

Bean Mythbusting





Beans is How

Beans are an incredibly nutrient-dense food that can simultaneously benefit human and environmental health. However, myths and misinformation about beans abound, which can have the unfortunate result of people eating less beans than is ideal. To increase bean intake - and thereby benefit public and planetary well-being - it is critical to address these myths with accurate information founded firmly in science.

Have you ever wondered if beans actually make you fart? Pondered if dry beans are better than canned beans? Or perhaps worried about nutrient quality and compounds in beans? Then you're in the right place. It's time for some bean mythbusting!

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Bean Mythbusting Topics

Flatulence

Do beans really cause flatulence? And is farting actually a bad thing?

Canned Beans Versus Dry beans

Are dry beans healthier than canned beans? And which is better for the environment?

Cooking Beans

Does it really take a long time to include beans in the diet, or are there convenient and delicious ways to do so?

Soaking

This section includes information on a very common question: Should you soak beans?

Bean Nutrition

- Protein quality - Are beans a good source of high quality protein?
- Carbohydrates in beans - Are beans high in carbohydrates?
- Iron in beans - Are beans a good source of bioavailable iron?

Antinutrients - What are these compounds, and are they actually of concern?

- Lectins
- Phytic acid

Is it okay to eat beans if I have...?

- Diabetes
- Gout
- Kidney stones



Common Misconceptions about Beans

Some people think beans are poor people's food, or just for vegetarians and vegans. Why is that not true?

Do Beans Cause Flatulence?

Concerns about flatulence from beans may be highly exaggerated. Many individuals do not experience increased flatulence, and those who do often have symptoms disappear within a 1 to 3 weeks of regularly eating beans.

Gas is natural - high-fiber, healthy diets feed our gut microbes, and gas is a natural byproduct of bacterial fermentation of compounds that are not digestible by human intestinal enzymes.

If you are concerned about flatulence associated with beans, there are several ways to help mitigate this, including: add beans to your diet slowly and give your body time to adapt to the healthy, higher fiber levels; soak dry beans and discard the soaking water to cook in fresh water; and try many types of beans - your body may react differently to different types.

Beans and Flatulence

Concerns about flatulence cause many people to avoid beans. However, the reality is that beans do not result in flatulence in all individuals, and even individuals who do experience gas when beginning to eat beans often have this symptom quickly disappear (Winham & Hutchins, 2011).

What in Beans May Cause Gas?

Certain compounds in beans are indigestible by human gastrointestinal enzymes, such as resistant starch, fermentable dietary fiber, and galactooligosaccharides (Brummer et al., 2015). These compounds are therefore fermented by bacteria in the gut, which can result in the release of gas (Thompson 2019).

Notably, it is also possible that simply believing that eating beans will cause flatulence can result in heightened attention and a perception of increased symptoms (Winham & Hutchins, 2011), even if that is not the case.



What Does the Research Say About Beans and Flatulence?

A paper published by Winham and Hutchins (2011) examined three studies where participants consumed a ½ cup of beans every day for approximately 2 to 3 months. In these studies, participants completed a weekly questionnaire that assessed gastrointestinal discomfort, asking about symptoms like flatulence and bloating.

What did the researchers find about beans and flatulence?

Less than half of participants experienced increased flatulence in the first week, and many of those who did have gas reported that it quickly dissipated. Seventy percent or more of those who indicated increased flatulence felt that it went away by the second or third week of regular, daily bean consumption. Reported increases in flatulence varied with the type of bean or other pulse. For example, fewer participants (only 19%) who consumed black-eyed peas reported increases in flatulence during the first week, when compared to participants eating other beans. Even 3 to 11% of people eating the control diet - which included canned carrots and not beans - reported increased flatulence. This suggests that food perceptions or other factors may play a role in reported increases in flatulence.

Why do symptoms of flatulence seem to disappear with regular bean consumption?

Recent work by Mego and colleagues (2017a) on the response of humans to galactooligosaccharides suggests that humans adapt to regular consumption of galactooligosaccharide prebiotics. The microbiota in the colon appears to adapt to the continued availability of the galactooligosaccharide, ultimately shifting the metabolism of the microbiota to pathways that produce less gas, in addition to absorbing a larger proportion of gas (Mego et al., 2017b).

Tips to Reduce Gas

Perhaps you are still concerned about beans causing gas. If so, here are several recommendations that may help minimize this issue: Remember that many people may not experience an increase in gas. Focusing on this issue may result in the perception of increased flatulence, even when there is not any difference.



Allow your body time to adapt. As the research outlined above suggests, many individuals who report increased flatulence upon first consuming beans on a daily basis quickly get used to this different, healthy diet. After a few weeks of maintained daily intake, most people perceive that flatulence returns to its normal levels. Any increases in flatulence you may experience are likely temporary! If it helps, you can also begin to add beans to your diet slowly, gradually increasing the amount you eat per day.

Try different types of beans. Responses to beans vary among individuals due to factors such as a person's gut associated microbiome. Furthermore, the body's reaction can vary with different types of beans or other pulses. Just because one type of bean does not seem to agree with you does not mean that will be the case for all beans, nor does it mean that your friend or family member will have the same response. Experiment to find what types work best for you.

Discard the soaking water. If cooking dry beans at home, discard the water in which you soak beans and cook them in new water. Research suggests that some amount of galactooligosaccharides (GOS), indigestible compounds associated with causing some flatulence, leach into the soaking water (Fernandes et al., 2010). Discarding this water and cooking in clean, fresh water minimizes the amount of GOS you consume. That being said, the GOS found in the soaking water are also prebiotics, meaning they can act as a good food source for gut microbes. Whether or not you discard the soaking water is a matter of personal choice and will depend on your individual concerns around flatulence vs the benefits of consuming additional prebiotics.

Remember, Gas Is Not a Bad Thing!

Beans are very nutrient-dense, with the nutritional benefits highly outweighing the possibility of short-term discomfort as the body adjusts to a healthful dietary pattern that includes beans on a regular basis. Moreover, flatulence is a normal part of human life. Just as we celebrate fermentation in food, we can celebrate fermentation in our guts, indicating that our intestinal microflora are well-fed and thriving, lively and diverse microflora is often cited as a cornerstone to many health benefits.



References for Beans & Flatulence:

1. Winham, Donna M., and Andrea M. Hutchins. "Perceptions of flatulence from bean consumption among adults in 3 feeding studies." *Nutrition journal* 10 (2011): 1-9.
(<https://nutritionj.biomedcentral.com/articles/10.1186/1475-2891-10-128>)
2. Fernandes, Ana Carolina, Waleska Nishida, and Rossana P. da Costa Proença. "Influence of soaking on the nutritional quality of common beans (*Phaseolus vulgaris* L.) cooked with or without the soaking water: a review." *International journal of food science & technology* 45.11 (2010): 2209-2218.
(<https://ifst.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2621.2010.02395.x>)
3. Thompson, Henry J. "Improving human dietary choices through understanding of the tolerance and toxicity of pulse crop constituents." *Current opinion in food science* 30 (2019): 93-97.
(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7449238/>)
4. Brummer, Yolanda, Mina Kaviani, and Susan M. Tosh. "Structural and functional characteristics of dietary fibre in beans, lentils, peas and chickpeas." *Food Research International* 67 (2015): 117-125.
(<https://www.sciencedirect.com/science/article/pii/S096399691400698X>)
5. A. Mego, M., et al. "Metabolic adaptation of colonic microbiota to galactooligosaccharides: a proof-of-concept-study." *Alimentary Pharmacology & Therapeutics* 45.5 (2017): 670-680.
(<https://onlinelibrary.wiley.com/doi/full/10.1111/apt.13931>)
6. B. Mego, M., et al. "Colonic gas homeostasis: Mechanisms of adaptation following HOST-G904 galactooligosaccharide use in humans." *Neurogastroenterology & Motility* 29.9 (2017): e13080.
(<https://onlinelibrary.wiley.com/doi/10.1111/nmo.13080>)



Dry Versus Canned Beans: Health and Environmental Impacts

- Dry beans cooked in the home and canned beans are both healthy options.
- Two of the main concerns about canned beans are sodium content and sauces with ingredients like added sugar. To minimize salt intake, choose canned beans with reduced-sodium or no salt added. To reduce added sugar and other ingredients that may be of concern, choose beans canned in water instead of a sugary sauce.
- Canned beans may have a slightly higher environmental impact than dry beans cooked in the home, primarily due to energy used in the canning process. However, both are environmentally friendly options with much smaller environmental impact than most sources of animal protein.

Dry Versus Canned Beans: Is One Healthier than the Other?

