# Determining the link between pulse foods, gut health, and chronic disease

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| SPG Contributions | Project Status | Duration/Timeline of Project (Year to Year) | Co-funders | Total Project Cost |
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| $329,563.00 | Completed | April 2013 – March 2018 | Agriculture and Agri-Food Canada | $1,241,688.00 |

## Project Description

Pulses are a rich source of gut health promoting bioactives, including fermentable fibers and an array of phenolic compounds, and are globally recognized as foods with human health promoting potential. Consumption of pulses has the potential to beneficially modulate gut health, which includes direct effects on the gut barrier integrity and function, and modulation of the gut microbiota community structure and activity. This project aimed to systematically determine the link between pulses and gut health, and the subsequent implications on human health and chronic disease with particular emphasis on determining the mechanisms of action with regards to maintaining or enhancing the integrity of the colonic barrier and modulation of the gut microbiota structure and activity, as well as determining implications with regards to the effects on relevant gut-associated chronic diseases, namely ulcerative colitis (UC) and obesity. The effects of different pulse processing/cooking procedures on the profile/content of relevant pulse bioactives before and after upper gut digestion and the resultant impacts on the structure and activity of the human fecal microbial community was assessed.

## Outcome

1) The levels and profiles of pulse bioactives differ depending on the pulse preparation method. Compared to cooked pulses, canned pulses have lower phenolics and galacto-oligosaccharides (GOS); higher starch and insoluble fiber levels and pulse crackers have lower resistant starch and insoluble dietary fiber.

2) After in vitro upper gut digestion, the pulse digesta (pulse components remaining after upper gut digestion and absorption, ie. the content available to the colon), contains increased concentrations of extractable phenolics compared to that extracted from the pulse food before upper gut digestion. Therefore phenolic content analysis of pulse foods underestimates the level of bioaccessible/bioavailable pulse phenolics following consumption and digestion of pulse foods.

3) In vitro lower gut fermentation of pulse digesta (lentil, chickpea, yellow pea) led to dramatic shifts in human microbial communities from healthy, UC and obese donors. The processing method also had small but significant effects on how much the microbial composition was altered, but this varied with pulse type. These observed differences may be attributable to the different amounts of specific bioactives (starch, fibre, GOS) detected in the various pulse digesta. Notably, most communities reverted back to their original composition shortly after removal of pulse.

4) In vivo studies in healthy mice, using dietary interventions with pulses (navy bean, chickpea, yellow peas and lentils), demonstrated beneficial effects on gut health through modulation of the colonic microenvironment, including the microbiota community structure and its activity (increased SCFAs). It also improved the integrity of the colonic mucosal barrier. Using a mouse model of human IBD, mice fed navy beans, chickpeas, yellow peas or lentils prior to induction of colitis consistently demonstrated beneficial effects in reducing the severity of colonic inflammation.

## Research Objective

**OBJECTIVE 1**
To determine the potential for different pulse foods to modulate the structure and activity of human gut microbiota communities from healthy, obese and inflammatory bowel disease subjects.

**OBJECTIVE 4**
To determine the mechanisms through which pulse diets affect human health and chronic disease through modulation of gut microbiota structure and activity, gut barrier integrity and function, and immune response.

**OBJECTIVE 2**
To determine the degree to which processing/cooking methods affect pulse bioactive bioaccessibility and bioactivity (gut microbiota structure and activity).

**OBJECTIVE 3**
To determine the impact of human microbiota structure and activity on pulse bioactive (phenolics) metabolism.