ORIGINAL ARTICLE Open Access

ISSN 2278-1404

International Journal of Fundamental & Applied Sciences

Nutritive and nutritional analyses of *Chanda nama* consumed by the *Bodos* of Kokrajhar District, BTAD, Assam

Sharmistha Chakraborty[1,2]*, Arvind Kumar Goyal[2,3], Mehdi al Kausor[1], Birendra Kumar Brahma[3]

[1]Department of Chemistry, Science College, Kokrajhar- 783370, BTAD, Assam, India; [2]Department of Biotechnology, Bodoland University, Kokrajhar-783370, B.T.A.D, Assam, India; [3]Centre for Bamboo Studies, Bodoland University, Kokrajhar-783370, B.T.A.D, Assam, India

Manuscript received 19th Nov, 2017, revised 19th Dec 2017, accepted 21st Dec, 2017

Abstract

The small indigenous food fishes are enriched in high quality nutrients. They are cheap sources of high grade protein. Due to the low price they are reachable to the poor communities and admired by the different classes of people of the country. *Chanda nama* is though small but popular food fish in Assam having good consumer preference. Proper measures must be taken for the better conservation of these fishes. In the present work, we report the nutrient profile of *Chanda nama* collected from ponds and wetlands in and around Kokrajhar Assam. The proximate analysis showed that the contents of moisture, ash, total protein, total carbohydrate and total lipids were 68.12 ± 0.06%, 5.59 ± 0.02%, 14.86 ± 0.04%, 0.33± 0.04% and 11.09± 0.07% respectively. The amino acid profile revealed the fair content of essential amino acid L-histidine (8.36 ± 0.05g/100g). The fatty acid profile documented that the fish is having a good content of palmitic acid (4.49 ± 0.01g/100g), oleic acid (1.94 ± 0.03g/100g) and stearic acid (1.43 ± 0.02g/100g) apart from various others. It was also found that *Chanda nama* may be a rich source of iron (3.90 ± 0.02mg/100g), zinc (3.18 ± 0.02mg/100g) and calcium (807 ± 0.02mg/100g) Phosphorus (2470 ± 0.02mg/100g). One of the macro mineral phosphorous was traced to be the most abundant one (2470 ± 0.02mg/100g). The good content of Vitamin A (378.96 ± 0.03µg/100g) was also reported in the present study. In conclusion, *C. nama* have plethora of nutritive value.

***Keywords*:** amino acids; *Chanda nama*; elongate glassy perchlate; fatty acids; fish; minerals; vitamin

1. Introduction

Chanda nama (Hamilton, 1822) popularly known as the elongate glassy perchlet, is a species of fresh water fish in the Asiatic glassfish, family Ambassidae, of order Perciformes, the only species in the genus Chanda. It is locally referred to as *Chanda Mach* (Assamese) and *Na Chanda* (Bodo) (Chakraborty et al., 2016). *C. nama* reaches a maximum overall length of 11cm (4.3 inches) total length[2]. It is widely consumed by the local communities of Kokrajhar district, BTAD, Assam. It is a member of a group known as glass fishes (Gupta, 2015). It is distributed in Bangladesh, India, Nepal and Pakistan (Talwar and Jhingran, 1991). It is a favorite food fish in Assam. The species inhabits canals, ponds, streams and flooded rice paddy fields in both fresh and brakish water and are abundantly found in rainy seasons. Because of various ecological changes, the natural habitats of them are degraded and leading to serious declination of its population (Hossain et al., 2012). The species feeds on mosquito larvae, worms and also eats the scales of other fishes (Lapidophagy), the species may have potential use in controlling malaria and parasites. They are harvested and sold for food in local markets. Recently it has been reported that these fishes are exported from India to other countries as indigenous fish (Gupta, 2015).

Fish plays a vital role for providing high quality protein in the human diet. Several studies so far, documented the beneficial effects on health by including fish in a diet.

