Middle-East Journal of Scientific Research 8 (5): 855-858, 2011
ISSN 1990-9233

Comparison of Proximate Composition and Energetic Value of Three Selected Marine Fishes with Prawn

Ali Aberoumand

Department of Fisheries, Natural Resources College,
Behbahan Khtamolanbia Technology University, Behbahan, Iran

Abstract: This study was conducted to compare between the proximate composition and energetic value of three selected marine fishes and prawn. Three fish species; *Skip Jack Tuna, Yellow fin Tuna* and *Long tail Tuna* were found to contain significantly lower moisture (23.11 to 25.2%) and significantly lower fat contents (0.75 to 1.6%). Prawn contained the highest protein (19.12+1.44%) compared to other studied fishes. The highest fat content among the three studied fish species was in *Yellow fin Tuna* fish at 6.89+2.76% while the fat content of prawn was 1.06%. *Yellow fin Tuna* fish contained the highest energetic value of 33.6kcal/g of all samples. These values are useful references for consumers in order to choose fish and prawn based on their nutritional contents.

Key words: Protein · Fat content · Energetic value · Marine fish · Prawn

INTRODUCTION

Fish and shellfish are important source of protein and income for people in Southeastern Asia [1]. They are also increasingly marketed for their health benefits to consumers [2]. Generally, marine fish can be divided into pelagic and demersal fish. Pelagic fish are those fish associated with the surface or middle depth of body water [3]. Marine pelagic fish can be divided further into coastal and oceanic fish depending on the continental shelf they inhabit [4]. Generally, the pelagic fish feeds on planktons [5]. Meanwhile, demersal fish are those fish sinking to or lying on the bottom of sea, feeding on benthic organisms [5]. In order to reduce the risk of cardiovascular diseases, emphasis has now been placed on the increased consumption of fish and fish products, which are rich in polyunsaturated fatty acids (PUFA) of the omega (*w) -3* family and poor in polyunsaturated fatty acids of *w*-6 family [6]. Various studies have been carried out on the proximate chemical composition [7-9] and fatty acids profiles of different fish species [10-11]. There is, however, dearth of accurate basic chemical composition data for fish species particularly from Asian sources [12]. This constitutes a barrier to development of the use of the resources.

Shrimps are an extremely good source of protein, yet are very low in fat and calories, making them a very healthy choice of food. Although shrimps have high cholesterol content, they are low in saturated fat, which is the fat that raises cholesterol levels in the body. Minerals are essentials in shrimp nutrition. Aside from playing important role in osmotic regulation and moulting [13], minerals ions are also components of many biological compounds such as enzymes, hormones and high energy compounds. Nevertheless, dietary requirements of important mineral elements are known for selected species of shrimp such as *Penaeus japonicus* [14], *P.aztecus* and *P.vannamei* [15].

MATERIALS AND METHODS

Collection and Preservation of Specimens: Fresh fishes, *Skip Jack Tuna, Yellow fin Tuna* and *Long tail Tuna* were purchased at a Bander Abbas Seaside fish processing factory in Southern Iran in March 2010. The samples were packed in separate polyethylene bags and stored in the cold room at -20°C pending laboratory analysis.

Corresponding Author: Dr. Ali Aberoumand, Department of Fisheries, Natural Resources College,
Behbahan Khtamolanbia Technology University, Behbahan, Iran.
Tel: +919166716540, Fax: +916712229969.
Postal Addresses: No:22, second Alley of Ab va barg, Zolfegari street, Behbahan, Khuzestan, Iran.

Analyses: Fish sample was gutted, washed, filleted, finely minced and homogenized for chemical analyses.

Triplicate determinations were carried out on each chemical analysis.

Protein Determination: The total nitrogen (crude protein) was determined by the Kjeldahl method. A known weight (0.5g) of prepared fish sample was weighed on a nitrogen-free paper. The paper was wrapped round the sample and dropped at the bottom of the Kjeldahl digestion flask together with 6-8 glass beads, 4-5 spatula full of granular mixture of $CuSO_4$ and K_2SO_4 as catalyst. 20ml of concentrated H_2SO_4 was added carefully. The flask was gently heated on a Gerhardt heating mantle in an inclined position in a fume cupboard until full digestion (when the liquid changed from brown colour to colourless). The contents of the flask were transferred to a clean 100ml volumetric flask and made up to volume. 25ml aliquot was used for distillation. The total nitrogen was determined colorimetrically.

