

# SoyConnection

Health & Nutrition News About Soy

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## EDIBLE OIL MILESTONES

**FDA Allows Soy Oil Health Claim**

**Clinical Study On High Oleic Soy Oil**

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## QUALIFIED HEALTH CLAIM FOR SOY OIL ALLOWED BY THE FOOD AND DRUG ADMIN



The U.S. Food and Drug Administration recently decided to allow a qualified health claim linking the consumption of soybean oil to reduced risk of coronary heart disease and lower LDL-cholesterol. The decision was based on a comprehensive review of the clinical data.

The FDA has allowed the use of a qualified health claim on certain products made with soybean oil. The claim 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. To achieve this possible benefit, soybean oil is to replace saturated fat and not increase the total number of calories you eat in a day." Packaging must say this: "One serving of this product contains \_\_\_\_ grams of soybean oil."

"Hopefully, the FDA claim will bring public awareness to the coronary benefits of soybean oil that dietitians and nutritionists have recognized for a long time," said Mark Messina, executive director of the Soy Nutrition Institute, a private non-profit organization dedicated to providing evidence-based information on the impact of soybeans and soy components on human health.

Soybean oil has a favorable fatty acid composition, being comprised predominantly of polyunsaturated fat, and contains no trans fat and just 2 grams of saturated fat per tablespoon. It is also a major contributor to the U.S. intake of omega-3 fatty acids.<sup>1,2</sup> Food companies will be permitted to use the claim on soybean oil and most products that are predominantly soybean oil (e.g., soy oil blends and shortenings, margarines/spreads and salad dressings) if they have less than a specified level of saturated fat, trans fat, cholesterol, and sodium. Other products that contain at least 5 grams of soybean oil, at least one of six beneficial nutrients identified by the FDA, and meet certain specifications for saturated fat, trans fat, cholesterol, and sodium can also use the claim. 🍷

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# HIGH OLEIC SOYBEAN OIL IMPROVES LIPID LEVELS

By David Baer, PhD

Soybean oil is a critically important oil in the global food supply. Conventional soybean oil, also known as “commodity” soybean oil, is high in polyunsaturated fatty acids (PUFA) which are consistently associated with decreased risk of chronic diseases such as diabetes and cardiovascular disease.<sup>1</sup> And while some individuals have suggested that the n-6 PUFA found in commodity soybean oil are “proinflammatory” and detrimental to health,<sup>2</sup> those claims are not supported by the scientific evidence.<sup>3</sup> Despite their positive impact on health, a limitation of oils high in PUFA is that they are susceptible to oxidation, which can reduce its shelf- and fry-life.

To overcome this limitation, the process of partial hydrogenation has been used. However, it has been recognized for some time that partial hydrogenation produces trans fatty acids which are extremely detrimental to health. As a result, the U.S. Food and Drug Administration has required the labeling of trans fatty acids since 2003, and in 2015 removed partially hydrogenated vegetable oils from the list of foods that are “Generally Recognized as Safe.” Since partially hydrogenated oils will no longer be widely available, alternatives are needed.

In 2011, high oleic soybean oils became commercially available. Unlike commodity soybean oil, high oleic soybean oils have a higher concentration of monounsaturated fatty acids and lower concentration of PUFA. More specifically, as the high oleic name implies, oleic acid is increased in these oils. Oleic acid is the predominant fatty acid in olive oil. While these oils are liquid at room temperature, they have a longer shelf- and fry-life than commodity soybean oil. Further, by blending high oleic soybean oil with other oils, it is possible to create oil blends that increase functionality for a greater variety of food applications.

In 2015, scientists at the USDA’s Agricultural Research Service from the Beltsville Human Nutrition Research Center conducted a clinical study to evaluate how high oleic soybean oil and blends of high oleic soybean oil affect cardiovascular disease risk factors.

