

Title: Physicochemical Properties and Sensory Evaluation of Nutrient-Rich Cookies: Substitution of Wheat Flour With Composite Flour of Pumpkin Seed, Chickpea, and Oats

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Abstract: Many countries are facing a significant problem of hunger and malnutrition due to the lack of balanced nutrients in regular diets. Cookies can serve as a consumer-friendly alternative to fulfill nutritional requirements. This study aimed to formulate cookies using nutrient-rich, locally available, and underused ingredients as substitutes for wheat flour to enhance nutritional content, excluding carbohydrates. Composite flours of whole pumpkin seed, chickpea, and oats were developed in three ratios to form Targeted Cookies (TCs, Targeted Cookies 1 [TC1]-2:1:1, Targeted Cookies 2 [TC2]-1:2:2, and Targeted Cookies 3 [TC3]-1:1:2, respectively). TCs were evaluated against Control Cookies (CC-100% wheat flour) for their physicochemical, nutritional, and sensory properties. Proximate composition was assessed using standard Association of Official Analytical Chemists (AOAC) methods. Fiber, minerals, and antioxidant properties were determined using gravimetric and atomic absorption spectrophotometric and standard analytical methods, respectively. The organoleptic test was conducted using the nine-point hedonic scale. All macronutrients, except carbohydrates, were significantly increased ($p \leq 0.05$) in composite flours compared to the wheat flour. The CC exhibited the highest carbohydrate content (63.78%), while TC1, containing the greatest proportion of pumpkin seed flour, demonstrated higher levels of protein (18.57%), fat (33.13%), ash (2.98%), and energy (532.68 kcal). Mineral and dietary fiber contents were enhanced in all TCs. TC2 contained balanced minerals, with the highest amount of iron (3.82 mg). TC3 showed superior soluble (3.01%), insoluble (13.42%), and total (16.43%) fiber contents. TC1 had the highest total phenolic content (586.49 mg), DPPH radical scavenging activity (87.23%), and carotenoids (2.78 $\mu\text{g/g}$) among the others. The organoleptic test revealed that TC1 achieved the highest scores of aroma (8.00) and taste (8.50), whereas TC2 had the highest score of texture (7.00). This study suggests that substituting wheat flour with a composite flour of pumpkin seeds, chickpeas, and oats, particularly in the 2:1:1 ratio (TC1), provides a nutritionally enriched and consumer-accepted alternative for improving nutrient intake. Further analysis may be conducted to support the results.

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