***Corresponding author**
Full Address :
Department of Chemistry, Science College, Kokrajhar- 783370, BTAD, Assam, India
Phone no. +91 8876022397
E-mail: chakrabortysharmisthakjh@gmail.com

Fish protein is easily digestible by adults as well as infants due to their long muscle fibers. Fishes are recommended for cardiovascular and other related health problems (Damsgaard et al., 2006; Mayer et al., 2006; Dahl et al., 2006; Mozaffarian et al., 2006). Fish muscle is comprised of moisture, protein and fat as major nutrients and carbohydrate and vitamins as the minor components. Fish protein in enriched with good amino acid composition in desirable requirements for human consumption. Regular consumption of fish promotes the defense capacity for protection against invasion of human pathogens due to the presence of antimicrobial peptide in the fish food (Ravichandran et al., 2010). All over the countries fish is well known to be the cheap source of essential nutrients needed in human diets (Fawole et al. 2007). Fish meat contains comparatively low lipids and high water contents in comparison to beef or chicken and hence appreciated over other white or red meats (Nestel, 2000). Fish lipids are experimentally justified to be a rich source of long chain n-3 polyunsaturated fatty acids (LC n-3 PUFA) such as Eicosapentaenoic acid (EPA) and docosahexacnoic acid (DHA) which cannot be synthesized by human and must be obtained from the diet (Alasalvar et al., 2002). Proximate composition is a good indicator of physiology needed for regular analysis of fisheries (Cui and Wootton et al., 1988). Fish of different species donot provide the same nutritional values to their consumers (Soriguer et al., 1997; Takama et al., 1999). These variations in the nutritional aspects of different species may be due to feeding habits, feeding rates, habitats, sex, age, size, genetic trails and migration (Dawson et al., 1980; Abdullahi, 2001; Ajah, 2009). Due to the high nutritional aspects of fishes the fish industries should be carefully developed for the contribution of it towards alleviation of food insecurity of the nation (Owaga et al., 2010). This is achieved by the maximum utilization of the fish species exploring their nutritional potentiality (Ghelichpour et al., 2012). To ensure the commercial values of the small fishes proper investigation of nutritional composition of them is very important.

The present study had been carried out to estimate the values of proximate composition, amino acid and fatty acid profiles of *Chanda nama* which is widely available and consumed by different communities of Kokrajhar district, BTAD, Assam, but is commercially not so much explored but commonly consumed by the local communities due to their low cost and excess availability.

2. Materials and method

2.1 Sample collection and morphometric analysis

Fresh *Chanda nama* were collected with proper care from the water bodies of Kokrajhar. They were thoroughly cleaned, descaled, degutted and stored frozen until analysis. The length, breadth and weight of each species were calculated.

2.1 Proximate composition analysis

The moisture and ash contents of the fish species were estimated following Directorate General of Health Services (DGHS) lab manual 6.0 (DGHS, 2005) and the protein and carbohydrate content were estimated using the method Indian Standard (IS): 7219:1973 (IS7219, 1973) and IS: 1656-2007 (IS1656, 2007) respectively. The percentage of total lipid was estimated following DGHS Lab manual 6.0 (DGHS, 2005).

2.3 Nutritive analyses

Amino acid composition was determined using by following the method of Ishida et al. (Ishida et al., 1981). Analysis of Vitamin A and Vitamin D was performed by using High Performance Liquid Chromatography (HPLC) according to the method of Chatzimichalakis et al. (Chatzimichalakis et al., 2004). The Fatty acid profile was done using Gas Chromatography – Flame Ionization Detector (GC-FID) according to the method described by Association of Analytical Communities (AOAC) (996.06) (AOAC, 2005). The minerals such as Iron, Zinc, and Calcium were estimated by using UV- Visible Spectrophotometer, Atomic Absorption Spectroscopy (AAS), according to the method of (QA.16.5.2). Phosphorus was estimated by using UV-visible spectrophotometer, AAS following the method of IS: 14828:2000 (IS14828, 2000).

3. Results and Discussion

The morphometric analysis of *Chanda nama* including the length, breadth and weight was found to be 70.10 mm, 5.40 mm and 6.07 g respectively. Our results are in accordance with the previous report where the maximum length attained by this species is recorded to be 110 mm[2].

