International Food Information Council

# WHAT YOU SHOULD KNOW ABOUT

# PLANT-BASED ALTERNATIVES TO MEAT

Vegetarian alternatives to meat are nothing new—veggie burgers, vegan deli meat and chicken-less nuggets have been around for decades. But while these products typically have aimed to meet the needs of vegetarians and vegans and don't consistently match the taste and texture of meat, newer plant-based alternatives to meat are attempting to mimic animal proteins as much as possible.

In this explainer, we'll take a closer look at how these products are made, their nutritional attributes, and their environmental impact. To date, many of these new products have been created to serve as alternatives to foods traditionally made with red meat, like burgers and sausages, so we'll focus on these alternatives. However, new products meant to mimic poultry, eggs and seafood are now also being sold, and more are coming to store shelves—an indicator that this novel wave in protein innovation may just be getting started.

## HOW ARE PLANT-BASED ALTERNATIVES TO MEAT MADE?

Plant-based alternatives to animal meat are made with ingredients and processing techniques that create colors, textures and flavors that are similar to those of animal meat. Protein sources in these plant products range from soy and potatoes to peas, rice and mung beans. The type of dietary fats used to make them include canola oil, cocoa butter, coconut oil and sunflower oil, and they're usually bound together by methylcellulose, which is used as a thickener and emulsifier in many types of foods. In addition to the ingredients needed to build color, structure and flavor, plant-based alternatives to meat are sometimes fortified with vitamins and minerals, like vitamin B12 and zinc, in order to offer some of the same nutrients that are inherent to animal meat.

## HOW DO PLANT-BASED ALTERNATIVES STACK UP NUTRITIONALLY?

Even though meatless protein foods benefit from a "health halo" because they're made from plants, it's unclear if these plant-based alternatives are any more nutritious than a burger or sausage made from animals. A side-by-side comparison of two Nutrition Facts labels—one for a ground plant-based alternative product and one for 100% ground beef—shows that these products can be similar to each other in some respects, but markedly different in others. In this case, the plant-based alternative is slightly higher in calories and has more saturated fat and sodium than the beef burger. It also has more fiber, calcium and iron (although the iron in the plant-based product is less bioavailable—that is, less readily absorbed and used by the body—than iron found in animal-derived foods). In addition, the 100% ground beef has much less sodium and a few more grams of protein. It's important to note that the plant-based product described here is just one option available in restaurants and grocery stores. The variety within this category of foods is expanding rapidly, and nutrition content will be different for each product.

**Assessing the environmental impact of plant-based alternatives to meat requires looking at multiple facets of their production...**

All in all, there are noticeable nutritional differences between the plant and animal burgers, but to date there isn't research to support whether these distinctions have an effect on health. Here's what we do know: 1) red meat and processed meats have been associated with health conditions like cardiovascular disease,[1] type 2 diabetes[2] and some types of cancer[3]; and 2) observational studies have shown that replacing red meat with plant foods like nuts and legumes is associated with lower risk of mortality from these conditions.[4] But because these new plant-based alternatives to meat are not whole plant foods, it's unclear if they have the same health impact as replacing meat with beans or lentils.

## ARE PLANT-BASED ALTERNATIVES HEALTHIER FOR THE ENVIRONMENT?

Assessing the environmental impact of plant-based alternatives to meat requires looking at multiple facets of their production as well as their nutrient density and amino acid content. Studies commissioned by the producers of popular brands of plant-based alternatives to meat[5,6,7] have shown that these products reduce land and water use, greenhouse gas (GHG) emissions and pollution caused by manure and fertilizers used to grow animal feed. More independently conducted studies are needed to confirm these results.

Many industries contribute to climate change, including animal agriculture. Livestock contribute about four percent of the total GHG emissions in the U.S.[8] At present, many ranchers and farmers are changing the way they raise animals to help reduce livestock emissions by incorporating techniques like regenerative agriculture and increasing pasture quality—the nutritional quality and intake of pasture

plants consumed by livestock animals. These changes can help reduce the amount of methane gas emitted per unit of animal product.[9] Additionally, there are various efforts underway to capture methane from manure decomposition in order to produce renewable energy.

