Good Food Institute

The nutritional profile of plant-based meat:

Strengths and opportunities

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Introduction

The purpose of this white paper is to provide an overview of the nutritional profile of plant-based meat as a category, including areas of strength and opportunities for improvement, relative to conventional meat products. As plant-based meat products vary globally, this white paper focuses on the U.S. market. Unless noted otherwise, conclusions are based on products in the U.S. market and U.S.-focused research.

This paper provides insights that can inform product development and reformulation, consumer communications, and research initiatives. Key audiences include plant-based meat industry executives, policymakers, researchers, consumer representatives, public health and health care experts, and business leaders in related industries.

What is plant-based meat?

The term "plant-based meat" refers to products made from plants that are analogs to conventional animal-based meat products. Plant-based meat includes plant-based beef, pork, poultry, and seafood products. Although alternatives to meat, such as tofu and tempeh, have existed for centuries, plant-based meat products, as defined for this white paper, are those designed to replicate, or biomimic, conventional meat and deliver the experience of eating meat.[1] While some plant-based meat products contain egg or dairy, the focus of this white paper is on products that are 100% plant-based (which are the majority).

Broadly, plant-based meat production involves growing crops for raw materials, processing those crops into ingredients, and using those ingredients to develop foods that deliver the sensory experience of conventional meat. Conventional meat production generally involves crop cultivation, animal feed production, animal husbandry, slaughter, and processing. The type and number of steps involved in both conventional and plant-based meat production vary depending on the production method and formulation.

Plant-based meat market

The United States and Europe have the largest plant-based meat markets in the world. In 2024, the U.S. retail plant-based meat market was valued at $1.2 billion, according to SPINS, nearly double its $682 million valuation in 2017.[2] This growth was largely driven by product innovation and expanded distribution of products that appeal to mainstream consumers by mimicking the taste, texture, and functionality of conventional animal products, produced by a range of companies, from startups to large food manufacturers.[2] The plant-based meat market represents about 1% of total meat, poultry, and seafood sales in U.S. retail.[2] The European retail plant-based meat market was estimated at $3.3 billion in 2024, according to Euromonitor.[2]

Despite large initial growth, in more recent years, U.S. sales of plant-based meat products have declined. While sales have been more resilient in Europe, there have been declines in some European markets and slight growth in others.[3, 4] Between 2022 and 2024, U.S. dollar sales declined 18% and unit sales declined 28%, according to SPINS.[2] In 2024, 13% of households purchased plant-based meat, down from approximately 19% in 2022.[2] The decline in sales during that time appears to be due to consumers leaving the category, as repeat purchases stayed relatively constant.[2] Surveys of lapsed consumers show that price, taste, and texture were among the top factors, but health concerns played a role for some.[5]

Consumer perceptions

Plant-based meat largely appeals to meat-eating consumers. Approximately 86% of plant-based meat consumers describe themselves as either "omnivores" or "carnivores," who eat meat regularly, or "flexitarians," who eat meat but strive to reduce their intake.[5] Plant-based meat is often consumed in place of conventional meat products (e.g., a plant-based burger in place of a beef burger). For those looking to reduce their meat consumption, health is a key motivating factor.[6]

A 2024 GFI study found that among consumers open to consuming plant-based meat and/or dairy, being "good for my health" was the most common benefit sought from meat or proteins. Almost half (43%) said "healthy" is a top attribute they associate with plant-based meat. Many also associate plant-based meat with specific health attributes, such as being "nutritious," "high-protein," or "low-fat."[6]

Importantly, there are still gaps to close around the core needs of taste and price before health can motivate choice for many consumers. Only 15% of consumers associate plant-based meat with being "affordable," and only 21% associate it with being "tasty."[6] While taste and price improvements most impact consumer purchase intent, the *US Plant-based Proteins Market Report 2023* stated that 27% of plant-based meat buyers said they would buy more if the nutritional content matched conventional meat, and 25% said they would buy more if it was "less processed."[7]

Consumer research findings indicate a need for increased consumer education on plant-based meat. A December 2023 consumer survey found that a majority of consumers had heard little or nothing about plant-based meat in the previous year, and only about one in five consumers said they understood "very well" what is in plant-based meat.[8] These gaps in awareness and understanding, combined with an interest in healthier protein foods, present opportunities for increased consumer education and engagement on the health benefits of plant-based meat.

