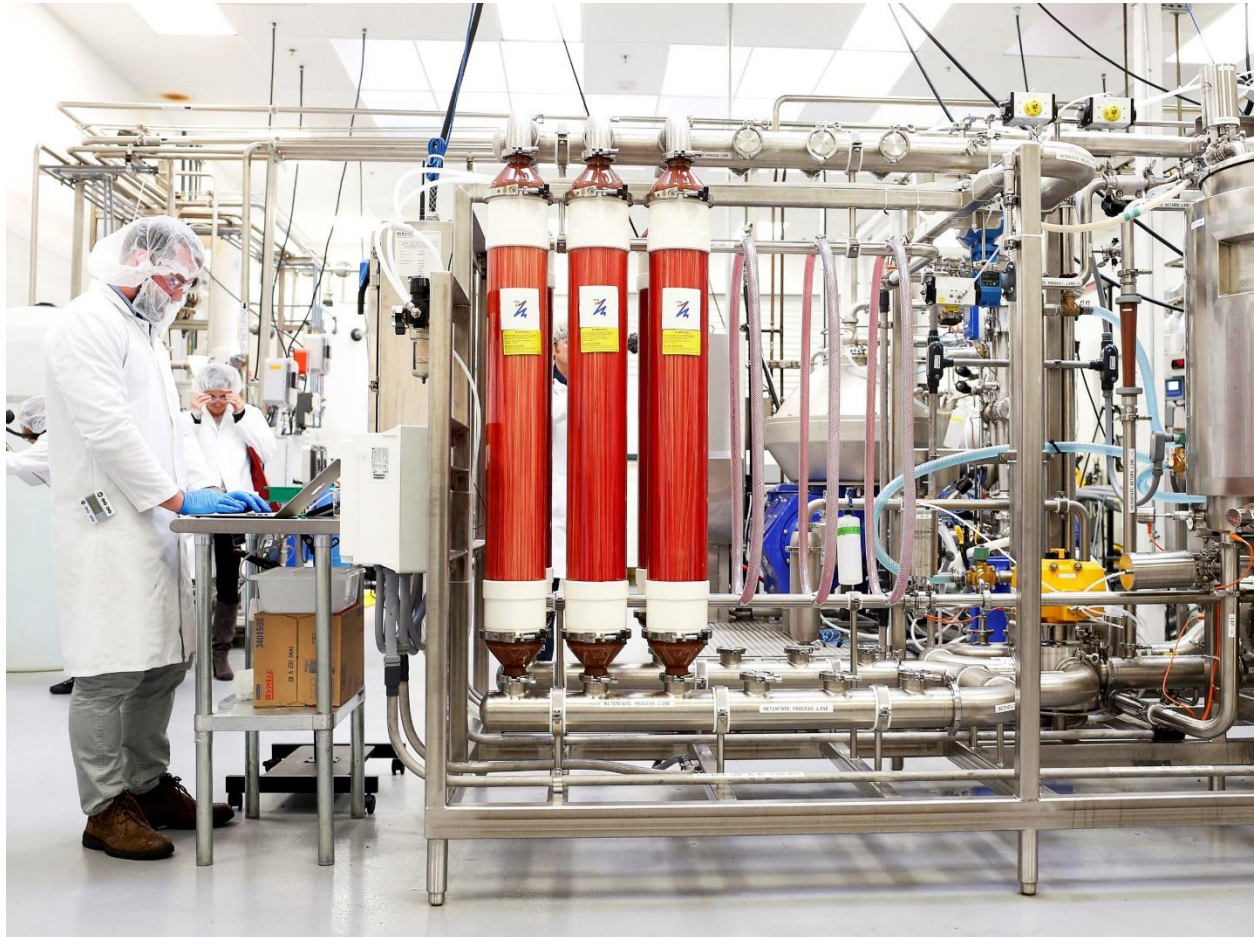


MEAT LAB GROWN and PLANT-BASED PROTEIN



SCIENCE
NOV 16, 2022

A Lab-Grown-Meat Startup Gets the FDA's Stamp of Approval

The US regulatory body has signed off on Upside Foods' cultivated meat—but the company is still figuring out how to make enough of it to sell.

CULTIVATED MEAT HAS been greenlit in the United States for the first time. The decision by the [Food and Drug Administration](#) means that a company called Upside Foods will soon be able to sell chicken made from real animal cells grown in bioreactors instead of requiring the slaughter of live animals.

A positive response from the FDA has long been seen as the next major milestone for the [cultivated meat industry](#). In the past few years, startups in the space have built [small-scale production](#) facilities and raised billions of dollars in venture capital funding but haven't been able to sell their products to the public. Until now, the small number of people invited to try cultivated meat have had to sign waivers acknowledging that the products were experimental.

There are just two smaller regulatory steps remaining until cultivated meat can be made available to the public. Upside's production facilities still require a grant of inspection from the United States Department of Agriculture, and the food itself will need a mark of inspection before it can enter the US market. These two steps are likely to be completed much more quickly than the long FDA premarket consultation process that resulted in the approval.

"It's the moment we've been working toward for the past, almost seven years now," says Uma Valeti, Upside's CEO. "Opening up the US market is what every company in the world is trying to do."

Different startups are focusing on a range of cultivated meats, including beef, chicken, salmon, and tuna. This announcement applies only to Upside Foods and its cultured chicken, although it's likely that other declarations will follow soon. Through this premarket consultation process, food manufacturers provide the FDA with details of their production process and the product it creates, and once the FDA is satisfied that the process is safe, it then issues a "[no further questions](#)" letter.

The FDA decision means that cultivated meat products may soon be available to the public to try, although it's likely that tastings will be

limited to a very small number of exclusive restaurants. Michelin-starred chef Dominique Crenn has already announced that she will serve Upside Foods' cultivated chicken at her restaurant Atelier Crenn in San Francisco.

Valeti says that he wants the public to have their first taste of Upside chicken through selected restaurants before they can buy and cook it at home. "We would want to bring this to people through chefs in the initial stage," says Valeti. "Getting chefs excited about this is a really big deal for us. We want to work with the best partners who know how to cook well, and also give us feedback on what we could do better."

Atelier Crenn won't be the first restaurant to serve cultivated meat, however. In December 2020, Singaporean regulators gave the green light to cultivated chicken from the San Francisco-based startup Eat Just. The chicken nuggets were sold at a members-only restaurant called 1880 and later made available for delivery.

Cultivated meat is different from plant-based meats because it contains real animal cells and is—theoretically—indistinguishable from real meat itself. Cells are initially isolated from an animal and developed into cell lines that are then frozen. Small samples from these cell lines can then be transferred to bioreactors—usually large steel tanks—where the cells are fed growth media containing the nutrients that cells need to divide. Once the cells have grown and differentiated into the correct kind of tissue, they can be harvested and used in cultivated meat products.

But growing cells in this way is still extremely expensive. Startups keep the exact cost of growing their cells tightly under wraps, but it's likely that pure cultivated meat will still be several times the cost of conventional meat. Some projections for future facilities suggest that even large facilities will [produce meat](#) at a cost of \$17 per pound—which would translate into much higher prices in restaurants and grocery stores. Because of this price premium, it's likely that the first cultivated meat products released to the public will be a blend of animal cells and plant-based meat.

The FDA decision doesn't mean that cultivated meat will be widely available in the near future. Current production facilities are very small, and many [in the industry](#) have serious reservations about lab-grown meat's ability to eventually put a dent in global meat consumption. "The next phase for us and the industry is demonstrating scalability," says Valeti, likening the cultivated meat industry today to the electric car industry's infancy. "Our industry is similar in that it'll take five, 10, 15 years to scale up and for most people to access it in many parts of the world. But it is the future."

Update 11-16-2022 2:35 pm ET: This story was updated to add comments from Upside's CEO.

Update 11-16-2022 5:08 pm PT: This story was updated to correct details about the FDA process.

Update 11-17-2022 12:51 am ET: This story was further updated to correct details about the FDA process.

Glutenin: A New Game-Changer in Lab-Grown Meat Production

BY AMERICAN CHEMICAL SOCIETY FEBRUARY 26, 2024



Glutenin, a wheat protein, shows promise for lab-grown meat production by supporting the cultivation of muscle and fat layers that mimic real meat's texture and composition, offering a sustainable alternative to traditional meat as the global population increases.

As the global population grows, lab-grown meat, which consists of animal muscle and fat cells cultivated in lab settings, presents a promising solution to meet the rising demand for protein. Additionally, affordable plant proteins could serve as a foundation for these cell cultures. Recent findings published in *ACS Biomaterials Science & Engineering* demonstrate that the non-allergenic wheat protein glutenin successfully grew striated muscle layers and flat fat layers, which could be combined to produce meat-like textures.

Development of Plant-based Scaffolds for Cultured Meat

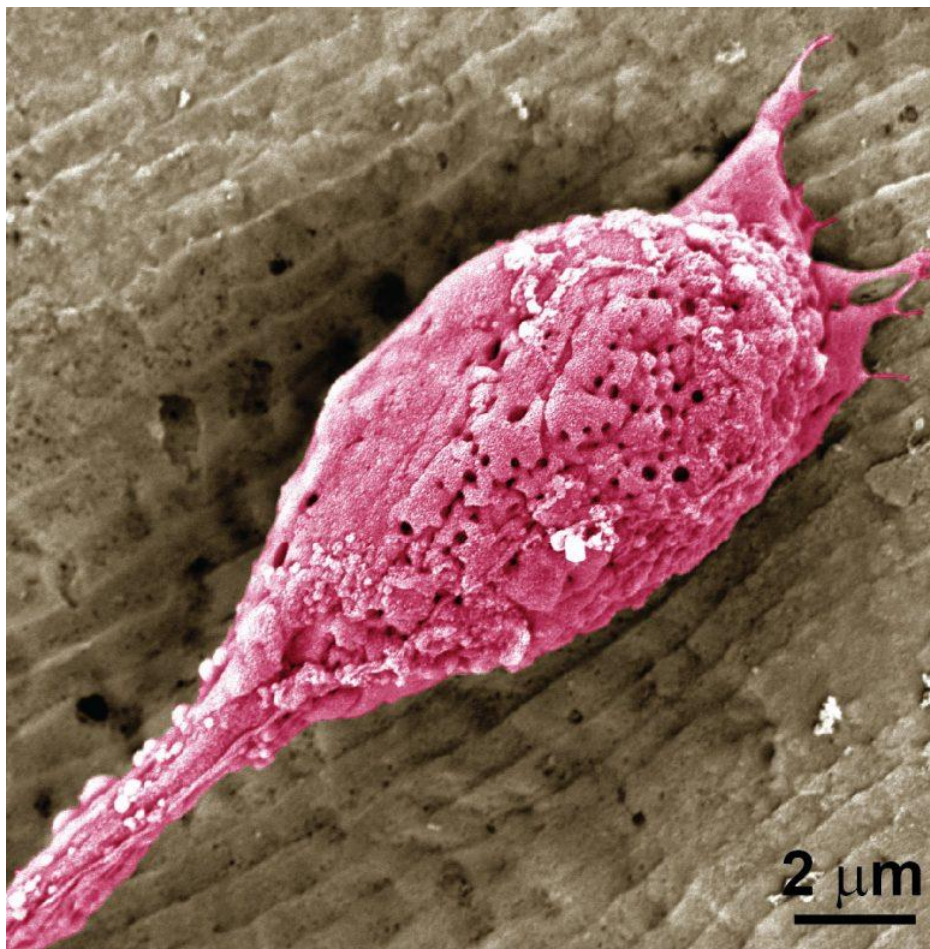
Cultured cells need a base or scaffold to adhere to produce lab-grown meat. Plant proteins are appealing candidates for the scaffolds because they are edible, abundant, and inexpensive. Previous researchers showed that a plant-based film made of glutenin was a successful base to cultivate cow skeletal muscle cells.

But for this technique to produce a promising meat-like alternative, the muscle cells need to form aligned fibers, similar to the texture in real tissues. Additionally, fat needs to be included in the 3D structure to replicate the composition of traditional meat products. To take advantage of using glutenin, a protein in gluten that people with celiac disease or a gluten sensitivity don't typically react to, Ya Yao, John Yuen, Jr., Chunmei Li, David Kaplan,

and colleagues wanted to develop plant-based films with it to grow textured muscle cells and fatty layers.

Experimental Results and Future Directions

The researchers isolated glutenin from wheat gluten and formed flat and ridge-patterned films. Then they deposited mouse cells that develop into skeletal muscle onto the protein bases and incubated the cell-covered films for two weeks. Cells grew and proliferated on both flat and ridged films. As expected, compared to cells grown on control films made of gelatin, the performance of the glutenin-based films was inferior but sufficient. The researchers say further work needs to be done to improve how cells attach to the plant-based film to get closer to the growth on the animal-derived biomaterial. During the second week of the culture, the cells on the patterned film formed long parallel bundles, recreating the fiber structure of animal muscles.



By putting ridges in a plant protein base, cultured muscle cells grew in a pattern that mimics the alignment of muscle fibers in animals. Credit: Adapted from ACS Biomaterials Science & Engineering 2024, DOI: 10.1021/acsbiomaterials.3c01500

In another test, mouse cells that produce fat tissues were deposited onto flat glutenin films. During the incubation period, as cells proliferated and differentiated, they produced visible lipid and collagen deposits.

The cultured meat and fat layers attached to the edible glutenin films could be stacked to form a 3D meat-like alternative protein. Because the glutenin material base supported the growth of both textured animal muscle and fat layers, the researchers say it could be used in an approach for more realistic cultivated meat products.

Reference: “Cultivated Meat from Aligned Muscle Layers and Adipose Layers Formed from Glutenin Films” by Ya Yao, John S. K. Yuen, Jr., Ryan Sylvia, Colin Fennelly, Luca Cera, Kevin Lin Zhang, Chunmei Li and David L. Kaplan, 16 January 2024, *ACS Biomaterials Science & Engineering*.

[DOI: 10.1021/acsbiomaterials.3c01500](https://doi.org/10.1021/acsbiomaterials.3c01500)

Textured plant protein

Plant-based meat alternatives

Driven by a growing consumer passion for balanced nutrition and sustainability, the market for plant-based meat alternatives is rapidly expanding. A whole new mainstream group of flexible vegetarians are highly demanding in relation to taste, texture, nutritiousness, footprint and getting offered value for money when seeking out plant-based solutions. Manufacturers therefore will benefit from plant protein ingredients that are plain in color and taste, easy to use and can deliver on texture, bite, chew and mouthfeel and succulence. One that can deliver the best possible eating & cooking experience for this growing group of consumers.

Cargill invests in start-up Bflike to help food manufacturers and retailers offer a new generation of plant-based meat and fish alternative products. Proprietary technology creates plant-based alternatives that look, feel and cook like their animal-based counterparts

MECHELEN, BELGIUM (April 22, 2020) — Responding to flexitarian consumers’ growing appetite for plant-based products that deliver a “meat-like” experience, Cargill is investing in Bflike, a start-up created by BOX NV, which is poised to be a new technology leader in the rapidly evolving meat and fish alternatives categories. The partnership combines Cargill’s extensive food ingredient solutions with Bflike’s recipes and technology,

to give food manufacturers and retailers the opportunity to bring tasty plant-based products to market quickly and affordably.

“Global volume consumption of protein is expected to nearly double by 2050. Plant-based protein, as a complement to animal protein, will help fulfill growing consumers’ desire for more options as part of a balanced diet,” said Belgin Köse, Segment Director Enrichment & Renewability for Cargill Starches, Sweeteners & Texturizers Europe. “This joint venture is another way in which Cargill is enabling plant-based alternatives that exceed consumer expectations and enrich consumer diets with responsible, sustainable and affordable options in various geographies.”

Bflike will license its proprietary technology and premix ingredient solutions to food manufacturers and retailers, supporting them to commercialize their own meat and fish alternative products.

Key to Bflike’s innovation is its patent-pending vegan fat and blood platforms. This ground-breaking technology results in plant-based meat and fish alternative products that are virtually indistinguishable from their animal-based counterparts, with similar visual appearance (both raw and cooked), texture, mouthfeel, melting behavior and cooking performance.

Equally important, the Cargill-Bflike collaboration will position customers to move seamlessly from pilot to commercialization and allow them to scale up quickly, using their own production process and machinery, whilst being supported by Cargill’s secure supply of critical ingredients.

The Cargill investment in Bflike is realized through a joint venture with Blue Ocean Xlator NV (BOX), a Dutch private incubator/accelerator focused on sustainable innovations in the food sector. Bflike also benefits from the technical support of TOP BV, a Dutch food technology service provider based in Wageningen Food Valley and a subsidiary company of BOX.

Bflike has a robust product pipeline of meat and fish alternative formulations, ready to hit the market in this year, next to the vegetarian burger and minced meat readily available.

“BOX and TOP have spent years developing a pipeline of diet enrichment solutions, allowing manufacturers and retailers to offer affordable, meat and fish alternatives that truly mirror the sensory experiences of traditional animal-based products,” said Koos van Haasteren, Chief Executive Officer of Bflike. “Now together with Cargill as a development partner, we can help expand the possibilities with a new generation of nutritious products that will continue to revolutionize the plant-based marketplace.”

About Cargill

Cargill is committed to providing food, ingredients, agricultural solutions, and industrial products to nourish the world in a safe, responsible, and sustainable way. Sitting at the

heart of the supply chain, we partner with farmers and customers to source, make and deliver products that are vital for living.

Our 160,000 team members innovate with purpose, providing customers with life's essentials so businesses can grow, communities prosper, and consumers live well. With 159 years of experience as a family company, we look ahead while remaining true to our values. We put people first. We reach higher. We do the right thing—today and for generations to come. For more information, visit [Cargill.com](https://www.cargill.com) and our [News Center](#).

About Bflike

Bflike is a start-up with headquarters and production facilities in Food Valley, the Netherlands. Its mission is to enable its partners to exceed consumer's expectations in enriching their diet with the next responsible and affordable plant-based real meat and fish experience. Together with its partners, Bflike aims to continuously stay ahead of consumer's taste in meat & fish analogues.

Humans eat a stunning amount of meat every year — some 800 billion pounds of it, enough flesh to fill roughly 28 million dump trucks. Our carnivorous cravings, particularly in industrialized, [beef-guzzling](#) countries like the United States, are one reason the planet is warming as fast as it is. Raising animals consumes a lot of land that could otherwise soak up carbon. Cows, sheep, and goats spew heat-trapping methane. And to grow the corn, soy, and other plants that those animals eat, farmers spray fertilizer that emits nitrous oxide, another potent planet-warming gas.

For all those reasons, and many more, activists and scientists have called for people to eat less meat or abstain altogether. At last year's United Nations climate conference in Egypt, activists chanted slogans like "[Let's be vegan, let's be free](#)." At this year's conference, which starts November 30, world leaders are expected to talk about ways to [shift diets](#) toward plant-based foods as a way to lower animal agriculture's climate pollution, the source of 15 percent of the planet's greenhouse gas emissions.

Cutting out meat can be an effective tool: The average vegan diet is linked to about one-quarter the greenhouse gas emissions of a meat-intensive one, according to a [paper](#) published in Nature in July.

But what would happen if everyone actually stopped eating meat tomorrow?

“It would have huge consequences — a lot of them probably not anticipated,” said Keith Wiebe, a senior research fellow at the International Food Policy Research Institute.

Such a quick shift probably wouldn’t cause the sort of turmoil that would come if the planet [immediately ditched](#) fossil fuels. But still, the upshot could be tumultuous, upending economies, leaving people jobless, and threatening food security in places that don’t have many nutritious alternatives.

Livestock accounts for about [40 percent](#) of agricultural production in rich countries and 20 percent in low-income countries, and it’s vital — economically and nutritionally — to the lives of 1.3 billion people across the world, according to the United Nations’ Food and Agriculture Organization. One-third of the protein and nearly [one-fifth](#) of the calories that people eat around the world come from animals.

Researchers say the economic damage caused by the sudden disappearance of meat would fall disproportionately on low-income countries with agrarian economies, like Niger or Kenya, where farming and raising livestock are critical sources of income. Niger’s livestock industry makes up about [13 percent](#) of the country’s gross domestic product; in the U.S., the entire agricultural system accounts for only around [5 percent](#).

It’s tough to predict exactly what the economic shock would look like on a global level. There has been “relatively little” research on how phasing out meat would affect employment around the world, Wiebe said. “It’s an issue that deserves a lot more attention.”

Millions of people would lose jobs, but demand for other sources of calories and protein might rise and offset some of those losses. Some workers might be drawn into agriculture to grow more crops like legumes. That shift in labor, some researchers hypothesize, could slow economic growth by pulling people out of more profitable industries.

Still, the effects would vary across cultures, economies, and political systems, and they aren’t as clear-cut as, say, the amount of [methane](#) that would be saved if cows [ceased to exist](#). “It depends on the species of livestock. It depends on the geographic location,” said Jan Dutkiewicz, a political economist at the Pratt

Institute, in New York City. "It's very difficult, if not impossible, to talk in universal terms about addressing those kinds of things."

It's easier to talk in broad terms about another challenge with getting rid of meat: nutrition. Eliminating livestock overnight would deprive many people of essential nutrients, especially in regions like South Asia and sub-Saharan Africa, where meat comprises a small but crucial sliver of the average person's starch-heavy diet. Animal-based foods are high in vitamin B12, vitamin A, calcium, and iron. That's why researchers say preserving access to meat, milk, and eggs is [key](#) to keeping people healthy in low- and middle-income countries right now, where nutritious plant-based options are harder to come by.

And then there's the issue of cultural damage. Taking away meat, according to Wilson Warren, a history professor at Western Michigan University, would do more than just deprive Americans of hot dogs and hamburgers and Italians of salami.

"Historically, the way that most people understood animals was through farming and having close contact with their livestock," said Warren, who's also the author of [Meat Makes People Powerful](#), a book about the global history of meat. "You get rid of that sort of close connection, [and] I envision people in some ways being even less environmentally in touch." (Warren grapples with this idea in a self-published novel called [Animeat's End](#) about a future world in which eating meat is a serious crime.)

Many researchers agree that phasing out meat entirely, let alone immediately, isn't an ideal solution to the climate crisis. It would be plenty, they say, to reduce consumption methodically and to focus on the countries that eat the most, particularly wealthy ones like the United States that have no shortage of alternatives.

It might be easier for the average American, who eats about 220 pounds of red meat and poultry each year, to trade a daily hamburger for a bowl of lentils than for someone in rural sub-Saharan Africa, who eats [10 times](#) less meat, to give up the occasional goat or beef stew for something less nutritious. Such a shift in beef-loving countries also might reduce [heart disease](#) and [cancer](#) linked to eating a lot of red and processed meat.

Dutkiewicz suggested using guidelines established by the EAT-Lancet Commission, an international group of scientists who have designed a [diet](#) intended to give people the nutrients they need without destroying the planet. It consists of roughly 35 pounds of meat per year. Adopting that diet would require a drastic reduction of cows and chickens in countries like the United States, Australia, China, Brazil, and Argentina, and a slight increase in parts of Africa and South Asia.

Gradually replacing meat with plants could have immense benefits for the planet. “It would be a huge net win for the environment,” Dutkiewicz said. By one [estimate](#), a complete phaseout of meat over 15 years would cut as much as one-third of all methane emissions and two-thirds of all nitrous oxide emissions. Water use would fall drastically. Biodiversity loss would slow. Animal welfare advocates would be happy to see fewer animals packed into tight pens wallowing in their own poop awaiting slaughter. And there would be ample opportunity to rewild abandoned rangelands and pastures at a scale that would sequester a whole lot of carbon — as much as [550 gigatons](#), enough to give us a pretty good shot at keeping warming below catastrophic levels.

Given the complexities and pitfalls of a complete phaseout, researchers and advocates have pointed instead to a more modest goal: cutting meat production in half. Replacing it with plant-based alternatives would lower agricultural emissions [31 percent](#) by 2050, a recent study found.