The proximate composition of this fish species was determined. In this study moisture, carbohydrate, lipid, protein and ash content of the fish species was 68.12 ± 0.06%, 0.33 ± 0.04%, 11.09 ± 0.07%, 14.86 ± 0.04% and 5.59 ± 0.02% respectively. The result shows that the studied fish species is rich in protein and also fair content of crude lipid. The high content of moisture is attributed to the fact that the major component of fish muscle is moisture (Mazumder et al., 2008). The present findings

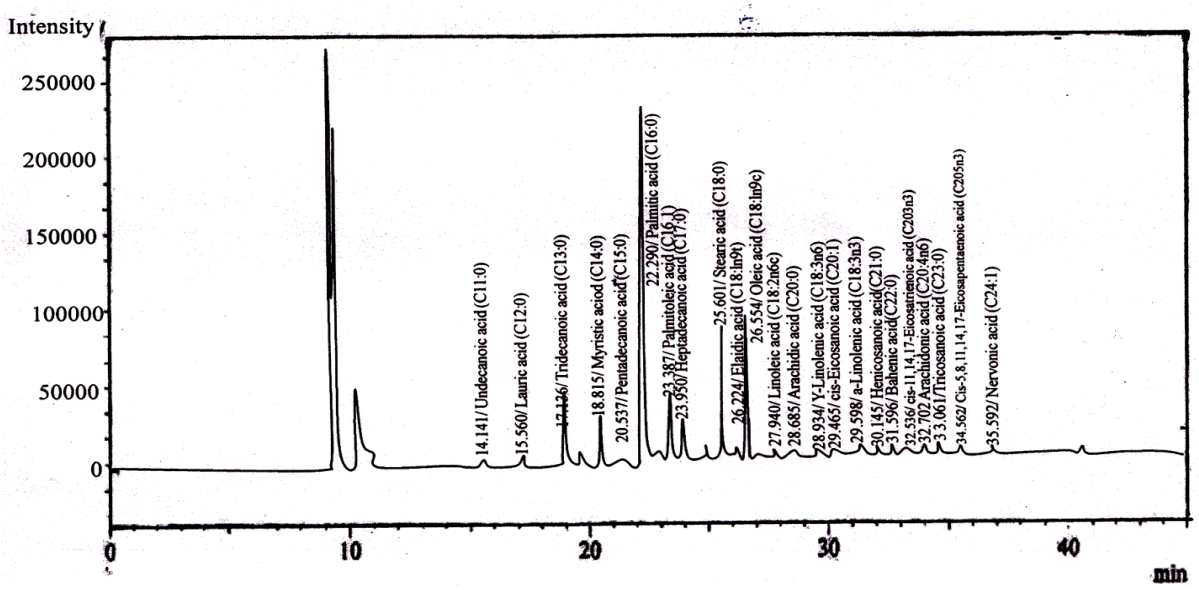

Figure I: GC-MS Chromatogram of Fatty acids in *Chanda nama*

Table I: Shows the fatty acid profile of *Chanda nama*

Fatty Acids	Content (g $100g^{-1}$)
Butyric acid	<0.1
Caproic acid	<0.1
Caprylic acid	<0.1
Capric acid	<0.1
Undecanoic acid	<0.1
Lauric acid	<0.1
Tridecanoic acid	0.12 ± 0.05
Myristic acid	0.78 ± 0.04
Myristoleic acid	<0.1
Pentadecanoic acid	0.52 ± 0.03
Cis-10-Pentadecanoic acid	<0.1
Palmitic acid	4.49 ± 0.01
Cis-10-Heptadecanoic acid	<0.1
Stearic acid	1.43 ± 0.02
Oleic acid	1.94 ± 0.03
Elaidic acid	0.13 ± 0.02
Linoleic acid	<0.1
Linolelaidic acid	<0.1
Arachidic acid	<0.1
Cis-11,14-Eicosatrienoic acid	<0.1
Cis-8,11,14-Eicosatrienoic acid	<0.1
Cis-11,14,17-Eicosatrienoicacid	<0.1
Arachidonic acid	<0.1
Cis-5,8,11,14,17-Eicosapentaenoic acid	<0.1
Haneicosanoic acid	<0.1
Behenic acid	<0.1
Erucic acid	<0.1
Cis-13,16-Docosadienoic acid	<0.1
Cis-4,7,10,13,13,16,19-Docosahexaenoic acid	<0.1
Tricosanoic acid	<0.1
Lignoceric acid	<0.1
Palmitoleic acid	0.67± 0.02
Gamma-Linolenic acid	<0.1
Alpha-Linolenic acid	<0.1
Heptadecanoic acid	0.44 ± 0.01
Cis-11-Eicosenoic acid	<0.1
Nervonic acid	<0.1

state that the low ash content might be due to lesser amount of skeleton in small indigenous *Chanda nama*. Similar values were observed in *Chanda nama* of Bangladesh (Mazumder et al., 2008) and *Puntius sophore* (Mahanty et al., 2014).

