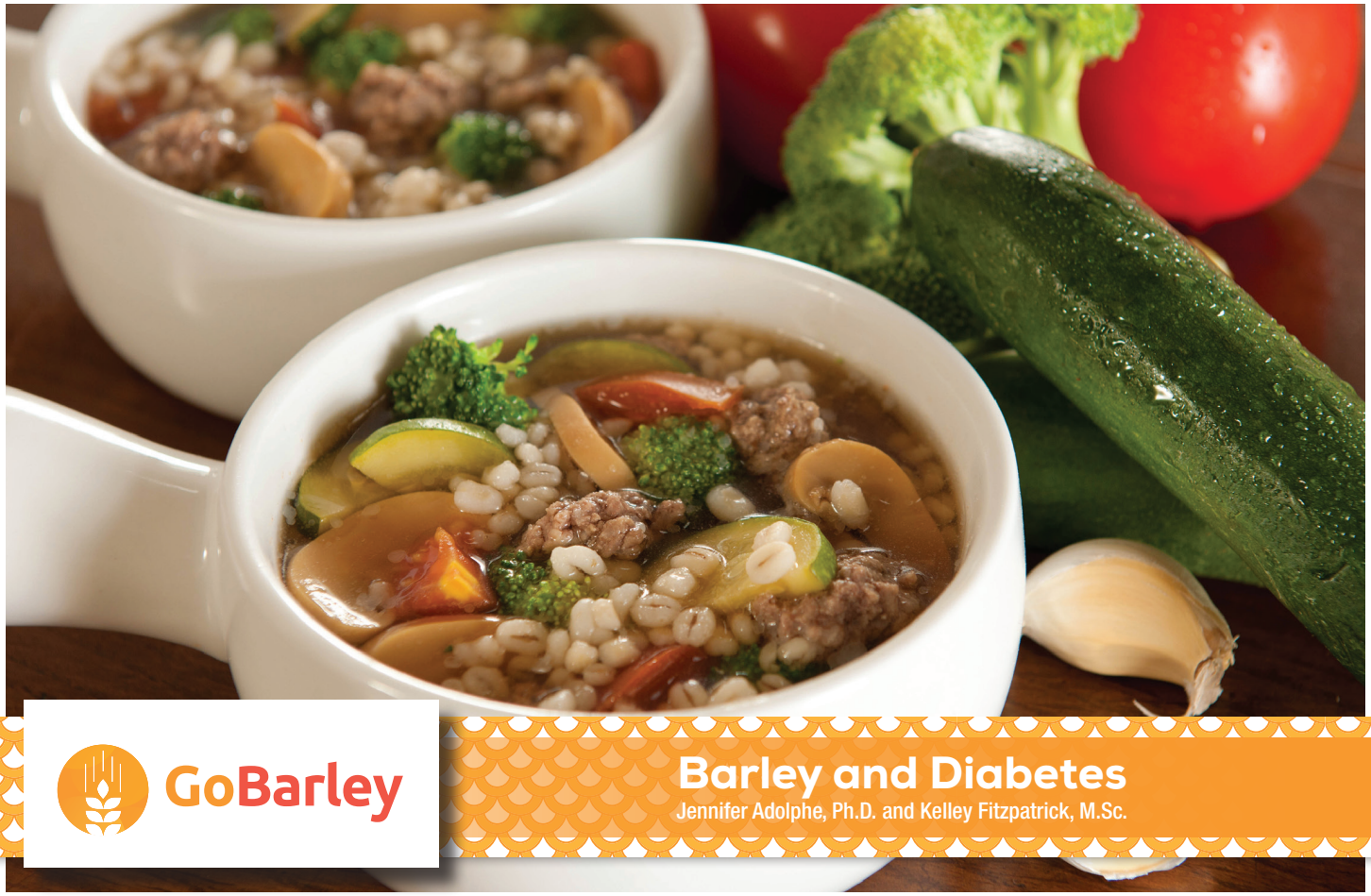

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Barley and Diabetes

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- Diabetes is a global health epidemic.
- Barley has the lowest glycemic index of the food grains.
- Barley is a rich source of total dietary fibre and β-glucan, a soluble fibre that positively affects the postprandial glycemic and insulinemic response.
- Consumption of barley may help in the prevention and treatment of diabetes and its associated conditions, including obesity, insulin resistance and metabolic syndrome.

Diabetes: Facts and Figures

The number of adults with diabetes worldwide has more than doubled over three decades and is now estimated to be 8.3 per cent, or 371 million people[3,4].

In Canada, diabetes' prevalence is projected to reach 3.2 million people in 2016[4].

Diabetes is predicted to rise from being the 11th leading cause of death worldwide in 2002 to the seventh by 2030; in high-income countries, it is expected to climb to become the fourth leading cause of death[4].