“It doesn’t have to be an all-or-nothing approach,” Raychel Santo, a food and climate researcher at the World Resources Institute, said in an email.

The solution, in other words, lies somewhere between culling cows in Niger and gorging ourselves on factory-farmed flesh.

Everything Can Be Meat© Illustration by Katie Martin. Source: Getty

Recently, a photo of rice left me confused. The rice itself looked tasty enough—fluffy, well formed—but its oddly fleshy hue gave me the creeps.

According to the scientists who'd developed it, each pink-tinged grain was seeded with muscle and fat cells from a cow, imparting a nutty, umami flavor.

In one sense, this "[beef rice](#)" was just another example of lab-grown meat, touted as a way to eat animals without the ethical and environmental impacts. Though not yet commercially available, the rice was developed by researchers in Korea as a nutrition-dense food that can be produced sustainably, at least more so than beef itself. Although it has a more brittle texture than normal rice, it can be cooked and served in the same way. Yet in another sense, this rice was entirely different. Lab-grown meat aims to replicate conventional meat in every dimension, including taste, nutrition, and appearance. Beef rice doesn't even try.

Maybe that's a good thing. Lab-grown meat, also widely known as cultivated meat, has long been heralded as [the future of food](#). But so far, the goal of perfectly replicating meat as we know it—toothy, sinewy, and sometimes bloody—has proved impractical and expensive. Once-abundant [funding has dried up](#), and this week, Florida moved toward becoming the [first state to ban sales of cultivated meat](#). It seems unlikely that whole cuts of cultivated meat will be showing up on people's plates anytime soon—but maybe something like beef rice could. The most promising future of lab-grown meat may not look like meat at all, at least as we've always known it.

The promise of cultivated meat is that you can have your steak and eat it too. Unlike the meatless offerings at your grocery store, cultivated meat *is* meat—just created without killing any animals. But the science just isn't there yet. Companies have more or less figured out the first step, taking a sample of cells from a live animal or egg and propagating them in a tank filled with a nutrient-rich broth. Though not cheaply: By one estimate, creating a slurry of cultivated cells costs [\\$17 a pound or more to produce](#).

The next step has proved prohibitively challenging: coaxing that sludge of cells to mature into different types—fat, muscle, connective tissue—and arranging them in a structure resembling a solid cut of meat. Usually, the cells need a three-dimensional platform to guide their growth, known as a scaffold. "It's something that is very easy to get wrong and hard to get right," Claire Bomkamp, a senior scientist at the Good Food Institute, a nonprofit supporting meat alternatives, told me. So far, a few companies have served up proofs of concept: In June, the

United States [approved the sale of cultivated chicken](#) from Upside Foods and Good Meat. However it is [virtually impossible to come by](#) now.

The basic science of lab-grown meat can be used for more than just succulent chicken breasts and medium-rare steaks. Cells grown in a tank function essentially like ground meat, imparting a [meaty flavor and mouthfeel](#) to whatever they are added to, behaving more like an ingredient or a seasoning than a food product. Hybrid meat products, made by mixing a small amount of cultivated-meat cells with other ingredients, are promising because they would be [more cost-effective](#) than entire lab-grown steaks or chicken breasts but meatier than purely plant-based meat.

Already, the start-up SciFi Foods is producing what has been described as a "[fatty meat paste](#)" that is intended to be mixed with plant-based ingredients to make burgers. Only small amounts are needed to make the burgers beefy; each [costs less than \\$10](#) to make, according to the company—still considerably more than a normal beef patty, but the prices should come down over time. Maybe it sounds weird, but that's not so different from imitation crab—which doesn't contain much or any crab at all. A similar premise underlies the [plant-based bacon laced with cultivated pork fat](#) that I tried last year. Was it meat? I'm not sure. Did it taste like it? Absolutely.

Meat can be so much more than what we've always known. "We don't have to make meat the same way that it's always come out of an animal," Bomkamp said. "We can be a little bit more expansive in what our definition of meat is." Beef rice, which essentially uses rice as a miniature scaffold to grow cow cells, falls into this category. It isn't particularly meaty—only 0.5 percent of each grain is cow—but the scientists who developed it say the proportion could change in future iterations. It's framed as a way to feed people in "underdeveloped countries, during war, and in space."

Eventually, cultivated meat could impart a whiff of meatiness to blander foods, creating new, meat-*ish* products in the process that are more sustainable than regular meat and more nutritious than plants. Beef rice is one option; [meat grown on mushroom](#) roots is in development. Even stranger foods are possible. Bomkamp envisions using the technology to make thin sheets of seafood—combining elements of salmon, tuna, and shrimp—to wrap around a rainbow roll of sushi. In this scenario, cultivated meat probably won't save the planet from

climate change and animal suffering. "It wouldn't serve its original function of being a direct replacement for commercial meat," Daniel Rosenfeld, who studies perceptions of cultivated meat at UCLA, told me. But at the very least, it could provide another dinner option.

Of course, it's in the interest of the cultivated-meat industry to suggest that cultivated meat isn't just outright doomed. No doubt some vegetarians would cringe at the thought, as would some dedicated carnivores. But considering how much meat Americans eat, it's not hard to imagine a future in which cultivated cells satisfy people searching for a new kind of meat product. Imagine the salad you could make with chicken cells grown inside arugula, or bread baked with bacon-infused wheat. But should those prove too difficult to produce, I'd happily take a bowl of beef rice, in all its flesh-tinged glory.



[Researchers fine-tune fermentation to impart meat and dairy flavors to plant-based foods© Provided by Anthropocene Magazine published by Future Earth](#)

Researchers have cooked up a recipe that mimics the rich aromas of meat, using an unusual mix of onions fermented with fungi. By fine-tuning the type of fungus and fermentation time, they were even able to produce a specific aroma that is almost indistinguishable from liver sausage, a panel of smell-testers found.

This could be a boon for the [meatless meat](#) industry, which has long struggled to replicate meat's [texture](#), flavor and scent. Meat gets its deliciously savory, smoky, caramelized aroma from a complex chain of reactions that unfold when it is cooked, releasing volatile compounds that are responsible for the mouth-watering odors of frying bacon, or a burger sputtering on the grill.

Food scientists have worked hard to mimic these qualities in plant-based meat alternatives using chemical additives that go some way to replicating the richness of those flavors. But there's a catch: these additives mean the food products that contain them can't be classed as 'natural', according to the law in places like Europe.

To get around this, the researchers on the new study went on a hunt for natural flavors, settling on *Basidiomycetes* as their starting point: this diverse group of fungi is known to generate meaty aromas when fermented with different types of food. The question was whether this flavor profile could be honed into something indistinguishable from meat.

To find out, the researchers picked a variety of spices to trial the fungi with: red bell peppers, chives, wild garlic, onions, ginger, mustard seeds, and leeks. These were individually mixed in a concoction of water and with different fungi, and then left to ferment for hours. Then, a panel of professional testers were asked to give the resulting broths an expert sniff.

[Recommended Reading:](#)

[What would happen if plant-based alternatives replaced half of meat and milk consumption?](#)

While ferments made with peppers, ginger, and mustard seeds didn't produce any meaty flavors, the other pairings more than made up for this, with the panel of testers detecting a pleasant aroma—likened to the savory scent profile of instant soup—from the broths made with onions, garlic, leeks and chives.

All in all, the researchers developed 13 fungi-food combinations that produced meaty scents. But of these, by far the meatiest combination came from onions mixed with a type of fungi called *Polyporus umbellatus*, which when fermented together for at least 18 hours, produced an intense, complex aroma that the testers likened to liver sausages.

The researchers also used gas chromatography-mass spectrometry to analyze the oniony broth, and found that several of the emitted chemicals were the same as those that produce the favorable flavors in meat. They think this is owing to onions' high sulfur content, which is also present in the compounds that give meat its unique aromas.

Meanwhile, this study isn't the only recent fermentation win for plant-based foods. In [separate research](#) published this month, a team of scientists managed to ferment pea proteins with cheese bacteria, finding a blend that produces the same firm, gel-like consistency, and some of the aromas, of real dairy cheese. That team of scientists thinks it could be an alternative to the array of starches, fats, gelling agents, and flavorings that are required to give [vegan cheese](#) its taste and consistency.

Both these inventions are far from product-ready. But they lay down a path for natural enhancements of plant-based alternatives, which have come under [rising scrutiny](#) in recent months due to the potentially harmful additives they contain. After the initial boom of plant-based foods, many of these companies are now also [struggling](#) to grow their consumer base—but the promise of all-natural, lusciously-flavored alternatives might be the boost they need.

Zhang et. al. "[Generation of Meaty Aroma from Onion \(*Allium cepa* L.\) with *Polyporus umbellatus*: Fermentation System, Sensory Profile, and Aroma Characterization](#)." *Journal of Agricultural and Food Chemistry*. 2023.



Scientists say foods made with an age-old process are the future of 'meat': 'We've been using [it] for millennia'© Provided by The Cool Down

Food scientists are harnessing the power of an age-old technique called fermentation to create [meat alternatives](#) that are tastier than ever. This natural process, used for millennia to make foods such as yogurt, tempeh, and kimchi, could be a game-changer, Allyson Chiu of [The Washington Post](#) says.

So, what exactly is [fermentation](#)? It uses microorganisms to transform ingredients, boosting shelf life and nutrition. For plant-based meats, precision fermentation creates specific proteins, fats, and other components that mimic real meat's taste and texture.

As Adam Leman, lead scientist for fermentation at the [Good Food Institute](#), explains: "Many of those products are then minimally processed, say with a heat treatment and then a drying or flash freezing to optimize their texture and shelf life. They can often contain beneficial nutrients alongside the protein, like dietary fiber and B vitamins."

The result is meat alternatives that are more flavorful and satisfying. "One of the cool things that the microbial world gives us is certain types of [protein-rich] fermentation-derived products that could be really savory or umami-tasting, or things that can be very neutral that can get added to other foods that people like," Leman said.

These fermentation-powered products aren't just yummy — they're also better for the planet. A [recent study](#) found that swapping just 20% of the world's beef with microbial proteins could cut deforestation rates in half and reduce carbon [and methane pollution](#) by 2050.

The plant-based meat market is sizzling, with over 130 companies now using fermentation, [a 12% increase from 2021](#). While matching the price of conventional meat is still a hurdle, experts believe fermentation's efficiency could help alternative proteins reach cost parity faster.

"Given the efficiency of fermentation, the fact that these products have the opportunity to potentially reach cost parity quicker than some of the other

alternatives is going to be important," Shayna Fertig, a senior adviser at the Good Food Institute, [told](#) the Post.

Lehman agrees. "We've been using fermentation for millennia to make food products," he told the Post. "We're able to use a lot of the same types of microbes that we've been using for a long time, but just using them in better ways to offer up more solutions for protein, for fats, and generally for feeding all the people that we can."

So, next time you're at the [grocery store](#), keep an eye out for meat alternatives powered by fermentation. With tasty and eco-friendly options, making the switch has never been easier.



Plant-based meat companies experiment with surprising ingredient added to products: 'There have to be alternatives'© Provided by The Cool Down

It appears that plant-based meat isn't just for vegans and vegetarians anymore.

In an ironic shift in strategy, plant-based meat companies are planning to add a [surprise ingredient](#) to their products: animal fat.

Some of the companies are growing the fat in laboratories with hopes of combining it with other ingredients (think "extra porky" plant-based bacon). Others are taking animal byproducts from traditional meat production and blending them with plant ingredients, [The Washington Post](#) reported.

Click your choice to see results and speak your mind

Though the market for plant-based meats looked promising in the late 2010s, unit sales dipped by [8%](#) in 2022.

One of the [barriers](#) for plant-based meat is that it just doesn't taste enough like what it's trying to imitate. Meanwhile, consumers primarily make purchasing decisions based on [cost and flavor](#).

"It's fundamentally difficult to make plants taste like meat," Saba Fazeli, co-founder of the startup Choppy, one of the companies incorporating fat into plant-based meat, told the [Post](#). "I would say it's impossible."

Meat-eating accounts for about [15%](#) of planet-warming pollution. Going vegan is one way to help reduce this impact, but finding plant-based substitutions can be challenging, and the percentage of people who call themselves vegans or vegetarians has stayed relatively steady at about [10%](#) over the past two decades.

That's why some advocate instead for simply [reducing meat consumption](#). In fact, supporters of the integration of animal fat into plant-based meat see it as a way to propel their products into the mainstream.

Aside from trying animal fat-infused plant-based products, consumers can also lower their meat consumption by following the ["plant slant" diet](#), which has been tied to longer lifespans in the world's five Blue Zones. This eating style goes heavy on beans, whole grains, and veggies while going easy on — but not completely eliminating — meat.

For those who do want to shift to an animal-free diet, it's not impossible. One vegan fitness buff [shared a list](#) of the least expensive and most filling plant proteins, including lentils.

Either way, the massive land requirements of the meat industry coupled with its pollution problems beg for another solution to how we get our protein, [according to experts](#).

"The way that we produce food is unsustainable," Faraz Harsini, senior scientist for cultivated meat at the Good Food Institute, told the [Post](#). "There have to be alternatives."

Meanwhile, the new corporate strategy for plant-based meat caused quite a stir in the [r/vegan](#) subreddit, with varied opinions. [One user](#) took a middle-of-the-

road approach, saying, "Small steps should be embraced not shunned and ridiculed."



Scientists accomplish major food breakthrough by creating a soybean like no other — here's why it's so important to our future food supply© Provided by The Cool Down

A [nutrient-dense](#) bean has gotten a boost that may pay dividends in the quest to feed a growing global population while minimizing environmental disruption from agriculture.

As [detailed](#) by Healthnews, scientists at United Kingdom-based company [Moolec Science](#) developed a soybean-pork hybrid by using the bean as a "vessel" for the animal protein.

The first-of-its-kind soybean, which Moolec Science dubbed "Piggy Sooy," contains 26% protein content from pork, though future information about its composition is unavailable.

"At this point, we can't disclose that, for intellectual property reasons," [chief science officer](#) Amit Dhingra [told](#) NewScientist over the summer.

Modifications in agriculture are nothing new, with Moolec Science [noting](#) on its website that "selective breeding of crops" has been a common practice in farming [since the beginning](#).

Genetically modified organisms (GMOs) simply take that up a notch with the introduction of a foreign genetic material, and this type of work has led to life-saving breakthroughs.

[Watch now: What's the *true* environmental impact of renewable energy?](#)

According to the [U.S. Food and Drug Administration](#), in 1982, human insulin for people with diabetes was "the first consumer GMO product developed through genetic engineering."

While modifying food is in a different realm, the need isn't any less important.

The overheating of our planet has led to an increase in [extreme weather](#) events, with disasters creating "unprecedented levels of damage and loss in agriculture around the world," as detailed by the [Food and Agriculture Organization](#) of the United Nations. The yields of some major food crops have [decreased](#) as well.

Why do you eat plant-based foods?

[The health benefits](#)

[It's cheaper](#)

[It's good for the planet](#)

[I prefer the taste](#)

Click your choice to see results and speak your mind

While rising temperatures have been mainly driven by the [use of dirty energy](#), the agricultural and livestock industry plays a role, with the Environmental Protection Agency noting that [37%](#) of human-caused [methane pollution](#) comes from our practices in that sector.

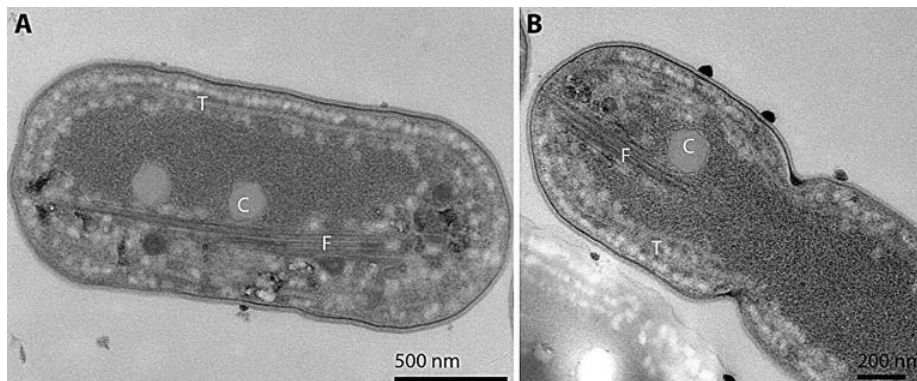
Piggy Sooy, which is in the process of obtaining a patent, is a long way from being ready for consumers, as Healthnews [pointed out](#).

With further testing and approval, though, it could be one of the solutions to the rising problem of food insecurity amid a warming planet. [Several types of lab-grown meats](#) are expected to hit the U.S. in the near future.

On its website, Moolec Science [says](#) that it envisions "millions of tons of soy proteins feeding humans instead of animals, without compromising real taste and nutrition."

Scientists use blue-green algae as a surrogate mother for 'meat-like' proteins

Story by Science X staff



Cyanobacteria with protein fibers seen through a microscope. The protein fibers are marked 'F'. Credit: ACS Nano (2023). DOI: 10.1021/acsnano.3c08600© Provided by Phys.org

Researchers from the University of Copenhagen have not only succeeded in using blue-green algae as a surrogate mother for a new protein—they have even coaxed the microalgae to produce "meat fiber-like" protein strands. The achievement may be the key to sustainable foods that have both the "right" texture and require minimal processing.

We all know that we ought to eat less meat and cheese and dig into more plant-based foods. But while perusing the supermarket cold display and having to choose between animal-based foods and more climate-friendly alternative proteins, our voices of reason don't always win. And even though flavor has been mastered in many plant-based products, textures with the 'right' mouthfeel have often been lacking.

Furthermore, some plant-based protein alternatives are not as sustainable anyway, due to the resources consumed by their processing.

But what if it was possible to make sustainable, protein-rich foods that also have the right texture? New research from the University of Copenhagen is fueling that vision. The key? Blue-green algae. Not the infamous type known for being a poisonous broth in the sea come summertime, but non-toxic ones.

"Cyanobacteria, also known as blue-green algae, are living organisms that we have been able to get to produce a protein that they don't naturally produce. The particularly exciting thing here is that the protein is formed in fibrous strands which somewhat resemble meat fibers. And, it might be possible to use these fibers in plant-based meat, cheese or some other new type of food for which we are after a particular texture," says Professor Poul Erik Jensen of the Department of Food Science.

In a [new study](#) appearing in *ACS Nano*, Jensen and fellow researchers from the University of Copenhagen, among other institutions, have shown that cyanobacteria can serve as host organisms for the new protein by inserting foreign genes into a cyanobacterium. Within the cyanobacterium, the protein organizes itself as tiny threads or nanofibers.

Minimal processing—maximum sustainability

Scientists around the world have zoomed in on cyanobacteria and other microalgae as potential alternative foods. In part because, like plants, they grow by means of photosynthesis, and partly because they themselves contain both a large amount of protein and healthy polyunsaturated fatty acids.

"I'm a humble guy from the countryside who rarely throws his arms into the air, but being able to manipulate a living organism to produce a new kind of protein which organizes itself into threads is rarely seen to this extent—and it is very

promising," says Poul Erik Jensen, who heads a research group specializing in plant-based food and plant biochemistry.

"Also, because it is an organism that can easily be grown sustainably, as it survives on water, atmospheric CO₂ and solar rays. This result gives cyanobacteria even greater potential as a sustainable ingredient."

Many researchers around the world are working to develop protein-rich texture enhancers for plant-based foods—e.g., in the form of peas and soybeans. However, these require a significant amount of processing, as the seeds need to be ground up and the protein extracted from them, so as to achieve high enough protein concentrations.

"If we can utilize the entire cyanobacterium in foodstuffs, and not just the protein fibers, it will minimize the amount of processing needed. In food research, we seek to avoid too much processing as it compromises the nutritional value of an ingredient and also uses an awful lot of energy," says Jensen.

Tomorrow's cattle

The professor emphasizes that it will be quite some time before the production of protein strands from cyanobacteria begins. First, the researchers need to figure out how to optimize the cyanobacteria's production of protein fibers.

But Jensen is optimistic, adding, "We need to refine these organisms to produce more protein fibers, and in doing so, 'hijack' the cyanobacteria to work for us. It's a bit like dairy cows, which we've hijacked to produce an insane amount of milk for us. Except here, we avoid any ethical considerations regarding animal welfare. We won't reach our goal tomorrow because of a few metabolic challenges in the organism that we must learn to tackle. But we're already in the process and I am certain that we can succeed."

"If so, this is the ultimate way to make protein."

Cyanobacteria such as spirulina are already grown industrially in several countries—mostly for health foods. Production typically occurs in so-called raceway ponds beneath the open sky or in photobioreactors chambers, where the organisms grow in glass tubes.

According to Jensen, Denmark is an obvious place to establish "microalgae factories" to produce processed cyanobacteria. The country has biotech companies with the right skills and an efficient agricultural sector.

"Danish agriculture could, in principle, produce cyanobacteria and other microalgae, just as they produce dairy products today. It would be possible to harvest, or milk, a proportion of the cells as fresh biomass on a daily basis. By concentrating cyanobacteria cells, you get something that looks like a pesto, but with protein strands. And with minimal processing, it could be incorporated directly into a food."

More information: Julie A. Z. Zedler et al, Self-Assembly of Nanofilaments in Cyanobacteria for Protein Co-localization, *ACS Nano* (2023). [DOI: 10.1021/acsnano.3c08600](https://doi.org/10.1021/acsnano.3c08600)

Provided by University of Copenhagen

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GOOD Meat / Instagram© Provided by Green Matters

The idea of [lab-grown meat](#) has been an exciting innovation in sustainability for almost a decade, but now that the [USDA has approved it for sale](#) to U.S. restaurants, lab-grown meat in grocery stores [and on your plate](#) is more of a reality than ever before. The science behind lab-grown, or "cultivated," meat involves taking stem cells from a live animal and creating an edible, complex structure.

Tragically, not everyone sees lab-grown meat as the scientific marvel it is. In 2024, Florida Governor Ron DeSantis signed a bill into [law banning lab-grown meat](#), which [does not include Impossible products](#), in the state of Florida, per *USA Today*. He said, "Take your fake lab-grown meat elsewhere. We're not doing that in the state of Florida."

So, what are the pros and cons of lab-grown meat? Let's explore.



Mission Barns / Instagram© Mission Barns / Instagram

Lab-grown meat, like other sustainable innovations, has its pros and cons.

According to the Good Food Institute, Dutch scientist Mark Post revealed [the first cultivated beef patty](#) on television in 2013. By 2015, four lab-grown meat

companies were founded, and by 2022, the lab-grown meat industry rose to nearly 150 companies across six continents!

There are obvious upsides to lab-grown meat. First and foremost, lab-grown meat allows for the production of meat without slaughtering or abusing animals, a frequent [criticism of the animal agriculture industry](#). Second, cultivated meat could significantly lessen greenhouse gas emissions — as per a 2020 study in *The Lancet*, the food industry is [responsible for about a quarter](#) of global greenhouse gas emissions.

Finally, according to *Bon Appetit*, lab-grown meat [is considered a food safety win](#). "In a controlled environment, you substantially reduce the risk of foodborne illnesses such as salmonella or E. coli," says Amy Chen, the COO of Upside Foods, one of the first companies to create cultivated meat.

There are a few downsides of lab-grown meat as well. While in theory, lab-grown meat can create real meat without an animal coming to harm, the process of obtaining stem cells to begin cultivating the meat [relies upon taking the cells from a live animal](#), typically from fetal bovine serum (FBS), which is taken from the blood of slaughtered pregnant cows, per EUFIC.

However, EUFIC notes that in 2022, several companies discovered a way to create lab-grown meat without FBS.

Second, while moving away from [methane emissions created by animal agriculture](#) is great for the planet, lab-grown meat might potentially create an even larger carbon footprint. According to a 2023 study from UC Davis, introducing lab-grown meat to the agriculture industry may result in extreme demand, leading to using more resources and [inadvertently contributing to the climate crisis](#).