Lipids and fatty acids have significant role in membrane biochemistry and have a direct impact on nutrient assimilation transport and also in osmoregulation. The values of nutrients may alter by the variation of species and habit (Conner , 1996; Czesny et al., 2000).

Altogether 37 different types of fatty acids were recognized in muscle tissues of *Chanda nama* (Figure I, Table I). The data have been expressed in g/100g. Of which, it was inferred from the study that the principal fatty acid in this fish species were palmitic acid (4.49 ± 0.01g/100g) followed by Oleic acid (1.94 ± 0.03g/100g) and stearic acid (1.43 ± 0.02g/100g). Apart from these eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) were also reported. Both EPA and DHA have been already established to have pharmaceutical importance and thus helps in reducing hypertension, cancer, rheumatoid arthritis, coronary heart diseases (Davis and Kris-Etherton, 2003; Johnson and Schaefer, 2006).

Traditionally the amino acids are classified as essential, non-essential and conditionally essential (Wu, 2010). Recently, another group of amino acids termed as functional amino acid has been proposed (Wu, 2013). This group of amino acids helps in prevention and treatment of various metabolic disorders. In this study the amino acid profiling was done (Figure II) and the result was tabulated in table II. All the 20 essential and

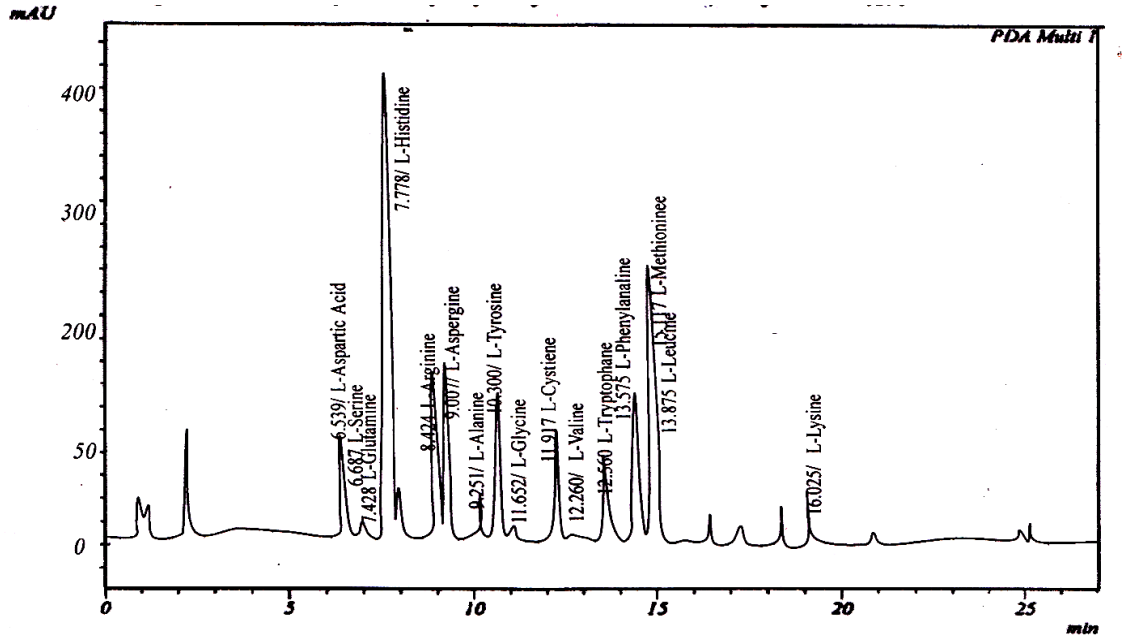

Figure II: HPLC Chromatogram of amino acids in *Chanda nama*

Table II: Shows the amino acid profile of *Chanda*

Amino acids	Content (g $100g^{-1}$)
L-Alanine	1.34 ± 0.01
L-Arginine	0.16 ± 0.02
L-Asparagine	1.06 ± 0.04
L-Aspartic acid	0.08± 0.01
L-Cystine	<0.05
L-Glutamic acid	0.28 ± 0.06
L-Glutamine	<0.05
L-Glycine	<0.05
L-Proline	0.20 ± 0.01
L-Serine	0.65 ± 0.04
L-Tyrosine	0.33 ± 0.02
L-Histidine	8.36 ± 0.05
L-Isoleucine	0.47 ± 0.01
L-Leucine	0.29 ± 0.04
L-Lysine	<0.05
L-Methionine	1.15 ± 0.04
L-Phenylalanine	0.10 ± 0.01
L-Threonine	<0.05
L-Tryptophan	0.37 ± 0.01
L-Valine	0.39 ± 0.03

Table III: Minerals and vitamin contents of *Chanda nama*

Test parameters	Results
Minerals (mg $100g^{-1}$)	
Iron	3.90 ± 0.02
Zinc	3.18 ± 0.02
Phosphorus	2470.00 ± 0.02
Calcium	807.93 ± 0.03
Vitamins (µg $100g^{-1}$)	
Vitamin A	378.96 ± 0.03
Vitamin D	<5.0

non-essential amino acids were reported to be present in *Chanda nama*. The fish species was reported to be rich in the essential amino acid, L-Histidine (8.36 ± 0.05g/100g) followed by L –Alanine (1.34 ± 0.01g/100g), L-Methionine (1.15 ± 0.04g/100g) and L-Asparagine (1.06 ± 0.04g/100g). The essential amino acid, Histidine is important for histamine biosynthesis. Histidine is the metalloprotein which plays several roles in protein interaction (Liao et al., 2013). Apart from this, histidine help in removing heavy metals from body and are also required for growth and repair of tissue (Mahanty et al., 2014). The rich content of histidine has already been reported in several small indigenous fishes (Mahanty et al., 2014). Methionine is used for treating a number of diseases and disorder apart from being hetatoprotective and improving wound healing (Mischoulon and Fava, 2002).