There is some discrepancy in the literature about the nutritional differences between canned and dry beans cooked in the home. Some studies claim that canning results in decreases in certain beneficial nutrients (Margier et al., 2018), while other studies suggest that canned beans demonstrate higher bioaccessibility (i.e., how accessible the nutrients in the beans are to our bodies) and mineral uptake (Faria et al., 2018). Despite slight differences, most studies agree that both home-cooked dry beans and canned beans are healthful choices.

A primary concern raised about canned beans is their high sodium levels (Zanovec et al., 2011). Indeed, one study by Mudryj and colleagues (2012) in 2012 on Canadian adults found that pulse consumers tended to have greater sodium intake, and the authors commented this may be due to sodium added during the processing of canned beans. However, these days it is relatively easy to purchase low-sodium or no salt added canned beans, which negates this concern. Furthermore, it is important to acknowledge that home cooks may also add salt when cooking beans, and this is generally not taken into account in studies of canned versus dry beans.

Both draining canned beans and draining followed by rinsing have been demonstrated to significantly reduce the sodium content of regular-sodium level canned beans. One study conducted by Duyff and colleagues (2011) on five different varieties of canned beans found that draining the beans reduced sodium content by 36%, and draining and rinsing resulted in an average reduction of 41%.

The Environmental Impact of Dry Versus Canned Beans

The environmental impact of canned beans versus dry beans cooked in the home can vary with many factors, such as sourcing and processing differences. A recent study by Henn and colleagues (2022) found that environmental impact varied with the type of pulse. Furthermore, the authors stated that canned pulses generally have a one- to fourfold higher environmental impact than dry beans cooked in the home.



Yet, the researchers make an important point that both dry and canned pulses are significantly more sustainable than animal proteins, which result in much higher greenhouse gas emissions. Regardless of whether the beans are canned or dry and cooked in the home, “increasing the general pulse consumption as an alternative to animal-based foods will have a greater impact on reducing climate and environmental impacts of food consumption” (Henn et al., 2022). This is because even though dry pulses cooked in the home can have a lower environmental impact than canned pulses, canned pulses are viewed as more convenient by many and therefore more likely to be actually consumed on a regular basis by consumers. Ultimately, the goal is to increase pulse consumption to advance sustainability and health.

Tidåker and colleagues (2021) assessed how origin, processing, and transport impacts the environmental footprint of pulses, focusing on Sweden. They determined that home cooking of dry pulses resulted in a lower environmental footprint than canned pulses. The authors reach a similar conclusion to Henn (2022) and also emphasize that canned pulses have an added benefit of convenience - it is essential to provide options that are easily accessible to consumers.

How Can Consumers Who Cook Dry Beans Reduce Their Environmental Impact?

A recent study by Bandekar and colleagues (2022) conducted a cradle-to-grave life cycle assessment (LCA) of the production and consumption of various pulses in the United States. This type of LCA evaluates the environmental impact from the extraction of resources for production through the consumption and ultimate disposal of the product.

The authors outlined that environmental impacts varied by the type of pulse. Furthermore, they found that the hotspot for environmental impact was the consumer stage, which included the purchasing of pulses, cooking, consumption, and associated waste. Three cooking methods were examined: 1.) cooking on the stovetop in an open cooking vessel, 2.) stovetop pressure cooking, and 3.) electric pressure cooking.

How can consumers reduce environmental impact when cooking dry pulses in the home?

- Cooking larger batches substantially reduces environmental impact, even after taking increased electricity use (including storage in the refrigerator/freezer and reheating in the microwave) and food waste into consideration. Although it takes more energy to bring a larger volume of water to a boil, the energy used to maintain a simmer remained similar for smaller and larger batches, thereby decreasing electricity consumption, normalized for the amount of pulses cooked (i.e., the energy consumption per gram of cooked pulse was much lower for large batches than for small batches).
- When preparing smaller batches (i.e., approximately 60 g, a number chosen to reflect actual weekly pulse intake), the electric pressure cooker had the lowest impact scores. This is due to improved energy efficiency and lower energy demand. When cooking larger batches (i.e., 1 kg), then the environmental impact of cooking in an open vessel was determined to be similar to smaller batches cooked in an electric pressure cooker.

In summary, this research determined that pulse variety, cooking method, and batch size all influence environmental impact. One way consumers can reduce their environmental impact is to cook larger batches of pulses, as this increases efficiencies.

Other Factors to Consider When Choosing Canned or Dry Beans

Impacts on health and the environment are often people's number one concern.

Beyond this, there are other factors to consider when selecting beans, including:

- **Convenience.** Canned beans are highly convenient. They store well and can be added directly to recipes without having to take time to soak and cook. If time is a concern but you want to use dry beans, see our section on cooking beans for tips to easily and quickly cook dry beans.
- **Cost.** Although cost varies with factors such as type of bean and brand, dry beans are generally cheaper than canned beans. However, there will be some energy costs associated with cooking dry beans in the home. Cooking larger batches of dry beans is one way to save on energy, as explained in the section on environmental impacts.



- **Control.** When working with dry beans, you control the ingredients you cook with, so it is easy to minimize or eliminate the use of salt, added sugars, and any other ingredients you may prefer to avoid. Similarly, you can add seasonings such as herbs during the cooking process if using dry beans, and you have more control over the final texture of the cooked beans. You can also select canned varieties that meet your dietary needs, such as those with low sodium and no or less sugar, if choosing a bean canned in a sauce.
- **Sourcing.** It may be easier to know where your beans are sourced from if you purchase dry beans over canned. Whereas you can purchase dry beans from a farmer or processor implementing farming practices you support or to benefit local food systems, sourcing information can be harder to find in canned beans.
- **Variety.** Generally, there is a much wider variety of dry bean types available than there are canned. However, canned bean companies are increasingly incorporating a wider variety of beans, including heirloom varieties such as Jacob's cattle (White et al., 2022).

Overall, dry beans cooked in the home and canned beans are both a healthy, environmentally-friendly staple to have in the home and include in our daily dietary patterns. Choose options that facilitate eating more beans, whether that be canned or cooked from dry, or a mix of both.



References for Canned Versus Dry Beans

1. Faria, Miguel A., et al. "Bioaccessibility and intestinal uptake of minerals from different types of home-cooked and ready-to-eat beans." *Journal of Functional Foods* 50 (2018): 201-209. (<https://www.sciencedirect.com/science/article/pii/S1756464618305127>)
2. Margier, Marielle, et al. "Nutritional composition and bioactive content of legumes: Characterization of pulses frequently consumed in France and effect of the cooking method." *Nutrients* 10.11 (2018): 1668. (<https://www.mdpi.com/2072-6643/10/11/1668>)
3. Michael, Zanovec, O'Neil Carol E, and Nicklas Theresa A. "Comparison of nutrient density and nutrient-to-cost between cooked and canned beans." *Food and Nutrition Sciences* 2011 (2011). (https://www.scirp.org/html/3-2700073_4521.htm)
4. Mudryj, Adriana N., et al. "Pulse consumption in Canadian adults influences nutrient intakes." *British Journal of Nutrition* 108.S1 (2012): S27-S36. (<https://www.cambridge.org/core/journals/british-journal-of-nutrition/article/pulse-consumption-in-canadian-adults-influences-nutrient-intakes/90DBE365654870C2CBE7E8BBE4685D5F>)
5. Duyff, Roberta L., John R. Mount, and Joshua B. Jones. "Sodium reduction in canned beans after draining, rinsing." *Journal of Culinary Science & Technology* 9.2 (2011): 106-112. (<https://www.tandfonline.com/doi/abs/10.1080/15428052.2011.582405>)
6. Bandekar, Prathamesh A., et al. "Cradle-to-grave life cycle assessment of production and consumption of pulses in the United States." *Journal of Environmental Management* 302 (2022): 114062. (<https://www.sciencedirect.com/science/article/pii/S0301479721021241>)
7. Henn, Katharina, et al. "The versatility of pulses: Are consumption and consumer perception in different European countries related to the actual climate impact of different pulse types?." *Future Foods* 6 (2022): 100202. (<https://www.sciencedirect.com/science/article/pii/S2666833522000880>)
8. Tidåker, Pernilla, et al. "Towards sustainable consumption of legumes: How origin, processing and transport affect the environmental impact of pulses." *Sustainable production and consumption* 27 (2021): 496-508. (<https://www.sciencedirect.com/science/article/pii/S2352550921000178>)
9. White, Brittany L., et al. "Processing and quality evaluation of canned dry beans." *Dry Beans and Pulses: Production, Processing, and Nutrition* (2022): 191-223. (<https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119776802.ch8>)



Cooking Beans: Time-Saving Tips to Easily and Deliciously Enjoy More Beans

- There are several tips to reduce bean cooking time, including soaking the beans, adding salt to the soaking and/or cooking water, and waiting to add acidic ingredients until the beans are cooked through.
- Fast-cooking varieties of beans can help improve time and fuel efficiency, and they may offer nutritional benefits as well.
- There are a variety of methods to cook beans that can fit within many consumer lifestyles, such as using a pressure cooker, slow cooker, or stovetop. You can also freeze extra beans to have them ready to use anytime.
- The increasing availability of pre-cooked beans and bean-based products is making it easier to include beans even when you do not have the time, equipment, or resources to cook your own from dry.

