Anti-Nutritional Factors in Yellow Pea Flours that Underwent Different Processing and Their Pizza Dough Products

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Abstract

Anti-nutritional factors (phytic acids, total phenolic acids, and trypsin inhibitors) were evaluated in pea flours and their pizza dough products. Flours were prepared with different pre-heat treatments and milling technologies. Results indicated that milling technologies had minimum effects on anti-nutritional factors levels. Moist heating showed remarkable effects on reducing total phenolic acids and trypsin inhibitor activities in pea flours. Cooking the pizza dough at 190 °C for 6 minutes achieved 60% to 85% trypsin inhibitor inhibition, but increased the total phenolic acid content (up to 62% increase). The phytic acid did not seem to be affected by these treatments.

Keywords: Yellow pea flours, anti-nutritional factors, milling, micronization, roasting

Introduction

Yellow peas (*Pisum sativum*), as a very important source of fiber, protein, vitamins and minerals, are often a component of the human diet. However, yellow peas also contain significant levels of anti-nutritional factors such as phytic acids, total phenolic acids, and trypsin inhibitors; these factors have been proven to have negative effects on protein digestion.

Specifically, phytic acid has an inhibitory effect on mineral bioavailability (Vidal-Valverde et al, 1994), while total phenolic acids are currently considered beneficial due to their antioxidant activity (Mattila & Kumpulainen, 2002). Previous research has shown that phenolic acids can decrease protein accessibility to humans. In addition, trypsin inhibitors are low molecular weight proteins which can decrease the protein utility by inactivating the digestive enzyme, trypsin (Vidal- Valverde et al, 1994).

The purpose of this research was to study the effects of various milling technologies and pre-milling heat treatments on the anti-nutritional content in yellow pea flours as well as the effects of oven cooking on the anti-nutritional contents in pizza dough products.

Results

A

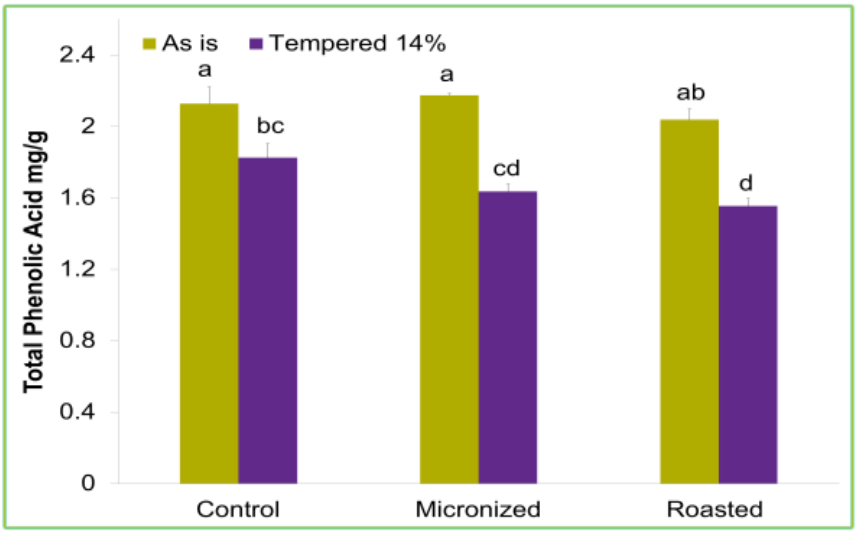

Figure 1: Effects of different thermal treatments prior to milling (at 100 °C) as well as different moisture contents on total phenolic acid in yellow pea flours (bars with different letters are significantly different, p<0.05) (A).

B

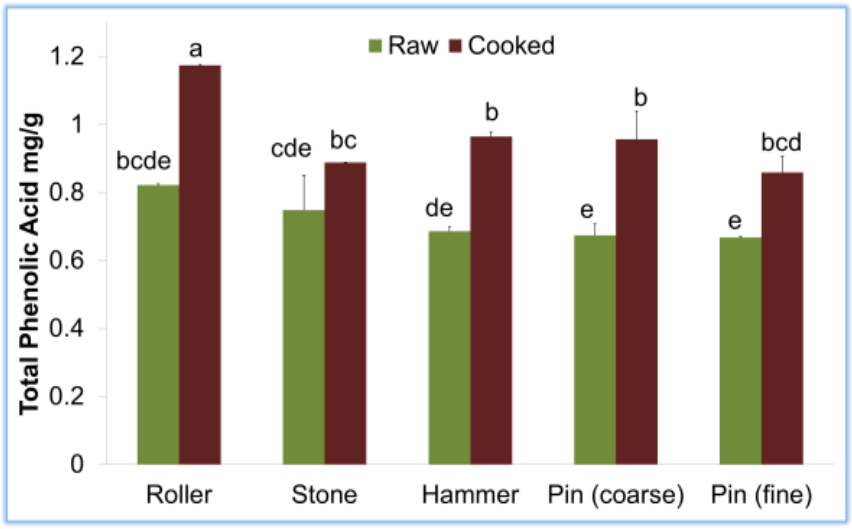

Figure 2: Total phenolic acid content in cooked or raw pizza dough which were made from (different types of milling) yellow pea flours (bars with different letters are significantly different, p<0.05) (B).

