DRY BEAN QUARTERLY
Smart Choice for a Healthy Life
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Low GI, High Fiber Food May Help Regulate Weight

By Elizabeth A. Rondini, PhD, RD and Jenifer I. Fenton, PhD, MPH



Obesity continues to be a significant public health concern on a global basis. In 2005, the World Health Organization estimated that more than one billion adults were overweight (body mass index [BMI] > 25) and 400 million considered obese (BMI > 30).[1] In the U.S. approximately 70% of adults are now classified as either being overweight or obese.[2] Excess body fat, particularly in the abdominal region, is associated with a number of health consequences including increased risk for type 2 diabetes, cardiovascular disease, hypertension, stroke, and certain types of cancer.[1,3] It is estimated that approximately 400,000 deaths per year in the U.S. are attributed to overweight and obesity,[4] with associated medical costs as high as $78 billion per year.[5] The increased prevalence in childhood obesity is even more disturbing, as overweight children are more likely to be obese as adults and face a higher risk for premature death and disability.[1,6,7]

Obesity is thought to develop from the interaction of both genetic and environmental factors,[8] however increasing physical activity and reducing energy intake are generally accepted measures to decrease one's chances of becoming obese. Hypocaloric, low fat (<30% kilocalories) diets are often recommended for managing body weight as well as metabolic risk factors associated with obesity (hyperglycemia, insulin resistance, hypertriglyceridemia).[3] However, decreasing the amount of dietary fat often leads to a concomitant increase in energy intake from carbohydrates. Along with the increasing prevalence of obesity and type 2 diabetes, total energy as well the percent of energy from carbohydrates has increased, particularly from more refined, low fiber sources.[9-12] This has led to the suggestion that the amount and type of carbohydrates consumed may influence food and energy intake, thereby regulating body weight gain.[13-15]

GI and Body Weight

One potential mechanism whereby carbohydrate-containing foods may influence body weight is related to the rate which glucose and insulin appear in the blood following a meal. The glycemic index (GI) measures the extent to which a test food increases blood glucose over a period of 2 hours compared to eating an equivalent amount of carbohydrate from either glucose or white bread.[16-18] Foods with a high GI cause a more rapid rise in blood glucose and insulin levels than

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Introducing *Dry Bean Quarterly*

Welcome to the inaugural issue of **Dry Bean Quarterly.** This quarterly newsletter, brought to you by The Bean Institute, will provide news about the latest research on the human health benefits of dry bean consumption, health news, and recipes. This newsletter is designed specifically for registered dietitians.

The Bean Institute is sponsored by the Northarvest Bean Growers Association (NBGA). NBGA is a commodity group that represents nearly 3,000 producers of dry beans in North Dakota and Minnesota.

For more information, please visit our new website: **www.beaninstitute.com.**

Historically Healthy, Dry Beans Provide Nutritional Value

By Susan Raatz, PhD, MPH, RD

Throughout history, dry beans have been used as a staple of the diet, and the health benefits derived from them have been well recognized. Documentation of their use goes back far into the past, long before biblical times. Evidence of dry bean use in Southeast Asia, the Middle East, Africa, the Americas, India and China is available from archeological evidence.[1]

Most Americans are not eating enough beans, although people in the southern and western regions of the United States consume more than those in the Midwest and Northeast, even though half of the beans grown in the country are from North Dakota and Minnesota . Americans consume, on average, about 6.5 pounds of dry beans yearly which is equal to 56g/week or a little more than 1/4 of the 2005 Dietary Guidelines for Americans' recommendation of 3 cups of beans per week (dry weight ~200 g).[2]

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Dry beans are nutrient-dense in that the amount of nutrients provided per calorie is particularly high. Increased intake will provide nutritional benefits to the diet, and may help to reduce disease risk and enhance longevity. In a recent multicultural study, the consumption of beans was shown to be the only dietary component related to longevity. In a study called the "Food Habits in Later Life Study," investigators found that for every 20g intake of legumes (including dry beans), the risk ratio of death was reduced by 6% in the older people (aged 70 and older) studied.[3]

Nutritionally Rich

Although dry beans vary considerably in flavor, size, color and shape, their nutritional composition is remarkably similar. (Table 1 provides an example of the nutrient content of cooked dry beans).[5] They are packed with protein, carbohydrates, vitamins and minerals and are low in fat. One half cup of cooked dry beans contains approximately 115 calories and provides 8 grams of protein.[4] In addition to macronutrients, vitamins and minerals, dry beans contain several types of phytochemicals. They are rich in lignans, which may play a role in preventing osteoporosis, heart disease, and certain cancers. The flavonoids in beans may help reduce heart disease and cancer risk. Phytosterols contained in dry beans may help reduce blood cholesterol levels.

