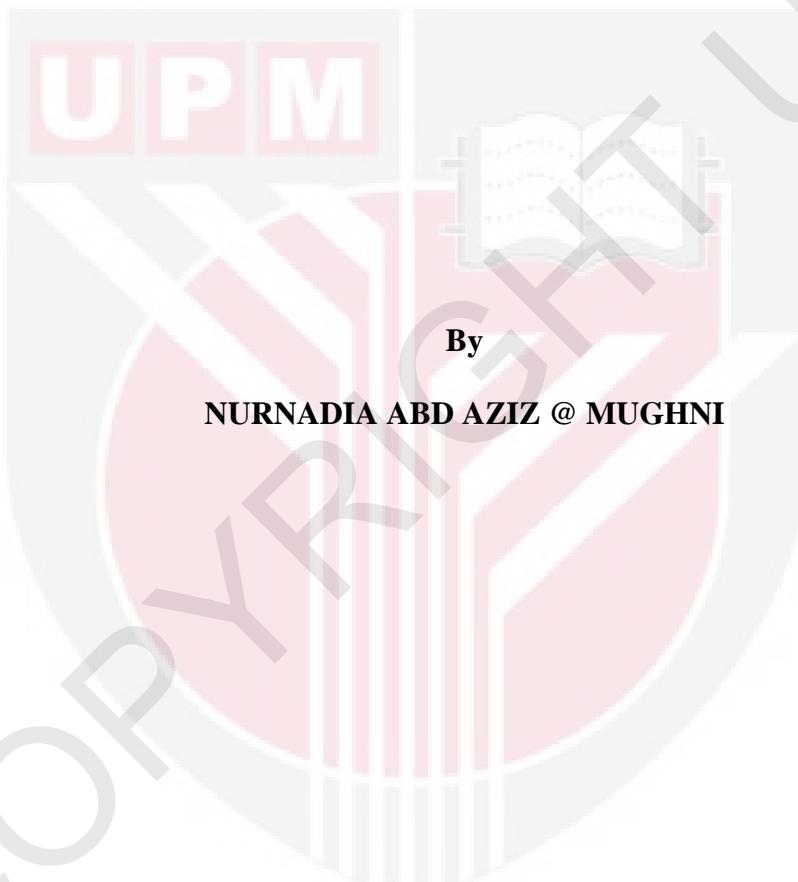# UNIVERSITI PUTRA MALAYSIA

PROXIMATE, FATTY ACIDS, CHOLESTEROL AND ALPHA-TOCOPHEROL CONTENTS IN SELECTED MARINE FISH AND SHELLFISH FROM WEST COAST OF PENINSULAR MALAYSIA

NURNADIA ABD AZIZ @ MUGHNI

FPSK(m) 2011 27

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By

NURNADIA ABD AZIZ @ MUGHNI

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

December 2011

Specially dedicated to…..

My dearest supervisor, Associate Prof Dr Azrina Azlan

My supportive co-supervisor, Prof Dr Amin Ismail

My beloved father, En.Abd Aziz Abd Wahab and mother, Pn.Sahibah Ali

My beloved sisters and brother

My inspiring colleagues

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of

the requirement for the Degree of Master of Science

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December 2011

Chairman   : Associate Professor Dr Azrina Azlan, PhD

Faculty   : Medicine and Health Sciences

Fish and shellfish are widely known as highly nutritious food. However, generally people always consider fish from different types are all of the same nutritional value and select fish only based on availability, freshness, flavour and other physical factors. Thus, to increase awareness on nutrient composition of local fish and shellfish among consumers, information on complete nutritional values must be made available. The main objective of the study was to determine and validate the proximate, fatty acids, cholesterol and alpha-tocopherol contents in selected marine fish and shellfish from West Coast of Peninsular Malaysia (WCPM). Stratified random sampling procedure was used and samples were collected from 10 fish landing areas located along WCPM. Nutritional data were derived from mean of values of the composite samples.

