

Development of Barley-Fortified Instant Noodles

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ABSTRACT SUMMARY

The main objective of this study was to develop instant noodle products with additional nutritional and health benefits through substitution of noodle flour with high β -glucan barley flour. Hard red winter wheat (HRW) noodle flour was substituted with 10%, 20%, and 30% of three types of barley flour, including waxy, hull-less, and hulled types. The varieties were Radiant, Salute, and Sustagrain. The results showed that as the substitution level of barley flour increased, both the noodle color L* (lightness) value and cooked noodle hardness generally decreased, although the degree of changes varied with the type of barley flour. Sensory evaluation indicated that up to 20% of HRW flour could be substituted by Salute or Radiant barley flour and produce acceptable products. For Sustagrain whole grain barley flour, the most acceptable level was 10% when color, flavor, and eating quality of instant noodle were considered.

Introduction

Consumers worldwide are increasingly at risk of premature death from both cardiovascular disease and diabetes due to overweight, elevated cholesterol, high blood pressure, and abnormal blood sugars. These risk factors are partially influenced by a diet low in fiber and high in refined grains, sugars, and saturated fats.

A great interest has recently risen in the development of “functional” foods, products that may provide a health benefit beyond the traditional nutrients. Foods rich in antioxidants and with a low glycemic index (GI) can reduce the risk of increased postprandial oxidative stress, which is one of the

constituents of the onset of several chronic diseases. Barley is a rich source of soluble and insoluble fiber. β -glucan, a fraction of the soluble dietary fiber, is the primary component in barley that is responsible for lowering serum cholesterol and blood glucose. The Food and Drug Administration (FDA) finalized a rule in 2006 allowing barley foods to carry a health claim specific to soluble fiber and coronary heart disease. Barley can be part of the solution to the development of healthy foods in American diet (2).

Instant noodle was the subject of this research since it has become one of the most popular foods consumed worldwide. According to the World Instant Noodle Association (3), over 95 billion pieces of instant noodle were produced in 2010, which was equivalent to 1.1 piece per person per month and represented a 4% increase from 2009. The top 10 instant noodle consumption countries in 2010 were China, Indonesia, Japan, Vietnam, the United States, South Korea, India, Thailand, the Philippines, and Brazil.

Experimental Methods

In this study, both deep-fried and air-dried instant noodles were experimented by substituting noodle flour with each of the three types of barley flours: Radiant, Salute, and Sustagrain. The substitution levels were 10%, 20%, and 30%. The basic instant noodle formula of the control noodle was: flour (HRW), 100%; water, 32%; salt, 1.5%; Na_2CO_3 , 0.1%; and K_2CO_3 , 0.1%. Instant noodles were processed on a pilot-scale noodle line (1). Additional 1–5% water was needed when HRW flour was substituted with barley flour. Barley-fortified instant noodles were evaluated for instrumental and sensory quality attributes. The maximum substitution level of each barley flour was determined for the acceptability of noodle products.

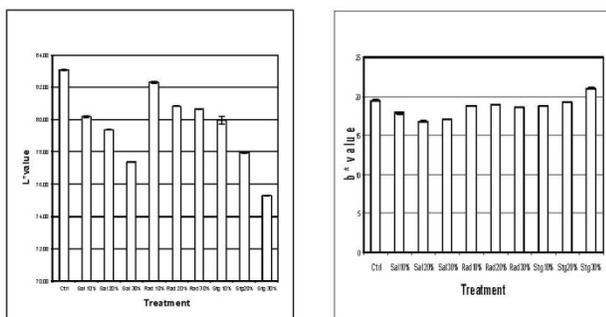


Fig. 1. Fried instant noodle color (L* and b* values)

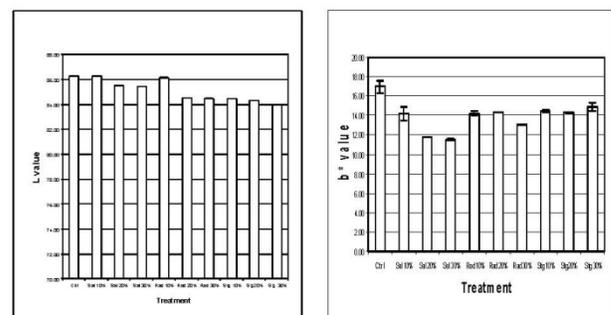


Fig. 2. Air-dried instant noodle color (L* and b* values)

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Results and Discussion

Figures 1 and 2 show the noodle color (L^* and b^*) of fried and air-dried instant noodles, respectively. As the substitution level increased, noodle lightness (L^*) decreased, especially for Sustagrain which was a whole grain barley flour. At the same substitution levels, Radiant yielded much brighter fried noodle color as it is proanthocyanidin-free. Less L^* value differences were seen in the air-dried instant noodles. As for yellowness (b^*), Radiant reduced it more than two other barley flours.

