



# SOY AND SUSTAINABLE NUTRITION

Cultural, environmental, nutritional, and socioeconomic considerations associated with plant-based eating patterns that include soy

**SoyConnection**  
By U.S. Soy

# Sustainable Nutrition

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It is widely known that diet plays a part in overall health, but statistics speak to the vital role of nutrition.

Globally, one in three individuals is affected by at least one form of malnutrition such as hunger, stunting, wasting, micronutrient deficiencies, overweight and/or obesity as well as resulting diet-related, chronic diseases.<sup>1</sup>

The leading causes of death, disability, and drivers of annual health care costs in the U.S. include chronic diseases such as heart disease, cancer, diabetes and others. Six in ten adults in the U.S. have one chronic disease, and four in ten adults have two or more.<sup>2</sup>

The need for wider accessibility to nutritious foods is compounded by environmental concerns. By 2050, we'll need to produce 60 percent more food using fewer resources<sup>3</sup>.

We have less land to grow food, more people in need of nutrient-dense foods, increased prevalence of chronic diseases, and growing concerns about our global climate. It's a complex challenge which is why understanding how food is grown, the environmental impact of production processes, and how eating patterns support food security is as important as knowing the nutritional quality of the food on your plate.

**Sustainable nutrition is the concept of a healthy eating pattern being accessible, affordable, and culturally relevant while also preserving planetary resources.**



## According to the Food and Agriculture Organization (FAO), sustainable diets have four dimensions:<sup>4</sup>

### **Nutrition and Health:**

Nutritionally adequate, safe, and helps reduce the risk of chronic diseases

### **Economic:**

Accessible and affordable for the individual

### **Environmental:**

Low environmental impact and supports planetary health

### **Social and Cultural:**

Appropriate for an individual's socio-cultural beliefs and background

Decisions about what we eat and the dietary patterns we recommend to our patients and clients can support health across the lifespan while also promoting positive change for future generations.

With these considerations in mind, it is imperative that healthcare professionals are aware of the nutritional and environmental benefits as well as the accessibility of U.S. grown soy. U.S. grown soy is a powerful source of nutrition that helps people, animals, and economies grow. It is a fundamental ingredient in sustainable diets. Soy supports food security, plays a role in a variety of eating styles, is sustainably grown, and provides high-quality protein along with other important nutrients.

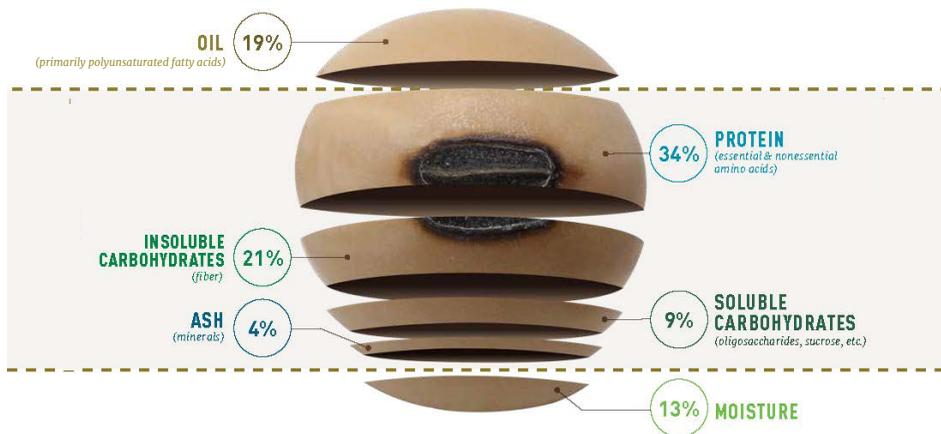
*“Considering the detrimental environmental impact of current food systems, and the concerns raised about their sustainability, there is an urgent need to promote diets that are healthy and have low environmental impacts. These diets also need to be socio-culturally acceptable and economically accessible for all.”*

**- FAO Sustainable Healthy Diets Guiding Principles<sup>2</sup>**



# Soy, Nutrition, and Health

The soybean's nutrient profile makes the legume a popular choice for use in food products, and a key contributor to health.