Though required in very trace amount, minerals plays a vital role in maintain homeostasis inside human body. Selected minerals analyzed are tabulated in table III. Two macrominerals (calcium and phosphorous) and two microminerals (iron and zinc) were detected in *Chanda nama*. The calcium and phosphorous content of *C. nama* were 807.93 ± 0.03mg/100g and 2470 ± 0.02mg/100g respectively. The small fishes are good sources of both the analysed macrominerals since they are eaten with their bones (Roos et al., 2007) and *C. nama* is no exception. This fish species was found to be nutritionally rich with zinc (3.18 ± 0.02mg/100g) and iron (3.90 ± 0.02mg/100g). Iron form the major constituent of haemoglobin in the erythrocytes which is responsible for

carrying oxygen to different parts of the body. Iron is associated with effective immuno-competence of the body and its deficiency might lead to increased risk of infection (Mahanty et al., 2014). Zinc is mainly an intracellular microelement required for wound healing. It also enhances cell growth and division, besides being an essential component of several enzymes (Mahanty et al., 2014). The mineral profile indicates that *C. nama* is rich source of phosphorous, calcium, iron and zinc.

Vitamin A and vitamin D profile of *Chanda nama* is presented in table 3. Vitamin A and vitamin D content was found to be 378.96 ± 0.03µg/100g and <0.5 µg/100g in *C. nama*. Vitamin A which is associated with the bone growth and normal vision is thought to be more readily available to the body from fish compared to plant source (Mohanty et al., 2012). Vitamin A content was found to be 378.96 ± 0.03µg/100g in *C. nama* and that of vitamin D was <0.5 µg/100g. Vitamin D not only plays a role in immune function but also possesses curative properties of various chronic diseases (Holick, 2007).

4. Conclusion

Chanda nama is too small in size to be highlighted for commercial exploration. But the fish is commonly consumed by the different communities of the country specially the north east part of India. The present investigation shows that *Chanda nama* so far the nutritional value is concerned, it is not less than any other larger carp species. It is concluded that the studied fish species may show excellence in the nutritional upliftment of the local peoples when included in the regular diet.

Acknowledgement

The authors are also obliged to Edward Food Research and Analysis Centre Limited, Kolkata-700121 for allowing us to work in their esteemed laboratory.

Conflict of interest

The authors declare none.

