

Abstract

The growing demand for gluten-free and functional food products has encouraged the development of snacks with enhanced health-promoting properties. Among functional ingredients, *Chlorella vulgaris* has attracted considerable attention due to its high content of bioactive compounds, including chlorophyll, carotenoids, and phenolic compounds. Therefore, this study aimed to determine the effect of flour substitution with *Chlorella vulgaris* microalgae powder at different concentrations (0%, 1%, 2%, and 3%) on the physical properties, antioxidant activity, and sensory characteristics of gluten-free crackers. It was found that increasing *C. vulgaris* substitution significantly decreased the L, a, and b* values, resulting in a darker, greener, and less yellow appearance, while also significantly reducing the water activity. In contrast, moisture content showed a slight increasing trend and hardness showed a slight decreasing trend, although both were not statistically significant. Moreover, higher *C. vulgaris* concentrations significantly affect the antioxidant activity and ascorbic acid equivalent (AAE) values both before and after baking ($p \leq 0.05$). Although baking caused a slight reduction in antioxidant activity, high antioxidant retention ($\geq 97\%$) was observed across formulations, with no significant differences among treatments. Nevertheless, higher substitution levels led to significantly lower sensorial acceptability due to stronger green color, grassy aroma, bitterness, and aftertaste. Among all formulations, crackers containing 1% *C. vulgaris* showed the most favorable balance between enhanced antioxidant properties and consumer acceptance. Therefore, these findings suggest that low-level incorporation of *C. vulgaris* can improve the functional value of gluten-free crackers while maintaining acceptable sensory quality and product acceptability.

Keywords: *Chlorella vulgaris*, gluten-free crackers, physical properties, antioxidant activity, sensory evaluation