

Can Bean Consumption Slow The Progression of Prediabetes Or Type 2 Diabetes?

By Hope Warshaw, MMSc, RD, CDE, BC-ADM

Prediabetes is defined as glucose elevated above normal (fasting plasma glucose: 100 to 125 mg/dL; A1C: 5.7 to 6.4%), but lower than diagnostic for diabetes.¹ Prediabetes is on the rise. An estimated 79 million Americans, 35 percent of adults 20 years of age or older and 50 percent of adults over 65 years of age, have prediabetes.²

Most people remain unaware they have prediabetes. The CDC reported from National Health and Nutrition Examination Survey (NHANES) data, that in 2009–2010 only 11 percent of people with prediabetes knew they had it.³ Each year 11 percent of people with prediabetes who do not engage in a healthy lifestyle and weight management will progress to type 2 diabetes in the following three years.⁴



Prediabetes is caused by excess weight, especially abdominal weight, which begets chronic inflammation and insulin resistance (which is initiated first is still debated). Over time these cause metabolic disturbances including lipid abnormalities, hypertension and eventually escalating

glucose levels due, in part, to relative insulin deficiency.⁵ What's the evidence that a dietary pattern which includes sufficient intake of beans/legumes could prevent or slow the progression from prediabetes to type 2 or help people with prediabetes regain normoglycemia?

Nutrition Recommendations Support Consuming Beans and Legumes

People with prediabetes may have the notion they need to avoid beans and legumes due to their carbohydrate content. Low carbohydrate consumption as a treatment for prediabetes is frequently discussed in the lay press and social media. It's also a premise of some popular diets. This belief is not consistent with research and recommendations.^{6,7} To date there are no clinical trials demonstrating the efficacy of low carbohydrate diets in prediabetes nor does the existing epidemiological data support that a high carbohydrate eating pattern causes insulin resistance.⁷ Research indicates excess calories across all nutrients and resulting excess weight as the main culprit for prediabetes.

Beans Help Control Glucose Levels, Offer A Positive Force Against Chronic Disease

By Andrea Hutchins, PhD, RD

High blood glucose levels after meals play a role in the development of chronic diseases like diabetes, heart disease, and even cancer. This observation has gained recognition in the health care community in recent years.^{1,2}

Dry beans, such as pinto, black, navy, or kidney which are part of the *Phaseolus vulgaris* species, are recognized as low glycemic index foods.^{3,4} Using low glycemic index foods is one way to moderate post-meal spikes in glucose and to lower the glycemic stress caused by these spikes. This dietary pattern can potentially prevent or treat some chronic diseases. In a recent review article published in the *British Journal of Nutrition*, Dr. Donna Winham, Sharon Thompson, and I examined the available research that has explored the relationship between dry bean consumption, glycemic response, and chronic disease risk.⁵

When beans are eaten with foods that have a high glycemic index (e.g., white rice, white bread, pasta made from white flour) the post-meal glucose levels will be lower than those resulting from eating the high glycemic index food by itself. This effect contributes to the improvement reported in hemoglobin A1C values, a marker of long-term glucose control, in research studies that had people with type 2

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Research in diabetes prevention conducted over the last 20 years, including the Diabetes Prevention Program (DPP) demonstrate that healthier eating, physical activity (>150 minutes/week), and modest weight loss (5–7 percent) can delay or prevent type 2 diabetes.⁸ In the DPP the primary nutrition goal was to lower fat intake as a means to reduce overall calorie intake and promote weight loss, which the outcome data show was the key factor in preventing the progression of prediabetes or restoring normoglycemia.⁸ The goal of Medical Nutrition Therapy (MNT) for prediabetes is to decrease type 2 diabetes and cardiovascular disease (CVD) with healthy food choices and physical activity for moderate weight loss that can be maintained over time.⁶

Consumption Estimates of Dry Beans and Related Nutrients

Carbohydrate: Americans have been eating about 45–50 percent of calories as carbohydrate for years,⁹ although total calorie intake has increased. Baseline nutrient intake data from the Look AHEAD Trial in type 2 diabetes showed that study subjects consumed 44 percent of calories from carbohydrate. Regarding sources of carbohydrates, Americans consume excess added sugars and insufficient quantities of nutrient-dense carbohydrates—fruits, vegetables, whole grains, legumes, and low fat dairy foods.

