



INTISARI

FORTIFIKASI NANOKALSIUM DARI TEPUNG TULANG LELE PADA *BROWNIES* SEBAGAI PRODUK TINGGI KALSIUM

Limbah tulang lele dumbo (*Clarias gariepinus*) memiliki potensi dalam memenuhi asupan sumber kalsium untuk mengatasi rendahnya tingkat konsumsi kalsium masyarakat melalui teknologi fortifikasi pangan. Penelitian ini bertujuan untuk mengetahui pengaruh fortifikasi nanokalsium dari tepung tulang lele terhadap mutu kimia, sifat sensoris, serta kontribusi *brownies* terhadap pemenuhan Angka Kecukupan Gizi (AKG) kalsium harian. Perlakuan yang digunakan adalah penambahan nanokalsium tepung tulang lele sebanyak 0%, 0,5%, 1%, 1,5%, dan 2% dari perhitungan total berat bahan kering pada *brownies*. Parameter yang dianalisis yaitu pengujian fisik (rendemen dan ukuran partikel); pengujian kimia (kadar air, abu, protein, lemak, karbohidrat, kalsium, dan fosfor); serta pengujian sensoris (aroma, rasa, tekstur, dan warna) dengan uji hedonik. Hasil penelitian menunjukkan bahwa nanokalsium tepung tulang lele memiliki rendemen 17,84%, ukuran partikel 141,57 nm, kadar kalsium 39,54%, dan kadar fosfor 13,04%. Fortifikasi nanokalsium pada *brownies* menghasilkan kadar air 7,71–3,23%; abu 1,50–2,34%; protein 3,11–4,61%; lemak 20,81–24,81%; karbohidrat 66,87–64,70%; kalsium 50–470 mg/100 g ; dan fosfor 110–250 mg/100 g. Fortifikasi tidak berpengaruh nyata terhadap atribut rasa dan warna, namun tekstur cenderung lebih disukai pada fortifikasi 1,5–2%. *Brownies* dengan fortifikasi 2% memiliki kontribusi terhadap AKG kalsium sebesar 25,64% per 60 g takaran saji, jauh lebih tinggi dibandingkan kontrol (4,55%). Dengan demikian, fortifikasi nanokalsium dari tepung tulang lele dumbo mampu meningkatkan kandungan kalsium *brownies* secara signifikan tanpa menurunkan tingkat penerimaan konsumen, sehingga berpotensi dikembangkan sebagai produk pangan fungsional sumber kalsium.

Kata kunci: *brownies*, fortifikasi, nanokalsium, tulang ikan lele, AKG



ABSTRACT

NANOCALCIUM FORTIFICATION OF CATFISH BONE FLOUR IN BROWNIES AS A HIGH-CALCIUM PRODUCT

Catfish bone waste (*Clarias gariepinus*) has the potential to serve as a calcium source to help address the low calcium intake among the population through food fortification technology. This study aimed to evaluate the effect of nano-calcium fortification derived from catfish bone flour on the chemical quality, sensory properties, and the contribution of brownies to the Recommended Dietary Allowance (RDA) of daily calcium intake. The treatments consisted of adding nano-calcium catfish bone flour at concentrations of 0%, 0.5%, 1%, 1.5%, and 2% based on the total dry weight of the brownie ingredients. The analyzed parameters included physical (yield and particle size), chemical (moisture, ash, protein, fat, carbohydrate, calcium, and phosphorus), and sensory attributes (aroma, taste, texture, and color) using a hedonic test. The results showed that catfish bone nanocalcium had a yield of 17.84%, particle size of 141.57 nm, calcium content of 39.54%, and phosphorus content of 13.04%. Nanocalcium fortification in brownies resulted in moisture content of 7.71–3.23%, ash 1.50–2.34%, protein 3.11–4.61%, fat 20.81–24.81%, carbohydrates 66.87–64.70%, calcium 50–470 mg/100 g, and phosphorus 110–250 mg/100 g. Fortification had no significant effect on taste and color, while texture was more preferred at 1.5–2% fortification levels. Brownies fortified with 2% nanocalcium contributed 25.64% of the calcium RDA per 60 g serving, significantly higher than the control (4.55%). Therefore, nanocalcium fortification from catfish bone flour can effectively enhance calcium content without reducing consumer acceptability, making it a promising functional food product rich in calcium.

Keywords: brownies, fortification, nano-calcium, catfish bone, RDA