Provided that they are available in the local food supply, plant-based foods can help consumers meet nutritional requirements while generating fewer GHG emissions, compared with omnivorous diets or animal foods.[10] However, these comparisons do not account for the lower bioavailability of some nutrients in plant foods, such as iron and protein. This means that the proportion of these nutrients that are absorbed by the body from plant foods is lower than the proportion absorbed from animal foods. When land use and greenhouse gas emissions are calculated to factor in amino acid content and nutrient density, the environmental footprint of animal foods becomes more similar to that of plant foods.[11,12]

**Plant-based alternatives to animal meat provide an innovative option for those looking to cut back on red meat consumption or add variety to their protein choices.**

# SUMMARY

Plant-based alternatives to animal meat provide an innovative option for those looking to cut back on red meat consumption or add variety to their protein choices. As these products' nutrition, flavor, and sensory attributes get closer to those of animal-derived burgers and sausages, they allow consumers to make a plant-based substitution without fully sacrificing the experience of eating meat. Despite their positive aspects, more research is needed to understand the health impacts of plant-based alternatives to meat as well as their impact on the environment—especially as their production scales up to meet consumer demand.

# REFERENCES


1. Zhong, Victor W., Van Horn, Linda, Greenland, Philip, Carnethon, Mercedes R., Ning, Hongyan, Wilkins, John T., Lloyd-Jones, Donald M., Allen, Norrina B. "Associations of Processed Meat, Unprocessed Red Meat, Poultry, or Fish Intake With Incident Cardiovascular Disease and All-Cause Mortality." *JAMA Internal Medicine*, 2020.

2. Talaei, Mohammad, Wang, Ye-Li, Yuan, Jian-Min, Pan, An, Koh, Woon-Puay. "Meat, Dietary Heme Iron, and Risk of Type 2 Diabetes Mellitus: The Singapore Chinese Health Study." *American Journal of Epidemiology*, Volume 186, Issue 7, 1 October 2017, pp. 824–833.

3. World Cancer Research Fund/American Institute for Cancer Research. *Diet, Nutrition, Physical Activity and Cancer: a Global Perspective*. Continuous Update Project Expert Report 2018. Available at dietandcancerreport.org.

4. Zheng, Y., Li, Y., Satija, A., Pan, A., Sotos-Prieto, M., Rimm, E., et al. "Association of changes in red meat consumption with total and cause specific mortality among US women and men: two prospective cohort studies." *BMJ* 2019; 365:12110.

5. Heller, M.C. and Keoleian, G.A. "Beyond Meat's Beyond Burger life cycle assessment: A detailed comparison between a plant-based and an animal-based protein source." University of Michigan Center for Sustainable Systems; 14 September 2018.

6. Dettling, J., Tu, Q., Faist, M., DelDuce, A., Mandelbaum, S. "A comparative life cycle assessment of plant-based foods and meat foods." Quantis USA and MorningStar Farms; March 2016.

7. Khan, S., Dettling, J., Loyola, C., Hester, J., Moses, R. "Comparative Environmental Life Cycle Analysis of the Impossible Burger with Conventioanl Ground Beef Burger." Quantis USA and Impossible Foods; 27 February 2019.

8. Environmental Protection Agency. *Sources of Greenhouse Gas Emissions*. Published 9 September 2020. Retrieved 19 November 2020.

9. Teague, W.R., Apfelbaum, S., Lal, R., Kreuter, U.P., Rowntree, J., Davies, C.A., Conser, R., Rasmussen, M., Hatfield, J., Wang, T., Wang, F., Byck, P. "The role of ruminants in reducing agriculture's carbon footprint in North America." *J Soil and Water Conserv*. March 2016. 71(2):156–164.

10. Eshel, G., Stainier, P., Shepon, A., Swaminathan, A. "Environmentally Optimal, Nutritionally Sound, Protein and Energy Conserving Plant Based Alternatives to U.S. Meat." *Sci* Rep. 8 August 2019;9(1):10345. *Erratum in: Sci* Rep. 20 September 2019;9(1):13888.

11. Drewnowski, A., Rehm, C.D., Martin, A., Verger, E.O., Voinnesson, M., Imbert, P. "Energy and nutrient density of foods in relation to their carbon footprint." *Am J Clin Nutr.* January 2015;101(1):184–91.

12. Tessari, P., Lante, A., Mosca, G. "Essential amino acids: master regulators of nutrition and environmental footprint?" *Sci* Rep. 25 May 2016;6:26074.