Bean Briefs

Research | Update | Analysis

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In addition to summarizing articles from scientific peer-reviewed journals, **Bean Briefs** *highlights news and research about beans and health.*

A high legume low glycemic index diet improves serum lipid profiles in men

Zhang Z, Lanza E, Kris-Etherton PM, et al
Lipids 2010; 45(9):765-75.

The inverse relationship between dietary fiber intake and the risk for cardiovascular disease and type 2 diabetes has been well documented. This randomized, controlled, cross-over study, the Legume Inflammation Feeding Experiment (LIFE), looked at the effects of feeding a low-glycemic-index, legume-rich, high-fermentable-fiber diet on biomarkers of inflammation and insulin resistance and on serum lipids in a group of 64 middle-aged men. The legume-rich diet included approximately 250 grams daily of a combination of cooked pinto, navy, kidney, lima, and black beans; the cross-over "healthy American" control diet was similar to the experimental diet in calories, total fat, saturated fat, carbohydrate, and protein.

The legume-rich diet was associated with significantly greater reductions in fasting serum total and LDL cholesterol, as compared to the control diet. Two sets of ratios—total cholesterol to HDL cholesterol and LDL to HDL cholesterol—also went down during the legume-rich food period. These reductions were particularly strong among men who were insulin-sensitive. Among men who were insulin-resistant, fasting serum total and LDL cholesterol went down but cholesterol ratios did not change.

Several mechanisms have been proposed to explain the beneficial influence of legumes on cardiovascular disease risk factors, including the dampening effects of soluble fiber on fat absorption and subsequent cholesterol synthesis. As a food with a low glycemic index and low glycemic load, legumes are thought to enhance insulin sensitivity, which has beneficial effects on serum lipids. Additionally, the phytosterols in legumes may interfere with cholesterol absorption in the intestine.

TAKE-HOME BEAN MESSAGE:
The simple addition of beans to your diet reaps significant health benefits. In fact, for many people, eating more beans can improve lipid levels even more than if you just follow the typical heart-healthy diet. While men in this study who were insulin resistant did not experience the full benefits in terms of cholesterol reduction, they still would be wise to include beans in their diets because, as a high-fiber, low-fat food, beans serve as an alternative to other protein foods that are less healthful.

Adherence to a Mediterranean diet and plasma concentrations of lipid peroxidation in premenopausal women

Gaskins AJ, Rover AJ, Mumford SL, et al
American Journal of Clinical Nutrition 2010; 92(6):1461-1467.

The Mediterranean Diet has long been linked to a lower risk of cardiovascular disease. It's been suggested that the mechanism of action might be that components of the diet act to reduce lipid peroxidation, a process that greatly increases the risk of heart attack and stroke. Until now, however, the limited research has focused mostly on men, with only one known study on postmenopausal women. This study aimed to demonstrate that a Mediterranean Diet can also benefit young, healthy women. The U.S. researchers studied 259 healthy, active women aged 18 to 44 (mean age 27) for more than two menstrual cycles, administering 24-hour dietary recalls four times during each cycle. The participants' adherence to a Mediterranean Diet was measured by the alternate Mediterranean Diet Score (1-9 scale; a higher score indicates better adherence to the diet). This score is a measure of the intake of nine food items, one of which is legumes, a key element of the Mediterranean Diet. Moreover, to increase the validity of the findings, this study looked at three measures of lipid peroxidation not evaluated previously. They included the gold standard measure of lipid peroxidation, isoprostanes in the form of free 8-iso-PGF2-alpha, as well as 9-HODE and TBARS.

The researchers found that the first two measures were significantly associated with a higher Mediterranean Diet Score, but TBARS did not show any correlation. Overall, women who scored more than 4 on the 1-9 Med Diet rating system had 10% lower plasma values of 8-iso-PGF2-alpha and 37% lower plasma values of 9-HODE.

