Beans:
Agriculture to Health

Leader's Guide

Jane U. Edwards, Ph.D., LRD
Nutrition Specialist

Goal

To help North Dakota families develop eating patterns to promote health and prevent chronic disease based on food produced on the Northern Plains. An increased focus on consuming foods produced in the Dakotas has the potential to expand the demand for agricultural products and to promote economic development. The specific goal of this lesson is to promote the health benefits of incorporating cooked dry beans into the diet.

Objectives

For the lesson on dry beans participants will:

1. Identify the role of bean production within North Dakota
2. Identify key nutrients
3. Identify health benefits
4. Identify role for vegetarians
5. Identify recommended guidelines for rehydration
6. Identify methods to reduce potential for gas formation

Audience

Adults

Before the Lesson

- Read through the leader's guide and handout.
- Select activities that will meet the interests and needs of the group. Also consider available time, meeting space and equipment.
- Obtain copies of the handout and evaluation forms (pre- and post-lesson) for each member.
- Decide whether visual aids included with the packet will be used to make overhead transparencies or small posters.
- Check with agricultural commodity groups related to dry bean production to determine whether dry bean samples, recipes or educational brochures may be downloaded or donated.

  http://www.northarvestbean.org
  http://www.americanbean.org

Leader's Packet

- Leader's guide
- Visual aids (PowerPoint slides, overhead transparencies or posters)
- Member "fact sheet"- Beans: Agriculture to Health
- Evaluation forms (pre- and post-lesson)

NDSU EXTENSION SERVICE
North Dakota State University
Fargo, North Dakota 58105
JULY 2004

Introduction of the Lesson

Have participants recall experiences about growing or harvesting dry beans; frequency of consumption of beans; cooking with beans; etc.

Pre-lesson Evaluation Form

For the "pre-lesson evaluation" form, read together and have participants complete. The form asks for the current frequency of consumption for cooked dry beans; form in which beans are purchased (dry, canned or in pre-prepared items); and knowledge–based questions.

Meeting Format

Using the overhead transparencies, posters or PowerPoint, discuss the lesson objectives, definitions, and concepts related to using dry beans in a diet pattern to promote health and prevent disease.

Meeting Activities

- Obtain and view a copy of the video, "Dry Beans from the Heart of Northarvest Country," which looks at the agricultural production of dry beans. Have participants complete the Northarvest Bean Growers Association's worksheet which accompanies the video.
- Purchase several classes of beans. Identify and discuss the classes which are most frequently grown in North Dakota and on the Northern Plains.
- Alternatively, use the handout entitled, "Beans: Class and Useage" from Northarvest Bean Growers Association to identify classes of beans and their general uses.
- The DASH diet suggests inclusion of four to five servings each week of the food category "cooked dry beans, seeds and nuts." Discuss how to incorporate cooked dry beans into the diet pattern several times each week. Consider bean dishes for meals and snacks.
- DASH Resources:
  www.nhlbi.nih.gov/hbp/prevent/h_eating/h_eating.htm
  www.nhlbi.nih.gov/health/public/heart/hbp/dash

Post-Lesson Evaluation Form

Have participants complete the post-lesson evaluation form. This evaluation form attempts to identify changes in the projected frequency of consumption of cooked dry beans and changes in the knowledge-based questions as a result of this lesson.

Background Information

Do people in North Dakota need to be concerned with promoting health and preventing chronic disease?

Heart disease is the leading cause of death for North Dakotans, causing 214 deaths for every 100,000 people in 2000 (CDC, NCHS). About 24 percent of North Dakotans indicated they had been told by a health professional that their blood pressure was elevated (2001, BRFSS, CDC). About 30 percent of adults in North Dakota report having had a health professional tell them that their blood cholesterol was elevated (2001, BRFSS, CDC).

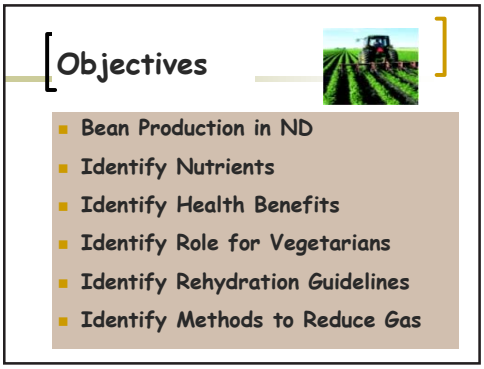
Cancer, the second leading cause of death in North Dakota, accounted for 185 deaths for every 100,000 people in 2000 (CDC, NCHS).