Sixty to 65% of the calories in dry beans are from carbohydrates, predominantly in the form of starch, resistant starch, and small amounts of non-starch polysaccharides. Dry beans have a low glycemic index, with values varying from 27–42% relative to glucose and 40–59% relative to white bread.[6] The reduced glycemic index of dry beans helps reduce the glycemic load of the diet when served in a mixed meal. The properties of the carbohydrates found in dry beans, along with their fiber content, make them helpful for the management of abnormalities associated with insulin resistance, diabetes and hyperlipidemia.

Beans contain some complex sugars of the raffinose family.[7] These are the sugars that cause digestive issues with bean consumption. These sugars must be broken down by enzymes that are not available in the human digestive system and are therefore available for microbial action in the colon, resulting in gas production and flatulence. These sugars can be removed effectively from the beans by soaking the beans and then cooking them, discarding the soaking and cooking liquids.

Dietary Fiber

Dry beans are rich in both soluble and insoluble fibers, so they provide the nutritional benefits of both fiber classes. The soluble fiber in beans dissolves in water, trapping bile which helps to lower blood levels of LDL cholesterol, especially if LDL cholesterol levels were high to begin with, without compromising the level of protective HDL cholesterol. Dry beans also provide substantial amounts of insoluble fiber, which helps attract water to the stool and enhances transit time of waste through the colon. This may help to combat constipation, colon cancer, and other conditions that afflict the digestive tract.[8]

Table 1. Nutritional Values, *Black Beans, Cooked*

Serving Size: 1/2 cup	Thiamin: <1mg
Calories: 113	Folic Acid: 128mcg
Fat: <1g	Copper: <1mg
Saturated Fat: <1g	Iron: 2g
Cholesterol: 0mg	Magnesium: 60mg
Carbohydrate: 20g	Manganese: <1mg
Protein: 8g	Phosphorus: 120mg
Dietary Fiber: 8g	Potassium: 306mg
Sodium: 1mg	

Dry beans are very good source of low fat protein. They contain between 21 to 25% protein by weight, which is much higher than other vegetable products. In many parts of the world, they provide a substantial proportion of the total protein intake for the population. The intake of dried beans as a protein source is extremely important worldwide as they provide a good source of protein at minimal cost relative to the production of animal protein sources.

The fat content of dry beans is very low (less than 2% of total content) and they contain predominately unsaturated fatty acids. There is some variation based on variety and growth conditions, but most beans contain about 85% of their fat as unsaturated fatty acids. Because dry beans are plant foods, they are cholesterol-free.

As for vitamins and minerals, beans are a source of copper, phosphorus, manganese and magnesium—nutrients that many Americans lack. Most dry beans are a rich source of iron, which makes them helpful for vegans who do not get an animal source of iron. The nutritional content of most dry beans is very similar, with the exception of iron content. White beans have almost twice the iron of black beans, while kidney beans are somewhere in between.

Dry beans are also a source of the water-soluble vitamins thiamin and folic acid and a good source of riboflavin and vitamin B6.

Complete references available online at ***www.beaninstitute.com***

DB QUICK BITE

First Lady Michelle Obama has announced a national goal of solving the challenge of childhood obesity within the next generation.

Mrs. Obama introduced the ambitious goal during the unveiling of the "*Let's Move*" program, which will involve every sector that impacts the health of children. The program will provide schools, families, and communities simple tools to help children be more active, eat better and get healthier.

Primary aspects of the program include the following:

- Helping parents make healthy family choices
- Serving healthier food in schools
- Accessing healthy, affordable food
- Increasing physical activity

For more information, visit *Let's Move* at **www.LetsMove.gov.**

LET'S MOVE

Black Bean Omelet with Avocado Salsa Verde

Recipe created by
The Culinary Institute of America

Black beans are an important part of this breakfast recipe, providing protein, fiber, and slowly digested carbohydrates to an omelet. Each serving of this recipe provides two servings of vegetables.