Lead study author Derrick Risner of the UC Davis Department of Food Science and Technology, said, "If this product continues to be produced using the "pharma" approach, it's going to be worse for the environment and more expensive than conventional beef production."

As the technology surrounding cultivated meat continues to evolve, hopefully, scientists will find solutions to the potential downsides, securing a better — and entirely meat-free — future for everyone.

If you tried a veggie burger years ago and dismissed it as a rubbery, flavorless patty, it's a good time to give meatless meat another chance. You can now find plant-based versions of chicken, pork, sausage, lamb, and even deli meats. Newer varieties mimic the look, flavor, and texture of meat. Some, like [Impossible Burger](#), even "bleed" like real beef and sizzle the same way as they cook.

These days, 71 percent of Americans say they have tried at least one plant-based alternative, and a quarter of adults say they eat plant-based meat or poultry fairly often. That's caused demand to soar, with retail sales of plant-based meats hitting \$7 billion in 2020. Analysts don't expect the meat-free movement to slow [anytime](#) soon; a 2021 Bloomberg Intelligence report predicts the market will skyrocket to a whopping \$74 billion by 2030—a 957 percent surge.

Even fast food companies are jumping on the bandwagon. Burger King has the Impossible Whopper, Dunkin' Donuts sells the Beyond Sausage Breakfast Sandwich, and White Castle offers Impossible Sliders. Pizza Hut offers Beyond vegan pepperoni in some locations, and McDonalds is testing a meatless burger called the McPlant created with Beyond Meat. Even KFC is working to perfect faux fried chicken as "finger-lickin' good" as their original.

Whether you think eating animals is barbaric and inhumane, you want to be healthier, you want to save the environment—or some combination of all three, you might want to fire up your grill for the latest meatless meat offerings.

But what is meatless meat exactly? And is it healthier? [Is plant-based meat better for the planet?](#) Here's what you need to know.

What is plant-based meat made of?

Plant-based meats are made from a variety of non-animal ingredients, depending on the brand. Common base components include soy, peas, beans, mushrooms, mung beans, wheat gluten, coconut oil, and rice. The newer, more meat-like products made by companies such as Beyond Meat and Impossible Foods tend

to be more processed and have more ingredients, including oils to give them a juicy texture and starch or cellulose as thickening and binding agents.

To create the signature “bleed” of meat, Beyond Foods uses beet juice, and Impossible Foods uses a tiny genetically engineered molecule called “heme.” The nonprofit Center for Food Safety filed a lawsuit challenging FDA approval of heme, saying more analysis was needed and the FDA should not have relied on testing conducted by Impossible Foods. However, an appeals court upheld the FDA’s decision, saying the FDA had “substantial evidence” to declare heme safe to eat.

What Is Meatless Meat?

A READER'S DIGEST GUIDE

Meatless meats are plant-based alternatives to traditional animal products. Coming soon: Meatless meat made from lab-grown animal cells.

Common Ingredients

 Soy  Peas  Beans  Mushrooms
 Egg  Wheat gluten  Coconut oil  Rice

Nutrition Comparison: Meat vs. Meatless Meat

	Calories	Fat	Sat fat	Chol	Sodium	Fiber	Protein
85% lean ground beef (4 oz)	240	17 g	7 g	80 mg	80 mg	0 g	22 g
85% lean ground turkey (4 oz)	153	11 g	2 g	66 mg	46 mg	0 g	14 g
Impossible Burger	240	14 g	8 g	0 mg	370 mg	3 g	19 g
Beyond Burger	230	14 g	5 g	0 mg	390 mg	2 g	20 g
Dr. Praeger's All American Burger	230	12 g	1.5 g	0 mg	530 mg	6 g	22 g

Top Brands

- Amy's
- Beyond Meat
- Boca Burger
- Daring Foods
- Dr. Praeger
- Field Roast
- Gardein
- Tofurky
- Impossible Foods
- Lightlife Foods
- Morningstar Farms
- Quorn Foods



Is meatless meat just for vegetarians?

Plant-based meats are no longer just for vegetarians and vegans. Impossible Foods and Beyond Meat—the current superstars of the alternative protein sector—actively target meat eaters. By placing their products in the meat case at the grocery store and creating TV spots that show their “meat” sizzling on a griddle, they’re pursuing consumers who enjoy meat but want to reduce their meat consumption for animal rights, health, or environmental reasons. So far, it’s a winning strategy: More than nine out of ten consumers who buy Beyond Burger and Impossible Food products also eat meat, the companies say.

And while only five percent of Americans identify as vegetarians, 71 percent have tried imitation meats, and a quarter of adults say they eat plant-based meat or poultry fairly often.

Many vegetarians don’t actually care for food that resembles meat. When CNET reporter Joan E. Solsman, a longtime vegetarian, tried a dish from the company Impossible Foods, she felt so nauseated that she couldn’t finish it. “Maybe the best sign that Impossible Foods has cracked the code to realistic fake meat is that I couldn’t stand to take another bite,” she wrote. “That’s a compliment, I think.”

Is plant-based meat unhealthy?

Meatless meats are generally a healthier choice than beef because they tend to contain less saturated fat and are cholesterol-free, plus they’re a good source of vitamins, minerals, protein, and fiber, says Samantha Heller, a registered dietician at NYU Langone Medical Center. Some plant-based meats, such as the Impossible Burger, also add vitamin B12, a nutrient only found in animals and one in which many vegetarians are deficient.

If meatless meat can help you stick to a plant-based diet, that, in itself can lead to better health. Not only has red meat been linked to cancer, but studies show that people who ditch meat have a lower body mass index, lower blood pressure,

lower average blood sugar, and lower cholesterol levels, and need less medication to treat chronic diseases such as high blood pressure, diabetes, cardiovascular disease, and obesity.

However, just because it's plant-based doesn't mean it's health food. Most imitation meats are highly processed and contain high amounts of sodium compared to traditional beef. The Impossible Burger and the Beyond Burger, for example, contain 370 and 390 milligrams of sodium, respectively, or about 16 percent of your daily value.

Those brands also contain saturated fat, notes Lisa Harnack, a dietitian at the University of Minnesota who analyzed the nutritional quality of 37 imitation meats, and saturated fat is a risk for those with heart disease or high blood pressure. The Impossible Burger and the Beyond Burger contain as much saturated fat as 85% lean ground beef.

"Think of a commercial plant-based burger as a once-in-a-while food," Heller suggests.

What is the healthiest meatless meat?

To evaluate a plant-based alternative, check the ingredient list and nutrition label before buying. While they may not taste as much like beef, the healthiest plant-based meats generally have an ingredient list that includes whole foods such as beans and grains; lower amounts of saturated fat and sodium; and added vitamins and minerals such as vitamin B12 or vitamin D.

If you want to avoid veggie burgers with high amounts of saturated fat, try the Gardein Garden Veggie Burger, Amy's California Veggie Burger, Dr. Praeger's vegan burgers, or Hillary's Eat Well burgers, suggests Gena Hamshaw, a registered dietitian, vegetarian, and author of the blog fullhelping.com. The latter two are also lower in sodium than other options.

If you need to eat more protein to fuel athletic performance, maintain muscle mass, or support immunity—or if you're a vegetarian who wants to make sure you get enough protein—it's also a good idea to check the grams of protein. The amount in plant-based burgers ranges from about 4 grams (Gardein Garden

Veggie) to 20 grams (Beyond Burger), which is almost the same number as in four ounces of beef (22 ounces).

What are the best brands of meatless meat?

The [best plant-based meat brands](#) for you really depend on your taste preferences and health priorities. Impossible Foods and Beyond Meat are the market leaders among products trying to simulate the taste and texture of ground beef, and Beyond Burger gets an additional nod from some groups because of its commitment to non-GMO ingredients.

Traditional brands MorningStar and Boca offer tried-and-true products that tend to be less expensive and lower in calories. Daring Foods is known for its faux chicken products, while Field Roast is known for producing sausages, roasts, nuggets, and deli slices. Many smaller companies are beginning to offer meat replacements as well.

Even Big Meat is jumping on the alt meat bandwagon. Tyson Foods, the biggest U.S. producer of meat, introduced its first veggie burger in 2019. Its plant-based lineup—sold under the Raised & Rooted brand—now includes a pea-based plant burger, ground “beef,” imitation chicken, meat-free bratwurst, and Italian sausage. JBS, the world’s largest meat producer, also sells plant-based products in the U.S. under the Ozo brand.

Not sure how to incorporate meatless meat into your diet? Check out the [plant-based recipes](#) even carnivores will love.

Is meatless meat better for the environment?

Studies show plant-based proteins generate significantly less greenhouse gas compared to their meat equivalents, and many consumers like them because they’re better for the environment. A [2018 analysis](#) conducted by the University of Michigan found that producing the Beyond Burger uses 99 percent less water,

93 percent less land, nearly 50 percent less energy and generates 90 percent fewer greenhouse gas emissions than producing a 1/4 lb. U.S. beef burger.

However, critics note that neither Impossible Foods nor Beyond Meat discloses the total amount of greenhouse gas emissions across all of their operations, supply chains, or consumer waste. It's also unclear what effect their overall production has on forests and how much water they use, according to the *New York Times*. One investor tracking firm gave Beyond Meat a zero on sustainability measures. Read more about whether [plant-based meat is better for the environment](#).

Impossible Burger vs. Beyond Burger

Which one is better? Hamshaw has tasted both and says each has its merits. The Beyond Burger has more distinctive seasonings, while the Impossible Burger has "a faint but detectible beef-like iron flavor (from the heme)." [Here's what's inside an Impossible Burger](#).

On balance, Hamshaw enjoyed both patties and said their flavors reminded her of the meat dishes of her childhood. See the [best plant-based burgers](#) according to taste tests at our sister site, *Taste of Home*.

The future of meatless meat

Coming soon to a store near you: whole "steaks" and "chicken breasts" made from mushroom meat. While current plant-based products mostly mimic ground beef and sausages, the new fungi-based meats have long, branching fibers that mimic the texture of whole cuts, so you can slice and serve them just like a steak. Mushroom meats also have fewer ingredients and require less processing than plant-based products. Although you can buy meatless meat products made from mushrooms (also called mycoprotein)—a company called Quorn makes nuggets, [meatballs](#), grounds, cutlets, and more—several startups working on fungi-based meats hope to bring them to market in 2022.

Israeli startup Redefine Meat is producing the first-ever category of 100 percent plant-based whole cuts—think steak and brisket—using AI technology and [3D printing](#). Made from proprietary blends of vegetarian ingredients including soy, coconut, barley-gluten, nuts, eggs, and more, the so-called New-Meat is already available in select restaurants in the UK, Germany, the Netherlands, and Israel, and the company hopes to reach thousands more by year-end.

Another frontier is lab-grown meat, also called “cultured” or “cell-based” meat. Grown from the stem cells of animals, they are animal-based products that start in a test tube, so they don’t require the breeding, raising, and slaughtering of animals. More than 70 companies are working on developing cell-cultured meat. Among them: Upside Foods, which is working on cultured chicken, and Eat Just, which is developing cultured beef using cells from prized wagyu cows.

Pushback from the meat industry

Although plant-based proteins have made only a small dent in the \$90 billion meat industry, Big Meat has already launched an advertising campaign against them. The Center for Consumer Freedom, funded by the food industry, produced a Super Bowl commercial in 2020 and took out full-page ads in newspapers with the headline, “What’s hiding in your plant-based meat?”

The healthiest meat alternatives

These new generations of alternate meat and meat substitutes get all the attention, but don’t forget about tofu, tempeh, portabella mushrooms, or just making your own patties out of whole grains and vegetables. Beans and lentils are an especially excellent protein substitute, says Kari Hamerschlag, deputy director of food and agriculture at Friends of the Earth, a nonprofit environmental organization: “They’re nutritious, inexpensive, and far more sustainable than any of the processed meatless substitutes on the market today.”

Sources:

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- [Dr. Praeger's](#): "All American Plant Based Burgers"
- [Impossible Foods](#): "What Are The Nutrition Facts For Impossible™ Burger?"

High-Protein Foods That Aren't Meat

Boosting your protein intake doesn't have to mean eating more meat. There are plenty of delicious, protein-packed options that can keep your meals exciting and nutritious. From snacks to main courses, these high-protein foods are versatile and easy to include in your diet. Check out these great alternatives.

Quinoa

Quinoa is a versatile grain that's packed with protein and all nine essential amino acids. It's also gluten-free and high in fiber, making it a great base for salads, bowls, or as a side dish.

Chickpeas

Chickpeas are a protein-rich legume that can be roasted for a crunchy snack, blended into creamy hummus, or added to soups and salads. They are also a good source of fiber and essential nutrients like iron and folate.

Lentils

Lentils are easy to cook and full of protein. They come in various colors, including green, brown, and red, each with a slightly different texture and flavor. Perfect for soups, stews, and salads, lentils are a hearty addition to any meal and are also high in fiber and iron.

Tofu

Tofu is a soy-based protein that's incredibly versatile. It absorbs flavors well, making it great for stir-fries, soups, and even grilled dishes. Tofu is also low in calories and high in iron and calcium, making it a nutritious addition to any meal.

Edamame

Edamame are young soybeans that are steamed and lightly salted. They make a great snack or addition to salads and bowls. Edamame is not only high in protein but also rich in fiber, vitamins, and minerals, including folate and vitamin K.

Hemp Seeds

Hemp seeds are small but mighty, packed with protein and healthy fats. They are also a good source of magnesium, iron, and zinc. Sprinkle them on salads, yogurt, or blend them into smoothies for an extra boost of protein and nutrients.

Pumpkin Seeds

Pumpkin seeds are a crunchy, protein-rich snack. They can be eaten on their own, added to granola, or sprinkled over salads for extra crunch and nutrition.

They are also high in magnesium, iron, and antioxidants, which support overall health.

Chia Seeds

Chia seeds are tiny but loaded with protein, fiber, and omega-3 fatty acids. When mixed with liquid, they form a gel-like consistency, making them great for thickening smoothies, yogurt, or making chia pudding. They also provide essential minerals like calcium and magnesium.

Almonds

Almonds are a high-protein nut that's perfect for snacking. They are also rich in healthy fats, fiber, vitamin E, and magnesium. Almonds can be eaten raw, roasted, or added to a variety of dishes, including salads, oatmeal, and baked goods, for an extra protein and nutrient boost.

Peanut Butter

Peanut butter is a popular and tasty way to add protein to your diet. It's also rich in healthy fats and can be spread on toast, added to smoothies, or used in baking. Look for natural peanut butter with no added sugar or hydrogenated oils for the healthiest option.

Black Beans

Black beans are a hearty and nutritious source of protein. They are also high in fiber, iron, and antioxidants. Use them in soups, stews, salads, or as a filling for tacos and burritos. Black beans can also be pureed to make delicious dips and spreads.

Green Peas

Green peas are a sweet, starchy vegetable that can be used in soups, stews, and salads. One cup of cooked green peas contains about 8 grams of protein. Their high fiber and vitamin content also contribute to overall health.

Oats

Oats are a whole grain that can be used to make oatmeal, granola, and baked goods. One cup of cooked oats provides around 6 grams of protein. Their soluble fiber content helps with digestion and heart health.

Spirulina

Spirulina is a blue-green algae that can be added to smoothies, juices, and energy bars. One tablespoon of spirulina contains about 4 grams of protein. Its high protein and nutrient density make it a powerful superfood.

Broccoli

Broccoli is a cruciferous vegetable that can be steamed, roasted, or eaten raw in salads. One cup of chopped broccoli offers about 3 grams of protein. Its high fiber, vitamin C, and antioxidant content make it a nutritious addition to any diet.

Amaranth

Amaranth is an ancient grain that can be used as a side dish or added to soups and stews. One cup of cooked amaranth provides about 9 grams of protein. Its high protein and mineral content make it a valuable addition to a vegetarian diet.

Would you eat laboratory-grown meat? This question, posed recently to respondents of Statista's Consumer Insights [survey](#), seems to divide opinions. Laboratory-grown meat, also known as [cultivated or cultured meat](#), is produced from animal cells, often taken by biopsy. These are then placed in a "nutrient bath" in order to develop meat outside the animal. In theory, cultured meat could offer an option to those concerned about animal welfare, or the meat industry's

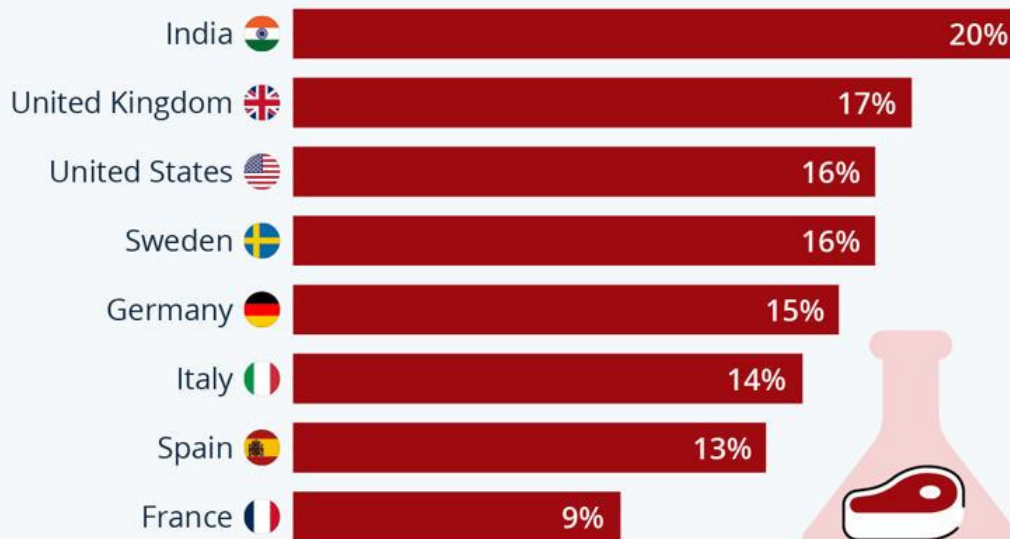
impact on our planet, as its production requires neither the breeding nor the slaughter of living animals.

However, as this infographic shows, the idea of eating laboratory-grown meat is still not that convincing to a majority of people. While one in five people surveyed in India said they would be willing to try this new type of food, only 9 percent of respondents in France said the same. In the United States, which is one of only two countries where this meat is currently marketed (alongside Singapore), 16 percent of respondents said they were open to the idea of eating it. It is unlikely though that cellular meat will soon find its way onto European plates, as no authorization application has yet been filed for the bloc's market.

This chart shows the share of respondents in a selection of countries saying they would eat laboratory-grown meat (in %).

Lab-Grown Meat Isn't for Everyone

Share of respondents in a selection of countries saying they would eat laboratory-grown meat



2,000-10,000 adults (18-64 y/o) per country surveyed in Jan.-Dec. 2023

Source: Statista Consumer Insights



Even though plant-based meat alternatives are ultra-processed, they still may be healthier for your heart than traditional meat is, a new review finds.

Risk factors for heart disease, including total cholesterol, [LDL cholesterol](#) and body weight, all improved when meats were replaced with a plant-based substitute, according to the analysis published Tuesday in the [Canadian Journal of Cardiology](#).

In one clinical trial reviewed, people consuming plant-based alternatives saw a 13% reduction in total cholesterol, a 9% reduction in LDL cholesterol, a 53% reduction in triglycerides and an 11% rise in "good" HDL cholesterol.

"Plant-based meat is a healthy alternative that is clearly associated with reduced cardiovascular risk factors," senior study author [Dr. Ehud Ur](#), a professor of medicine at the University of British Columbia in Vancouver, told NBC News.

Still, the researchers did find a wide variation in the nutritional value of meat substitutes, such as in the amount of sodium and saturated fat they contained.

For example, Ur's team focused on two burger brands: an older one and a newer one that tasted more like beef. The older burger had 6% of the recommended daily allowance for saturated fat, compared to 30% in the newer burger. Meanwhile, the older brand had 0% cholesterol, compared with 27% in the newer brand.

Most meat substitutes are highly processed, and such foods tend to be low in fiber and loaded with salt, sugar and additives, NBC News reported.

But Ur argued that not all ultra-processed foods are bad for the heart.

"In and of itself, processing is not necessarily a bad thing," Ur said. "It's true that these plant-based meats are highly processed, but not in the sense that they have lots of saturated fats or certain carbohydrates that are associated with adverse outcomes."

A randomized trial looking at heart attack and stroke in people who eat meat substitutes compared to regular meat eaters is needed next, Ur said.

"Obviously, it could be difficult to conduct a double-blind trial because people might be able to tell whether they were eating meat or an alternative," he acknowledged. "But some of the newer plant-based meats are very close in flavor to actual meat."

Still, [Dr. Walter Willett](#), a professor of epidemiology and nutrition at the Harvard T.H. Chan School of Public Health, told NBC News that, "in general, the best option would be to consume whole foods."

But not everyone can do that, "so I do think there is space for foods that might be called ultra-processed," he added.

He pointed to a study published in 2020 in the [American Journal of Clinical Nutrition](#), in which participants consumed meat for eight weeks and then a plant-based meat alternative for eight weeks.

When participants ate the meat alternative, "cholesterol and blood pressure were reduced by about 10%, which is pretty substantial," Willett said. "Just the fact that something might fall under the definition of ultra-processed doesn't mean it's bad."

[Dr. Anu Lala](#), director of heart failure research at the Mount Sinai Fuster Heart Hospital in New York City, told NBC News that longer follow-up studies are needed to determine whether plant-based meat alternatives are healthier.

"There needs to be a concerted effort -- like there has been with the Mediterranean diet -- to understand the plant-based dietary programs and their long-term effects," Lala said.

More information

Consumer Reports has more on [plant-based meat alternatives](#).

When you go out for a [burger](#), you face a lot of choices: Fries or onion rings, bun or lettuce wrap, beef patty or veggie burger? Veggie, of course! That's the healthier choice, right?

Not so fast.

Because while there's a vegan alternative to just about any meat product from beef burgers and chicken nuggets to hot dogs and breakfast sausages, the nutritional content may not be quite what you were hoping for.

"People think that if it's [plant-based](#), it's healthy or healthier, and that certainly can be, but it doesn't necessarily have to be," says D. Julian McClements, PhD, a distinguished professor of food science at the University of Massachusetts Amherst, whose research focuses on plant-based foods. "It really depends on [if] the company [is] designing it correctly."

What's in plat-based meat?

The global alternative meat, or meat analogue, industry is vast—valued at \$18.78 billion in 2023 and projected to nearly double by 2032.

Traditional veggie burgers are typically made of [beans](#) and vegetables that get mashed and pressed into a patty, allowing you to often see the whole foods—black beans, lentils, corn, chickpeas—that make up these products. But newer meat analogues, the most famous brands being Beyond and Impossible, much more closely resemble the meats they mimic than the distant plant cousins—pea protein for Beyond, soy for Impossible—from which their ingredients are aggressively extracted.

"These are definitely [ultra-processed](#) products," says McClements. "Ultra-processed can mean that something is less healthy for you, but it can also mean that it's healthier than the alternative."

Is plant-based meat good for you?

The more closely meat alternatives mimic real meat, the more processed they likely are. And that's where you might run into problems.

For starters, ultra-processing can rob otherwise good-for-you foods of their nutritional value. When whole foods are broken down and forced into other forms—whether it's a corn chip or a soy patty—a lot of their natural [fiber](#) is lost, according to the [American Medical Association](#). Lower-fiber foods digest more quickly, which causes a blood sugar spike and also doesn't leave you feeling as satisfied as whole, unprocessed foods do. That's ok for a treat now and then. But diets high in ultra-processed foods can lead to overeating, obesity, and diabetes.

That's the problem with any ultra-processed food. Fake meats in particular can have other problems.