The prevalence of **diabetes** in North Dakota for adults has increased from 3.6 percent in 1994 to 6.1 percent in 2002 (CDC). For those age 55 or older, 11 percent of the population report having been told they have diabetes (BRFSS, CDC).

About 80 percent of the North Dakota population report that they **did not eat an average of five servings of fruits and vegetables each day** (2002, BRFSS, CDC). And about 22 percent of North Dakota adults reported **not participating in any physical activity** during the previous month compared to 24 percent of adults nationwide (2002, BRFSS, CDC). From self-reported data about 62 percent of the adult population is either **obese** (23.4 percent have a BMI* $\geq$30) or **overweight** (38.2 percent have a BMI $\geq$ 25 but <30).

*BMI=Body Mass Index which relates weight (in kg) to height (in meters squared).

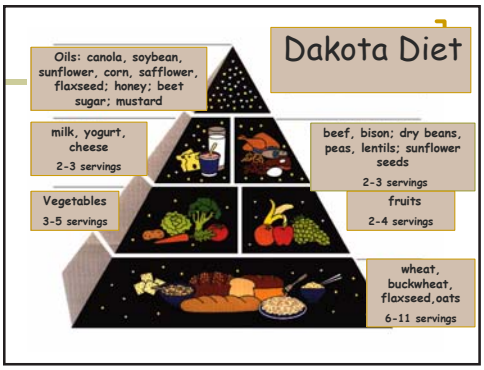
Visual # 1:
Objectives



Talking Points

The goal of this lesson is to promote the health benefits of incorporating cooked dry beans into the eating pattern of North Dakota families. Foods produced in the Dakotas and Northern Plains, when consumed within the framework of the Food Guide Pyramid can promote health and reduce the risk of chronic disease. This eating pattern may also benefit economic development by developing a new market or increasing demand for agricultural products within North Dakota and across the nation.

Visual #2
Dakota Diet Food Guide Pyramid

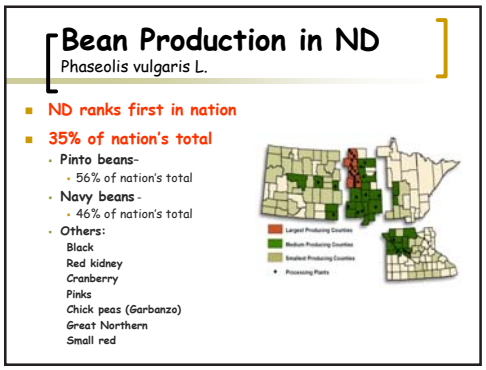


Talking Points

The Dakota Diet concept was introduced at the Governor's Healthy North Dakota Summit in Bismarck during August 2002 by Dr. Gerald Combs, the director of the USDA, ARS Human Nutrition Research Center in Grand Forks.

The health benefits of cooked dry beans have been promoted by NDSU and the bean growers from North Dakota and the Northern Plains for more than 25 years.

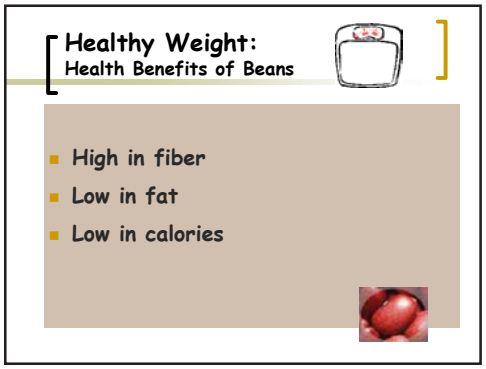
Visual # 3:
Bean Production in North Dakota



Talking Points

In the United States, North Dakota ranks first in production of dry beans with 35 percent of the nation's total. In 2003, North Dakota produced 56 percent of the nation's total for pinto beans and 46 percent of the nation's total for navy beans . Several other classes of beans are produced. The highest production of beans is found along the Red River Valley in both North Dakota and Minnesota, and in east-central North Dakota.

