An Overview Of Nutrition:

The Nutrients, Dietary Reference Intake, Diet, and Health

Course Name: Clinical Nutrition

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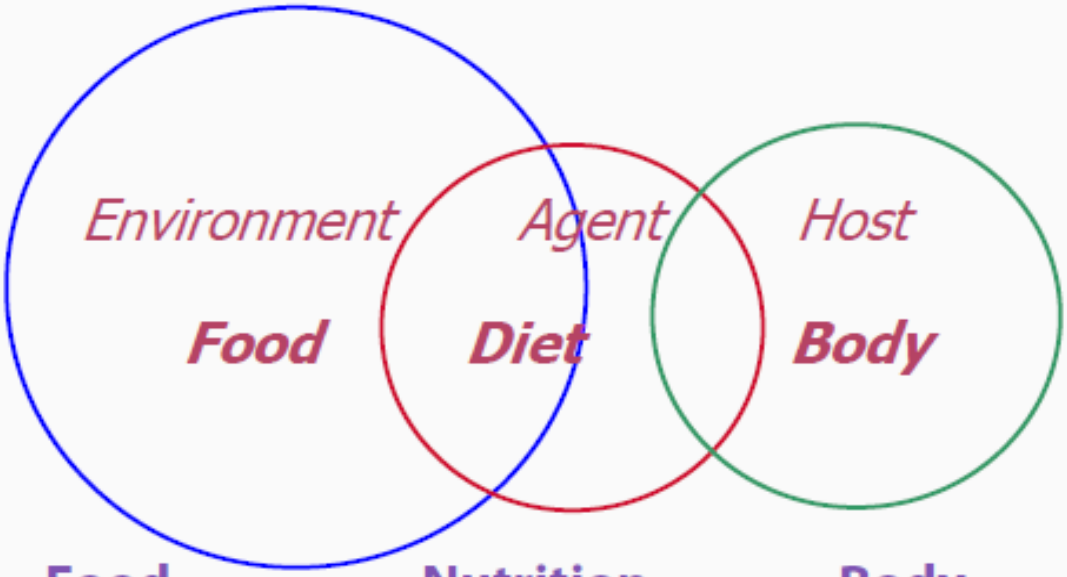
The Science of Nutrition

- Nutrition: The science of foods and the substances they contain.
- It is the social, economics, cultural and psychological implications of food and eating.
- Nutrition studies the interaction between the individual and the environment mediated by food.

Food, Nutrition, and the Body



Food	Nutrition	Body
Production	Carbohydrates	Genetics
Distribution	Proteins	Physiology
Hygiene	Fats	Lifestyle
Preparation	Vitamins	Needs
Food labels	Minerals	
Meals		

DEFINITIONS

Food

- Derived from plant or animal sources.
- Provide energy and nutrients.
- Used by the body for maintenance, growth, and repair.

Diet

- The foods one consumes, (that can affect the person health).

Food Choices

- **Personal preference→ taste**
- Habit
- Ethnic heritage or tradition
- Social interactions
- **Availability (**Marketing**), convenience, economy**
- Positive and negative associations
- Emotional comfort
- Values
- Body weight and image

Nutrition and health benefits

Functional foods

- Provide health benefits beyond their nutrient contributions.

- Ex. Whole foods, fortified foods or modified foods.

What Is a Healthy Diet?

- Fulfills energy needs (macronutrients)
- Provides sufficient amounts of essential nutrients (micronutrients)
- Reduces risk of disease
- Is safe to consume (low contaminants or potentially harmful added substances)

The Nutrients

Nutrient:

Chemical substances obtained from food and used in the body.

Food's Energy:

Chemical energy to mechanical, electrical and heat energy.

Body Composition

The Essential Nutrients

- ✓ **Definition**:

  Nutrients a person must obtain from food because the body cannot make them for itself in sufficient quantity to meet physiological needs; also called *indispensable nutrients.*

- ✓ About 40 nutrients are currently known to be essential for human beings.
- ✓ Carbohydrate, fat, and protein are sometimes called *macronutrients* because the body requires them in relatively large amounts (many grams daily).
- ✓ Vitamins and minerals are *micronutrients,* required only in small amounts (milligrams or micrograms daily).

Nutrients

Definition:

Substances that support the growth, maintenance, and repair of the body's tissues.