For this study, four oil treatments were employed:

- Commodity soybean oil
- High oleic soybean oil (50:50) blend of the two commercially available high oleic soybean oils
- Blend of two high oleic soybean oils and fully hydrogenated soybean oil (40:40:20)
- Blend of palm oil and palm kernel oil (50:50).



Using these oils, it was possible to address three objectives. The first objective was to demonstrate that the replacement of high oleic soybean oil for saturated fats improves LDL cholesterol and other biomarkers of cardiovascular disease. Since high oleic soybean oil is less prone to oxidation than commodity soybean oil (because of its reduced PUFA content), it is a reasonable replacement for partially hydrogenated vegetable oils or oils high in saturated fatty acids, for some food system applications. Additionally, use of an oil high in saturated fats (the palm blend) serves as a positive control for this study.

Continued on pg. 4

A graphic designed to look like a chalkboard with a dark green background and a wooden frame. The text is written in white, chalk-like font. At the top, it says "Read It. Take Test. Earn Free Credits!". Below this, it says "Visit our testing center at www.soyconnection.com". In the top right corner, there is a logo for "CPE Accredited Provider" from the "Commission on Dietetic Registration" and the "Academy of Nutrition and Dietetics". In the bottom right corner, there is a circular logo for "PA AAPA CATEGORY 1 CME".

The second objective was to determine the effect of replacing commodity soybean oil with high oleic soybean oil on cardiovascular disease biomarkers.

Finally, the third objective was to compare the effect of two oils with similar functional properties but different mono- and polyunsaturated fatty acid profiles on cardiovascular disease biomarkers. To accomplish this objective, high oleic soybean oil was blended with fully hydrogenated soybean oil. This oil blend was compared with the palm blend—as both of these blends have similar functional properties (semisolid at room temperature) yet very different fatty acid profiles. The high oleic soybean oil blended with fully hydrogenated soybean oil has a lower saturated fatty acid content (and more of the saturated fat from stearic acid) and a higher monounsaturated fatty acid composition than the palm blend.

Over 200 individuals were screened for this study to make sure they met the criteria to participate. The eligibility criteria were selected to represent a group of individuals who did not have heart disease but were at-risk for developing it. Eligibility criteria included that they have at-risk lipoprotein profiles (higher LDL cholesterol and triglycerides, and a lower HDL cholesterol) as well as three of five metabolic syndrome risk factors, they were between the ages of 30–70 years, and not taking medications to lower cholesterol. Also important was their willingness to eat all of the foods that were provided and nothing else for the 4-month duration of the study. After the recruitment process ended, 60 individuals initiated the feeding phase of the study.

Since the study utilized a cross-over design, each volunteer ate each of the four treatments for about one month in random order with a two-week washout between treatments. During the active period, volunteers came to the Research Center Monday through Friday and ate breakfast and dinner in our research dining room under our supervision. Lunches and meals for weekends were prepared by the staff but consumed off site.

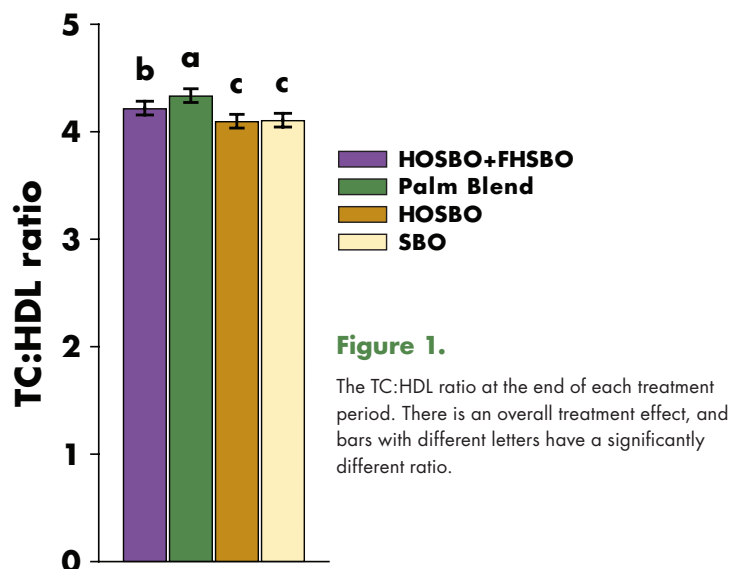
Menus were developed for the feeding phase of the study using foods that most people enjoy. Many of the food items were identical across all four treatments (beef, chicken, vegetables, etc.). In order to incorporate the four treatment oils into the diet, recipes for fourteen foods were developed. These recipes included sauces, gravies, cakes,

