ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Nutritional Composition Of Freshwater Carps *Ctenopharyngodon Idella* And *Hypophthalmichthys Molitrix* In Cauvery Delta,Tamil Nadu, India.

Nasreena Shaban[1]*, Ishfaq Mohiuddin[2]

[1]Department of Zoology, Faculty of Sciences, Annamalai university, Annamalai nagar, Tamil Nadu, India - 608 002

[2] Department of Zoology, Faculty of Sciences, Annamalai university, Annamalai nagar, Tamil Nadu, India - 608 002; lone6449@gmail.com

* nasreenashaban11@gmail.com

Abstract

The study was conducted with a view to assess the nutritional composition of freshwater carps *Ctenopharyngodon idella* and *Hypophthalmichthys molitrix* in Cauvery Delta. Fish samples were chemically analyzed for moisture, carbohydrate, protein, lipid and ash. When chemical composition of two fish species collected was compared, the differences were substantial. Considering proximate composition highest content of moisture (76.98%) was recorded in *Hypophthalmichthys molitrix* than *Ctenopharyngodon idella* (72.60%). Lipid content was slightly more in *Ctenopharyngodon idella* (2.43%) than *Hypophthalmichthys molitrix* (2.21%). Eminent levels of protein and lipid were observed in *Ctenopharyngodon idella* while lower in *Hypophthalmichthys molitrix*. The percentages of protein content ranged between 15.34% in *Hypophthalmichthys molitrix* to 17.53% in *Ctenopharyngodon idella*, which is quite high. Carbohydrate content present in *Hypophthalmichthys molitrix* was recorded 1.08% which is less than *Ctenopharyngodon idella* where it was recorded 1.13%. The range of ash content from 1.18 - 1.38% gave an indication that the fish sample may be good source of minerals such as calcium, potassium, zinc, iron and magnesium.

Keywords: Cauvery Delta, chemical composition, *Ctenopharyngodon idella*; *Hypophthalmichthys molitrix.*

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Introduction

Aquaculture is the field where we can obtain more production in the form of aquatic organism. It has been estimated that the world wide human consumption of fish is 20 kg of fish per annum per capita, of which half is supplied by aquaculture (FAO, 2016). The efficiency of production of aquaculture has been increased in order to meet the growing demand of fish and seafood for an increasing population, which also regard the environmental sustainability of the industry. The freshwater aquaculture cultivation production in India assessed about 2.36 million ha of ponds and tanks and accounts for about 55% of the entire fish production in India. Currently, only an estimation 40% of the reachable area is in use because of technical and activity access issues (FAO, 2014).). Fish as a whole has a lot of food potential and can therefore be expected to provide relief from malnutrition. It provides superior quality protein to that of meat, milk and eggs and well balanced essential amino acid profile, necessary minerals and fatty acids (Hossain, 1996). In addition to that fish flesh is tasty and highly digestible. Over and above it minimizes the risk of heart diseases and increases life expectancy (Barlas, 1986).

Silver and grass carp are freshwater Chinese fishes. Silver carp is surface feeder feeding mainly on phytoplankton. It has longer digestive canal as compared to grass carp hence digestion and utilization of feed is complete. Grasscarp feeds on aquatic weeds and terrestrial grasses and has short intestine. Young ones of both species feed on zoo plankton (Santhanam *et al*., 1990).

Nutritive value of fish depends mainly on the proximate composition: moisture, protein, lipid, and ash of the body. Proximate composition is used as an indicator of fish quality and all the constituents together form about 95-98% of the total weight of the tissue. A variety of many other minor constituents are also present in small quantities, like carbohydrate, vitamins, free amino acids and non-protein nitrogenous compounds. The biochemical composition of fish varies widely and these variations are determined by many factors such as biological status of life cycle, feeding habits and enviromental conditions (Gopakumar, 2002). Proximate composition is used as an indicator of fish quality.

Materials and Methods

Fish ranging from 0.5 kg to 1.5 kg were collected and were brought to the laboratory in plastic bags using ice boxes in order to prevent them from fat oxidation, protein denaturation etc., their body weight was weighed and recorded.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Biochemical analysis of the study animals

Fish was dissected and muscle was removed with the help of dissecting scissors and knife. Collected muscle parts were grinded with the help of mortar and pestle and was then preceded for analysis.