## High-Quality Plant Protein, Favorable Fatty Acid Profile, Plus Other Beneficial Nutrients

Protein accounts for over one-third of a soybean's weight. Soy is the only plant protein comparable in quality to animal protein. A complete protein, soy provides all nine essential amino acids, in the amounts needed by the body.<sup>5</sup> As such, soy foods, soy protein ingredients, and soy-based products have high protein digestibility corrected amino acid scores (PDCAAS) and digestible indispensable amino acid scores (DIAAS), two methods that are used to measure protein quality.

	Protein digestibility corrected amino acid scores (PDCAAS) <sup>†6,7</sup>	Digestible indispensable amino acid score (DIAAS) <sup>†6,8</sup>
Soy Protein Isolate	1.00	0.90
Soy Protein Concentrate	0.65-0.90	0.88
Pea Protein Concentrate	0.89	0.82
Milk Protein Concentrate	1.00	1.18
Whey Protein Concentrate	1.00	0.97
Whey Protein Isolate	1.00	1.09
Cooked Ground Beef	0.92	0.99-1.10
Eggs	1.00	1.01
Cooked Kidney Beans	0.65	0.59
Soy Milk	-	1.17
Cooked Rice	0.62	0.60
Tofu	-	0.97
Soy-based Burger	-	1.07
Pea-based Burger	-	0.83

<sup>†</sup> Protein Digestibility Corrected Amino Acid Score (PDCAAS) is a method of evaluating protein quality based on the amount of essential amino acids in the food as well as amino acid requirements of humans and our ability to digest the amino acids. While PDCAAS was adopted by the FDA and, FAO/WHO in 1993 as the preferred method to determine protein quality, new research has since provided more data, and limitations of this evaluation have been recognized. In 2013, the FAO proposed using the Digestible Indispensable Amino Acid Score (DIAAS) instead which is viewed as a superior measure that compares amino acid digestibility to age-specific amino acid requirements. The maximum value using the PDCAAS method is 1.0 whereas DIAAS values can go beyond 1.0 which is argued to be a more accurate reflection of quality.

Soybeans are used to create [various protein ingredients for the food industry including](#) soy protein isolate, soy protein concentrate, textured soy protein (also known as textured vegetable protein or TVP), and soy flour which are widely used by the food industry in products such as protein bars, breads, baked goods, and plant-based meat alternatives.

Foods made from soybeans, like tofu, tempeh, natto, soynut butter, and soy milk, not only offer a complete protein source but beneficial polyunsaturated fats. In contrast to other legumes, which are nearly fat free, approximately 20% of a soybean, by weight, is made up of fat – primarily unsaturated fat.



The fatty acid composition of soybean oil makes it a heart-healthy choice as it is comprised of about 57% polyunsaturated fat (omega-6 linoleic acid and omega-3 alpha-linolenic acid), 23% monounsaturated fat, and 15% saturated fat.<sup>10</sup> Nutrition organizations such as the Dietary Guidelines for Americans and American Heart Association recommend consuming unsaturated fats, especially polyunsaturated fats, in place of saturated fats.<sup>11</sup>



Some soy foods like tempeh, natto and soynut butter also come with the added benefit of fiber, a nutrient that most Americans do not get enough of.<sup>4</sup>



## Key Part of a Healthy, Plant-Based Eating Pattern

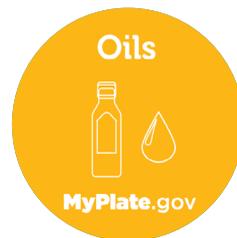
As a nutritious, plant-based protein option, soy is a natural fit for healthy plant-forward eating patterns which may support weight management goals<sup>4</sup> as well as help reduce the risk of heart disease,<sup>12</sup> type 2 diabetes,<sup>13</sup> and certain types of cancer, including breast cancer.<sup>14</sup>

