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Extended Abstract

Evaluation of Physicochemical, Textural and Cooking Characteristics of Enriched Spaghetti with Barley Bran and Xanthan Gum

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Abstract

Dietary fibers have beneficial physiological and metabolic effects and the enrichment of high-consumption products such as spaghetti with fibers can increase the health and reduce the risk of various diseases in the community. In this study, the effect of processed barley bran (at 40, 50 and 60% levels replacement), xanthan gum (at 1 and 2% levels) and their interactions on cooking properties (water absorption, cooking loss, optimum cooking time and swelling index), microstructural, texture and sensory of spaghetti were evaluated. With increasing barley bran content, the water absorption and cooking loss of spaghetti samples significantly decreased and increased, respectively (P<0.05). The gluten network was weakened by adding fiber by adding fiber, which reduced the cooking time to 10 min. The red value (a index) increased and the brightness (L index) decreased with the increase in the amount of the bran. Increment of barley bran increased the hardness of spaghetti texture noticeably, while the presence of xanthan gum improved the textural properties. The electron microscopy images showed that by adding xanthan, the walls of the air bags become more swollen, and in the presence of the bran caused rough structure. Sensory evaluation results indicated lower total acceptance of bran containing samples. Although the sample containing 40% barley bran and no xanthan gum had the highest overall acceptance among the fiber enriched samples.

Keywords: Barely Bran, Dietary Fiber, Hydrocolloid, Spaghetti

Introduction

Pasta products are very popular among consumers, however, many consumers are concerned about the high caloric intake of these products (Bergman, 1994). Today, researchers and manufactures tend to produce pasta products with reduced or even zero calories. Replacing high fiber sources in pasta products formulations can be an alternative for this goal (Mosharraf, Kadivar, & Shahedi, 2009).

Barley is a good source of fiber, vitamins, minerals and bioactive compounds like phenols, phytic acid, beta-glucan, and carotenoids. The aim of this study was to produce spaghetti

enriched with barley bran as a fiber source and xanthan gum for improving product characteristics (El Rabey, Al-Seeni, & Amer, 2013; Pins & Kaur, 2006).

Material and methods

The dry ingredients (flour, barely bran (40, 50 and 60%), xanthan gum (1 and 2%) and gluten) were mixed with water (60 °C) until the final dough moisture content reached 30%. In the next step, the dough was kneaded for 10 min. The homogeneous dough fed into a Pasta Maker. Pasta samples were dried in two steps: in the first step, a temperature of 40 °C and a moisture content of 70% for 12 h and a second step at 50 ° C and a relative humidity of 60 percent dried for 4 h until the moisture of spaghetti reached about 12%. The samples were then cooled at 25 °C and were packaged until the test was performed. Moisture (AOAC, 2005b) and ash content (AOAC, 2005a), optimal cooking time (Aravind, Sissons, Fellows, Blazek, & Gilbert, 2012a; Bustos, Pérez, & León, 2011a), water absorption (Aravind, Sissons, & Fellows, 2012b), cooking loss (Aravind *et al*., 2012b), swelling index (Aravind *et al*., 2012a), color evaluation (Pedreschi, Leon, Mery, & Moyano, 2006), textural properties (Irie, Horigane, Naito, Motoi, & Yoshida, 2004), microstructure (Kim, Kim, Bae, Chang, & Moon, 2017) and sensory properties (Padalino *et al*., 2014) of spaghetti were determined.

Results and discussion

Increasing the amount of barely bran and xanthan gum gave no significant changes in water contents, however, the ash content in spaghettis significantly increased with increasing incorporation of barely bran and xanthan gum due to their high ash contents. The water absorption and swelling index decreased significantly as the barely bran was incorporated into spaghetti formulation. The highest water absorption was observed in spaghetti contain 2% xanthan gum with no barely bran. The barley bran enriched spaghetti had low adhesiveness, hence it had increasing cooking loss due to lower gluten and amylose contents which are responsible to form protein-polysaccharide matrix. Regarding to color quality, addition of barely bran significantly decreased the lightness of spaghetti but xanthan gum showed no influence. Results clearly indicated that addition of barely bran reduced the firmness of spaghetti while xanthan gum incorporation increased it. It seems that higher fiber contents led to gluten matrix disruption. The image of SEM (Fig. 1) showed that addition of xanthan gum reduced the air packs in spaghetti matrix due to water absorption and increasing volume which led to fill empty spaces. Barely bran incorporation resulted in organized system with size and shape of honey hives. In point of sensory properties, overall quality and acceptance related to spaghetti contain 40% barely bran and without xanthan gum.

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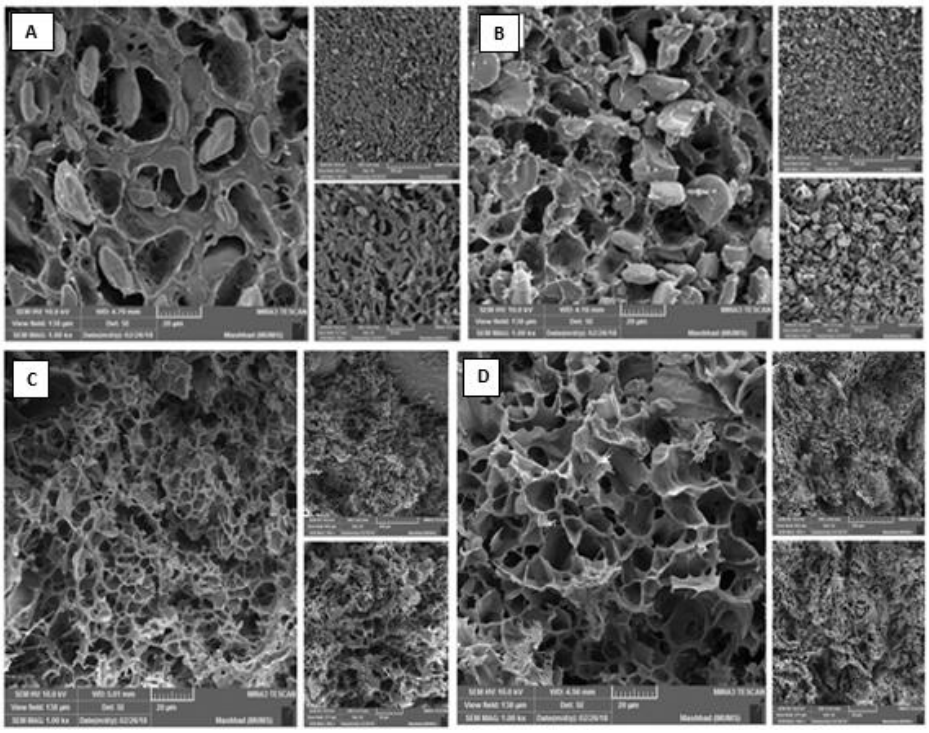

Fig. 1. Cross-section of scan electron microscope images of cooked spaghetti; A: wheat flour spaghetti, B: with flour spaghetti contain 2% xanthan gum, C: spaghetti contain 50% processed barley bran and D: spaghetti contain 50% processed barley bran and 2% xanthan gum. In each, left upper right and bottom right images magnified 1000x, 200x 500x respectively

Conclusion

Incorporation of barely bran more than 40% reduced cooking properties of spaghetti and addition of xanthan gum had a slight role in its improvement. The best barely bran-enriched spaghetti obtained with 40% replacement and without xanthan gum. Further investigations can be focused on net fiber of barely bran to improve quality and acceptability as well as nutritional value.

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