
EAR VS RDA VS AI vs UL…

BIG PICTURE OF DRI'S

Figure 2–2

Individuality of Nutrient Requirements

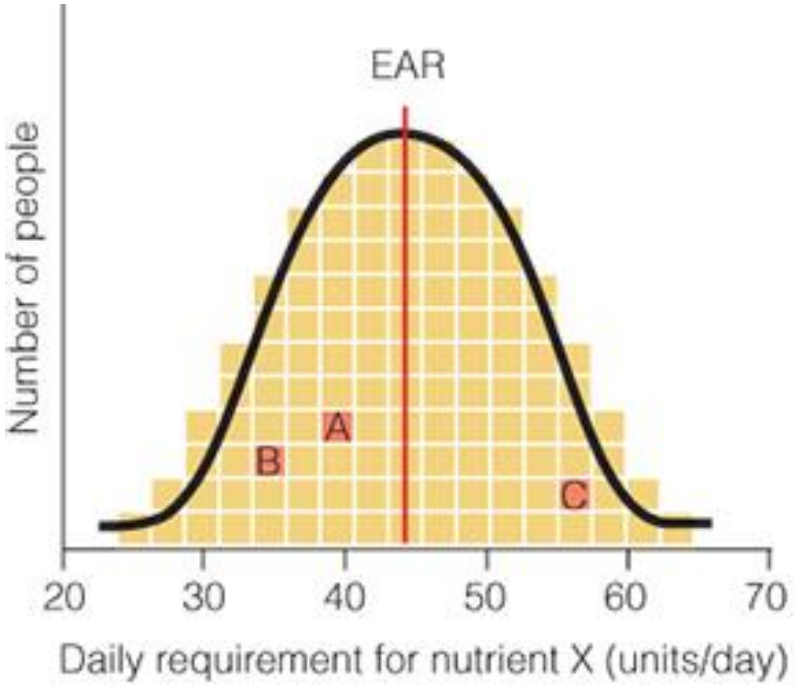
Each square represents a person. A, B, and C are Mr. A, Mr. B, and Mr. C. Each has a different requirement.



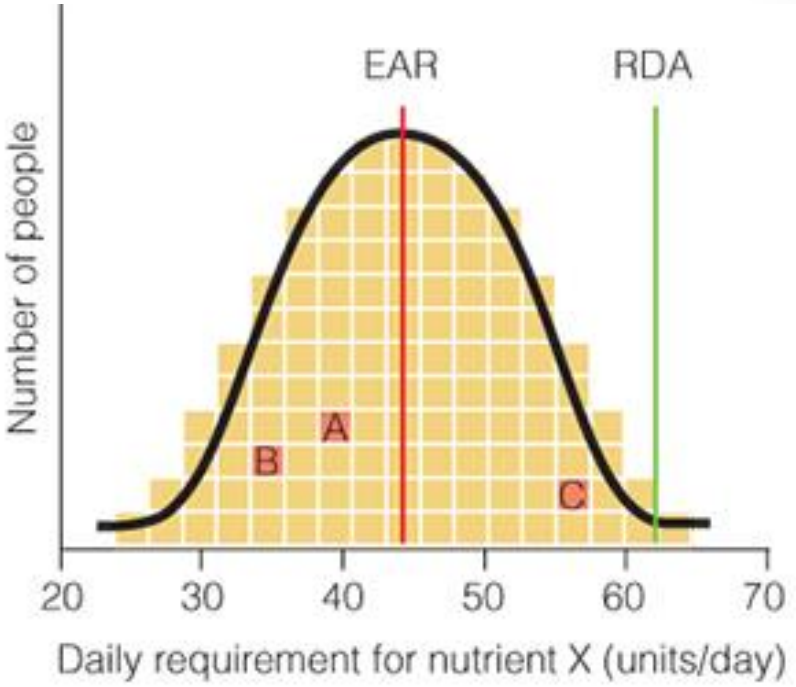
Establishing DRI Values—RDA Example

- To set value, we have to decide what intake to recommend for everybody
  - EAR value is probably close to everyone's minimum need
  - The RDA value is set so that 97%-98% of the population will be covered but not so high as to be excessive

EAR and RDA Compared



The Estimated Average Requirement (EAR) for a nutrient is the amount that meets the needs of about half of the population (shown here by the red line).