The nutritional profile of plant-based meat: Overarching considerations

Consumers seek a range of benefits from healthy and nutritious foods. According to the *US Food & Drink Nutrition Claims Report 2024*, top benefits sought include digestive health, energy, heart health, and weight management.[9] Some consumers have a particular interest in levels of specific nutrients, such as protein, sugar, fat, sodium, or fiber.[9] Others care about processing or specific ingredients or vitamins. Delivering some of these key attributes or benefits can motivate consumers to choose plant-based meat.[9]

Eating more whole, plant-based foods holds a bevy of benefits. However, for the billions who enjoy meat, or for those looking for an easy, high-protein plant-based option, plant-based meat can be a nutritious and accessible alternative.

Table 1: Nutritional comparison of plant-based and conventional burgers* [10]

	Plant-based burgers	Conventional burgers
Lower calorie density	✓	
Lower saturated fat	✓	
Lower dietary cholesterol	✓	
Lower sodium+		✓ or =
Greater dietary fiber	✓	
Lower added sugar	=	=
Greater protein	=	=
Greater iron	✓	

* Based on standardized product weight (e.g., per 100 g) of the products. Comparison of products as packaged prior to preparation.

+ Sodium is often added to conventional burgers during preparation and cooking. Research comparing diets high in plant-based meat with diets high in conventional meat finds no significant difference in total sodium intake.[11]

When considering the nutritional quality of plant-based meat products, it is important to compare them to conventional meat products. Plant-based meat is intended to be eaten as a substitute for conventional meat, rather than replacing other plant-based protein foods, such as beans or lentils.

With respect to nutrient content, there is considerable variation in the nutritional composition of plant-based meat products, as is the case with conventional meat products. This variation exists across product categories (e.g., burgers, chicken, sausages) and across brands and products within a single category.

Overall, both conventional and plant-based meats are good sources of protein and iron. Plant-based meat has no dietary cholesterol, and some varieties are low in saturated fat, which has an even stronger link to LDL (unhealthy) cholesterol in the blood.[12] Some plant-based meat products are also good sources of dietary fiber, which is important for cardiovascular and gut health and is underconsumed by the large majority of Americans.[13] Plant-based meat also has fewer calories than conventional meat (lower calorie density).[10, 14] Both conventional and plant-based meat could benefit from reductions in sodium content.

These nutritional characteristics are consistent with the outcomes observed in studies examining the health outcomes associated with replacing conventional meat with plant-based analogs. In fact, compared with conventional meat, intake of plant-based meat is associated with improvements in body weight, multiple cardiovascular disease indicators, and the gut microbiome.[15-18]

Despite the strong nutritional profile of plant-based meat, opportunities for improvement remain. Manufacturers can reduce sodium through gradual reformulations or the use of salt substitutes. While plant-based meat is generally lower in saturated fat than conventional meat, the fat profile of some plant-based meat products could be further improved by replacing tropical oils high in saturated fat with structured fats from seed oils or other vegetable oils with less saturated fat.[19] Emerging research also focuses on using hydrogels, oleogels, and emulsion gels to reduce the saturated fat in plant-based meat products while retaining their original properties.[20] In addition, while the protein content of plant-based meat on the U.S. market is often close to that of the comparable animal product for the same product weight,[10, 11] there may be differences in protein quality, with potential health implications.

Another important consideration is that while plant-based meats are generally ultraprocessed, the nutritional profile of plant-based meat is very different from most ultraprocessed foods that are high in added sugars, sodium, and saturated fat,[10, 21] and intake of plant-based meat is not associated with the same adverse health outcomes.[22, 23] Further, research on the health implications of ultraprocessed foods generally does not include plant-based meat, which limits the generalizability of findings about ultraprocessed foods and plant-based meats. Unlike other ultraprocessed foods, plant-based meats are healthier than the foods they are intended to replace and generally don't have other negative characteristics typical of ultraprocessed products.[24]

Plant-based meats may have longer ingredient lists than some conventional meats. While there is nothing inherently wrong with this from a nutritional perspective, some research has identified an association between longer ingredient lists and less favorable nutrient composition.[25]

Nutritional considerations of fermentation-derived meat

While fermentation-derived meat, which offers several health benefits,[26] accounts for nearly 20% of plant-based meat sales in Western Europe,[27] it holds only a small share of the U.S. market; therefore, it is not the primary focus of this white paper.

