UNIVERSITI PUTRA MALAYSIA

CHARACTERISATION OF LOCAL IKAN PEKASAM AND DEVELOPMENT OF A PROCESS FOR PRODUCTION OF IKAN PEKASAM FROM BLACK POMFRET (Parastromateus niger BLOCH)

EZZAT BINTI MOHAMAD AZMAN

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By

EZZAT BINTI MOHAMAD AZMAN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master Science

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DEDICATION

Special Dedicated to my Beloved Husband and Daughter
for their Support and Unconditional Love
CHARACTERISATION OF LOCAL IKAN PEKASAM AND DEVELOPMENT OF A PROCESS FOR PRODUCTION OF IKAN PEKASAM FROM BLACK POMFRET (Parastromateus niger BLOCH)

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July 2014

Chairman : Professor Hasanah Mohd Ghazali, PhD
Faculty : Food Science and Technology

Ikan pekasam is a fermented fish product produced in Malaysia. It is usually made from freshwater fish, and the main source of carbohydrate for the fermentation process is ground roasted rice. In this study, the sensory and physicochemical properties including pH, titratable acidity, salt concentration, amino acids, biogenic amines, trans- and cis-urocnic acid (UCA), and organic acids of 15 commercially available samples were determined. The samples comprised ikan pekasam made from two types of commonly used freshwater fish, namely lampam jawa (Puntius gonionotus) and black tilapia (Oreochromis mossambicus), that had undergone either natural or acid-assisted fermentation. Acid-assisted fermented samples are those that included either tamarind pulp (Tamarindus indica) or Garcinia atroviridis dried slices as an ingredient in the fermentation process. The result showed that there were significant differences (p ≤ 0.05) in pH values, total UCA (trans- plus cis-UCA) and cis-UCA contents between naturally and acid-assisted fermented ikan pekasam samples. However, there were many similarities including titratable acidity, salt concentration, biogenic amine contents namely histamine, tyramine, putrescine, cadaverine, 2-phenylethylamine, spermidine, and tryptamine.

Other than that, there was also no difference in organic acid contents including for lactic, acetic, succinic, formic, malic, oxalic, citric, L-pyroglutamic, and fumaric acids between naturally and acid-assisted fermented ikan pekasam samples. However, there were significant differences (p ≤ 0.05) in amino acid contents namely leucine,
isoleucine, valine, phenylamine, tyrosine, methionine and cysteine between naturally and acid-assisted fermented ikan pekasam samples. Garcinic and tartaric acids were detected in all samples fermented with added G. artroviridis slices and tamarind pulp, respectively. In general, biogenic amine, UCA, and organic acid contents varied greatly in both natural and acid-assisted fermented ikan pekasam samples. Sensory evaluation of the fifteen samples based on 9-hedonic scale indicated that there was no difference (p > 0.05) between natural and acid-assisted fermented ikan pekasam.

Based on the sensory acceptability results of commercial ikan pekasam samples, ikan pekasam was then prepared from black pomfret (Parastromateus niger) using two separate processes used in natural and acid-assisted fermentation. In the first part, the fish were naturally fermented after they were mixed with 20% (w/w) salt for 3 days, washed after which equal proportion (w/w) of ground roasted rice and 10% (v/w) water were added to each batch and then mixed. For acid-assisted fermentation in the second part, black pomfret (P. niger) was mixed 100% salt (w/w). After salting for 1 week, 50% (w/w) of ground roasted rice, 3% (w/w) tamarind pulp, and 150% (v/w) water were added to each batch and also mixed. After mixing, all of batches were allowed to ferment for up to five weeks at ambient temperature for further analysis. According to the results of analysis, there were significant differences (p ≤ 0.05) in physicochemical properties between different fermentation periods in both fermentation processes (natural and acid-assisted). For example, pH value was significantly lower (p ≤ 0.05) in five weeks fermented black pomfret compared to two and zero weeks fermented black pomfret. Other than that, biogenic amine, trans- and cis-UCA, and organic acid contents were significantly higher (p ≤ 0.05) in five weeks fermented black pomfret compared to two and zero weeks fermented black pomfret.

Furthermore, there were only slight differences in physicochemical and sensory properties between ikan pekasam made from black pomfret, a marine fish, and ikan pekasam made from freshwater fish (black tilapia and lampam jawa). For example, there were significant differences (p ≤ 0.05) in total biogenic amine, total UCA (trans-plus cis-UCA), total organic acid including lactic, acetic, malic, and formic acids contents. However, there were many similarities between ikan pekasam from marine and freshwater fish including pH values, titratable acidity, salt content, and especially biogenic amine concentrations, namely histamine, tyramine, putrescine, cadaverine, 2-phenylethylamine, spermidine, and tryptamine.