Estimation of moisture was done by Drying method (APHA,1998). Protein estimation was done by Lowry *et al*.(1951). Lipid estimation was done by Soxlet method (1957). Estimation of carbohydrates was done by using anthrone reagent (Travelyan and Harrison,1952). Estimation of ash content was determined by burning oven-dried sample in a muffle furnace at 550°C (AOAC, 1995). The fatty acid composition (oils) was analysed by using GC-FID.

Results

Table 1. Nutritional composition of *Hypophthalmichthys molitrix* (Silver carp).

S. No.	Parameters	Percentage
1	Moisture	76.98 ± 0.07
2	Carbohydrate	1.08 ± 0.03
3	Protein	15.34 ± 0.39
4	Lipid	2.21 ± 0.04
5	Ash	1.18 ± 0.02

Table 2. Nutritional composition of *Ctenopharyngodonidella* (Grass carp).

S.No	Parameters	Percentage
1	Moisture	72.60 ± 0.47
2	Carbohydrate	1.13 ± 0.02
3	Protein	17.53 ± 0.09
4	Lipid	2.43 ± 0.06
5	Ash	1.38 ± 0.10

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Table 3. Concentration of saturated fatty acids present in *Hypophthalmichthys molitrix* (Silver carp).

SATURATED FATTY ACID	g/100g fats
Lauric acid (C12:0)	1.90
Myristic acid (C14:0)	1.95
Pentadecanoic acid (C15:0)	0.27
Palmitic acid (C16:0)	17.28
Heptadecanoic acid (C17:0)	0.39
Stearic acid (C18:0)	2.77
Archidic acid (C20:0)	0.16
Behenic acid(C22:0)	0.16
Lignoceric acid (C24:0)	0.71
TOTAL	**25.59**

Table 4. Concentration of monounsaturated fatty acids present in *Hypophthalmichthys molitrix* (Silver carp).

MONOUNSATURATED FATTY ACID	g/100g fats
Palmitoleic acid (C16:1)	9.98
10-Heptadecenoic acid(C17:1)	0.19
Oleic acid (C18:1)	31.56
Vaccenic acid (C18:1 11C)	3.95
Eicosenoic acid (C20:1)	1.32

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Erucic acid (C22:1)	1.86
Nervonic acid (C24: 1)	1.48
TOTAL	**50.34**

Table 5. Concentration of polyunsaturated fatty acids present in *Hypophthalmichthys molitrix* (Silver carp).

POLYUNSATURATED FATTY ACID	**g/100g fats**
Gamma linoleic acid (C18:3:n-6)	8.78
Alphalinolenic acid (C18: 3:n-3)	0.98
Eicosadienoic acid (C20:2	0.61
Henecosenoic acid (C21:0)	0.70
Homo γ Eicosadienoic acid (C20:3)	0.95
Gamma Eicosatetraenoic acid (C20:3)	0.51
Arachidonic acid (C20:4)	1.77
Eicosapentaenoic acid (C20:5:n-3)	1.98
Docosapentaenoic acid (C22:5:n-3)	0.31
Docosahexaenoic acid (C22:6:n-3)	2.75
TOTAL	**19.34**

Table 6. Concentration of trans fatty acids present in *Hypophthalmichthys molitrix* (Silver carp).

TRANS FATTY ACID	**g/100g fats**
C-9, T-12 (C18:2), Trans	0.29
T-9, C-12, (C18:2),Trans	0.08

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Myristoeladic acid (C14:1 Trans)	0.35
Pentadecanoic acid (C15:1 Trans)	0.19
Eicosenoic acid (C20:1 Trans)	3.43
Bracidate (C22:1 Trans)	0.39
TOTAL	**4.73**

Table 7. Total SFA, MUFA, PUFA and TFA of *Hypophthalmichthys molitrix* (Silver carp)

S.No	Parameters	Concentration (g/100g fats)
1	Saturated fatty acid	25.59
2	Mono unsaturated fatty acid	50.34
3	**Poly unsaturated fatty acid**	**19.34**
4	Trans fatty acid	4.73

Table 8. Concentration of saturated fatty acids present in *Ctenopharyngodonidella* (Grass carp).