muffins, fried potatoes, and fried donut holes. Again, these recipes were identical except for the oil. Fried foods were included in the menus since some of the oils (especially palm blend and high oleic soybean oil) are suitable for frying applications. Baked products were developed since some of the oils (especially the palm blend and high oleic soybean oil and fully hydrogenated soybean oil) are suitable for baking applications. Using these “real life” food preparation methods was an important way to incorporate the oils into the menus, and not typically done in research clinical studies.

At the beginning and end of each of the four treatment periods, blood was collected to measure biomarkers and risk factors for cardiovascular disease. Concentration of markers associated with increased risk of coronary heart disease [LDL cholesterol, apolipoprotein B, Non HDL cholesterol, LDL particles] were higher after consumption of the palm blend compared to high oleic soybean oil and the other treatments. LDL cholesterol and apolipoprotein B were higher after consumption of the high oleic soybean oil compared to commodity soybean oil. There were no significant differences in the atherogenic markers between the blend of high oleic soybean oil and fully hydrogenated soybean oil and the high oleic soybean oil. Thus, replacement of up to 20% of high oleic soybean oil with fully hydrogenated soybean oil provides solid fat functionality with no change in these atherogenic markers.

Consumption of the palm blend increased HDL cholesterol (good cholesterol) and apolipoprotein AI compared to all other treatments, with no differences among the other treatments for HDL cholesterol and apolipoprotein AI. Ratios of total cholesterol-to-HDL cholesterol (see Figure 1) and LDL cholesterol-to-HDL cholesterol were highest after consumption of the palm blend compared to the other treatments (higher ratios are associated with increased risk of coronary heart disease). Triglycerides, fasting glucose, and blood pressure were similar across all four treatments.

High oleic soybean oil, an important option for replacement of solid fat and liquid oils in multiple food applications, maintains or improves lipid and lipoprotein profiles in humans compared to alternative functional fats. Additional analyses of data from this clinical study is ongoing. To date, it appears that high oleic soybean oil will provide new opportunities for food formulation and heart health. 🍌



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## ABOUT THE AUTHOR

**David Baer, PhD**, is a supervisory research physiologist with the U.S. Department of Agriculture’s Beltsville Human Nutrition Research Center located in Beltsville, Maryland. He serves as the research leader for the Center’s Food Components and Health Laboratory and also serves as the director of the Center’s Human Studies Facility. Baer earned his bachelor’s degree from the University of Illinois and graduate degrees in nutrition from Michigan State University.

# SUSTAINABILITY KEY TO SUCCESS OF AMERICAN SOYBEAN CROP

By Marty Matlock, PhD, PE, BCEE

The success of soybeans as a global crop reflects its value, resilience, and low environmental impact. Maintaining the highly sustainable quality of this important crop means continually improving these characteristics. U.S. soybeans are sustainable in part because of the aggressive adoption by American farmers of technologies that improve efficiencies and reduce impacts. These technologies include crop genetics, field cultivation, pest control, automation, precision agriculture, and post-harvest quality control.