Based on the sensory evaluation using quantitative descriptive analysis (QDA), the intensity of attributes in two and five weeks naturally fermented black pomfret such as sourness odor, cohesiveness of fish flesh, sourness, saltiness, fishy, and fermented flavors were significantly higher (p ≤ 0.05) than two and five weeks acid-assisted fermented black pomfret, respectively. Furthermore, the panelists could detect significant (p ≤ 0.05) differences in five weeks naturally and acid-assisted fermented black pomfret samples, whereas the intensity of color, roughness of fish skin, sourness
odor, sourness flavor, saltiness flavor, bitterness flavor, fishy flavor, fermented flavor, crispiness of fish skin, and oiliness texture increased as the fermentation time was increased.

Also, there was no significant difference (p > 0.05) in overall acceptability scores between naturally and acid-assisted fermented *ikan pekasam* from freshwater fish (black tilapia and *lampam jawa*) and marine fish (black pomfret). It could be concluded that Malaysian traditional fermented freshwater fish (black tilapia and *lampam jawa*) and marine fish (black pomfret) can be consumed without any health risks. In general, there was no difference in most of the physicochemical and sensory properties between naturally and acid-assisted fermented fish even from different type of fish or fermentation process. However, there were significant differences (p ≤ 0.05) in physicochemical properties between different fermentation periods in naturally and acid-assisted fermented black pomfret, respectively.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi sebahagian keperluan untuk Sarjana Sains

PENCIRIAN IKAN PEKASAM TEMPATAN DAN PERKEMBANGAN PROSES PENGHASILAN IKAN PEKASAM DARIPADA BAWAL HITAM

(Parastromateus niger BLOCH)

Oleh

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Ikan pekasam adalah produk ikan pemeraman yang dihasilkan di Malaysia. Ia biasanya diperbuat daripada ikan air tawar, dan beras panggang yang dikisar adalah sumber utama karbohidrat untuk proses fermentasi. Dalam ujikaji ini, sifat-sifat deria dan fizikokimia seperti pH, keasidan tertitrat, kandungan garam, asid amino, biogenic amine, trans-dan cis-UCA, dan asid organik di dalam 15 sampel komersial telah dikaji. Kebiasaannya, sampel ikan pekasam dihasilkan daripada dua jenis ikan air tawar, iaitu lampam jawa (P. gonionotus) dan tilapia hitam (O. mossambicus), yang melalui proses fermentasi secara semulajadi atau asid-bantuan. Sampel fermentasi asid-bantuan dijalankan dengan memasukkan pulpa asam jawa (T. indica) atau hirisan kering G. atroviridis (asam keping) sebagai bahan dalam proses fermentasi. Terdapat perbezaan signifikan (p ≤ 0.05) dalam nilai pH, jumlah UCA (jumlah trans- dan cis-UCA) dan kandungan cis-UCA di antara sampel ikan pekasam yang melalui proses fermentasi secara semulajadi atau asid-bantuan. Namun, terdapat banyak persamaan termasuk keasidan tertitrat, kepekatan garam, kandungan biogenic amine iaitu histamine, tyramine, putrescine, cadaverine, 2-phenylethylamine, spermidine, dan tryptamine.

Tiada perbezaan dalam kandungan asid organik termasuk asid laktik, asetik, succinic, formic, malic, oxalic, citric, L-pyroglutamic, dan fumaric di antara sampel ikan pekasam yang melalui proses fermentasi secara semulajadi atau asid-bantuan. Walaubagaimanapun, terdapat perbezaan signifikan (p ≤ 0.05) di antara ikan pekasam...
yang diperam secara semulajadi dan asid-bantuan dalam kandungan asid amino iaitu leucine, isoleucine, valine, phenylamine, tyrosine, methionine, dan cysteine. Asid garcinic dan tartarik dikesan di semua sampel yang masing-masing diperam dengan asam keping dan pulpa asam jawa. Umumnya, biogenic amine, UCA, dan kandungan asid organik amat berbeza dalam kedua-dua sampel ikan pekasam yang diperam secara semulajadi dan asid-bantuan. Penilaian deria daripada lima belas sampel berdasarkan 9-skala hedonik menunjukkan bahawa tiada perbezaan (p > 0.05) antara ikan pekasam diperam secara semula jadi dan asid-bantuan.

