

# The Nutrition Limitations of Mimicking Meat

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## ABSTRACT

Over the past decade, the pursuit of developing plant-based alternatives that mimic meat products in order to give consumers a wider range of choices at the supermarket has reached a new level of production and investment. Plant-based meat alternatives provide consumers with choices for enjoying the sensory characteristics of meat products, but nutritional implications exist. Because these new products are plant based, they often have a “health halo.” However, currently available plant-based burgers have macronutrient profiles similar to 80% lean ground beef burgers, especially with regard to their fat and saturated fat contents. In addition, sodium levels are significantly higher and the bioavailability of protein, calcium, and iron are lower in plant-based burgers. Recent consumer surveys indicate that plant-based meat alternatives are viewed through a wider lens than nutrient composition and personal health.

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Interest in alternatives to animal-based proteins is not new. In the 19th and early 20th centuries, when animal-based proteins were considered a premium purchase, a combination of beans and cornbread (or rice) was a common meat alternative, without consideration given to the differences in nutrition. Over the years, as interest in vegetarianism grew, vegetable- and soy-based burgers became a small part of a few company portfolios, but they were not a primary focus because the texture and taste of these products were unlike meat burgers. More recently, some consumers interested in decreasing their intake of animal-based proteins, especially from red meats, have sought plant-based alternatives that satisfy the preferred sensory characteristics of meat products and fit within their flexitarian mindset. With ongoing research and innovation in food science and technology, consumers will have an increasingly wide variety of food choices to satisfy their preferences for meat alternatives (8).

Over the past decade, the pursuit of developing alternatives that mimic meat products has reached a new level of production and investment. From startup companies on a mission to decrease reliance on animal proteins to established animal protein companies looking to balance their portfolios, plant-based meat analogues are the “new frontier.” In 2017 and 2018, investors directed more than US\$12 billion in U.S. plant- and cell-based meat companies, which was 80% more capital than was invested in the previous seven years combined (5). According to the investment firm UBS, the growth of plant-based protein and meat alternatives is projected to increase to US\$85 billion by 2030 (2). Results of the International Food Information Council (IFIC) consumer survey on plant alternatives to animal

meat conducted in December 2019 (7) indicated that approximately half (49%) of U.S. consumers have tried a plant-based meat alternative and that most of those surveyed were not vegetarians. The Hartman Group’s “Food and Technology 2019: From Plant-Based to Lab-Grown” report found that only 12% of U.S. consumers purchasing plant-based meat alternatives identified themselves as vegetarians, while 41% identified their eating style as “omnivore” (6). The rise of plant-based meat alternatives is believed to be based on a combination of consumers perceiving them as both healthier options and as ethical and sustainable alternatives to animal agriculture (8). In addition, plant-based meat alternatives may have achieved the “health halo” effect.

## The Health Halo

So, how do consumers evaluate the healthfulness of plant-based meat analogues? According to recent U.S. consumer research, plant-based meat alternatives appear to have achieved a “health halo.” The IFIC consumer survey on plant alternatives to animal meat conducted in December 2019 provides interesting insights when comparing “burger-type” products (7). When consumers were asked to select the healthier product based on the Nutrition Facts Panels (NFP) of two unidentified products, a plant-based meat alternative or an 85% lean ground beef patty, nearly half (45%) of the consumers selected the plant-based product. The protein, total fat, and calorie contents were similar in both products, while sodium and fiber were higher in the plant-based meat alternative. The NFP for the plant-based product included a complete vitamin and mineral profile, while the NFP for the beef patty included only four nutrients. In a follow-up survey in March 2020, IFIC sought to gain a better understanding of the criteria consumers used in making their selection between the two products, using the same NFP labels from the December survey (7). In both surveys, 45% of participants believed the plant-based meat alternative to be healthier than the 85% ground beef patty. When asked about influencers of their decision, consumers who selected the plant-based patty cited the number of vitamins and minerals listed on the NFP (33%), the amounts of specific vitamins and minerals (29%), and the absence of cholesterol (24%). The beef patty was selected as healthier by 32% of participants, an increase of 7% from the 2019 survey. The lower sodium content most influenced the decision of 52% of consumers, followed by the saturated fat content, which was identified by 42% of consumers. Consumers were also asked which product label descriptions appealed to them when choosing between the plant-based or 100% beef products. The term “all natural” (34%) was the most popular description, closely followed by “100% beef” (33%) and “plant-based” (23%) (7). Although these consumer data reflect consumer perceptions, a closer look at the actual nutritional comparisons reveal some interesting facts.

