Volume : 3 | Issue : 8 | Aug 2014 • ISSN No 2277 - 8179

Research Paper

Proximate Composition and Amino Acid Profile of Some Hill-Stream Fishes of Manipur

Food Science

KEYWORDS : Proximate, amino acids, hill stream fishes.

Hawaibam Romharsha	Department of Life Sciences, Manipur University, Canchipur-795003.
Abdul Hei	Department of Life Sciences, Manipur University, Canchipur-795003.
Ch. Sarojnalini	Department of Life Sciences, Manipur University, Canchipur-795003.

ABSTRACT

The fish muscles were investigated to determine the major components of the three hill stream fishes of Manipur. Proximate composition of the three fish species viz., Neolissochilus stracheyi, Labeo pangusia and Semiplotus manipurensis were carried out. The crude protein ranges between 19.00±0.92 to 20.64±0.03. The highest total lipid was recorded in S. manipurensis(3.56±0.04) and lowest in L. pangusia (2.45±0.02). The moisture content ranges from 72.80±0.04 to 76.30±0.07. Lowest ash content was recorded as 1.20±0.04 in S. manipurensis and highest as 1.98±0.01 in N. stracheyi. Total amino acid of the three fish species varied from 104.42 to 113.92 g/100g. Total essential amino acid (EAA) was recorded as 55.08 to 66.51 g/100g and total non-essential amino acid as 46.09 to 56.74 g/100g. The most abundant amino acid in all the fish species was glutamic acid. Leucine, Lysine, Histidine, Valine, Threonine, Phenylalanine and Isoleucine were dominantly found essential amino acids in all the fish species. Knowledge of Amino acid composition of the fish is good to serve as a unique source for nutrients and enlightens the nutritive quality of these fishes.

Introduction

Fish is one of the major sources of protein nutrition for human beings. Efforts are being made all over the world to exploit both the marine and fresh water bodies for fish production. Besides cultural fishes, the wild fishes also provide a major bulk of fish protein. Hence, studies on different sources and nutritive values of wild fishes are necessary (Bhagowati & Ratha, 1982). North-eastern part of India in particular Manipur has significant reservoir of many hill streams.

Hill stream fishes form an important part of fish resources of Manipur as the maximum areas of the state are hill regions which have a number of streams and drainages. Along with distinctive ecological features of hill streams, the hill stream fishes stand out from the other fishes with quality. In Manipur, hill stream fishes are highly esteemed and fetch much higher prices than cultured carps because of their better taste and food value. It is also observed that protein and lipid value of the endemic fishes of Manipur was found to be higher than that of the other freshwater fishes of India (Sarojnalini & Vishwanath, 1988). Hill stream fish species are very precious and delicious food dish. The taste and flavour of hill stream fishes are still highly esteemed and preferred to other cultured fishes (Kosygin et al., 2001).

Fish is a potential source of animal protein and essential nutrients for human diets. Fish meat contains significantly low lipids and high water content than beef or chicken and is favoured over other white or red meats. The nutritional value of fish meat comprises the contents of moisture, dry matter, proteins, lipids, vitamins and minerals plus the caloric value of the fish. Fishes are valuable sources of high-grade protein and other organic products. Generally, animal protein is better than plant protein in respect of qualities. Consumption of fish provides important nutrients to a large number of people worldwide and makes a very significant contribution to nutrition. And, the information concerning the chemical composition of the fishes is very much necessary to ensure that they meet the requirements of man's diet. And, the contents of proximate composition are traditionally used as indicators of the nutritional value of fish (Stansby, M.E.,1962). Composition of live-weight, whole body fish is 70-80% water, 20-30% protein and 2-12% lipid (Love, 1980). FAO has also reported that normally fish contains 72% water, 19% protein, 8% fat, 0.5% calcium, 0.25% phosphorus and 0.1% vitamin A, D, B & C. etc. (FAO, 1991. Fish for Food & Development). There are some reports on the nutritive value of hill stream fishes of Manipur as well as the other north eastern states of India (Bhagowat & Ratha, 1982; Kosygin et al., 2001; Abdul & Sarojnalini, 2012, 2014). Fish is also a good source of essential fatty acids, vitamins & minerals. The nutritional as well as culinary importance of fish depends not only on protein but also known as a source of several other nutrients (Vishwanathan et al., 2000). So, the purpose of study was taken up to determine the proximate composition and amino acid profile of some hill stream fishes of Manipur.