C

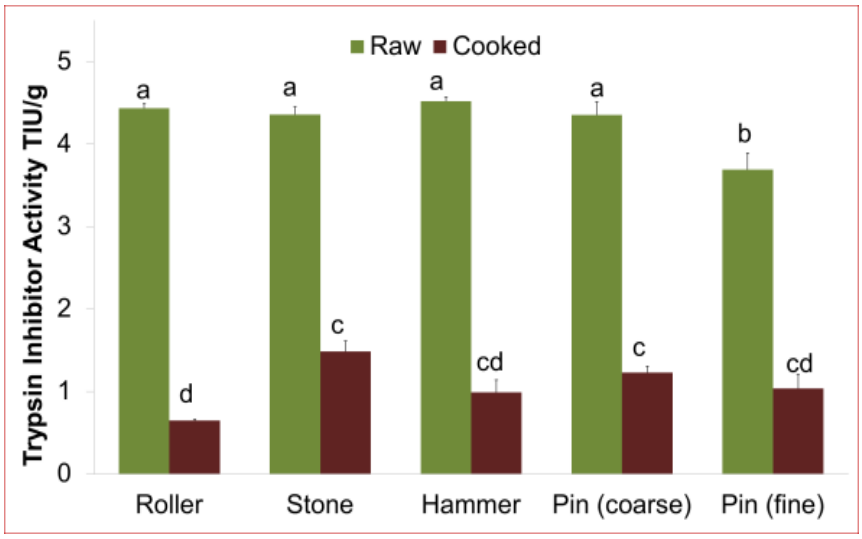

Figure 3: Trypsin inhibitor activity in cooked or raw pizza dough which were made from yellow pea flours that underwent different types of milling (bars with different letters are significantly different, p<0.05) (C).

Upon analysis of the experimental data, it can be seen that phytic acid was not significantly affected by any of the treatments in the experiment. In addition, milling technologies had no significant effects on total phenolic acid content and trypsin inhibitor activity in pea flours (only figures with significant difference are included).

From Figure 1, tempering to 14% moisture content decreased 14% the total phenolic acid content in the commercial pea flours (control), but 24% total

phenolic content for pre-heated (micronization or roasting) flours. However, pre-heating and tempering had no significant effects on trypsin inhibitor activity. After the pizza dough was cooked at 190 °C for 6 min, the total phenolic acid content achieved a25% to 62% increase (Figure 2), possibly because cooking broke the pizza dough cell wall to release more phenolic acids. However, 60% to 85% trypsin inhibitor activity was inactivated by cooking (Figure 3). A higher temperature and longer cooking time may be needed to totally inactivate the trypsin inhibitors in pizza.

Discussion and Conclusions

In summary, milling technologies had only minimal effects on the anti-nutritional factors of pea flour. Tempering and preheating did not reduce the phytic acid content and trypsin inhibitor activity in the pea flour. However, moist heating (14% moisture content) effectively reduced the total phenolic acid content in the flours which may benefit the animal feeding industry. The animal could grow faster if it is fed with low phenolic acid content pea flour. Cooking effectively inactivated the trypsin inhibitor found in the pizza dough and interestingly the total phenolic acid level increased in cooked pizza dough; this increase may be valued by the consumer seeking greater antioxidants because total phenolic acids are commonly regarded as an antioxidant agent nowadays.

Methods

Canadian whole yellow peas were either treated as is or tempered to 14% moisture content and thermally processed with micronizing or roasting at 100°C. These yellow peas were treated by different milling technologies including stone, hammer and pin milling. Moreover, all flours had their anti- nutritional content measured. Finally, these yellow pea flours were made into pizza dough products, cooked at 190°C for 6 minutes, and then had their anti-nutritional content measured.

Anti-nutritional factor analyses for all pea flours and pizza dough were as follows:

- Phytic acid measured by the method from Latta and Eskin (1980)
- Total phenolic acid evaluated by Folin-Ciocalteu method (Gao et al., 2002)
- Trypsin inhibitor activity determined by AACC method (AACC 22-40.1)

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