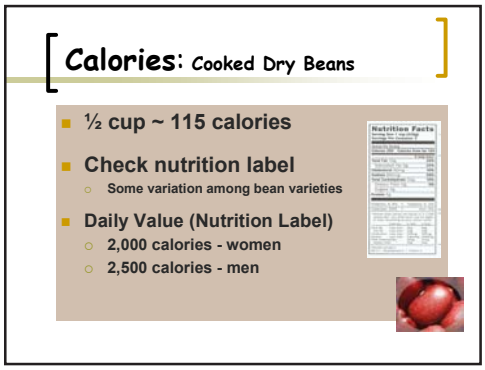
Visual # 4:
Healthy Weight: Health Benefits of Beans



Talking Points

Including beans in the diet on a regular basis can help with weight control. The dietary fiber in beans helps slow the blood glucose response (called low glycemic index). This is good for weight control because the absorption of carbohydrate occurs over a longer period of time and prevents hunger from re-occurring again so soon. Reduced frequency of hunger helps lower the total number of calories eaten. Beans are also low in fat and calories.

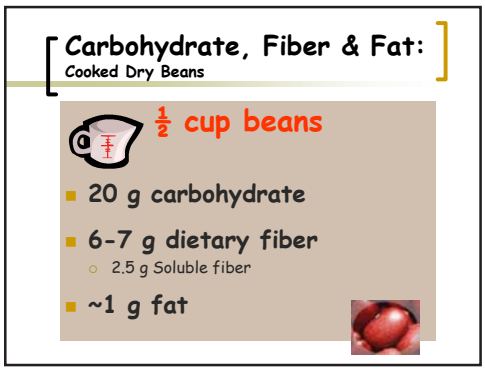
Visual # 5:
Calories: Cooked Dry Beans



Talking Points

The 115 calories found in one-half cup of beans represents a small percentage of the total day's calories. "Nutrition labels" on food products suggest an estimated caloric allowance for women of about 2,000 calories per day and for men about 2,500 calories. Caloric needs vary among individuals, depending on many factors.

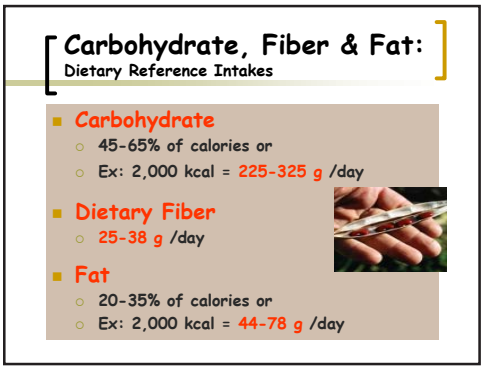
Visual #6:
Carbohydrate, Fiber & Fat: Cooked Dry Beans



Talking Points

A serving of beans (half a cup) has a moderate amount of carbohydrate, similar to one slice of bread (standard size of 1 oz or 28 grams). Beans are an excellent source of dietary fiber, including soluble fiber, which helps control blood glucose and blood cholesterol. Beans are very low in fat. A bean dish with added fat and/or sugar will have a higher calorie level.

Visual # 7:
Carbohydrate, Fiber and Fat: Dietary Reference Intakes



Talking Points

How does the amount of carbohydrate, fiber and fat in beans compare to the total amount recommended per day (Dietary Reference Intake)?

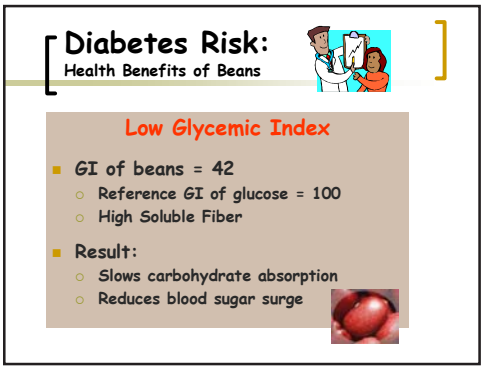
Beans have about 20 grams of carbohydrate per 1/2 cup. A suggested total amount of carbohydrate is 225-325 grams per day for a 2,000-calorie intake. So including beans in the diet will allow a wide variety of other carbohydrate containing foods to be included in a well-balanced diet.