Materials and methods

Neolissochilus stracheyi (Day) (length= 20 - 45.5 cm; weight= 276 - 1300 gm), *Labeo pangusia* (Hamilton-Bachanan) (length= 20 - 31.5 cm; weight= 250 - 361gm) and *Semiplotus manipurensis* (Vishwanath and Kosygin) (length= 28 - 32cm; weight= 247 - 405gm) were collected from the Maklang river (94°32´E, 25°12´N), a hill stream in the Ukhrul district of Manipur during March-April. The site is located at an altitude of about 1,600 m asl. Fishes were brought to the Laboratory with proper caring in a cold chain. The fishes were washed immediately with tap water and the bones and muscles were separated for biochemical analysis.

Moisture was determined by the Hot air oven method of AOAC (1990). Total lipid was extracted following the method of *Bijen et al.*, , 1990. Total protein was estimated following the modified micro – kjedahl's method of AOAC (1990) and, the ash was calculated following the ISI method (1982). The samples were analysed for amino acid profile as according to the method of Ishida *et al.*, (1981).

Statistical analysis

Three samples were used for each determination. Statistical analysis was done by using SPSS version 16.0 and the data are presented as means±S.D.

Result and discussion:

Proximate composition and amino acid profile of the three fish species found in hill stream environment of Manipur were analysed and the results were shown in Tables 1 and 2 respectively. The moisture content among the fish species was found highest in *Labeo pangusia* (76.30± 0.07%). It ranges from 72.80 ± 0.04% to 76.30 ± 0.07%. According to Bassey et al., 2011, knowledge of the moisture content of food stuffs serves as a useful index of their keeping qualities

Volume : 3 | Issue : 8 | Aug 2014 • ISSN No 2277 - 8179

and susceptibility to fungi infection. It has been recorded that protein content among the fish species were slightly similar, ranging 19.00±0.92% to 20.64±0.03%. The high protein content can be attributed to its omnivorous feeding habit (Bello-Olusoji *et al.*, 1995). The highest total lipid is found in *Semiplotus manipurensis* (3.56±0.04) and lowest in *L. pangusia* (2.45±0.02%). According to Okuzumi and Fujii (2000), lipids are highly efficient as sources of energy and they contain twice the energy of carbohydrates and proteins. As a general rule, they act as major food reserve along with protein and are subject to periodic fluctuations influenced by environmental variables like temperature (Nagabhushanam & Farooqui, 1982), 1982. Ash content is also found in a range of 1.20±0.04% (*S. manipurensis*) to 1.98±0.01% (*Neolissochilusstracheyi*). High ash content is of significance in measuring the mineral content of the species as the amount of ash shows the richness of the food in terms of element composition (Hanan *et al.*, 2009).

Proximate composition generally refers to the percentage composition of basic constituents such as water, protein, lipids and ash. Information concerning the chemical composition of freshwater fishes in general is valuable to nutritionists concerned with readily available sources of low-fat, high protein foods such as most freshwater fishes (Sadiku & Oladimeji, 1991; Mozoffarin *et al.*, 2003; Foran *et al.*, 2005). The measurement of some proximate profiles such as protein contents, lipids and moisture contents is often necessary to ensure that they meet the requirements of food regulations and commercial specifications.

Table no. 1. Proximate composition ofthe three hills stream fishes.

Sl. no	Fish species	Moisture %	Total Protein %	Total Lipid %	Total Ash %
1.	*N. stracheyi*	72.80±0.04	20.64±0.03	2.78±0.02	1.98±0.01
2.	*L. pangusia*	76.30±0.07	19.28±0.08	2.45±0.02	1.43±0.01
3.	*S. manipurensis*	75.48±0.59	19.00±0.92	3.56±0.04	1.20±0.04

The results are mean ± S.D. of the samples taken in triplets.

