Relation between sensory properties and structural characteristics of gluten-free bread as affected by modified dietary fibers

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Background

Gluten is a major protein component of some cereals, which plays a main role in the functional properties of flour in the bakery application. However, it is important to eliminate gluten from the diet of patients with celiac disease. In order to produce a good-quality gluten-free bread, a suitable replacer is commonly needed to be added to the bread formulation to mimic its sensory and functional properties.
The objective of present study was to evaluate the crystalline and textural properties of gluten-free bread fortified with modified dietary fibers (wheat bran, resistant starch and inulin). Moreover, time-intensity evaluation was used to study temporal dynamics of sensory attributes of fortified-breads.

Methods

At first, gluten-free bread samples were fortified with different modified dietary fibers (wheat bran, resistant starch and inulin) and then their effects on crystalline and textural properties were evaluated using X-ray diffraction and texture analyser, respectively. Time Intensity (TI) as a dynamic sensory tool (SensoMaker software) was applied with a panel of 40 trained individuals to rate the changes in the intensity of firmness, chewiness and dryness attributes of 4 gluten-free bread samples (Fig. 1).

Fig. 1. Bread samples evaluated in the present study.

Results

Crystalline pattern were paralleled with textural properties and showed crystallinity and hardness were much more increased in bread with resistance starch. In contrast, inulin considerably decreased bread crystallinity, resulting in a softer crumb (Fig 2 and 3). Instrumental findings were closely related to sensory attributes like firmness, chewiness and dryness. Time-intensity investigation revealed inulin-fortified bread had lowest firmness and chewiness with less dryness, whereas resistant starch-fortified bread showed highest intensity of these descriptors (Fig 4). Sensory evaluation by consumer panel indicated highest score of overall acceptability in gluten-free bread with inulin. As a consequence, using inulin in bread-making as a softening agent allows the improvement of functional and sensory features of bread quality and received the highest acceptance value by consumers whereas resistant starch-fortified bread was considerably harder, more cohesive, more chewable with the lowest acceptance among the consumers.

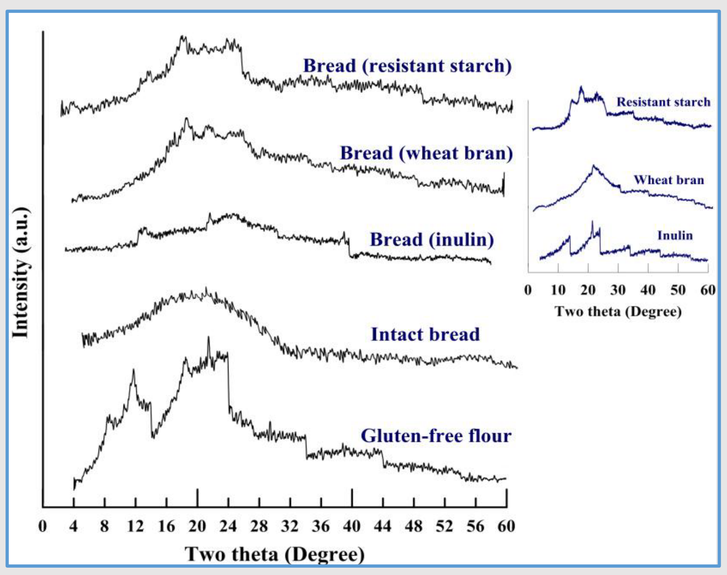

Fig. 2. X-ray diffraction patterns of gluten-free bread as affected by different modified dietary fibers (Left). Diffractogram of modified dietary fibers (Right).

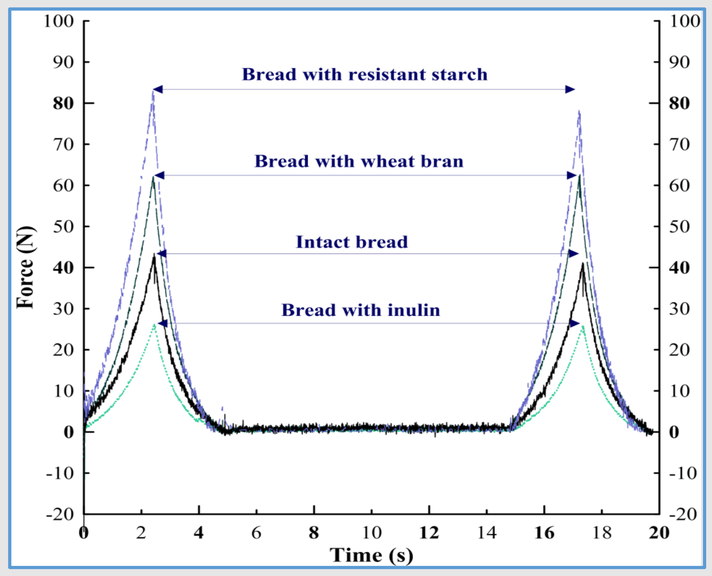

Fig. 3. Texture profile analysis (TPA) of control and fortified bread samples.

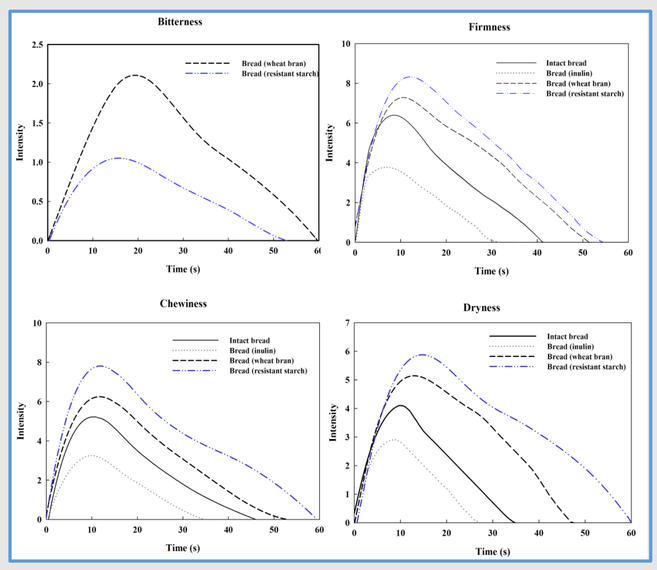

Fig. 4. Sensory evaluation: Time-intensity curves of bitterness, firmness, chewiness and dryness of control and fortified bread samples.

Conclusion

The present work shows that the use of inulin in bread-making as a softening agent allows improving the gluten-free bread quality and the acceptability by consumers. The presence of resistant starch is not essential for gluten-free bread production. This fact provides new perspectives for the selection of raw materials and technological parameters, which may notably diminish production costs and facilitate gluten-free products development.