How to Cook Beans Faster

Long cooking times present a challenge to increasing bean consumption because of time availability and cooking fuel scarcity. Here are several tips and considerations to help shorten cooking time.

1. Soaking
2. Adding salt to the soaking and/or cooking water - adding salt (sodium chloride) helps reduce cooking time
3. Waiting to add acidic ingredients
4. Storing beans properly
5. Sourcing fresh beans
6. Selecting a pulse that fits your time availability - for example, lentils tend to cook more quickly and do not require soaking
7. Remembering that cooking time increases with elevation

Soaking Beans

Although you can cook beans without presoaking them, there are several potential benefits of soaking:

- **Faster cooking times.** Soaking beans and other pulses allows them time to soak up water before beginning the cooking process, which shortens cooking time (Bhokre & Joshi, 2015).
- **Soaking beans helps reduce antinutrients.** Soaking can help reduce the levels of certain antinutrients. The amount of the reduction depends on factors such as pulse variety. Soaking and discarding the soaking water can also reduce galactooligosaccharides, compounds which human gastrointestinal enzymes cannot break down, and may result in flatulence (Fernandes et al., 2010).
- **May improve texture.** Soaking can help prevent bean skins from splitting when cooking (Munthali et al., 2022).

Note that pulses like lentils and split peas are generally not soaked prior to cooking, and they still cook quickly.

Are There Fast-Cooking Beans?

Cooking time varies with factors such as type of pulse and age, with older beans generally taking longer to cook. One of the factors bean breeders consider when developing new varieties is cooking time, as they know that fast cooking is a desirable trait for consumers (Cichy et al., 2019).

In addition to improving time and cooking fuel efficiency, there is evidence of nutritional benefits for faster cooking beans, too. Researchers have found that fast-cooking dry beans tend to retain protein and minerals better than their slow-cooking counterparts within the same market class, i.e., type of bean. For example, Wiesinger and colleagues (2016) determined that a fast-cooking yellow bean variety offered 20% more protein and 10% more iron and zinc than a slow-cooking yellow bean variety. In addition, they found that the iron bioavailability, or amount of the iron available for the body to absorb and use, was higher in the fast-cooking varieties. A similar finding was made by Wiesinger and researchers (2021) in slow-darkening pintos, which cook 30% faster and can have 2 to 7 times more bioavailable iron as do regular-darkening pinto varieties. (As pinto beans age, they turn a darker color, but the slow-darkening pintos maintain their original color much longer.)

Cooking Methods

If you are preparing dry beans in the home - which is one way to help reduce your environmental impact - there are many ways to do so. Choose the cooking method(s) that best fits with your lifestyle. One way to help save time and mitigate environmental impact is by cooking larger batches and storing them in the refrigerator or freezer for later use, so you always have beans readily available to add to dishes (Bandekar et al., 2022).

Cooking methods that involve boiling the beans in water include:

- Stovetop.
- Pressure cooker (traditional or electric).
- Air fryer.
- Slow cooker.
- In an oven.
- Over an open fire.

Other Convenient and Delicious Ways to Eat Beans

More and more options are becoming available to easily add beans and other pulses to our diets. Of course, canned or jarred beans make a convenient pantry staple. Beans available in pouches or individually quick frozen (IQF) beans are also becoming more prevalent.

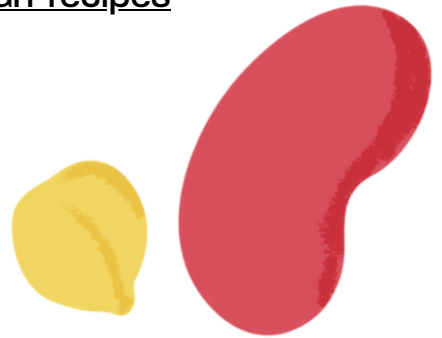
In addition to these choices that work as a direct substitute for dry beans cooked in the home, an increasing number of products that incorporate beans can be substituted for more traditional options. Some products are made with 100% pulses while others are a mix of pulses with other ingredients, like corn or wheat. Products include pulse flours and pastas, as well as pulse-based snacks such as chips or roasted fava beans or chickpeas.



Recipe Ideas

If you are looking for culinary inspiration, explore some of the recipes provided on our site and by some of our partners:

- Beans Is How: <https://beansishow.org/get-involved/>
- Bold Bean Co: <https://boldbeanco.com/blogs/beanspo-recipes>
- Hodmedod's: <https://hodmedods.co.uk/blogs/recipes>
- Heinz: <https://www.heinz.co.uk/beanz/recipes/100185000002>
- Bush Beans: https://www.bushbeans.com/en_US/bean-recipes



References for Cooking Beans

1. Martínez-Manrique, Enrique, et al. "Enzymatic changes in pectic polysaccharides related to the beneficial effect of soaking on bean cooking time." *Journal of the Science of Food and Agriculture* 91.13 (2011): 2394-2398. (<https://onlinelibrary.wiley.com/doi/full/10.1002/jsfa.4474>)
2. Coşkuner, Yalçın, and Erşan Karababa. "Effect of location and soaking treatments on the cooking quality of some chickpea breeding lines." *International journal of food science & technology* 38.7 (2003): 751-757. (<https://ifst.onlinelibrary.wiley.com/doi/abs/10.1046/j.1365-2621.2003.00727.x>)
3. Bhokre, C. K., and A. A. Joshi. "Effect of soaking on physical functional and cooking time of cowpea, horsegram and mothbean." *Food Science Research Journal* 6.2 (2015): 357-362. (http://researchjournal.co.in/upload/assignments/6_357-362.pdf)
4. Munthali, Justice, et al. "Soaking beans for 12 h reduces split percent and cooking time regardless of type of water used for cooking." *Heliyon* 8.9 (2022): e10561. (<https://www.sciencedirect.com/science/article/pii/S2405844022018497>)
5. Pirhayati, Mansoureh, Nafiseh Soltanizadeh, and Mahdi Kadivar. "Chemical and microstructural evaluation of 'hard-to-cook' phenomenon in legumes (pinto bean and small-type lentil)." *International journal of food science & technology* 46.9 (2011): 1884-1890. (<https://ifst.onlinelibrary.wiley.com/doi/epdf/10.1111/j.1365-2621.2011.02697.x>)
6. Yi, Jianyong, et al. "Detailed analysis of seed coat and cotyledon reveals molecular understanding of the hard-to-cook defect of common beans (*Phaseolus vulgaris* L.)." *Food Chemistry* 210 (2016): 481-490. (<https://www.sciencedirect.com/science/article/pii/S030881461630694X>)
7. Sadohara, Rie, et al. "The *Phaseolus vulgaris* L. Yellow Bean Collection: genetic diversity and characterization for cooking time." *Genetic Resources and Crop Evolution* 69.4 (2022): 1627-1648. (<https://link.springer.com/article/10.1007/s00122-015-2531-z>)
8. Cichy, Karen A., et al. "The role of genotype and production environment in determining the cooking time of dry beans (*Phaseolus vulgaris* L.)." *Legume Science* 1.1 (2019): e13. (<https://onlinelibrary.wiley.com/doi/full/10.1002/leg3.13>)
9. Wiesinger, Jason A., et al. "Demonstrating a nutritional advantage to the fast-cooking dry bean (*Phaseolus vulgaris* L.)." *Journal of agricultural and food chemistry* 64.45 (2016): 8592-8603. (<https://pubs.acs.org/doi/10.1021/acs.jafc.6b03100>)
10. Wiesinger, Jason A., et al. "Faster cooking times and improved iron bioavailability are associated with the down regulation of procyanidin synthesis in slow-darkening pinto beans (*Phaseolus vulgaris* L.)." *Journal of Functional Foods* 82 (2021): 104444. (<https://www.sciencedirect.com/science/article/pii/S1756464621000931>)
11. Bandekar, Prathamesh A., et al. "Cradle-to-grave life cycle assessment of production and consumption of pulses in the United States." *Journal of Environmental Management* 302 (2022): 114062. (<https://www.sciencedirect.com/science/article/pii/S0301479721021241>)
12. Fernandes, Ana Carolina, Waleska Nishida, and Rossana P. da Costa Proença. "Influence of soaking on the nutritional quality of common beans (*Phaseolus vulgaris* L.) cooked with or without the soaking water: a review." *International journal of food science & technology* 45.11 (2010): 2209-2218. (<https://ifst.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2621.2010.02395.x>)

Bean Nutrition

Beans are an incredibly nutrient-dense food, packed with dietary fiber, protein, and micronutrients (i.e., vitamins and minerals) such as potassium, iron, and B vitamins like folate. Plus, pulses are very low in fat and are cholesterol-free.