Avocado Salsa Verde
1 Haas avocado, ripe, peeled, seeded, and cut in ½" dice
1 tomato, diced
2 Tbsp. red onion, finely chopped
1 tsp. serrano chile, seeded and minced
½ tsp. garlic, minced
1 Tbsp. fresh lime or lemon juice
2 Tbsp. fresh cilantro leaves, chopped
Pinch of sugar
Pinch of salt

Black Bean Filling
1 Tbsp. extra virgin olive oil or canola oil
¼ cup scallions, stemmed and chopped
1 Tbsp. garlic, minced
¼ tsp. cayenne
1 tomato, chopped
1 cup canned black beans, drained and rinsed
3 Tbsp. cilantro, minced
¼ tsp. black pepper

Omelet
8 large eggs
½ tsp. salt
1 Tbsp. extra virgin olive oil or canola oil
½ cup Monterey Jack cheese, grated
Avocado Salsa Verde

PREPARATION

1. Prepare the Avocado Salsa Verde by carefully combining all ingredients in a medium mixing bowl. Cover and refrigerate at least one hour before serving to allow the flavors to marry.

2. In a skillet with the canola oil, sauté the scallions, garlic and cayenne for 1 minute; add the tomato and beans and cook until the liquid has evaporated. Season to taste, set aside, and keep warm.

3. In a bowl, beat the eggs and salt. Heat an 8-inch skillet over medium-low heat and add the oil. Pour in ¼ of the egg mixture. As the eggs set, lift the edges, letting the uncooked portion flow underneath. When the eggs are nearly set, sprinkle ¼ of the bean mixture over one side; sprinkle with 2 tablespoons grated cheese.

4. Fold the omelet over the filling; cover and let stand for 1 minute or until the cheese is melted. Repeat this until all four omelets are ready. Serve each omelet with a ½ cup of the Avocado Salsa Verde.



YIELD:
4 omelets

NUTRIENT INFORMATION PER SERVING:
Calories: 390, total fat: 27g, saturated fat: 7.5g, monounsaturated fat: 13g, polyunsaturated fat: 3g, protein: 21g, carbohydrate: 19g, cholesterol: 435mg, dietary fiber: 7g, sodium: 515mg, potassium: 670mg

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foods with a low GI. Because the extent to which different foods raise blood glucose also depends on the quantity of carbohydrates consumed, the term glycemic load (GL) was introduced.[19] The GL is calculated by multiplying the individual GIs of each food by the quantity of available carbohydrate eaten. Many factors can influence the glycemic response of foods including the nature of the starch, cooking methods, as well as the amount of fat, protein, and dietary fiber.[20-22] However, in general, standard servings of non-starchy vegetables, legumes, and fruits produce lower glycemic responses compared to more refined grains and potatoes.[13]

Consumption of low GI/GL food sources may benefit weight control by more favorably affecting metabolic and hormonal profiles after a meal, leading to increased satiety and reduced propensity for hunger.[13,23,25] A majority of short-term feeding studies reported a delay in return of hunger, increased satiety, and/or reduced voluntary food intake at subsequent meals when low compared to high GI/GL foods were consumed.[13,23] Two systemic reviews compared the long term efficacy of dietary GI on body weight regulation.[26,27] Thomas *et al* [9-12] analyzed randomized control studies conducted in non-diabetic, overweight or obese individuals in which dietary intervention was greater than 5 weeks duration. They found that low GI/GL diets were associated with significant reductions in body weight (1.1 kg), fat mass (1.1 kg), and BMI (1.3 units) when compared to high glycemic or conventional, reduced energy diets. A more beneficial effect of low GI diets on body weight was found in obese individuals. Livesey *et al.*[26] evaluated the relationship between gylcemic response and markers of health. They found that low GI/GL diets were significantly associated with lower body weights under free living conditions and when food intake control is limited.[26] Reducing the GL resulted in less available carbohydrate intake (therefore fewer kilocalories) leading to more weight loss, although there was a threshold before these effects occurred. Additional benefits of low GI/GL, high fiber diets were seen for blood glucose, insulin sensitivity, and fasting blood triglyceride levels.