Lipid Determination: Lipid determination was carried out using the modified Bligh and Dyer procedure [16]. Methanol and chloroform were used as solvents at ratio 1:1.

Moisture Determination: The moisture content of each fish sample was estimated using the oven dry method [16]. 5g of the homogeneous mixture was placed in weighed crucibles maintained at 100°C in an oven until constant weights. The samples were transferred to a desiccate to cool to ambient temperature and reweighed. The difference in weights (weight-loss) indicates the moisture content.

Ash Determination: Ash content of fish samples was determined by incineration in a carbolite Sheffield LMF3 muffle furnace at 500°C [16]. The difference in weight of the fish samples before and after heating was taken as the ash content.

Statistical Analysis: Analysis of variance (ANOVA) was used to compare means of the proximate composition and fatty acid data. Further analysis was carried out where there was significant difference (P<0.05).

RESULTS AND DISCUSSION

Proximate Composition: The species except *Long tail Tuna* had mean protein content of 4.32%, lipid 1.55%, moisture 24.16% and ash 17.8%. Protein content ranged from 0.69 to 4.8%, lipid from 0.75 to 1.6%, moisture 23.11 to 25.2% and the ash content from 16.8 to 18.2%. The sum of moisture and lipid varied from 23.86 to 26.8%. The range, mean and standard deviation of the proximate composition are summarized in Table 1. For moisture, protein and fat contents, there were no significant differences in two species fishes except for *Long tail Tuna*. The fat content of this fish was significantly lower (p<0.05). The differences in proximate composition values could be due to many factors as fat content in fish vary according to seasons, species and geographical variations. Age variation and maturity in the same species may also contribute to the significant differences in the total lipid [17]. According to Ackman [18], generally fish can be grouped into four categories according to their fat content: lean fish (<2%), low fat (2–4%), medium fat (4-8%) and high fat (>8%). All species are categorized as lean fat fish. After all, the carbohydrate content in fish

Table 1. Proximate composition of tested fish samples

Fishes species	Moisture(%)	Protein(%)	Fat(%)	Ash(%)	Energetic value(kcal/g)
Skip Jack Tuna	25.2b	3.85c	1.5e	18.2a	28.40
Yellow fin Tuna	25.2b	4.8c	1.6e	17.5a	33.6
Long tail Tuna	23.11b±0.15	0.69	d±0.16	0.75f±0.06	16.8b 9.51

Value is the mean of three replicates. Means within the column with different letters are significantly different (P<0.05).

Table 2: Proximate values of prawn

Samples	Moisture	Ash	Protein	Fat	Energetic value (kJ/g)
Mean percentage (%)					
Prawn	79.47±1.29ab	1.35±0.14ab	19.12±1.44b	1.06±0.10a	4.94

*different letters in the same row shows significant difference at P<0.05).

*All values are based on wet weight basis by Nurnadia *et al*., 2011.

*Carbohydrate (%) was calculated by subtracting moisture (%), ash (%), protein (%) and fat (%) from 100%.

is generally very low and practically considered zero [19-20]. Other than that, the energetic values for two species fishes were between the range of 28.40kcal/g and 33.6kcal/g, except for *Long tail Tuna*, with lower value of 9.51kcal/g. This was due to its significantly lower fat content if compared to other fish. Comparison of proximate composition of tested fishes with prawn showed that Prawn contain the highest protein content (19.12±1.44 %) while fat content of prawn was lower than *Skip Jack Tuna* and *Yellow fin Tuna* fishes. Fat content for *Long tail Tuna* fish was the lowest. Prawn was found to contain no carbohydrate but had energetic value that fall within small range of 4.94 kJ/ g. This was because their content of protein, fat and carbohydrate did not differ much.

CONCLUSION

Generally, fish and prawn are low in fat and carbohydrate contents, but present an excellence source of protein. However, findings of this study have noticed slight differences in the composition of the fish and prawn from other previous local studies. There were many possible factors such as size, sex, maturity of samples that can affect the differences in proximate composition of marine fish. Sampling procedures also played important role in the differences of the findings. One of possible factors was the representativeness of the samples. Different approach of sampling procedures, which included the method of sample collection, different sample collection sites and difference in the inclusion criteria of samples with other previous studies, explained the slight difference in the proximate composition values. There was also certain information in previous studies that was insufficient to be used for comparison with the current study. Thus, it is hopeful that details on the sampling procedures and methods of analysis used in this study will be able to provide sufficient information for any comparative purposes in the future. The proximate values obtained from this study would be useful to help the consumers in choosing fish and shellfish based on their nutritional values besides providing an update to food composition database.