A healthy eating pattern, as recommended by the Dietary Guidelines for Americans, emphasizes plant foods and includes vegetables, fruits, whole grains, oils (like olive, soybean, and sunflower oil), and fat-free/low-fat dairy or dairy alternatives like soy milk, as well as protein from foods like nuts, seeds, legumes (like edamame – immature green soybeans – black beans, lentils), soy foods (such as tofu and tempeh) and lean animal proteins.<sup>4</sup>



Fortified soy milk and yogurt are the only plant-based alternatives recommended by the Dietary Guidelines for Americans to help meet nutrient needs from dairy.

Aside from protein, fortified soy milk and yogurt provide nutrients also found in traditional dairy products including calcium, potassium, vitamin D, and vitamin A.



## Supports Health cross the Lifespan

Soy is a unique food that has been consumed for centuries and has been researched extensively for its role in human health. The Dietary Guidelines for Americans recognizes soy as a food that helps shape healthy eating patterns for chronic disease risk reduction.

## Heart Health

Claims similar to the FDA claim have subsequently been approved in more than ten other countries, and meta-analyses show soy protein statistically significantly lowers LDL cholesterol. However, in October 2017, the FDA announced its intention to revoke the existing “unqualified” claim, citing inconsistency in the data. It is possible that soy protein will receive a “qualified” claim, but the FDA has not made a final decision.



Soy protein carries the FDA heart health claim stating that, “25 grams of soy protein a day, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease.”<sup>15</sup>

Soybean oil’s health claim was issued in 2017. It states:

*“Supportive but not conclusive scientific evidence suggests that eating about 1½ tablespoons (20.5 grams) daily of soybean oil, which contains unsaturated fat, may reduce the risk of coronary heart disease.”*

Concerns have been raised about high intakes of omega-6 linoleic acid (LA) polyunsaturated fat (PUFA) and the association with increased inflammation and risk of heart disease. However, the American Heart Association has rejected concerns about the pro-inflammatory effects of omega-6 and concluded that omega-6 polyunsaturated fats play an important role in healthy eating patterns that support heart health.<sup>17</sup>

From a mechanistic standpoint, there are several reasons why omega-6 LA is not as proinflammatory as once thought. One is that, although LA is converted to arachidonic acid (AA), from which a number of pro-inflammatory eicosanoids are produced, tissue levels of AA don't substantially increase in response to LA intake because they are tightly regulated.<sup>18</sup> It is also now recognized that not all of the eicosanoids produced from AA are pro-inflammatory; some may be anti-inflammatory.<sup>19</sup>



## Breast Cancer

The relationship between soy and breast cancer has been rigorously investigated for 30 years. While this relationship is responsible for much of the research attention soy foods have received, it has also been a source of confusion about the healthfulness of soy foods.

Though the evidence supporting the hypothesis that adult soy intake reduces breast cancer risk has been somewhat disappointing, the notion that early life soy intake is protective against this disease has gained increasing support over the years. Population studies suggest a link between soy intake and lower risk of breast cancer. Soy foods are uniquely rich sources of isoflavones which are naturally occurring compounds in plants. Isoflavones may be protective against breast cancer.<sup>20, 21</sup>

Current evidence suggests that consuming soy foods in childhood and adolescence may reduce breast cancer risk in later life. While the effect of soy during childhood and adolescence has been studied to only a very limited extent, there is encouraging research about the role of soy intake in younger age groups.<sup>22, 23, 24, 25, 26</sup> This evidence is consistent with mounting data that early life events, including dietary patterns, greatly impact breast cancer risk and cancer risk in general.<sup>11, 27, 28</sup>

In addition, independent health organizations around the world, such as the American Institute for Cancer Research and American Cancer Society, have concluded that women diagnosed with breast cancer can safely consume soy foods. While research data are not a sufficient basis for recommending breast cancer patients consume soy specifically for the purpose of improving prognosis, women with breast cancer can enjoy the nutrient benefits of soy by making it a part of an overall healthy diet.