Beans have a high content of dietary fiber: about 6-7 grams per 1/2 cup. Compare the amount of dietary fiber in beans to the amount in the following foods: 4 grams in a medium apple; 2 grams in one slice of whole wheat bread (~1 oz or 28 grams); or about 2 grams in 1/2 cup of broccoli. More than a third of the dietary fiber in beans is classified as soluble fiber which is important for controlling blood sugar and cholesterol.

For those restricting carbohydrate for weight loss, beans are a good carbohydrate choice because of the high content of dietary fiber. Low-carbohydrate diets are not recommended for long-term use because of concerns with reduced intakes of dietary fiber and many micronutrients associated with prevention of chronic disease.

Beans are very low in fat, containing less than 1 gram per 1/2 cup serving. A suggested total amount of fat is 44-78 grams per day for a 2,000-calorie intake.

Visual # 8:
Diabetes Risk: Health Benefits of Beans

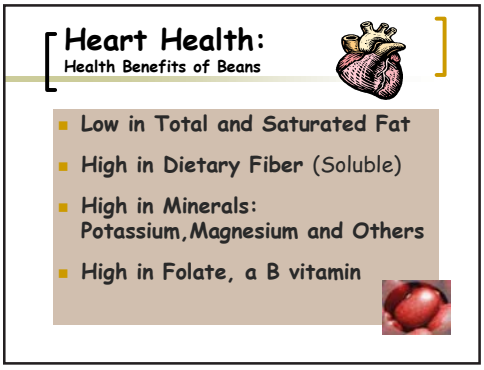


Talking Points:

Beans have a low "glycemic index," which means the carbohydrate is slowly absorbed over a longer period of time (compared to glucose). In beans, the high content of dietary fiber, especially soluble fiber, contributes to the low "glycemic index".

The slow absorption of carbohydrate from beans reduces the blood sugar surge after meals, and thus helps to maintain blood sugar levels within normal limits. Lower "glycemic index" foods such as beans may help with the prevention or management of diabetes.

Visual #9:
Heart Health: Health Benefits of Beans



Talking Points

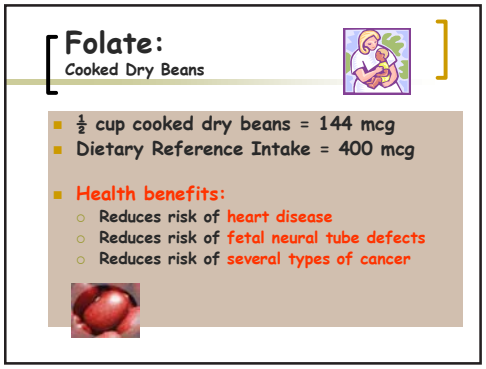
Beans are low in total fat and saturated fat. Saturated fat is the type of fat which contributes the most to the elevation of blood cholesterol, one of the major risk factors for heart disease.

Beans are high in dietary fiber, including soluble fiber, which helps to reduce the absorption of cholesterol. Soluble fiber, when broken down by bacteria in the large intestine, produces a substance that helps reduce cholesterol production in the body.

Beans are a good source of several minerals. The low sodium and high potassium content promote a healthy blood pressure. Other minerals found in beans such as magnesium may also help promote normal blood pressure.

Beans are a good source of folate, a B vitamin. Folate helps reduce blood homocysteine levels, a risk factor for heart disease.

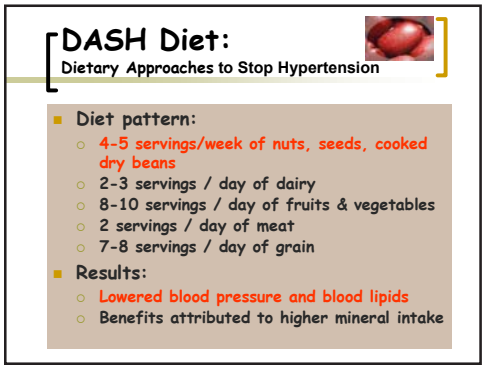
Visual # 10:
Folate: Health Benefits



Talking Points

Beans are a good source of folate, a B vitamin. A 1/2 cup serving of beans has more than 1/4 of the suggested amount (Dietary Reference Intake) of folate per day. The health benefits of folate relate not only to heart health but also to reducing the risk of neural tube defects and several types of cancer.