Total Dietary Fiber: Fiber is considered a nutrient of concern. Average intake is estimated at 15 grams/day, however, research shows a scant four percent of American adults achieve the recommended 25 grams/day.¹⁰ This is not a surprise because Americans don't consume sufficient fiber-rich foods, including beans. The baseline Look AHEAD trial data indicated that only 20 percent of subjects with type 2 diabetes met their fiber goal based on federal nutrition guidelines.¹¹

Resistant Starch (RS): RS is slowly fermented in the large intestine where it acts like dietary fiber and is considered a prebiotic.¹² RS is present in some carbohydrate containing foods with beans being a leading source.¹³ It is estimated that Americans consume 5 g/day of RS.¹³

Dry Beans: United States Department of Agriculture (USDA) data show that nearly 14 percent of the U.S. population eat dry beans on a given day with the greatest consumption being in the West and South. After peaking in the early 1940s, bean consumption has stayed below 8 pounds per person annually¹⁴ or about 50 grams/day.¹⁵

Health Benefits of Dietary Components of Beans and Legumes

Research demonstrates a number of potential dietary

components of beans/legumes which may play a role in the prevention of prediabetes and/or progression to type 2 diabetes. Several of these confer multiple health benefits which may cumulatively improve metabolic parameters and assist with weight management.¹⁶ As is common with nutrition research, it is difficult to discern the impact of a single component of the diet vs. the dietary pattern as a whole. A brief summary of this research follows:

Nutrition Assets: It is important to consider the nutrition profile of beans. Dry beans provide a source of vegetable protein, nutrient dense carbohydrate, and a concentrated source of total fiber, viscous fiber,¹⁷ and RS.¹³ They provide rich sources of vitamins and minerals including folate, iron, calcium, magnesium, zinc, and potassium.¹⁸ They contain phytate and phenolic compounds that may function in similar ways to α -glucosidase or α -amylase inhibitors to reduce insulin resistance.¹⁹ Interestingly, acarbose, a glucose lowering medication used in type 2 diabetes, is an α -glucosidase inhibitor. However, it is infrequently prescribed due to the side effect of flatulence. Other nutrition benefits of beans and legumes are their low sodium and calorie content. While similar in their nutrition profile, all beans/legumes are not exactly alike.

Weight Management: A primary goal in the management of prediabetes is weight loss with the retention of the maximal amount of lost weight over time.⁶ Dietary patterns that include beans as part of an otherwise healthy eating plan, which is also calorie controlled, have been associated with the maintenance of a lower body weight over time.⁹ This speaks to the many nutrition assets of beans noted above.

Cardiovascular Benefits: CVD, including hypertension, is common among people with prediabetes and type 2.² People with diabetes are two to four times more likely to experience a heart attack or stroke and nearly three quarters of adults with diabetes have hypertension.² The common abnormal lipid problem resulting from the underlying dysmetabolism of insulin resistance and over production of very-low-density lipoprotein (VLDL) cholesterol is an elevation of VLDL-cholesterol, a reduction in HDL-cholesterol, and an LDL-cholesterol fraction that contains a greater proportion of small, dense LDL particles and increased postprandial lipemia.²⁰

Nutrition management of hypertension focuses on weight loss (if needed), lowering sodium intake, and increasing potassium intake to blunt the impact of excess sodium on blood pressure.⁹ Dry beans are naturally low in sodium and high in potassium, which makes them an ideal food for

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hypertension management.

Research consistently shows an increased consumption of beans provides improvement in lipid levels (lower total cholesterol and LDL-cholesterol) among people with the common dysmetabolism of prediabetes.²¹ A study among people with pre-metabolic syndrome (defined by increased waist circumference) who, within a self-selected diet, substituted a modest portion of pinto beans each day for an isocaloric and isonitrogenous soup showed a favorable shift in their lipid profile.¹⁵ The authors note difficulty delineating whether the beneficial effects of the dry beans was the dry beans as a food source or specifically their fiber content. They concluded, however, that adding dry beans in quantities of 100 g/day can change lipid profiles to decrease the risks of CVD. An evaluation of NHANES data of men and women who consumed legumes 4 times per week showed a risk reduction of 22 percent for coronary heart disease and 11 percent for CVD compared with people consuming one serving of legumes per week.²² Saturated fat is known to increase insulin resistance.²¹ The small amount of fat in beans is mainly unsaturated fat and beans are cholesterol-free.¹⁷ If consumers replace saturated fat and cholesterol-containing sources of protein (such as red meats and cheese) with beans/legumes, they will potentially consume less saturated fat and cholesterol which could lead to improvements in insulin sensitivity.