The six classes of nutrients include:

- Carbohydrates
- Lipids (fats)
- Proteins
- Vitamins
- Minerals
- Water

- Foods rich in the energy-yielding nutrients (carbohydrate, fat, and protein) provide the major materials for building the body's tissues and yield energy for the body's use or storage.

- Vitamins, minerals, and water do not yield energy; instead they facilitate a variety of activities in the body.

Nutrients (continued)

- **VITAMINS:** organic, essential nutrients required in small amounts by the body for health.

✓ The water-soluble vitamins are vitamin C and the eight B vitamins: thiamin, riboflavin, niacin, vitamins B6 and B12,folate, biotin, and pantothenic acid.

✓ The fat-soluble vitamins are vitamins A, D, E, and K.

✓ **MINERALS:** inorganic elements. Some minerals are essential nutrients required in small amounts by the body for health.

✓ The major minerals are calcium, phosphorus, potassium, sodium, chloride, magnesium, and sulfate.

✓ The trace minerals are iron, iodine, zinc, chromium, selenium, fluoride, molybdenum, copper, and manganese.

Chemical composition of nutrients
Inorganic vs. Organic nutrients

TABLE 1-1 Elements in the Six Classes of Nutrients

Notice that organic nutrients contain carbon.

	Carbon	Hydrogen	Oxygen	Nitrogen	Minerals
Inorganic nutrients					
Minerals					✓
Water		✓	✓		
Organic nutrients					
Carbohydrates	✓	✓	✓		
Lipids (fats)	✓	✓	✓		
Proteins[a]	✓	✓	✓	✓	
Vitamins[b]	✓	✓	✓		

[a] Some proteins also contain the mineral sulfur.

[b] Some vitamins contain nitrogen; some contain minerals.

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Energy Yielding Nutrients:

Definition:

The nutrients that break down to yield energy the body can use: Carbohydrate, Protein and Lipid

- Because fat provides more energy per gram→ it has a greater **energy density** than either carbohydrate or protein.
- **Energy density:** a measure of the energy a food provides relative to the weight of the food (kcalories per gram).

TABLE 1-2 kCalorie Values of Energy Nutrients

Energy Nutrients	kCalories[a] (per gram)
Carbohydrate	4 kcal/g
Fat	9 kcal/g
Protein	4 kcal/g

NOTE: Alcohol contributes 7 kcalories per gram that can be used for energy, but it is not considered a nutrient because it interferes with the body's growth, maintenance, and repair.

[a] For those using kilojoules: 1 g carbohydrate = 17 kJ; 1 g protein = 17 kJ; 1 g fat = 37 kJ; and 1 g alcohol = 29 kJ.

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Energy from Foods (Kcal vs. Joules)

- The energy released from carbohydrates, fats, and proteins can be measured in **calories.**

Calories

- Units by which energy is measured.
- Energy provided by foods and beverages is measured in *kilocalories* (1000 calories equal 1 kilocalorie), abbreviated *kcalories* or *kcal.*
- ***Definition****:* One kcalorie is the amount of heat necessary to raise the temperature of 1 kilogram (kg) of water 1°C→ Heat energy
- The scientific use of the term *kcalorie* is the same as the popular use of the term *calorie*.

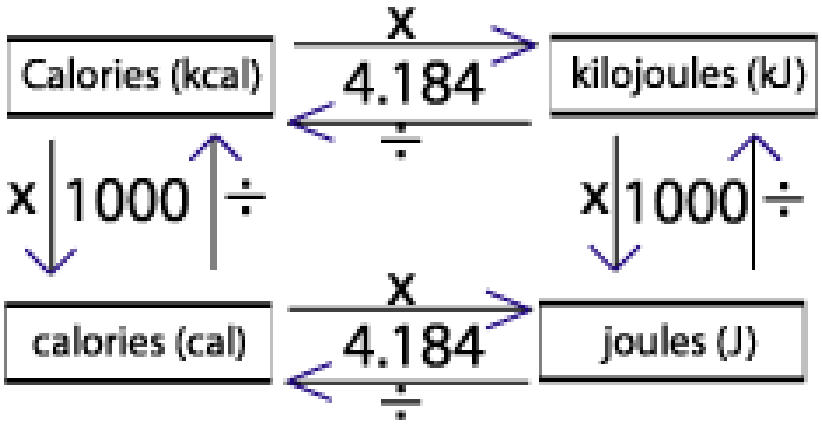
Joules

→ The amount of energy expended when 1 kilogram is moved 1 meter by a force of 1 newton. → Work energy.