## Nutrient Comparisons

When comparing the publicly available nutritional profiles of seven plant-based burgers to a traditional meat burger made

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with 100% ground beef (80% lean), the calorie, protein, and total fat contents were relatively similar, yet none of them matched the lower calorie and higher protein and fat contents of the 95% lean ground beef burger (Table I). The plant-based burgers were significantly higher in sodium than the beef options. The sodium content range in the plant-based burgers was 160–580 mg/patty, and approximately 70% of these burgers were near the 400–600 mg range, which is approximately one-third of the recommended daily intake for adults. The U.S. Centers for Disease Control and Prevention warn that consuming too much sodium increases the risk of developing serious medical conditions such as high blood pressure, heart disease, and stroke (3).

The dietary fat content and source of fat are also important in assessing nutrition, and plant-based products are often associated with foods that have a lower fat content. However, the plant-based meat alternatives were only slightly lower in fat than the 100% ground beef burger (80% lean), with six of the seven meat alternatives ranging from 14 to 18 g/patty (Table I). Four of the seven had a saturated fat profile of 5 to 9 g/patty versus the 100% ground beef burger (80% lean) at 8 g/patty. Regardless of the source of saturated fat (coconut, cocoa butter, beef), overconsumption of saturated fat is associated with negative health effects. The 100% ground beef (95% lean) product, which was lower in total fat (5.7 g) and saturated fat (4.4 g) than all of the other plant- and meat-based burgers listed in Table I, is a healthier alternative. If one evaluates the plant-based burgers based on their sodium and fat contents, the “health halo” profile is questionable.

### Protein Quality and Bioavailability

When comparing amounts of protein in beef burgers versus plant-based meat alternatives, the protein content was similar in six of the seven alternative products (Table I). However, the qual-

ity and bioavailability of the protein sources differed. The quality of a protein is determined by its essential amino acid composition and the digestibility and bioavailability of its amino acids (4). Although quality and bioavailability are not reflected in the NFP, they are critical to the functionality of protein in the body. Animal protein sources are considered “complete” sources of protein because they provide all of the essential amino acids in ratios needed for normal body function. Plant protein sources, however, are considered “incomplete” because they lack the proper amounts of one or more of the essential amino acids the body needs to function properly. The digestible indispensable amino acid score (DIAAS) is the most specific tool for determining protein quality because it incorporates both bioavailability (the amount digested and absorbed from food) and the amino acid concentration relative to the body’s amino acid requirements (1). For food claims, a food with a DIAAS value greater than 100 is considered an “excellent” source. A “good” quality protein has a DIAAS value between 75 and 99. Meats (1) are an excellent source of protein (DIAAS of 100), while soy and pea (9) are good sources of protein (DIAAS of 90 and 82, respectively).

### Beyond Macronutrients

Based on IFIC consumer research, the vitamin and mineral contents listed on the NFP do influence consumers’ opinions of the healthfulness of a product (7). Even though the fiber and calcium contents of the plant-based burgers were higher due to added ingredients, an animal-based protein source naturally contains a more complex nutrient profile of vitamins and minerals (Table I). Food companies are only required to list the minerals calcium, iron, and potassium on the NFP, which may lead consumers to overlook the completeness of the vitamin and mineral contents of a food. Specifically, beef and other animal proteins are key sources of niacin, thiamine, vitamins B<sub>6</sub> and B<sub>12</sub>, zinc, choline, and selenium, which are often not included

**Table I. Nutritional content of plant-based burger alternatives versus beef burgers**

Items (uncooked)	Beyond Meat <sup>a</sup>	Nestle Sweet Earth <sup>b</sup>	Impossible Foods <sup>c</sup>	Tyson Foods Raised & Rooted <sup>d</sup>	Beyond the Butcher UNCUT <sup>e</sup>	Lightlife Burger <sup>f</sup>	Smithfield Pure Farmland <sup>g</sup>	100% Beef Burger (80% Lean) <sup>h</sup>	100% Beef Burger (93% Lean) <sup>i</sup>
Serving size (g)	113	113	113	112	113	113	112	113	113
Calories	260	260	240	150	260	270	240	287	237
Protein (g)	20	26	19	19	19	20	14	19	33
Primary protein source	Pea, mung bean, fava bean, brown rice	Pea	Soy isolate	Beef, pea, egg	Soy	Pea	Soy	Beef	Beef
Fat (g)	18	15	14	7	17	17	18	23	11
Primary fat source	Cocoa butter, coconut, sunflower, canola	Coconut, canola	Coconut, sunflower	Canola, beef fat	Canola, coconut	Canola, coconut	Coconut, canola	Beef fat	Beef fat
Saturated fat (g)	5	7	8	2.5	9	2.5	3	8.6	4.4
Fiber (g)	2	6	3	1	6	2	3	0	0
Na (mg)	350	400	370	160	260	540	580	75	97
Ca (mg)	100	170	170	60	115	70	192	16	10
Fe (mg)	4.0	4.9	4.2	1.9	3	3.8	3	2.2	3.6

<sup>a</sup> <https://www.beyondmeat.com/products/the-beyond-burger>.

