

Chemical Investigation of Pectoral and Ventral Fins of Fish *Cirrhina mrigala* At Different Stages of Growth

Babita Agrawal

*Dept. of Chemistry, B.S.A. College, Mathura
babitanodiya10@gmail.com*

Abstract: The present study was undertaken to evaluate the variations in minerals composition, crude fat, crude proteins and component amino acids along with their sequence in the proteins. Calcium and phosphorus form major proportions of minerals while quantity of magnesium being comparatively low. Sodium occurs in traces at all the three stages of growth. Crude fat and crude proteins show a decrease with increasing age. Major quantities of amino acids are serine, hydroxylysine, hydroxyproline, glycine, arginine as these are essentially present in collagen. Amino acids also decrease in their content with increasing age.

Keywords: Amino acids, Eriochrome black T, Pectoral fins, Ventral fins, Silica Crucible

1. INTRODUCTION

For reason of being organs of locomotion of fishes, fins are of paramount importance and maintain their wave like movements. Mineral and organic analysis of fins at different stages of growth adequately reveal that ageing of fins is association with deposition of mineral in greater proportions which imparts stiffness and hardness to them. Fins of fishes are of two kinds; Median or unpaired fins include dorsal fin anal and caudal fins & paired fins (pectoral fins, more prominent and large) take a forward position and help to keep aloft the body. The other is pelvic fins or ventral fins, comparatively small and act as additional or secondary elevating planes, when necessity arises. On ageing, the collagen content of fins tend to be organized in the form of coarser fibres. As a result, the tissue of fins become less hydrated, less elastic and therefore, less able to resist mechanical forces (G. B. Talwar, 1980). Ageing brings progressive loss of tissues function along with possible accumulation of diseases including osteoporosis, arthritis, obesity etc. This study deals chemical investigation of Pectoral and Ventral fins of fish *Cirrhina mrigala* at different stages of growth.

2. MATERIALS AND METHODS

First ten fishes of each age group of *Cirrhina mrigala* were collected. Pectoral and Ventral fins were taken, washed thoroughly in several changes of distilled water, dried in air at room temperature for 36 hours and then ground to a fine powder separately. The crude fat was extracted in a soxhlet extractor using petroleum ether (40°C - 60°C). Nitrogen was determined by Kjeldahl method. Crude protein was determined with the help of total Nitrogen. Amino acids were determined with the help of HPLC. Moisture was determined by keeping 1 g of the air dried material in an aluminium cup in an electric oven at 100°C for 24 hours and then weighing the air dried material in an analytical balance. Ash content was determined by keeping 1 g of the material in a muffle furnace at 900°C. Calcium was determined with the help of calcium oxalate. Mg was determined calorimetrically after removing calcium as calcium sulphate precipitate using the reagent eriochrome black - T. Phosphorus was determined by alkalimetric method. Sodium was precipitated as sodium zinc uranyl acetate and estimated in Eel's colorimeter using green filter.

Table 1: Mineral composition of Pectoral and Ventral fins of Fish Cirrhina mrigala at three different stages of growth (Value are expressed as g/100g of the dry material)

Stages of Growth	Average age of 10 fish			Moisture		Ash		Mineral Values			Mineral Oxides Values			Ash Unaccounted for	
	Length (cm)	Girth (cm)	Weight (g)	Pectoral Fins	Ventral Fins	Pectoral Fins	Ventral Fins		Pectoral Fins	Ventral Fins		Pectoral Fins	Ventral Fins	Pectoral Fins	Ventral Fins
I	30	16	2700	11.30	11.50	53.75	53.29	Ca	20.78	20.59	CaO	29.09	28.83	0.0333	0.0333
								Mg	0.36	0.36	MgO	0.6	0.6		
								Na	0.005	0.005	Na ₂ O	0.0067	0.0067		
								P	10.49	10.40	P ₂ O ₅	24.02	23.82		
								F ₂	0.025	0.023					
								Total			53.7167	53.2567			
II	61	30	5355	11.28	11.48	67.01	68.39	Ca	25.43	25.20	CaO	35.60	35.28	0.0319	0.0119
								Mg	0.44	0.43	MgO	0.73	0.72		
								Na	0.008	0.006	Na ₂ O	0.0081	0.0081		
								P	13.38	13.26	P ₂ O ₅	30.64	30.37		
								F ₂	0.033	0.029					
								Total			66.9781	66.3781			
III	89	35	7950	11.03	11.23	73.03	72.41	Ca	28.57	28.33	CaO	40.00	39.66	0.0633	0.0333
								Mg	0.54	0.55	MgO	0.9	0.9		
								Na	0.005	0.004	Na ₂ O	0.0067	0.0067		
								P	14.00	13.89	P ₂ O ₅	32.06	31.81		
								F ₂	0.034	0.032					
								Total			72.9667	72.3767			