As to how a Mediterranean Diet might reduce lipid peroxidation, the researchers cite the following higher intakes as possibly instrumental: (1) vitamin E in the form of tocopherols from nuts and oils, (2) vitamin C from fruits and vegetables, (3) monounsaturated fats from olive oil, (4) flavonoids from fruits, vegetables, olive oil, and red wine. In addition, and perhaps most important, is the possibility of an overall synergistic effect of these factors with other components of the diet, including legumes. That would help explain why studies of single nutrients don't show as beneficial an effect as does following the Mediterranean Diet.

TAKE-HOME BEAN MESSAGE:
Eating a traditional Mediterranean Diet encourages the intake of foods that promote less lipid peroxidation, which lowers the risk of cardiovascular disease as well as cancer and other chronic diseases. Beans are a traditional part of a Mediterranean way of eating—think pasta fagioli—which is key to an overall healthier lifestyle that continues to provide consistent and concrete evidence of health benefits.

Pulse consumption, satiety, and weight management

McCrory MA, Hamaker BR, Lovejoy JC, Eichelsdoerfer PE
Advances in Nutrition 2010; 1:17-30.

This literature review examines the evidence related to the effect of pulse consumption on weight control. Pulses are non-oilseed legumes, which include dry beans, dry peas, chickpeas, and lentils, but excludes soybeans and peanuts. Thus, studying pulses is often preferable to studying all legumes, because the inclusion of soybeans in studies can skew results due to their unique health effects. Only one study in this review looked at beans separately from other pulses, a phenomenon that seems to be a void in this area of study.

The review reports evidence confirming pulses' purported effect of increased satiety, as a result of keeping study participants full longer. The pooled data confirms that a higher intake of pulses is linked to a lower BMI, though perhaps only if pulses are eaten regularly and if overall calories are not increased. As for mechanisms of action, most studies show lower glucose and insulin responses after pulses are eaten. Their relatively high soluble fiber content may contribute to their slower digestion, both in gastric emptying and movement through the intestinal tract.

Considering these results, eating beans to aid weight control would seem to be a valid message to give to the overweight public. A greater problem, however, is that few Americans consume pulses regularly—the best estimate from the latest NHANES date is that only 8 to 30 percent of Americans eat pulses or legumes every two days. The average intake based on the studies reviewed in this paper

was only about 1/2 cup per day. The authors suggest bean intake in the U.S. is likely low for many reasons including fears over perceived difficulty with digestion, cultural food habits not instilled while growing up, unfamiliar taste, and ignorance about how to prepare. However, extolling two top virtues of beans might be the ticket to headlines: the low cost of beans and their unique nutrient content. Now, perhaps, weight control can be added incentive.

TAKE-HOME BEAN MESSAGE:
Beans help keep you full longer, a natural boon to limiting how much you eat. It is not surprising that pulse intake has been consistently linked to lower BMIs. If Americans make beans part of their regular diet by replacing other protein sources, it will likely aid in their weight control.

Consumption of vegetables, cooked meals, and eating dinner is negatively associated with overweight status in children

Yannakoulia M, Ntalla I, Papoutsakis C, et al
The Journal of Pediatrics 2010; 7(5):815-820.

This school-based cross-sectional study in Greece utilized 1,138 children whose diets were analyzed and divided into five lifestyle behavioral patterns. These were then compared to obesity indicators, such as weight, BMI and triceps skinfold measures. Dietary intake was evaluated by two 24-hour recalls, then analyzed for nutrient intake, eating frequency, and meal quality.

The researchers found that two meal patterns were the least likely to correlate with overweight. The first was the "dinner, cooked meals and vegetables pattern," which showed a negative correlation with all measures of obesity. The other was the "high-fiber pattern," which included high consumption of legumes and whole grains, and low intake of sugar-sweetened beverages. However, this latter pattern's negative correlation with weight did not hold once the researchers excluded participants who seemingly underreported their caloric intakes.