Continued

- **1 cal_{15} = 4.1855 J**
  Cal = 4.2 Joules
  Joules = cal /4.2

  For example, a 50-kcalorie cookie provides 210 kilojoules:
  → 50 kcal X 4.2 = 210 kJ



a 4.18 kilogram object moving at 1 meter per second....

4.18 Joules = 1 calorie

....has enough energy to heat 1 gram of water from 15°C to 16°C.

Energy Density Comparison

LOWER ENERGY DENSITY

This 450-gram breakfast delivers 500 kcalories, for an energy density of 1.1 (500 kcal ÷ 450 g = 1.1 kcal/g).

© Matthew Farruggio (both)

HIGHER ENERGY DENSITY

This 144-gram breakfast also delivers 500 kcalories, for an energy density of 3.5 (500 kcal ÷ 144 g = 3.5 kcal/g).

How To Think Metric??

A liter of liquid is approximately one US quart.
(Four liters are only about 5 percent more than a gallon.)

One cup is about 240 milliliters; a half-cup of liquid is about 120 milliliters.

A half-cup of vegetables weighs about 100 grams;
one pea weighs about ½ gram.

→ 5-pound bag of potatoes weighs about 2 kilograms,
→ a 176-pound person weighs 80 kilograms.

EXERCISE

- 1 slice of **bread** with 1 tablespoon of **peanut butter** on it contains

→16 grams carbohydrate

→ 7 grams protein

→ and 9 grams fat..

CALCULATE THE ENERGY AVAILABLE FROM FOOD…

ANSWER!!

16 g **carbohydrate** X 4 kcal/g = 64 kcal

7 g **protein** X 4 kcal/g = 28 kcal

9 g **fat** X 9 kcal/g = 81 kcal

Total = 173 kcal

How To Calculate the Energy Available from Foods *(CONTINEUD)*

To determine the percentage of kcalories from fat, for example, divide the 81 fat kcalories by the total 173 kcalories:

81 fat kcal ÷ 173 total kcal = 0.468 (rounded to 0.47)

Then multiply by 100 to get the percentage:

0.47 X 100 = %47

How To Calculate the Energy Available from Foods *(CONTINEUD)*

Dietary recommendations that urge people to **limit fat** intake *to 20 to 35 percent of kcalories refer to the day's total energy intake*, not to individual foods.

Still, if the proportion of fat in each food choice throughout a day exceeds 35 percent of kcalories, then the day's total surely will, too.

Knowing that this snack provides 47 percent of its kcalories from fat alerts a person to the need to make lower-fat selections at other times that day.

Dietary Reference Intakes (DRI)

- Using the results of thousands of research studies, nutrition experts have produced a set of standards that ***define the amounts of energy, nutrients, other dietary components, and physical activity that best support health***.

- These recommendations are called **Dietary Reference Intakes (DRI), and they reflect the collaborative** efforts of researchers in both the United States and Canada.