Fermentation uses microbes to produce protein products that mimic the taste and texture of conventional meat. The types of fermentation used to make these products include traditional fermentation, biomass fermentation, and precision fermentation.

The nutritional benefits of fermentation-derived meat are a topic of growing interest. Recent studies have found that fermentation with certain microorganisms may improve a product's digestibility, reduce allergenicity, and reduce antinutritional factors, thus improving the availability of nutrients.[28, 29] Fermentation can also improve a product's nutritional value.[29] In addition, fermented plant foods that are rich in probiotics support gut health.[29]

Research examining the health effects of replacing conventional meat with fermentation-based mycoprotein found improvements in blood cholesterol and glycemic response[30, 31] and improved lipid profiles, glycemic markers, dietary fiber intakes, satiety effects, and muscle/myofibrillar protein synthesis.[32] In addition, a small randomized controlled trial (n=20) comparing intake of mycoprotein and conventional meat found reductions in intestinal genotoxicity, which can cause bowel cancer, and increases in healthy gut bacteria in the mycoprotein group.[33]

Additional research, including studies with longer durations and larger sample sizes, could further identify health implications of fermentation-derived meat.

Nutritional strengths of plant-based meat

The nutritional profile of plant-based meat has several advantages over conventional meat. As noted previously, plant-based meat is lower in calories and saturated fat, free from cholesterol, is a good source of fiber, and is associated with positive health outcomes.

Health outcomes

Multiple studies have found that, overall, diets that are mostly plant-based are more healthful than diets high in conventional meat and dairy. Compared with diets high in meat, plant-based diets are associated with lower body weight and reduced risk of heart disease, diabetes, diverticular disease, kidney stones, and cataracts.[34, 35] Studies have also found that intake of plant-based meat can improve satiety,[36] reduce heart disease risk factors,[37] and improve gut health.[18] Indeed, several types of plant-based meat have received the American Heart Association's Heart-Check certification.[38]

Replacing some conventional meat with plant-based meat could provide considerable health benefits at both the individual and population levels. While some studies finding no effect[39] often attract media attention, the overall international body of evidence shows cardiovascular benefits. A 2024 systematic review and meta-analysis of studies comparing the cardiovascular effects of intake of plant-based or fermentation-derived meat with conventional meat found that replacing conventional meat with plant-based or fermentation-derived meat lowered total cholesterol and low-density lipoprotein (LDL) cholesterol, reducing the risk of cardiovascular disease,[15] the leading cause of death in the United States.[40]

In addition, a 2024 literature review found that plant-based meats generally align with recommendations for improving cardiovascular health due to their low saturated fat, high polyunsaturated fat, and dietary fiber.[16] To reach this determination, the review referenced several studies in which participants replaced conventional meat in their diets with plant-based alternatives, resulting in improvements to total and LDL cholesterol and reductions in body weight.[16]

One such study, the Study With Appetizing Plantfood-Meat Eating Alternative Trial (SWAP-MEAT), conducted in the United States, was a randomized crossover trial with no washout period in which half of the 36 participants consumed at least two servings per day of plant-based meat for eight weeks followed by at least two servings per day of conventional meat (or vice versa) for eight weeks, keeping all other dietary components consistent.[11] The study found that the concentration of trimethylamine N-oxide, a cardiovascular disease risk factor, was significantly lower when participants were consuming plant-based meat, and lowest among the study participants who consumed plant-based meat after the conventional meat in the trial. LDL cholesterol was also significantly lower at the end of the eight-week plant-based phase than at the end of the eight-week conventional meat phase.[11]

There is strong evidence that a high intake of processed meat increases the risk of developing colorectal cancer,[41] which is the second leading cause of cancer death in the United States.[42] The World Health Organization has classified processed (conventional) meat as a Group 1 carcinogen, as there is sufficient evidence that its intake causes colorectal cancer in humans, and (conventional) red meat as a Group 2A carcinogen, meaning that its intake probably causes cancer in humans.[43] Plant-based meats are intended to replace conventional meat products, including these known carcinogens. The American Institute for Cancer Research/World Cancer Research Fund, leading authorities on diet and cancer risk, recommend

limiting intake of red meat to no more than 12-18 ounces (about three servings) per week and consuming little or no processed meat.[44] Several leading U.S. cancer centers also recommend avoiding processed meat.[45, 46]