The researchers note that the family-style eating pattern that correlated with lower weight is a lifestyle akin to that valued as part of the Mediterranean diet experience. Having an actual prepared meal, not just sitting down to eat together, might be an important factor contributing to the healthy attributes of the Mediterranean Diet, as might the high intake of vegetables, including beans, in the dinner meals.

TAKE-HOME BEAN MESSAGE:
The addition of beans, naturally high in fiber, may be valuable for the diets of children, especially if they are part of an eating style that includes meals prepared and eaten at home and accompanied by plenty of other vegetables. This approach might give added value to bean recipes that can be the basis of meals, maybe even ones that children could help prepare, increasing the likelihood they will eat them.

IgE-mediated cross-reactivity among leguminous seed proteins in peanut allergic children

Ballabio C, Magni C, Restani P, et al
Plant Foods for Human Nutrition 2010; 65(4):396-402.

Legumes are increasingly being used as food ingredients, and certain legumes, namely soybeans, are incorporated extensively into nondairy infant formulas. Allergy experts are now concerned that more frequent exposure to legumes may increase the risk of potential adverse effects, specifically among individuals who have unknown cross-sensitivities between peanuts or soybeans and other legumes. Legumes share several storage globulins, including a highly reactive legumin-like subunit that may be responsible for cross-reactivity.

This study employed three different tests of allergic reaction—immunoblotting, immuno-CAP and skin prick tests—to compare *in vitro* IgE binding and *in vivo* allergic reactions to legumes in a group of children with peanut allergies. The legumes used in the tests were lupin beans, lentils, peas, and kidney beans, in addition to peanuts and soybeans. The heterogeneity of legume proteins made it difficult to evaluate IgE binding. *In vitro* reactions, however, were particularly strong for lentils, peas, and soybeans and were attributed to the polypeptides in storage globulins.

TAKE-HOME BEAN MESSAGE:
Allergic cross-reactivity between peanuts and legumes is common, but challenging to diagnose because of the diversity of proteins in legumes. People who are highly allergic to peanuts should pay attention to any unusual reactions when eating dry beans and peas.

The Nutrient Rich Foods Index helps to identify healthy, affordable foods

Drewnowski A
American Journal of Clinical Nutrition 2010; 91(4):1095S-1101S.

The Nutrient Rich Foods (NRF) Index is a scoring system developed to measure the relative concentration of nutrients in foods and to guide consumers toward more healthful food choices. Using a proprietary algorithm, the NRF Index evaluates foods based on their content of nine nutrients whose consumption is encouraged—protein, fiber, vitamins A and C, calcium, iron, vitamin E, potassium, and magnesium—and three nutrients that should be limited (saturated fat, added sugar, and sodium), as calculated per 100 calories. The NRF Index is supported by the Nutrient Rich Foods Coalition, a partnership of agricultural commodity organizations.

The author ranked foods in the nine USDA food groups based on their NRF Indexes and then evaluated their relative cost in terms of nutrients provided in a typical portion for each food type. The objective in this study was to identify foods that provide good calorie and nutrient value for the dollar. Dry beans and peas, along with fats and oils, grains, sugars and sweets, and milk and milk products deliver the most calories per unit cost. Dry beans and peas also are among the lowest cost sources of protein, fiber, iron, and zinc. The Index demonstrates that dry beans and peas are among the few groups that provide exceptional nutrition relative to their cost.

TAKE-HOME BEAN MESSAGE:
The NRF Index is a particularly valuable tool for families and individuals who experience food insecurity, helping them to identify affordable foods that give them the most calories *and* nutrition for their dollar. Dry beans and peas provide both calories and nutrients at a relatively low cost, are recognized nutritionally as both a vegetable and a protein food, and are highly versatile as a meal ingredient.

The cost of US foods as related to their nutritive value

Drewnowski, A
American Journal of Clinical Nutrition 2010; 92(5):1181-1188.