Scientific Basis for Establishing DRIs

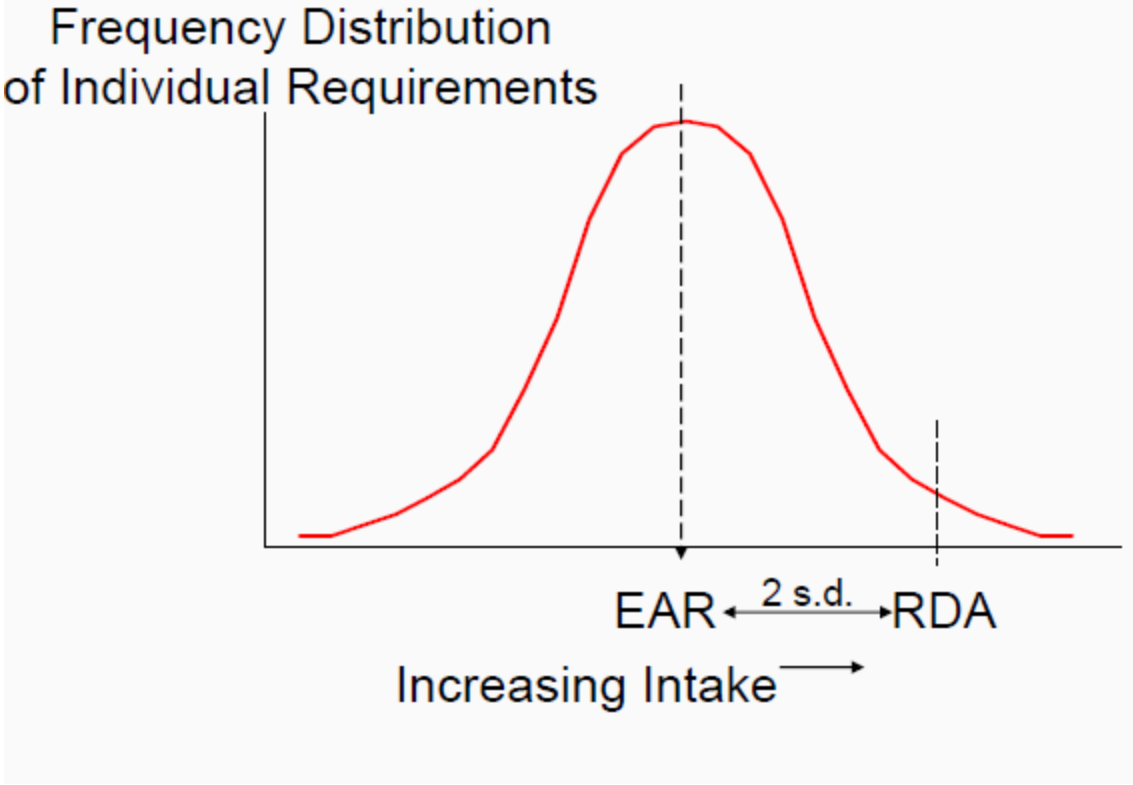
- Observed intakes in healthy populations
- Epidemiological observations
- Balance studies
- Depletion/repletion studies
- Animal experiments
- Biochemical measurements

Dietary Reference Intakes (DRI) Values

- **Estimated Average Requirement (EAR):** the average daily amount of a nutrient that will maintain a specific biochemical or physiological function in **half the healthy people** of a given age and gender group.
- **Recommended Dietary Allowance (RDA):** the average daily amount of a nutrient considered adequate to meet the known nutrient needs of practically **all healthy people**; a goal for dietary intake by individuals.
- **Adequate Intake (AI):** the average daily amount of a nutrient that appears sufficient to maintain a specified criterion; a value used as a guide for nutrient intake **when an RDA cannot be determined**.
- **Tolerable Upper Intake Level (UL):** the maximum daily amount of a nutrient that appears safe for most healthy people and beyond which there is an increased risk of adverse health effects.
- ***Special note:*** *These recommendations apply to healthy people and may not be appropriate for people with diseases that increase or decrease nutrient needs.*
- **Deficient:** inadequate; a nutrient amount that fails to meet the body's needs and eventually results in deficiency symptoms.

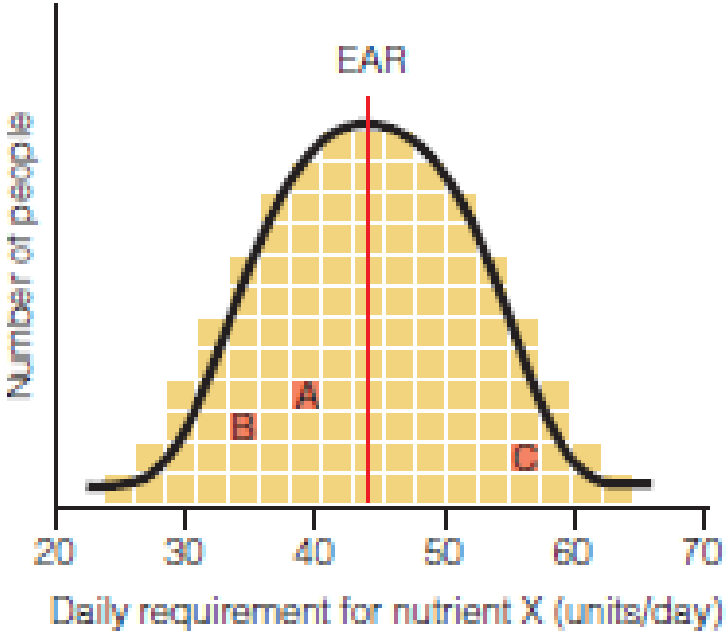
Relationship of EAR and RDA

RDA = EAR + 2 SD (EAR)