To make these meatless burgers greasy like a beef burger, you need fat, which usually comes in the form of added sunflower, coconut, or canola oil. That helps explain why some burger lookalikes have as much—and sometimes more—[saturated fat](#), which can raise cholesterol levels, as a frozen all-beef patty. And they may log five times as much sodium. They also contain carbs, which can raise blood sugar, although some of those carbs are fiber, which is a good thing and an area where meat falls short. They tend to pack just as many calories as beef patties, too—about 2 to 2.5 calories per gram or 200 calories per 3.5-ounce patty.

"You have to know what's in them and compare them to what you'd be replacing," says Judy Simon, RD, a dietitian in the Nutrition Clinic at UW Medical Center in Seattle.

While side-by-side comparisons with plain frozen beef patties from your grocer's freezer don't differ much, these plant-based products may deliver a good bit less sodium and sugar than a hamburger from the major fast food chains, which might make them a wise option when eating out as opposed to cooking at home, if it is salt and sugar you are trying to avoid. Just beware, they don't promise to save you any calories and, surprisingly, may contain even more fat.

What does the science say about plant-based meat?

Scientific research gives faux meat mixed reviews.

In a small November 2020 [study](#) in the *American Journal of Clinical Nutrition*, researchers tracked a group of 36 adults for 16 weeks. For eight weeks, they had two servings of meat per day, such as pork, hamburgers, sausage and ground beef. For the other eight weeks, they had two daily servings of the Beyond brand counterpart instead of meat. Half the group did the meat diet first; the other half went veg first. Then they switched. Everything else stayed the same over the four months, including daily exercise and overall calorie intake. Still, during the eight-week fake meat diet, most people lost weight and saw a drop in their LDL (“bad”) cholesterol.

But more recent studies haven’t been so positive.

A [2024 study](#) took the same eight-week approach. Only this time, it included 82 people. Half ate from a predetermined menu of meats the whole time. The other half ate the veggie version of each of those meats from various brands, including Impossible, Beyond, and others. The researchers checked everyone’s weight, cholesterol, blood sugar, blood pressure, and other health markers at the beginning and the end.

The people in the plant-based group didn’t come out any better in the end than their meat-eating counterparts.

But coming out “better” is not exactly the point of these burger lookalikes, says Sunil Chandran, Chief Scientific Officer at Impossible Foods.

“Our products are not intended to be salads or veggie burgers,” he says. “Everything we make is designed to replicate the full sensory and nutritional experience of eating meat that meat-lovers crave, and more often than not, classic veggie burgers aren’t hitting the mark for these folks. Our goal is to offer a better option for meat eaters who are looking to incorporate more plant-based foods, but don’t want to change their lifestyle so drastically.”

Meat analogues don't seem to help with inflammation, either. Chronic inflammation is a risk factor for many diseases, including [heart disease](#), diabetes, [Alzheimer's](#) and certain cancers, and past research has suggested that a meat-heavy diet causes inflammation. More recent research is shifting away from that conclusion, but researchers are still asking whether alt meats can counter inflammation.

A [small 2022 study](#) in the *American Journal of Clinical Nutrition* says no. In it, the same 36 adults from the 2020 study showed very little difference in inflammation levels after eight weeks on alt meats and eight weeks on beef.

The good news is: You have choices. If health is a concern, you have to look beyond the "plant-based" branding and read the label. Go for the options with more fiber and less sugar, fat and sodium.

Beyond Meat recently announced that they've reformulated their burger and ground beef alternatives to replace coconut and canola oils with avocado oil, bringing the saturated fat content down by 60% to just 2 grams per serving. The new formulation, scheduled to arrive in supermarkets in June, also cuts sodium by 20%.

"It's important to note that our products are similar to or lower in sodium than plain ground beef once you add salt or a seasoning blend [to plain ground beef], which most people do during the cooking process," says Joy Bauer, RDN, nutrition advisor to Beyond Meat.

The changes to the formula, she says, "have garnered recognition from the American Diabetes Association, which certified our products as part of their 'Better Choices for Life' program, and the American Heart Association, which certified a [collection of heart-healthy recipes](#) featuring our products."

Impossible, too, offers options with a better nutrition profile than its standout Impossible Burger, like Lite Beef, which also got a nod from the American Heart Association. "But not only is it a healthier product, it still tastes as meaty and delicious as lean animal beef – proving that heart-healthy choices don't necessarily have to be less flavorful," Chandran says.

"A majority of our meat products contain at least 25% less total fat and saturated fat compared to the animal [product]," Chandran says. "And because our meat is

made from plants, our products are higher in intrinsic fiber content than animal meat.”

It's also important to note that a plant-based diet [has been shown](#) to lower the risk of diabetes, high cholesterol, dementia, depression, and some cancers—but just be sure to opt for whole foods over processed as often as possible.

Too soon to tell

Sugar, fat, sodium, calories, inflammation—all the devil you know. But meat analogues may also introduce a devil that even food and nutrition experts don't know about yet.

“We’ve been grinding up meat and making hamburgers for a hundred years,” says [Youling Xiong](#), PhD, a professor of food and animal sciences at the University of Kentucky in Lexington. “But we just don’t have enough data to assess everything related to long-term consumption of plant-based meats.”

Nobody knows the potential health consequences of the new ingredients and processes that are unique to alt meats.

“People don’t recognize the incredible complexity of creating these products,” McClements says. “Using plants to make something that looks or tastes exactly like meat is incredibly challenging and requires all sorts of biology, chemistry, and physics.”

Impossible Foods, for example, pioneered the use of [plant heme](#)—an iron-rich molecule found in every living thing—to beef up the taste and smell of its burgers. In real meat, heme comes from hemoglobin found in blood. In Impossible meat, it comes from leghemoglobin found in legumes, specifically soy, from which Impossible derives heme in its manufacturing plants.

“With plant hemoglobin, it behaves more or less the same as a meat product, and that’s what makes it go from red to brown when you cook it,” McClements says.

Thanks to plant heme, at first glance, sniff, and maybe even first bite, an Impossible burger might fool even the most ardent carnivore.

"It's a genetically engineered product that we just don't have enough history on to know whether, for example, people are going to be sensitive to it or just whether it's OK," Simon says.

Future impact

But plant-based meat substitutes still do measurable good. Their manufacture uses less water and land, causes less water and air pollution, and produces fewer greenhouse gasses than meat production. They have [about half the environmental impact](#) of real meat.

"Animal production cannot sustain the world's population or the world climate," Xiong says. "But plants we can grow, so sustainability is a driving force of this market."

As the plant-based protein market continues to grow, and processing advances, experts expect you'll have healthier choices, too.

"In the past, food scientists designed foods to be delicious, convenient, and affordable," McClements says. "But this next generation of plant-based foods is where we're trying to design health and sustainability as well."

Experts Confirm Swapping Meat With Plant-Based Foods is Good for Health

Researchers analyzed data from dozens of studies, and confirmed a plant-based diet is healthier for your heart

Published | Updated
Shishira Sreenivas



Swapping red and processed meat with nuts, legumes and whole grains is good for the heart, experts confirm. Getty Images© Getty Images

Swapping red and [processed meat](#) with [plant-based](#) foods, such as nuts, legumes and whole grains, can reap numerous health benefits, such as lowering the odds of heart disease, type-2 diabetes, and overall risk of dying, a new study finds.

Researchers from Germany, who published their findings last week in [BMC Medicine](#), analyzed data gathered from 37 previous studies that looked into the health benefits of substituting animal-based foods with plant foods.

Through the comprehensive review, the researchers found that replacing 50 grams or 1.8 ounces of processed meat with 28 grams to 50 grams, or about a third of a cup of nuts per day resulted in a 27% reduction in the risk of heart disease and a 23% dip when consuming similar amounts of legumes instead of meat.

Swapping the same amount of meat with 10 to 28 grams of nuts (about 20 almonds) led to a 22% decrease in the chances of developing type-2 diabetes.

Trading dairy-based butter for olive oil and eating nuts instead of eggs was also found to lower the risk of type-2 diabetes and heart problems. However, the researchers found that substituting other dairy products like milk or yogurt, fish and poultry with plant-based options didn't make much difference.

Researchers admit that the findings from the review weren't anything new or surprising. On the contrary, it echoes similar findings from previous studies.

In fact, according to the American Heart Association, [eating](#) more plant-based meals at any age can have potential health benefits down the line.

For instance, in [one 2020 study](#), young adults who opted for a plant-based diet were seen to lower their risk of heart attacks in middle age. A [second 2021 study](#) found that eating cholesterol-lowering plant foods, such as whole grains, berries, tofu, soy and nuts, lowered the risk of heart disease in menopausal women.

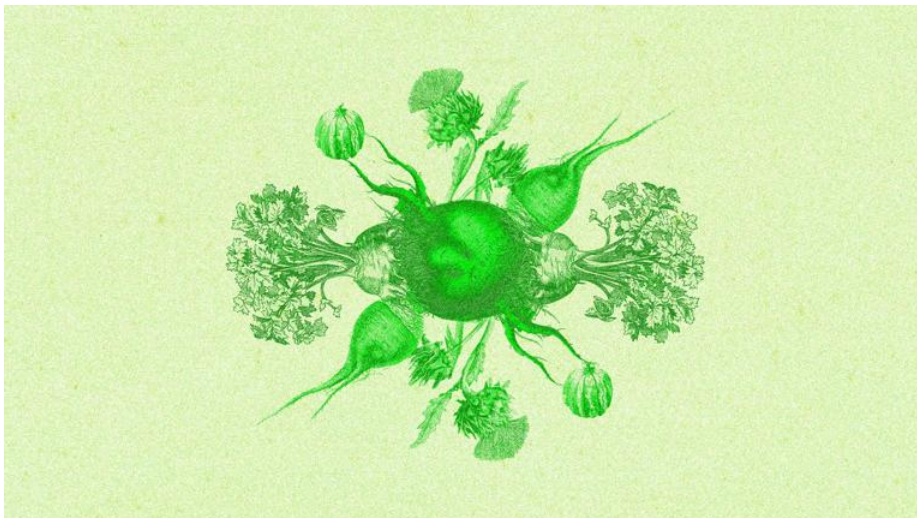
However, lead author Sabrina Schlesinger, M.Sc., head of the systematic reviews research group at the German Diabetes Center in Düsseldorf, told [CNN](#), that the research holds an important place as it does “not rely on the results of a single study but systematically summarize all available evidence on the topic.”

And the results, researchers say, are largely consistent.

Plus, researchers claim the review is the first to present the wide range of health benefits that stem from red and processed meat with plant-based options.

Considering a more plant-based diet? According to the [U.S. Department of Agriculture's \(USDA\)](#) Dietary Guidelines for Americans, those looking to follow a vegetarian or vegan diet should incorporate a wide variety of foods to fulfill their daily nutritional needs.

For example, key essential nutrients necessary for a healthy, well-rounded diet include iron, zinc, vitamin B12, choline, and iodine. Adding nutrient-dense foods, such as tofu, lentils, peas, nuts, seeds, beans and whole grains, can boost your nutritional intake.



Several years ago, I made a New Year's resolution to eat more plants. Doing so, I assumed, would be better for my health, for animals, and for the planet. Besides, it would be easy: The rise of plant-based meat alternatives, offered by companies such as Impossible Meat and Beyond Meat, made it a breeze to eat less meat but still satisfy the occasional carnivorous urge. I could have my burger and eat it too.

Or so I thought. Meat alternatives, I found, cost more than their conventional counterparts and are made with complicated ingredients that raise doubts about their healthiness—and even then, [taste just okay](#). Other people have had similar concerns, part of the reason the popularity of those products has declined in recent years to such a degree that Beyond Meat is [reportedly now in "survival mode."](#) But beyond the meat aisle, the "plant-based" label lives on in virtually every food product imaginable: instant ramen, boxed mac and cheese, [Kraft singles](#), KitKat bars, even queso. You can now buy plant-based [peanut butter](#). You can also wash your hair with plant-based [shampoo](#) and puff on a plant-based [vape](#).

Queso made from cauliflower instead of milk is correctly described as plant-based. But if peanut butter is vegan to begin with, then what is the point of the label? And who asked for plant-based liquor? On packaging and ad copy, *plant-based* has been applied to so many items—including foods that are highly processed, or those that have never contained animal ingredients—that it has gotten "diluted to nothing," Mark Lang, a marketing professor at the University of Tampa who studies food, told me.

Technically, *plant-based* does have a clear definition. The Cornell University biochemist Thomas Colin Campbell is often credited for coining the term in the 1980s as a [neutral, less fraught descriptor for diets considered "vegan" or "vegetarian."](#) That is what made *plant-based* a popular term for companies eager to sell their meat replacements to a wide range of eaters. The Plant Based Foods Association uses essentially the same criteria—foods made from plants that do not contain animal products—to determine which products can bear its "Certified Plant Based Seal."

Some companies describe products as “plant-based,” however, even if they *don’t* meet these criteria. Items sold as such include foods that have always been vegan, such as [prepackaged jackfruit](#), and those mixed in with some animal products, such as [Wahlburgers’ “Flex Blend” patties](#). But even a product that is properly described as “plant-based” might mean different things to different people, because there is no one reason to try to avoid the consequences of animal rearing and consumption. Health is the leading one, followed by environmental and ethical concerns, Emma Ignaszewski, the associate director of industry intelligence and initiatives at the Good Food Institute, told me.

The label’s vagueness has been a marketer’s dream, creating an enormous opportunity to capitalize on the perceived virtuousness and healthiness of eating plant-based. Brands use the “plant-based” label to “draw people’s attention to the aggregate goodness of a particular product” and simultaneously “deflect attention” from any less appealing attributes, Joe Árvai, a professor of psychology and biological sciences at the University of Southern California, told me. Some, like [coconut water](#), are relatively good for you; others, like [booze](#), are probably not. And their environmental benefits remain murky: Using fewer animal ingredients generally decreases emissions, but the climate impacts [are not always straightforward](#).

In this way, the evolution of *plant-based* mirrors that of *organic* or *gluten-free*. These terms have specific meanings that are legitimately useful for helping people make choices about their food, but they have been overused into oblivion. You can now buy [organic marijuana](#) and [gluten-free water](#) along with your [plant-based energy drinks](#). With multiple labels, including *gluten-free*, *plant-based*, *GMO-free*, *Earth-friendly*, and *Fair Trade*, “some products look like a NASCAR” vehicle, Lang said. “You’re just putting buttons all over the place, trying to get my attention.”

We may have already hit peak “plant-based.” According to a [recent survey](#) from the Food Industry Association, there is substantial confusion about what the label means—and that could be discouraging people from buying plant-based products. Some are now outright skeptical of the label. A 2023 [study](#) co-authored by Árvai suggested that people are less likely to go for foods described as “plant-based” (or “vegan”) compared with those called “healthy” or “sustainable.” One reason may be negative associations with plant-based meat alternatives, which are [seen as “artificial”](#) because of their ultra-processed nature, co-author Patrycja

Sleboda, an assistant professor of psychology at Baruch College, City University of New York, told me.

Another may be that consumers are not sure whether “plant-based” foods are healthy. Americans may respond better when the actual benefits of the food are highlighted, she said. Similarly, market research conducted by Meati, a company that sells meat alternatives made of mushrooms, found that the “plant-based” label, applied to food, signaled “bad eating experience, bad flavor, bad texture, poor nutrition, too many ingredients, and overprocessing,” Christina Ra, Meati’s vice president of marketing and communications, told me.

Some good may still come out of the messiness of “plant-based” everything. Meati deliberately avoids the label altogether, opting instead to highlight the contents of its products (“95 percent mushroom root”). A recent Whole Foods [report](#) predicted that in 2024, consumers will want to “put the ‘plant’ back in ‘plant-based’” by replacing “complex meat alternatives” with recognizable ingredients such as walnuts and legumes. In a particular literal interpretation of this prediction, the company Actual Veggies sells a greens-and-grains patty called “The Actual Green Burger.” And some [milk alternatives](#) are also now skipping “plant-based” and simplifying their ingredient lists to just [two items](#) (nuts and water).

Shoppers just want to know what’s in their food without having to think too hard about it. *Plant-based* hasn’t helped with that. Even Campbell, after he coined the term, acknowledged that it was a limiting, potentially misleading phrase that left too much room for unhealthy ingredients, such as sugar and flour. Perhaps shoppers’ exasperation with the vagueness of “plant-based” eating may eventually lead brands to promote more plant-based eating: that is, just eating plants.



Swedish startup uses hydroponics, AI to offer fresh, supermarket-grown vegetables

SweGreen, a Stockholm-based startup, has given a new meaning to the word farm fresh after bringing farms to the supermarket. The company has installations in Sweden and Germany and is showcasing a sustainable way to grow crops while also reducing food wastage and carbon emissions.

Estimates suggest that 16 billion pounds of food goes to waste every year in American supermarkets alone. As much as 30 percent of the food that reaches US stores is then thrown away as customers are offered the best-looking fruits and vegetables to pick from, while the rest land up in the bin.

With the global population likely to hit nearly 10 billion by 2050, shrinking agricultural land due to climate change, and increased risks of global trade due to geopolitical tensions, countries need to work now to ensure food security.

Swedish startup SweGreen offers an innovative solution to all this by bringing farms to the supermarket, where people pick their fruits and vegetables.

How does it work?

SweGreen uses a well-known method of soilless agriculture called [hydroponics](#). In this, plants are grown in rock wool plugs instead of soil, and a continuous flow of water provides the nutrients for them to grow.

According to SweGreen's website, this approach can use up to 99 percent less water, which is also further recycled. To cite an example, SweGreen says that growing a kilo of lettuce requires about 66 gallons (250 liters) of water. The company, however, achieves the same output in a quarter of a gallon (one liter) of water.

Related video: Meet SweGreen: This Swedish vertical farm start-up grows vegetables inside of supermarkets (Dailymotion)

In addition to water savings, the approach also prevents emissions that would be released in transporting the crops from farms to supermarkets while also assuring pesticide-free produce. Since the crop is grown in a sterile and controlled environment, there are no pests or weeds that need to be contended with, thereby eliminating the need for dangerous sprays and chemicals.

The size of the setup depends on the size of the supermarket itself. A larger facility covering 485 square feet (45 sq m) can grow up to 300 crops per day, while a smaller setup of 130 square feet (12 sq m) can grow up to 118 crops a day.

SweGreen's AI tool can help further

Currently, SweGreen installations are growing up to 100 crop species, including leafy greens like parsley, dill, mint, and lettuce. The company is also working on adding strawberries to its portfolio of products alongside microgreens and fruit-bearing plants.

But how will supermarket staff know how to grow them? This is where [artificial intelligence](#) (AI) will help.

The [company has also developed](#) an AI tool that can take into account seasonal crop demand, consumer preferences, and plant growth times to arrive at a to-do list for the staff. When the tasks are done, the system will produce the crops as per demand and ensure availability on the day.

Not just supermarkets but even hotels and restaurants are keen to source fresh ingredients and are using SweGreen's [technology](#) to grow their produce. In addition to delivering on sustainability, the approach also delivers freshness and taste like never before.



Food-tech startup uses unique collaboration to develop plant-based alternatives: 'We ended up working to help endangered species'

NotCo is a forward-thinking food-[tech](#) company that aims to change the food industry by creating plant-based products with the help of data and artificial intelligence.

The founder, Matias Muchnik, became a health nut during his stint playing rugby and had difficulty in nailing down the best food choices for fitness and well-being, [according](#) to a profile by SOSV. Vegan options were confusing and often very processed.

"Whenever an industry is generating that much confusion, it's because the industry is broken and there are conflicts of interest," as Muchnik [explained](#).

After finding success with Eggless Company, a vegan mayo startup, by 2015, the Chile-based entrepreneur reached out to Karim Pichara, a professor and AI researcher who many of Muchnik's friends had studied with, as SOSV detailed.

The newly created NotCo then received the funding it needed to set the company into action, developing plant-based products with the help of its own AI called "Giuseppe."

By creating scalable plant-based versions of [animal products](#), they hoped to reduce polluting gases like [methane](#), a byproduct from livestock farming that accounts for [32%](#) of all human-caused output. The industry generates around [15%](#) of all planet-warming pollution, which is greater than the transportation sector.

The latest innovation to come from NotCo, as Reuters [reported](#), is a dish that tastes like the exotic (and frequently illegal) turtle soup. Using their AI, they aimed to recreate the dish as closely as possible using plant-based ingredients while raising awareness about the [endangered](#) green turtle.

"We wanted to generate an impact through artificial intelligence," said Bernardo Molledo, NotCo's AI culinary science leader, per the report.

"We have been working on this for several years. We always ask ourselves 'why not,' that's why we ended up working to help endangered species, as is the case with turtle soup," he said.

It's been hard going for these [primarily vegetarian](#) turtles, which face [threats](#) by commercial fishing, loss of habitats due to coastal development, and the changing climate.

NotCo's work is reshaping food research and development by speeding up the process in finding and combining [plant-based ingredients](#). If successful, it could help revive the flagging market for these products, some of which have seen sales fall by 13% in the past two years, as Wired [noted](#).

Switching to more [sustainable](#) food sources helps protect the environment and provides health benefits at the same time. Forward-thinking companies like NotCo are choosing to develop meat alternatives using plants, with offerings

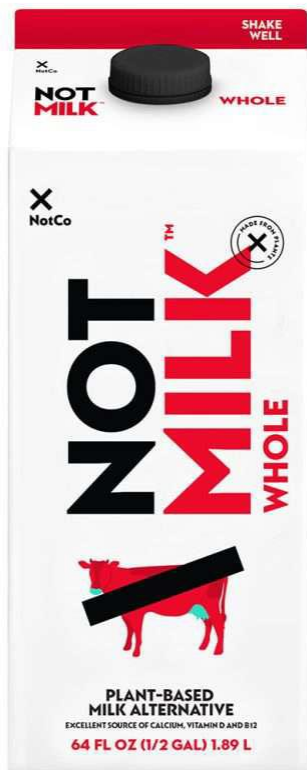
like [faux pork ribs](#) with edible vegan bones to help sway consumers. Others are simply bypassing the cultivation of live animals with [lab-grown meat](#).

If we could replace half of our meat products with plant-based ones, we could potentially [reduce pollution](#) by one-third by 2050. As Muchnik shared in an [interview](#) with Refrigeration & Frozen Foods, AI may be the key to producing the satisfying food experiences everyone craves while reducing the industry's deleterious footprint.

"By understanding taste at the molecular level and interpreting the emotion our brains associate with it, Giuseppe can recreate these experiences through flavor and aroma using only plant-based ingredients."



plant-based-milk-woman© Provided by Anthropocene Magazine published by Future Earth



AI is making an adventurous and sustainable plant diet possible© Provided by Anthropocene Magazine published by Future Earth

The carton looks like every other carton in the cooler. The white cardboard pyramid, dewy with condensation, has the usual screw-top cap and waxy feel. It recalls school lunches, morning breakfast cereal, models bearing frothy white mustaches on billboards alongside the words, "Got milk?"

But where the other cartons list the contents you'd expect, this one has something different emblazoned on the side. It reads, in big black letters: "NotMilk." Just in case you didn't get that the first time, there is also a helpful diagram. Crossed out by a thick black line is the silhouette of a cow.

The liquid within looks exactly like milk. It tastes almost exactly like milk. But it was designed by biochemists and computer scientists who combed databases of plant-based ingredients using artificial intelligence, trying to predict what combinations would yield the milkiest not-milk. The final list developed by the Not Company, a Chilean startup that uses AI to create mimics of animal products, includes pineapple juice and cabbage concentrate. NotChicken nuggets draw on

ingredients like fava beans and peach powder, without tasting like fava beans or peaches. There's a NotBurger, too, and NotIceCream, available in the South American markets where the company got its start, as well as in Mexico. NotCo expanded into the US in late 2020—NotMilk was their first product available in US markets.

Looking at a carton in the dairy aisle at a Whole Foods near my home, two central questions came to mind: How have they accomplished this technological feat? And more significantly, Why?

Why produce something that tastes as close as science can make it to milk, and then loudly trumpet its falseness? The short answer can be seen all around you in the climate crisis.