<sup>b</sup> <https://www.sweetearthfoods.com/our-products/awesome-burger>.

<sup>c</sup> <https://impossiblefoods.com/burger>.

<sup>d</sup> <https://www.raisedandrooted.com/products/blended-patties>.

<sup>e</sup> <https://btbfoods.com/retail>.

<sup>f</sup> <https://lightlife.com/product/plant-based-burger>.

<sup>g</sup> <https://pure-farmland.com/products/pure-farmland-burger-patties/#ingredients3>.

<sup>h</sup> <https://fdc.nal.usda.gov/fdc-app.html#/food-details/174036/nutrients>.

<sup>i</sup> <https://fdc.nal.usda.gov/fdc-app.html#/food-details/171790/nutrients>.

on the NFP. Although most of the plant-based burgers in Table I were higher in iron than the 100% beef burgers, the types of iron (heme and nonheme) were not of equal value. Nonheme iron, found in plant-based foods, is not absorbed by the body as well as the heme iron found in animal-based foods.

### Consumer Choices

Consumer choice at the supermarket is the foundation of the food system. With advancements in food science and technology, plant-based meat alternatives are now available that provide taste, texture, and macronutrient profiles that are similar to those of a variety of meats, with the traditional meat-based burger leading the way in these categories. However, there are nutritional implications to these choices, both in plant- and meat-based products. Even though the protein content was similar in “burger-type” products, if a consumer is seeking protein options with a higher bioavailability of vitamins, minerals, and amino acids, animal-based products fulfill that need better. If a consumer is seeking to reduce total calories, total and saturated fats, and sodium, then the best alternative to all of these products is the 95% lean ground beef burger (Table I). Despite their nutritional similarities and differences, U.S. consumer surveys show plant-based meat alternatives are viewed through a wider lens than nutrient content (7). The nutritional data may not support the “health halo,” but plant-based alternatives do provide consumers with choices that may align with personal beliefs beyond meeting their nutritional needs.

### References

1. Bailey, H. M., and Stein, H. H. Can the digestible indispensable amino acid score methodology decrease protein malnutrition. *Anim. Front.* 9:4, 2019.
2. Byington, L. Tracking the plant-based protein movement. Published online at [www.fooddive.com/news/plant-based-protein-tracker/564886](http://www.fooddive.com/news/plant-based-protein-tracker/564886). Food Dive, Washington, DC, 2019.
3. Centers for Disease Control and Prevention. Heart disease resources for health professionals: Sodium. Published online at [www.cdc.gov/heartdisease/sodium.htm](http://www.cdc.gov/heartdisease/sodium.htm). CDC, Atlanta, GA, 2020.
4. FAO Expert Consultation. Dietary protein quality evaluation in human nutrition. Published online at [www.fao.org/ag/human\\_nutrition/35978-02317b979a686a57aa4593304ffc17f06.pdf](http://www.fao.org/ag/human_nutrition/35978-02317b979a686a57aa4593304ffc17f06.pdf). Food and Agriculture Organization of the United Nations, Rome, Italy, 2013.
5. Good Food Institute. The state of the industry reports. Published online at [www.gfi.org/industry](http://www.gfi.org/industry). GFI, Washington, DC, 2019.

6. Hartman Group. Five things you should know about consumers and plant-based foods. Published online at [www.hartman-group.com/newsletters/1667442327/five-things-you-should-know-about-consumers-and-plant-based-foods](http://www.hartman-group.com/newsletters/1667442327/five-things-you-should-know-about-consumers-and-plant-based-foods). Hartman Group, Bellevue, WA, 2020.
7. International Food Information Council Foundation. Consumer survey on plant alternatives to meat shows that nutrition facts are more influential than the ingredients list. Published online at <https://foodinsight.org/consumer-survey-plant-alternatives-to-meat>. IFIC, Washington, DC, 2020.
8. Kuhn, M. E. Meet the next generation of plant-based meat. *Food Technol.* 74:3, 2020.
9. Phillips, S. M. The impact of protein quality on the promotion of resistance exercise-induced changes in muscle mass. *Nutr. Metab.* DOI: 10.1186/s12986-016-0124-8. 2016.

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