Generally, the proximate analysis showed that most samples contained moisture values (70-90%), ash content (1-2%); protein content for fish (18-20%) and for shellfish (13-16%) samples. Based on the fat contents, nine species of fish samples can be categorized as lean fish (<2% fat); hardtail scad (Megalapsis cordyla), golden snapper (*Lutjanus johnii)*, indian mackerel (*Rastrelliger kanagurta)*, indian threadfin (*Polynemus indicus)*, malabar red snapper (*Lutjanus argentimeculatus)*, dorab wolfherring (*Chirocentrus dorab)*, long-tailed butterfly ray (*Gymnura spp.)*, large-scale tongue sole (*Cynoglossus arel)*, and spanish mackerel (*Scromberomorus guttatus).* Meanwhile, nine species were categorized as low fat fish (2-4% fat); black pomfret (*Parastromateus niger)*, silver pomfret (*Pampus argentus)*, sixbar grouper (*Epinephulus sexfasciatus)*, japanese threadfin bream (*Nemipterus japonicas)*, yellowstripe scad (*Selaroides leptolepis),* gray eel-catfish (*Plotosus spp.)*, fourfinger threadfin (*Eleutheronema tetradactylum)*, giant seaperch (*Lates calcarifer)*, and fringescale sardinella (*Clupea fimbriata);* moonfish (*Trachinotus blochii)* as medium fat fish (4-8% fat), and longtail shad (*Hilsa macrura)* as high fat fish (>8% fat). Only four samples contained carbohydrate; fringescale sardinella (*Clupea fimbriata*), cuttlefish (*Sepia officinalis*), cockles (*Anadara granosa*) and oyster (*Ostrea spp*.) at 3.07%, 0.87%, 1.51%, and 6.45%, respectively.

For micro minerals contents, cockles (*Anadara granosa*) and oyster (*Ostrea spp*.) contained significantly higher ($p < 0.05$) levels of cobalt, iron, manganase and zinc compared to other samples. Meanwhile for copper, prawn (*Metapenaeus affinis*) and oyster (*Ostrea spp*.) were significantly higher ($p < 0.05$) compared to others. Overall, the contents of micro minerals in all samples were below the permissible limits; except for oyster (*Ostrea spp*.); with copper slightly higher than the limit set by FAO/WHO (1984),

but below the limit set by Malaysian Food Regulation (1985); and zinc content higher than the limit set by Malaysian Food Regulation (1985), but below the limit set by FAO/WHO (1984). Meanwhile for macro minerals, most samples contained comparable sodium contents, significantly lower of potassium contents, higher calcium contents, and extremely higher of magnesium contents compared to the common ranges reported in the literatures. All samples were good sources of other micro and macro minerals and could provide multi-health benefits if consumed in recommended amounts.

Quantification of fatty acids in all samples showed that longtail shad (*Hilsa macrura)*, yellowstripe scad (*Selaroides leptolepis)*, and moonfish (*Trachinotus blochii)* contained significantly higher ($p<0.05$) amounts of eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and alpha-linolenic acid (ALA) contents, respectively. The polyunsaturated/saturated (P/S) ratio for most samples were higher than Menhaden oil (P/S=0.58) (recommended PUFA supplement by Food and Drug Administration), which was beneficial to lower blood pressure. yellowstripe scad (*Selaroides leptolepis)* (highest DHA, ω-3/ω-6=6.37, P/S=1.71); moonfish *(Trachinotus blochii)* (highest ALA, ω-3/ω-6=1.88, P/S=0.96); and longtail shad (*Hilsa macrura*) (highest EPA, ω-3/ω-6=0.76, P/S=0.36) were samples with outstandingly desirable overall composition of fatty acids.

Most samples contained low amount of cholesterol, except for sixbar grouper, long-tailed butterfly ray, yellowstripe scad (*Selaroides leptolepis)*, cuttlefish (*Sepia officinalis)*, large-scale tongue sole (*Cynoglossus arel)*, and longtail shad (*Hilsa macrura*) which were fairly high in cholesterol (119.39-353.97 mg/100g wet samples). However, these fish were high in ω-3 fatty acids with desirable ω-3/ω-6 and P/S ratios

for lowering blood cholesterol and giving other health benefits. Only a few samples contained alpha-tocopherol, with four of them; indian mackerel (*Rastrelliger kanagurta)*, giant seaperch (*Lates calcarifer)*, prawn (*Metapenaeus affinis)*, and moonfish (*Trachinotus blochii*) were fairly high of this antioxidant vitamin. Validation procedures proved that methods used for selected nutrients (fatty acids, cholesterol, alpha-tocopherol) analysis were highly accurate and able to produce reliable and precise data.