In this section on bean nutrition, we'll address three common questions we get about beans:

- Protein quality
- Carbohydrate quantity
- Iron bioavailability

Protein in Beans: Are Beans a Good Source of High Quality Protein?

- Beans and other pulses are a rich source of plant protein, with one serving ($\frac{1}{2}$ cup of cooked beans) providing about 7 grams of protein. This is generally at least double the amount seen in other grains.
- Beans are sometimes called an “incomplete protein” and people believe they are completely lacking some amino acids, which are the building blocks of protein. However, beans contain all 20 amino acids, they simply have relatively low amounts of some amino acids. This is why it is often recommended to eat beans with other grains, like rice or millet, which have different amino acid make-ups. You do not have to eat them during the same meal, just have a varied diet throughout the day and week.
- When plant proteins are eaten as part of a well-rounded diet, they can meet all protein requirements, even if animal proteins are not included.

Protein in Beans

Beans are generally composed of about 16-30% protein content (Messina, 2014; Azarpazhooch & Ahmed, 2022). This means that they generally contain at least double the amount of protein of many other grains, making beans an excellent source of plant protein (Marinangeli et al., 2017). In $\frac{1}{3}$ - $\frac{1}{2}$ cup of cooked beans, there are about 7 grams of protein (Didinger & Thompson, 2021), similar to the amount in 1 cup of milk. Conversely, the protein content of similar portions of grains is lower, with only about 2 grams of protein in rice, 2 grams in corn tortillas or grits, and 4 grams in whole wheat pasta (Didinger & Thompson, 2021).

The fact that beans are rich in protein is especially important as we look for more sustainable protein choices that can help mitigate climate change while simultaneously reversing protein malnutrition seen in some regions. Notably, the populations of many countries, like the United States, hyperfocus on protein consumption despite the risk of protein inadequacy being low (Katz et al., 2019).

Amino acids are the building blocks of proteins. Some amino acids - called essential or indispensable amino acids - cannot be synthesized by humans, thus we must eat foods rich in these amino acids. Whereas animal proteins are complete proteins, meaning they contain adequate amounts of all the essential amino acids, plant proteins tend to be incomplete proteins that contain inadequate amounts of one or more essential amino acids. This does not mean that plant foods are missing any amino acids because beans and other plant foods do contain all 20 amino acids, they just have relatively lower amounts of some of them (Katz et al., 2019). Indeed, plant-based foods can meet the required protein in healthy adults, even with the exclusion of animal protein, provided they are eaten as part of a varied, healthful diet (Mariotti et al, 2017; Katz et al, 2019).



Limiting Amino Acids and Protein Complementation

Beans tend to have low amounts of the sulfur-containing amino acids, methionine and cysteine, and sometimes tryptophan (Messina, 2014; Nosworthy et al., 2017). Of cysteine and methionine, methionine is the limiting essential amino acid, because our body can synthesize cysteine from methionine. Although beans do contain some methionine, it is generally available in relatively low amounts. This is why you will often hear the term “protein complementation” and the recommendation to eat beans and grains together. Grains like millet and rice are rich in methionine, but they tend to be lower in lysine, another essential amino (Anitha et al., 2020). Beans, on the other hand, are lysine-rich.

hus, eating beans with a grain like millet or rice results in consuming adequate amounts of all the essential amino acids, because the amino acids that are limiting in beans are available in adequate amounts in these grains, and vice versa.

It is important to note that although consuming beans and other grains together can be delicious and nutritious, you do not have to eat these foods in the same meal for protein complementation to work. Also, if you include animal proteins in your diet, these proteins are already providing adequate amounts of all the essential amino acids. Eating a diverse, varied diet throughout the day and week will ensure you get adequate amounts of all the essential amino acids. Also, when talking about protein quality, it is critical to not only consider amino acid composition, but the impacts of foods on public and environmental health. Emphasizing nutrient-dense, environmentally-friendly sources of protein and other nutrients - like beans - will play a key role in promoting more sustainable, healthy food systems (Katz et al., 2019).



References for Protein in Beans:

1. Messina, Virginia. "Nutritional and health benefits of dried beans." *The American journal of clinical nutrition* 100.suppl_1 (2014): 437S-442S. (https://academic.oup.com/ajcn/article/100/suppl_1/437S/4576589)
2. Azarpazhooh, Elham, and Jasim Ahmed. "Composition of Raw and Processed Dry Beans and Other Pulses." *Dry Beans and Pulses: Production, Processing, and Nutrition* (2022): 129-157. (<https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119776802.ch6>)
3. Marinangeli, Christopher PF, et al. "Enhancing nutrition with pulses: defining a recommended serving size for adults." *Nutrition reviews* 75.12 (2017): 990-1006. (<https://academic.oup.com/nutritionreviews/article/75/12/990/4675268>)
4. Didinger, Chelsea, and Henry J. Thompson. "Defining nutritional and functional niches of legumes: A call for clarity to distinguish a future role for pulses in the dietary guidelines for Americans." *Nutrients* 13.4 (2021): 1100. (<https://www.mdpi.com/2072-6643/13/4/1100>)
5. Katz, David L., et al. "Perspective: The public health case for modernizing the definition of protein quality." *Advances in Nutrition* 10.5 (2019): 755-764. (<https://www.sciencedirect.com/science/article/pii/S2161831322004276>)
6. Mariotti, François. "Plant protein, animal protein, and protein quality." *Vegetarian and plant-based diets in health and disease prevention*. Academic Press, 2017. 621-642. (<https://www.sciencedirect.com/science/article/pii/B9780128039687000356>)
7. Nosworthy, Matthew G., et al. "Impact of processing on the protein quality of pinto bean (*Phaseolus vulgaris*) and buckwheat (*Fagopyrum esculentum* Moench) flours and blends, as determined by in vitro and in vivo methodologies." *Journal of Agricultural and Food Chemistry* 65.19 (2017): 3919-3925. (<https://pubs.acs.org/doi/full/10.1021/acs.jafc.7b00697>)
8. Anitha, Seetha, Mahalingam Govindaraj, and Joanna Kane-Potaka. "Balanced amino acid and higher micronutrients in millets complements legumes for improved human dietary nutrition." *Cereal Chemistry* 97.1 (2020): 74-84. (<https://onlinelibrary.wiley.com/doi/full/10.1002/cche.10227>)



Carbohydrates in Beans: Are Beans High in Carbohydrates?

- Beans are a rich source of healthy carbohydrates.
- Beans are a low glycemic index food, which can help to avoid spikes in blood glucose levels and improve insulin sensitivity.
- The carbohydrate fraction of pulses includes dietary fiber and resistant starch, which are both associated with a wide variety of health benefits.

Carbohydrates in Beans

Approximately 50-60% of the content of beans is carbohydrates (Azarpazhooch & Ahmed, 2022). Some media headlines suggest this means that beans are too high in carbohydrates, but that is not true. Why? Carbohydrates are an important macronutrient that forms part of healthy diets, and moreover, the body responds differently to the carbohydrates present in beans than it does to those found in white bread, which contains little fiber and minimal beneficial nutrients.

Much of the carbohydrate fraction of pulses is composed of starch (Hall et al., 2017; Azarpazhooch & Ahmed, 2022). Based on how quickly glucose is released and absorbed in the gastrointestinal tract, starch is categorized into rapidly digestible starch, slowly digestible starch, and resistant starch (Azarpazhooch & Ahmed, 2022). The carbohydrate fraction also includes galactooligosaccharides and dietary fiber, which is associated with a wide variety of health benefits. Many people do not consume adequate amounts of dietary fiber, and as one of the richest natural sources of dietary fiber, beans can help reverse this trend.