First, the Why. Why produce something that tastes as close as science can make it to milk, and then loudly trumpet its falseness? The short answer can be seen all around you in the climate crisis. More than a quarter of all greenhouse gas emissions come from agriculture. The majority of [agriculture's emissions](#) can be traced back to eating meat and fish. It is hard to conceive of anything more wasteful than meat production, when it comes to producing food. [A third of all arable land](#) on the planet goes to feed livestock. At the same time, a serving of plant-based protein requires up to [1000 times less water](#) than an animal version to make. "I decided early that plant-based was one of the best mechanisms to create a very sustainable and at the same time delicious food landscape," said Matias Muchnick, NotCo's CEO.

But clearly the sentiment alone is not moving any needles. Despite a growing mountain of evidence on the environmental costs, consumption of animal-based foods is not declining; indeed it is escalating. In the next decade, according to the [FAO](#), global meat consumption is expected to climb by 14%. In developing countries, eating animals is a sign of arrival in the global middle class; in the rich world, it's simply an old habit.

If a habit is linked to someone's identity, like eating meat often is, making the change is more complicated than just buying lentils instead of hamburgers, [write Joop de Boer and Harry Aiking](#), a pair of scientists with backgrounds in psychology, biochemistry, and microbiology who have been collaborating for years on issues in environmental studies. When the researchers asked why people resist moving to plant-based diets, they found evidence from prior research that

the work—the inconvenience of learning new recipes, the trial-and-error of finding new favorites—was easier for people to handle if they felt it [meshed with their own identities](#). (There are many other factors involved, Aiking points out, but this is one.) [A study by other researchers](#) looking at why people did not eat healthier found that a surprising amount of the time, the culprit was inertia. People did not want to learn a new way of cooking; they did not want to learn new tastes, even if they knew their current ones were a problem. “We eat what we like,” says Aiking, reflecting that matters of health, as well as matters of sustainability, ought to drive change. “But it simply doesn’t happen.”

Enter, then, the simulacra.

Pat Brown, the Stanford biochemist who launched the Impossible Burger, spent some of the company’s early days on his knees in a clover field, in search of the molecules that would allow him to recreate the taste of beef. (Impossible Burgers use heme, a molecule found in blood and in plants, in aid of this goal.) A perfectly done Beyond Burger, a pea-protein-based patty, will seep red onto the burger bun just like a beef patty, thanks to a formulation that includes beets. NotCo’s products, in turn, are all nearly pitch-perfect mimics of the original, animal-based versions.

“We are not launching it if we don’t have statistical parity with what we are trying to replace,” says Muchnick, meaning that in tests, people would mistake the plant version for the animal one. “We came to the US understanding that 60% of plant-based milk consumers are not completely happy with the taste of the product they are buying, and 30% of dairy milk consumers are willing to change if they found something that tasted like milk. That was a big chunk of the market—that’s why we came with NotMilk.”

plant-based milk© Provided by Anthropocene Magazine published by Future Earth

AI learned more about what molecules make milk the way it is, and what molecules in plants taste like, it started to make matches between them. . . The effects are truly something no human would have expected.

Now, for the How: NotCo’s central product isn’t really, when you get down to it, milk. It’s a set of artificial intelligence algorithms that look for connections between the qualities of some of our most beloved foods and the taste, smell,

and texture of ingredients from plants. The technology, whimsically named Giuseppe, has the potential to make it faster and easier to design plant-based foods that meet people where they're at—getting them onto a plant-based diet without making them give up tastes they love.

Usually, when a team of food scientists put together a snack cake or microwavable burrito, they make educated guesses about how to extend its shelf life, how to make it compatible with manufacturing equipment—or how to remove that slight chalky note in a chocolate coating or that too-artificial tang in a strawberry jelly. They create a prototype, they take a bite, they repeat.

It is a laborious process for even well-understood foods, much less novel ones. When it came to making convincing plant-based mimics of milk and other animal-based foods, Muchnick felt the process failed spectacularly. For one, it's an inherently conservative process based on making small adjustments to known quantities. The NotCo team was aiming for something more disruptive.

Muchnick and his co-founders thought a form of artificial intelligence called machine learning could break the mold. AI is adept at finding patterns. Maybe, if they could give an AI tons of information about what humans like to eat, alongside tons of information about plants, it could see patterns where food scientists had failed.

So, they started to teach an AI about food.

The team created some of the first databases they gave to the AI themselves, tasting all kinds of food, good and bad, and recording their impressions. "You can imagine how many bad things we tasted," said Muchnick. But it was in the service of their vision: If a person, or for that matter an algorithm, is going to match a food with a perfect plant-based mimic, "you need to understand the world of plants and animal-derived foods," he said, "but most importantly, their connection with the human brain."

Imagine taking a sip of milk. It's sweet, mild, creamy, and sometimes, depending on the brand, even a bit grassy. Swish it around. It's thicker than water or coffee. And after you swallow, there's a feeling that lingers on your teeth and tongue. Look at what's left in the glass: It's opaque, white, with a very faint hint of blue. It's not quite like anything else.

But, as the AI learned more about what molecules make milk the way it is, and what molecules in plants taste like, it started to make matches between them. It started to suggest mixtures of plant ingredients that might do something similar.

One day one of NotCo's food scientists came up to Muchnick with a green liquid in a glass and asked him to try it. "It tasted exactly like milk," recalls Muchnick. Then they used the algorithm's suggestions for how to get the color closer to what people expect. "You cannot sell [green] milk on the mainstream market," he says.

The ingredients don't always seem straightforward. NotMilk contains pineapple and cabbage, which on their own are about as far from milk as you can imagine when it comes to taste. But in the right amounts and in combination the right bedfellows, the effects are truly something no human would have expected. "In the chemical interaction with everything else in the ingredient list, [cabbage] does its own thing to get your mind into the milk experience," said Muchnick.

The milk experience—without the milk.

NotMilk is asking if environmentalists might be willing to get into bed with processed foods, if it means more people eating plants? If it's healthier? If it's more transparent?



Muchnick, NotCo© Provided by Anthropocene Magazine published by Future Earth

In 2022, NotCo announced some big news: It had plans to set up a joint venture company with food behemoth Kraft Heinz. It's not uncommon for small, scrappy food start-ups to get swallowed by the big guys, but the joint venture, which is operated largely under NotCo's control, was a calculated move by Muchnick and his co-founders in pursuit of their broader goal. If people have allegiances to familiar foods, they have allegiances just as significant to brands. "You cannot underestimate the importance of familiarity of brands when it comes to penetrating the mass market," said Muchnick. "Kraft is well-known [in] American households."

When we walk into a grocery store, the visual cacophony of packaging and advertising can be overwhelming. It's easiest to go with what is familiar and reliable. Muchnick speculates that if NotCo launched a plant-based cheese or a macaroni-and-not-cheese dinner, not that many people would necessarily take a chance on the product. But under the umbrella of Kraft, with that familiar blue logo and comforting orange color, a lot of people who otherwise would not be buying plant-based products might give the stuff a try.

When I first spoke with Muchnick, this cheese was still officially a hypothetical. But in November of 2022, NotCheese Kraft Singles, the first product yielded by the joint venture with Kraft Heinz, arrived in American stores. Their testbed was a set of 30 Giant supermarkets in the Cleveland area. Within that market, the results were promising, said Muchnick: "We became the Number 1 plant-based cheese in less than three months." He thinks that it's easy for people to pick up the Kraft packaging, in that moment drawing on the emotional legacy of the brand. And then when they realize the product is plant-based, they're willing to give it a go. (As of July 2023, the slices were in more than 2,500 US supermarkets.)

What's important is that consumers actually stop buying the animal-based product, though. A world in which people just eat more cheese, whatever its origin, is not moving us to a better climate situation—they need to give up what the simulacra mimic.

That, it turns out, is not as straight-forward as one might assume. Early market research on ground beef alternatives has delivered some counterintuitive results. In [one study](#), researchers built an economic model to see how the production and consumption of beef in the US, would change if the price of Impossible Burgers, Beyond Burgers, and other similar products decreased. As expected, as

prices dropped, people's appetite for plant-based meat grew. But cattle production didn't budge. The reasons behind this seeming paradox come down to the interplay between consumption and production; or put another way, consumer appetites are not the only factors that steer the market.

The same dynamic played out in [a real-world study in the UK](#). A big supermarket chain there ran a month-long campaign called "Veganuary." They offered promotions, discounts, and meal ideas for meat alternatives to increase the visibility of these foods. At the end of the month, sales of plant-based meats grew by an impressive 57%. But when researchers looked closer, they found that people were adding plant-based meat to their shopping carts but not taking the chicken, pork, and beef out. In fact, trends show that chicken, pork, and beef sales remained remarkably stable and insulated before, during, and after the event.

Still, these are early days, and there is reason for optimism as markets mature, products improve, and old habits die. When NotMilk became available in Starbucks in Chile, it ended up taking over about 15% of all the orders, perhaps displacing some cows' milk. If people in NotCo's new markets do the same—if food designed with help from AI starts displacing animal versions—they might be onto something.

But to truly make a dent, NotCo and other plant-based food mimics will also have to confront the elephant in the room: What they make is processed food. There's no way around it. And if there's anything the environmental movement has agreed on, it's the evils of processed foods.

In the last century, the processed big food industry has poured salt, fat, and ingredients of murky origin into people's homes and diets breeding not only distrust, but also the enduring sense that processed food contains a lie.

NotMilk overtly challenges that notion. They are asking if environmentalists might be willing to get into bed with processed foods, if it means more people eating plants? If it's healthier? If it's more transparent? These are questions that NotCo appears to be grappling with in its packaging, laced as it is with negation. By exposing the lie of processed foods—by pointing out of their own accord that what they have made is false—they seem to be banking on transparency to overcome the skepticism of the consumer. Yes, it's not milk, they seem to be saying. But if it's better, in the bigger picture, would you take a sip?

Want a taste of health? Put down the [artery clogging red meat](#) and pick up a veggie burger, brimming with the good stuff essential for a healthy diet.

Experts have revealed the best plant-based alternatives to the classic, grilled meat patty — consumption of which has been linked to an array of health issues, such as [type 2 diabetes](#).

“Veggie burgers often incorporate a variety of vegetables, whole grains and legumes, which are rich in essential nutrients such as dietary fiber, vitamins, minerals and antioxidants,” registered dietitian nutritionist Sam Schleiger told [HuffPost](#).

“These nutrients are important for maintaining overall health, supporting digestion, reducing the risk of chronic diseases and promoting a well-balanced diet.”

Plant-based meat has climbed in popularity in recent years with [a market value of \\$4.8 billion last year](#), as [restaurants adopt the vegan-friendly alternative](#) on their menus and [meatless eateries crop up across New York City](#).

But while veggie burgers seem to promise an array of health benefits, experts warn that some brands load their products with additives, preservatives and sodium.

Registered dietitian nutritionist Danielle Gaffen cautioned consumers to avoid food additives, like thickening agents such as xanthan gum.



[Here are the best, healthiest veggie burgers — and why cult favorites Impossible and Beyond didn't make the cut](#) © Provided by New York Post

Some brands of plant-based meats have been slammed for their high levels of sodium. Shutterstock

While their purpose is to enhance the flavor, texture, appearance or shelf-life of grocery store grub, some additives can lead to negative health consequences, such as digestive problems.

Next up on the chopping block is sodium content.

Unfortunately, some brands of the processed plant-based protein sources are more salt lick than nutrient haven.

In fact, [compared to a 4 ounce service of 85% lean beef](#), which has 80 milligrams of sodium, green-eating fan favorites [Impossible](#) and Beyond could very likely send your blood pressure spiking.

The Impossible burger has a whopping 370 milligrams of sodium for a 4 ounce serving, while the Beyond is truly beyond, delivering a jaw-dropping 390 milligrams for the same portion size.

According to the [Centers for Disease Control and Prevention](#), Americans already consume too much sodium — 3,400 milligrams of their 2,300 milligram daily allowance.

“While some sodium is necessary for bodily functions, too much can lead to high blood pressure,” said Gaffen.

And health-conscious foodies might think they’re escaping saturated fats by noshing on plant-based burgers, but some brands still contain high concentrations.

A traditional burger has around 7 grams of saturated fat, while Beyond has 6 and Impossible 8.

“While plant-based, some veggie burgers can still be high in saturated fats, particularly if they contain coconut oil,” Gaffen explained, adding that too much of it can increase cholesterol levels and the risk of heart disease.

Despite the lackluster performance of many of the burgers, others can be a good source of protein and vitamins for those that are meat-averse or who are looking for a health-conscious dinner option.

Here, a selection of expert-approved choices — most, if not all of them found in your typical supermarket.

Dr. Praeger’s Black Bean Quinoa Veggie Burgers

[Here are the best, healthiest veggie burgers — and why cult favorites Impossible and Beyond didn’t make the cut](#)© Provided by New York Post

While experts recommended more than one plant-based alternative from Dr. Praeger’s, the burgers made from black beans and quinoa came out on top. Dr. Praeger’s

Found in the frozen aisle, these plant-based patties are a favorite among the experts, especially Gaffen, who applauded the ingredient list.

“It incorporates five distinct types of vegetables, offers 5 grams of protein per serving [and] it caters to various dietary requirements by being both gluten-free and vegan,” she said.

The experts were also fond of Dr. Praeger’s Perfect Burger — which touts 20 grams of protein — and Dr. Praeger’s Kale Veggie Burger.

Hilary’s Organic World’s Best Veggie Burger

[Here are the best, healthiest veggie burgers — and why cult favorites Impossible and Beyond didn't make the cut](#)© Provided by New York Post

With a name like “world’s best,” it’s no surprise these plant-based burgers were a favorite among experts. Hilary's Eats Well
Schleiger prefers Hilary’s due to their organic ingredients that are jam-packed with nutrients “from whole grains, vegetables and things like ground flaxseed and apple cider vinegar,” she said.

Not to mention, they’re allergy-friendly and lack artificial additives and pesky preservatives.

Engine 2 Poblano Black Bean Veggie Burger

[Here are the best, healthiest veggie burgers — and why cult favorites Impossible and Beyond didn't make the cut](#)© Provided by New York Post

These burgers are full of fiber and lack cholesterol. Whole Foods Market
These patties have no cholesterol — you read that right. And better yet, they are chock-full of fiber.

Amy’s Organic Black Bean Veggie Burger

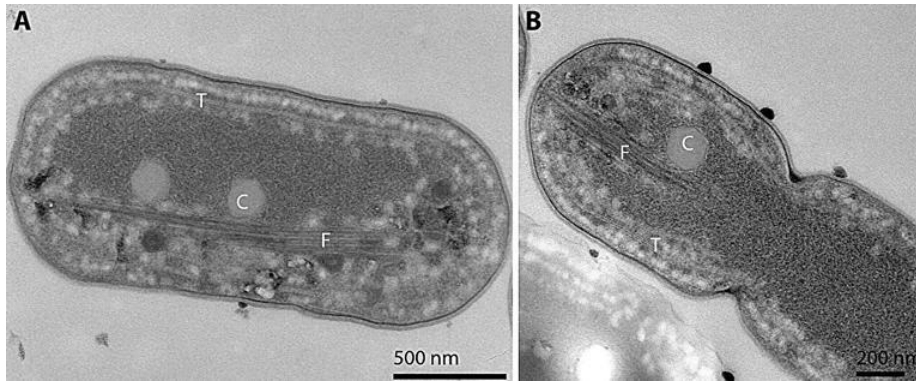
[Here are the best, healthiest veggie burgers — and why cult favorites Impossible and Beyond didn't make the cut](#)© Provided by New York Post

Amy’s plant-based black bean patties are organic, non-GMO and nutrient-dense. Whole Foods Market
“I like the variety of quality ingredients and think this can fit within a well-balanced diet, even if you include meat in your diet,” Schleiger said, praising the patties for their organic, non-GMO and nutrient-dense qualities.

Hilary’s Fiesta Black Bean Veggie Burger

[Here are the best, healthiest veggie burgers — and why cult favorites Impossible and Beyond didn't make the cut](#)© Provided by New York Post

These patties are free of the 12 common allergens, making it a great choice for people with dietary restrictions due to allergies. Hilary's Eats Well
Allergens can be difficult to avoid when eating plant-based, as many veggie-friendly options are manufactured with nuts, soy, gluten. But this burger is made without the 12 most common food allergens, Gaffen explained, and is “an excellent choice for those with specific dietary restrictions.”



Cyanobacteria with protein fibers seen through a microscope. The protein fibers are marked 'F'. Credit: ACS Nano (2023). DOI: 10.1021/acsnano.3c08600© Provided by Phys.org

Researchers from the University of Copenhagen have not only succeeded in using blue-green algae as a surrogate mother for a new protein—they have even coaxed the microalgae to produce "meat fiber-like" protein strands. The achievement may be the key to sustainable foods that have both the "right" texture and require minimal processing.

We all know that we ought to eat less meat and cheese and dig into more plant-based foods. But while perusing the supermarket cold display and having to choose between animal-based foods and more climate-friendly alternative proteins, our voices of reason don't always win. And even though flavor has been mastered in many plant-based products, textures with the 'right' mouthfeel have often been lacking.

Furthermore, some plant-based protein alternatives are not as sustainable anyway, due to the resources consumed by their processing.

But what if it was possible to make sustainable, protein-rich foods that also have the right texture? New research from the University of Copenhagen is fueling that vision. The key? Blue-green algae. Not the infamous type known for being a poisonous broth in the sea come summertime, but non-toxic ones.

"Cyanobacteria, also known as blue-green algae, are living organisms that we have been able to get to produce a protein that they don't naturally produce. The particularly exciting thing here is that the protein is formed in fibrous strands which somewhat resemble meat fibers. And, it might be possible to use these

fibers in plant-based meat, cheese or some other new type of food for which we are after a particular texture," says Professor Poul Erik Jensen of the Department of Food Science.

In a [new study](#) appearing in *ACS Nano*, Jensen and fellow researchers from the University of Copenhagen, among other institutions, have shown that cyanobacteria can serve as host organisms for the new protein by inserting foreign genes into a cyanobacterium. Within the cyanobacterium, the protein organizes itself as tiny threads or nanofibers.

Minimal processing—maximum sustainability

Scientists around the world have zoomed in on cyanobacteria and other microalgae as potential alternative foods. In part because, like plants, they grow by means of photosynthesis, and partly because they themselves contain both a large amount of protein and healthy polyunsaturated fatty acids.

"I'm a humble guy from the countryside who rarely throws his arms into the air, but being able to manipulate a living organism to produce a new kind of protein which organizes itself into threads is rarely seen to this extent—and it is very promising," says Poul Erik Jensen, who heads a research group specializing in plant-based food and plant biochemistry.

"Also, because it is an organism that can easily be grown sustainably, as it survives on water, atmospheric CO₂ and solar rays. This result gives cyanobacteria even greater potential as a sustainable ingredient."

Many researchers around the world are working to develop protein-rich texture enhancers for plant-based foods—e.g., in the form of peas and soybeans. However, these require a significant amount of processing, as the seeds need to be ground up and the protein extracted from them, so as to achieve high enough protein concentrations.

"If we can utilize the entire cyanobacterium in foodstuffs, and not just the protein fibers, it will minimize the amount of processing needed. In food research, we seek to avoid too much processing as it compromises the nutritional value of an ingredient and also uses an awful lot of energy," says Jensen.

Tomorrow's cattle

The professor emphasizes that it will be quite some time before the production of protein strands from cyanobacteria begins. First, the researchers need to figure out how to optimize the cyanobacteria's production of protein fibers.

But Jensen is optimistic, adding, "We need to refine these organisms to produce more protein fibers, and in doing so, 'hijack' the cyanobacteria to work for us. It's a bit like dairy cows, which we've hijacked to produce an insane amount of milk for us. Except here, we avoid any ethical considerations regarding animal welfare. We won't reach our goal tomorrow because of a few metabolic challenges in the organism that we must learn to tackle. But we're already in the process and I am certain that we can succeed."

"If so, this is the ultimate way to make protein."

Cyanobacteria such as spirulina are already grown industrially in several countries—mostly for health foods. Production typically occurs in so-called raceway ponds beneath the open sky or in photobioreactors chambers, where the organisms grow in glass tubes.

According to Jensen, Denmark is an obvious place to establish "microalgae factories" to produce processed cyanobacteria. The country has biotech companies with the right skills and an efficient agricultural sector.

"Danish agriculture could, in principle, produce cyanobacteria and other microalgae, just as they produce dairy products today. It would be possible to harvest, or milk, a proportion of the cells as fresh biomass on a daily basis. By concentrating cyanobacteria cells, you get something that looks like a pesto, but with protein strands. And with minimal processing, it could be incorporated directly into a food."

More information: Julie A. Z. Zedler et al, Self-Assembly of Nanofilaments in Cyanobacteria for Protein Co-localization, *ACS Nano* (2023). [DOI: 10.1021/acsnano.3c08600](https://doi.org/10.1021/acsnano.3c08600)

Provided by University of Copenhagen

[Plant-based meat](#) alternatives are healthier for your heart than real meat, according to a major review.

Researchers analyzed the impact of plant-based meat alternatives, or PBMA, on cardiovascular disease risk factors - such as cholesterol levels and blood pressure.

They found that PBMA have a more cardioprotective nutritional profile and have been shown to improve cardiovascular risk factors compared to real meat.

The team said that even though there is "substantial variability" in the contents and nutritional profiles of PBMA, the nutritional profiles tend to reflect a heart-healthy dietary pattern.

The review of available studies directly comparing the impact of plant-based and animal-based meats, published in the [Canadian Journal of Cardiology](#), consistently suggests that plant-based alternatives improve cardiovascular risk factors.

Lead author Dr. Matthew Nagra said: "While the plant-based meat market has experienced significant growth in recent years and more and more Canadians are enjoying plant-based burgers, surprisingly little is known about how these meat alternatives may impact health and in particular cardiovascular disease risk.

"Thus, we sought to review the available literature on the topic to identify what is currently known and to provide direction for future research."

The team reviewed research published from 1970 to 2023 on PBMA, their contents, nutritional profiles, and impact on cardiovascular disease risk factors, such as cholesterol levels and blood pressure.

Their analysis showed that, on average, PBMA tend to have a more heart-healthy nutritional profile than meat, although the high salt content of some products may be of concern.

PBMA were also shown to improve some cardiovascular risk factors, including cholesterol levels, in several controlled trials, while PBMA were not shown to raise blood pressure, despite the high sodium content of some products.

The team said there was a lack of long-term research evaluating how the alternatives may affect the risk of developing a heart attack or stroke.

They were also surprised to find that there is a near complete lack of research on vital wheat gluten, which is the primary protein source incorporated into many popular PBMA's, and cardiovascular risk factors.

Dr. Nagra added: "The lack of research on cardiovascular outcomes as of 2023 is shocking, given that there are randomized controlled trials evaluating risk factors dating back to 1990.

"More detailed research is needed in light of the increasing consumption of PBMA's and our lack of knowledge of how these products impact risk."

In an accompanying editorial, Professor David Spence said: "What really matters is not the effect of individual components of a diet, nor the effect of diet on cardiovascular risk factors; it is the effect of diet on the actual risk of cardiovascular events such as myocardial infarction and stroke.

"Most physicians markedly underestimate the cardiovascular benefit of diet and place far too little emphasis on diet in the management of patients at high risk of cardiovascular events."

Senior author of the review article Professor Ehud Ur of the [University of British Columbia](#), said: "For those looking to reduce their meat intake, especially if it's red meat, replacing that with PBMA's is likely a heart-healthy choice.

"For those who already limit their meat intake, PBMA's can be incorporated into a healthy dietary pattern as an excellent protein source; however, it may be beneficial to choose options that are lower in saturated fat and sodium if consuming them regularly."

Spence added: "Persons at risk of cardiovascular disease should limit meat intake and avoid egg yolk, so plant-based meat substitutes and egg substitutes are helpful to patients wishing to reduce their cardiovascular risk.