## Bone Health

Osteoporosis is the most common bone disease. It is often described as a “silent” disease because there are typically no symptoms until a bone is broken. Characterized by low bone mass and weakening of the bones, osteoporosis is a major contributor to mortality and loss of independence in older age. It is more common in women affecting almost 20% (one in five) of women aged 50 and older and almost 5% (one in 20) of men 50 and older.<sup>29</sup>

Consuming an adequate amount of protein at all stages of life is fundamental for bone growth in childhood, adolescence, and early adulthood as well as preserving bone mass during aging.<sup>30</sup> As a high-quality protein source, soy protein may benefit bone health. Some soy foods also provide calcium and vitamin D, two nutrients that are essential to bone health.<sup>31,32</sup>



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Even though soybeans contain phytate and oxalate, compounds known to inhibit calcium absorption, the absorption of calcium from calcium-fortified soy milk and calcium-set tofu (tofu made with calcium sulfate as the coagulant) is similar to the absorption of calcium from cow’s milk.<sup>33,34,35</sup>

## Learn more about Soy Nutrition and Health Research [Here](#)



# Soy and Planetary Health

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Soybeans are one of the most versatile and resilient plants in the U.S. Soy is grown using sustainable farming practices, making soy a helpful solution in feeding a growing domestic and global population.

Sustainability is a priority for U.S. soybean farmers. As stewards of the land, soybean farmers follow sustainable soy farming techniques that help improve efficiencies, yield more crops, and produce sustainable soy.

## Practices include:

**Crop rotation** moves crops from different fields during different years to reduce the burden on those fields.

**Reduced tillage** is a practice where farmers “till” or dig up the land less, or not at all, before or after harvesting crops.

**Nutrient management** uses proper levels of fertilizers or amendments to keep the soil and plants thriving.

**Precision farming** is an approach to farm management that uses technology to ensure crops and soil receive what they need at the right time.

**Cover crops** are planted purposefully to cover soil rather than be harvested. They help manage erosion and maintain soil quality.



### Together, these practices help to:

- Improve nutrient efficiency of soil
- Use less pesticides
- Boost crop productivity
- Conserve water
- Enrich soil quality

### Through these efforts, U.S. Soy farmers have:

- Reduced greenhouse gas (GHG) emissions per bushel by 43%
- Improved irrigation water use efficiency by 60%
- Increased land use efficiency by 48%
- Improved energy use efficiency by 46%
- Improved soil conservation by 34%
- Increased soy production by 130% using roughly the same amount of land

U.S. soybean farmers are widely recognized for their innovative solutions to the challenge of a changing climate. Through their commitment to sustainable agriculture, they are managing to produce more with fewer resources while at the same time supporting a healthy society and preserving the planet. As a result, U.S. Soy has the lowest carbon footprint, including land use change, compared with soy of other origins.<sup>36</sup>



# Soy Affordability and Accessibility

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A stable availability of nourishing and affordable foods is fundamental to a healthy, sustainable eating pattern. As an economical, convenient, and high-quality source of protein, soy foods and soy-based meat and dairy alternatives, can play an important role.

## Availability

Soybeans can be transformed into a wide range of nutritious products, making them versatile and accessible to different markets and consumers. Soy foods and soy-based dairy and meat alternatives are widely available at mainstream grocery stores across the country and through online ordering and delivery.

## Maximize Food Budgets

As an affordable source of protein, soy foods and products may help stretch food budgets. For instance, textured vegetable protein (TVP), also known as textured soy protein (TSP), is a budget-friendly way to add protein to grains, extend ground meat, and provide a versatile meat alternative for chili and pasta sauces. In addition, crumbled tofu can be easily transformed into a tasty, plant-based protein for tacos, stir-fry, and spaghetti sauce.