SATURATED FATTY ACID	g/100g fats
Lauric acid (C12:0)	0.53
Myristic acid (C14:0)	2.21
Pentadecanoic acid (C15:0)	0.39
Palmitic acid (C16:0)	18.00
Heptadecanoic acid (C17:0)	0.52
Stearic acid (C18:0)	3.88

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Archidic acid (C20:0)	0.15
Behenic acid(C22:0)	0.18
Lignoceric acid (C24:0)	0.61
TOTAL	**26.47**

Table 9. Concentration of monounsaturated fatty acids present in *Ctenopharyngodonidella* (Grass carp).

MONOUNSATURATED FATTY ACID	**g/100g fats**
Palmitoleic acid (C16:1)	7.98
10-Heptadecenoic acid(C17:1)	0.52
Oleic acid (C18:1)	30.35
Vaccenic acid (C18:1 11C)	3.91
Eicosenoic acid (C20:1)	1.22
Erucic acid (C22:1)	0.58
Nervonic acid (C24: 1)	1.50
TOTAL	**46.06**

Table 10. Concentration of polyunsaturated fatty acids present in *Ctenopharyngodonidella* (Grass carp).

POLYUNSATURATED FATTY ACID	**g/100g fats**
Gamma linoleic acid (C18:3:n-6)	9.44
Alphalinolenic acid (C18: 3:n-3)	1.27
Eicosadienoic acid (C20:2	0.62

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Henecosenoic acid (C21:0)	0.60
Homo γ Eicosadienoic acid (C20:3)	0.82
Gamma Eicosatetraenoic acid (C20:4)	0.50
Arachidonic acid (C20:4)	2.02
Eicosapentaenoic acid (C20:5:n-3)	3.32
Docosapentaenoic acid (C22:5:n-3)	0.31
Docosahexaenoic acid (C22:6:n-3)	3.95
TOTAL	**22.85**

Table 11. Concentration of trans fatty acids present in *Ctenopharyngodonidella* (Grass carp).

TRANS FATTY ACID	**g/100g fats**
C-9, T-12 (C18:2), Trans	0.32
T-9, C-12, (C18:2),Trans	0.08
Myristoeladic acid (C14:1 Trans)	0.26
Pentadecanoic acid (C15:1 Trans)	0.16
Eicosenoic acid (C20:1 Trans)	3.41
Bracidate (C22:1 Trans)	0.39
TOTAL	**4.62**

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Table 12: Total SFA, MUFA, PUFA and TFA of *Ctenopharyngodonidella* (Grass carp)

S.NO	Parameters	Concentration (g/100g fats)
1	Saturated Fatty Acid	26.47
2	Mono unsaturated Fatty Acid	46.06
3	**Poly unsaturated Fatty Acid**	**22.85**
4	TransFatty Acid	4.62

Discussion

Fish have been a fundamental origin of nutrient for humans (Ayoola, 2010) and fish protein occupies all important ingredients in human (Nargis, 2006). Protein is a nutrient needed by the human body for growth and maintenance (Herman, 2014). Fish is one of the cheapest source of quality animal proteins and plays an important role in quenching the protein requirement in developing and under developed countries of the world.

The biochemical composition of fish flesh is an indicator of fish quality. Proximate biochemical composition of a species help to assess its nutritional and edible value in terms of energy units compared to other species. Freshwater fish are also in a position to meet the requirement for several minerals and vitamins. Good digestibility of fish flesh is a reason that it is well suited as a healthy diet in children as well as in adults. The high nutritional value of freshwater fish should be therefore, used for advertising and improving the market.

In general, the biochemical composition of the whole body indicates the fish quality. Due to different biological parameters such as age, growth, maturity, season, sex, as well as the environmental conditions and by the growing technology and feeding, the distribution of these parameters among various organs and tissues show considerable variations (Chandra Shekhar *et al.,* 2014; Stansby, 1954; Jauquot,1961). Food composition, environmental factors and genetic trait are also known to influence chemical composition of fish (Oni *et al.*,1983).