"Their effect on reducing actual cardiovascular risk is undoubtedly much greater than their effect on cardiovascular risk factors."

Thinking about eating less meat for health, budget, environmental, or ethical reasons? Keep reading to learn why it really is a good idea!



Eating Less Meat© Provided by MomsWhoSave

Why Eating Less Meat is a Good Idea

You don't need to become a full-time vegetarian to enjoy the benefits of eating less meat. In fact, there's a name for people who go heavy on the plants and light on the meat: *flexitarian*. Even if you prefer to eat meat every chance you get, consider these eight reasons for cutting back, even just a little.

Don't worry, I have a whole list of delicious and nutritious options to fill in any gaps. But first, why eating less meat is a good idea:

1. **You'll eat fewer calories.** People who eat little to no meat tend to fill up on fruits and vegetables, leading to a slimmer waistline and longer-lasting ideal weight.
2. **You'll reduce your risk of cancer.** Consuming high amounts of red and processed meats has been linked to increased risk of colon and stomach cancers.
3. **You'll lower your risk of heart disease.** The fat and cholesterol in meat can lead to clogged arteries, which leads to heart problems, including heart failure. Studies have shown that switching to a plant-based diet can even *reverse* the progression of heart disease.
4. **You'll eat a more healthy variety of food.** When you cut back on meat in your everyday diet, you'll have to come up with other ways to fill in the gaps. You may be surprised by how much you enjoy all the foods you've been missing out on!
5. **You'll save money.** Meat is expensive, especially high-quality meats. Limiting your intake could have quite the impact on your [grocery budget](#).
6. **The production of meat has a considerable impact on the planet's resources.** The livestock industry creates greenhouse gases and takes

up 30 percent of the earth's usable land according to a United Nations report.

7. **Family farms have given way to factory farms.** Factory farming is under fire because thousands of animals are confined into small facilities, poor conditions lead to disease, and consumers who eat these products can be exposed to serious health effects.
8. Along with the issue of factory farming, come the **ethical reasons** you may want to cut back on eating meat (or give up meat altogether). People are taking a closer look at where their food is coming from and how animals in the meat industry are treated.

Fact checked by Nick Blackmer

- Prioritizing protein in a well-balanced diet can be helpful for weight management.
- Plant-based protein options often contain more fiber than animal proteins, which can provide additional health benefits.
- Experts recommend people work to incorporate at least some plant-based protein, like beans, into their diet, as well as focusing on lean animal protein like fish or chicken.

The kind of protein you're eating could play an important role in managing a healthy weight.

Now more than ever, people are focused on hitting their protein goals. But it's not just the amount of protein you get that's important—where it comes from is also key.

Protein is essential for the body to function and can be found in a wide variety of foods, including everything from low-fat dairy to [tofu](#). However, not all sources of protein are created equally.

Generally speaking, people can get protein from animal sources—this includes [chicken](#), fish, and eggs—or they can get protein from plant-based sources, such as nuts, lentils, beans, or [whole grains](#).

And though many people associate protein with meat, experts say plant-based options may be the healthiest option, particularly for people looking to lose or manage their weight.

“The data has started to demonstrate more and more that plant protein is equally efficacious in terms of providing the nourishment needed for the human body,” [Amanda Velazquez, MD](#), director of obesity medicine at Cedars-Sinai, told *Health*. “With plant-based protein, there’s more benefits as a whole compared to animal protein.”

Here’s how animal protein and plant-based proteins compare when it comes to weight loss, as well as how to prioritize protein in a well-balanced diet.



Getty Images / FreshSplash© Provided by Health

How Does Protein Play a Role in Weight Loss?

No matter the source, protein is a great way to aid in healthy weight loss or management.

Since protein can improve a person’s metabolism, higher protein intake can lead to greater feelings of fullness, [Amber Schaefer, MS, RDN](#), clinical nutrition lead

and nutrition instructor at the Mayo Clinic College of Medicine and Science, told *Health*.

And protein doesn't just help people feel full—it can help people feel full for longer periods of time.

"[Each macronutrient] affects the body differently in terms of how long it takes for digestion and processing in the gastrointestinal tract," said Velazquez. "For protein, it takes longer to break it down and, as a result, requires more energy."

In addition to protein aiding in weight loss itself, it's also a vital part of keeping the body healthy while people cut calories.

"Inadvertently, an individual is going to lose some degree of muscle mass when they're losing weight in combination with fat mass," said Velazquez. "So in order to preserve that muscle mass, it's critical for one to be taking in adequate amounts of protein for their body."

Related: [Ask Health: Should I Hit My Protein Goal Every Day?](#)

Overall, Plant-Based Protein Comes Out on Top

In terms of where to source protein from, experts agree that plant-based options tend to be healthier for the body as a whole.

For one, plant-based protein sources tend to have more fiber than animal protein.

"When it comes to weight loss, it's especially important to be not only having high protein in the diet, but also a high fiber diet," said Velazquez. "Animal protein is not going to have as high fiber as plant-based proteins."

For example: A cup of black [beans](#) has about 42 grams of protein and about 30 grams of fiber. A half filet of yellowtail fish has about 43 grams of protein, but no fiber.

The boost of fiber often associated with plant-based proteins can promote additional aspects of well-being.

“Plant-based proteins do incorporate fiber, of course, that also helps us to feel fuller longer and helps with our gut health and promotes regular bowel movements,” said Schaefer. “That in itself can help in weight management.”

Plant-based products also tend to be overall healthier for the body.

It depends on the specific type of protein and how it’s cooked, but in general, plant-based proteins have fewer saturated fats than animal proteins, Schaefer explained.

“We do recommend to stay away from overly processed options, because that can, of course, give extra calories from saturated fat,” she said.

And, not only can processed foods be more caloric, but they also take more of a toll on the body.

Lunch meat, Velazquez said, is a good example of this—it’s often processed with nitrites, which have been associated with colorectal cancer.

More broadly, consuming large amounts of [red meat](#)—especially processed—has been linked to higher rates of type 2 diabetes, heart disease, and mortality.

“If we overdo our consumption of animal-based products—so say we’re eating large amounts of steak or pork—over time, that can put a lot more stress on the body,” Schaefer said.

Related: [Is Eating Vegan Actually Better For Heart Health? Study Says Yes](#)

Prioritizing a Nutritious, Protein-Packed Diet is Key

In general, the [amount of protein adults need](#) each day boils down to about 0.8 grams for every kilogram of body weight.

That means someone who’s 150 pounds needs about 55 grams of protein each day.

Whether it’s to lose weight or just to maintain health, people should try to get the right amount of protein for them every day.

Choosing where to get this protein from can be tricky. Products like [protein powder](#) can be easy additions to someone's routine that help them hit their [protein goals](#).

"It's a processed item, so being very vigilant and reading the nutrition label is key when it comes to protein powders," said Velazquez. "If they have not tried one before and are looking to try one, then I would encourage plant-based."

Beyond just increasing protein intake with powders, the best thing to do is add more protein directly to your diet.

Plant-based protein may be the healthiest option, but that doesn't necessarily mean that a person has to go vegetarian or [vegan](#) overnight, Schaefer explained. Instead, make swaps whenever possible.

"We do recommend at least getting three servings of some form of legume, whether that be [lentils](#) or chickpeas, or if you like, beans," said Schaefer. "Just switching out maybe the red meat from that week so you're reducing the amount of saturated fat that you're getting."

She emphasized that restricting all animal protein isn't necessary to lose weight or maintain health, either.

"A balanced diet can incorporate both animal and plant-based proteins," she said. "My typical recommendation is to get a combination of the two."

In general, people should try "leaning towards plant-based proteins," Velazquez said, but leaner proteins such as fish, seafood, chicken, and turkey are also good options if people do want to stick with some animal protein.

"The important thing to know is that quality matters," she said.

The 10 Best Vegan Protein Powders, Reviewed and Tested

Our favorite vegan protein powders are third-party tested and taste great

By

[Isabel Vasquez RD LDN](#) and [Shushy Rita Setrakian MS, RD](#)

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HEALTH / ALEXANDER HUANG

Vegan protein powder might be a good choice if you struggle to eat enough protein, are always on the go, or eat plant-based and exercise regularly. [Mary Wirtz, MS, RD, CSSD](#), a board-certified sports dietitian, suggests vegan protein powders can be an **easy, convenient, and cost-effective way to get in more protein**, especially when you follow a plant-based diet. Consuming [protein after a workout](#) (in addition to some carbohydrates) can also help **support muscle recovery**.

When selecting a protein powder, we recommend checking the type of protein it contains, any added ingredients (especially if you have food allergies), and whether it is third-party tested. We took these factors into consideration as well as **testing more than 60 different protein powders ourselves** to rate each powder for taste, texture, aftertaste, and smell. We sifted through all these options to recommend only the ones that we think taste, smell, and mix the best.

A registered dietitian on our [Medical Expert Board](#) also reviewed this article for medical and scientific accuracy regarding what to look for in vegan protein powders, the best sources of vegan protein, and whether they're just as good as whey protein.

About Supplements

Dietary supplements are minimally regulated by the FDA and may or may not be suitable for you. They also may interact with other supplements or medications you are taking. Our team of registered dietitians reviews supplements according to our

rigorous dietary supplement methodology. We also had a registered dietitian review this page for its scientific accuracy. Please always speak with a healthcare provider to discuss any supplements you plan on taking.

What to Know Before You Shop

We go into detail about [What To Pay Attention To](#) for vegan protein powders, but here are some things to know before shopping.

- **Ingredients:** Some powders have a long ingredient list that includes sweeteners, flavors, probiotics, or digestive enzymes, which might or might not work for you. This is especially important to consider if you take medications or have sensitivities to certain ingredients.
- **Taste:** Some powders just contain the protein source and are unsweetened, some are sweetened with added sugars, and some have non-caloric sweeteners. Some flavored protein powders can be intensely sweet, and some are just slightly flavored. Consider whether you want a powder that is already flavored and whether you want just the protein.
- **Testing:** Protein powders can contain traces of heavy metals, which is why [we recommend choosing ones that have been third-party tested](#) for **safe levels of contaminants** and ingredient accuracy.

Our Top Picks

BEST OVERALL:

[Ritual Essential Vegan Plant-Based Protein Powder at Amazon \\$49](#)

[Jump to Review](#)

BEST BUDGET:

[Now Foods NOW Sports Nutrition Pea Protein at Amazon \\$25](#)

[Jump to Review](#)

BEST VANILLA:

[Sprout Living Epic Protein Vanilla Lucuma at Amazon \\$35](#)

[Jump to Review](#)

BEST SOY:

SALE

[NOW Sports Soy Protein Isolate at Amazon \\$26 \\$19](#)

[Jump to Review](#)

BEST UNSWEETENED:

[NorCal Organic Premium Pea Protein at Amazon \\$42](#)

[Jump to Review](#)

BEST HEMP:

[Nutiva Hemp Protein Powder at Amazon \\$51](#)

[Jump to Review](#)

BEST CHOCOLATE:

SALE

[Vega Sport Premium Protein Powder at Amazon \\$65 \\$43](#)

[Jump to Review](#)

BEST NUTRIENT BOOST:

[Manitoba Harvest Hemp Yeah! Max Fiber Protein Powder at Amazon \\$26](#)

[Jump to Review](#)

BEST NUTRIENT BOOST (RUNNER-UP):

[Navitas Organics Hemp Powder at Amazon \\$15](#)

[Jump to Review](#)

BEST WITH GREENS:

SALE

[Vega Protein & Greens at Amazon \\$47 \\$32](#)

[Jump to Review](#)

Best Overall

[Ritual Essential Vegan Plant-Based Protein Powder](#)

We love that **Ritual Daily Shake 50+ pea-based protein powder** is not only third-party tested but also delicious. It blended really well with other ingredients and made a **thick, pleasant, creamy smoothie**. The flavor wasn't overpowering and had a **pleasant, slight sweetness**.

While this protein powder is **suggested for adults aged 50 and over**, note it's **ideal for adults of any age**, as it's higher in calcium and choline in comparison to other vegan protein powders. Choline is a key nutrient for brain health, and calcium helps **promote bone strength**, which can be especially important in lowering the risk of osteoporosis as we age.¹ Another distinguishing ingredient in this supplement is calcium β -hydroxy β -methylbutyrate (HMB), which can help **promote muscle strength and protect against muscle decline in older adults**—an important consideration because we tend to lose muscle mass with age.² We love these thoughtful, research-backed nutrients in this powder, but know **Ritual also has a [Daily](#)**

[Shake 18+](#) without these additions and the same delicious taste and ingredient quality we love.

When a product is **third-party tested**, you know that the product is not contaminated with high levels of heavy metals or other harmful contaminants. This protein powder is both [Informed Protein certified](#) and [Informed Sport certified](#), meaning it has been tested to ensure its protein content is accurate and that it doesn't contain any banned substances for athletes.³⁴ Plus, all of the **ingredients in this product are traceable**, meaning you can check their website to see exactly where the ingredients are sourced from.

It's Worth Noting

If you're mixing this protein powder with just water, you might prefer a sweeter or more strongly flavored protein powder.

Product Details:

- **Serving Size:** 2 scoops
- **Sugar per serving:** 0 grams
- **Protein per serving:** 20 grams
- **Fiber per serving:** 3 grams
- **Main Protein Source:** pea
- **Dietary Considerations:** gluten-free and non-GMO (not certified)

Best Budget

[Now Foods NOW Sports Nutrition Pea Protein](#)

If you're looking for a simple and affordable protein powder, we recommend **Now Sports Pea Protein**. Pea protein is a [complete protein](#), which means it contains all nine essential amino acids that our body can't produce on its own.

We like that this powder packs an impressive 24 grams of protein per scoop, as this is considered high for a vegan protein powder. Each serving also includes an impressive **45% DV of Iron**. Iron is needed for the transport of oxygen throughout your body, including muscle cells.⁵ This protein powder is **Informed Sport certified**, making this a great choice for athletes and anyone wanting a protein powder with strong third-party testing.³

The Now Sports protein powder **contains only one ingredient—pea protein**—making it more **allergen-friendly** and easy to add to a variety of foods or beverages. We found it blended well with other ingredients in a smoothie, and we also recommend using this in food like soups to boost protein content.

It's Worth Noting

This protein has a **slight pea-like aftertaste** even when blended with other ingredients, so if you don't love that earthy flavor, this may not be the best pick for you. It is also **higher in sodium** compared to some other choices, with a 14% Daily Value per serving; though this could be helpful for [replacing electrolytes](#) after exercise, as sodium is lost in sweat. However, some may not want or need the higher sodium level.

Product Details:

- **Serving Size:** 1 scoop
- **Sugar per serving:** 0 grams
- **Protein per serving:** 24 grams
- **Fiber per serving:** 0 grams
- **Main Protein Source:** pea
- **Dietary Considerations:** non-GMO, kosher, organic, soy-free, dairy-free

Best Vanilla

[Sprout Living Epic Protein Vanilla Lucuma](#)

Sprout Living's Epic Protein Vanilla Lucuma Powder uses its plant protein blend mixed with vanilla lucuma blend to make a tasty, protein-packed powder. This supplement is third-party tested for ingredient amounts and safe levels of heavy metals such as arsenic, lead, cadmium, and mercury.

In our testing, we were pleased with the delightful taste of this protein powder—it scored some of the **highest ratings for taste**. It is subtly sweet even when just mixed with water. The lucuma and baobab fruit, cinnamon, ginger root, and vanilla bean give it a creamy and spiced flavor that is unique compared to your traditional vanilla.

We also like that each serving has 20 grams of protein and 30% DV of iron from a **blend of yellow peas, sunflower seeds, pumpkin seeds, sacha inchi, and cranberry seeds**. This supplement is also a **good source of vitamin C** (30% DV). This is note-worthy because vitamin C can help absorb iron more effectively, is needed to make [collagen](#), and is an [antioxidant](#).

It's Worth Noting

One of the sources of fiber—Jerusalem artichoke—may cause some [digestive discomfort, like bloating](#), for those who are sensitive to inulin or who follow a low FODMAP diet for [irritable bowel syndrome](#) (IBS).

Product Details:

- **Serving Size:** 2 scoops
- **Sugar per serving:** 6 grams (4 grams added sugar)
- **Protein per serving:** 20 grams
- **Fiber per serving:** 3 grams
- **Main Protein Source:** EPIC protein base (yellow pea, sunflower seed, pumpkin seed, sacha inchi, cranberry seed)
- **Dietary Considerations:** organic, non-GMO, gluten-free, soy-free, dairy-free, kosher

Best Soy

[NOW Sports Soy Protein Isolate](#)

Soy is another [good vegan protein source](#), and **Now Sports** won our top spot for soy protein because it has **one simple ingredient—soy protein isolate**. It also has strong third-party testing, as it is **Informed Sport certified**.³ It contains 20 grams of protein per serving and is **lower in sodium** than many competitors, with only 7% Daily Value (DV) of sodium per serving. We also like that it's a **good source of calcium and iron**, with one serving providing 15% DV each for calcium and iron.

You may have heard about the fears of phytoestrogens with soy, but research suggests **soy is generally safe and may even benefit heart health**.⁶ This is through its ability to significantly reduce total **and LDL cholesterol**, or "bad" cholesterol."⁸ So, if you're not a fan of the more common pea protein as a vegan option, this pick could be a good fit for you.

It's Worth Noting

If you aren't a big fan of the taste of soy, then this may not be your ideal protein powder because we found the **soy taste to be quite noticeable even when mixed into a smoothie**. We tested the unflavored option, but Now Sports also has soy protein powder in chocolate and vanilla flavors.

Typically, vegan protein powders tend to have higher amounts of [fiber](#) in comparison to whey-based proteins, but unfortunately, this one doesn't have any fiber. If you blend it in a smoothie, make sure to add some fruit, leafy greens, [chia seeds](#), or ground flaxseeds to increase the fiber content.

Product Details:

- **Serving Size:** ⅓ cup
- **Sugar per serving:** 0 grams
- **Protein per serving:** 20 grams
- **Fiber per serving:** 0 grams
- **Main Protein Source:** soy
- **Dietary Considerations:** non-GMO, kosher
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[The 11 Best Tasting Protein Shakes, Tested & Reviewed](#)

Best Unsweetened

[NorCal Organic Premium Pea Protein](#)

NorCal Organic's pea protein powder contains **one simple ingredient—organic yellow pea protein isolate**. Some competitors' pea protein powders have a strong, earthy taste that can be off putting, but we found that this one had **a more mild flavor**. So, if you're looking for a vegan **protein boost in your favorite baked goods or oatmeal**, this could be a great option.

We love that this protein powder is **low in sodium**, with only 4% Daily Value per serving, and each serving has **22 grams of protein**. However, if you're an athlete looking to replenish sodium and get adequate protein after a sweaty workout, you may want to consider adding electrolytes to your post-workout shake as well.

This powder can be a **good option if you have a common food allergy**, as it is free of dairy, gluten, and soy. The peas are **sustainably sourced from Canadian organic farms**, and the company reports third-party testing of their supplements.

It's Worth Noting

The package indicates this powder has been third-party tested, but we don't see specifics on their testing processes, just that an independent lab is used.

Product Details:

- **Serving Size:** 2 scoops
- **Sugar per serving:** 0 grams
- **Protein per serving:** 22 grams
- **Fiber per serving:** 1 gram
- **Main Protein Source:** pea protein isolation
- **Dietary Considerations:** dairy-free, gluten-free, soy-free,

Best Hemp

Nutiva Hemp Protein Powder

Nutiva's Organic Cold-pressed Raw Hemp Seed Protein Powder is **third-party tested** and has a pleasant taste when mixed into a smoothie. It is **lower in protein than some alternatives**, with 15 grams per serving, but it has the bonus of being a **good source of fiber**—including six grams per serving. Fiber is important for **digestive health, cholesterol management, and [blood sugar stability](#)**, but it also keeps you feeling fuller for longer.⁹

We like that the **only ingredient is hemp seed protein**, as hemp seeds provide a good source of fats, minerals, fiber, and antioxidants. Omega-3s are a standout heart-healthy fat in these seeds, **helping reduce the risk for cardiovascular disease**.¹⁰ There are higher amounts of omega-3s in fatty fish, but if you aren't a fan, hemp seeds are another great source. When it comes to minerals, this supplement is a good source of iron (35% DV), [zinc \(35% DV\)](#), [and magnesium \(60% DV\)](#). These nutrients can be hard to get enough of from food alone, so a benefit of using this choice is getting a mineral boost. Zinc plays a role in the **immune and digestive systems**, while magnesium **can help with blood sugar levels and the functioning of muscles and nerves**.

It's Worth Noting

Through our testing, we found that this powder **definitely tastes better in a smoothie**, which is how Nutiva recommends using it. We felt that its **earthy flavor and grittier texture** were more noticeable when just mixed with water.

Product Details:

- **Serving Size:** 4 tablespoons
- **Sugar per serving:** 1 gram
- **Protein per serving:** 15 grams
- **Fiber per serving:** 6 grams
- **Main Protein Source:** hemp seed
- **Dietary Considerations:** organic, non-GMO

Best Chocolate

[Vega Sport Premium Protein Powder](#)

If you want a deliciously sweet chocolate protein powder that is high in protein, we recommend **Vega's Premium Sport Protein Powder**. It has the **highest protein content—30 grams per serving**—of all the protein powders we tried. This high protein can help active people—specifically strength-based athletes—**repair and strengthen muscles [after a tough workout](#)**. This protein powder is also **[NSF certified for sport](#)**, meaning it has been third-party tested to ensure its label is accurate and that it doesn't contain unsafe levels of contaminants or banned substances for athletes.¹¹

We found this protein had a **thick, rich, creamy texture** that we loved when blended as a smoothie, and it has a sweet, tootsie roll smell. It uses protein sources, including **peas, pumpkin seed, sunflower seed, and alfalfa**, which leads to a well-rounded and **complete amino acid profile**. It also provides 6% DV calcium and 40% DV iron per serving. Calcium can be especially important for athletes to maintain strong bones and support muscle contractions during exercise. Iron is needed to deliver oxygen to muscles during exercise, and it can be harder to **[get enough iron when following a vegan diet](#)**.

This athlete-targeted protein powder also has **tart cherry powder, beet root powder, and turmeric extract** added to provide **[anti-inflammatory benefits](#)**, and some research suggests these ingredients may **help promote muscle recovery**.¹²¹³¹⁴ Athletes will appreciate each serving is higher in sodium—17% DV—which can help **restore electrolytes** after sweating in longer or intense workouts.

It's Worth Noting

This protein powder **contains probiotics and digestive enzymes**, which may not be helpful for everyone, especially if you have underlying digestive issues. It is **sweetened with stevia**, but we found that no aftertaste lingers very long compared to some other protein powders.

Product Details:

- **Serving Size:** 1 scoop
- **Sugar per serving:** 0 gram
- **Protein per serving:** 30 grams
- **Fiber per serving:** 1 gram
- **Main Protein Source:** pea, pumpkin seed, sunflower seed, alfalfa
- **Dietary Considerations:** non-GMO

Manitoba Harvest's Hemp Yeah! Max Protein powder is a great option for those who want a boost of both protein and fiber. It has an **impressive 13 grams of fiber per serving**, making it easy to have a high-fiber breakfast or snack when added to smoothies, yogurt, oatmeal, or baked goods. Fiber is a carbohydrate that we cannot digest and gets fermented in our large intestine by gut bacteria. This process produces beneficial compounds like short-chain fatty acids that **help reduce inflammation** and give gut bacteria the energy they need to survive.¹⁵

On top of the high fiber amount, this pick is also a **great way to get more minerals** in your diet. Each serving provides 30% of your daily needs (DV) of iron, 40% DV magnesium, 25% DV zinc, and 80% copper. It also provides lesser amounts of potassium and calcium.

It's Worth Noting

While we love that this powder is high in fiber and minerals, it is on the **lower side for protein**—13 grams per serving. However, if you were to blend it in a smoothie with non-dairy yogurt or nut butter, that could help boost the overall protein amount. Manitoba Harvest also has hemp protein powders that are higher in protein and lower in fiber if you want a more balanced blend between the two nutrients.