Diabetes is a health concern for people of all ages, as half of all those who die from diabetes are under the age of 60[1]. In parallel with the rise in childhood obesity, there has been an alarming emergence of youth-onset type 2 diabetes, although type 2 was long regarded as an exclusively adult disease[2].

In Canada, diabetes prevalence is projected to reach 3.2 million people in 2016[4]. Worldwide healthcare expenditure for diabetes among people aged 20 to 79 was estimated to be US $376 billion in 2010 (12% of healthcare expenditures), which is predicted to climb to US $490 billion in 2030[6].

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Barley is a Healthy Choice for People with Diabetes

Studies indicate that nutrition therapy can significantly lower hemoglobinA1C by approximately one per cent in type 1 diabetes and by one to two per cent in type 2 diabetes within three to six months[3].

Whole grain and fibre intake has been shown to be inversely associated with insulin resistance and the risk of developing metabolic syndrome and type 2 diabetes[4-6]. Soluble fibre is the component of whole grains that has been associated with regulating postprandial blood glucose and insulin responses[7]. As a whole grain, barley contributes to a healthy diet and can significantly contribute to total dietary fibre intake. Barley is a rich source of soluble fibre in the form of β-glucan (3.5 to 5.9 per cent of dry matter), which can slow gastric emptying, delay glucose absorption and improve postprandial glycemic response[8].

Barley aligns with the nutrition guidelines for overall health as proposed in Eating Well with Canada's Food Guide[9], and for the prevention and management of diabetes established by the Canadian and American diabetes associations:

- A dietary pattern that includes carbohydrates from fruits, vegetables, whole grains, legumes and low-fat milk is encouraged[3]. As a whole grain, barley is part of a healthy diet.
- The use of glycemic index (GI) and glycemic load in diet planning may provide a modest additional benefit over only considering total carbohydrates[3]. Barley has the lowest GI of cereal grains[10,11].
- It may benefit people with diabetes to consume more fibre (25 to 50 grams per day) than is recommended for the general population[12]. Barley contains more fibre than other cereal grains such as wheat and oats[13].
- The percentage of daily energy intake from carbohydrates should be no less than 45 per cent. Glycemic and lipid control may be improved in adults with type 2 diabetes with diets that provide greater than 60 per cent of total daily energy from low-GI, high-fibre carbohydrate sources[12]. Barley is a low-GI, high-fibre source of complex carbohydrates.

In addition to being beneficial for individuals with diabetes, barley consumption has been shown to prevent insulin resistance, an important risk factor for diabetes, and may also improve insulin sensitivity among those with impaired glucose tolerance, even in the absence of weight loss[7,14,15].

Barley is a Low-Glycemic-Index Food that Helps with Blood Glucose Control

The GI, developed to rank carbohydrate-containing foods based on their effect on postprandial glycemic response, is positively associated with the risk of developing type 2 diabetes[16,17].

Barley is classified as having the lowest GI of the food grains (Table 1)[10,11]. Soluble fibres, such as the β-glucan in barley, form gel-like substances when mixed with water, resulting in viscous gastrointestinal contents and a reduced rate of gastric emptying and carbohydrate absorption[18,19]. This affects the physiological response to carbohydrate ingestion by blunting the increase in postprandial plasma glucose and insulin[18]. It has been demonstrated that for each gram of β-glucan, the GI may be lowered by as much as four to 15 GI units[16,17]. Barley may not only have a beneficial effect on the glycemic response after the meal in which it was consumed, but may also impact glycemia and insulinemia after subsequent meals[20,21].

A review of 34 human clinical trials that investigated the glycemic response to oats and barley found that, for barley, 64 per cent of treatments demonstrated significant reductions in area under the glucose response curve and/or GI[22].Oat and barley products were not significantly different in their average reduction in area under the curve and GI, with an average combined reduction compared to glucose control of 48 ± 33 and 31 ± 17 mmol•min/l, respectively. This is a substantial decrease in glycemic response with biological relevance[22]. The combined data from these studies provides information about the effect of a wide variety of oat and barley products from different food formats (bread, pasta, hot and cold breakfast cereals, beverages as well as intact grains) and food-processing technologies, suggesting that products containing β-glucan consistently provide glycemic benefits in both healthy individuals as well as those with type 2 diabetes[22].

Barley has been shown to improve the GI when included as an ingredient in a range of food products[21,22]. Besides barley's nutritional advantages, barley tastes great and can be used to create delicious side dishes, salads, snacks, breakfast cereals and baked goods. Barley is available in a variety of forms including pearled barley, barley flour, flakes and grits. High β-glucan fractions and extracts are also available.

Table 1. Glycemic Index of Selected Foods[10]

Food Item	GI*
Barley	**40**
Lentils	41
Corn	75
Buckwheat	78
Couscous	93
Rice, brown	94
Bread	100
Millet	101
Potato	117

*Glycemic index determined using white bread as reference food in subjects with normal glucose tolerance

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Growing Forward 2
A federal-provincial-territorial initiative