Calorie density

U.S. and international studies have found that plant-based meat is lower in calories than conventional meat, both on a per serving basis and when product weight is standardized.[10, 14] Consuming foods high in calorie density (also called energy density), which refers to the calories per weight of food, can lead to weight gain, while research shows that consuming foods lower in energy density produces weight loss.[47] Both U.S. and international trials have found that substituting plant-based meat for conventional meat can lead to weight loss.[11, 15] About one in five U.S. children and two in five adults have obesity,[48, 49] increasing the risk for a range of costly chronic health conditions.[50]

Dietary cholesterol

Unlike conventional meat, which is the leading source of dietary cholesterol in Americans' diets,[51] plant-based meat contains no dietary cholesterol. Many foods high in cholesterol are also high in saturated fat, which increases the risk of cardiovascular disease, primarily by elevating LDL cholesterol levels in the blood.[52] While national dietary guidance has moved away from specific cholesterol targets, meta-analyses have shown that high cholesterol intake is associated with high total and LDL cholesterol concentrations in the blood.[53] Elevated total and LDL cholesterol increases the risk for cardiovascular disease. The American Heart Association recommends following a healthy dietary pattern that is inherently low in cholesterol.[53]

Dietary fiber

Conventional meat contains little or no dietary fiber. Both U.S. and international analyses have found that plant-based meat contains significantly more dietary fiber than conventional meat.[10, 14, 54] While the nutrient composition of plant-based meat products varies, some are a "good source" of dietary fiber, meaning they contain between 10 and 19% of an individual's daily fiber needs, per serving.[55] A high intake of dietary fiber is associated with a lower risk of developing coronary heart disease, stroke, hypertension, diabetes, and obesity.[13] Dietary fiber also has positive effects on the gut microbiome.[56] Despite these benefits, most people eat less than half of the recommended amount (minimum of 28 grams per day of fiber for a 2,000-calorie diet).[13, 57] More than 90% of women and 97% of men do not consume enough dietary fiber.[57]

While intake of whole plant-based foods, which also contain dietary fiber, should be encouraged to address the chronic shortfall in most Americans' diets, plant-based meat presents an opportunity to increase dietary fiber without major behavioral shifts.

Iron and other essential nutrients

While conventional meat is high in iron, many plant-based foods are a good source of iron, too. Examples include nuts, beans, seeds, fortified grain products,[57] and foods made with these items. Iron is important for numerous bodily functions, including moving oxygen throughout the body, muscle metabolism and healthy connective tissue, physical growth, neurological development, cellular functioning, and hormone synthesis.[58] Iron needs are highest for women during pregnancy and childbearing years,[58] making a deficiency more likely in these life stages.

Compared to analog conventional products, plant-based meat contains similar or greater amounts of iron. A 2024 international systematic review found that, overall, plant-based meat contains more iron than conventional meat.[54] A U.S. study found similar findings when product weight is standardized.[10] More than 95% of plant-based meat products on the U.S. market contain iron.[59]

While international markets vary, a 2023 analysis of the nutrient content of various types of plant-based and fermentation-derived burgers in the United Kingdom found that the amount of bioavailable iron in most products tested was comparable to beef burgers.[60] Compared with beef burgers, the plant-based burgers had higher amounts of the essential minerals calcium, copper, magnesium, and manganese, which naturally exist in the plant proteins from which they are made. While the plant-based burgers were lower in zinc,[60] the bioavailable zinc was comparable in the fermentation-derived meat burger and the beef burger.[60] International studies have shown that mycoprotein-based (fermentation-derived) meat products are rich in zinc.[61]

An international systematic review has found that, overall, plant-based meat is lower in zinc, but higher in calcium, than conventional meat.[54] However, there is significant variation in micronutrient content among plant-based products, presenting opportunities for innovation.

In some countries, particularly in Western Europe, plant-based meat is fortified to match the content of key micronutrients in conventional meat. For example, more than 70% of plant-based meat products in the Netherlands are fortified with both iron and vitamin B12.[59] Vitamin B12 is important for nervous system function, red blood cell formation, and DNA synthesis and does not naturally occur in plant-based foods.[62] International studies have found that despite some fortification, plant-based meat is lower in vitamin B12 than conventional meat.[14, 54] Increased iron and vitamin B12 fortification of plant-based meat products on the U.S. market could help ensure that Americans who eat a primarily plant-based diet meet nutrient needs. Additional vitamins and minerals could also be added to plant-based meats to address other nutrient shortfalls in the population.