In our testing, we did find that this protein powder had a **gritty texture** that was not very visually appealing. It was mostly masked when blended into a smoothie, but it was still more noticeable than some other picks.

When we spoke with Manitoba Harvest, they **reported their products are internally and third-party tested** for levels of heavy metals.

Product Details:

- **Serving Size:** 4 tablespoons
- **Sugar per serving:** 1 gram
- **Protein per serving:** 13 grams
- **Fiber per serving:** 13 grams
- **Main Protein Source:** hemp
- **Dietary Considerations:** non-GMO, organic
- [The 7 Best Shaker Bottles of 2024, Tested and Reviewed](#)

Best Nutrient Boost (Runner-Up)

[Navitas Organics Hemp Powder](#)

Navitas Organic's Hemp protein Powder has only one ingredient: **hemp protein powder**. It's also rich in fiber and iron. It has no sweeteners—including stevia—making it versatile and easy to add to baked goods, oatmeal, smoothies, and more. It's a great option if you want a boost in fiber and protein.

Similar to other simple hemp powders, it is **lower in protein** than other options, with **13 grams per serving**, but it's also a **great source of fiber**, with seven grams per serving. Each serving also provides 35% of your daily needs (DV) of iron and 4% DV calcium.

Navitas Organics' website says this product is third-party tested, but we don't have more detailed information on that testing.

It's Worth Noting

We loved that this hemp powder's earthy flavor was neutralized in a smoothie, and it had a more pleasant texture than other hemp powders we tested. However, it did have a **somewhat earthy aftertaste**.

Product Details:

- **Serving Size:** 4 tablespoons
- **Sugar per serving:** 1 gram
- **Protein per serving:** 13 grams
- **Fiber per serving:** 7 grams
- **Main Protein Source:** hemp
- **Other ingredients:** N/A
- **Dietary Considerations:** organic, non-GMO, gluten-free, kosher

Best with Greens

[Vega Protein & Greens](#)

Sometimes you may want more than a protein boost; you may also be looking for a boost in nutrients from green vegetables. **Vega's Protein and Greens Plant-Based Protein Powder** does just that. It includes a blend of vegetables and other plant foods to provide a **good source of micronutrients like vitamin K, calcium, and iron**. It also provides a small amount (6% of your daily needs) of vitamins A, C, and potassium.

The protein in this powder is from peas, providing all essential amino acids and making this a **complete protein**, and each serving has 20 grams of protein. The [greens in this powder](#) come from **powdered spinach, kale, alfalfa grass, and broccoli**. An added bonus is it has two grams of fiber per serving—7% of your daily needs.

It's Worth Noting

It's important to note these powdered greens **may interfere with some medications**, so you should talk to a healthcare professional before taking this choice if you're on any medication. In particular, Vitamin K can interact with medications like blood thinners, those for lower cholesterol, or controlling seizures.

It does not appear this product is third-party tested, but other products by Vega have been approved by third-party testers. Since it is **sweetened with**

stevia, we found it had a pretty sweet, somewhat artificial aftertaste. But we still liked it when blended as a smoothie.

Product Details:

- **Serving Size:** 1 scoop
- **Sugar per serving:** 1 gram
- **Protein per serving:** 20 grams
- **Fiber per serving:** 2 grams
- **Main Protein Source:** peas
- **Dietary Considerations:** non-GMO, gluten-free

More To Consider

While these protein powders didn't reach our top ratings, they may still be of interest to you.

- **Sunwarrior Warrior Blend:** We noticed this protein powder had a stronger medicinal, chalky aftertaste compared to other powders we tried.
- **Garden of Life SPORT Organic Plant-Based Protein Powder:** We appreciate the higher protein amount and strong third-party testing for this powder, but we found it to have a stronger, more artificially sweet flavor compared to other protein powders we tested.
- **Garden of Life Raw Organic Protein Powder:** We liked the third-party testing for this powder and that it's a good source of minerals. However, we also found this on the sweeter side, and it wasn't as thick when blended up as other choices.

Should I Use Vegan Protein Powder?

Vegan protein powders are generally safe for most people, but the following people may want to warrant caution before using a protein powder and consult a healthcare professional.

- **People with chronic kidney disease.** Protein can tax the kidneys, especially at the high concentrations found in protein powders. If you have chronic kidney disease, you probably need to stay away from

protein powders and speak with a healthcare professional on the safest way for you to consume protein.

- **Those who are minimally active.** If you are pretty sedentary or only engage in moderate intensity physical activity, you probably don't need protein powder to meet your protein needs. Focusing on consuming a well-rounded diet should be adequate to meet your protein needs.
- **Those who eat a variety of food sources of protein.** If you have a well-rounded diet that regularly includes a variety of food sources of protein, you probably won't need protein powder. Plant-based sources of protein include beans, tofu, tempeh, nuts, seeds, soy milk, or pea milk.

Vegan protein powders can be a beneficial addition for those with higher-than-average protein needs or who don't consume enough food sources of protein. They could be especially beneficial for:

- **Plant-based athletes.** Athletes, especially those doing a lot of strength training, have [higher protein needs](#) compared to less active individuals. For vegan athletes who struggle to meet their high protein needs with food or who want a more convenient means of getting protein after workouts, vegan protein powder can help.
- **Older adults.** Loss of muscle mass is a health concern for older adults. As muscle mass declines, it can reduce strength and increase risk of injury in the elderly. One way to combat this is to do a combination of strength exercises and eating enough protein (and total calories). Getting enough protein from foods may be challenging for this age group especially if they have a reduced appetite. Protein powders may be especially helpful to boost protein intake.
- **Pregnant individuals.** Meeting your increased protein needs during pregnancy can be difficult, especially if you have nausea. Before starting a protein powder, always consult a healthcare professional for individual guidance. If a healthcare provider has recommended using a protein powder as part of a well-balanced diet, always choose one that is clearly third-party tested for contaminants and heavy metals.

Our Supplements Testing Process

Our team works hard to be transparent about why we recommend certain supplements; you can read more about our [dietary supplement methodology here](#).

We support supplements that are evidence-based and rooted in science. We value certain product attributes that we find to be associated with the highest quality products. We prioritize products that are third-party tested and certified by one of three independent, third-party certifiers: USP, NSF, or ConsumerLab.com.

It's important to note that the [FDA](#) does not review dietary supplements for safety and effectiveness before they go to market. Our team of experts has created a detailed, science-backed methodology to choose the supplements we recommend and gives more details on what we specifically look for in supplements.

To get our top-rated picks, **we have personally taste-tested more than 60 protein powders, and we continue to test different powders** every quarter. We research the top brands on the market and any new products, looking for different main protein sources and options across a variety of price points. Our staff dietitians carefully look through the ingredients and if a powder is third-party tested. We tasted each protein powder blended with just water and as a smoothie with plant-based milk, banana, and nut butter.

We evaluated these powders based on how they performed on the following attributes.

- **Flavor:** We judged each product on how good it tasted overall. Was it overly sweet, bitter, or artificial-tasting? We also rated each powder on whether it provided an enjoyable taste, if there were any unexpected flavors, or if it was off-putting.
- **Texture:** We noted if the powder was smooth and finely milled and easy to drink or if it was clumpy, grainy, or unpleasant. We also took into account mixability and how long you have to shake the protein powder with liquid before it dissolved enough to be drinkable.
- **Aftertaste:** We considered whether there was an aftertaste after consuming the protein powder and how long it lasted. We also noted whether there was a smell upon opening the protein powder and whether it was consistent with the flavor listed on the packaging. Because taste and smell are linked, we considered whether the smell of the powder impacted taste when consumed.

- **Value:** We looked at a range of price points that could accommodate a variety of budgets. We asked our testers to evaluate the appropriateness of the price point for each product they tested.
- **Nutrition:** Our dietitians reviewed the ingredients and assessed the nutritional profile of each product.
- **Third-Party Testing:** As we mentioned above, we prioritize products that have been successfully third-party tested for heavy metals, banned substances, and other harmful ingredients, purity, potency, and labeling accuracy.

The Experts

We use expert advice at every stage of writing, reporting, and testing the products in this story. Here are the people we consulted for this piece.

- [Blair Persyn](#), MS, RDN, LDN, CNSC, vegan registered dietitian and owner of Bites With Blair, LLC
- Mary Wirtz, MS, RD, CSSD, board-certified sports dietitian and consultant for Mom Loves Best
- [Allison Knott MS, RDN, CSSD](#), board-certified sports dietitian and founder of Anew Well Nutrition, helped us research what to look for in a vegan protein powder and which powders to test.

Ingredients: What To Pay Attention To

It is essential to carefully read the ingredient list and nutrition facts panel of a supplement to know which ingredients and how much of each ingredient is included, relative to the recommended daily value of that ingredient. Please bring the supplement label to a healthcare provider to review the different ingredients contained in the supplement and any potential interactions between these ingredients and other supplements and medications you are taking.

The biggest difference in form between vegan protein powders is the protein source. Common sources are soy, peas, seeds, brown rice, hemp, or a combination of these sources. Soy, pea, and hemp proteins are considered complete proteins because they contain all nine essential amino acids.

Vegan protein powders can also come in raw form, meaning the protein source is as close to its natural state as possible. Beans, nuts, and seeds can also be sprouted which could help ease the way be digest nutrients from these foods.

Flavored protein powders can contain [artificial sweeteners](#) that, in large amounts, may cause gastrointestinal symptoms. Vegan protein powders may also contain adaptogens, digestive enzymes, probiotics, and other herbal-based ingredients that are not as well-researched and may not be safe for some people, especially in large amounts.

How Much Vegan Protein Powder Should I Use?

The Recommended Dietary Allowance for adults is 0.8 grams of protein per kilogram of body weight each day.¹⁶ For a 150-pound individual, this means 55 grams of protein, and for a 200-pound individual, this means 73 grams of protein. However, [your protein needs](#) can vary greatly based on your physical activity level, whether you are pregnant or lactating, or if you have other medical conditions that affect protein needs.

The protein needs of a competitive athlete can be 1.4 to 2 grams per kilogram of body weight—over double that of a sedentary person.¹⁷¹⁸ For this reason, **athletes may benefit more from protein powders** to help make sure they are getting the recommended amount of protein.

While it can be safe to take vegan protein powders daily, we recommend also **consuming a variety of food sources of protein**. Food sources of plant-based protein will contain other important nutrients like vitamins, minerals, phytonutrients, and fiber that protein powders don't have.

While there is no tolerable upper limit (UL) for protein, research has shown that consuming over 2 grams per kilogram long-term could increase the risk for kidney, heart, or digestive problems.¹⁹ Some people who have been told to follow a lower protein diet, like those with kidney disease, can have a lower upper limit for daily protein. Ultimately, **a healthcare professional can help you determine what specific protein amount is best for your health**.

Vegan Protein Powder and Heavy Metals

Vegan and non-vegan protein powders will also **naturally contain some heavy metals** since heavy metals are naturally found in soil.²⁰ So, if you consume many servings of protein powder per day, you could risk getting higher amounts of heavy metals, especially if the powder is not third-party tested for heavy metal amounts. **Keep this in mind, especially if you are pregnant** and considering adding a protein powder to your eating routine. [ConsumerLab.com](https://www.consumerlab.com) has more information on heavy metals found in protein powders that they tested.

Another consideration for how much vegan protein powder is too much is the amount of fiber or other added ingredients in vegan protein powders. Getting a lot of fiber, thickeners, or sweeteners in protein powders could cause some side effects for some people when eaten in high amounts.

Risks of consuming [too much vegan protein powder](#) could include:

- Digestive upset
- Consuming higher levels of heavy metals
- Not getting enough of other important nutrients not in protein powder

Your Questions, Answered

Is a vegan protein powder just as good as whey protein?

Research on some sources of vegan protein is sparse since they are relatively new compared to whey protein. Soy, peas, and hemp are complete proteins like whey, while protein sources like brown rice are not complete proteins like whey protein.

Blair Persyn, MS, RDN, LDN, CNSC, registered dietitian and owner of Bites With Blair, LLC says, “**Pea protein powders can be just as helpful as whey protein in maintaining and building muscle.**”²¹ She also says, “People with [lactose-intolerance](#) can have issues tolerating whey and may benefit from switching to a vegan protein powder.” Wirtz highlights soy protein, saying, “Consuming **soy and whey protein has no significant differences in muscle growth** and strength development. Furthermore, soy is a complete protein and contains all essential amino acids.”

What is the best source of protein in a vegan protein powder?

Persyn says, “My favorite vegan protein powders are pea-based protein powders because they often have a more optimal nutrition breakdown. Look for vegan protein powders that have 120–130 calories and 20–30g protein per scoop. This will ensure that your protein powder is mainly just protein and doesn’t include excess fat or carbohydrates.”

Overall, the best source of vegan protein for you will depend on your unique nutritional needs, taste preferences, and budget.

Editor’s note: This is an edited excerpt from “Mastering the Art of Plant-Based Cooking” by Joe Yonan (Ten Speed Press, 2024).

Of all the eating trends over the last few decades, few have gotten more traction — or press — than the move toward plant-based cooking.

The truth is, vegetarian and vegan diets date back millennia, to the Buddhism and Jainism of the Indian subcontinent and to ancient Greece. And what’s really grown over the last decade or two is not the number of people who label themselves vegan or vegetarian; [that has stayed mostly static at between 1 and 6 percent of the population](#), depending on the survey. What keeps increasing is the number who are eating more plant-based meals. In the same ways that people have long said, “Let’s go get Italian tonight,” now they might sometimes say, “Let’s go to that vegan place.”

In a [2023 AP-NORC survey](#), 4 percent of Americans identified as vegetarian and 3 percent as vegan, while 45 percent said they were eating less meat and 46 percent said they were eating less dairy.

“Vegan” or “vegetarian” is a lifestyle and a commitment, while “plant-based,” “meat-free” or “dairy-free” is ... dinner. Or a product like all those [alt-milks that have taken over grocery dairy aisles](#). So-called [tech meats](#) like the Beyond and Impossible burgers aren’t even targeting vegans and vegetarians; they’re after

the omnivores who, whether it's for their own health or the planet's, have vowed to nudge their diet away from meat, one burger at a time.

Meanwhile, when it comes to modern plant-based cooking, many separate but overlapping iterations make up the whole: There's hippie, [post-punk](#) and [cutting-edge](#). There's comfort, [wellness](#), natural and [whole foods](#), [African diasporic](#), [Middle Eastern](#). And of course there are the original vegetarians and vegans, including [Indian](#), [Chinese](#), [Korean](#), Japanese and other Asian cuisines influenced by Buddhist or other ancient religious traditions, along with precolonial [Central](#) and [South American](#) and Indigenous. In my new book, I bring them together with the aim of helping codify plant-based cooking as not a lifestyle, not a philosophy, but as a cuisine.

Fluffy Vegan Pancakes: some plain, some with bananas and walnut, and some with pumpkin and five-spice. © Tom McCorkle for The Washington Post; food styling by Gina Nistico for The Washington Post

That's because I'm like a lot of readers: interested in the myriad ways to make plant-based meals delicious — vibrant in flavor, interesting in texture, wholesome and nourishing to eat — and perhaps less interested in claiming an identity, as helpful as that can be for those who want to. After all, you don't have to renounce your U.S. citizenship to learn how to make a great Spanish paella, so why would you need to become vegan to learn how to make a [great fried tofu dish](#)?

In my writing and editing work, I've dived into the complexities of regional cuisines in virtually every place I've been — and plenty I haven't. So I know firsthand that a cuisine is defined by its history, its practitioners, often its geography. Since plant-based cooking is practiced all over the world, it has many underpinnings, making it particularly rich and complex. It borrows from cuisines everywhere, but in the same way that American cooking is made up of influences from all the immigrants who have come (or been brought) here, along with Native Americans, plant-based cooking is made up of traditionally vegetable-focused cuisines the world over, along with interpretations that turn meat-focused cuisines more fully toward vegetables.

Sometimes this involves looking back as much as forward. Take Mexican cooking, for example. When I [talked with Eddie Garza](#), author of the 2016 book “¡Salud!,” he explained that the presence of lard, cheese and other animal products

represented the influence of Spain on Mexico. Before colonization, the Mesoamerican diet was primarily grains, legumes and vegetables — all of which remain crucial to Mexican cuisines. Similarly, [Bryant Terry](#), among others, has spoken many times about how modern “soul food” is disconnected from the traditionally agrarian and, yes, plant-based diets of his African ancestors.

The point is, I want to help people learn how to cook better plant-based dishes no matter what their motivation, and for however many meals they desire, from a [special-occasion dinner party](#) to [a weeknight dinner](#) and many possibilities in between. Moreover, these skills are applicable far beyond vegan cooking, as almost all modern meals contain plants in some way or another.

Vegan Buttermilk.© Tom McCorkle for The Washington Post; food styling by Gina Nistico for The Washington Post

Can plant-based cooking be defined by something other than what it’s missing? It’s a difficult question to answer, and one that I’ve seen many people struggle with. I always bristle at the idea that something vegan or vegetarian is so good, “you won’t miss the meat.” The meat shouldn’t have anything to do with it; a pasta dish with [a mushroom Bolognese](#) is good because [mushrooms themselves are so good](#), especially when layered with aromatic vegetables and concentrated tomatoes. Plant-based foods deserve accolades because of their own outstanding qualities; love them for what they are, not for what they’re not.

Still, because animal products are so ingrained in our food culture, plant-based cooking can’t fully escape references to them; that’s why I’ve long promoted (and developed) recipes for plant-based cheeses, milks, butter, creamy sauces and burgers, and for dishes whose traditional version includes meat or another animal product.

Both recipes I’m sharing today — [Vegan Buttermilk](#) and [Fluffy Vegan Pancakes](#) — exemplify my approach in different ways.

In my recipes, I sometimes call for store-bought versions of animal-free products, especially the butters and [milks](#), out of a sense of convenience and appreciation for the top quality of some of my favorite brands. But even though this is becoming less and less true, at times no such version exists, and that’s where DIY approaches such as the buttermilk can come in handy.

You start the process the way you start so many homemade dairy-free milks, butters and cheeses: by pureeing nuts (in this case cashews) and water.

Nuts and seeds are staples in the plant-based kitchen. They're nutritional powerhouses that bring a welcome, crunchy finishing touch to any salad, grain bowl or so much more. But once you soak, blend and strain, virtually any raw nut or seed can transform into a nondairy milk. They can also turn into beautiful spreadable butters and positively indulgent plant-based ice cream. I prefer to have unroasted, unsalted nuts on hand because they last longer in the freezer. Plus, they taste so fresh [when I toast them](#) for a recipe or leave them raw to make a milk.

Plant-based milks, from left: rice milk, oat milk, soy milk, coconut milk, hemp milk and almond milk.© Rey Lopez for The Washington Post; Food styling by Lisa Cherkasky for The Washington Post

Perhaps the most versatile nut is the cashew (botanically the seed of a type of drupe fruit), whose fat content and texture help it blend into a wonderfully creamy, rich sauce that can play different parts on the skim-milk-to-heavy-cream continuum depending on the proportion of water to nut. For this buttermilk, the amount of water is quite minimal, and to add even more flavor and texture, you include coconut milk, one of my other hero ingredients.

In some ways, coconut, the fruit of the coconut palm, is an entire food production system of its own. What we eat is considered the endosperm, which is thin and milky when the coconut is unripe (coconut water) and hardens into the white "meat" as the fruit matures. The meat can be flaked and dried, or combined with water and turned into milk or cream — and sold in cans. The popular oil can be made from coconut milk or meat.

Along with cashew milk, coconut milk is perhaps the most common, useful and delicious plant-based substitute for dairy milk, and in its canned form is incredibly convenient.

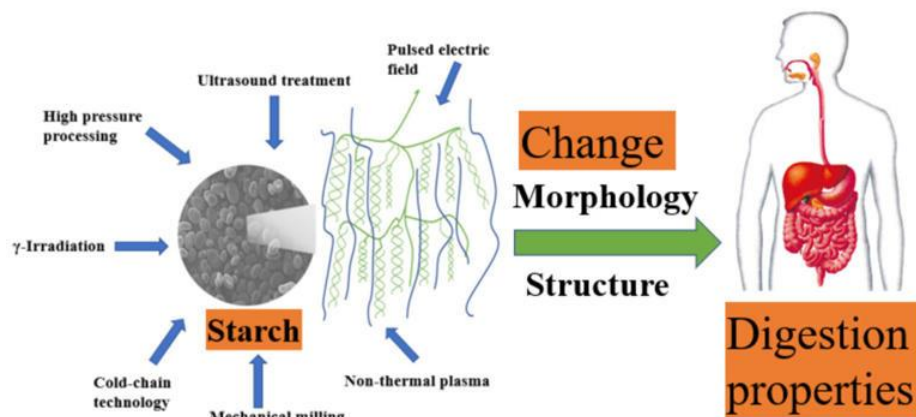
How do you get the tang of buttermilk into [this cashew-coconut concoction](#)? All it takes is a single probiotic capsule and some patience. Once you stir its contents into the blend, you cover the container with cheesecloth and give it a couple of days for the probiotics to work their fermentation magic.

The [pancakes](#) demonstrate one of my favorite secrets about creating plant-based versions of traditional dishes: Sometimes you don't need to do all that much to make them great without animal products. Pancakes traditionally include eggs, but when you think about the eggs' functions — structure, richness and lift — you realize that the latter two are easily accomplished by other ingredients. The buttermilk gives you the welcome fat, and baking powder and/or soda are all the leavening pancakes need, especially if you goose their lifting power with a little acidity from the buttermilk and/or a dash of vinegar.

When it comes to pancakes, structure isn't an issue: You want them fluffy and light, and these deliver. As with many other pancake recipes, this one has you mix the batter just until it comes together, leaving any lumps intact, so you don't develop too much gluten and make them tough.

With the buttermilk in your fridge, you can make the pancakes in a snap, keeping them basic or adding various fruits, nuts and other ingredients to jazz them up in whatever way you like. You can also use the buttermilk to make vegan cornbread, biscuits and any other cake or quick bread that would benefit from its combination of richness and tanginess.

Must you decide that from here on out, buttermilk made from cashews and coconut milk is the only version you'll ever use? Must you commit to making only vegan pancakes the rest of your life? Of course not. But once you learn strategies like these, you've added more than two recipes to your repertoire: No matter why you might want to, you've started building the knowledge you need to put delicious plant-based cooking within your reach.



Graphical abstract. Credit: Grain & Oil Science and Technology (2024). DOI: 10.1016/j.gaost.2024.05.002

Starch is a vital component of the human diet, serving as a primary energy source. However, high-glycemic starches are linked to the increasing prevalence of chronic diseases like obesity and diabetes. Traditional starch modification methods, such as chemical and enzymatic treatments, present environmental and economic drawbacks.

In contrast, non-thermal processing techniques—like ultrasound and high-pressure processing—have emerged as efficient, safer alternatives. Given these challenges, there is a pressing need to explore the effects of non-thermal methods on starch digestibility to promote healthier food solutions.

Conducted by a team from Nanchang University and University College Dublin, a review [published](#) in *Grain & Oil Science and Technology* examines the impact of non-thermal processing techniques, including ultrasound, high-pressure treatment, and γ -irradiation, on starch digestibility.

The results show that these methods significantly improve the digestion properties of starch, lowering blood glucose levels and offering a healthier dietary alternative to combat chronic diseases. This innovative approach underscores the transformative potential of non-thermal techniques in food processing and public health.

The review provides an in-depth review of non-thermal techniques that enhance starch digestion by modifying its structure. For instance, ultrasound disrupts

starch granules, forming new crystalline structures that resist enzymatic breakdown, thus lowering the glycemic index.

High-pressure processing (HPP) alters starch's molecular composition, increasing its resistance to enzymes, while γ -irradiation changes its crystallinity, making it less digestible and reducing post-meal glucose spikes. The research highlights non-thermal processing techniques (NTPT's) distinct benefits, including safety, environmental sustainability, and superior efficiency compared to traditional thermal and chemical methods.