It's an oft-repeated assertion that healthful foods are more expensive than less-healthful foods. This noted University of Washington author sought to confirm that logic by updating seminal research that compared the price per bushel or pound of foods with the prices per calorie for the same foods. In general, he found the common assumption to be true, with one important exception—legumes. It turns out that beans and other legumes have one of the highest micronutrient to price ratios.

Using updated Department of Agriculture data and current prices, the author established why it's no fluke lower-income families eat more of the grains and sugar food groups than they do of the fruits, vegetables, and meat groups. His analysis shows that, in general, foods brimming with carbohydrates, fats and sugars are all associated with lower food prices than foods rich in protein, vitamins and minerals. And close examination of his published data finds that the food group listed as "dry beans, legumes, nuts and seeds" is the third least expensive food group, after grains and fats, oils and salad dressings. And the author notes that within this group the results are actually skewed upwards in price, blunting what would be an even better rating for beans, because many nuts are considerably more expensive than legumes.

TAKE-HOME BEAN MESSAGE:
Beans are an excellent source of plant protein. They also provide important vitamins and minerals, such as folate and magnesium. This study bears out that beans are good for you and your budget.

Diets supplemented with chickpea or its main oligosaccharide component raffinose modify faecal microbial composition in healthy adults

Fernando WMU, Hill JE, Zello GA, et al
Beneficial Microbes June 2010; 1(2):197-207.

Prebiotics are carbohydrates that cannot be digested by humans but serve as a substrate for gut bacteria. Research on prebiotics evaluates their ability to stimulate the growth and metabolic activity of bacterial strains that offer potential health benefits by changing stool pH, short-chain fatty acid content, consistency, and the balance of intestinal bacteria. These actions are thought to lower the risk of gut infections, improve bowel health, and lessen certain allergic symptoms.

This study evaluated the effects on stool bacteria composition and metabolites of two different prebiotic sources of oligosaccharides: chickpeas and the trisaccharide raffinose. Raffinose, a galactose-fructose-glucose trisaccharide that is found in cruciferous vegetables, asparagus, and whole grains cannot be digested by human digestive enzymes and instead is broken down by bacteria in the large intestine. The research team investigated whether raffinose, other oligosaccharides, or other compounds in legumes in general, and chickpeas specifically, might enhance the growth of beneficial *Bifidobacteria* cultures in the feces. Twelve healthy adults were assigned randomly to three 3-week diets: a usual diet that served as the control and the same diet supplemented with either 5 grams of raffinose or 200 grams of chickpeas daily. The raffinose and chickpeas were added to soups and desserts. Fecal samples were collected during the third week of each diet period and analyzed.

Composition of fecal bacteria and production of short-chain fatty acids did not differ significantly during each of the three feeding periods. A slight increase in potentially beneficial *Bifidobacteria* followed the raffinose-supplemented diet. During the chickpea diet, fewer individuals tested positive for pathogenic and putrefying *Clostridia* strains. Furthermore, potentially detrimental ammonia-producing strains were detected in only 42 percent of the subjects following the chickpea diet, compared to 83 percent after the control period and 92 percent after raffinose supplementation.

TAKE-HOME BEAN MESSAGE:
Chickpeas appear to offer gut health benefits by reducing the number of *Clostridia* strains and the production of nitrogen-containing compounds thought to have a negative effect on intestinal health. The researchers suggest that eating chickpeas and other beans over a longer period of time may have additional benefits.

Findings on dietary patterns in different groups of African origin undergoing nutrition transition

Delisle H
Applied Physiology, Nutrition, and Metabolism 2010; 35:224-228.

Populations that migrate from their traditional homelands to other regions or countries typically undergo a transition to a different way of eating, merging traditional foods with their new food culture. This transition often is accompanied by a deterioration in the nutritional quality of the diet and an increased risk of diet-related chronic diseases. This study examined culture-specific eating patterns and their healthfulness among three different populations: Haitian residents in Montreal, Equatorial Guinea Bubu immigrants in Madrid, and native residents of Benin. Diets were classified as traditional, transitional, or modern, and were evaluated nutritionally using several different indices, including WHO/FAO recommended intakes, Healthy Eating Index, and Mediterranean Diet Score.

