NO PREP

The Six Nutrient Groups

What Your Body Actually Needs

Includes: Student reading, case study, differentiated questions, teacher key

Name: Period: Date:

The Six Nutrient Groups: What Your Body Actually Needs

Six Groups, One Very Old List

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Nutrition looks complicated from the outside, mostly because there is an entire industry built on making it look complicated. Strip away the marketing and the underlying science is unusually settled. Everything your body needs from food fits into six nutrient groups: carbohydrates, proteins, fats, vitamins, minerals, and water. That list has not meaningfully changed in decades, and no supplement, cleanse, or trending eating plan has ever added a seventh. Nutritionists split those six into two categories based on how much of them a person needs. Macronutrients, which means carbohydrates, proteins, and fats, are needed in large amounts, measured in grams, and they are the only nutrients in food that supply calories. Micronutrients, which means vitamins and minerals, are needed in tiny amounts measured in milligrams or micrograms, and they supply no calories at all. Water sits in a category of its own. It has no calories, but the body needs it by the liter. The two categories do two completely different jobs, and confusing them is where most bad nutrition advice begins. Macronutrients are fuel and building material. They power muscles, run the brain, and provide raw material for tissue the body rebuilds constantly. Micronutrients are not fuel. They are the tools and switches that let the fuel get used, acting as helpers in chemical reactions, as signals, and as structural pieces. A vitamin does not hand over energy the way a candy bar wrapper implies. It helps the body release energy from food already eaten. That single distinction explains a great deal. It is why a person can take in plenty of calories and still be poorly nourished, and it is why a multivitamin has never once substituted for a meal.

The Three That Come With Calories

Carbohydrates, protein, and fat are the only things in food that supply energy, and they do not supply it equally. Carbohydrates provide four calories per gram. Protein

also provides four calories per gram. Fat provides nine calories per gram, more than twice as much as either of the others. That one number explains why fat-heavy foods are so calorie-dense in a way that regularly surprises people. A single tablespoon of oil, which barely coats the bottom of a pan, carries roughly 120 calories, while a full cup of raw spinach carries about seven. Carbohydrates are the body's preferred fuel, and the brain in particular runs almost entirely on glucose under ordinary conditions. They arrive as sugars, starches, and fiber. Fiber is the odd member of that group, because humans cannot digest it, which is exactly what makes it useful. It slows digestion, feeds the bacteria living in the large intestine, and adds bulk without adding usable calories. Protein is the one macronutrient the body cannot stockpile for later in any meaningful way, which is why it needs to show up regularly rather than all at once. Protein is assembled from twenty amino acids, nine of which are called essential because the body cannot manufacture them and has to get them from food. Fat has been the most unfairly treated nutrient of the last fifty years. It carries the fat-soluble vitamins into the body, builds every cell membrane a person owns, insulates nerves, and makes food taste good enough to actually eat. Dietary fat is not optional. This is also where the phrase empty calories comes from. A food with empty calories delivers macronutrients, usually sugar or fat, with almost no vitamins, minerals, or fiber attached. The calories are real. The nutrition is missing.

Vitamins: Tiny Amounts, Loud Consequences

Vitamins are organic compounds the body needs in very small amounts in order to run chemical reactions it cannot run without them. There are thirteen of them, and they split into two groups based on what they dissolve in, which turns out to matter far more than it sounds like it should. Water-soluble vitamins, meaning the eight B vitamins and vitamin C, dissolve in water, travel freely in the bloodstream, and are not stored in any significant quantity. Whatever is not used is generally excreted. That has two practical consequences. A person needs them regularly, more or less daily, and overdosing on them through ordinary food is close to impossible. It also means they leach out into cooking water, which is why boiled vegetables surrender more nutrition than steamed or roasted ones. Fat-soluble vitamins, meaning A, D, E, and K, dissolve in fat and are stored in the liver and in body fat. They are not required every single day, because the body keeps a reserve. But storage cuts both

ways. Because these vitamins accumulate, it is genuinely possible to reach toxic doses of vitamin A or vitamin D through supplements. Nobody has ever been poisoned by eating too many carrots, but people have been hospitalized by high-dose pills. Deficiencies are where vitamins earned their reputation. Scurvy, the disease that killed sailors for centuries, is nothing more complicated than a vitamin C deficiency, and it is cured with citrus. Rickets, which softens and bows the growing bones of children, is a vitamin D deficiency. Neither is a historical curiosity, because both still appear today. The amounts involved are almost absurdly small. A deficiency measured in milligrams can end a life.

Minerals: The Body's Hardware

Minerals differ from vitamins in one basic way. They are inorganic elements taken straight off the periodic table, and they cannot be created or destroyed by cooking. Burn a food down to ash and the minerals are still sitting there in the ash. They come out of soil and water, move into plants, and reach people through what they eat. Minerals are grouped by how much of them a body needs. Major minerals, required in amounts above 100 milligrams a day, include calcium, phosphorus, potassium, sodium, chloride, magnesium, and sulfur. Trace minerals, required in far smaller amounts, include iron, zinc, iodine, selenium, copper, and fluoride. Needing less of something does not make it matter less. Iodine is required in micrograms, and iodine deficiency remains one of the leading preventable causes of intellectual disability worldwide, which is precisely why ordinary table salt is iodized. Some minerals do structural work. About ninety-nine percent of the calcium in a human body is locked into bone and teeth. Others do electrical work. Sodium, potassium, and chloride are electrolytes, meaning they carry electrical charge in body fluids and make nerve signals and muscle contractions possible, including the contraction of the heart. Iron deserves particular attention in a high school classroom. Iron sits at the center of hemoglobin, the molecule that carries oxygen in red blood cells. Iron deficiency is the most common nutrient deficiency in the world, and in the United States it shows up most often in teenage girls and young women, because monthly blood loss raises iron needs at exactly the age when eating patterns get least predictable. The symptoms, meaning exhaustion, poor concentration, and feeling cold, are very easy to blame on simply being a teenager.