## What is Sustainability?

In short, sustainability is the ability to continue to do what you are doing. The history of soybean production provides insight into the sustainability of this crop. It has been one of the most successful and sustainable crops in human history, having originated in China 4,500 years ago. The characteristics of a crop that make it sustainable include its nutritional value, resiliency, and impact on the land.<sup>1</sup>

Soybean seeds have the highest protein content (40 percent by weight) and among the highest gross output of oil (20 percent by weight) of any crop.<sup>2</sup> In addition, the soybean plant fixes nitrogen from the atmosphere, which enhances soil health and fertility without the addition of commercial nitrogen. Resiliency, the ability to produce high yields under changing conditions, is clearly demonstrated by the diversity of locations where soybeans are now produced. Today the top three producing areas for soybeans are the U.S. (116 million MT, 35 percent), Brazil (107 million MT, 28 percent), and Argentina (57 million MT, 18 percent). China is a distant fourth, at just under 14 million MT (less than five percent).<sup>3</sup>

The ability to produce a high value crop that is versatile and adaptable makes soybeans attractive to farmers. The ability to produce this crop without degrading land and water resources makes it truly sustainable.

Measuring the impacts of soybean production on environmental systems is not a simple process. To help accomplish this task, two organizations spearheaded the development of the U.S. Sustainability Assurance Protocol (SSAP) in 2013. The organizations were the U.S. Soybean Export Council (USSEC) and the United Soybean Board (USB). The protocol was developed to demonstrate soybean sustainability practices in the U.S. for international markets and to support continuous improvement in soybean production at home.<sup>4,5</sup>

The SSAP documents the American system of conservation laws and regulations combined with implementation of best management practices by the nearly 300,000 soybean producers in the United States. Most of these soybean farmers participate in financial and conservation programs with the United States Department of Agriculture (USDA), and thus are subject to random audits to insure they are complying with best management practices on the land.<sup>5</sup>

The SSAP does not certify individual producers; rather, it is a certified, aggregate approach to the sustainability performance of all U.S. soybean production. The goal is to improve the sustainability of all domestic producers.

Measuring sustainability requires the expertise of many people across many disciplines. In 2006, an organization was started to help provide that expertise and lay the ground work for establishment of the sustainability protocol.

“Field to Market—the Alliance for Sustainable Agriculture,” is a multi-stakeholder organization that develops and analyzes science-based measurements of sustainability indicators.<sup>6</sup> Field to Market has over 150 members, including conservation organizations, industries, and representatives from across the U.S. agricultural supply chain. USB was a founding member, and along with USSEC, has provided Field to Market with expertise and support in measuring soybean sustainability metrics.

Field to Market publishes an annual report on the environmental sustainability of major agronomic crops including corn for grain and silage, cotton, potatoes, rice, soybeans, wheat, barley, peanuts, and sugar beets. The environmental indicators include land use, soil conservation, irrigation water use, energy use, and greenhouse gas emissions.

Analysis of publicly available data from USDA for U.S. soybeans showed that total production and planted area of soybeans increased from 1980 to 2015. This yield improvement drove improvements in efficiency metrics like irrigation water use, energy use, and greenhouse gas emissions on a per-bushel basis. Soil conservation improved dramatically from 1980 to 2015, with soil loss per acre declining 47 percent.<sup>6</sup>

Farmers remain vigilant against emerging and expanding disease as well as unintended impacts from production practices. Organizations like Field to Market, and programs like the SSAP, give U.S. soybean producers the insights, guidance, and tools to insure that soybeans remain a sustainable crop for years to come. 🍷

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## ABOUT THE AUTHOR

**Marty Matlock, PhD**, is executive director of the University of Arkansas Resiliency Center and professor of Ecological Engineering in the Biological and Agricultural Engineering Department. He received his PhD in Biosystems Engineering from Oklahoma State University; his research focuses on technologies to increase the resilience of ecosystem services in human-dominated landscapes.