Traditional diets scored higher than Western diets across the three populations. Focusing on Beninese populations, the author found that their traditional diet included more cereals, legumes, fish, and vegetables and scored higher nutritionally than transitional and modern diets. Beninese who ate a traditional diet were less likely to be insulin resistant or have heart disease risk factors, including hypertension and abdominal obesity.

TAKE-HOME BEAN MESSAGE:
Traditional diets around the world tend to be higher in protective food groups, including plant foods such as legumes. As a result, when populations relocate, they should be encouraged to retain the healthful aspects of their traditional diets, as well as educating them on ways to incorporate newly available foods into their cultures without compromising their overall nutrition.

Estrogenic and antiestrogenic activities of phytoalexins from red kidney bean (*Phaseolus vulgaris L.*)

Boué SM, Burow ME, Wiese TE, et al
Journal of Agricultural and Food Chemistry 2011; 59:112-120.

Legumes are rich sources of isoflavones considered to be phytoestrogens, which are defined as plant compounds that mimic the hormone estradiol in the body by fooling estrogen receptors into thinking they are the real thing, thus competing with estrogen for available receptor spots. In this way, they help prevent the negative effects that estrogen can have on promoting breast cancer and other maladies.

The isoflavones and flavonoids found in foods can have both estrogenic and antiestrogenic effects. One type of isoflavones called phytoalexins are plant defensive compounds that are induced when plants are subjected to stress from their environment, such as insect damage, physical damage, or diseases like molds. These phytoalexins also produce significant antiestrogenic activity in addition to estrogenic effects.

In this government study, Tulane University and Xavier University researchers treated extracts from red kidney beans with *Aspergillus sojae* to induce the phytoalexins kievitone and phaseollin, then measured the treated beans' estrogenic and antiestrogenic activities compared to that of untreated bean extracts. It appeared that kievitone was responsible for most of the antiestrogenic activity. This correlates with previous research in which kievitone has been shown to reduce the growth of breast cancer cells in laboratory studies. Thus, the potential may exist for scientists to enhance these properties in future food development.

TAKE-HOME BEAN MESSAGE:
This study sheds new light on under-appreciated phytonutrients in beans that may have the potential to improve human health. It might mean that someday red kidney beans could exert anticancer activity greater than the isoflavones genistein and daidzein in soy.

Beans and diabetes: *Phaseolus vulgaris* preparations as antihyperglycemic agents

Helmstadter A
Journal of Medicinal Food
2010; 13(2):251-254.

This German researcher set out to investigate whether there was any truth to the claim that historical plant remedies for diabetes were effective. Of a thousand plants said to have antidiabetic effects, beans are among the most commonly mentioned in the literature and in folklore. And because they are eaten the world over, it made sense to see if they had a health potential waiting to be tapped.

The paper summarizes a literature search that revealed contradictory results, both from 100 years ago and recently. Many of the preparations used were injected alcoholic extracts or aqueous solutions, often hot, as in bean pod tea. Some reports noted a 10 to 40 percent drop in blood sugar values, but only in certain situations, such as before food was eaten or only by healthy participants. A 2006 study that utilized the dry plant extract of common bean seed *(Phaseoli vulgari* pericarpium) did not find any benefit from beans on blood glucose levels, but noted the antidiabetic potential of beans' inherent nutritional attributes of chromium, soluble fiber and vitamin C, all of which are known to help lower blood sugar levels. In addition, inhibitory effects on alpha-amylase support a potential benefit from beans.