The Recommended Dietary Allowance (RDA) for a nutrient (shown here in green) is set well above the EAR, meeting the needs of about 98% of the population.

So what's the AI and UL??

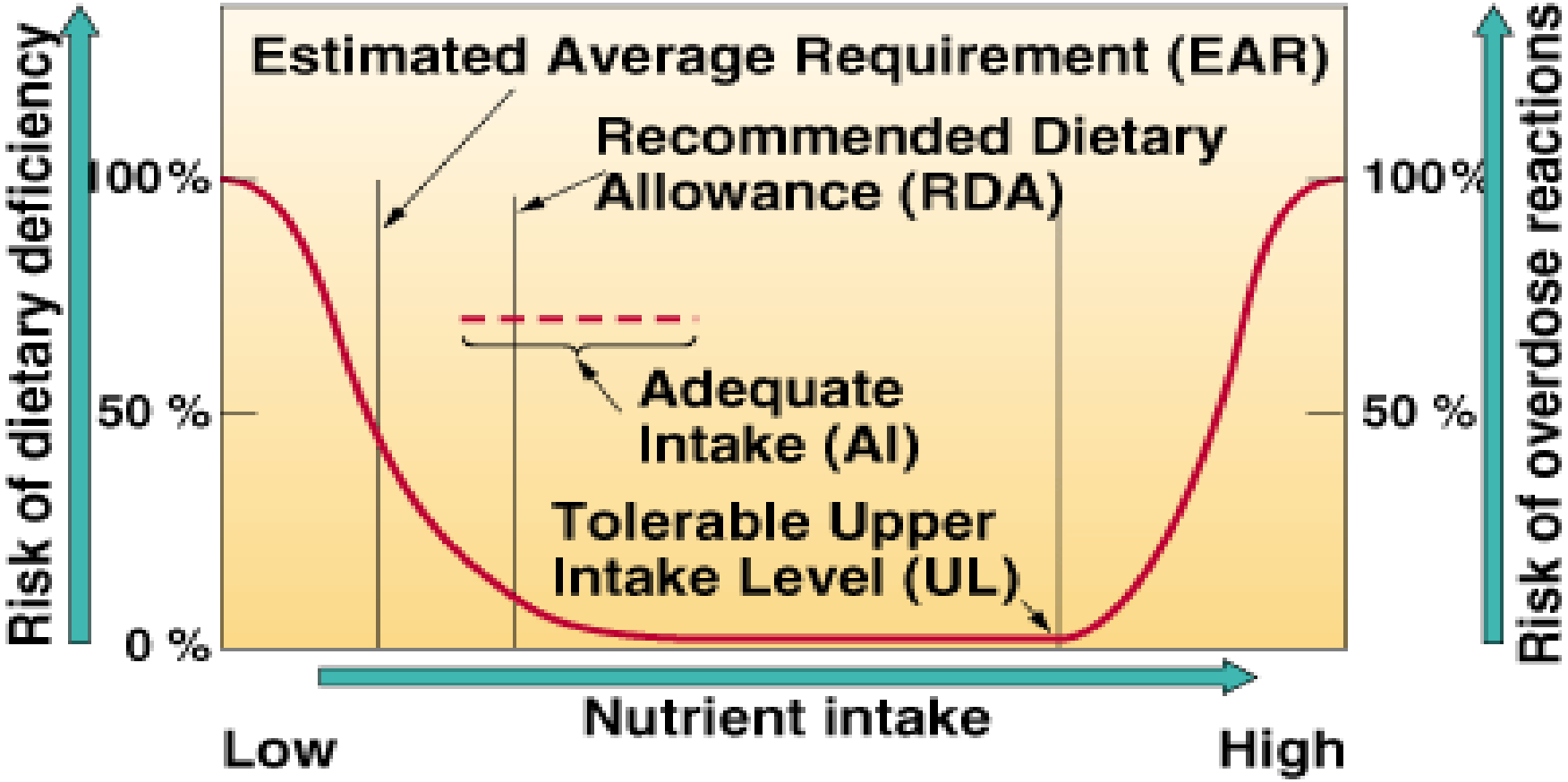
AI

- Not enough research for EAR
- Have food records from large population to determine an average amount that maintains health

UL

- Highest average daily intake for age group that is likely to pose no risk to almost all healthy individuals
- Usual intake above this level is likely to cause toxic effects

SUMMARY: NUTRIENT REQUIREMENTS



Using Nutrient Recommendations

- **Estimates apply to *healthy people***
- Recommendations—not minimum levels nor optimal levels
- Goals intended to **be met through foods**
- Values apply to ***average*** daily intakes
  - assumes day to day variance
  - set high enough to ensure body nutrient stores will meet nutrient needs during periods of inadequate intakes

Understanding the DRI Recommendations

HOWEVER…. the DRI guidelines are for healthy populations…

- Adjustment required for medical problems, malnourishment, or other conditions
  - A person may require a much higher or possibly lower intake of certain nutrients during the stress of illness or malnutrition
- Therapeutic diets take into account increased nutrient needs imposed by certain medical conditions

Setting Energy Requirements

- Estimated energy requirements (EER):
  - Average dietary energy intake, predicted to maintain energy balance in healthy adult of certain age, gender, weight, height, and level of physical activity
- Enough food energy is critical to support health and life.
  - Too much causes unhealthy weight gain
  - No UL

Acceptable Macronutrient Distribution Ranges

- AMDR: A diet with these proportions can provide adequate nutrients in a healthy balance and reduce risk of chronic diseases
    - 45%-65% from carbohydrates
    - 20%-35% from fat
    - 10%-35% from protein

Class activity: Let's get curious

- Use your DRI tables:
- For your age group, how does the RDA of protein compare to the AMDR for % protein? Use the EER to do your calculations.

- What is the trend for iron and calcium needs from infancy to > 70 in men vs women? What happens with pregnancy and lactation?

- What is the UL for Iron and Ca? Does this vary with age and sex?

- What nutrients have an AI?

Nutrient Recommendations

- **Daily Values (DV)** are another set of nutrient standards; they are practical for people seeking to make wise choices
  - Nutrient standards are printed on food labels
  - Allow comparison among foods with regards to nutrient content
  - Based on nutrient and energy recommendations for a general 2,000-Calorie diet

