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## Example of an amino acid sequence

As a healthy eater, you probably know a thing or two about carbs, protein, and fats. But we're guessing there's one thing you don't give much thought to: amino acids. They're essential for life, and yet, WTF are they!?!If you've ever taken the time to Google the term, you likely got a mind-boggling answer about carbon bonds. Luckily, there is a more straightforward answer: "Amino acids are the building blocks of protein," says Elizabeth Shaw, R.D.,an adjunct nutrition professor at San Diego Mesa College. "Unlike carbs or fats, proteins need to have amino acids to form their structure."If that still seems like a lot of technical jargon, here are the only things you really need to know.1. Protein is made up of amino acids.News flash: We need protein to live. It's present in every cell and helps us build and maintain healthy bones, muscle, and skin. Protein, which is found in nuts, seeds, dairy, fish, meat, poultry, and beans, is essentially a long chain of amino acids. So when your body breaks down protein from food, amino acids are what's left.There are three types of amino acids: essential, nonessential, and conditional. (Creative, right?) Essential are the kind that can't be made by your body but are necessary for survival (more on that below). While nonessential seems to imply "not needed," it actually describes amino acids that your body produces on its own. Conditional amino acids are the kind you usually only need if you're ill or stressed.2. Your body can't produce all of them.Of the 20 total amino acids, there are nine your body can't make on its own."These amino acids must come from food sources," says Amy Gorin, R.D. "Without them, the body's cells would use their own proteins to get those missing amino acids. Eventually, this would lead to degradation of the muscles and organs." Translation: No bueno for your body.In case you're curious, the nine essential amino acids are: histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. Your body needs each of these in different amounts to build muscle, break down food (i.e., digest it), repair tissue, and many other functions. For example, tryptophan (which gets a false bad rap for making you sleepy after Thanksgiving dinner) helps your body make serotonin, a chemical that's sometimes referred to as a mood-regulating hormone.3. Eating a wide variety of real food is enough.You don't have to go crazy trying to figure out which foods do or don't have certain amino acids, as long as you're eating a decent variety of protein sources every day. Gorin offers this example: If you ate plain 2 percent fat Greek yogurt, pistachios, an apple, and whole-grain cereal for breakfast, you'd be getting a small amount of every essential amino acid—and that's just one meal.So what about supplements? Read enough health blogs and you're bound to come across BCAAs, or branched-chain amino acids. There are three BCAAs: isoleucine, leucine, and valine. Because some studies have suggested BCAAs play a role in exercise performance and recovery, they're popular amongst bodybuilders and athletes, though these findings have been inconsistent.Branched-chain amino acids supplementation enhances exercise capacity and lipid oxidation during endurance exercise after muscle glycogen depletion. Gualano AB, Bozza T, Lopes De Campos P. The Journal of sports medicine and physical fitness. 2011, Jun.;51(1):0022-4707. Branched-chain amino acid supplementation before squat exercise and delayed-onset muscle soreness. Shimomura Y, Inaguma A, Watanabe S. International journal of sport nutrition and exercise metabolism. 2010, Sep.;20(3):1526-484X. But in general, whole foods are a better choice."Speaking for the average athlete—not the Olympian out there—there's no reason to take a supplement unless there's a medical indication you need one," Shaw says. "You can get amino acids from food sources, even as a vegetarian, and still build your muscles."If you're still interested in supplementation, it's best to speak with a doc or dietitian before starting.4. Don't worry about combining incomplete proteins.You've probably heard that rice and beans are a complete or complementary protein, meaning that when you eat them together, you get all essential amino acids at once. Separately, each is considered an incomplete protein, meaning it's low in one or more essential amino acid. Researchers used to believe that incomplete proteins needed to be eaten together (at the same meal in a single sitting) in order for your body to best use them. But that's no longer valid."You don't need to eat the complementary proteins in the same meal," Gorin says. "So if you have a salad with black beans at lunch and a stir-fry over brown rice for dinner, you're getting those complementary proteins in the same day."But she also stresses: Don't overthink this. "What's more important is including a protein source—such as chicken, salmon, eggs, Greek yogurt, tofu—with every meal," Gorin says. If you're eating a balance of protein sources, healthy fats (think nuts or avocados), and whole grains (think brown rice or 100 percent whole-grain bread), you're probably getting a healthy balance of amino acids, Gorin says.We've teamed up with our friends at KIND to help break down some complicated nutrition facts. KIND has even more great content about the ingredients that make for a flavorful life happening over on Medium. Follow Ingredients by clicking below and be sure to recommend the articles you love.Follow Ingredients Called the "building blocks of life," amino acids can be obtained in healthy amounts by eating foods that contain them.Amino acids are compounds that combine to form proteins.Naturally found in our bodies, they're often referred to as the "building blocks of life."Amino acids are needed for the production of enzymes, as well as some hormones and neurotransmitters.They're also involved in numerous metabolic pathways within cells throughout the body.You can obtain amino acids through the foods you eat.After your body digests and breaks down protein, amino acids are left in the body to help do the following:Break down foodGrow and repair body tissueProvide a source