

Blood glucose attenuation and satiety levels in humans following consumption of whole lentil and yellow pea and their food products; effect of processing and starch fractions

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SPG Contributions	Project Status	Duration/Timeline of Project (Year to Year)	Co-funders	Total Project Cost
\$281,747.00	Completed	April 2013 – March 2018	Agriculture and Agri-Food Canada	\$1,048,361.00

Project Description

Diet and lifestyle related diseases such as type 2 diabetes (T2DM) and coronary heart disease are affecting increasing numbers of people, and pose a significant public health problem in Canada. There is consistent observational evidence to suggest that pulse based foods may be useful in the prevention and management of diabetes and cardiovascular disease. However, in Canada and in many other countries, the consumption of pulses is very low, so a large proportion of the population do not accrue the health benefits of pulses. In order to raise awareness of the health benefits of pulses and to encourage increased consumption, the pulse industry needs to be able to advertise these messages to the general population. Advertising a health claim for a food item is regulated and requires approval by Health Canada based on credible evidence.

The research activities being pursued in this project have a primary aim of generating credible evidence to support regulatory approval of a pulse health claim for the reduction of blood glucose.

In order to complement other projects in the Pulse Cluster the workplan of this project is being limited to studies on commonly consumed lentil and yellow pea varieties. To meet the regulatory requirements of Health Canada we are testing lentil and yellow market class varieties that are sold in supermarkets and therefore commonly consumed by Canadians. Healthy Canadians are being asked to volunteer for testing these pulses and food items made from them; this meets another requirement of Health Canada.

Outcome

The overall aim of this project was to define the effects of replacing commonly consumed starchy foods with whole lentil and yellow pea varieties, on satiety and blood glucose in healthy human volunteers. Additionally, the mechanism by which these pulses lower blood glucose was explored. A total of 35 emerging and market class pulse varieties of red lentil, green lentil, and yellow pea were studied to determine the effect of cooking on microstructure, starch content, in vitro glucose release and polyphenol content. This led to the development of a modified method for simulating the digestion of foods in the upper gastrointestinal tract and allowed for the testing of freshly prepared foods. This method is currently being used to predict blood glucose response. In another study, processing methods of pulses were shown to affect their rate of glucose release during digestion; which could guide formulation of pulse based products. Several human studies were conducted to assess the effect of replacing a portion of a starchy food (instant potato or white rice) with common market class varieties of lentil and yellow pea on post prandial blood glucose response. Results showed that replacing half of the starch of rice or potato with varieties of lentil and yellow pea significantly lowers blood glucose response. Three pulse based foods (chili, muffin, soup) were successfully formulated and consumer acceptability studies showed that chili was favoured over the other foods. In human studies, the three foods were assessed for their ability to lower blood glucose after consumption, along with their satiety effects. Compared to wheat muffins, those made with pulses lowered blood glucose response by different amounts, with red lentil being more effective. Chili and soup made with lentils or peas also reduced blood glucose significantly more than chili made with rice or soup made with potato. Satiety studies of muffins showed that substituting wheat flour with either green or split red lentils had no significant effects on subjective appetite, food intake, or 24-hour energy intake. These studies also showed that substituting white rice with green, but not red, lentils in a chili may help to increase satiety, but may not translate to a decrease in subsequent food intake. Overall, this project successfully achieved its objectives, demonstrated the effectiveness of lentils and yellow pea on reducing blood glucose. Foods formulated from these pulses were acceptable to consumers and were effective in reducing blood glucose to varying extent, and could potentially be commercialized. Collectively, the results generated can be added to the body of evidence needed to provide guidance for regulatory approval of a health claim for blood glucose lowering and pulse consumption.

Research Objective

OBJECTIVE 1

To define the physicochemical and structural effects of processing of whole lentil and yellow pea varieties and to relate these to satiety and blood glucose attenuation in healthy human volunteers.

OBJECTIVE 4

To assess the acute blood glucose response and satiety of selected varieties of whole lentil and yellow pea, and food items made from these varieties.

OBJECTIVE 2

To conduct in vitro studies on whole red/green lentils and yellow pea varieties to define the effect of cooking on microstructure, starch content, in vitro glycemic index and polyphenol content.

OBJECTIVE 3

To formulate, produce, characterize and perform sensory evaluation of food items made from selected varieties of lentils and yellow pea with varying starch content.