These representative and reliable nutritional data are now available for wide range of local marine fish and shellfish species and would be a very useful reference to people throughout the country.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai

memenuhi keperluan untuk Ijazah Master Sains

KANDUNGAN NILAI PROKSIMAT, ASID LEMAK, KOLESTEROL DAN ALPHA-TOKOFEROL DALAM IKAN DAN KERANG-KERANGAN TERPILIH DARI PANTAI BARAT SEMENANJUNG MALAYSIA

Oleh

NURNADIA ABD AZIZ @ MUGHNI

Disember 2011

Pengerusi   : **Professor Madya Dr Azrina Azlan**

Fakulti   : **Perubatan dan Sains Kesihatan**

Ikan dan kerang-kerangan telah diketahui ramai sebagai makanan dengan nilai pemakanan yang tinggi. Namun, secara umum orang ramai selalu menganggap ikan daripada jenis yang berbeza mempunyai nilai pemakanan yang sama. Pemilihan ikan dilakukan berdasarkan faktor-faktor fizikal; seperti kebolehdapatan, kesegaran, dan rasa.

Maklumat nilai pemakanan yang lengkap bagi ikan dan kerang-kerangan tempatan seharusnya diwujudkan bagi meningkatkan kesedaran tentang komposisi nutrien ikan dan kerang-kerangan di kalangan pengguna. Objektif utama kajian ini adalah untuk mengkaji kandungan dan validasi nilai proksimat, asid lemak, kolesterol dan alpha-tokoferol dalam ikan dan kerang-kerangan laut yang terpilih dari Pantai Barat Semenanjung Malaysia. Prosedur persampelan secara rawak berstrata digunakan dan

sampel dikutip dari 10 kawasan pendaratan ikan sepanjang Pantai Barat Semenanjung Malaysia. Data nilai pemakanan adalah merupakan nilai purata bagi beberapa sampel komposit.

Secara umum, analisis proksimat menunjukkan bahawa kebanyakan sampel mengandungi peratusan nilai kandungan lembapan pada 70-90%, kandungan abu (1-2%), kandungan protein bagi ikan (18-20%) dan bagi sampel kerang-kerangan (13-16%). Berdasarkan kandungan lemak, sembilan spesis sampel ikan dapat dikategorikan sebagai ikan sangat rendah lemak (<2% lemak); cencaru (*Megalapsis cordyla*), jenahak (*Lutjanus johnii*), kembung (*Rastrelliger kanagurta*), kurau (*Polynemus indicus*), merah (*Lutjanus argentimeculatus*), parang (*Chirocentrus dorab*), pari (*Gymnura spp.*), sebelah (*Cynoglossus arel*), dan tenggiri (*Scromberomorus guttatus*). Manakala sembilan lagi spesis dikategorikan sebagai ikan rendah lemak (2-4% lemak); bawal hitam (*Parastromateus niger*), bawal putih (*Pampus argentus*), kerapu (*Epinephulus sexfasciatus*), kerisi (*Nemipterus japonicas*), selar kuning (*Selaroides leptolepis*), sembilang (*Plotosus spp.*), senangin (*Eleutheronema tetradactylum*), siakap (*Lates calcarifer*), dan tamban (*Clupea fimbriata*); nyior-nyior (*Trachinotus blochii*) sebagai ikan sederhana rendah lemak (4-8%), dan terubuk (*Hilsa macrura*) sebagai ikan tinggi lemak (>8% lemak). Hanya empat sampel mengandungi karbohidrat; tamban (*Clupea fimbriata*), sotong (*Sepia officinalis*), kerang (*Anadara granosa*) dan tiram (*Ostrea spp.*), masing-masing pada 3.07%, 0.87%, 1.51%, dan 6.45%.