of energyPerform other bodily functionsTypes of Amino AcidsAmino acids can be placed in three different groups:Nonessential amino acids: These are produced naturally by your body and have nothing to do with the food you eat.The following are examples of nonessential amino acids:AlanineAsparagineAspartic acidGlutamic acidEssential amino acids: These can't be produced by the body and must come from the food you eat.If you don't eat foods that contain essential amino acids, your body won't have them. The following are essential amino acids:HistidineIsoleucineLeucineLysineMethioninePhenylalanineThreonineTryptophanValineIt isn't associated to eat essential amino acids at every meal. You can get healthy amounts by eating foods containing them throughout the day.Animal-based foods such as meat, milk, fish, and eggs provide essential amino acids.Plant-based foods such as soy, beans, nuts, and grains also contain essential amino acids.Over the years, there has been controversy about whether vegetarian diets can provide adequate amounts of essential amino acids.Many experts believe that while it may be harder for vegetarians to maintain an adequate intake, they should be able to do so if they follow the American Heart Association's guidelines of 5 to 6 servings of whole grains, and 5 or more servings of vegetables and fruits, per day.Conditional amino acids: These are usually not essential to everyday living but are important when you're sick, injured, or stressed.Conditional amino acids include:ArginineCysteineGlutamineTyrosineGlycineOrnithineProlineSerineWhen you're ill or injured, your body may not be able to produce enough conditional amino acids, and you may need to give your body what it needs through diet or supplements.Talk with your doctor about the safest way to do this.Can Amino Acids Be Harmful?When your body has too much of amino acids, the following effects can occur:Gastrointestinal distress, such as bloatingAbdominal painDiarrheaIncreased risk of gout (buildup of uric acid in the body, leading to joint inflammation)Unhealthy drop in blood pressureChanges in eating patternsNeed for your kidneys to work harder to maintain balanceMost diets provide safe amounts of amino acids.Still, talk with your doctor if you plan to follow a diet that's very high in protein or one that includes amino acid supplements for any reason — including any supplements taken to support intense athletic training. You should try to include each of the nine essential amino acids in your diet each day. These amino acids are present in a variety of different protein-rich foods. The following is a list of the daily required amounts for an average adult (mg/kg of body weight) and the best food sources for each of the nine essential amino acids: Histidine (10 mg/kg). The highest concentrations of histidine are found in various types of meat, poultry, seafood and dairy products. Some grain products, such as rice and buckwheat, also contain histidine. Other sources of histidine include eggs and beans. You'll even find this amino acid in fruits and vegetables, including apples, pomegranates, citrus fruits, bananas, cantaloupe, cauliflower, potatoes, mushrooms, corn, spinach, carrots, celery, cucumber and beets. Leucine (39 mg/kg): Animal-based sources of leucine include beef, poultry, pork, fish, eggs (particularly the whites), gelatin and dairy products. Plant-based sources include soy, legumes (such as beans and lentils), corn, grains, seeds and nuts. In addition, a supplement called spirulina contains exceptionally high levels of leucine, and 100 grams of spirulina can provide more than your daily recommended value of leucine. Isoleucine (20 mg/kg): Isoleucine is found in many of the same sources as leucine but typically at slightly lower concentrations. Animal-based sources include meats, fish, eggs and dairy. Beef, tuna and yogurt are good examples of isoleucine-rich foods. Plant-based sources include soy, legumes, oats, wheat and certain types of seeds. Lysine (30 mg/kg): The highest concentrations of lysine are found in meats, particularly red meat, pork and poultry. However, it can also be found in dairy, certain fish and eggs. Plant-based sources include legumes, soy, spirulina and some fruits and vegetables (such as avocados, mangos, potatoes, leeks and peppers). Methionine (10.4 mg/kg): Meats, eggs and seafood contain the highest concentrations of methionine. In particular, consuming 100 grams of tuna or brazil nuts will give you more than your daily recommended intake. Other plant-based sources, such as grains, soy, beans, corn, cauliflower and spirulina, also contain methionine at lower concentrations. Phenylalanine (25 mg/kg): Eating meat is the best way to get enough phenylalanine, which is found in the highest concentrations in beef, pork and poultry. Seafood, eggs and dairy are also animal-based sources with high phenylalanine levels. Legumes, soy, nuts, seeds and some grains are examples of plant-based sources. In addition, the artificial sweetener aspartame is a source that's often overlooked. Threonine (15 mg/kg): Lean meats (particularly beef, lamb and fish), gelatin and dairy products are good examples of animal-based sources with high threonine content. Carrots, bananas and soy are the richest plant-based sources; 100 grams of soybeans will provide more than your daily recommended value of threonine. Other legumes, nuts, seeds and vegetables contain lower levels of threonine. Tryptophan (4 mg/kg): Although it's commonly associated with turkey, the highest concentrations of tryptophan are actually found in soy, cocoa and certain nuts and seeds. Animal-based sources for this amino acid include poultry, red meats, fish, dairy and eggs. Valine (26 mg/kg): Dairy products and meat are the best sources of valine. Plant-based sources have lower concentrations of this amino acid, but good examples include soy, peanuts, some types of seeds, leafy greens, lentils and mushrooms. Medical content reviewed by Madeline Hubbard, RN, BSN Resource Links: You should try to include each of the nine essential amino acids in your diet each day. These amino acids are present in a variety of different protein-rich foods. 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