ACKNOWLEDGEMENTS

The author would like to thanks to Behbahan Branch, Islamic Azad University, Behbahan, Iran for the financial assistance provided.

REFERENCES

1. Agusa, T., T. Kunito, A. Sudaryanto, I. Monirith, S. Kan-Atireklap, H. Iwata, A. Ismail, J. Sanguansin, M. Muchtar, T.S. Tana and S. Tanabe, 2007. Exposure assessment for trace elements from consumption of marine fish in Southeast Asia. Environ. Pollution, 145(3): 766-777.
2. Schmidt, E.B., L.H. Rasmussen, J.G. Rasmussen, A.M. Joensen, M.B. Madsen and J.H. Christensen, 2006. Fish, marine n-3 polyunsaturated fatty acids and coronary heart disease: A minireview with focus on clinical trial data. Prostaglandin, Leukotrienes and Essen. Fatty Acids, 75(3): 191-195.
3. Fisheries Research Institute. 2004. Field guide to selected commercial marine fishes of Iranian waters. Iran.
4. McLintock, A.H., 2007. The Encyclopedia of New Zealand: Fish, Marine.
5. Eun, J.B., H.J. Chung and J.O. Hearnsberger, 1994. Chemical composition and microflora of channel catfish (*Ictalurus punctatus*) roe and swim bladder. J. Agric. and Food Chem., 42(3): 714-717.
6. Exler, J., 1987. Composition of foods: Finfish and shellfish products. US Department of Agriculture, Agriculture handbook. pp: 9-15.
7. Sargent, J.R., 1996. Origins and functions of egg lipid. In: N. R. Bromage & R. J. Roberts (eds.), Broodstock management and egg and larval quality, Oxford: Blackwell, pp: 353-372.
8. Schonfeldt, H.C., 2002. Food composition program of AFRO FOODS. J. Food Comp. and Anal., 15: 473-479.
9. Chandrashekar, K. and Y.G. Deosthale, 1993. Proximate composition, amino acid, mineral and trace element content of the edible muscle of 20 Indian fish species. J. Food Comp. and Anal., 6(2): 195-200.
10. Uauy, R. and A. Valenzuela, 2000. Marine oils: the health benefits of n-3 fatty acids. Nutr., 6(7/8): 680-684.
11. Wanasundara, U.N. and F. Shahidi, 1998. Lipase-assisted concentration of n-3 polyunsaturated fatty acids in acylglycerols from marine oils. J. the Amer. Oil Chemist's Soc., 75(8): 945-951.
12. Adeyeye, E.I., 2000. Bio-concentration of macro and trace minerals in four prawns living in Lagos lagoon. Pak. J. Sci. Indus. Res., 43: 367-373.
13. Adeyeye, E.I., 2005. The composition of the winged termites, *Macrotermes bellicosus.* J. Chem. Soc. Nigeria, 30: 145-149.

14. Adeyeye, E.I., 2002. Determination of the chemical composition of the nutritionally valuable parts of male and female common West African fresh water crab *Sudananautes africanus africanus.* Int. J. Food Sci. Nutr., 53: 189-196.
15. Okoye, F.C., G.S. Ojewola and K. Njoku-Onu, 2005. Evaluation of shrimp waste meal as a probable animal protein source for broiler chicken. Int. J. Poult. Sci., 4: 458-461.
16. Association of Official Analytical Chemists, 1994. Official Methods of Analysis of the Association of Official Analytical Chemists, Vols. I & II, Association of Analytical Chemists, Arlington., pp: 1298.
17. Piggot, G.M. and B.W. Tucker, 1990. Seafood: Effects of Technology on Nutrition. New York, USA: Marcel Dekker, Inc.
18. Ackman, R.G., 1989. Characteristics of the fatty acid composition and biochemistry of some fresh-water fish oils and lipids in comparison with marine oils and lipids. Comparative Biochem. and Physiol., 22(3): 907-922.
19. Anthony, J.A., D.D. Roby and K.R. Turco, 2000. Lipid content and energy density of forage fishes from the Northern Gulf of Alaska. J. Experimental Marine Biol. and Ecol., 248: 53-78.
20. Payne, S.A., B.A. Johnson and R.S. Otto, 1999. Proximate composition of some north-eastern Pacific forage fish species. Fish Oceanog., 8(3): 159-177.