Opportunities to improve the nutritional profile of plant-based meat

While plant-based meat has several nutritional advantages relative to conventional meat, opportunities exist to further improve its nutritional profile.

Sodium

Ninety percent of Americans consume more than the recommended amount of sodium.[63] Excess salt intake is associated with hypertension (high blood pressure), which is a major risk factor for heart disease and early death.[64] Average sodium intake of 3,400 mg per day is almost 50% more than the target limit for adults of 2,300 mg per day.[63] The American Heart Association recommends an even lower limit of 1,500 mg per day for most individuals.[65, 66]

Processed conventional meats are a leading source of sodium in U.S. diets.[57] While raw whole cuts of conventional meat are low in sodium, salt is often added during preparation and cooking. The sodium content of plant-based meat products varies widely, and some plant-based meats contain moderate or high sodium levels.[10] While reducing sodium as much as possible should be a long-term goal, even shifting high-sodium products to a more moderate level is a worthwhile interim step and would improve their nutritional quality.

Given that sodium is often added to whole cuts of conventional meat during cooking, the total sodium in meals containing plant-based meat may be comparable to similar meals made with conventional meat. International studies examining the differences in nutrient content have yielded varying findings regarding the sodium content of plant-based and conventional meat products.[14, 54] International randomized controlled trials that explored the impact of replacing conventional meat with plant-based meat also have varying findings.[39] However, the U.S.-based SWAP-MEAT trial found no significant difference in total dietary intake of sodium when consuming plant-based versus conventional meats.[11] While excess sodium intake directly increases blood pressure in some individuals,[67] both the U.S.-based SWAP-MEAT trial and a 2024 international systematic review and meta-analysis of randomized controlled trials found no difference in blood pressure when substituting plant-based meat for conventional meat.[11, 15] While opportunities remain for reducing sodium content in plant-based meat, evidence suggests that its present levels do not negate the observed cardiovascular benefits.[16]

Sodium is present in many plant protein isolates as a result of wet extraction methods.[68] For example, the high solubility of protein from peas, soybeans, fava beans, and other legumes in salt or alkali solutions is leveraged to isolate the protein. Salt extraction and neutralization byproducts of alkali extractions contribute to the sodium content of the final protein ingredients.[69] As sodium is also important for flavor, texture, and preservation, lowering sodium in plant-based meat products may negatively affect these attributes. Advancements are needed to address these challenges.

Alternatives to sodium chloride, including potassium chloride, monosodium glutamate (MSG), yeast extract, mycoprotein, mushroom powder, and Alberger salt, could also be considered. However, each poses challenges as a salt substitute. For example, potassium chloride can require additives to mask bitter notes.[70] Some adverse effects are associated with consuming large amounts of MSG,[71,72] but it is not considered harmful in amounts typically consumed through food.[71, 73] However, MSG's negative consumer perception limits its viability, regardless of health effects. The use of sodium substitutes would likely increase the price of plant-based meat products for consumers, reducing their accessibility. Further research is needed to identify and implement strategies to

reduce sodium in plant-based meat, including advancements in extraction and processing methods for plant protein, alternatives to sodium chloride, and options to enhance flavors.

Additionally, dry extraction of plant proteins does not inherently introduce salt. Optimizing this method for various plant proteins could also help minimize salt content.[74]

Certain markets, such as schools, have requirements for sodium levels in the foods they serve, and reformulations have been made to meet those requirements, demonstrating that sodium reduction is possible. While reduced-sodium marketing claims may deter some consumers, such claims are not required on packages. Companies could choose to reduce sodium in their products without directly alerting consumers (beyond any required changes to the Nutrition Facts label and ingredients list), if such an approach is preferred. In addition, the U.S. Food and Drug Administration (FDA) has proposed requiring a front-of-package Nutrition Info box to identify whether foods are high, medium, or low in sodium, saturated fat, and added sugars.[75] If finalized, the rule could incentivize further sodium reduction.

Methylcellulose

Methylcellulose is a common food additive that serves as a binder, emulsifier, and thickener in many foods, including plant-based meat. It is considered safe by FDA and the Joint Food and Agriculture Organization (FAO)/World Health Organization (WHO) Expert Committee on Food Additives (JECFA) at levels typically consumed, based on multiple safety assessments.[76, 77] However, some consumers have expressed concerns about such food additives.[78] Additional research could identify potential alternatives for the unique texture and gelation properties of methylcellulose.

