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Nutritional Evaluations of Green Catfish, *Mystus nemurus*

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ABSTRACT

The nutritive values of green catfish, *Mystus nemurus* such as proximate analysis, fatty acid profile (especially omega – 3 fatty acids, EPA : eicosapentaenoic acid; DHA : docosahexaenoic acid), amino acid contents, vitamins and minerals were studied. The composition of dried green catfish and sardine meal were also carried out. The results showed that percentages of protein, fat, moisture in fresh, dried green catfish, *Mystus nemurus* and sardine meal were 18.43, 65.99, 68.80; 4.93, 22.40, 7.78 and 75.75, 7.04, 6.17, respectively. Vitamin E content in dried green catfish (264 μg/100 g) was higher than that in sardine meal (84 μg/100 g) while calcium and phosphorus in dried green catfish were lower than those in sardine meal. Fatty acid contents especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in dried green catfish (0.4256, 1.7472 g/100 g) were also found to be higher than those in sardine meal (0.0467, 0.1011 g/100 g respectively). The results of this study indicated that dried green catfish, *Mystus nemurus* were high in nutritive values especially omega – 3 fatty acids (EPA, DHA). The green catfish, an inland fish, was also found to have higher omega – 3 fatty acids than marine fish, sardine.

Key words: green catfish, *Mystus nemurus*, eicosapentaenoic acid, docosahexaenoic acid, omega – 3 fatty acid

INTRODUCTION

Green catfish, *Mystus nemurus* (Cuv. & Val.) a common name of this catfish (Suvatti, 1950), is a fish in Siluroidei family. It has 4 pairs of barbels which were nasal barbels, maxillary barbels, mandibulary barbels and mental barbels but has no scale. Fishes in gastrointestinal tract of green catfish are many kinds such as *Cyclocheilichthys apogon, Puntius tetrazona, P. fasciatus, Rasbora* sp. etc. Green catfish finds the food at night time (NamPong Env. Mgt. Research Project, 1980).

Mystus nemurus has been found from Indochina and Thailand to Malaya and Java, attaining a length in some cases of nearly 60 cm, although individuals of 25-35 cm are more common. It occurs throughout the lengths of many rivers, from the headwaters down to the mouths, where they may be found in brackish water. There seems to be no evident preference for either clear or muddy environments. They dine on a variety of items, among which are crustaceans (crabs, prawns), aquatic and terrestrial insects, fishes, and vegetation. Among the fishes identified as eaten were species of Clarias and Kryptopterus. One specimen was reported as having its stomach crammed full of large red ants. Females from 12.3 to 32 cm long

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contained enlarged ova, the 32 cm specimen with eggs that measured 1 mm in diameter. This species has a thin black lateral stripe at all sizes and a black spot at the end of the adipose fin (Burgess, 1989; Sriwatana and Kasisuwan, 1996).

The spawning season is not sharply defined and is protracted. A fish 32 cm long taken in the Chantabun River at Chantabun June 11, 1926, had very large ovaries with nearly ripe eggs 1 mm in diameter, while fish in spawning condition have been observed in the Menam Chao Phya in November (Smith, 1945).

Production of green catfish from many fishery sources is not constant because green catfish fishery lacks of academic document of feeding method and green catfish strain (Amatyakul *et al*., 1995). Nowadays it is known that omega-3 polyunsaturated fatty acids (n-3 PUFAs) intake relates with low risk incidence of coronary heart disease especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) n-3 PUFAs. EPA and DHA can decrease metabolism of eicosanoid in blood platelet which may inhibit incidence of atherosclerosis and hypertension (Kinsella *et al*., 1990). These omega-3 are found from both marine and inland fish.

Many studies showed that omega-3 fatty acids were very important to life development because docosahexaenoic acid (DHA) was found in brain and retina. It was believed that brain and visual development of infant relates with DHA. So it was recommended that infant milk should be supplemented with omega-3 fatty acids. In according to the importance of omega-3 fatty acid for life, the experts from many countries define that omega-3 fatty acid must be enough consumed. Public Health Ministry of England defines dietary reference value of omega-3 fatty acid not less than 0.2 percent of energy intake (Dahlan, 1995).

The objective of this research was to demonstrate the nutritional values of green catfish especially omega-3 fatty acid such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) to provide more complete informations in feeding and intake of green catfish. Another objective was to compare the nutritional values especially omega-3 fatty acid between green catfish which is inland fish and sardine meal which is marine fish.