Water: The Nutrient Nobody Counts

Water is a nutrient. It gets left off lists because it carries no calories and nobody runs advertisements for it, but by every definition that matters it belongs with the other five. It makes up roughly fifty to sixty percent of adult body weight, and a larger share of a child's. Every chemical reaction in the body happens in water. Water transports nutrients in and carries waste out, cushions the joints and the spinal cord, and regulates temperature through sweat. Losing as little as one to two percent of body water is enough to measurably reduce concentration, physical performance, and mood, which for a student is the difference between an ordinary afternoon and a bad one. Water is also the nutrient with the shortest survival window by an enormous margin. A person can live for weeks without food. Without water, survival is measured in days. Nothing else on the list is that urgent. Needs vary with body size, activity level, climate, and health, so no single number fits everyone, although roughly nine cups a day for women and thirteen for men is a common reference for water from drinks. That last phrase does real work. About twenty percent of a typical person's water intake arrives in food rather than in drinks. Fruits and vegetables are mostly water, since a cucumber runs about ninety-five percent, and soups, milk, and yogurt all count toward the total. Thirst is a reasonable guide for most healthy teenagers, but it is a lagging one, because by the time thirst registers a person is already slightly behind. Thirst also becomes unreliable with age, which is why dehydration is a common and serious problem among older adults who simply stop feeling thirsty.

Key Information: The Six Nutrient Groups

Detail	Information
The Six Groups	Carbohydrates, protein, fat, vitamins, minerals, water
Macronutrients	Needed in grams; the only nutrients that supply calories
Micronutrients	Vitamins and minerals; needed in tiny amounts, no calories
Carbohydrate and Protein	4 calories per gram each

Detail	Information
Fat	9 calories per gram, more than twice carbohydrate or protein
Water-Soluble Vitamins	The 8 B vitamins and vitamin C; not stored, needed regularly
Fat-Soluble Vitamins	A, D, E, K; stored in liver and body fat, can reach toxic levels
Water	50-60 percent of adult body weight; survival measured in days

Case Study: Two Breakfasts, Same Calories

Dontae's foods class ran a two-week nutrient log, and he expected his to look fine. He wrestles, he is not overweight, and he eats plenty. On Friday his teacher pulled up his Tuesday entry beside a classmate's. Dontae's breakfast was a glazed donut and a 20-ounce soda, roughly 480 calories. His classmate Priya's was two scrambled eggs, a bowl of oatmeal, and a banana, roughly 470 calories. "Basically a tie," Dontae said. Then they looked at the second column. Priya's breakfast delivered protein, fiber, potassium, iron, and several B vitamins. Dontae's delivered sugar and fat and almost nothing else. His iron came in at four percent of the day's target and his fiber came in at zero. "I always figured I was eating too much," Dontae said. "Turns out I'm eating nothing." His teacher wrote two words on the board: empty calories. Dontae kept the donut on Fridays and moved oatmeal into the other four mornings, which he described as a compromise he could actually live with.

1. Both breakfasts supplied about the same number of calories. Use the reading to explain why they are not nutritionally equivalent.

2. Dontae said he was eating nothing. Explain what he meant using the difference between macronutrients and micronutrients.

_____

_____

Multiple Choice

1. Which list correctly names all six nutrient groups?

    a) Carbohydrates, protein, fat, vitamins, minerals, fiber

    b) Protein, fat, vitamins, minerals, water, calories

    c) Carbohydrates, protein, fat, vitamins, minerals, water

    d) Carbohydrates, protein, fat, fiber, sugar, water

2. A tablespoon of oil carries far more calories than a tablespoon of sugar because fat supplies:

    a) 12 calories per gram

    b) 9 calories per gram

    c) 4 calories per gram

    d) 7 calories per gram

3. Why is it possible to overdose on vitamin A from supplements but not on vitamin C?

    a) Vitamin A is stored in body fat while vitamin C is excreted

    b) Vitamin C is destroyed by stomach acid before it is absorbed

    c) Vitamin A is a mineral and vitamin C is not

    d) Vitamin A is needed in much larger daily amounts

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Macronutrient	A) A mineral carrying charge that makes nerve and muscle signals possible
2. ___ Micronutrient	B) A nutrient needed in gram amounts that supplies usable energy
3. ___ Fat-Soluble Vitamin	C) A nutrient needed in milligram amounts that supplies no energy
4. ___ Electrolyte	D) Energy delivered with almost no vitamins, minerals, or fiber attached
5. ___ Empty Calories	E) A vitamin held in reserve in the liver and body fat

Fill-in-the-Blank

1. Fat supplies nine calories per _____.

2. The most common nutrient deficiency worldwide is _____ deficiency.

3. Water is about fifty to sixty percent of adult _____ weight.

Short Answer

Answer each question in 2-4 complete sentences.

1. Explain how a person can eat plenty of calories and still be poorly nourished.

_____

_____

_____

2. Explain why boiling vegetables costs more nutrition than roasting them does.

3. Explain why iron deficiency appears most often in teenage girls.