Table 2: Crude fat, Total Nitrogen and Crude protein contents of the Pectoral and Ventral Fins of Fish Cirrhina mrigala at three different stages of growth. (Values are expressed as g/100g of the dry material)

Stages of Growth	Average age of 10 fish			Pectoral Fins			Ventral Fins		
	Length (cm)	Girth (cm)	Weight (g)	Crude fat	Total N	Crude Protein (N x 6.25)	Crude fat	Total N	Crude Protein (N x 6.25)
I	30	16	2700	0.67	7.29	45.55	0.68	7.36	46.00
II	61	30	5355	0.53	5019	32.42	0.58	5028	33.00
III	89	35	7950	0.44	4024	26.49	0.46	4.33	27.09

Total of Crude Protein, Crude Fat, Fluorine and Ash

Pectoral Fin	Stage I	$45.55 + 0.67 + 53.75 + 0.025 = 99.99$
	Stage II	$32.42 + 0.53 + 67.01 + 0.031 = 99.99$
	Stage III	$26.49 + 0.44 + 73.03 + 0.034 = 99.99$
Ventral Fin	Stage I	$46.00 + 0.68 + 53.29 + 0.023 = 99.99$
	Stage II	$33.00 + 0.58 + 66.33 + 0.029 = 100.00$
	Stage III	$27.09 + 0.46 + 72.41 + 0.032 = 99.99$

Table 3: Amino acid composition of Pectoral and Ventral fins of Fish *Cirrhina mrigala* at three different stages of growth. (Values are expressed as g/100g of the dry material)

Sl. No.	Amino Acid	Pectoral Fins			Ventral Fins		
		Stage I	Stage II	Stage III	Stage I	Stage II	Stage III
1.	Alanine	0.53	0.41	0.47	0.54	0.42	0.48
2.	Arginine	1.91	1.33	1.05	1.94	1.35	1.07
3.	Aspartic Acid	0.30	0.27	0.25	0.30	0.28	0.26
4.	Cystine	1.02	1.08	0.94	1.03	1.11	0.96
5.	Glutamic Acid	1.13	0.76	0.52	1.14	0.77	0.53
6.	Glycine	2.43	2.28	1.80	2.45	2.32	1.83
7.	Histidine	0.73	0.52	0.45	0.74	0.53	0.46
8.	Isoleucine	0.59	0.47	0.39	0.60	0.48	0.40
9.	Leucine	0.67	0.62	0.43	0.68	0.63	0.44
10.	Lysine	0.51	0.39	0.21	0.51	0.40	0.22
11.	Methionine	0.41	0.31	0.24	0.41	0.33	0.25
12.	Phenyl alanine	0.55	0.47	0.48	0.56	0.48	0.49
13.	Proline	0.20	0.15	0.13	0.16	0.14	0.13
14.	Serine*	4.08	2.18	1.69	4.12	2.22	1.72
15.	Threonine*	0.76	1.22	0.96	0.77	1.24	0.98
16.	Tryptophan	0.54	0.34	0.24	0.55	0.35	0.25
17.	Tyrosine	0.32	0.27	0.25	0.33	0.28	0.26
18.	Valine	0.45	0.33	0.29	0.46	0.34	0.30
19.	Hydroxy proline	3.35	1.74	1.40	3.38	1.77	1.43
20.	Cysteine	0.49	0.35	0.28	0.49	0.36	0.29
21.	Hydroxylysine	3.54	2.28	1.68	3.57	2.32	1.71
	Total	24.51	17.77	14.15	24.73	18.12	14.46

N - Terminal residue not determined.

- CONH₂ group not determined.

* - Corrected for the loss during hydrolysis.