It is an accepted fact that there exists a strong link between the main energy yielding reserves like fat and protein to the water, the 'milieu' of all biological functions. An increase in proportion of one of these constituents leads to the decrease of the other, so that the sum remains approximately constant (Love,1970). Carbohydrate forms a minor percentage of the total composition of the muscle. The low value carbohydrate recorded in the present could be because glycogen in many fishes does not contribute much to the reserves in the body (Jayasree *et al*.,1994 and Ramaiyan *et al*.,1976). The low value of carbohydrates recorded in the present

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

study supports the view that carbohydrates plays an insignificant role as energy reserve in aquatic animals (Love,1970). Protein content, which is vital constituent of living cells, tends to vary relatively little in healthy fish unless drawn upon during particular demands of reproduction or during food deprivation periods (Ali, 2009). Similar to the fat, the protein content in the body of fishes change depending on season, stage of maturity of gonads, environmental conditions, stage of nutrition and age.

In the present study, protein was found to be most dominant biochemical constituent in the muscles of Grass carp to that of Silver carp. Fish lipids are known to provide high contents of nutritional lipid soluble vitamins (A and D) and essential ω-3 PUFA (Simopoulos, 1997). Some fat soluble vitamins have regulatory or coenzyme functions, and the prostaglandins and steriod hormones play major roles in controlling the homeostasis of the body. They offer higher calories of energy than that offered by proteins and carbohydrates. The lipid content of fish varies depending on the environmental factors such as season, temperature and stage of reproduction(Jezierska *et al*.,1982 and Lee *et al*.,1993). Present investigation was focused on the nutritional composition of two freshwater fish species and the result obtained showed that the lipid content of Grass carp was slightly more when compared to the lipid content of Silver carp. Ash is considered waste in animal feeds, and low ash content is considered good. The range of ash content gives an indication that fish sample may be a good source of minerals such as calcium, potassium, zinc, iron and magnesuim. Ash content recorded in Grass carp is slightly more than Silver carp.

Fatty acids are aliphatic monocarboxylic acids derived from, or contained in esterfied form in animal or vegetable fat, oil, or wax. There are many interacting external (temperature, salinity, food availability) and internal factors, including species, sex, physiological status that determine and affect the PUFA content of aquatic organisms. Among them one the most important factor is diet. EPA, some DHA, and shorter- chain C16 and C18 ω3 PUFA are produced by microalgae, macroalgae and some bacteria (Lewis *et al*.,1999). Freshwater fish showed marked difference in quantities of PUFA especially DHA and was observed that these type of fish are highly unsaturated with high concentration of DHA (Ravichandran et al., 2011). In the present study it was observed that *Hypophthalmichthys molitirix* and *Ctenopharyngodon idella* consist of desirable amount of fatty acids. Being a freshwater fish, are more rich in MUFA than PUFA. *Hypophthalmichthys moltirix* contain more MUFA (50.34%) than *Ctenopharyngodon idella* (46.06%).

In conclusion present study was carried out to find out the nutritional quality of two freshwater fishes in Cauvery Delta. Results showed that these fish are a good source of protein, carbohydrate, lipid and ash, hence consumption of these fishes is highly recommended. Further, through this bio-monitoring study, present results of proximate composition analysis can be used as a baseline data for comparison in future, with regard to fish nutritional quality.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Acknowledgement

The authors are thankful to the Department of Zoology, Annamalai university, Annamalainagar, Tamil Nadu, India, for providing all the facilities to carry out the research work.

References

Ali Aberoumand. (2012). Proximate composition of less known some processed and fresh fish species for determination of the nutritive values in Iran. J. Agri. Tech. 8(3) : 917-922.

APHA (1998). Standard Methods for examination of water and waste water. 20th Ed. American Public Health Association. AWWA, WPCA, Washington, D.C., U.S.A. 1193.

AOAC (1995). Official methods of analysis (16th ed.). Washington, DC: Association of Official Analytical Chemists.

