

New types of functional pasta enriched with lyophilized tomato or wheat bran antioxidant extracts

The increasing demand for healthy foods has encouraged food companies to direct new research and development activities towards products providing, beyond basic nutritional functions, beneficial effects for health and/or reducing the risk of chronic diseases, i.e. functional foods. Pasta can be a useful carrier for substances acting as nutrition enhancers or improving specific physiological functions.

We produced new types of functional pasta by adding to dough: i) a powdery lyophilized tomato matrix, employed at 1.5% and 2.5% supplementation level; ii) aqueous extract of wheat bran; iii) oleoresin of wheat bran. The latter two extracts were respectively produced by ultrasound-assisted and supercritical CO₂ green technologies. The levels of bioactive compounds and antioxidant activity, as well as pasta quality, were compared with conventional control pasta produced with the same semolina but without supplementations.



Fig. 1. New functional pasta types. From left to right: pasta enriched with 2.5% powdery lyophilized tomato matrix; pasta enriched with 1.5% powdery lyophilized tomato matrix; pasta enriched with oleoresin of wheat bran; pasta enriched with aqueous extract of wheat bran.

Pasta enriched with lyophilized tomato contained high levels of lycopene, a red-colored liposoluble antioxidant compound typically contained in tomato and absent in conventional pasta. After cooking, 70 g of pasta enriched with lyophilized tomato at 1.5% and 2.5% provided about 84% and 156%, respectively, of the daily dosage of lycopene for adults suggested by scientific literature.

Pasta enriched with bran oleoresin contained relevant levels of other bioactive compounds: a portion of 70 g contained 1785 µg of tocochromanols, that are compounds related to vitamin E, and 28 µg of carotenoids, related to vitamin A. In conventional pasta the amounts of these bioactive compounds were definitely lower.

Pasta enriched with bran aqueous extract showed significantly higher levels of phenolic compounds than conventional pasta. Phenolics are hydrosoluble antioxidant compounds typically contained in bran.

An increase in antioxidant activity is one of the main aims of pasta supplementation. Therefore, we also measured the antioxidant activity of pasta, ascribable to hydrophilic and lipophilic compounds. Bran oleoresin-enriched pasta showed the highest antioxidant activity. In particular, we found that this kind of pasta had hydrophilic and lipophilic antioxidant activity respectively 4 and 2 times higher than conventional pasta. The hydrophilic antioxidant activity halved with cooking, but remained significantly higher than in conventional pasta. Interestingly, the lipophilic antioxidant activity did not decrease during pasta cooking.

We also determined the sensory features of pasta as well as its cooking behavior in terms of cooking loss, chewiness, and structural properties. These characteristics are essential for consumers acceptability.

Pasta enriched with lyophilized tomato, with intermediate antioxidant activity between control and bran oleoresin enriched pasta, was reddish (Fig. 2) and showed unconventional taste and odor, affected by a tomato note. Based on a suitable communication strategy, this kind of pasta might be well accepted by consumers aware of the importance of increasing antioxidants and nutraceuticals dietary intake.

Pasta supplemented with aqueous extract of bran was the most similar to control pasta, for both sensory features and cooking properties. However, it did not significantly improve antioxidant activity, therefore further research is needed to increase the concentration of phenolic compounds and the antioxidant activity of the end product.



Fig. 2. Appearance of new functional pasta types after cooking. Top (from left to right): pasta enriched with aqueous extract of wheat bran; pasta enriched with oleoresin of wheat bran. Bottom (from left to right): pasta enriched with 1.5% powdery lyophilized tomato matrix; pasta enriched with 2.5% powdery lyophilized tomato matrix.

Pasta enriched with bran oleoresin had an appearance very similar to control pasta, but showed weaker structural characteristics, although within the normal quality variation of commercial pasta products on the market. In fact, scanning electron microscopy observations showed that, probably due to its lipophilic nature, the oleoresin altered starch swelling and gluten network. However, the extent of this phenomenon did not affect significantly the overall sensory judgment on bran oleoresin enriched pasta. Therefore, supplementation with bran oleoresin was the most effective to increase the antioxidant activity of pasta without jeopardizing sensory quality. This new kind of functional pasta can improve the overall dietary intake of antioxidants.

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