EFFECT OF SOAKING AND COOKING ON THE OLIGOSACCHARIDES AND LECTINS IN RED KIDNEY BEANS (PHASEOLUS VULGARIS L.)

G. Nyombaire[1], M. Siddiq[1], K. Dolan[1,2]
[1]Department of Food Science and Human Nutrition, [2]Department of Biosystems and Agricultural Engineering, Michigan State University, East Lansing, MI, 48824

INTRODUCTION

Common beans (*Phaseolus vulgaris*), owing to their nutrient-dense attributes, offer a potential to be developed as multiple-use products. However, in general, the consumption of beans has rarely gone beyond traditionally processed bean products and their uses. The reason for this stagnancy in the growth of processed bean consumption may be linked to 2 antinutritional factors found in common beans: 1) mainly due to the presence of flatulence-causing oligosaccharides, namely raffinose and stachyose (Silva-Queiroz et al., 2002), and 2) to a lesser extent, the presence of toxic lectins (Sharon and Lis 2002) that have been associated with food poisoning. Thus, any newly developed bean product would find acceptability among consumers only if these negative characteristics of common beans were minimized or eliminated. Pre-soaking beans at suitable conditions for oligosaccharides reduction and then cooking them at temperatures above 80 °C for elimination of lectins are necessary to produce a safe bean product. The objective of the present study was to see the effect of soaking beans at an elevated temperature and cooking for short time on hydration, oligosaccharides and lectin content.

MATERIALS AND METHODS

Whole dry red kidney beans were purchased from a local source. Beans were soaked for 12 hour in distilled water containing sodium bicarbonate and sodium polyphosphate (Dolan et al., 2006). The initial soak temperature was 77 °C and samples were then let to equilibrate to room temperature, 24 ± 1 °C. The initial soak temperature of 77 °C was chosen because bean processors in Michigan use this for commercial production of canned beans. Soaked beans were cooked in boiling water (~99.3 °C) for 14 minutes. Bean hydration, oligosaccharides (raffinose and stachyose), and lectins were determined by the methods of Matella et al. (2005) and Siddiq et al. (2006).

RESULTS

The total weight gain at the end of 12-hour soak was 67.1 g/100 g dry beans. About 80% of the weight gain was attained during the first hour of soaking (Fig. 1).

There was a significant reduction in lectin activity at the end of 12-hour soak, as evidenced by a 48.88% drop. Following 12-hour soak, cooking beans in boiling water for 45 min reduced lectins by a total of over 93%, with very little or no differences between 14, 30, or 45 min cook times (Fig. 2).

Soaking for 12 hours resulted in 80.83% reduction in raffinose, however, as was the case with weight gain, a significant portion of the total loss (65.28%) occurred during the initial 4 hours of soaking (Fig. 3). Total reduction in raffinose content, including cooking, was about 96%. As compared to raffinose, the rate of stachyose reduction was higher during soaking cycle, accounting for 83.44% loss. Cooking beans at 99.3 °C for 14 min further reduced raffinose content significantly ($p < 0.05$) but had no such effect on stachyose reduction (Fig. 3).

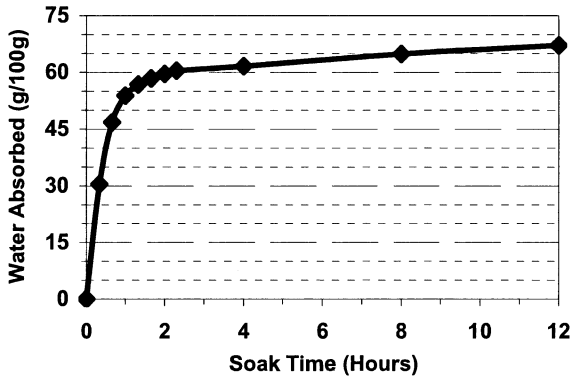

Figure 1. Red Kidney bean hydration pattern during 12-hour soaking

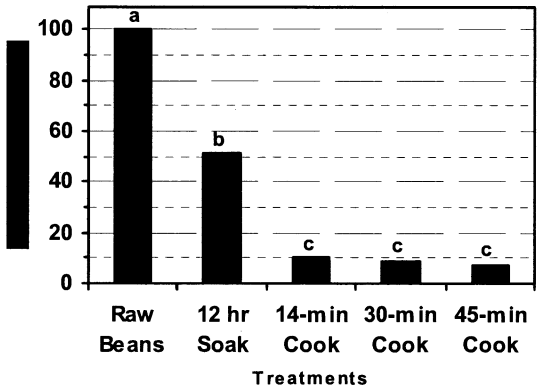

Figure 2. Effect of soaking and cooking on the lectins content in red kidney beans.

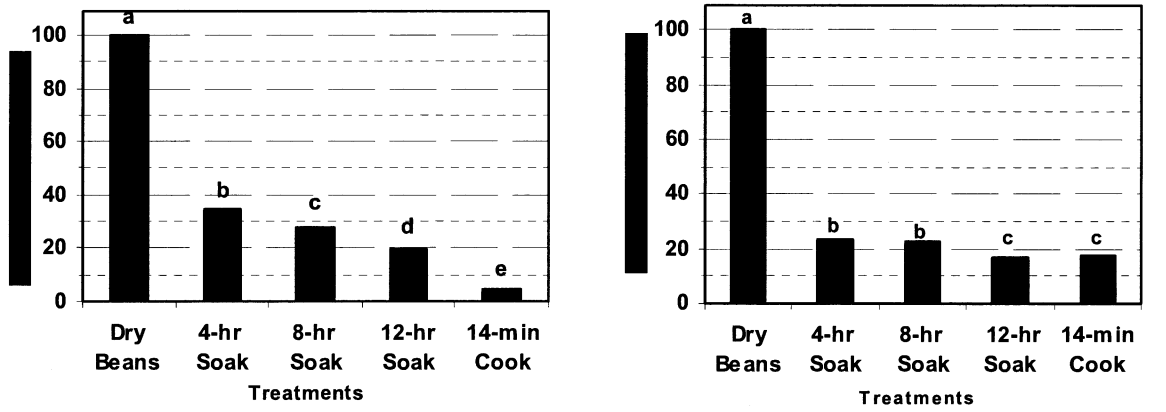

Figure 3. Effect of soaking and cooking on the raffinose and stachyose content in red kidney beans.

CONCLUSION

In conclusion, it was demonstrated that the soaking and cooking conditions used in our study were effective in significantly reducing antinutrient factors in red kidney beans, namely flatulence-causing oligosaccharides (raffinose and stachyose) and toxic lectins.

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