Fiber content—Total: Beans and legumes are rich in total dietary fiber with each half cup serving of cooked beans providing ~5–8 grams. A study of Latino adolescents who decreased added sugars intake by an average of 47 g/day (equivalent to a 12 ounce can of sugar sweetened soda), had an average 33 percent increase in insulin secretion.²³ Participants, who also increased their fiber intake by an average of 5 g/day (equivalent to a half cup of beans), had an average 10 percent reduction in visceral adipose tissue volume. The authors note these findings are consistent with the adult literature, in which prospective studies have shown that an excess intake of added sugars is a risk factor for the development of type 2 diabetes, while fiber intake is a protective factor.

A common notion regarding fiber and glycemic control is that any amount of dietary fiber will cause a lower glycemic impact, both lower post-prandial glucose (PPG) levels and overall A1C. Research shows that it requires 40 g/day of fiber or more to affect PPG and A1C.²¹ Fiber intake at or below 24 g/day, an amount well in excess of the fiber intake of most Americans, does not improve glycemic control.

Fiber content—Type: Beyond being a rich source of total fiber, beans and legumes contain viscous

fibers that offer lipid-improving and glucose-lowering properties and resistant starches which are fermentable fibers. RS is partially digested (fermented) in the large intestine where they produce short-chain fatty acids (SCFA).¹³ These SCFA have positive benefits on several hormones involved in decreasing hunger and appetite and improving glucose control and insulin sensitivity.^{24,25,26} (Though it's common to continue to see fibers discussed and labeled in terms of soluble and insoluble types, this delineation is no longer recommended.)²⁷

Low Glycemic Index/Impact: Beans are identified as having a relatively low glycemic index/impact.¹⁵ However, regarding the value of the concept of glycemic index, the American Diabetes Association (ADA) suggests there is not sufficient and consistent data to conclude that low glycemic load diets reduce the risk for diabetes. ADA does note that low glycemic foods should be encouraged due to their fiber content and other important nutrients.⁶ A recently published ADA macronutrient review noted a slight improvement in glycemic control from a lower-glycemic index diet, but that the higher fiber content of these diets confound the evidence.²⁸

There is sufficient evidence to support the consumption of beans and legumes within the context of a healthy eating pattern consistent with the recommendations of the Dietary Guidelines for Americans²⁹ and the ADA⁶ to prevent prediabetes and/or delay the progression to type 2 diabetes. The health benefits of beans for the prevention of type 2 diabetes is likely due to the cumulative effect of their numerous nutrition assets rather than one particular asset. More research is needed to tease out which nutrition qualities confer the most significant health benefits and to determine the related physiologic mechanisms. Another increasingly interesting area in which beans may play a role in the related conditions of obesity and prediabetes is their potential contribution to a healthy gut microbiome. The connection between the gut microbiome, energy balance, inflammation, and the development of obesity-related conditions are being increasingly recognized.³⁰ Research should also be conducted to determine the quantity and frequency of bean/legume consumption needed to achieve their varied health benefits in prediabetes. 🌿

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diabetes consume legumes as part of their diets. However, we do not know if the favorable impact that dry beans may have on type 2 diabetes prevention and treatment is due solely to their impact on glucose levels or if other aspects of the beans also play a role.

Dry beans are known to favorably reduce risk factors for heart disease like low-density lipoprotein (LDL) cholesterol. However, this beneficial effect is likely due to the soluble fiber content of the beans and is not associated with the glycemic response that they produce. There is speculation that controlling post-meal glucose responses through inclusion of low-glycemic index foods like beans may lower oxidative stress, another risk factor for heart disease. Unfortunately, we were unable to identify any studies that examined how the inclusion of dry beans in the diet may influence oxidative stress, and subsequently, heart disease prevention or treatment.



Researchers theorize that controlling glucose levels may have a positive effect on cancer risk by regulating hormone concentrations and responses. If this theory is true, then using dry beans as a means of modulating the post-meal glucose response could reduce a person's cancer risk. However, we were unable to find any research studies that explored the relationship between dry bean intake, glycemic response, and cancer risk during our review of the literature. Studies have examined how dry bean intake influences biomarkers, other than glucose response, for cancer risk and generally report a favorable impact of dry bean consumption.

Although research exploring the role that dry beans play in chronic disease risk and treatment has been increasing in recent years, there is still much that we do not know about this powerful food. More research is needed to determine the full spectrum of beneficial effects dry beans provide for the prevention and treatment of chronic diseases. 

About the Author

Andrea Hutchins, PhD, RD, is an associate professor in the Department of Health Sciences at the University of Colorado Colorado Springs. She teaches and conducts research on the relationship between functional foods, like dry beans, and their role in optimal health and chronic disease risk.