# SOYBEANS

## LEGUMES ARE ENVIRONMENTALLY FRIENDLY

By Virginia Messina, RDN

While cost, taste and nutrition are all factors that drive food purchases, consumers are increasingly concerned about the carbon footprint of their dietary choices. Nearly 50 years ago, the book *Diet for a Small Planet* by Frances Moore Lappé emphasized the impact of food choices on water and land usage.<sup>1</sup> More recently, researchers have also focused on how different diets impact greenhouse gas emissions (GHGE).

A number of studies suggest that production of protein from legumes requires less land, water, fuel and fertilizer than production of equivalent amounts of protein from meat.<sup>9,10</sup> Although many factors affect these comparisons, soybeans appear to be a particularly efficient means of providing dietary protein. Estimates are that it takes 6–17 times less land, 4–26 times less water, and 6–20 times less fossil fuel to produce an equivalent amount of soy protein as it does from animal protein.

In looking at the impact of different protein-rich foods on the environment, it is important to consider protein quality. While legumes in general represent a useful strategy for planning healthful diets with a small carbon footprint, soybeans are particularly high in protein (even compared to other beans) and they also provide higher quality protein.<sup>3,4</sup> As a result, growing an amount of rice required to meet dietary requirements for essential amino acids results in 20 times more GHGEs than growing the quantity of soybeans sufficient to meet these requirements. Likewise, production of either soybeans or corn results in similar levels of GHGEs on a per kg basis, but soybeans provide much greater amounts of protein. A recent study published in the journal *Food Policy* found that among all of the plant foods studied, soybeans produced the least GHGE per unit of protein provided.<sup>5</sup>

Although data are limited, individual soyfoods also take a smaller toll on environmental resources. Both soymilk<sup>6</sup> and soy-based burgers<sup>7</sup> have a smaller water footprint than cow's milk and hamburgers and produce fewer GHGEs. Recent data also show tofu is a sustainable source of protein.<sup>8</sup>

As consumers shift toward more plant-based diets for environmental concerns, it is clear that soyfoods, because of the amounts of high-quality protein they provide, can play an important role in these diets. 🌱

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#### ABOUT THE AUTHOR

**Virginia Messina, MPH, RD** is the author of books on vegan nutrition for consumers and co-authored the first vegetarian textbook for health professionals, *The Dietitians' Guide to Vegetarian Diets*. She contributes to online health magazines and websites, and speaks about plant-based nutrition at conferences for health professionals and the public.



# Chipotle Shrimp Salad

**Prep time:** 10 min  
**Cook time:** 20 min  
**Total time:** 30 min  
**Makes:** 4 servings

## Ingredients

1½ cup red wine vinegar, divided  
4 tablespoons soybean oil, divided  
1½ cup cilantro, chopped  
3 cloves garlic, chopped  
1 tablespoon chipotle chile in adobo  
12 large shrimp, raw, peeled and deveined  
12 cups chopped romaine hearts  
1 cup fresh corn kernels  
2 sweet bell peppers, diced  
1 cup black beans, drained and rinsed  
1 ripe avocado, peeled, pitted and diced

## Instructions for Chipotle Shrimp Salad

1. Puree ¼ cup vinegar, 2 tablespoons soybean oil, cilantro, garlic and chipotle in blender until smooth. Reserve 2 tablespoons marinade mixture to small bowl; set aside.
2. Place remaining marinade in medium bowl. Add shrimp, toss to coat; refrigerate for 1 hour.
3. Whisk reserved 2 tablespoons marinade with remaining vinegar and soybean oil. Season to taste with salt and pepper; set aside.
4. Heat large non-stick frying pan over medium heat. Add shrimp, cooking until just opaque in the center.
5. Combine lettuce, corn kernels, bell peppers, black beans and avocado on large platter. Drizzle salad with prepared dressing, tossing lightly. Top with warm shrimp.

## Nutrition Per Serving:

Calories 350, Protein 20g, Carbohydrate 33g, Fiber 12g,  
Fat 16g, Sat Fat 2.5g, Cholesterol 105mg, Sodium 590mg



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