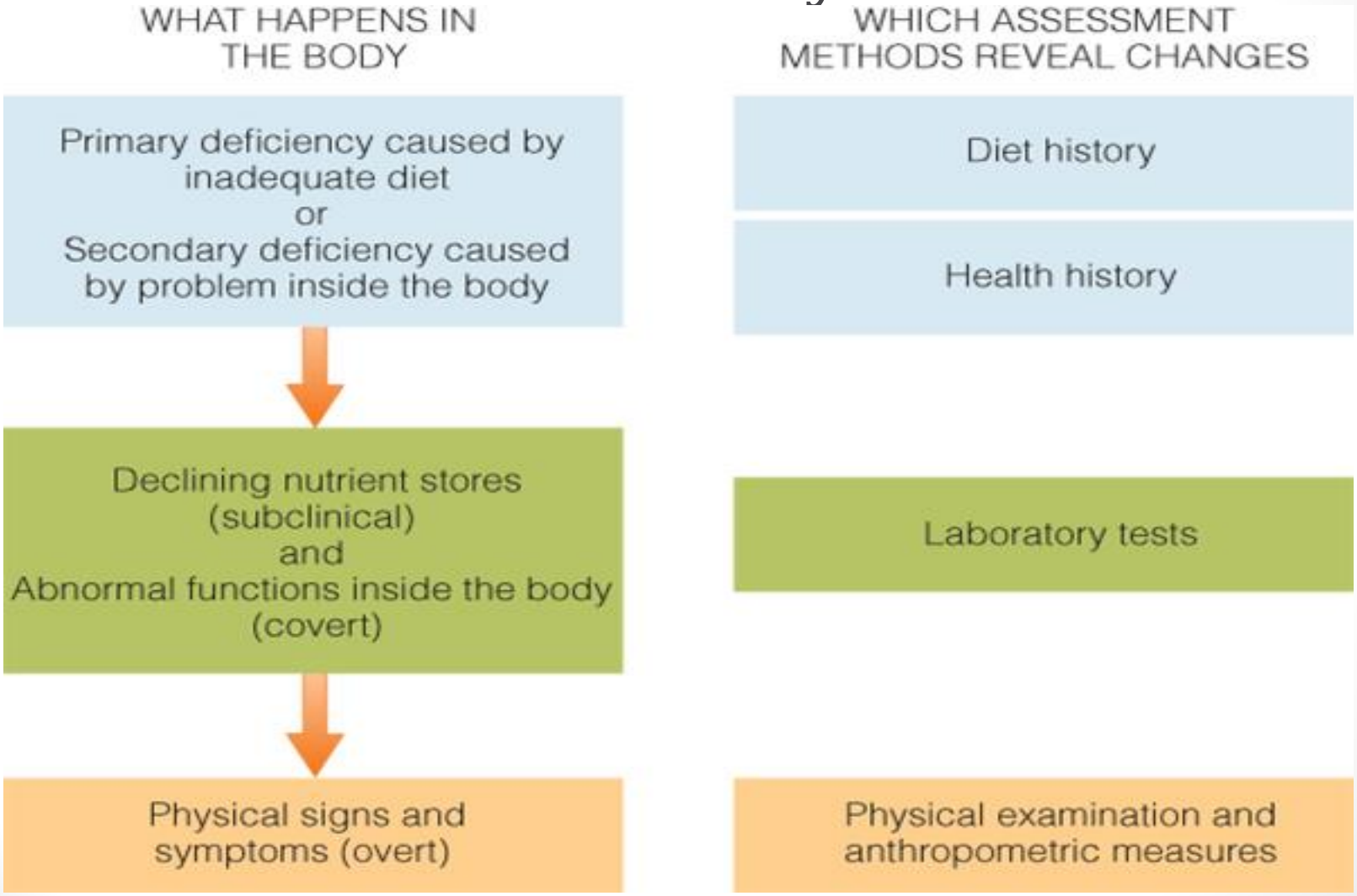
Nutrition Assessment

- Deficiency or excess over time leads to malnutrition
  - Undernutrition and overnutrition
- Symptoms of malnutrition (over or under nutrition)
  - Diarrhea
  - Skin rashes
  - Fatigue
  - Others

Creating a "Total Picture" of the Individual

- Historical information
  - Health status, Socioeconomic status, drug use
  - Diet history—intake over several days; portion sizes; computer analysis
- Anthropometric measurements
  - Height and weight—track to identify trends
- Physical examinations
  - Hair, skin, eyes, tongue, fingernails
- Laboratory tests

Stages in the Development of a Nutrient Deficiency



Nutrition Assessment of Populations

- National nutrition surveys
  - One survey collects data on food types and amounts
  - Another collects anthropometric data about people
  - Results used by government, scientists, food industry
- National health goals
  - Healthy People program
- National trends

Recommendations for Daily Physical Activity – Think Fitness

- The Canadian Physical Activity Guidelines for adults 18-64 years:
  - Accumulate at least 150 minutes of moderate-to vigorous-intensity aerobic physical activity per week
  - Add muscle and bone strengthening activities two+ days per week