

A quantitative assessment of the anti-nutritional properties of Canadian pulses

Dr. Michael Nickerson
 University of Saskatchewan

SPG Contributions	Project Status	Duration/Timeline of Project (Year to Year)	Co-funders	Total Project Cost
\$33,408.00	Completed	April 2014 – March 2017	Agriculture and Agri-Food Canada	\$240,003.00

Project Description

The overall goal of this research was to quantify the levels of antinutritional compounds within a wide range of Canadian pulses (chickpea, lentil, pea, faba bean, and beans) as compared to soybean (as a control), both with and without soaking/cooking. Samples were processed into a flour and assays were conducted for phytic acid, trypsin/chymotrypsin inhibitors, amylase inhibitors, total phenolics, saponins, oligosaccharides, lectins and oxalates.

Outcome

Enzyme inhibitors: Considerable differences in these enzyme inhibitors were detected among all investigated seeds. Soybean contained relatively high contents of protease inhibitors when compared with pulses. A combination of soaking and cooking was more effective than soaking alone in reducing enzyme inhibitors. Chymotrypsin inhibitors were destroyed as were the trypsin inhibitors in lentils, faba beans and some peas. The levels of trypsin inhibitors in cooked chickpeas and beans and amylase inhibitors in cooked beans were considerably lower than in the raw product and should not be a concern in terms of human consumption. Lectin, phytic acid and oxalates varied widely in Canadian pulses, but were generally lower than in soybean. Beans were high in hemagglutinating activity, but low in oxalates. Chickpea had the lowest lectin content while peas were lowest in phytic acid. Faba beans contained moderate levels of lectins and oxalates, but relatively high phytic acid content. In general, the contents of lectin, phytic acid and oxalate in Canadian soybean and pulses were comparable to that reported in literature. Soaking markedly decreased the levels of lectins, total and soluble oxalates, but had no impact on phytic acid. Cooking of presoaked seeds was more effective; hemagglutinating activity was reduced by more than 93%, and significant reductions in phytic acid content (11 – 67%) were observed in all samples, except for common beans and soybean. Cooked samples also had dramatically decreased oxalate contents, but had no detectable changes when compared with the soaking treatment. Oligosaccharides, total phenolics and saponin contents also varied widely among Canadian pulses. All flours contained higher levels of oligosaccharide than for soybean. The total polyphenol levels found in the red lentils and dark red kidney beans were comparable to literature reported values for soybean. In general, values for other Canadian pulses were on the order of 2-5x lower than those reported for soybean. The saponin content was found to be highest in whole pinto beans, and lowest in faba beans. However, in all Canadian pulses, levels of saponins were much lower than those reported for soybean. Soaking/cooking did prove to be an effective method at reducing the levels of oligosaccharides, polyphenols, vicine/convicine and saponins, however none of these antinutritional factors were eliminated.

Research Objective

OBJECTIVE 1

To perform a comprehensive chemical analysis of the antinutritional factors (ANFs) found within Canadian pulses, focusing on measuring levels of ANFs in whole and split pulses rather than pulse fractions.