TAKE-HOME BEAN MESSAGE:
This review concludes that beans, at least in the forms studied here—*Phaseolus vulgaris* alcoholic extracts or aqueous solutions—do not consistently prevent or slow the progression of diabetes. These extracts have a long history of purported use to lower blood sugar levels, however, as well as a dietary profile and laboratory evidence that contributes to blood sugar lowering. Therefore, as long as a physician-monitored plan for diabetes treatment is followed, there may be additional benefit to be gained by adding bean extracts to their diets.

New Prominence for Beans in the 2010 Dietary Guidelines for Americans

The January 2011 release of the latest edition of the Dietary Guidelines for Americans (DGA 2010) was eagerly anticipated by nutrition professionals, the food industry, and others who use this important policy document to guide their work. The 100+ page report is the culmination of months of scientific evidence review, distilled into advice on eating healthfully. DGA 2010 focuses on encouraging consumption of nutrient-dense foods while achieving and maintaining a healthy weight.

What's New? Although the fundamental recommendations for a healthy eating pattern have changed little from the 2005 Guidelines, DGA 2010 differs from the previous edition in several important ways:

- Recommendations are qualitative rather than quantitative, food-centric rather than nutrient-centric.
- Guidelines recommend specific nutrient-dense foods and food groups, including beans, while calling for a reduction in diet components that are associated with increased risk of chronic disease and weight gain, nicknamed SoFAS for solid fats (those high in saturated and trans fats) and added sugars, as well as sodium.
- For the first time, the Guidelines clearly and firmly advocate for reducing the incidence and prevalence of overweight and obesity, encouraging Americans to cut calories and increase physical activity.
- Guidance was formulated from evidence-based reviews, using the new USDA Nutrition Evidence Library (NEL).

Because beans are so nutrient-rich, they are classified into two food groups – vegetables and protein foods – so they can be counted in either group (though not both). A sidebar in the 2010 report notes that "…beans are excellent sources of protein, fiber, potassium and folate."

Added Focus on Beans. The 2010 Dietary Guidelines are highly favorable toward beans. They are featured prominently in the chapter on foods and nutrients to include in your diet, with beans repeatedly named as nutrient-dense foods to eat more often, along with vegetables and fruits, whole grains, nuts and seeds, seafood, and fat-free or low-fat dairy products.

Beans are named among the top food sources for meeting current fiber recommendations. The 2010 Guidelines point out that because Americans do not eat enough vegetables, fruits, whole grains, dairy products, and seafood, they are likely to consume too little dietary fiber, potassium, calcium, and vitamin D. In the section on nutrients of concern for specific populations, the 2010 Guidelines suggest eating white beans as sources of dietary iron if adequate intake of iron is a particular problem.

How to Be Sure You Get Enough. The appendix to the Guidelines provides specifics on healthful meal plans across a range of daily calorie levels. Beans are represented in a separate food category in both the DASH and USDA eating plans, the latter of which specifies higher recommendations for vegetarians and vegans. As an example of significant changes, the standard USDA plan for 2,000 calories cuts the 2005 recommendation in half to 1 ½ cups of beans per week (ranging from ½ cup to 3 ½ cups for lower and higher total daily calories). That's about ¼ cup a day—an attainable goal for most people.

Comparing the New Realistic Bean Goals

This chart translates and summarizes the various recommendations for a person eating 2,000 calories a day.

Pattern	Amount	Food Group
Dietary Approaches to Stop Hypertension (DASH)	Approx ¾ cup/week	Protein foods
USDA—DGA 2010	1 ½ cups/week	Vegetables
USDA vegetarian—DGA 2010	4 cups/week	Vegetables or Protein foods
USDA vegan—DGA 2010	4 ¾ cups/week	Vegetables or Protein foods

For more information: http://www.cnpp.usda.gov/DGAs2010-PolicyDocument.htm

The United States Dry Bean Council (USDBC) is a private trade association in the United states that represents growers, shippers and end users of U.S. edible dry beans. The USDBC promotes the use, consumption, and marketing of edible dry beans worldwide.

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