MATERIALS AND METHODS

Sample preparation

The edible portions including skin of eight months old green catfishes, with an initial weight of 500–550 g were obtained from Songkhla Inland Fisheries Station, Department of Fisheries, Ministry of Agriculture and Cooperatives to Institute of Food Research and Product Development, Kasetsart University, Bangkok. They were fed with fishes composed of 72.72 % moisture, 21.10 % protein, 0.28 % fat and 3.14 % ash. Fresh green catfishes were dried in hot air oven at 40°C for 6 hours and continued drying at 60°C for 15 hours. Then dried green catfish was blended into powder. From 4700 g fresh green catfish was dried and blended into 1285 g dried green catfish so the percentage of the yield was 27. After that fresh green catfish, dried green catfish and sardine meal were determined for nutritional evaluation.

Analytical procedures

Three kinds of fish were determined for proximate analysis by AOAC method (1998). Cholesterol and free fatty acid were analysed by gas chromatography (AOAC 1998). Mineral were analysed by atomic absorption (AOAC 1998). Vitamins were analysed by HPLC and microbioassay method. Amino acid composition was determined by a high speed amino acid analyzer (Hitachi Model L-8500, Japan) and tryptophane was analysed (Matheson, 1974).

RESULTS AND DISCUSSION

Table 1 showes the highest percentage of

moisture in fresh green catfish (75.75) whereas the lowest percentage of moisture in sardine meal (6.17). It showed the highest percentage of protein in sardine meal (68.80) which was nearly the same as in dried green catfish (65.99). The percentage of fat in dried green catfish was higher (22.40) (nearly 3 times) than in sardine meal (7.78). Khan *et al.* (1993) reported that the percentage of moisture, protein, fat and ash in green catfish fed 27 % protein and 10 % fat were 75.50, 14.90, 5.85 and 3.75 respectively. It showed that moisture and fat content in fresh green catfish in this experiment were the same as the study of Khan *et al*., in spite of difference of fat content feeding. In this experiment, fresh green catfish was fed with 0.28 % fat whereas in Khan *et al.*'s experiment, fresh green catfish was fed with 10.00 % fat. Protein content (18.43 %) of green catfish in this experiment was higher than in Khan *et al.*'s experiment (14.90 %). However protein content (21.10 %) of feeding diet in this experiment was lower than in Khan *et al.*'s experiment (27 %).

Table 2 shows that mineral contents of sardine meal were higher than fresh and dried green catfish. This may be because the sardine meal was prepared from the whole fish whereas the green catfish was prepared only from the edible portion. The sardine meal in this experiment showed higher calcium, phosphorus, iron, copper and zinc than the sardine produced from roller dried fish which head and bone were cut (Phithakpol *et al*., 1984).

Table 3 shows that vitamin C was found only in fresh green (460 μg/100 g). Vitamin B_1, B_6, E, folic acid and pantothenic acid in dried green catfish were higher than in fresh green catfish and sardine meal. The sardine meal in this experiment

Table 1 Proximate analysis of green catfish and sardine meal.

Fish	Moisture	Protein	Fat	Ash
		(g / 100 g)		
Fresh green catfish	75.75	18.43	4.93	0.59
Dried green catfish	7.04	65.99	22.40	3.74
Sardine meal	6.17	68.80	7.78	15.62

Table 2 Mineral contents of three kinds of fish.

Mineral	Fresh green catfish	Dried green catfish	Sardine meal
		(mg / 100 g)	
Calcium	18.17	257.68	4660.95
Phosphorus	165.72	685.90	2938.65
Sodium	60.82	165.47	545.36
Potassium	216.09	817.42	940.08
Magnesium	28.19	85.70	211.16
Iron	1.00	4.58	35.93
Iodine	0.03	0.09	0.21
Copper	0.07	0.22	1.24
Zinc	0.99	3.43	9.13
Chloride	36.43	124.71	447.56

Table 3 Vitamin contents of three kinds of fish.

Vitamin	Fresh green catfish	Dry green catfish (μg / 100 g)	Powder sardine
Vitamin C	460	0	0
Vitamin B_1	20	90	20
Vitamin B_2	50	140	240
Vitamin B_6	140	450	80
Vitamin B_{12}	2	6	8
Vitamin E	20	264	84
Folic acid	5	38	22
Niacin	2800	12000	13800
Pantothenic acid	1810	5590	240
Biotin	1	4	28

had similar vitamin B_1 content (20 μg / 100 g) to in the report of Phithakpol *et al*. (1984).