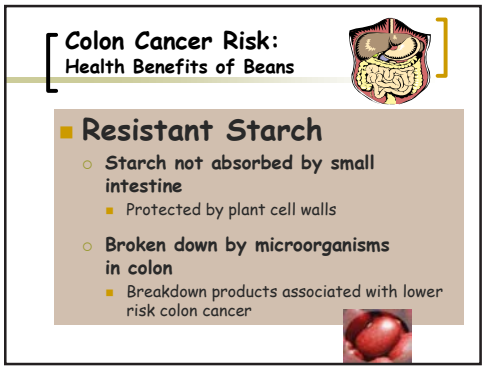
Visual # 11:
DASH Diet: Dietary Approaches to Stop Hypertension



Talking Points

The Dietary Approaches to Stop Hypertension or DASH clinical trial was conducted to determine if a "pattern of eating" would reduce blood pressure when fed over an eight week period. The diet pattern included "nuts, seeds and cooked dry beans" 4-5 times per week as well as a strong emphasis on dairy (2-3 servings per day), fruits and vegetables (8-10 servings per day). The experimental diet was not low sodium (about 3,000 mg). Blood pressure was significantly reduced on the experimental diet compared to a control diet (typical of U.S.). The blood pressure reduction was similar in magnitude to that found when administering a single blood pressure lowering medication. Blood lipids such as total and LDL-cholesterol were also found to be reduced with this diet. So regular inclusion of beans in a balanced "eating pattern" results in reducing heart disease risk.

Visual #12: Colon Cancer Risk: Health Benefits of Beans



Talking Points

"Resistant starch" is a term that refers to starch that is not broken down and absorbed in the small intestine. The "resistant starch" is, however, broken down by bacteria in the large intestine. The breakdown products appear to play a role in reducing the risk of colon cancer.

Beans are a good source of "resistant starch." The starch in beans contains approximately 16 percent "resistant starch." This would be approximately three grams of "resistant starch" out of the total 20 grams of starch (carbohydrate) found in 1/2 cup of beans.

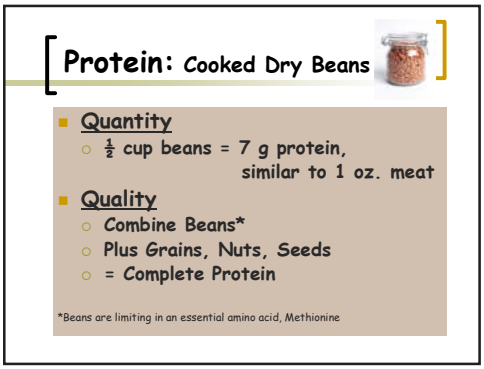
Visual # 13: Serving Size: Cooked Dry Beans

Talking Points

Beans are the only food included in two of the food groups within the Dietary Guidelines. The serving size of cooked dry beans is 1/2 cup in the vegetable group. The serving size for cooked dry beans is 1 cup in the meat group. A serving in the meat group contains approximately 14 grams of protein whether it comes from beans or meat. Thus, 2 ounces of meat has approximately 14 grams of protein similar to 1 cup of cooked beans.

The exchange lists are widely used for diabetic and weight control diets. In the exchange system, 1/2 cup of beans is equivalent to 1 very lean meat exchange (1 oz) plus 1 starch exchange. This reflects the nutrient composition of beans which includes both protein and carbohydrate with a very low fat content.