Fat quality

Plant-based meats vary in the type and amount of fat they contain. While both U.S. and international studies have shown that, overall, conventional burgers have more total fat and saturated fat[10, 14, 54] than plant-based burgers, some plant-based meats may still be high in saturated fat.

Research has shown that replacing saturated fat with polyunsaturated fat reduces the risk of heart disease.[12, 79] The *Dietary Guidelines for Americans* and the WHO recommend limiting saturated fat to no more than 10% of calories.[12, 57] The American Heart Association recommends even further reductions, to 6% of calories.[80] Replacing foods high in saturated fat with alternatives lower in saturated fat can reduce the risk of cardiovascular disease.[80]

An opportunity exists to replace the tropical oils, such as coconut oil, that are high in saturated fat and commonly used in plant-based meat, with structured fats from seed oils or other vegetable oils (such as canola, sunflower, or soybean) with more favorable fat profiles. While seed oils may be negatively perceived by some consumers, leading experts do not have concerns about them.[81-83] In fact, the American Heart Association recommends increasing the intake of polyunsaturated fatty acids from vegetable oils to reduce heart disease risk.[84] A vegetable oil such as avocado oil could be an ideal option for plant-based meat, given its mild flavor, high smoke point, positive consumer perception, and favorable fat profile. However, research and development and use of higher-priced oils may increase the price of the final product for the consumer. Some consumers have also expressed concerns about the allergenicity of avocado oil.

Omega-3 fatty acids can benefit health, but sourcing some types of them for plant-based seafood and other plant-based meats can be challenging. Intake of omega-3 fatty acids is associated with improved heart, brain, eye, and prenatal health.[85] Shorter-chain omega-3 fatty acids are found widely in plants, while long-chain fatty acids (EPA and DHA) mostly come from marine animal sources and microalgae. Long-chain omega-3 fatty acids are strongly associated with the health benefits of conventional seafood.[85] A 2023 Good Food Institute survey of companies and academic researchers on the use of omega-3 ingredients in alternative meat and seafood products found that companies face medium-sized challenges in sourcing omega-3 fatty acids, with larger challenges anticipated over the next five years.[86] The leading source of omega-3 fatty acids for plant-based meat is microalgae, but survey results found that companies may be open to diversifying with other sources, including precision fermentation and plant molecular farming.[86]

Additional nutritional considerations

Food processing

Plant-based meats typically meet the definition of ultraprocessed foods under the NOVA Food Classification System. However, they are generally healthier than the conventional meats they aim to replace and differ significantly in nutritional profile from many other ultraprocessed foods.[24] Ultraprocessed foods are defined as "industrial formulations typically with 5 or more and usually many ingredients. … Ingredients include food substances not commonly used in culinary preparations, such as hydrolyzed protein, modified starches, and hydrogenated or interesterified oils, and additives whose purpose is to imitate sensorial qualities of unprocessed or minimally processed foods and their culinary preparations or to disguise undesirable qualities of the final product … "[87] The NOVA food classification system was originally intended as a sociopolitical designation and does not consider a food's nutrient profile.[88]

Moreover, processing can enhance the nutrition of plant proteins. For example, extrusion processing improves the digestibility of sunflower protein and reduces the concentration of antinutrients.[89] It has also been shown to minimize losses in vitamins and prevent foodborne illness.[90, 91]

In the United States, more than half of all calories consumed by adults and two-thirds consumed by children come from ultraprocessed foods.[92, 93] The category of ultraprocessed foods includes a range of products such as sweet and savory packaged snacks, cookies, flavored yogurt, ice cream, processed conventional meats, infant formula, mass-produced packaged bread, and breakfast cereals.[87] While many of these foods are high in saturated fat and added sugars and low in fiber,[21] others, such as whole grain breads and cereals and plant-based protein foods, like plant-based meat, have generally favorable nutrition profiles.

