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Okara-Enriched Bread: Effects on Physical Quality, Nutritional Composition and Sensory Acceptance

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Structured Abstract

Background: Okara, the insoluble by-product of soy milk and tofu production, has gained increasing attention as a sustainable functional ingredient due to its high protein, dietary fibre, and bioactive compound content. Nevertheless, its utilisation remains limited because of high moisture content and short shelf life, leading to significant disposal as agro-industrial waste. This research focuses on valorising okara as a functional ingredient in bakery products. This study aims to formulate bread with soy by-product, investigating its physical, nutritional and sensory qualities.

Methods: Breads were prepared in five formulations comprise of varying concentration of okara paste (0, 5, 10, 15, and 20% w/w). The structural morphological, physical quality, nutritional composition, and sensory acceptance were investigated.

Results: Increasing levels of okara incorporation in bread resulted in reduced loaf volume and specific volume, accompanied by increased density. This indicates impaired dough expansion due to fibre–gluten interactions which is supported by SEM micrographs that shows progressive disruption of the gluten network as okara increased. Texture profile analysis revealed improved moistness and resilience of the bread as okara added. Nutritional analysis confirmed significant ($p<0.05$) increases in protein, dietary fibre, and mineral (Magnesium, Calcium, and Potassium) contents with increasing okara levels. In addition, antioxidant assays revealed elevated phenolic (61.39 to 71.61 mg GAE/g sample) and flavonoid (14.91 to 19.19 mg QE/g sample) contents in okara-enriched breads as compared to control bread (phenolic- 55.40 mg GAE/g sample; flavonoid- 13.58 mg QE/ g sample), respectively. Sensory evaluation demonstrated that breads containing 5–10% okara maintained acceptability comparable to the control, while bread with 20% okara paste achieved the highest consumer preference due to enhanced moistness and favourable mouthfeel.

Conclusion: Bread incorporates with 20% okara provides an enhance physical and nutritional quality as well as consumer acceptability. This study highlights the potential of okara as a sustainable functional ingredient in bread production.

Keywords: Okara-enriched bread, Sustainable, Functional foods, Sensory acceptability, Nutritional value

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