Visual # 14: Protein: Cooked Dry Beans

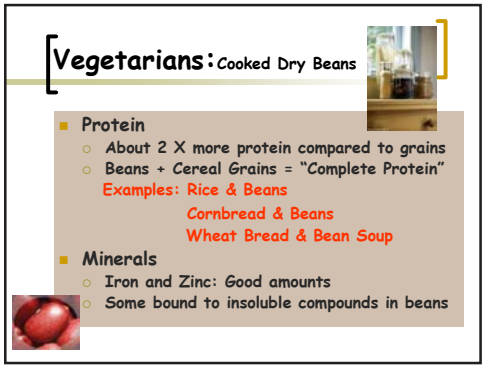


Talking Points

Beans are an excellent source of plant-based protein. A 1/2 cup serving of beans has the same amount of protein as 1 ounce of meat, which is approximately 7 grams.

Amino acids are the building blocks of proteins. Certain amino acids that we cannot make in the body are required (essential) in the diet. Beans are limiting in sulfur-containing essential amino acids. The combination of beans with certain other plant-based proteins (which are limiting in different essential amino acids) can produce an amino acid profile containing all the essential amino acids. This combination of plant-based proteins containing all the essential amino acids forms what is called a "complete protein."

Visual # 15: Vegetarians: Cooked Dry Beans

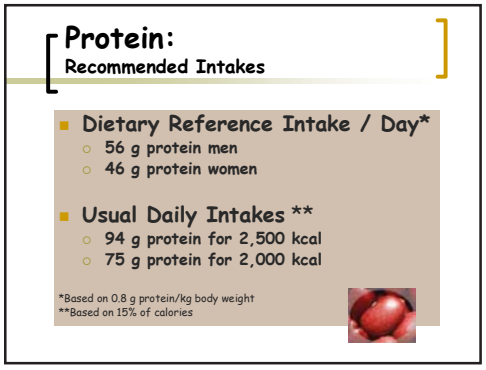


Talking Points

Beans are an excellent plant-based protein source for vegetarians, providing more than twice as much protein as cereal grains per serving. For example, 1/2 cup of beans has an average of 7 grams of protein whereas 1/2 cup of grains, such as spaghetti, has an average of 3 grams of protein. The protein in beans and cereal grains are each lacking different essential amino acids required by the body. However, all the essential amino acids are provided when combining together beans and cereal grains.

Beans also contain a good amount of iron and zinc (1 cup of beans with 14 grams of protein has 4.46 mg iron and 1.85 mg zinc). These minerals are found in good amounts in meat, especially red meat (2 oz lean ground beef with 14 grams of protein has 1.61 mg of iron and 3.66 mg of zinc). Vegetarians who consume no meat need to find plant-based sources of these minerals. However, some of the iron and zinc in beans is bound to insoluble compounds (phytates) thus reducing the amount of these minerals available to be absorbed compared to meat sources. A current research need is to quantitate the amount of iron and zinc available for absorption (not bound to phytate) from beans.

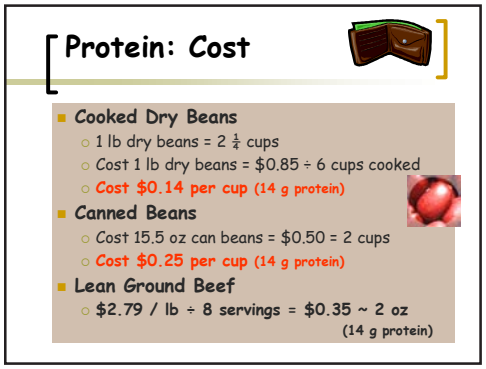
Visual #16 Protein: Recommended Intake



Talking Points

Beans contain 7 grams of protein in a 1/2 cup serving. The Dietary Reference Intake suggests that adequate protein intake for men is 56 grams/day and for women is 46 grams/day. The total amount of dietary protein comes from many different foods including animal-based protein (meats and dairy) as well as plant-based (beans, cereal grains, nuts and seeds). Plant-based proteins such as beans when combined with cereal grains, as well as some types of seeds or nuts, provide all the essential amino acids. Usual daily intakes of protein in the United States are greater than the recommended intakes.

