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Abstract

The Combined Effect of Gluten Addition, Cell Wall Integrity, and Low Hydration Level in Durum Wheat Bread on Textural Quality and Starch Digestibility †

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Abstract: Several studies have focused on reducing the glycemic and insulinemic responses of starchy foods to lower the risks for major non-communicable diseases. A promising approach to limit the starch accessibility to alpha-amylase in cereals is by preserving the integrity of the cells where the starch is encapsulated. This protective effect is effective in flour, but it is lost when coarse semolina, rich in intact cells, is used to produce bread. It was hypothesized that long mixing times increased the cell wall porosity and, in turn, the digestive enzyme penetration. Moreover, food structure plays a key role in digestion and oral processing. The use of coarse semolina, however, reduced the cohesiveness of the breadcrumbs, increasing the disintegration and, in turn, the starch accessibility. Different bread structures can even be obtained by playing with water absorption in the dough. To investigate the effect of cell wall integrity, dough mixing times, and different bread textures on starch digestibility, six durum wheat bread samples were prepared using coarse semolina (CS, >1000 µm) or 20% gluten in substitution of CS, 70% water (optimum water absorption) or 55% water (low water absorption) and with different mixing times (5 or 45 min). The textural properties were evaluated by a texture profile analysis (TPA) and in vitro digestibility was assessed according to the Englyst's method. The bread sample produced with the addition of 20% gluten, low hydration (55%), and 5 min of dough mixing, was the least digestible at the end of intestinal digestion. This could be explained by the preservation of cell wall integrity, the effect of the gluten network being able to hamper the enzyme, and the presence of a cohesive crumb texture, due to the gluten addition and the low hydration. However, there is no information on the effect of such bread characteristics on oral processing and glucose and insulin release in humans. For this reason, we are now evaluating in healthy volunteers the oral processing and glycemic and insulinemic responses of the developed bread compared to a standard bread made with fine semolina to confirm the results found in vitro.

Keywords: semolina; intact cells; bread texture; starch digestibility

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