Health Benefits of Bean Carbohydrates

The carbohydrates in beans are digested more slowly in the body, allowing for a slow release of energy and helping avoid spikes in blood glucose. Pulses have a low glycemic index (Didinger et al., 2022), which is a measure of how quickly a food causes blood glucose levels to increase (Harvard Health). White rice and white bread, on the other hand, have a high glycemic index. Diets with a low glycemic index have been found to reduce fasting blood glucose and can improve insulin sensitivity (Livesey et al., 2008). Importantly, a reduction in fasting blood glucose concentration may be better achieved by choosing low glycemic index and high-fiber foods than by decreasing carbohydrate intake (Livesey et al., 2008). Pulses provide just such a food choice.

Dietary fiber is indigestible carbohydrates associated with numerous benefits, including cholesterol attenuation, promotion of stable blood glucose levels, and laxation (Mudgil, 2017). There are many types of dietary fiber, and solubility is one way to categorize fiber. Beans contain both soluble and insoluble fiber. The high soluble fiber content of beans also contributes to them being good sources of slow release carbohydrates.

Slowly digestible starch has been associated with diabetes management, improved satiety, and helping stabilize glucose metabolism (Azarpazhooch & Ahmed, 2022). Resistant starch is also included in the definition of dietary fiber, as it is not digested and reaches the large intestine, becoming a source to feed gut microbes. Resistant starch has been found to function much like dietary fiber, and researchers are investigating its potential health benefits, which include colon cancer prevention, promotion of gut health, and cholesterol-lowering effects (Azarpazhooch & Ahmed, 2022). Furthermore, resistant starch slows the rate of glucose release into the bloodstream, helping avoid spikes in blood glucose levels (Crosby, 2015).

Overall, because dietary fiber and resistant starch are not metabolized in the small intestine, there is less glucose released into the blood, helping with glucose metabolism. Also, the caloric density of the food is lower, because part of the carbohydrate fraction is not readily digested by the body's gastrointestinal enzymes (Crosby, 2015). Between the healthy carbohydrates provided and the benefits of dietary fiber, pulses represent a nutrient-dense, healthful food.



References for Carbohydrates in Beans:

1. Azarpazhooh, Elham, and Jasim Ahmed. "Composition of Raw and Processed Dry Beans and Other Pulses." *Dry Beans and Pulses: Production, Processing, and Nutrition* (2022): 129-157. (<https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119776802.ch6>)
2. Hall, Clifford, Cassandra Hillen, and Julie Garden Robinson. "Composition, nutritional value, and health benefits of pulses." *Cereal Chemistry* 94.1 (2017): 11-31. (<https://onlinelibrary.wiley.com/doi/abs/10.1094/CCHEM-03-16-0069-FI>)
3. Harvard Health. Carbohydrates and blood sugar. <https://www.hsph.harvard.edu/nutritionsource/carbohydrates/carbohydrates-and-blood-sugar/>
4. Didinger, Chelsea, et al. "Nutrition and human health benefits of dry beans and other pulses." *Dry Beans and pulses: Production, processing, and Nutrition* (2022): 481-504. (<https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119776802.ch19>)
5. Livesey, Geoffrey, et al. "Glycemic response and health—a systematic review and meta-analysis: relations between dietary glycemic properties and health outcomes." *The American journal of clinical nutrition* 87.1 (2008): 258S-268S. (<https://academic.oup.com/ajcn/article/87/1/258S/4633425>)
6. Mudgil, Deepak. "The interaction between insoluble and soluble fiber." *Dietary fiber for the prevention of cardiovascular disease*. Academic Press, 2017. 35-59. (<https://www.sciencedirect.com/science/article/abs/pii/B9780128051306000033>)
7. Crosby, Guy. Legumes and resistant starch. Harvard Health (2015). <https://www.hsph.harvard.edu/nutritionsource/2015/11/16/ask-the-expert-legumes-and-resistant-star>



Iron in Beans: Is the Iron in Beans Bioavailable?

- Beans are a rich source of iron.
- Plant foods like beans contain non-heme iron, which is less bioavailable than the heme iron in meat, poultry, and seafood. Eating foods with non-heme iron along with vitamin C- or heme iron-rich foods can improve the body's ability to absorb non-heme iron.
- Cooking beans reduces antinutrients like phytic acid, which may otherwise bind to iron and make it less bioavailable to the body.

Iron

The mineral iron is critical in the body, including in the production of healthy red blood cells, which carry oxygen throughout the body (Harvard Health, 2023). Despite its importance, iron deficiency is common worldwide and can result in iron-deficiency anemia, which may lead to fatigue and lightheadedness. The number of women - who are at a greater risk - around the world with iron deficiency was nearly 571 million in 2019 (FAO, 2022). This can contribute to numerous female health challenges as well as adverse pregnancy outcomes.

Iron is available as both heme and non-heme iron (Harvard Health, 2023). Heme iron is only found in animal flesh (e.g., meat, poultry, seafood), whereas non-heme iron is found in plant foods, like beans. Non-heme iron is also found in fortified foods and animal flesh. Non-heme iron is not as bioavailable as heme iron. Beans are a rich source of non-heme iron, and eaten as part of a balanced diet they can help ensure populations around the world get the amount of iron required for healthy lives.

Improving the Absorption of Iron in Beans.

Cooking method can impact iron availability in beans. A recent study by Huertas and colleagues (2022) found that iron present in raw beans leached into the cooking water. Thus, one way to enhance mineral availability could be to include the bean cooking liquid in the final dish, for example by incorporating it into a sauce or broth.

Beans are rich in non-heme iron, which is not absorbed as well by the body as is heme iron. If iron status is a concern for you, here are some considerations about how food can impact the body's absorption of non-heme iron:

- Eating vitamin C and/or heme iron (available in meat, poultry, and seafood) at the same meal as non-heme iron can improve absorption (Heffernan et al., 2017; Harvard Health, 2023).
- Pay careful attention to how and when foods are eaten. Phytic acid, tannins, and high levels of calcium can inhibit absorption of iron. One recommendation is to avoid having coffee or tea with non-heme iron-rich foods, as this may reduce iron absorption (Harvard Health, 2023).

Bean Varieties with Higher Iron Bioavailability

Certain varieties of beans appear to have higher iron bioavailability than others. For example, Wiesinger and colleagues (2021) found that although slow-darkening and regular darkening pinto beans have similar iron content, the slow-darkening pinto beans have 2 to 7 times more bioavailable iron than their regular-darkening counterparts. Studies on major market classes of yellow bean also have revealed varieties with higher iron bioavailability. For instance, the Manteca yellow bean showed higher iron bioavailability than the other four yellow bean market classes to which it was compared in a recent study by Wiesinger (2018). It was also found to possess both a fast cooking genotype and higher iron retention after cooking.

As bean breeders find beans with naturally higher iron bioavailability and use traditional methods to breed this trait into new varieties, there is exciting potential to increase access to beans that can improve iron status of populations around the world.



References for Iron in Beans:

1. Harvard Health. Iron. Last reviewed March 2023.
<https://www.hsph.harvard.edu/nutritionsource/iron/>
2. FAO, IFAD, UNICEF, WFP and WHO. 2022. The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable. Rome, FAO. <https://doi.org/10.4060/cc0639en>
3. Huertas, Raul, et al. "Iron and zinc bioavailability in common bean (*Phaseolus vulgaris*) is dependent on chemical composition and cooking method." *Food Chemistry* 387 (2022): 132900. (<https://www.sciencedirect.com/science/article/abs/pii/S0308814622008627>)
4. Heffernan, A., et al. "The regulation of dietary iron bioavailability by vitamin C: A systematic review and meta-analysis." *Proceedings of the Nutrition Society* 76.OCE4 (2017). (<https://doi.org/10.1017/S0029665117003445>)
5. Wiesinger, Jason A., et al. "Faster cooking times and improved iron bioavailability are associated with the down regulation of procyanidin synthesis in slow-darkening pinto beans (*Phaseolus vulgaris* L.)." *Journal of Functional Foods* 82 (2021): 104444. (<https://www.sciencedirect.com/science/article/pii/S1756464621000931>)
6. Wiesinger, Jason A., et al. "The fast cooking and enhanced iron bioavailability properties of the Manteca yellow bean (*Phaseolus vulgaris* L.)." *Nutrients* 10.11 (2018): 1609. (<https://www.mdpi.com/2072-6643/10/11/1609>)



Antinutrients: What Are Antinutrients, and Are They Really a Concern?