## Long Shelf Life

A longer shelf life reduces food waste, allows for efficient storage, and makes it easy to keep nutritious choices on hand. Many soy foods and soy products are available in forms that allow for a prolonged shelf life such as:

- Shelf stable tofu, soy milk, soynut butter, soy protein bars, soy protein powder
- Frozen edamame and soy-based burgers, sausages, and crumbles
- Refrigerated tempeh (*can also be frozen to extend shelf life*)
- Canned soybeans

## Qualify for Federal Nutrition Programs

Soy foods like tofu, soy milk, and dried or canned soybeans are also accessible through many of the USDA's Food and Nutrition Service Nutrition Programs. These foods are eligible through the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).<sup>37</sup> For school and childcare foodservice programs, including the National School Lunch Program (NSLP), National School Breakfast (NSB), and Child and Adult Care Food Program (CACFP), soy foods can be credited in both the meat/meat alternate and vegetable components of school and childcare meals, while soy beverages may be served as milk substitutes.

## Abundance and Scale

Soybeans are one of the most widely cultivated crops globally, and the sheer abundance of soybean production contributes to their affordability. Large-scale soybean cultivation and harvesting result in economies of scale, allowing for cost-effective production and distribution of soy products.

## Economical and Functional Solutions for Food Manufacturers:

Soy is a functional plant protein that translates well to various applications, including baking, grilling, microwaving and pan frying. Soy ingredients, like soy protein isolate, soy protein concentrate, and soy flour can promote moisture and flavor retention, aid emulsification and enhance the texture of many foods. Most often, these ingredients are found in plant-based meat alternatives, cereals, and energy bars.

“Insofar as ‘easy to cook’ foods reduce effort or save water or fuel, affordability and convenience remain important considerations in economic access to nutritious foods by low-income groups worldwide.”

– FAO Sustainable Healthy Diets Guiding Principles

## Soy in a Variety of Food Practices and Cuisines

There are numerous diverse cultures around the globe and even more diversity found within these cultures. No one population is homogenous emphasizing the importance of customizing eating patterns to reflect personal preferences.

Soy foods have been consumed for centuries in [Asian cuisines](#) and are commonly used in certain populations. For instance, soybean oil prominently labelled “Aciete de Soja” or “Óleo de Soya” is a pantry staple in [Hispanic households worldwide](#).

As more consumers have adopted plant-based foods into their diets, soy foods and products have gained widespread acceptance and integration into various cuisines and food practices. Soy offers a variety of options for integrating quality, plant-based protein into eating patterns.



### Tofu

Tofu, also known as soybean curd, is a soft, cheese like food made by curdling fresh, hot soy milk with a coagulant. Tofu is a bland product that easily absorbs the flavors of other ingredients with which it is cooked. Firm tofu is higher in protein, fat, and calcium than other forms of tofu.

#### Recommended Uses:

- Crumble firm tofu and mix it with ground meat to add in plant protein or be used as a replacement for ground meat
- Blend soft tofu and use it as a replacement for sour cream and as a base for creamy dips and salad dressings
- Blend soft tofu into smoothies



### Tempeh

Tempeh, a traditional Indonesian food, is a chunky, tender soybean cake. Whole soybeans, sometimes mixed with another grain such as rice or millet, are fermented into a rich cake of soybeans with a smoky or nutty flavor.

#### Recommended Uses:

- Marinate and then grill or sauté and use as a topping on rice or other grains
- Crumble and add to soups, casseroles, and stews
- On a sandwich, in a wrap, burrito, taco, or flatbread



## Soy Milk

Soybeans soaked, ground fine, and strained produce this creamy beverage.

### Recommended Uses:

- Use as a replacement in recipes that call for cow's milk
- Add to cereals like oatmeal, porridge, muesli, cream of wheat
- Blend into smoothies
- Add to coffee and tea



## Edamame

Also known as fresh soybeans, these large soybeans are harvested when soybeans are still green and sweet tasting. They are sold frozen either in the pod or shelled. They can be prepared by boiling in water, steaming, microwaving, or sautéing.