These non-thermal approaches effectively increase resistant starch and reduce rapidly digestible starch, making them crucial for managing chronic metabolic conditions. By targeting various structural levels of starch—from granules to lamellar layers—NTPT offers a promising pathway to tailor starch digestibility for health benefits.

Dr. Jianhua Xie, a leading researcher from Nanchang University, noted, "Our findings reveal the significant impact of non-thermal processing techniques on food science. By adjusting starch digestion properties using environmentally friendly methods, we can greatly influence public health. This sustainable alternative to traditional techniques helps reduce the risk of chronic diseases linked to high-glycemic diets. We are confident that our research paves the way for developing starch-based foods that are not only healthier but also more sustainable and safe."

The findings have significant implications for the food industry, especially in the development of healthier starch products. By leveraging NTPT to modulate starch digestibility, manufacturers can create foods that better control blood glucose levels, benefiting those with or at risk of diabetes.

Additionally, these non-thermal techniques align with the growing demand for sustainable, clean-label food processing, offering an eco-friendly approach that preserves nutritional quality. The study sets the stage for scaling NTPT in industrial food production, potentially reshaping dietary health on a broader scale.

More information: Liyuan Rong et al, Modulation of starch digestibility using non-thermal processing techniques: A review, *Grain & Oil Science and Technology* (2024). [DOI: 10.1016/j.gaost.2024.05.002](https://doi.org/10.1016/j.gaost.2024.05.002)



Broccoli contains sulforaphane, which has been linked to reduced inflammation and improved brain health.© Provided by HuffPost

Most people know [which foods to avoid for a healthy heart](#). Yet, do you often think about the foods you eat and how they affect the brain?

It's been scientifically proven that diet can influence brain health. "The brain represents about 2% of our body weight, but it consumes about 20% of all of our calories," said [Dr. Robert Melillo](#), a brain researcher, clinician, autism expert, and founder of The Melillo Center in Long Island, New York. "The brain uses more calories than any other organ in our body; what we eat can have a big impact on our brain."

Diet and nutrition are essential to keep the brain healthy. "Proper nutrition is the foundation upon which our mental acuity and vitality rest," said [Dr. Brett Osborn](#), a board-certified neurosurgeon and the chief of neurosurgery at St. Mary's Medical Center in Jupiter, Florida. "Just as we care for our bodies through exercise and a balanced diet, nurturing our brains through the right foods is essential for a vibrant and youthful mind."

Although scientists still don't know what causes Alzheimer's disease, a type of dementia, many think diet and environmental factors play a role. One study in the journal [Neurology](#), published in November 2022, showed that increasing foods high in flavonoids showed it [lowered the chances of developing dementia](#).

"The two major groups of factors driving Alzheimer's are reduced energetics — blood flow, oxygen saturation, mitochondrial function and ketones — and increased inflammation from various pathogens, toxins and metabolic disease," explained [Dr. Dale Bredeesen](#), a neuroscience researcher and neurodegenerative disease expert. "Diet and environmental factors impact both energetics and inflammation, by multiple mechanisms, and therefore play key roles in both Alzheimer's and treating cognitive decline."

According to Dr. Philip Gold, the chief of neuroendocrine research and senior investigator at the National Institute of Mental Health, "The key positive environmental influences include exercise, which is extremely important, level of education, and cognitive 'exercise' throughout life." Getting sufficient sleep is also key. "Adequate sleep is also critical because, in part, it is during sleep that the brain repairs itself," he said.

Regularly eating foods that are not good for you can have negative consequences on both the body and the brain. "An unhealthy diet may negatively impact gut microbiota, leading to inflammation and potentially influencing the brain," Osborn said. "Obese people — most of whom have an unhealthy gut microbiome — are at a marked risk for the development of Alzheimer's dementia," he added.

So which foods are the most beneficial for brain health? The experts break it down below.



Good news for fans of avocado toast (and eggs!).© Provided by HuffPost

Avocado

Love eating guacamole, mashing avocado on toast or dicing it into a salad or rice bowl? Avocados have healthy monounsaturated fats, and according to Bredesen, "These help to reduce vascular disease, and provide excellent energy for the brain, without the problems associated with simple carbs or saturated fats."

Broccoli

Whether you like broccoli steamed with melted cheese on top, in stir-fries or as a veggie you sneak into your smoothie, you may want to find more ways to enjoy this crunchy vegetable.

"Broccoli is a cruciferous vegetable that contains compounds like sulforaphane, which have been linked to reduced inflammation and improved brain health," Osborn said. A 2019 study published in the journal [Brain Circulation](#) shows sulforaphane is an important antioxidant, and has anti-inflammatory properties that shows potential to protect the nervous system and reduce the burden of pervasive diseases on the body.

Blueberries

If you like to add blueberries to your morning bowl of yogurt, your brain will thank you. "Blueberries contain flavonoids, which are neuroprotective and have been shown to increase neuroplasticity and cerebral blood flow," said [Lynn A. Schaefer](#), Ph.D, a board-certified clinical neuropsychologist in Long Island. A randomized, double-blind placebo-controlled study published in [Nutritional Neuroscience](#) in 2022 showed older adults who consumed wild blueberries had an increase in processing speed, suggesting blueberries may slow down cognitive decline.

And these small berries are full of antioxidants, including anthocyanins. Osborn says anthocyanins can "help protect the brain from oxidative stress and inflammation." He eats blueberries daily, either in a smoothie or on top of a salad.

Eggs

Eggs are known for being a good protein option, especially for those who are vegetarian or follow a plant-based diet. And there's another reason to celebrate eggs: the yolk contains choline. Choline is an essential nutrient and important to produce acetylcholine.

"Acetylcholine is a neurotransmitter that is very important for the parasympathetic nervous system, and important for memory," Melillo explained. Choline is found in different foods, but the highest concentration is in egg yolks. According to Gold, "Critical to normal cognition, acetylcholine neurotransmission is pronouncedly decreased in Alzheimer's disease."



Salmon is a fatty fish that's high in omega-3 fatty acids.© Provided by HuffPost

Fatty fish

Salmon, sardines and mackerel are examples of fatty fish that contain omega-3 fatty acid. "These essential fats are crucial for maintaining brain health and have been linked to improved memory, mood regulation, and reduced risk of cognitive decline," Osborn said. Omega-3 fatty acids are also important for creating new nerve cells and protecting brain cells from damage, according to Gold.

Leafy greens

Doctors and nutritionists encourage patients to eat more leafy greens because they are packed with nutrients. "Leafy greens such as spinach and kale are packed with vitamins, minerals and antioxidants," Osborn said. "They promote healthy brain function by reducing inflammation and improving cognitive performance." Magnesium is an important mineral in leafy greens — Melillo says it helps relax the body, lowering blood pressure and the effects of stress.

Tuna

Tuna is a low-fat fish and contains the amino acid tyrosine, an important component for producing neurotransmitters in the brain. "Tyrosine is used for making dopamine and norepinephrine, two of the main neurotransmitters in the brain," Melillo explained. "Dopamine is more of a left brain neurotransmitter and norepinephrine is more of a right brain neurotransmitter." Tuna also contains high concentrations of creatine. "Creatine facilitates the entry of water into brain and muscle cells to prevent their dehydration," Gold said.

Turmeric

Spices provide plenty of flavor and as a bonus can have important compounds that the body needs. Turmeric is a common ingredient that is grated or chopped fresh, or used as a powder in curries. "Turmeric, which contains curcumin, is remarkable in that it has anti-inflammatory effects, and also binds to both the amyloid and tau associated with Alzheimer's disease, so it has multiple mechanisms to support brain health," Bredesen said.

A study published in the journal [Molecules](#) in February 2023 showed curcumin to be antimicrobial and neuroprotective in a variety of neurodegenerative diseases, including Alzheimer's disease.

Ginger

Another spice used in both fresh and powdered form is ginger. "Ginger is a potent anti-inflammatory agent that has been shown to enhance cognitive function," Osborn said. "The antioxidant effects are also thought to protect neurons against oxidative stress that underpin neurodegenerative diseases, such as Parkinson's and Alzheimer's disease."

Ginkgo biloba

Ginkgo biloba is known to enhance memory and cognitive function. "It is believed to improve blood flow to the brain and protect brain cells from oxidative damage," Dr. Osborn. "Some research supports its potential benefits in age-related cognitive decline."

Fermented foods

Fermented foods, such as kimchi, kefir, kombucha, sauerkraut and yogurt may also be beneficial for the brain. "[Research](#) has established that the brain and gut communicate through the nervous system as well as through the immune system," Schaefer said. "Therefore, changing the bacteria in the gut with probiotics and prebiotics, and not overdoing antibiotics, may play a role in improving brain functioning."

According to Osborn, "Foods that cultivate a healthy microbiome will likely serve as 'medicines' to remedy or slow the onset of all age-related diseases, including those affecting the brain."

There are different ways to lose weight, and boosting your metabolism is among the most efficient as it allows you to achieve that calorie deficit quickly.

So, if you're considering adding a metabolism booster to your routine, we've helped you narrow down the top 6 brands this year, starting with the #1 pick on our list, [PhenGold](#). Keep reading to learn more about each option and why it may suit your needs.

Best Metabolism Booster Supplements in 2024

1. [PhenGold](#) - Best overall metabolism booster
2. [PrimeShred](#) - Best metabolism booster for men

3. [Trimtone](#) - Best metabolism booster for women
4. [PhenQ](#) - Multi-pronged metabolism booster
5. [Instant Knockout](#) - Best for athletes and bodybuilders
6. [Zotrim](#) - Best for natural fat-burning

We analyzed the best metabolism booster supplements this year, ultimately selecting PhenGold as our number one choice. We also included an in-depth analysis of their outstanding features, ingredient profiles, safety, and effectiveness. We've also reviewed 5 other metabolism boosters giving PhenGold a run for their money.

1. PhenGold - Overall Best Metabolism Booster

Pros

- May enhance energy and focus
- Green tea and L-theanine promote weight loss and cognitive benefits
- Cayenne boosts thermogenesis
- Suitable for vegans and vegetarians
- 100-day money-back guarantee

Cons

- Not for people sensitive to caffeine

Who Is PhenGold Best For?

[PhenGold](#) is the best metabolism booster if you are looking for a supplement that also enhances energy boost. It's also helpful for those who struggle to maintain their diet, as it promotes focus. This may help you stick to your weight loss routine.

Ingredients

- **500 mg Green Tea:** Known to boost metabolism and increase fat burning [1].
- **250 mg L-Theanine:** An amino acid that may promote relaxation without drowsiness, reducing stress and improving focus [2].
- **250 mg Rhodiola Rosea:** Known for its potential to enhance exercise performance and reduce mental fatigue [3].

User Reviews

One user shared that after buying PhenGold directly from the website, they felt it was the best investment ever, especially after other diets like keto didn't work for them. They love that just 3 pills in the morning curb their appetite before breakfast, and they believe the glowing reviews are well-deserved [4]. Conversely, another user mentioned having a slight energy boost but was disappointed after gaining 4 pounds, feeling like the supplement wasn't helping at all [5].

2. PrimeShred - Best Metabolism Booster for Men

Pros

- Specifically formulated for men
- May promote fat loss and enhance mental focus
- Contains no harmful additives or fillers
- Green tea extract may help boost metabolism

Cons

- Charges \$15 for returns

Who Is PrimeShred Best For?

If you're a man looking for a comprehensive approach to weight loss, PrimeShred is the right option. It is one of the best metabolism-boosting supplements for losing fat while maintaining lean muscle mass.

Ingredients

- **500 mg Green Tea Extract:** Known for its fat-burning properties and ability to boost metabolism [1].
- **300 mg L-Tyrosine:** Enhances focus and alertness, particularly during workouts [6].
- **250 mg Rhodiola Rosea Root:** Helps the body handle stress and boosts energy levels [3].

User Reviews

One user on the official PrimeShred page shared that the supplement has been of great help in boosting energy, curbing appetite, and supporting their weight loss journey. They noted that the appetite suppressant effect made them feel full, which helped them eat less [7]. On the flip side, another user on Amazon wished the formula was condensed into just one pill instead of three and mentioned that they didn't experience any appetite suppression at all [8].

3. Trimtone - Best Metabolism Booster for Women

Pros

- Requires only 1 capsule per day
- Naturally helps you burn more calories
- May help curb cravings

- Suitable for vegans and vegetarians
- Ideal for women

Cons

- Not for those who are caffeine-sensitive

Who Is Trimtone Best For?

Trimtone is for those who hate taking many capsules, as it only needs 1 pill a day to work. It's also suitable for vegans and vegetarians. It's also formulated with caffeine (120 mg; over 1 cup), but just enough to wake you up and not give you that jittery feeling.

Ingredients

- **100 mg Green Tea:** One of the best fat burners on the market, thanks to its antioxidants [1].
- **40 mg Grains of Paradise:** A herb from the ginger family that can help regulate blood sugar levels and prevent cravings [9].
- **100 mg Glucomannan:** A dietary fiber that may help control appetite [10].

User Reviews

A user on the official Trimtone page shared that as a busy mom of a 2-year-old, Trimtone has been a perfect match for their hectic life, and they'd recommend it to anyone looking for a wellness boost [11]. However, another user on Amazon had mixed feelings—they appreciated the appetite-suppressing effects of the supplement and better meal control, but they felt jittery and nervous after taking the recommended dose for about 2 weeks [12].

4. PhenQ - Multi-Pronged Metabolism Booster

Pros

- Designed to tackle weight loss from multiple angles
- 1 convenient pill for various benefits
- Ideal for vegans and vegetarians
- 60-day money-back guarantee

Cons

- Available on the official website only

Who Is PhenQ Best For?

PhenQ attacks weight loss from multiple angles. It is one of the [best weight management pills](#) for consumers who need more than one way to shed pounds from a single formula.

Ingredients

- **25 mg a-Lacys Reset:** Clinically proven to aid in weight loss and body recomposition [13].
- **50 mg Capsimax Powder:** Capsimax powder is a mix of capsicum, piperine, caffeine, and niacin (vitamin B3) that can help burn fat [14].
- **80 mcg Chromium Picolinate:** May support healthy blood sugar levels and reduce cravings [15].

User Reviews

A user on the official PhenQ page shared their excitement about dropping 3 dress sizes in 12 weeks, calling it the happiest they've been in years [16]. On the flip side, another user on Trustpilot wasn't as thrilled—they took PhenQ twice a day for several months but ultimately felt it didn't make any difference to their appetite or cravings [17].

5. Instant Knockout - Best for Athletes and Bodybuilders

Pros

- Formulated for athletes and bodybuilders
- Many users have reported reduced cravings
- Green tea extract and caffeine may help boost energy
- Vegan friendly

Cons

- Includes lots of caffeine

Who Is Instant Knockout Best For?

If you're looking for top metabolism-boosting supplements to support your intense workout routines and help manage your diet, Instant Knockout is your best option. It's also the best metabolism booster if you're looking for a formula that gets you up and awake in 1 serving, thanks to its 300 mg caffeine content (over 3 cups of coffee).

Ingredients

- **500 mg Green Tea Extract:** Known for its fat-burning properties and ability to boost metabolism [1].
- **100 mg Cayenne Pepper Seeds:** Boosts metabolism and helps burn calories [18].
- **1800 mg Glucomannan:** Can help reduce cravings by making you feel full for longer [10].

User Reviews

One user on Trustpilot praised Instant Knockout, saying it's a good product with even better customer service, and they're planning on buying it again [19]. However, another user on the same platform had a completely different experience, feeling that it did nothing for them and was too expensive [20].

6. Zotrim - Best for Natural Fat-Burning

Pros

- Contains potent appetite-suppressing ingredients
- May provide a natural energy boost
- Suitable for those following a vegan or vegetarian diet
- Ideal for both men and women

Cons

- Requires multiple doses

Who Is Zotrim Best For?

Zotrim is an excellent choice for individuals who [struggle with portion control or frequent snacking](#). It's also suitable for vegans and vegetarians. It's also best if you want a more focused formula instead of a brand trying to do everything simultaneously.

Ingredients

- **112 mg Yerba Mate Leaf Extract:** Known to reduce hunger and fatigue, it has been linked to increased energy expenditure [21].
- **95 mg Guarana Seed Extract:** A natural source of caffeine, it helps boost energy levels [22].

- **36 mg Damiana Leaf Extract:** Traditionally used for mood enhancement [23].

User Reviews

A user on the official Zotrim page shared that they've always struggled with weight loss due to their love for snacking, but Zotrim helped them kick those cravings to the curb, making those extra pounds melt away [24]. On the other hand, another user on Amazon didn't have the same success, simply stating that it didn't work well for them [25].

What Is Metabolism?

Metabolism is the process by which our bodies **convert food into energy and building blocks for growth and repair**. It's a set of life-sustaining chemical reactions that occur in our bodies and involves processes that break down nutrients to produce energy (catabolism) and processes that use energy to build complex molecules (anabolism).

How Does Metabolism Impact Weight Loss?

Your metabolism can influence your weight in the following ways:

- **Basal Metabolic Rate (BMR).** This is the number of calories your body needs to perform essential functions like breathing and circulation. People with a higher BMR burn more calories at rest and are likely to lose weight more quickly.
- **Thermogenesis:** This is the process of heat production in organisms. It includes energy burned during physical activity and the energy used to process food, also known as the thermic effect of food.

- **Hormonal Factors:** Hormones regulate your metabolism. Imbalances can affect how efficiently your body burns calories and stores fat, impacting weight loss.
- **Muscle Mass:** Muscle tissue burns more calories even when resting. So, the more muscle mass you have, the more calories you burn throughout the day, helping with weight loss.

How Do Metabolism Boosters Work?

The best natural metabolism boosters are designed to [enhance the body's metabolic rate](#), leading to **increased calorie burning, elevated energy levels, and appetite suppression**. They often contain a combination of natural ingredients that produce these effects. Let's explore how natural metabolism boosters work to achieve these benefits:

Burning Fat

The best supplements for boosting metabolism often contain green tea extract or caffeine that stimulates the body's fat-burning processes. They increase the rate at which your body burns calories, even at rest, leading to more fat loss.

Increasing Energy

Many metabolism supplements contain stimulants that increase energy levels. This helps you feel more active and alert and helps you exercise more effectively, further contributing to weight loss.

Suppressing Appetite

Some metabolism boosters work by suppressing appetite. They make you feel fuller for longer, reducing your food intake. This helps create a calorie deficit, which is essential for weight loss.

Common Ingredients of Metabolism Boosters

Here's the low down on some of the most common ingredients in the best metabolism booster pills for weight loss.

Caffeine

Caffeine is a stimulant that can increase your metabolic rate, helping your body burn more calories. It also boosts energy, **enhancing physical performance during exercise** [26].

Capsaicin

Capsaicin, found in chili peppers, can boost your metabolism by increasing the body's heat, leading to more calories burned. It may also help suppress appetite [18].

L-Carnitine (Amino Acid)

L-carnitine is an amino acid that helps transport fatty acids into cells to be burned for energy. This can improve exercise performance and increase fat burning [27].

Chromium Picolinate

Chromium Picolinate is a mineral that may enhance the action of insulin, helping your body regulate blood sugar levels. It may also help you eat less. [15]

Green Tea

Green tea is an excellent choice among the best metabolism booster ingredients. It contains catechins, antioxidants that speed up your metabolism and help you burn more fat, primarily when you work out. It also has a little caffeine, which makes it even more effective [1].

Vitamins B and D, Plus Other Minerals

Metabolism-boosting vitamins like the B-complex can help your body [turn food into fuel and torch unwanted fat](#). Vitamin D also allows you to shed pounds by aiding in the absorption of other vital nutrients. And let's not forget those superstar minerals like zinc, magnesium, selenium, and iodine! They keep your thyroid running smoothly, which is the master controller of your metabolism.

Lifestyle Changes That Boost Your Metabolism Naturally

Your metabolism is like the engine that keeps your body running smoothly, significantly managing your weight and overall health. Luckily, there are plenty of simple lifestyle tweaks you can make to give it a boost naturally. Here are a few tips to help you burn calories more efficiently and feel more energized:

Drink Lots of Water

Staying hydrated is critical to a speedy metabolism. In fact, cold drinks or water can be especially effective—your body burns extra calories just by warming itself up to its internal temperature.

Consume More Protein

Eating protein-packed meals or sipping on a [good protein shake](#) can boost your metabolism for a few hours. It's all thanks to the thermic effect of food, where your body burns more calories just digesting your meal. Plus, protein is among the foods that help you feel full the fastest, so you're less likely to snack throughout the day.

Eat Spicy Foods

Some of the best metabolism booster foods, like those packed with capsaicin, have a kick. They can give your metabolism a little nudge and help you burn more fat. But it's not a miracle solution; the effects might be minor and don't last long.

Do HIIT Exercises

HIIT is like a turbocharged workout. Short bursts of all-out effort followed by quick recovery periods. It's a fantastic way to torch a ton of calories in a short amount of time, and the best part is that your metabolism stays revved up for hours afterward, like an afterburner on a jet engine [28].

Avoid Sitting for Too Long

Staying glued to your chair for too long can pack on the pounds and cause health problems. So, make it a point to stand up or take a stroll. You can even

start with some light activities whenever you get a break. It'll keep your metabolism humming and your body feeling good.

Stick to a Sleep Schedule

Believe it or not, skimping on sleep can complicate your metabolism and make losing weight challenging. **Aim for a solid 7-9 hours of quality sleep each night**, and keep a consistent sleep schedule. Your body will thank you for it by running more efficiently and helping you achieve your desired weight quickly.

Best Metabolism Booster FAQs

Finding metabolism supplements overwhelming? Check out our short answers to common questions about metabolism-boosting supplements and learn more.

What Is the Best Supplement to Boost Metabolism?

Based on our review, PhenGold is our number-one pick for the best metabolism booster. But the best one for you will depend on what you need. Zotrim is the best option if you struggle with cravings, while Instant Knockout is suitable for athletes, bodybuilders, or anyone serious about exercise performance. But if you need supplements to increase metabolism after 40, try PhenQ.

Do Metabolism Boosters Actually Work?

Some ingredients in these supplements, like green tea extract or caffeine, **might give your metabolism a slight nudge**. But don't expect miracles. If you're serious about boosting your metabolism, focus on combining supplements with the tried-and-true methods: regular exercise, a balanced diet packed with

vegetables and fruits, and quality sleep. These lifestyle changes have a much more significant and longer-lasting impact than taking only the pill.

How Can I Speed Up My Metabolism?

Get moving with regular exercise, pump some iron with strength training, drink plenty of water, and nosh on metabolism-boosting foods, such as protein-packed options. And don't forget to get enough sleep—a well-rested body is a happy, efficient one. It's all about creating a symphony of the healthiest habits; those fast metabolism boosters will sing along in no time.

Are Metabolism Booster Pills Approved by the FDA?

Most metabolism booster pills fall into the "dietary supplement" category, not "drug," meaning they don't need the FDA's green light before they land on store shelves. However, the FDA can intervene if these pills prove unsafe or make misleading claims.

What Is the Best Metabolism Booster for Women?

While there's no single "best" metabolism booster for women, look for options with ingredients like **B vitamins, iron, and green tea extract**. And if you're curious about what foods speed up female metabolism, remember that women, particularly those of reproductive age, often have higher iron needs due to menstruation, making iron-rich foods especially crucial.

Final Thoughts on Metabolism Boosters

If you're wondering how to boost metabolism naturally, supplements like [PhenGold](#) are formulated to help your body use more energy all day to help

maintain a caloric deficit for effective weight loss. Some of them even include stimulants to help support your exercise performance.

But they work best as part of a rounded routine, which should include regular exercise and a balanced diet, including foods that increase metabolism and burn fat. Also, consult your doctor before adding any new supplement to your routine.

[>>Get the best deal on PhenGold](#)

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