



Development of a Small-Scale Extruder Machine and Evaluation with the Production of Jackfruit Seed Flour-Based Extruded Snack

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The development of small-scale extruder machines has become increasingly important due to the growing demand for efficient food processing technologies. This study focuses on the design and fabrication of a screw-type extruder machine and the assessment of its performance using jackfruit seed flour as the primary raw material for the production of extruded snacks. Among existing designs, screw-type mechanisms were chosen over piston-type mechanisms due to their simpler operation and continuous processing capability. The fabricated machine consists of essential components, comprising the feeder, barrel, screw, heating system, and die, all mounted on a single integrated frame. The performance of the machine was evaluated at different moisture contents, while the quality of the extruded snacks assessed through physicochemical and sensory analysis. Quality parameters measured as expansion ratio, density, water absorption, and water solubility index. Results showed that for the density, expansion ratio, Water Absorption Index (WAI), and Water Solubility Index (WSI) were $1.11 \pm 0.08 \text{ g cm}^{-3}$, $1.33 \pm 0.02\%$, $3.58 \pm 0.04 \text{ g g}^{-1}$, and $22.85 \pm 0.07\%$ respectively. Regression analysis revealed that the temperature had the statistically significant effect on the expansion ratio ($P < 0.001$). Sensory evaluations were carried out for two treatments by a panel comprising 30 untrained panelists. According to the Friedman nonparametric test, sensory evaluation results for treatment two has the highest preference in terms of color (4.50), aroma (4.25), texture (4.50), flavor (4.50), mouthfeel (4.50), appearance (4.50) and overall acceptability (4.50). In treatment number two, the formulation was composed of 30 g jackfruit seed flour, 49 g wheat flour, 20 g powdered sugar, and 1 g salt. Commercially imported extruders normally cost more than LKR 100,000, whereas the estimated total cost of the small-scale extruder was approximately LKR 13,000. The study concludes by recommending future research on incorporating a vacuum chamber within the barrel to further enhance product quality.

Keywords: Extruded snack, Jackfruit seed flour, Single-screw design, Small-scale food extruder, Value-added snack