- Beans - and other plant foods, which we know form the cornerstone of a healthy diet - contain compounds that have previously been called “antinutrients”, a word that sounds scary. However, cooking beans eliminates or reduces antinutrients, with the amount of reduction depending on factors like the type of bean, antinutrient, and cooking method.
- Many of these so-called antinutrients are also associated with health benefits, such as antioxidant activity and anti-cancer properties. “Bean bioactives” may be a better term!
- Lectin activity is eliminated with proper cooking of beans.
- Phytic acid is reduced with soaking and cooking of beans. Phytic acid is also associated with many benefits, including anticarcinogenic properties.

Antinutrients

Beans contain compounds called “antinutrients”, as do other plant foods, such as grains, nuts, and seeds (Petroski & Minich, 2020). Antinutrients play critical roles in plant health, including plant defense and nutrition storage during unfavorable growing conditions (Shi et al., 2018; Harvard Health, Anti-nutrients, 2022). When consumed by humans, these compounds can reduce the absorption of other nutrients present in foods, such as minerals like zinc and iron, hence the word antinutrients. So, are plant foods bad? On the contrary, we know that plant foods are the foundation of a healthy, sustainable diet. Moreover, scientists are discovering that these so-called antinutrients demonstrate a wide range of health-promoting, bioactive properties, including potential antioxidant, anticarcinogenic, and hypoglycemic properties (Campos-Vega et al, 2010; Petroski & Minich, 2020; Geraldo et al., 2022). This is an active area of research.

Antinutrients in Beans

It is well-established that processes such as soaking and cooking beans eliminate or reduce antinutrients, depending on the type of antinutrient. The percent reduction can vary with type of bean and processing methods. Lowering the content of antinutrients improves nutrient bioavailability in cooked pulses, and some level of certain antinutrients remaining may also relay health benefits.

Lectins

Lectins are carbohydrate-binding proteins that can cause negative side effects, such as diarrhea and reduced mineral absorption, when consumed in their active state. However, lectin activity can be completely eliminated by the cooking process, especially by wet, high-heat cooking, like boiling on the stovetop or using a pressure cooker. A combination of soaking and cooking appears to be the best way to reduce lectin activity. Studies demonstrate that 10-15 minutes of boiling eliminates the toxic activity of lectins, even for varieties that tend to have higher lectin content, such as red kidney beans. This type of cooking permanently denatures the lectins, meaning they are no longer in their active state and are safe to eat. Thus, provided you are eating properly cooked beans and not raw beans, lectins should not be a problem.

Overall, a narrative review by Petroski and Minich (2020) of antinutrients concluded that, "In their whole and cooked form, there is currently no strong evidence from human trials to support the claim that lectin-rich foods consistently cause inflammation, intestinal permeability, or nutrient absorption issues in the general population." Interestingly, there are also studies ongoing about potential health benefits of lectins, including anticarcinogenic properties.

Phytic Acid

Phytic acid, or phytates, may inhibit the absorption of nutrients like iron, zinc, and calcium. However, phytic acid also is actively being studied for its ability to protect against DNA damage, as well as its potential to prevent cancer cell growth. Moreover, phytic acid may prevent kidney stone formation because it inhibits calcium crystal buildup, which can contribute to kidney stones.

Generally, if you are consuming a varied diet rich in plant-based and some animal foods, phytic acid is not a concern. However, those at risk for nutrient deficiencies of iron, zinc, and calcium may need to take more precautions. One option is to consider the timing of when you eat certain foods. For example, eat iron- and zinc-rich foods at a different time than foods high in phytic acid, to minimize negative impacts on mineral absorption. It is important to recognize that traditional preparation methods for beans and other legumes already reduce phytic acid content. Soaking, sprouting, fermenting, and cooking may all help reduce phytic acid. There is also research ongoing about pulse varieties with low levels of phytic acid.



Summary of Antinutrients

Overall, the current view is that although plant foods - like beans - may contain minimal amounts of antinutrients after cooking, the health benefits of these foods far outweigh the potential negative effects. As research continues to emerge about the health benefits of antinutrients, it may be appropriate to consider renaming them “bean bioactives” when referring to their presence in beans.

References for Antinutrients

1. Petroski, Weston, and Deanna M. Minich. "Is there such a thing as "anti-nutrients"? A narrative review of perceived problematic plant compounds." *Nutrients* 12.10 (2020): 2929. (<https://www.mdpi.com/2072-6643/12/10/2929>)
2. Shi, Lan, Susan D. Arntfield, and Michael Nickerson. "Changes in levels of phytic acid, lectins and oxalates during soaking and cooking of Canadian pulses." *Food Research International* 107 (2018): 660-668. (<https://www.sciencedirect.com/science/article/pii/S0963996918301492>)
3. Harvard Health. Are anti-nutrients harmful? Last reviewed January 2022. (<https://www.hsph.harvard.edu/nutritionsource/anti-nutrients/>)
4. Campos-Vega, Rocio, Guadalupe Loarca-Piña, and B. Dave Oomah. "Minor components of pulses and their potential impact on human health." *Food research international* 43.2 (2010): 461-482. (<https://www.sciencedirect.com/science/article/pii/S0963996909002695>)
5. Geraldo, Rafaela, et al. "Widening the perspectives for legume consumption: The case of bioactive non-nutrients." *Frontiers in plant science* (2022): 56. (<https://www.frontiersin.org/articles/10.3389/fpls.2022.772054/>)
6. Lectins. Harvard Health. Last reviewed January 2022. (<https://www.hsph.harvard.edu/nutritionsource/anti-nutrients/lectins/>)
7. Nciri, Nader, et al. "Toxicity assessment of common beans (*Phaseolus vulgaris* L.) widely consumed by Tunisian population." *Journal of medicinal food* 18.9 (2015): 1049-1064. (<https://www.liebertpub.com/doi/10.1089/jmf.2014.0120>)
8. Kumar, Sandeep, et al. "Clinical complications of kidney bean (*Phaseolus vulgaris* L.) consumption." *Nutrition* 29.6 (2013): 821-827. (<https://www.sciencedirect.com/science/article/pii/S0899900712004339>)
9. Curhan, Gary C., et al. "Dietary factors and the risk of incident kidney stones in younger women: Nurses' Health Study II." *Archives of internal medicine* 164.8 (2004): 885-891. (<https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/216978>)
10. Hummel, Marijke, et al. "Iron, zinc and phytic acid retention of biofortified, low phytic acid, and conventional bean varieties when preparing common household recipes." *Nutrients* 12.3 (2020): 658. (<https://www.mdpi.com/2072-6643/12/3/658>)

Beans and Health Concerns: Is It Okay to Eat Beans If...?

Disclaimer: This resource is for informational purposes only and does not contain medical advice. Seek the advice of a physician for any questions you have about a medical condition or treatment, or undertaking changes to your healthcare regimen.

People worried about certain health concerns may wonder if beans can be included in their diet. Here is what the research says about the following:

- Diabetes
- Gout
- Kidney stones

Beans and Diabetes: Is It Okay to Eat Beans if You Have Diabetes?

The high-fiber and low glycemic index of beans can be beneficial for diabetes prevention and management.

Numerous studies suggest that pulses may play a role in helping with diabetes management and prevention.

Diabetes

Rates of diabetes are increasing globally among both adults and children, with prevalence rising more quickly in low- and middle-income nations than high-income nations. Diabetes occurs when the pancreas does not produce adequate amounts of insulin - a hormone that regulates blood glucose - or when the body cannot effectively use insulin. A common effect of diabetes that is not controlled is elevated blood glucose (also called blood sugar), which can result in serious damage to the body over time. Maintaining a normal body weight and eating a healthy diet are two primary ways to help prevent type 2 diabetes.

Research on the Effects of Beans on Diabetes

Nutrition studies are challenging to conduct in such a way that the exact effect of one type of food is proven. This is due to several reasons, including challenges with data collection, study length, and the fact that foods are consumed as part of a larger diet and eaten as part of a lifestyle. Thus, there is some conflicting evidence about the exact role of pulses in diabetes. Several studies have failed to find evidence of a significant association between legume intake and diabetes. Yet, many other studies have found positive effects of legume consumption.

or example, a study by Becerra-Tomas and colleagues (2018) revealed that the group with the highest total legume and lentil intake had a decreased diabetes risk. The same researchers also found that substituting a mere half-serving of legumes for a half-serving of different protein- or carbohydrate-rich foods (like eggs and potatoes, respectively) was also associated with a lower risk for diabetes. A meta-analysis conducted by Sievenpiper and colleagues (2009) found that pulses alone, or as part of low-glycemic index or high-fiber diets, could improve markers of glycemic control, such as lowered fasting blood glucose levels. Benefits were even stronger in individuals with diabetes.