Despite ultraprocessed foods not being defined by their nutritional quality, there is growing consumer interest in limiting their intake due to concerns about their healthfulness. Global evidence has linked dietary patterns high in ultraprocessed foods with a range of adverse health outcomes, including increased total and cardiovascular disease-related mortality, type 2 diabetes, respiratory challenges, anxiety and depression, and sleep difficulties.[94]

Research is ongoing to elucidate the mechanisms through which diets high in some ultraprocessed foods lead to adverse health outcomes. Preliminary findings suggest that the hyperpalatable nature of some ultraprocessed foods (e.g., a combination of high salt, fat, sugar, or carbohydrates that is not usually found in nature)[95] and high energy density may be driving excess consumption, weight gain, and other adverse health outcomes.[96] Another hypothesis is that differences between ultraprocessed and minimally processed foods in fiber type and content may also play a role in their relationship to weight gain.[97] While nutrient profiles vary across products, as noted previously, plant-based meat is lower in energy density than conventional meat, while also being high in fiber.[10, 14]

Most studies on the health effects of ultraprocessed foods either do not include plant-based meat at all or consider it a small proportion of participants' diets. For example, in a study assessing the health effects of ultraprocessed food intake using the European Prospective Investigation into Cancer and Nutrition (EPIC), plant-based meat and dairy products comprised 0.1% of daily dietary intake by weight.[23] Another study based on UK Biobank data found that plant-based and fermentation-derived meat, combined with tofu and tempeh, provided 0.2% of total calories.[98] An analysis of U.S. data focused on the relationship between various categories of ultraprocessed food intake and cardiovascular disease did not even include plant-based meat as a category,[92] and a U.S.-based intervention trial comparing the health effects of various ultraprocessed food diets with a minimally processed food diet also did not include plant-based meat in either study arm.[96] The lack of inclusion of plant-based meat in ultraprocessed food studies makes the research findings about the adverse

health effects of diets high in ultraprocessed food intake not generalizable to plant-based meat. As noted previously, most studies comparing the intake of plant-based meat with conventional meat find that replacing conventional meat with plant-based meat provides health benefits.[15]

Ultraprocessed foods are diverse, and studies examining the health implications of various subcategories of ultraprocessed foods have found that the health effects vary by subcategory. Adverse health outcomes tied to the high consumption of ultraprocessed foods appear to be driven largely by sweetened beverages and processed meats.[24] For example, studies published in *The Lancet* found that, unlike other foods classified as ultraprocessed foods, plant-based meat and milk intake was not associated with increased risk of multimorbidity of cancer and cardiometabolic diseases[22] or type 2 diabetes,[23] while the opposite was true of processed conventional meat.[22, 23] Other studies have found that processed meat (which plant-based meat is designed to replace), sugary drinks, and artificially sweetened drinks were responsible for driving the majority of the increased cardiovascular risk[92] and increase in total mortality[99] associated with the ultraprocessed food group as a whole.

In support of these findings, the Academy of Nutrition and Dietetics stated in a 2025 position paper, "Although plant-based alternatives, including plant milks, meet the definition of ultraprocessed foods, plant-based alternatives have not been associated with the same negative health effects as other ultraprocessed foods such as sodas and ultraprocessed animal products. In addition, plant-based milks and other vegan foods intended to replace or serve as alternatives to animal-based foods may be key sources of nutrients."[100] Overall, the evidence suggests that plant-based meats may be a "rare ultraprocessed exception," given the distinct nutritional profile compared to typical ultraprocessed foods and generally favorable health profile relative to the conventional meat products they are intended to replace.[24]

Clean label

While the term "clean label" lacks an official definition, it often describes products with a short, consumer-friendly ingredient list and/or that are free from pesticides and heavy metals or artificial additives.[101-103] The clean label movement is of interest to a subset of consumers, and aligning products with clean label criteria presents an opportunity to improve consumers' perceptions of plant-based meat. Consumer concerns about ultraprocessed foods may be related to their interest in moving toward clean-label products.

Many, but not all, plant-based meats have long ingredient lists, presenting challenges for clean label designations. As consumers lack rigorous ways to assess product healthfulness, cues such as the number of total or hard-to-pronounce ingredients and label claims like "high in" positive attributes are often used as proxies.

