

EFFECTS OF FREEZING AND THAWING ON THE PHYSICAL PROPERTIES
AND ACCEPTABILITY OF TEMPEH FISH BALL

By

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ENDORSEMENT

This project report entitle **EFFECTS OF FREEZING AND THAWING ON THE PHYSICALS PROPERTIES AND ACCEPTABILITY OF TEMPEH FISH BALL** by **Nurfatin Binti Mohd Halimi**, Matric No. **UK16781** has been reviewed and corrections have been made according to the reccomendations by examiners. This report is submitted to Department of Fod Science (Food Technology), Faculty of Agrotechnology and Food Science, Universiti Malaysia Terengganu.



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DECLARATION

I hereby declare that the work in this thesis is my own excepts for quotations and summaries which have been duly acknowledged.

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ABSTRACT

The main approach of this study was to evaluate the effects of freezing and thawing process on the physical properties and acceptability of tempeh fish ball. Five formulations of tempeh fish ball were developed. These formulations were the incorporation of tempeh in the ingredients at 0%, 5%, 10%, 15% and 20%. Physical analyses were carried out for five freeze-thaw cycles (FT0, FT1, FT2, FT3 and FT4) at every week within 28 days of storage. Tempeh fish balls were analyzed for physical characteristics including color (whiteness index), texture (hardness, chewiness, springiness, and gumminess) and folding test for every freeze thaw cycle. Whereas, only fresh sample (FT0) were analyzed for chemical properties (moisture content, protein, fat, ash, carbohydrate and crude fiber). The chemical composition of tempeh fish balls were ranged from 74.55 to 77.22% of moisture content, 10.78% to 12.43% of protein, 0.55% to 1.07% of fat, 9.13% to 10.51% of carbohydrate, 1.36% to 1.65% of ash and 0.09% to 0.67% of crude fiber content. Increment of the percentage of tempeh incorporation, increased the composition of moisture, ash and crude fiber of the fish ball. On the other hand, the protein, fat and carbohydrate were reduced significantly ($p \leq 0.05$). Most of the physical characteristics showed reduction in their values with the increased of tempeh incorporation as well as through freeze-thaw cycles. Microscopic structure showed that freezing and thawing enlarged pore sizes and changed the structure of tempeh fish ball. For the sensory evaluation, the consumer acceptance level of tempeh fish ball were significantly decreased when the percentage of tempeh in the formulations increased as well as when the freeze-thaw cycle increased. Most of the attributes showed the decreasing of acceptability values with the increasing of tempeh incorporation, especially formulation E (20% tempeh). All formulations also showed the reduction of acceptance level after three freeze thaw cycles. Formulations B (5% tempeh) was selected as the most accepted tempeh fish ball as it showed similar acceptance score values with the control (0% tempeh) for the most attributes evaluated.

ABSTRAK

Pendekatan utama kajian ini adalah untuk menilai kesan proses pembekuan dan pencairan ke atas sifat fizikal dan penerimaan bebola ikan dengan tempeh. Lima formulasi bebola ikan dengan tempeh telah dihasilkan. Formulasi ini adalah penambahan tempeh ke dalam ingredien pada 0%, 5%, 10%, 15% dan 20%. Analisis fizikal telah dijalankan untuk lima kitaran pembekuan dan pencairan (FT0, FT1, FT2, FT3 dan FT4) pada setiap minggu dalam tempoh 28 hari penyimpanan. Bebola ikan dengan tempeh dianalisis untuk ciri-ciri fizikal termasuk warna (indeks keputihan), tekstur (kekerasan, keliutan, keliatan dan kekenyalan) dan ujian lipatan (*folding test*) bagi setiap kitaran pembekuan dan pencairan. Manakala, hanya sampel segar (FT0) telah dianalisis untuk menentukan sifat kimia (kandungan kelembapan, protein, lemak, abu, karbohidrat dan serat kasar). Komposisi kimia bebola ikan dengan tempeh adalah pada julat dari 74.55 kepada 77.22% kandungan kelembapan, 10.78% kepada 12.43% protein, 0.55% kepada 1.07% lemak, 9.13% kepada 10.51% karbohidrat, 1.36% kepada 1.65% kandungan abu dan 0.09% kepada 0.67% daripada kandungan serat mentah. Kenaikan peratus penambahan tempeh, meningkatkan komposisi lembapan, abu dan serat kasar. Sebaliknya, protein, lemak dan karbohidrat berkurang dengan ketara ($p < 0.05$). Kebanyakan ciri-ciri fizikal menunjukkan pengurangan nilai dengan peningkatan penambahan tempeh serta melalui kitaran pembekuan pencairan. Struktur mikroskopik menunjukkan bahawa proses pembekuan dan pencairan menyebabkan saiz liang menjadi besar dan mengubah struktur bebola ikan dengan tempeh. Untuk penilaian deria, tahap penerimaan pengguna bebola ikan dengan tempeh telah menurun dengan ketara apabila peratusan tempeh dalam formulasi meningkat serta apabila kitaran pembekuan dan pencairan meningkat. Kebanyakan atribut menunjukkan penurunan nilai penerimaan dengan peningkatan penambahan tempeh terutama formulasi E (20% tempeh). Semua formulasi juga menunjukkan pengurangan tahap penerimaan selepas tiga kitaran pembekuan dan pencairan. Formulasi B (5% tempeh) telah dipilih sebagai bebola ikan tempeh paling diterima kerana ia menunjukkan nilai skor penerimaan yang sama dengan kawalan (0% tempeh) untuk sebahagian besar atribut yang dinilai.