A review article by Ramdath and colleagues (2016) on the role of pulses in management of diabetes found that a single serving of pulses can help attenuate postprandial blood glucose responses. Even at lower doses, the researchers explain that pulses are better at attenuating postprandial glucose than are other starchy foods. They also found that pulse consumption of 5 cups a week may offer improvements in glycemic control. Moreover, as pulses can contribute to satiety, they can help regulate body weight, and maintaining a healthy body weight is directly tied to diabetes management. Overall, the authors argue that there is solid support for regularly eating pulses to help prevent and manage diabetes.

Should Individuals with Diabetes Eat Beans?

Many organizations recommend that individuals with diabetes and/or insulin resistance eat beans to help with blood glucose management. This is largely due to the high-fiber content and low glycemic index of pulses. Indeed, the literature suggests that high fiber intake is associated with a reduced risk for type 2 diabetes. Also, research suggests that switching from high glycemic index to low glycemic index foods can improve insulin sensitivity in individuals with and without diabetes, as well as in overweight and obese individuals. Insulin sensitivity reflects how sensitive the body is to insulin. When an individual has impaired insulin sensitivity, or insulin resistance, then insulin is less effective and glucose levels build up in the blood.

A study by Thompson and colleagues (2012) found that eating white rice and beans together - a tradition in many countries around the world - attenuated the body's glycemic response when compared to rice alone. This suggests that dietary practices that incorporate beans may help with management of blood glucose.

Overall, although research is ongoing, beans are often recommended as a healthful food for people with diabetes, and they may even help prevent and manage diabetes.

Beans & Diabetes References

1. World Health Organization. Diabetes. 2023. <https://www.who.int/news-room/fact-sheets/detail/diabetes>
2. Dinger, Chelsea, et al. "Nutrition and human health benefits of dry beans and other pulses." *Dry Beans and pulses: Production, processing, and Nutrition* (2022): 481-504. (<https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119776802.ch19>)
3. Becerra-Tomás, Nerea, et al. "Legume consumption is inversely associated with type 2 diabetes incidence in adults: A prospective assessment from the PREDIMED study." *Clinical Nutrition* 37.3 (2018): 906-913. (<https://www.sciencedirect.com/science/article/abs/pii/S0261561417301061>)
4. Sievenpiper, J. L., et al. "Effect of non-oil-seed pulses on glycaemic control: a systematic review and meta-analysis of randomised controlled experimental trials in people with and without diabetes." *Diabetologia* 52 (2009): 1479-1495. (<https://pubmed.ncbi.nlm.nih.gov/19526214/>)
5. Ramdath, Dan, Simone Renwick, and Alison M. Duncan. "The role of pulses in the dietary management of diabetes." *Canadian Journal of Diabetes* 40.4 (2016): 355-363. (<https://www.sciencedirect.com/science/article/abs/pii/S1499267116300922>)
6. Harvard Health. Carbohydrates and blood sugar. <https://www.hsph.harvard.edu/nutritionsource/carbohydrates/carbohydrates-and-blood-sugar/>
7. Livesey, Geoffrey, et al. "Glycemic response and health—a systematic review and meta-analysis: relations between dietary glycemic properties and health outcomes." *The American journal of clinical nutrition* 87.1 (2008): 258S-268S. (<https://academic.oup.com/ajcn/article/87/1/258S/4633425>)
8. Thompson, Sharon V., Donna M. Winham, and Andrea M. Hutchins. "Bean and rice meals reduce postprandial glycemic response in adults with type 2 diabetes: a cross-over study." *Nutrition Journal* 11.1 (2012): 1-7. (<https://nutritionj.biomedcentral.com/articles/10.1186/1475-2891-11-23>)



Beans and Gout: Is It Okay to Eat Beans if You Have Gout?

/ Can Beans Cause Gout?

- Beans are not associated with an increased risk for gout. In fact, studies suggest that beans may even have a protective effect against gout.
- Dietary risk factors associated with an increased risk for gout include high red meat, seafood, and alcohol consumption, but not vegetable protein intake.

Beans and Gout

Beans are not associated with an increased risk of gout. But before we dive into the research on that, what exactly is gout?

What Is Gout, and What Causes It?

Gout is a form of arthritis that can affect anyone, and the resulting acute inflammation in one or more joints is very painful. The buildup of uric acid crystals in the body is the cause of the inflammation. These crystals can accumulate in the joint when uric acid levels in the blood are high, although high concentrations (i.e., hyperuricemia) do not always result in a gout attack. The body produces uric acid when it breaks down purines, substances found naturally in the body and in certain types of foods. Uric acid normally passes through the body, but if there is high production or low excretion, uric acid levels can build up.

There are several risk factors for gout - meaning factors that may make someone more likely to develop gout - including being overweight, being male, a family genetic history of gout, and diet. Years ago, the recommendation to prevent gout was to follow a purine-restricted diet. However, these diets are difficult to maintain and were not found to be very effective. Therefore, the current recommendation is to lose weight, minimize red meat and seafood, and reduce sugary beverage and alcohol intake, especially beer. Yet, the older advice to restrict purines is still circulating, which begs the question: do purine-rich vegetables, like beans, cause gout?

What Does the Research Say About Beans and Gout?

A study by Choi and colleagues (2004) examined this very question. The authors conducted a prospective study where they followed more than 47,000 men over 12 years. At the start of the study, the men had no history of gout, and the research team examined the relationship between dietary risk factors and the development of new cases of gout. Whereas high levels of meat (in particular beef, pork, and lamb) and seafood consumption were associated with an increased risk of gout, total protein intake and the level of intake of purine-rich vegetables (including beans, lentils, and peas) was not associated with an increased risk. Interestingly, the results even suggested that protein from vegetable sources may have a protective effect against gout.

Other research supports these findings. In the Shanghai Men's Health Study conducted by Villegas and colleagues (2012), roughly 4,000 men aged 40 to 74 years were evaluated in a cross-sectional study to investigate associations between high purine-content foods and the prevalence of hyperuricemia. No association was found between consumption of purine-rich vegetables and the prevalence of hyperuricemia.

Similarly, in a meta-analysis and systematic review by Li and colleagues (2018), the authors examined 19 studies to assess the impacts of diet on risk of gout and hyperuricemia. Foods that were associated with an increased risk of hyperuricemia and gout included red meat, seafood, fructose, and alcohol. In contrast, intake of dairy products and soy foods correlated with a reduced risk for hyperuricemia and gout. No association was found between high purine-vegetables and hyperuricemia, but high-purine vegetables did demonstrate a negative association with gout, meaning they were associated with a decreased risk for gout.

Why do scientists think there is a difference in the effects between different purine-rich foods? For one, there is somewhat limited knowledge on the actual level of purines in foods, especially after cooking or processing. Additionally, the bioavailability of purines may vary between different foods. For example, purines in animal-based foods may be more bioavailable to be processed and broken down into uric acid than the purines in plant-based foods.

Beans & Gout References:

1. Mayo Clinic. Gout. <https://www.mayoclinic.org/diseases-conditions/gout/symptoms-causes/syc-20372897>
2. Harvard Health. All About Gout. 2023. https://www.health.harvard.edu/newsletter_article/all-about-gout
3. Choi, Hyon K., et al. "Purine-rich foods, dairy and protein intake, and the risk of gout in men." *New England Journal of Medicine* 350.11 (2004): 1093-1103. (<https://www.nejm.org/doi/full/10.1056/nejmoa035700>)
4. Villegas, Raquel, et al. "Purine-rich foods, protein intake, and the prevalence of hyperuricemia: the Shanghai Men's Health Study." *Nutrition, Metabolism and Cardiovascular Diseases* 22.5 (2012): 409-416. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3150417/>)
5. Li, Rongrong, Kang Yu, and Chunwei Li. "Dietary factors and risk of gout and hyperuricemia: a meta-analysis and systematic review." *Asia Pacific Journal of Clinical Nutrition* 27.6 (2018): 1344-1356. (<https://pubmed.ncbi.nlm.nih.gov/30485934/>)



Beans and Kidney Stones: Can Eating Beans Contribute Kidney Stones?

- If you have calcium oxalate kidney stones, your doctor may recommend avoiding high oxalate foods. However, many oxalate-rich foods, like some beans, also contribute to health and excluding them can have negative health consequences.
- Soaking and cooking beans reduces their oxalate content.