There were also visible color differences in the final products (Fig. 3). For the fried instant noodles, Salute gave a pale color appearance, Sustagrain made noodle darker, while Radiant yielded more similar color to the control noodle showing a brighter yellowish color. The maximum substitution level for Sustagrain was about 20%, above which the noodle color became brown. This could be potentially unattractive to consumers. Similar noodle color differences were observed in the air-dried instant noodles.

Figure 4 shows the hardness and cohesiveness values of cooked instant fried noodles as determined by the texture profile analysis (TPA) (1). As the substitution level of barley flour increased, both hardness and cohesiveness values decreased for all three barley flours, although the degree of changes varied with the type of barley variety. Salute showed the most reduction in noodle hardness. Radiant and Sustagrain did not significantly reduce the noodle hardness up to 20% substitution level. However, at 20% and 30% substitution levels, both Radiant and Sustagrain significantly reduced the noodle cohesiveness.

Figure 5 shows the hardness and cohesiveness values of cooked air-dried instant noodles. Compared to the control noodle, Salute significantly reduced the noodle hardness at 20% and 30% substitution levels, while Radiant and Sustagrain both maintained or increased the noodle hardness. For the cohesiveness value, similar to the instant fried noodle results, Salute did not affect it significantly while Radiant and Sustagrain both decreased it as the substitution level increased.

The sensory evaluation of noodles fortified with different barley flour was conducted with a panel of regular consumers of instant noodles. The purpose was to define the acceptance level that the regular consumers had regarding the amount of barley flour that could be added in instant noodles. Sensory evaluation results indicated that up to 20% of HRW flour in the noodle formula could be substituted by Salute or Radiant barley flour and produced acceptable products. The blend of HRW and Radiant flour (80/20) produced the most acceptable product. For Sustagrain barley flour, the most acceptable substitution level was 10% when noodle color, flavor, and eating quality were all considered.

Conclusion

Three types of barley flour were used to substitute HRW flour in instant noodle to enhance nutritional and health benefits. Extra water addition was necessary to optimize the noodle process. Sustagrain whole barley flour required more water than the other two barley flours at the same substitution levels. The most acceptable substitution level for Sustagrain flour was 10% when color, flavor, and eating quality were all considered. For Salute and Radiant barley flours, however, up

to 20% substitution level was acceptable in noodle processing and end product quality characteristics. The best blend of instant noodle formula was HRW/Radiant (80%/20%). In conclusion, high β -glucan barley flour can be a good option to improve the nutritional and health benefits of instant noodles without compromising functional quality.

Acknowledgements

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Fig. 3. Instant noodles (left: fried; right: air-dried)

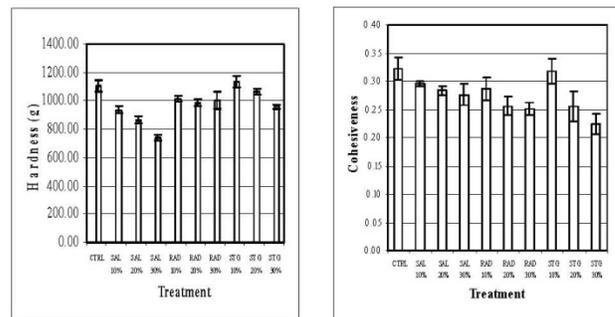


Fig. 4. TPA of cooked instant fried noodles

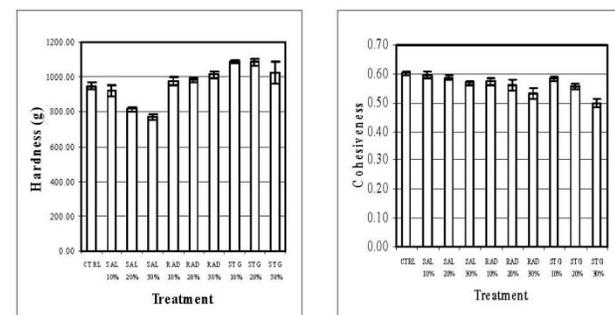


Fig. 5. TPA of cooked air-dried instant noodles