3. RESULTS AND DISCUSSION

The mineral analysis of Pectoral fins and Ventral fins of fish *Cirrhina mrigala* shows that moisture contents of both the fins decrease from Stage I to Stage III of ageing. The moisture contents follow the order – Pectoral Fin < Ventral Fin. Ash contents of both the fins of fish exhibit an increase from Stage I to Stage III of ageing. The total ash contents of both the fins follow the order opposite to that of moisture content i.e., Pectoral Fin > Ventral Fin. Calcium content of Pectoral fin is maximum, calcium content increases from Stage I to Stage III of growth in both the fins. Phosphorus is also the major constituent of both the fins of fish. Sodium occurs in traces in both the fins. Amount of magnesium is minute at all the stages.

Table 2 shows that the value of crude fat, total nitrogen and crude protein decreases from Stage I to Stage III of ageing.

Table 3 indicates that at all the three stages of growth, Pectoral and Ventral fins both contain twenty one amino acids of the collagen group. Total amino acid content decreases from Stage I to Stage III in both the fins. Serine

occurs in the maximum quantity at Stage I whereas at Stage II glycine and hydroxylysine are equal & maximum. Amino acids present in appreciable amount are arginine, Cysteine, glutamic acid, glycine, serine, hydroxyl proline and hydroxylysine. Total value of amino acids of Pectoral fins at Stages I, II and III are 24.51, 17.77 and 14.15 respectively. Total values of amino acids of Ventral fins at Stages I, II and III are 24.75, 18.12 and 14.46 respectively.

4. CONCLUSION

Results of the minerals and organic constituents of both fins (Pectoral and Ventral) are reported. Ash content increases with ageing while moisture content decreases. All minerals are found in increasing order. The study shows that crude fat and crude protein decrease in both the fins as a result of growth. Total amino acid content decreases from Stage I to Stage III. However, all the ten essential amino acids are invariably present in both the fins. It reveals that ageing of both the fins is associated with deposition of minerals in greater proportions which imparts stiffness and hardness to them. As well amino acids decreases with increasing age.

REFERENCES

- [1] Albert, L. Lehninger (1987), Principles of bio-chemistry P-160.
- [2] Barnard, J. A. R. Chayen (1965), Modern methods of Chemical Analysis, Mc Graw hill Publishing company Ltd London, p -215.
- [3] Buerger, L. and Gies, W. J. (1901), Am. J. Physiol 6:219.
- [4] Cameron, A.T. (1946), A Text Book of bio-chemistry for students of medicine and science p-210.
- [5] Chibnall, A. C. (1942), Proc. Roy. Soc. B 131-136.
- [6] Cumming and Kay (1956), Quantitative chemical analysis revised by Robert Alaxander, Chalmers, Oliver and Boyd. Edinburgh. London P 111-112, 124-125, 332-334.
- [7] Deshmukh, K. and Nimni, M. E. (1948), Chemical changes associated with ageing of collagen in vivo and vitro. J. Biochem. 397.
- [8] Hiroyuki Hanai, Makoto Ishida, C. Tony Liang and Bertram Sacktor (1986), Parathyroid Hormone increases Sodium/Calcium exchange activity in renal cells and the blunting of the response in ageing. The Journal of Biological chemistry. Vol. 261, No. 12, Issue of April 25, pp-5419-5425, 1986. Printed in U.S.A
- [9] Lansing, A.I., Roberts, E., Ramasarma, G. B., Rosenthal, T. B. and Alese, M. (1951), Changes with age in amino acid composition of arterial elastin Proc. Soc. exper. Biol. And Ned. 76:714-717.
- [10] Patricia C. Brown and Dr. R consden (1958), Variation with age of Shrinkage temp. of collagen (human) Nature 1, 349.
- [11] R. C. Saraswat and R. K. Garg (1974), Studies on the mineral constituents of fins of wallago attu (Bloch and Schneider) at different stages of growth. Indian J. animal. Research 8(1) 36-38.
- [12] Robin Holliday (1988), Genes, Proteins and cellular ageing. Indian Journal of Experimental Biology, Vol. 26, April 1988, p-327.
- [13] Saraswat R.C. and Newton Ram (1972), Organic composition of fins of fish wallago attu (Bloch & Schncidere) at different stages of growth. Indian Journal of experimental Biology, Vol. 10, No. 3 pp. 243-244.
- [14] Thakur, M. K. (1984), Age related changes in the structure and function of chromatin: A review. Mech. Ageing Dev. 27, pp-263-286.