Amino acid profile

Total amino acid content and Amino acid composition of the three species are shown in Table No. 2. Fish is widely consumed in many parts of the world by humans because it has high protein content. Fish muscle is consistent of an excellent amino acid composition and is a unique source for nutrients and easily digestible protein (Venugopal *et al*., 1996; Yanes *et al*., 1976). Moreover, the constituent amino acids of protein act as precursors of many coenzymes, hormones, nucleic acids, and other molecules essential for life. Thus an adequate supply of dietary protein is essential to maintain cellular integrity and function, and for health and reproduction.

The highest total amino acid was found in *Semiplotus manipurensis*(113.92 g/100g protein) and lowest in *Neolissochilus stracheyi* (104.42 g/100g protein). Total essential amino acid was found highest in *Labeo pangusia* (66.51 g/100g protein) whereas highest total non-essential amino acid was recorded in *S. manipurensis* (56.74 g/100g protein).

Table No. 2. Amino acid profile of the three fish species (g/100g):

Sl. no.	Amino acid	*N. stracheyi*	*L. pangusia*	*S. manipurensis*
1.	**Essential amino acid**			
	Histidine	6.35	11.79	4.30
	Isoleucine	4.96	5.97	6.10
	Leucine	10.09	8.38	8.42
	Lysine	7.13	9.17	8.56
	Methionine	2.95	4.26	4.82
	Phenylalanine	5.10	6.72	5.91
	Threonine	5.51	5.49	5.90
	Tryptophan	1.51	2.14	1.58
	Valine	6.02	6.35	6.38
2.	**Non-essential amino acid**			
	Aspartic acid	9.69	10.92	11.12
	Serine	4.42	2.31	5.23
	Glutamic acid	15.87	15.93	20.04
	Proline	4.59	1.11	5.28
	Glycine	3.05	2.90	3.07
	Alanine	7.56	8.31	7.60
	Cysteine	1.24	0.74	0.82
	Tyrosine	2.92	3.87	2.97
	Arginine	5.46	6.24	5.82
3.	Total amino acid	104.42	112.6	113.92
4.	Total essential amino acid	55.08	66.51	57.79
5.	Total non-essential amino acid	49.34	46.09	56.74

In this study, nine essential amino acids like Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan and Valine were detected. The essential amino acid spectrum is an index of biological value of the fish protein. This shows that fish protein is well balanced with essential amino acids. So we must depend on fish for EAA, as it is not synthesised in our body. According to FAO/WHO/UNU Expert Consultation on Protein and Amino Acid Requirements in Human Nutrition (2007), essential amino acids are required daily by human for healthy living.

Aspartic acid, glutamic acid and lysine were reported as the major amino acids of fishes (Ozden, 2005). Oluwaniyi & Dosumu (2009) reported that glutamic acid is the most abundant amino acid in all the four species *(Clupea harengus, Scomber scombrus, Trachurus trachurus and Urophycistenuis)*. This is very much similar to the present study that, the most abundant amino acid in all the fish species is glutamic acid among the non-essential amino acid. The highest glutamic acid was recorded in *Semiplotus manipurensis* (20.04 g/100g protein). Aspartic acid is another non-essential amino acid found significantly high in all the three fish species. Essential amino acids, viz., Leucine, Lysine, Histidine, Valine, Threonine, Phenylalanine and Isoleucine were found abundantly in all the three fish species. Leucine was found highest in *Neolissochilus stracheyi* (10.099 g/100g protein) and lowest in *Labeo pangusia* (8.38 g/100g protein). Lysine was found highest in *L. pangusia* (9.17 g/100g protein) and Histidine was significantly high in *L. pangusia* (11.79 g/100g protein). It is recommended that Amino acids necessary for growth and maintenance must be included in the diet.

ACKNOWLEDGEMENT

We are grateful to the University Grant Commission, New Delhi (vide order no. 41-46/2012 (SR)) for financial assistance.