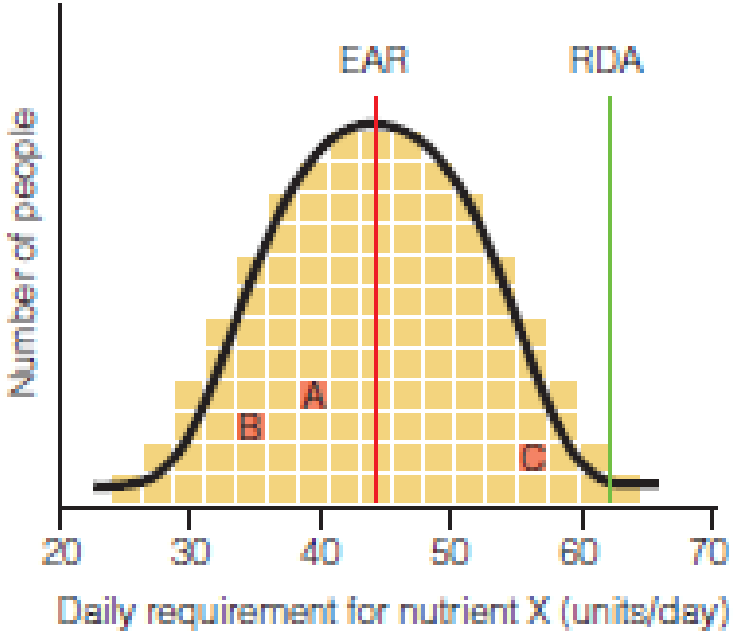


Comparison of the EAR *with the RDA*

Each square in the graphs below represents a person with unique nutritional requirements. (The text discusses three of these people—A, B, and C.) Some people require only a small amount of nutrient X and some require a lot. Most people, however, fall somewhere in the middle.



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.



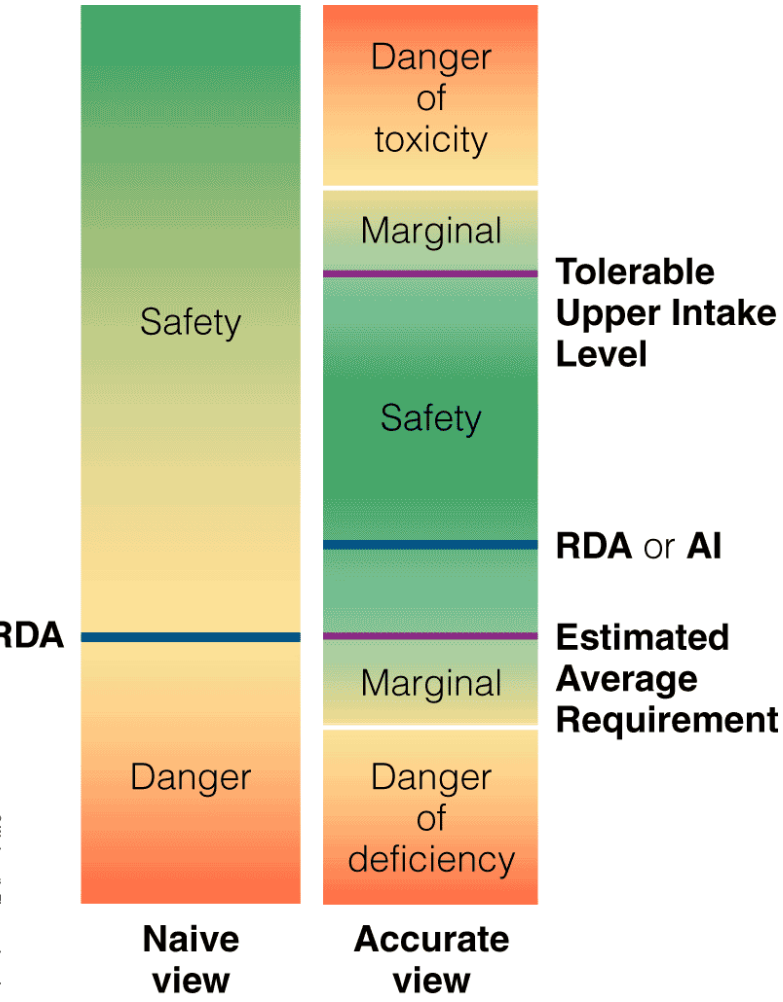
The Estimated Average Requirement (EAR) for a nutrient is the amount that meets the needs of about half of the population (shown here by the red line).