Berdasarkan kepada keputusan penilaian deria ke atas sampel ikan pekasam komersial, ikan pekasam telah disediakan daripada bawal hitam (P. niger) menggunakan dua proses berasingan iaitu fermentasi semulajadi dan asid-bantuan. Dalam bahagian pertama, ikan telah diperam secara semulajadi selepas dicampur dengan 20% (w/w) garam selama 3 hari, selepas itu dibasuh dan beras panggang yang dikisar dicampur dengan sama kadarnya (w/w) dan 10% (v/w) air telah ditambah kepada setiap kelompok dan kemudian digaul. Dalam fermentasi asid bantuan di bahagian kedua, bawal hitam (P. niger) dicampur dengan garam 100% (w/w). Selepas proses pemasinan selama seminggu, 50% (w/w) beras panggang yang dikisar, 3% (w/w) pulpa asam jawa, dan 150% (v/w) air telah ditambah kepada setiap bekas dan seterusnya digaul. Selepas itu, semua sampel dibiarakan untuk diperam sehingga lima minggu pada suhu ambien untuk analisis selanjutnya. Menurut analisis, terdapat perbezaan yang signifikan (p ≤ 0.05) dalam ciri fizikokimia antara tempoh penapaian dalam kedua-dua proses fermentasi (semula jadi dan asid-dibantu). Contohnya, nilai pH adalah lebih rendah (p ≤ 0.05) dalam ikan pekasam bawal hitam yang diperam selama lima minggu berbanding bawal hitam yang diperam selama dua dan kosong minggu. Selain itu, kandungan biogenic amine, trans dan cis-UCA, dan asid organik adalah lebih tinggi (p ≤ 0.05) dalam ikan pekasam bawal hitam yang diperam selama lima minggu berbanding bawal hitam yang diperam selama dua dan kosong minggu.

Tambahan pula, hanya terdapat sedikit perbezaan antara ikan pekasam yang diperbuat dari bawal laut (bawal hitam) dan ikan pekasam yang diperbuat dari bawal air tawar (tilapia hitam dan lampam jawa). Contohnya, terdapat perbezaan signifikan (p ≤ 0.05) dalam jumlah biogenic amine, jumlah UCA (trans- dan cis-UCA), jumlah asid organik termasuk asid laktik, asetik, malik, dan formik. Walaubagaimanapun, terdapat banyak persamaan antara ikan pekasam dari laut dan ikan air tawar termasuk nilai pH, keasidan tertitrat, kandungan garam, dan biogenic amine (histamine, tyramine, putrescine, cadaverine, 2-phenylethylamine, spermidine, dan tryptamine).

Berdasarkan pada penilaian deria dengan menggunakan analisis deskriptif kuantitatif, keamatan sifat dalam bawal hitam yang masing-masing diperam selama dua dan lima minggu secara semulajadi seperti bau masam, keseduan daging ikan, rasa masam, masin, hanyir, dan rasa diperam adalah jauh lebih tinggi (p ≤ 0.05) daripada bawal hitam yang masing-masing diperam selama dua dan lima minggu secara asid bantuan.
Tambahan pula, ahli-ahli panel dapat mengesan secara signifikan \((p \leq 0.05)\) perbezaan dalam bawal hitam yang diperam selama lima minggu secara semulajadi dan asid bantuan, manakala keamatan warna, kekasaran kulit ikan, bau masam, rasa masam, masin, pahit, hanyir, rasa ditapai, kegaringan kulit ikan, dan tekstur kulit berminyak meningkat seiring dengan masa fermentasi.

Selain itu, tiada perbezaan signifikan \((p > 0.05)\) dalam skor penerimaan keseluruhan antara sampel ikan pekasam komersial dan sampel ikan pekasam daripada bawal hitam. Kesimpulannya, ikan pekasam komersial dari sumber air tawar di Malaysia (tilapia hitam dan lampan jawa) dan ikan laut (bawal hitam) boleh dimakan tanpa sebarang risiko kesihatan. Secara umum, tiada perbezaan dalam kebanyakan sifat fizikokimia dan penilain deria antara ikan yang diperam secara semulajadi dan asid-bantuan walaupun menggunakan berlainan jenis ikan atau proses fermentasi. Namun, terdapat perbezaan yang signifikan \((p \leq 0.05)\) dalam ciri fizikokimia antara tempoh penapaian dalam bawal hitam yang diperam secara semulajadi dan asid-bantuan.
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I certify that a Thesis Examination Committee has met on 23 July 2014 to conduct the final examination of Ezzat Binti Mohamad Azman on her thesis entitled "Characterisation of Local Ikan Pekasam and Development of Process for Production of Ikan Pekasam from Black Pomfret (Parastromateus niger Bloch)" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the supervisory committee were as follows:

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