



**A REVIEW ON NUTRITIONAL COMPOSITION AND
HEAVY METAL CONTENT IN MALAYSIA
AQUACULTURE PRODUCTS**

by

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LIST OF ABBREVIATIONS AND SYMBOLS

Abbreviation/ Symbol	Caption
%	Percent
µg	Microgram
AIZ	Aquaculture Industrial Zone
As	Arsenic
Ca	Calcium
Cd	Cadmium
Cr	Chromium
Cu	Copper
DHA	Docosahexaenoic acid
DOF	Department of Fisheries Malaysia
EPA	Eicosapentaenoic acid
EPP	Entry Point Project
FAO	Food and Agriculture Organization
Fe	Iron
ha	Hectare
Hg	Mercury
HUFA	Highly unsaturated fatty acid
I	Iodine
K	Potassium
kg	Kilogram
m ²	Meter square
Mg	Magnesium
mg	Milligram
MT	Metric tonnes

MUFA	Monounsaturated fatty acid
n.d.	Not detected
N/A	Not available
Na	Sodium
NAFP	National Agrofood Policy
NKEA	National Key Economic Area
P	Phosphorus
PA	Palmitic acid
Pb	Lead
PUFA	Polyunsaturated fatty acid
RE	Retinol Equivalents
RNI	Recommended Nutrient Intake
SEA	Southeast Asia
SEAFDEC	Southeast Asian Fisheries Development Centre
SFA	Saturated fatty acid
US\$	United States Dollar
USDA	United States Department of Agriculture
WHO	World Health Organization
Zn	Zinc

KAJIAN KOMPOSISI NUTRISI DAN KANDUNGAN LOGAM BERAT DALAM PRODUK AKUAKULTUR DI MALAYSIA

ABSTRAK

Industri akuakultur Malaysia menunjukkan perkembangan pesat yang selaras dengan peningkatan permintaan terhadap produk perikanan. Produk akuakultur dapat dijadikan sebagai makanan berkhasiat dengan adanya komposisi protein, lemak, asid lemak, vitamin dan mineral yang seimbang. Penyelidikan ini bertujuan untuk menilai komposisi nutrisi dan kandungan logam berat dalam produk akuakultur di Malaysia. Komposisi nutrisi mengenai 18 produk akuakultur, termasuk 10 spesis ikan, 3 spesis krustasea, 2 spesis moluska, dan 3 spesis rumpai laut dari air tawar dan air payau telah dikaji. Semua spesis terpilih mempunyai kandungan protein yang tinggi (12.02–23.0%) kecuali rumpai laut. Walau bagaimanapun, rumpai laut mengandungi karbohidrat yang paling tinggi (41.52–66.66%) antara semua spesis. Spesis air tawar mengandungi lebih banyak asid lemak politaktepu (PUFA) omega-6 manakala kandungan PUFA omega-3 dalam spesis air payau adalah lebih tinggi kerana kandungan asid lemak eikosapentanoik dan dokosaheksanoik yang tinggi. Nisbah omega-6/omega-3 dalam semua spesies adalah sederhana (0.23–6.94) kecuali tilapia merah (10.18). Kandungan vitamin bagi semua spesis adalah rendah kecuali ikan kakap yang mengandungi vitamin D3 yang tinggi (10.2 µg/100 g). Kerang-kerangan mengandungi sejumlah besar kalsium (52–142 mg/100 g) sementara ikan air tawar mengandungi tinggi fosforus (200 mg/100 g). Sementara itu, kerang air laut dan rumpai laut merupakan sumber zat besi yang kaya (5.09 mg/100 g) sedangkan ikan air payau kaya sumber iodin. Dari segi kandungan logam berat, kandungan arsenik adalah lebih tinggi dalam ikan air payau (0.74–4.52 µg/g) berbanding dengan ikan air tawar (0.02–1.07 µg/g) tetapi yang paling tinggi adalah dalam rumpai laut (4.47

$\mu\text{g/g}$). Semua kandungan kupang hijau (2.51–7.98 $\mu\text{g/g}$) dari lokasi kajian telah melebihi had yang dibenarkan (0.5–2 $\mu\text{g/g}$). Sementara itu, kerang-kerangan menunjukkan kandungan logam berat yang paling tinggi, terutamanya kandungan tembaga dan plumbum, antara semua spesis yang dikaji. Tiada spesis yang diketahui melebihi had yang dibenarkan untuk merkuri.

A REVIEW ON NUTRITIONAL COMPOSITION AND HEAVY METAL CONTENT IN MALAYSIA AQUACULTURE PRODUCTS

ABSTRACT

Malaysia aquaculture industry had shown rapid development correlating to the rising demand of fisheries products. Aquaculture products form a nutritious part in human diet with its balanced composition of proteins, lipids, fatty acids, vitamins and minerals. This research aimed to evaluate the nutritional composition and heavy metal content in Malaysia aquaculture products. Nutritional composition of 18 aquaculture products, including 10 finfish, 3 crustaceans, 2 molluscs, and 3 seaweeds from freshwater and brackishwater were determined. All selected species had high protein content (12.02–23.0%) except seaweeds. However, seaweeds had the most carbohydrates content (41.52–66.66%) among all species. Freshwater species consisted of more omega-6 polyunsaturated fatty acids (PUFAs) than brackishwater species but omega-3 PUFAs in brackishwater species were greater than most freshwater species due to high eicosapentaenoic and docosahexaenoic acid contents. Omega-6/omega-3 ratio of all species was modest (0.23–6.94) except for red tilapia (10.18). Vitamin content in all species were minimal except for snapper having high vitamin D3 content (10.2 µg/100 g). Shellfish contained significant amounts of calcium (52–142 mg/100 g) while freshwater finfish contained high amount of phosphorus (200 mg/100 g). Meanwhile, brackishwater shellfish and seaweeds were rich source of iron (5.09 mg/100 g) whereas brackishwater finfish were a rich source of iodine. In terms of heavy metal content, arsenic was found higher in brackishwater fish (0.74 – 4.52 µg/g) than freshwater fish (0.02 – 1.07 µg/g) but the highest was found in seaweeds (4.47 µg/g). Regardless of the location of aquaculture sites, all lead content of green mussel (2.51–7.98 µg/g) exceeded the permissible

limit (0.5–2 µg/g). Shellfish showed considerably higher heavy metal content, particularly copper and lead, than all other selected species. No species were identified to have exceeded the permissible limit for mercury.