Kidney Stones and Oxalates

Calcium oxalate stones are the most common type of kidney stone. They can form when there is a high amount of oxalates in the urine, which may then attach to calcium and form crystals. One recommendation that may help prevent stone formation is to drink water to dilute the urine, preventing oxalates from collecting. Timing of food intake may also be important. For instance, eating oxalate- and calcium-rich foods together can result in oxalate and calcium binding in the stomach, with oxalate consequently not being absorbed into the body.

Oxalates in Beans

Many beans contain oxalic acid, the salts of which (i.e., oxalic acid bound to a mineral) are called oxalates. The ability of oxalic acid to bind to minerals like calcium reduces the bioavailability of these minerals, or the amount available to the body. However, research has shown that soaking and cooking beans reduces oxalate content, with the amount of reduction varying between types of pulses. Therefore, simply by cooking beans, you are reducing the level of oxalates.

Beans and Kidney Stones: A Role in Prevention?

Notably, phytic acid - which is also present in beans - may reduce the risk of kidney stone formation by binding tightly to calcium, thereby preventing calcium oxalate stones from forming.

One recent study by Jalal and colleagues (2020) found a bean extract to be an effective management strategy for individuals with kidney stones, for instance by increasing urinary volume, which could help eliminate stones and prevent new stone formation. In addition, a review by Ferraro and colleagues (2020) on the influence of dietary patterns on kidney stone risk summarized that, "Available scientific evidence agrees on the harmful effects of high meat/animal protein intake and low calcium diets, whereas high content of fruits and vegetables associated with a balanced intake of low-fat dairy products carries the lowest risk for incident kidney stones.

Overall, research on the role of oxalate-rich foods - like some pulses - and kidney stones is ongoing. Consult with your physician about any dietary changes.

Beans & Kidney Stones References

1. Harvard Health. Are anti-nutrients harmful? Last reviewed January 2022. <https://www.hsph.harvard.edu/nutritionsource/anti-nutrients/>
2. Curhan, Gary C., et al. "Dietary factors and the risk of incident kidney stones in younger women: Nurses' Health Study II." Archives of internal medicine 164.8 (2004): 885-891. (<https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/216978>)
3. Shi, Lan, Susan D. Arntfield, and Michael Nickerson. "Changes in levels of phytic acid, lectins and oxalates during soaking and cooking of Canadian pulses." Food Research International 107 (2018): 660-668. (<https://www.sciencedirect.com/science/article/pii/S0963996918301492>)
4. Jalal, Sahbanathul Missiriya, et al. "Effect of Phaseolus Vulgaris on urinary biochemical parameters among patients with kidney stones in Saudi Arabia." Nutrients 12.11 (2020): 3346. (<https://www.mdpi.com/2072-6643/12/11/3346>)
5. Ferraro, Pietro Manuel, et al. "Risk of kidney stones: influence of dietary factors, dietary patterns, and vegetarian–vegan diets." Nutrients 12.3 (2020): 779. (<https://www.mdpi.com/2072-6643/12/3/779>)



Are Beans for Everyone, or Only Certain Groups?

- Beans are sometimes viewed as “poor person’s food” or perceived as food for vegetarians. This negative stigma is a barrier to enjoying more beans and reaping the benefits.
- On the contrary, beans are a perfect food choice for conscious consumers who want to advance public and environmental health.
- As the pulse category expands, affordable options still abound, but high-end and value-added options are becoming more and more prevalent.
- Beans can be an important staple in your diet, regardless of whether you are vegetarian or not. Beans are packed with plant-based protein and other nutrients like potassium. Importantly, they are also one of the best natural sources of dietary fiber, which is not present in animal proteins.

Common Misconceptions About Beans

Unfortunately, some people associate beans with poverty (Palmer et al., 2018) or view them as a food for only vegetarians and vegans, not for those who eat meat (Melendrez-Ruiz., 2019). However, with the increasing development of the pulse food category, there is a wide range of beans and bean products available, ranging from options with more affordable price points to very high-end items. Moreover, beans can be just as much a satiating, healthy part of the diets of omnivores and pescatarians as they are for vegetarians and vegans. Chefs and the food industry can play a role in helping shift the narrative by highlighting the deliciousness and culinary versatility of beans, including on high-end menu items.

Are Beans a Poor Person’s Food?

Beans are known to be affordable, and this is one of their critical benefits that allows them to more equitably promote nutrition security (Loke et al., 2016; Rawal & Navarro, 2019). But, as the pulse market category expands, luxury choices are also becoming more of an option. For instance, companies like Rancho Gordo, Bold Bean Co, and others offer a premium bean product with a much higher price point than the average bag or can of beans available in the grocery store.

Similarly, value-added products that include pulse flours or ingredients often demand a higher price than their non-pulse counterparts (Kim & Kuo, 2022). For example, pulse-based cereals, chips, and pastas are more expensive by several fold than the non-pulse versions. Part of the ability to demand a higher price for these items is due to the improved nutritional profile, with higher protein and fiber. Companies also often advertise the associated human and environmental health benefits afforded by beans on their packaging and websites (Amin & Borchgrevink, 2022).

Are Beans Only for Vegetarians?

Beans can be an important staple in your diet, regardless of whether you are vegetarian or not. Beans are packed with plant-based protein and other nutrients like potassium (Mitchell et al., 2021). Importantly, they are also one of the best natural sources of dietary fiber, which is not present in animal proteins (Didinger & Thompson, 2021).

For those who eat animal proteins, adding beans to a meat-based dish has the benefit of boosting dietary fiber, as well as helping save money because it helps stretch the meat, which is generally more expensive than beans (Didinger & Thompson, 2020). Whether a dish is completely bean-based or a mix of beans and meat, beans are a satiating and delicious option. In fact, research suggests that high-protein bean-based meals can be more satiating than high-protein meat-based meals. In a study by Kristensen and colleagues (2016), even lower protein bean-based meals demonstrated the same satiety (i.e., fullness) and palatability as did animal-based high-protein meals. This could be due to the high-fiber profile of beans.

Overall, shifting to a more plant-based diet rich in beans can help reduce environmental impact, all while being satiating and delicious.



Resources for Beans Are for All:

1. Palmer, Shelly M., et al. "Socio-ecological barriers to dry grain pulse consumption among low-income women: A mixed methods approach." *Nutrients* 10.8 (2018): 1108. (<https://www.mdpi.com/2072-6643/10/8/1108>)
2. Melendrez-Ruiz, Juliana, et al. "French consumers know the benefits of pulses, but do not choose them: An exploratory study combining indirect and direct approaches." *Appetite* 141 (2019): 104311. (<https://pubmed.ncbi.nlm.nih.gov/31173775/>)
3. Didinger, Chelsea, and Henry Thompson. "Motivating pulse-centric eating patterns to benefit human and environmental well-being." *Nutrients* 12.11 (2020): 3500. (<https://www.mdpi.com/2072-6643/12/11/3500>)
4. Loke, Atul, et al. *Pulses: nutritious seeds for a sustainable future*. Food & Agriculture Organization on the United Nations, 2016. (<https://www.fao.org/publications/card/en/c/3c37a47f-228c-4bdc-b8a5-593759464eb4/>)
5. Rawal, Vikas, and Dorian Kalamvrezos Navarro. "The global economy of pulses." (2019). (<https://www.fao.org/documents/card/en/c/i7108en>)
6. Kim, Sun-Hwa, and Wan-Yuan Kuo. "The Role of Beliefs, Pride, and Perceived Barriers in Decision-Making Regarding Purchasing Value-Added Pulse Products among US Consumers." *Foods* 11.6 (2022): 824. (<https://www.mdpi.com/2304-8158/11/6/824>)
7. Amin, Samir, and Carl P. Borchgrevink. "A Culinology® perspective of dry beans and other pulses." *Dry beans and pulses: Production, processing, and nutrition* (2022): 453-480. (<https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119776802.ch18>)
8. Mitchell, Diane C., et al. "Pulse intake improves nutrient density among US adult consumers." *Nutrients* 13.8 (2021): 2668. (<https://www.mdpi.com/2072-6643/13/8/2668>)
9. Didinger, Chelsea, and Henry J. Thompson. "Defining nutritional and functional niches of legumes: A call for clarity to distinguish a future role for pulses in the dietary guidelines for Americans." *Nutrients* 13.4 (2021): 1100. (<https://www.mdpi.com/2072-6643/13/4/1100>)
10. Kristensen, Marlene D., et al. "Meals based on vegetable protein sources (beans and peas) are more satiating than meals based on animal protein sources (veal and pork)—a randomized cross-over meal test study." *Food & Nutrition Research* 60.1 (2016): 32634. (<https://www.tandfonline.com/doi/full/10.3402/fnr.v60.32634>)