Although the effect of lowering dietary GI/GL alone on body weight appears modest, more recent studies suggest that an individual's insulin response at 30 minutes (insulin-30) following a glucose challenge is a better predictor of weight loss on low GI/GL diets and may account for some of the variation between studies.[28-29] Consumption of low glycemic diets may also complement lifestyle interventions for weight loss.[30] In obese individuals, combining low glycemic diets with aerobic exercise for 12 weeks had a synergistic effect on weight loss and in improving insulin sensitivity and plasma triglycerides.[30] Collectively these studies suggest that consumption of low glycemic carbohydrate sources (GI < 45), a low glycemic load (<100 g equivalents per day), and at least 25 g per day of dietary fiber would likely benefit individuals by helping them to consume fewer kilocalories, thereby reducing body weight and improving metabolic risk factors associated with obesity.[26]

Beans and Body Weight

Increasing consumption of legumes (peas, beans, lentils, peanuts) to 3 cups per week is recommended as a part of the Dietary Guidelines for Americans to promote health and reduce risk of chronic disease.[31] However despite these recommendations, overall intake of legumes in the U.S. remains low.[32,33] The incorporation of beans into the standard U.S. diet in place of more high GI carbohydrate sources may have clinical value in the management of obesity. Compared to other carbohydrate sources, dry beans have a relatively low glycemic index, varying from 27–42% relative to glucose and 40–59% that of white bread.[34] Additionally 1/2 cup of cooked beans provides ~2 g of soluble dietary fiber, which has been associated with delayed gastric emptying and a more sustained increase in glucose and insulin levels. Higher intakes of dietary fiber are also associated with improved glycemic control,[35-37] lower blood cholesterol,[37-41] as well as reduced body fat.[37,42-44]

Limited evidence suggests that increasing consumption of beans may be advantageous in managing body weight. In a short-term feeding study, bean consumption resulted in greater satiety after a meal and delayed the return of hunger compared to a high GI food source.[45] In epidemiology studies, legume intake evaluated as part of a healthy diet pattern was associated with lower energy intakes,[46] reduced waist circumferences,[46-48] and/or lower BMIs.[47-49] Papanikolaou *et al.*[50] specifically examined the influence of bean consumption on body weight and cardiovascular disease risk factors in adults from the National Health and Nutrition Examination Survey (1999–2002). They reported that bean consumers in general had better nutrient profiles for dietary fiber as well as several key micronutrients including potassium,

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magnesium, iron, and copper. Regular consumers of beans also had significantly lower body weights (77.5 ± 1.1 *vs.* 80.5 ± 0.3 kg), smaller waist size (94.2 ± 1.0 *vs.* 96.1 ± 0.3 cm), and a trend towards lower systolic blood pressure. This was associated with a 22% less chance of being obese. Legume intake may also aid in nutritional interventions for weight loss.[51] Abete *et al* [51] studied the effect of hypocaloric diets (30% restriction in energy) with legumes (4 servings/week) compared to a control, macronutrient-matched diet on weight loss in obese males. Consumption of a high legume diet for 8 weeks was associated with significantly more body weight loss (-8.3% ± 2.9 *vs.* -5.5% ± 2.5) and a greater reduction in systolic blood pressure compared to individuals on the control diet. In addition, legumes reduced LDL (-25.5% ± 11.8) and total cholesterol (-19.5% ± 9.3) compared to baseline values.

Bottom Line

Collectively, available evidence suggests that low glycemic/high fiber containing foods such as beans, can impact metabolic profiles associated with obesity and may be an effective dietary measure to aid in weight loss and/or maintenance. Evidence specifically linking consumption of beans to body weight is limited. However some benefits may be achieved in lowering cholesterol and blood pressure as well as maintaining glycemic control.

About the Authors

Dr. Elizabeth Rondini and Dr. Jenifer Fenton are currently employed at Michigan State University (MSU) in the Department of Food Science and Human Nutrition. Dr. Rondini received her bachelor's degree in Dietetics at MSU and completed a dietetic internship at the University of Michigan Medical Center. She then received a Master's of Science and Doctorate degree in Human Nutrition from MSU. Her research was focused on studying molecular mechanisms of colon cancer chemoprevention by dietary factors (fiber, black beans, and soy). She was involved in post-doctorate research in the area of pulmonary inflammation and carcinogenesis, and is currently employed as a research associate with Dr. Fenton in the area of diet, inflammation, and colon cancer. Dr. Jenifer Fenton is an Assistant Professor in the Department of Food Science and Human Nutrition at Michigan State University. She received a doctorate degree in nutrition from MSU in 1999. Dr. Fenton also has a Public Health degree in Epidemiology from the University of Michigan and was a Cancer Prevention Fellow at the National Cancer Institute. Dr. Fenton's research is focused on understanding how obesity influences colon cancer risk as well as identifying dietary approaches to reduce this risk. Her research is currently funded by the NIH and includes basic cell biology, animal modeling, and human biomarker discovery. Dr. Fenton also teaches a graduate course in Human Nutrition and Chronic Disease Prevention at MSU.

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