

WHAT ARE THE NUTRITIONAL NEEDS OF HUMANS?

ANDY TRATTNER

Our bodies are composed of carbon, oxygen, hydrogen, nitrogen, calcium, and phosphorus, with small amounts of potassium, sulfur, sodium, chlorine, magnesium, and other trace elements. Deficiency in any single element could lead to death. To survive, we must maintain a delicate balance.

Unfortunately, few guidelines exist to help us understand the actual nutritional needs of our bodies. All the standard recommendations for consuming more vegetables or less carbohydrates fall short of thorough, flexible understanding. For example, how much magnesium should I consume each day, and where can I get it? This gap in common knowledge may play a role in the obesity epidemic and other public health issues.¹

The first step to understanding nutrition is to understand the digestive process. Food typically enters the mouth where chewing and saliva break down starches. Swallowing brings the food down the esophagus to settle in the stomach, where digestive juices and acids break down proteins. The small intestine comes next, where other digestive fluids—such as from the liver and pancreas—further break down starches, proteins, and carbohydrates. At the end, the large intestine mainly removes water and compacts the leftover waste products into stool.

Nutrient absorption occurs along the digestive pathway. A few things may be absorbed early on, such as alcohol through the stomach lining or certain drugs and sugars through the mouth. But mostly, absorption occurs in the small intestine. We often think our body will completely absorb everything we put into it, but fortunately for us, this is not the case. If the body is lacking certain vitamins, for example, those vitamins will be absorbed more readily (Freeman). Also, the body tries its best to decrease absorption when it already has enough of a given

¹Obesity has been linked to certain forms of cancer. The mental health crisis may also be related to poor nutritional practices.

nutrient (Freeman). Other factors affecting absorption include stress levels, drugs, and overall fitness (Freeman).

The nutrients we need to absorb fall into five large groups: carbohydrates, water, fats, proteins, and vitamins and minerals. Carbohydrates and water are two nutritionally simple categories. Carbohydrates² provide the body with sugar fuel and cleansing digestive fiber. Water constitutes the majority of the body and facilitates aqueous chemical reactions. The other categories are slightly more complex nutrition-wise. Fats help to produce hormones and promote cardiovascular health. Proteins break down into amino acids, which do a variety of things: they compose cartilage, they encode our genes, and they attack viral invaders. Vitamins and minerals provide elements which help blood oxygenation and muscle relaxation.

To understand more fully the nutrition intake needs of humans, we need to break down the more complicated categories of fats, proteins, and vitamins and minerals. Fats yield fatty acids, specifically linoleic and α -linolenic acids (Westman). Specific amino acids from proteins include histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine (Westman). Vitamins include ascorbic acid, vitamin A, vitamin D, vitamin E, vitamin K, thiamine, riboflavin, niacin, vitamin B-6, pantothenic acid, folic acid, biotin, and vitamin B-12 (Westman). Minerals include calcium, phosphorus, magnesium, and iron, with trace minerals (zinc, copper, manganese, iodine, selenium, molybdenum, and chromium), electrolytes (sodium, potassium, and chloride), and ultratrace minerals (Westman).

The list of essential nutrients is long and technical, so it is easy to get lost in all the names. To simplify the task, we can make a list of foods containing these nutrients. Then we need not worry about specific daily dosages of each nutrient, which would add more technical information without much practical benefit. Instead, we can just ask ourselves if we have eaten any of the essential foods recently, or we can look at the food list and try to plan a weekly menu for ourselves to make sure we are meeting our nutritional needs. Such a list of food sources is compiled in the

²It is unknown whether carbohydrates are strictly necessary to the human diet, since sugars may be obtained via breakdown of proteins and fats (Westman).

appendix. These food sources can all be easily found once you know the nutrient to search for.

Because there are multiple sources of each nutrient, it is possible to navigate around dietary restrictions and food preferences. However, a close examination of the figures indicates places where one should be extra careful as well. Vegetarian diets, for instance, need to include Vitamin B-12. Broccoli-haters need to ensure they are finding enough chromium. And Soylent drinkers should make sure that their bodies are absorbing equivalent amounts from its synthetic ingredients as they would from natural foods.

For a typical college student such as your author, certain nutrients pop out as difficult to incorporate into daily eating habits. Vitamins A and K are easy so long as vegetables like broccoli and carrots are consumed. Vitamin D requires mushrooms or fortified drinks like milk and orange juice. Vitamin E comes from nuts and oils. Carnivores and egg-eaters have it easy in terms of niacin, vitamin B-6, and pantothenic acid. Seafood or organ meats are essential for obtaining vitamin B-12. Green leafy vegetables, grains and brown rice, and soy and other beans will adequately cover the rest of the minerals, fats, and proteins.

One might wonder if it is possible to obtain all the essential nutrients in a single day of eating. It turns out that such a thing is possible, but the menu looks quite rich. Such a day might look like: oranges, oatmeal, and sausages for breakfast, a salad of Brussels sprouts, kale, mushrooms, spinach, cheese, and salmon sprinkled with sunflower seeds and oil for lunch, then liver on buttered toast with beans and chickpeas on the side followed by a tofu dessert for dinner. Since each dish would have to be quite small to fit everything in, perhaps it is more reasonable to spread the food out over a couple days of eating. This would allow slightly larger portions and still ensure that every few days, the body obtains fresh doses of all the essential nutrients.