Bagi kandungan mineral mikro, kerang (*Anadara granosa*) dan tiram (*Ostrea spp.*) mengandungi kobalt, besi, mangan dan zink yang lebih tinggi secara signifikan ($p < 0.05$)

berbanding sampel lain. Manakala untuk kuprum, udang (*Metapenaeus affinis*) dan tiram (*Ostrea spp.*) mempunyai kandungan yang lebih tinggi secara signifikan ($p<0.05$) berbanding sampel lain. Secara keseluruhannya, kandungan mineral mikro dalam semua sampel adalah di bawah paras yang dibenarkan; kecuali tiram; dengan kandungan kuprum yang sedikit tinggi berbanding paras yang ditetapkan oleh FAO/WHO (1984), tetapi di bawah paras yang ditetapkan oleh Akta Makanan Malaysia (1985); serta kandungan zink yang lebih tinggi berbanding paras ditetapkan Akta Makanan Malaysia (1985), tetapi di bawah paras yang ditetapkan oleh FAO/WHO (1984). Manakala bagi mineral makro, kebanyakan sampel mengandungi kandungan natrium yang setanding, kandungan kalium yang lebih rendah secara signifikan, kandungan kalsium yang lebih tinggi, dan kandungan magnesium yang sangat tinggi berbanding dengan nilai kebiasaan yang dilaporkan dalam rujukan. Semua sampel adalah sumber yang baik bagi mineral mikro dan makro serta boleh memberi pelbagai manfaat kesihatan jika diambil dalam jumlah yang disyorkan.

Pengukuran kandungan asid lemak secara kuantitatif dalam semua sampel menunjukkan terubuk, selar kuning, dan nyior-nyior masing-masing mengandungi kandungan *eicosapentaenoic acid* (EPA), *docosahexaenoic acid* (DHA) dan *alpha-linolenic acid* (ALA) yang lebih tinggi secara signifikan ($p<0.05$). Nisbah asid lemak politaktepu/asid lemak tepu (P/S) untuk kebanyakan sampel adalah lebih tinggi daripada Minyak Menhaden (P/S=0.58) (suplemen asid lemak politaktepu yang disyorkan FDA), yang berguna bagi menurunkan kandungan kolesterol dalam darah. Selar kuning (*Selaroides leptolepis*) (DHA tertinggi, ω-3/ω-6=6.37, P/S=1.71); nyior-nyior (*Trachinotus blochii*) (ALA tertinggi, ω-3/ω-6=1.88, P/S=0.96); dan terubuk (*Hilsa macrura*) (EPA tertinggi,

ω-3/ω-6=0.76, P/S=0.36) adalah merupakan sampel-sampel yang terserlah dengan komposisi keseluruhan asid lemak yang baik.

Kebanyakan sampel mempunyai kandungan kolesterol yang rendah; kecuali kerapu (*Epinephulus sexfasciatus*), pari (*Gymnura spp.*), selar kuning (*Selaroides leptolepis*), sotong (*Sepia officinalis*), sebelah (*Cynoglossus arel*), dan terubuk (*Hilsa macrura*) yang mempunyai kandungan kolesterol yang agak tinggi (119.39-353.97 mg/100g sampel basah). Namun, ikan-ikan ini mempunyai kandungan asid lemak ω-3 yang tinggi serta nisbah ω-3/ω-6 dan asid lemak politaktepu/asid lemak tepu (P/S) yang baik bagi menurunkan paras kolesterol dalam darah dan memberi pelbagai faedah kesihatan yang lain. Hanya beberapa sampel mengandungi alpha-tokoferol, dengan empat daripadanya; kembung (*Rastrelliger kanagurta*), siakap (*Lates calcarifer*), udang (*Metapenaeus affinis*) dan nyior-nyior (*Trachinotus blochii*) mempunyai kandungan yang agak tinggi bagi vitamin anti-oksida ini. Prosedur validasi membuktikan kaedah yang digunakan bagi analisis nutrien terpilih (asid lemak, kolesterol, alpha-tokoferol) mempunyai nilai ketepatan yang tinggi dan mampu menghasilkan data yang diyakini dan tepat.

Kini, data nilai pemakanan yang representatif dan diyakini merangkumi pelbagai jenis ikan dan kerang-kerangan tempatan telah wujud dan akan menjadi rujukan yang berguna bagi individu di seluruh negara.

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I certify that a Thesis Examination Committee has met on 13 December 2011 to conduct the final examination of Nurnadia Abd Aziz @ Mughni on her thesis entitled "Proximate, fatty acids, cholesterol and alpha-tocopherol contents in selected marine fish and shellfish from West Coast of Peninsular Malaysia" 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 Degree of Master of Science.

Members of the Thesis Examination Committee were as follows:

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This thesis 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 are as follows:

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Date:

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or any other institutions

_____
NURNADIA ABD AZIZ @ MUGHNI

Date:

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