Visual #17: Protein: Cost



Talking Points

Beans are often suggested as a lower price option for a protein source in the diet. Comparisons are made for the cost of 14 grams of protein whether from beans or lean ground beef. Prices may vary from one area to another, but similar comparisons can be done using the cost of these items at other grocery stores. According to these calculations (based on grocery store prices in Fargo during the

summer of 2004), beans cooked from the dry state cost $0.14 per cup (14 g protein), canned beans cost $0.25 per cup (14 g protein), and lean ground beef cost $0.35 for 2 oz (14 g protein). Meat is often served in portions larger than 2 oz, but the above example compares the costs of equal amounts of protein from various sources.

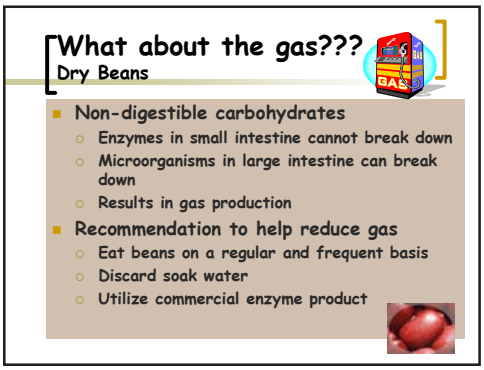
Visual #18: Rehydration: Dry Beans

Talking Points

Water is lost in the ripening and drying of beans and must be replaced by heating and soaking. The rate of hydration is faster in hot water than an all night soak in cold water. If beans are boiled initially for two to three minutes, the beans will rehydrate more in one hour **(Quick Soak Method)** than in 15 hours (all night) of soaking in cold water. The **Hot Soak Method**, with a soak time of 4-16 hours, is the recommended procedure. The extended soak time helps to reduce the cooking time and to leach more of the "gas" producing carbohydrates from the beans. The rehydrated beans need to be drained and the initial soak water discarded. Fresh water needs to be added and the beans put to simmer until tender. Different classes of beans will rehydrate at different rates. The cooking time to become tender will also vary by class of bean and age (length of time since harvest).

Preparation time can be greatly reduced by use of canned beans. Due to the addition of salt during processing, canned beans may have a higher sodium content compared to those prepared at home from dry beans.

Visual #19: What about the gas???: Dry Beans



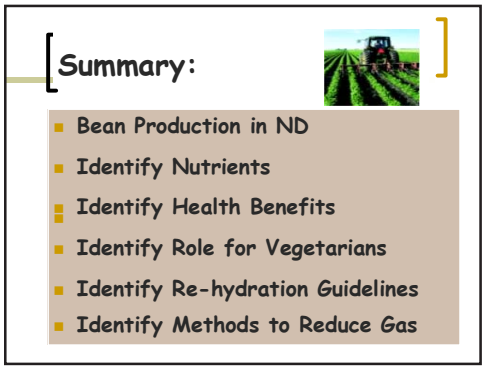
Talking Points

One of the problems sometimes encountered when including beans in the diet is development of unwanted "gas." The gas is produced when some "nondigestible" carbohydrate (cannot be broken down by human digestive enzymes in the small intestine) is broken down by bacterial enzymes in the large intestine . [The "nondigestible" carbohydrate are the oligosaccharides, raffinose and stachyose.]

There are several methods suggested to help reduce the gas-forming potential when eating beans:

1. Eat beans on a regular and frequent basis. Frequent consumption of beans allows the digestive tract to adapt.
2. Discard the soak water. During the soaking process for rehydration, the "non-digestible" carbohydrate leaches out of the bean. Thus, discarding the soak water will remove much of the "non-digestible" carbohydrate.
3. Utilize a commercial enzyme product (examples: BEANO, Bean-Zyme, etc.) which will help to digest (break down) the "non-digestible" carbohydrate from beans so it can be absorbed. This prevents the bacteria in the lower part of the intestine from converting the "non-digestible" carbohydrate to gas.