APPENDIX

Vitamins	ascorbic acid	papaya, strawberries, oranges, pineapple, lemon, cauliflower, kale, melon, garlic, Brussels sprouts, lychee, guava, chili pepper, gooseberry, parsley, kiwi, broccoli, rose hips
	vitamin A	cod liver oil, yam, carrot, broccoli, butter, kale, squash, dandelion, spinach
	vitamin D	fortified drinks, liver oil, UV-irradiated yeast and mushrooms
	vitamin E	wheat germ oil, almonds, sunflower oil, hazelnuts, canola oil, olive oil, peanuts
	vitamin K	kale, spinach, collards, broccoli, Brussels sprouts, spinach
	thiamine	seeds, legumes, rice, cereals, pork, spinach, cornflour
	riboflavin	milk, cheese, eggs, leaf vegetables, liver, mushrooms, almonds
	niacin	tuna, turkey, pork, venison, sesame seed flour, ginger, tarragon, portabella mushrooms, sunflower seeds, dried apricots, baked potato
	vitamin B-6	cereals, pork, turkey, beef, banana, chickpeas, potato, pistachio
	pantothenic acid	dried mushrooms, liver, egg yolks, sunflower seeds, alfalfa, cereal
	folic acid	avocado, beets, spinach, yeast, Brussels sprouts, dark green leafy veggies, fruits, nuts, dairy
	biotin	yeast, soybeans, beef liver, butter, peas, sunflower seeds, lentils, peanuts, walnuts
	vitamin B-12	clams, liver and organ meats, fish eggs, mackerel, crab, fortified foods, supplements

FIGURE 1. Essential Vitamins

Minerals	calcium	dairy, salmon, figs, spinach, bok choy, oranges, pkale, okra, collards, soy
	phosphorus	seeds, cheese, fish, scallops, soy, lentils
	magnesium	dark green vegetables, legumes, cereals, wheat bread, fish, nuts
	iron	meats, beans, spinach, cereals, enriched rice and breads
	zinc	oysters, red meat, poultry, beans, nuts, crab, whole grains, fortified cereals and dairy
	copper	oysters, whole grains, beans, nuts, potatoes, organi meats, dark leafy greens, dried prunes, cocoa, black pepper, yeast
	manganese	cloves, oats, brown rice, chickpeas, spinach, pineapple, pumpkin seeds, tempeh, rye, soybeans
	iodine	sea vegetables, scallops, cod, yogurt, shrimp, sardines, salmon, milk, eggs, tuna
	selenium	fish and shellfish, Crimini and shiitake mushrooms, asparagus, mustard seeds, tofu, eggs
	molybdenum	lentils, peas, lima beans, kidney beans, black beans, soy, pinto beans, oats, tomatoes, cucumber, celery
	chromium	broccoli, barley, oats
	sodium	salt, processed foods with salt, celery, beets, milk
	potassium	squash, potatoes, beans, yogurt, halibut, orange juice, broccoli, cantaloupe, banana
chloride	table or sea salt, seaweed, rye, tomatoes, lettuce, celery, olives	

FIGURE 2. Essential Minerals

Fats	linoleic acid	chicken, eggs, mayonnaise, soybean oil, corn oil, safflower oil, sesame oil, sunflower oil, pine nuts, pecans, Brazil nuts, blue cheese, brie, swiss cheese, milk
	α -linolenic acid	flax seeds and oil, canola oil, soybeans and oil, pumpkin seeds and oil, tofu, walnuts
Amino Acids	histidine	beef, lamb, Parmesan cheese, pork, turkey, chicken, soy, tuna, seeds and nuts, eggs, beans, lentils, grains
	isoleucine	eggs, soy, seaweed, turkey, chicken, lamb, cheese, fish
	leucine	whey protein, soy, hemp, beef, peanuts, salmon, wheat, almond, chicken, oats, chickpeas
	lysine	fish, beef, chicken, azuki bean, milk, soy, egg, peas, kidney beans, chickpeas
	methionine	egg, sesame, cheese, Brazil nuts, soy, chicken, tuna, beef, bacon
	phenylalanine	eggs, chicken, liver, beef, milk, soybeans
	threonine	cottage cheese, poultry, fish, lentils, black turtle bean, sesame seeds
	tryptophan	egg, spirulina, cod, soy, Parmesan and cheddar cheese, sunflower seeds, pork, turkey, oats, salmon, lamb, perch
	valine	Parmesan cheese, cottage cheese, soy, lamb, beef, chicken, pork, nuts, tuna, portobello mushroom, whole grains

FIGURE 3. Essential Fats and Proteins

REFERENCES

- [1] “Dietary Guidelines for Americans 2015-2020.” *U.S. Department of Agriculture*, eighth edition, December 2015.
- [2] Freeman, Victoria. “All About Absorption.” *Experience Life*, February 2005. Accessed: 17 November 2017.
- [3] Geissler, Catherine A.; Powers, Hillary J. *Human Nutrition*. Oxford University Press, thirteenth edition, 2017.
- [4] Hill, T. R.; Mendonça, N.; Granic, A.; Siervo, M.; Jagger, C.; Seal, C. J.; Kerse, N.; Wham, C.; Adamson, A. J.; Mathers, J. C. “What do we know about the nutritional status of the very old? ” *Proceedings of the Nutrition Society*, vol. 75, 2016, pp. 420-430.
- [5] Kau A. L.; Ahern, P. P.; Griffin N. W.; Goodman A. L.; Gordon J. I. “Human nutrition, the gut microbiome and the immune system.” *Nature*, vol. 474 no. 7351, 16 June 2011, pp. 327-36.
- [6] Olcott, H. S. “What Is Known about Human Nutritional Needs.” *American Journal of Agricultural Economics*, vol. 60 no. 5, 1978, pp. 800-802. *JSTOR*.
- [7] Westman, Eric C. “Is dietary carbohydrate essential for human nutrition?” *The American Journal of Clinical Nutrition*, vol. 75, 202, pp 951-3.