Ashraf, M., Zafar, A., Rauf, A., Mehboob, S. and N.A. Qureshi.(2011). Nutritional values of wild and cultivated silver carp (*Hypothalmichthys molitrix*) and grass carp (*Ctenopharyngdonidella*). Int. J. Agric. Biol.,13: 210-214.

Ayola, S. (2010). Sustainable fish production in Africa. African J. Food, Agri, Nutr and Dev. 10: 1-9.

Chandra Shekhar, A., Rao, P and Abidi, A.B. (2004). Changes in muscle biochemical composition of *Labeo rohita* (Ham.) in relation to season. Indian J. Fish Vol. 51 (3): 319-323.

FAO (2006). The production of fish meal and oil. FAO Fisheries Technical Paper, Rome, Italy, 142: 63.

FAO (2014). Fish Trade and Human Nutrition: The Role of Fish in Nutrition and Food Security. Working Document COFI:FT/XIV/2014, Bergen, Norway.

FAO (2016). The State of World Fisheries and Aquaculture. Food and Agriculture Organisation Rome, 200.

Folch, J., Lees, M and Stanley, G.H.S (1957). A simple method for the isolation and purification of total lipids from animal tissues. Journal of Biological Chemistry, 226: 497-509.

Gopakumar, K. (2002). Biochemical composition of fish. Textbook of fish processing technology, Indian Council of Agricultural Research, New Delhi, pp:18-30.

Hermann, J. R. (2014). Protein and the Body. Oklahoma Cooperative Extension Service. Division of Agricultural Sciences and Natural Resources, Oklahoma State University, T. 3163: 1–4.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 08, 2022

Hossain, M.A. (1996). Proximate and amino acid composition of some potential Bangladeshi fish feed ingredients. Bangladesh J. Zool., 24: 163–168.

Jayasree, V., Parulekar, A.H., Wahidulla, S. and S.Y. Kamat (1994). Seasonal changes in biochemical composition of *Holothuria vleucospilota* (Echinodermata). Indian J. of Marine Science, 23: 117-119.

Jezierska, B., Hazel, J.R. and Gerking S.D.(1982). Lipid mobilization during starvation in rainbow trout, *Salmo gairdnerii*, with attention to fatty acids. J. Fish Biol., 21: 681-692.

Lewis, T.E., Nichols, P.D. and T.A. McMeekin (1999). The biotechnological potential of thraustochytrids. Marine Biotechnology,1: 580-587.

Love, R.M. (1970). The Chemical Biology of Fishes. Academic Press, London and New York.

Lowry, O.H., Rosebrough, N.J., Farr, A.L. and Randall, R.J.(1951). Protein measurement with the Folin phenol reagent. J. Biol. Chem, 193: 265-275.

Nargis, A. (2006). Seasonal variation in the chemical composition of body flesh of koi fish *Anabas testudineus* (Bloch) (Anabantidae: Percifomes). Bangladesh Journal of Scientific and Industrial Research, 41: 219-226.

Oni, S.K., Olayemi, J.Y and Adegboye, J.D. (1983). Comparative physiology of three ecologically distinct freshwater fishes, *Alestes nurse* (Rupell), *Synodontis schall* (Bloch and Schneider) and *Tilapia zilli* (Gervais). Journal of Fish Biology.22: 105-109.

Ramayan,V., Paul, A.L. and Pandian,T.J. (1976). Biochemical studies on the fishes of order Clupeiformes. J. of Marine Biology Association India,18(3): 516-524.

Ravichandran, S., Kumaravel, K., Pamela and Florence, E. (2011). Nutritive composition of some edible fin fishes. International J. of Zoological Reasearch, 7(3): 241-251.

Stansby, M.Z. (1954). Composition of certain species of freshwater fish. Food. Res. 19: 231-234.

Simopoulos, A. (1997) Nutritional aspects of fish, in Seafood From Producer to Consumer, Integrated Approach to Quality, Luten, J., Borrensen, T., and Oehlenschlager, J., eds., Elsevier Science, London, U.K., 589.

Travelyan, W.E and Harrison, J.S. (1952). Studies on yeast metabolism, fractionation and micro determination of cell carbohydrates. Biochem. 50: 298-303.