References

1. Chakraborty S, Goyal AK, Brahma BK, Ichthyofaunal diversity of various water bodies of Kokrajhar district, BTAD, Assam, *Int J Fund Appl Sci*, 5 (2016) 9-15.
2. Gupta S, A note on morphology biology and possible conservation measures for *Chanda nama* (Hamilton 1822) a threatened fish of Indian subcontinent, *Int J Fish Aquat Stud*, 3(2) (2015) 468-470.
3. Talwar PK, Jhingran AG, *Inland fishes of India and adjacent countries* (Vol 2) (1991) CRC Press.
4. Hossain MY, Rahman MM, Fulana B, Jewel MAS, Ahmed F, Ohtomi J, Length-weight and Length Length relationship of five threatened fish species from the Jamuna (Brahmaputra River tributary) River Northern Bangladesh, *J Appl Ichthyol*, 28(2) (2012) 275-277.
5. Damsgaard CT, Schack-Nielsen L, Michaelsen KF, Fruekilde MB, Hels O, Lauritzen L, Fish oil affects blood pressure and the plasma lipid profile in healthy Danish infants, *J Nutr*, 136(1) (2006) 94-99.
6. Mayer K, Schaefer MB, Seeger W, Fish oil in the critically ill: from experimental to clinical data, *Curr Opin Clin Nutr Metab Care*. 9(2) (2006) 140-148.
7. Dahl L, Bjørkkjaer T, Graff IE, Malde MK, Klementsen , [Fish--more than just omega 3] Tidsskrift for den Norske laegeforening: tidsskrift for praktisk medicin ny raekke 126(3) (2006) 309-311.
8. Mozaffarian D, Rimm EB, Fish intake contaminants and human health: evaluating the risks and the benefits, *Jama*, 296(15) (2006) 1885-1899.
9. Ravichandran S, Kumaravel K, Rameshkumar G, AjithKumar TT, Antimicrobial peptides from the marine fishes, *Res J Immunol*, 3(2) (2010) 146-156 .
10. Fawole OO, Ogundiran MA, Ayandiran TA, Olagunju OF, Proximate and mineral composition in some selected fresh water fishes in Nigeria, *Internet J Food Safety*, 9 (2007) 52-55.
11. Nestel PJ, Fish oil and cardiovascular disease: lipids and arterial function, *Am J Clin Nutr*, 71(1) (2000) 228S-231S.
12. Alasalvar C, Taylor KDA, Zubcov E, Shahidi F, Alexis M, Differentiation of cultured and wild sea bass (*Dicentrarchus labrax*): total lipid content fatty acid and trace mineral composition, *Food Chem*, 79 (2) (2002) 145-150.
13. Cui Y, Wootton RJ, Effects of ration temperature and body size on the body composition energy content and condition of the minnow *Phoxinus phoxinus* (L), *J Fish Biol*, 32(5) (1988) 749-764.
14. Soriguer F, Serna S, Valverde E, Hernando J, Martín -Reyes A, Soriguer M, Esteva I, Lipid protein and calorie content of different Atlantic and Mediterranean fish shellfish and molluscs commonly eaten in the south of Spain, *Eur J Epidemiol*, 13(4) (1997) 451-463.
15. Takama K, Suzuki T, Yoshida K, Arai H, Mitsui T, Phosphatidylcholine levels and their fatty acid compositions in teleost tissues and squid muscle, *Comp Biochem Physiol B Biochem Mol Biol*, 124(1) (1999) 109-116.
16. Dawson AS, Grimm AS, Quantitative seasonal changes in the protein lipid and energy content of the carcass ovaries and liver of adult female plaice *Pleuronectes platessa* L, *J Fish Biol*, 16(5) (1980) 493-504.
17. Abdullahi SA, Investigation on nutritional status of chrysicttys nigrodigitatus Barus filamentous and Aucheoglanis accidentatis (Family Bagridae), *J Arid Zone Fish*, 1 (2001) 39-50.