Table 4 shows that valine was the first limiting amino acid in fresh green catfish and sardine meal. Amino acid contents in dried green catfish were more complete than those in fresh green catfish and sardine meal. All amino acid contents of sardine meal were lower than roller dried sardine (Phithakpol *et al*., 1984).

The result from table 5 shows that free fatty acid contents of fresh green catfish were the lowest whereas all free fatty acid contents of dried green catfish were the highest except lauric acid which was lower than in sardine meal. The interesting free fatty acids were eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) of dried green catfish which were 9 and 17 times higher than sardine meal respectively inspite that green catfish is inland fish

Table 4 Essential amino acid composition of three kinds of fish.

Amino acid	Fresh green catfish	Dried green catfish	Sardine meal	FAO / WHO[2]
	(mg / g protein)			
Tryptophane	16	11	12	10
Threonine	49	47	41	40
Isoleucine	43	44	37 (92)[1]	40
Leucine	84	84	72	70
Lysine	99	97	77	55
Methionine + Cystine	42	41	36	35
Phenylalanine + Tyrosine	78	79	115	60
Valine	46 (92)[1]	51	44 (88)[1]	50

1 Limiting amino acid with chemical score

2 Source : Food Composition Table for Use in East Asia (FAO, 1972)

$$\text{Chemical score} = \frac{\text{amino acid content in fish}}{\text{amino acid content in FAO / WHO standard}} \times 100$$

Table 5 Fatty acid composition of three kinds of fish.

Fatty acid	Fresh green catfish	Dried green catfish (g / 100 g)	Sardine meal
Lauric	0.0049	0.0448	0.0467
Myristic	0.1232	0.6944	0.1867
Palmitic	1.2276	5.3312	3.2987
Palmitoleic	0.1775	1.0752	0.0545
Stearic	0.5670	2.6208	0.6146
Oleic	1.5579	6.9888	2.7463
Linoleic	0.5571	2.3296	0.5835
Linolenic	0.0246	0.2688	0.0156
Octadecatetraenoic	0.0000	0.0000	0.0000
Arachidic	0.0394	0.4032	0.0233
Gadoleic	0.0789	0.0000	0.0000
Eicosapentaenoic	0.0887	0.4256	0.0467
Behenic	0.0197	0.0672	0.0233
Erucic	0.1183	0.4256	0.0311
Docosahexaenoic	0.3352	1.7472	0.1011

whereas sardine is marine fish. The reason may be dried green catfish was composed of 22.40 % fat content whereas sardine meal was composed of 7.78 % fat content. But fresh green catfish was composed of 4.93 % fat content which was lower than fat content (7.78 %) of sardine meal. Nevertheless EPA and DHA in fresh green catfish were 2 and 3 times higher than in sardine meal respectively. Cholesterol contents of fresh green catfish, dried green catfish and sardine meal were 42.50, 268.30 and 63.60 mg / 100 g respectively.

CONCLUSION

Eight months-old green catfish fed with 21.10 % protein, 0.28 % fat, with weight of 500 – 550 g from Songkhla Inland Fisheries Station were determined for nutritional value compared with sardine meal. The results showed that the percentage of protein, fat and moisture of fresh green catfish, dried green catfish and sardine meal were 18.43, 65.99, 68.80; 4.93, 22.40, 7.78 and 75.75, 7.04, 6.17 respectively. Mineral contents of green catfish were lower than sardine meal. Vitamin C was found only in fresh green catfish. Vitamin E content of dried green catfish (264 μg / 100 g) was higher than sardine meal (84 μg / 100 g). Valine was the first limiting amino acid in fresh green catfish and sardine meal. Amino acid contents in dried green catfish were more complete than those in sardine meal. The results of fatty acid contents of green catfish were very interesting because two omega-3 fatty acids, which eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) of dried green catfish were higher than sardine meal. It may be because of higher fat and cholesterol contents of dried green catfish than sardine meal. Nevertheless fresh green catfish showed lower fat and cholesterol contents than sardine meal but the interesting results showed that omega – 3 fatty acid contents, EPA and DHA were 2 and 3 times higher than sardine meal respectively. Eventhough green catfish is inland fish whereas sardine is marine fish. Since omega-3 fatty acid (especially EPA and DHA) were found

in brain and retina, food containing high EPA and DHA may reduce the risk of hyperlipidemia, high blood pressure and coronary heart disease. So green catfish consumption may be very useful for health of normal population and patients from those diseases except diabetes mellitus.

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