Visual #20: Summary



Talking Points

- North Dakota is the top producer of beans in the United States.
- Beans are high in dietary fiber and protein, low in calories and fat. Beans contribute many vitamins and minerals which promote heart health.
- The health benefits from consuming beans on a regular basis include:
  - Maintenance of a healthy weight
  - Reduced risk of diabetes
  - Reduced risk of heart disease
  - Reduced risk of colon cancer
- Beans are an excellent source of protein for vegetarians, especially when combined with cereal grains to make a “complete protein.” Beans also provide a good source of iron and zinc which may be found in lower amounts in vegetarian diets which exclude meat.
- The rehydration technique that is recommended for optimal bean quality is called the “hot soak” method. This method requires boiling beans for 2-3 minutes followed by a soak period of 4-16 hours prior to cooking until tender.
- There are three recommended methods to reduce the gas-forming potential of beans: 1) eat beans on a regular and frequent basis; 2) discard the soak water when rehydrating dry beans; and 3) utilize a commercial enzyme preparation to break down the non-digestible carbohydrates before they reach the large intestine which contains gas-forming bacteria.

References

General

Kushi, L.H. et al. Cereals, legumes and chronic disease risk reduction: evidence from epidemiologic studies. Am. J. Clin. Nutr. 1999;70(suppl):451S-458S.

Messina, M.J. Legumes and soybeans: overview of their nutritional profiles and health effects. Am. J. Clin. Nutr. 1999;70(suppl):439S-450S.

Guillon, F. & Champ, M.M. Carbohydrate fractions of legumes: uses in human nutrition and potential for health. Brit. J. Nutr. 2002;88(suppl3):S293-S306.

Northarvest Bean Growers Association, 50072 E. Lake Seven Road, Frazee, MN 56544

Diabetes

Araya, H., et al. Digestion rate of legume carbohydrates and glycemic index of legume-based meals. Int. J. Food Sc.i Nutr 2003;54(2):119-126.

Jenkins, D.J.A., et al. Type 2 diabetes and the vegetarian diet. Am. J. Clin. Nutr. 2003;78(suppl):610S-616S.

Rizkalla, S.W., et al. Health benefits of low glycemic index foods, such as pulses, in diabetic patients and healthy individuals. Brit. J. Nutr. 2002:88 (suppl 3):S255-S262.

Schafer, G., et al. Comparison of the effects of dried peas with those of potatoes in mixed meals on postprandial glucose and insulin concentrations in patients with type 2 diabetes. Am. J. Clin. Nutr 2003;78:99-103.

Heart Health

Anderson, J.W., et al. Cardiovascular and renal benefits of dry bean and soybean intake. Am. J. Clin. Nutr 1999;70(suppl):464S-474S.

Appel, L.J., et al. A clinical trial of the effects of dietary patterns on blood pressure. New Engl. J. Med. 1997:336(16):1117-1124.

Bazzano, L.A., et al. Legume consumption and risk of coronary heart disease in US men and women: NHANES I Epidemiologic Follow-up Study. Arch. Intern. Med. 2001;161(21):2573-2578.

Lin, P.H., et al. (the DASH-Sodium Collaborative Research Group). Food group sources of nutrients in the dietary patterns of the DASH-Sodium Trial. J. Am. Diet. Assoc. 2003;103:488-496.

Obarzanek, E., et al. Effects on blood lipids of a blood pressure-lowering diet: The Dietary Approaches to Stop Hypertension (DASH) Trial. Am. J. Clin. Nutr. 2001;74:80-89.

Sachs, F.M., et al. Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hyperten-sion (DASH) diet. New Engl. J. Med. 2001;344(1):3-10.

Cancer

Bird, A.R., et al. Starches, resistant starches, the gut microflora and human health. Curr. Issues Intest. Microbiol 2000;1:25-37.

Noah, L., et al. Digestion of carbohydrate from white beans (Phaseolus vulgaris L.) in healthy humans. J. Nutr. 1998;128:977-985.

Wollowski, I., et al. Protective role of probiotics and prebiotics in colon cancer. Am. J. Clin. Nutr. 2001;73(2 suppl):451S-455S.

Special Thanks

Reviewers

Duane Berglund, Ph.D., NDSU Extension Agronomist

Lynne Bigwood, Home Economist, Northarvest Bean Growers Association

Gerald Combs, Ph.D., Director, USDA, ARS Grand Forks Human Nutrition Research Center

Graphics

Northarvest Bean Growers Association
www.northarvestbean.org/index.cfm

American Dry Bean Board
www.americanbean.org

Minnesota Extension Service
www.extension.umn.edu/

For more information on this and other topics, see: www.ag.ndsu.nodak.edu

7-04