REFERENCE

Abdul Hei & Sarojnalini, Ch. 2014. Nutritional assessment of some traditionally processed hill stream fishes of Manipur with special reference to n-3 fatty acids. J. Aqua. Food Prod.Technol. Taylor & Francis. Doi. org/10.1080/10498850.2013.797535. | Abdul Hei & Sarojanlini, Ch. 2012. Proximate composition, Macro & Micro elements of some smoke-dried hill stream fishes from Manipur, India. Nature & Science.10(1). | AOAC. 1990. Official Methods of Analysis. 12thEdn.Association of official Analytical Chemists, Washington D.C. | Bassey, S.C.O., Eteng, M.U., Eyong, E.U., Ofem, | O.E., Akunyoung, E.O. and Umoh, I. B. 2011. Comparative nutritional and biochemical evaluation of Ergeriaradiata(clams) and Pomeciapalludosa(gastropods).Res. J. Agric& Biol. Sci. 7(1): 98-104. | Bello-Olusoji, O.A., A.M. Balogun, , O.A | Fagbenro, and N. Ugbaja, 1995. Food and feeding studies of the African river prawn. In: Proceedings of Fish and Shellfish Larviculture Symposium. Lavens P., Japan E. and Roelants, I. (Eds.). Europ.Aquac.Soc., Special Publication. 24: 425-427. | Bhagowati, A.K., Ratha, B.K. 1982. Biochemical composition and nutritional value of three species of Hill stream Fish belonging to the Garra Garra from North Eastern India. Proc. Indian natn.Sc. Acad-B48 No. 1. Pp 67-72. | Bijen, M., Ch. Sarojnalini & Vishwanath, W. 1990.Nutritive value of sun-dried Esomus danricus and smoked Lepidochephalus guntea.Food Chemistry (Elsevier, U. K.) 36: 89-96. | FAO. 1991. Fish for Food & Development. Pp: 1- | 49. | Foran, J.A. et al. 2005. Risk-based consumption advice for farmed Atlantic and wild pacific salmon contaminated with dioxins and dioxin-like compounds. Environ.Health Persp. 33: 552-556. | Hanan, A.T., Madlen, M.H. and Hanaa, M.S.2009. | Residues of some heavy metals and hormones in freshwater prawn (Macrobranchium rosenbergii) and marine shrimps (Panaeus semisculatus) with reference to their nutritive value.World Journal of Zoology. 4(3):205-215. | Islam, N.M., Razzaq, A.M. 2005. Seasonal variation of the Proximate composition of Freshwater Gobi, Glossogobius giuris (Hamilton) from the river Padma. Pakistan J. Biol. Sc. 8(4): 532-536. | Joint FAO/WHO/UNU Expert Consultation on Protein and Amino acid Requirements in human Nutrition. WHO Technical Report Series No. 935. 2007. | Kosygin, L., Lilabati, H., Vishwanath, W. 2001. Proximate composition of commercially important Hill stream fishes of Manipur. J. Fish. 48(1): 111-114. | Kumaran, R. et al. 2012. Estimation of Proximate, Amino acids, Fatty acids & mineral compositions of mullet (Mugil cephalus) of Perangipettai, South-east coast of India.Advances in Applied Science research. 3(4): 2015-2019. | Love, R.M. 1970. The chemical Biology of Fishes. | Acad. Press, London. pp 547. | Okuzumi, M. &Fujii, T. 2000. Nutritional and | functional properties of squid and cuttle fish. National Cooperative Association of Squid Processors, California.Pp 223. | Oluwaniyi, O.O., &Dosumu, O.O.2009. Biokemistri.21(1), 1-7. | Ozden. 2005. Changes in amino acid and fatty acid composition during shelf-life of marinated fish. J. Sci. Food Agric. 85: 2015-2020. | Sadiku, S.O.E. &Oladimeji, A.A. 1991.Relationship of proximate composition of Lates niloticus (L), Synodontisschall RES. Commun. 3(1): 29-40. | Sarojnalini, Ch. &Vishwanath, W. 1988.Studies on the biochemical composition of some fresh water fishes of Manipur. J. Adv. Zoo. 1. 9(1): 1-5. | Stansby, M.E. 1962. Proximate composition of Fish.Fish in nutrition. 55-60. Fish News (Books) Ltd. Lond. | Venugopal, V., Chawla, S.P., Nair, P.M. 1996. J. | Muscle Foods. (7)55. | Yanes, E., Ballester, D., Monckeberg, F. 1976. J. Food sci. (41)1289. | Mozaffarin, M.D. et al. 2003. Cardiac benefits of fish meal consumed. Circulation. 107: 1372-1382. | Nagabhushanan, R. &Farooqui, V.M. 1982.Mobilization of protein, glycogen, and lipid during ovarian maturation in mature crabs, Scylla serrate. Indian J. Mar. Sci. 11: 184-189. |