### Recommended Uses:

- Serve as a vegetable side dish
- Mix into pastas, stews, and soups
- Add to salads
- Blend to make a hummus or dip



## Soy Nut Butter

Made from roasted, whole soynuts, which are then crushed and blended with soybean (vegetable) oil and other ingredients. Soynut butter has a slightly nutty taste.

### Recommended Uses:

- Spread on toast
- Blend into a sauce for noodles or topping for cooked proteins
- Add to baked goods in place of some of the butter or oil

# Custom Plant-Forward Shopping List and Meal Ideas for Patients and Clients

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Use this worksheet-style handout to collaborate with your patients and clients on a custom plant-forward shopping list that meets their unique needs and preferences. Work together to identify meals and snacks that they enjoy and are accessible and convenient. Along the way, ask questions that help identify and address barriers such as who prepares food in their home, their comfort level with cooking and food preparation, and what meal and snack times look like for them.

## Plant-Based Eating Shopping List and Meal Ideas

A healthy eating pattern, as recommended by the Dietary Guidelines for Americans, emphasizes plant foods and includes vegetables, fruits, whole grains, oils, and fat-free/low-fat dairy or dairy alternatives from soy as well as protein from foods like nuts, seeds, legumes, soy foods, and lean animal proteins.<sup>4</sup>



Start your grocery list by writing in foods from each category that you enjoy and like to cook with.

### Fruits

*Examples:* berries, melons, pears, apples, bananas, avocado, citrus

1

4

2

5

3

6

## Vegetables

*Examples:* dark green, red, and orange vegetables – greens, broccoli, carrots, squash, peppers | starchy vegetables – hominy, cassava, corn, potatoes | other – cucumbers, eggplant, okra, squash, onion | beans, peas, and lentils – edamame, soy, lima, fava, black, or mung beans

1

4

2

5

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6

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## Grains

*Examples:* rice, bulgur, farro, quinoa, buckwheat, teff, amaranth, oats

1

4

2

5

3

6

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## Protein

*Examples:* soy products - tofu, tempeh, soy-based meat alternatives | meat and poultry | seafood | eggs | beans, peas, and lentils | nuts and seeds – walnuts, almonds, cashews, pumpkin seeds

1

4

2

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3

6

## Dairy

*Examples:* milk - soy milk, cow's milk | yogurt – cow's milk-based yogurt, soy yogurt, kefir | cheese - queso fresco, cheddar, mozzarella

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## Oils

*Examples:* soybean oil (vegetable oil), olive oil, avocado oil

1

4

2

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3

6

## Inspiration for Easy Meal and Snacks

These recipes offer a mix of plant foods and protein options including soy foods, meats, seafood, and dairy. They're also flexible enough to customize to your liking. Try swapping in your favorite proteins, fruits, veggies, grains, and more.

**Grain bowls topped with tempeh or tofu and a mix of your favorite vegetables**



**Try this:**

Tempeh Nourish Bowl with Lemon Miso Dressing\*

**Smoothie with your favorite fruits and veggies, soy milk, and soy protein powder**



**Try this:**

Berry-nana Soy Smoothie\*

**Bean-based dip like hummus or yogurt-based dip with fresh veggies and whole grain crackers or bread**



**Try this:**

Edamame Hummus\*

**Fajitas, tacos, flatbreads, and sandwiches made with beans, tofu or tempeh and your favorite toppings**



**Try this:**

Veggie and Tofu Fajitas\*

**Pasta/noodles with your favorite meat or seafood, edamame, and veggies**



**Try this:**

Easy Shrimp and Veggie Pasta Fresca\*

**Chili, soups, or stews with a blend of texturized soy protein and ground turkey or beef**



**Try this:**

Soy Turkey Chili Recipe\*

## What Meals and Snacks Do You Enjoy?

### Meals

1

4

2

5

3

6

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### Snacks

1

4

2

5

3

6

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