18. Ajah PO, Fish breeding and hatchery management Jerry commercial production Calabar, (2009) p.183
19. Owaga EE, Onyango CA, Njoroge CK, Influence of selected washing treatments and drying temperatures on proximate composition of dagaa (*Rastrineobola argentea*) a small pelagic fish species, *Afr J Food Agric Nutri Dev*, 10(7) (2010) 1-14.
20. Ghelichpour M, Shabanpour B, Hoseine SM, comparative study on the effect of different cooking methods on physicochemical properties and color characteristics of golden grey mullet (Lizaaurate) fillets, *Latin Am Appl Res*, 42 (2012) 155-159.
21. Directorate General of Health Services (DGHS), Manual of methods of analysis of foods Food additives Lab Manual No 6 New Delhi (India): DGHS Ministry of Health and Family Welfare Government of India (2005) p 1-39.
22. Indian Standard 7219, Method for determination of protein in foods and feeds [FAD 16: Foodgrains Starches and Ready to Eat Foods] (1973).
23. Indian Standard 1656, Milk-Cereal Based Complementary foods [FAD 19: Dairy Products and Equipment] (2007).
24. Ishida Y, Fujita T, Asai K, New detection and separation method for amino acids by high-performance liquid chromatography, *J Chromatogr A*, 204 (1981) 143-148.
25. Chatzimichalakis PF, Samanidou VF, Verpoorte R, Papadoyannis IN, Development of a validated HPLC method for the determination of B-complex vitamins in pharmaceuticals and biological fluids after solid phase extraction, *J Sep Sci*, 27(14) (2004) 1181-1188.
26. AOAC, AOAC Official Method 99606: Fats (total saturated and monounsaturated in foods) Hydrolytic Extraction Gas Chromatographic Method In Official Methods of Analysis of the Association of Official Analytical Chemists 18th ed Assoc Off Anal Chem Arlington VA (2005).
27. Indian Standard 14828, Animal Feeding Stuff - Determination of Total Phosphorus Content - Spectrophotometric Method [FAD 5: Livestock Feeds Equipment and Systems] (2000).
28. Mazumder MSA, Rahman MM, Ahmed ATA, Begum M, Hossain MA, Proximate composition of some small indigenous fish species (SIS) in Bangladesh, *Int J Sustain Crop Prod*, 3(4) (2008) 18-23.
29. Mahanty A, Ganguly S, Verma A, Sahoo S, Mitra P, Paria P, Mohanty BP, Nutrient profile of small indigenous fish Puntius sophore: proximate composition amino acid fatty acid and micronutrient profiles, *Natl Acad Sci Lett*, 37(1) (2014) 39-44.
30. Conner WE, Lipids. 31(Suppl) (1996) S 183-S 187.
31. Czesny S, Sabrowski K, Christensen JE, Eenennam JV, S Doroshov, Discrimination of wild and domestic origin of sturgeon ova based on lipids and fatty acid analysis, *J Aquacult*, 189 (2000) 145-153.
32. Davis BC, Kris-Etherton PM, Achieving optimal essential fatty acid status in vegetarians: current knowledge and practical implications, *Am J Clin Nutr*, 78(3) (2003) 640S-646S.
33. Johnson EJ, Schaefer EJ, Potential role of dietary n−3 fatty acids in the prevention of dementia and macular degeneration, *Am J Clin Nutr*, 83(6) (2006) S1494-1498S.
34. Wu G, Functional amino acids in growth reproduction and health Advances in Nutrition, *Int Rev J*, 1(1) (2010) 31-37.
35. Wu G, Functional amino acids in nutrition and health. *Amino Acids,* 45(3) (2013) 407-411.
36. Liao SM, Du QS, Meng JZ, Pang ZW, Huang RB, The multiple roles of histidine in protein interactions, *Chem Cent J*, 7(1) (2013) 44.
37. Mischoulon D, Fava M, Role of S-adenosyl-L-methionine in the treatment of depression: a review of the evidence, *Am J Clin Nutr*, 76(5) (2002) 1158S -1161S.
38. Roos N, Wahab MA, Hossain MAR, Thilsted SH, Linking human nutrition and fisheries: incorporating micronutrient-dense small indigenous fish species in carp polyculture production in Bangladesh, *Food Nutr Bull*, 28(2 suppl2) (2007) S280-S293.
39. Mohanty BP, Paria P, Das D, Ganguly S, Mitra P, Verma A, Sankar TV, Nutrient profile of giant river-catfish Sperata seenghala (Sykes), *Natl Acad Sci Lett*, 35(3) (2012) 155-161.
40. Holick MF, Vitamin D deficiency, *N Engl J Med*, 357 (2007) 266–281.