Some of the potential opportunities discussed previously may have implications for clean label. For example, replacing methylcellulose, though safe, could make progress toward a clean label designation. However, other changes to improve the nutritional profile, such as replacing sodium chloride with alternatives or fortifying products with additional vitamins or minerals, could add to the ingredient list and move away from clean label. Ingredient changes that have implications for clean label could also increase the price for the consumer, which is a notable purchase barrier.[7]

Protein quality

Both conventional meat and plant-based meat are good sources of protein. While some demographic groups, such as older women, are more likely to be protein-deficient, the vast majority of Americans consume enough protein from both animal and plant sources.[57] When serving sizes are comparable by weight, plant-based meat has a protein content similar to conventional meat.[10]

Protein quality refers to both the balance of essential amino acids (completeness) and the digestibility (bioavailability) of a protein. Protein quality varies considerably by type of plant protein. For example, potato and soy proteins are classified as excellent and high-quality proteins, respectively.[104] Protein quality of other types of plant-based proteins can be optimized by combining complementary plant protein sources. For example, the addition of potato, soy, and pea proteins at specific ratios to a broad range of plant proteins can increase the overall protein quality.[104]

Differences in bioavailability between plant-based protein sources are generally due to antinutrient content. While antinutrients make it harder for the body to digest protein and micronutrients, they also have beneficial polyphenols associated with health benefits.[105] The processing used to make plant-based meat can improve the bioavailability of the protein relative to its raw ingredients.[106]

Lower protein quality can have both advantages and drawbacks. The higher fiber content and lower digestibility of some plant-based meats may contribute to their association with improved gut health, for example.[18]

Potential actions and next steps

Food industry leaders, policymakers, researchers, public health and health care professionals, and other stakeholders can take action to improve the nutritional profile and overall healthfulness of plant-based meat as a category.

Improving the healthfulness of plant-based meat and educating consumers can motivate them to choose plant-based over conventional meat. However, these benefits only matter if the products also deliver on core consumer needs of taste and price. These expectations must be met for consumers to consider plant-based meat, and there is still work to be done on that front.

Research

Many potential improvements to the nutritional profile of plant-based meat require additional research. Both academic research and industry research and development (R&D) are needed.

With respect to independent academic research, longer-duration studies on plant-based meat intake could help clarify its long-term health benefits. Most trials on the health effects of plant-based meat are relatively short (e.g., 4-12 weeks),[37] but it can take many months, if not years, to see changes in some disease indicators or risk factors. In addition, most studies have used relatively small sample sizes (e.g., 20-50 participants).[37] Studies using larger and more diverse sample sizes and a range of plant-based meat products of multiple types and brands could enhance the evidence base on the health effects.

Further, additional research on ultraprocessed foods could better distinguish the effects of eating plant-based meat from other less healthful ultraprocessed foods that are more energy-dense (high in calories), such as candy, chips, and cookies.

R&D could also address challenges to product reformulation, such as improving nutritional quality through protein extraction processes and developing salt substitutes that allow for reductions in sodium content, while maintaining a focus on taste. R&D could also identify alternative solid fat sources to improve the nutritional profile and consumer perceptions of plant-based meat.

Consumer education

As many consumers lack familiarity with plant-based meat and an understanding of its ingredients, opportunities exist to educate consumers about the health benefits of plant-based meat. In particular, there is a need to improve consumer understanding of the steps involved in plant-based meat production and ingredient processing. There is also an opportunity for increased education about the interplay between ultraprocessed foods and plant-based meats, as well as the nutritional and health benefits of plant-based meat compared with conventional meat.

Public policy

Changes to public policy could help increase the intake of plant-based meat and improve its healthfulness. Some public policy opportunities include:

- Increased investment in public sector research programs focused on overcoming barriers to improving the nutritional quality of plant-based meat and increasing understanding of its health implications.
- Improved integration of plant-based meat into updates to the *Dietary Guidelines for Americans* and associated materials, such as MyPlate.
- Ensuring that any U.S. government nutrition targets consider plant-based meat as a category separate from other ultraprocessed foods, such as candy, chips, and cookies, given their different nutritional profiles.

Increased collaboration

Many of the challenges and opportunities to improve the nutritional profile of plant-based meat are consistent across the category. Thus, improved collaboration on topics including research, consumer education, and public policy engagement has the potential to benefit companies across the sector.

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About GFI

The Good Food Institute is a nonprofit think tank working to make the global food system better for the planet, people, and animals. Alongside scientists, businesses, and policymakers, GFI's teams focus on making plant-based and cultivated meat delicious, affordable, and accessible. Powered by philanthropy, GFI is an international network of organizations advancing alternative proteins as an essential solution needed to meet the world's climate, global health, food security, and biodiversity goals. To learn more, please visit gfi.org.

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