Comparison of the AI with the RDA

- An AI, **must** rely more heavily on scientific judgments because **sufficient evidence is lacking**. → (Example: Vitamin K)
- For this reason, AI values are more **tentative (uncertain)** than RDA values. (greater degree of judgment).
- Use with greater care when using (AI).

- ***RDA*** *for a given nutrient is based on* ***enough scientific evidence*** *to expect that the needs of almost all healthy people will be met.*

Inaccurate versus Accurate View of Nutrient Intakes



- The RDA (or AI) for a given nutrient represents a point that lies within a range of appropriate and reasonable intakes between toxicity and deficiency.
- Both of these recommendations are high enough to provide reserves in times of short-term dietary inadequacies, but not so high as to approach toxicity.
- Nutrient intakes above or below this range may be **equally** harmful.

Establishing Energy Recommendations

- In contrast to the RDA and AI values for nutrients, the recommendation for energy is not generous.
- Excess energy cannot be readily excreted and is eventually stored as body fat.
- These reserves may be beneficial when food is scarce, but they can also lead to obesity and its associated health consequences.
- ***THUS:***
- **A. Estimated Energy Requirement (EER).**
- **B. Acceptable Macronutrient Distribution Ranges (AMDR).**

A. Estimated Energy Requirement (EER).

- **Estimated Energy Requirement (EER):** the average dietary energy intake **that maintains energy balance** and **good health** in a person of a given age, gender, weight, height, and level of physical activity.

- Represents the average dietary energy intake (kcalories per day).

- **Balance** is key to the energy recommendation.

B. Acceptable Macronutrient Distribution Ranges (AMDR)

- **Acceptable Macronutrient Distribution Ranges (AMDR):** ranges of intakes for the energy nutrients that provide **adequate energy and nutrients** and **reduce the risk of chronic diseases.**

The DRI committee has determined that the composition of a diet that provides adequate energy and nutrients and reduces the risk of chronic diseases is:

- 45 to 65 percent kcalories from carbohydrate.→ 4Kcal/gm
- 20 to 35 percent kcalories from fat. → 9Kcal/gm
- 10 to 35 percent kcalories from protein. → 4Kcal/gm

Diet-Planning Principles

- Diet planners have developed several ways to select foods. Whatever plan or combination of plans they use, though, they keep in mind the **six basic diet-planning principles**

1.Adequecy.

2.Balance.

3. kCalorie (energy control)→ One key to **kcalorie control is to select foods of high nutrient density.**

4. Nutrient density→ Success depends on getting many nutrients for each kcalorie.

5. Moderation.

6. Variety.

Nutrient Density

- Foods that are notably low in nutrient density—such as potato chips, candy, and colas—are called **empty-kcalorie foods.**

- **The kcalories these foods provide are** called "empty" because they deliver energy (from added sugars, solid fats, or both) with little, or no, protein, vitamins, or minerals.

Compare Foods Based on Nutrient Density

1- One way to evaluate foods is simply **to notice their nutrient contribution *per serving***:

→ 1 cup of milk provides about 300 milligrams of calcium, and ½ cup of fresh, cooked turnip greens provides about 100 milligrams.

2-Another valuable way to evaluate foods is to consider their **nutrient density—their nutrient contribution *per kcalorie*.**

- *Fat-free* milk delivers about 85 kcalories with its 300 milligrams of calcium.
- To calculate the nutrient density, divide milligrams by kcalories: 300 mg calcium = 3.5 mg per kcal.

→ The fresh turnip greens, which provide 15 kcalories with the 100 milligrams of calcium: 100 mg calcium = 6.7 mg per kcal

→***The more milligrams per kcalorie, the greater the nutrient density.***