Chemical Study and Effect of Ageing on the Bones of the Fish Channa Striatus

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Abstract- This study was undertaken to evaluate the minerals and organic constituents of the bones of fish Channa striatus at three different stages. All minerals are present in increasing order with the growing age. Ash contents are very high at all the stages. The values of Calcium and Phosphorus are very high. Magnesium is present in low amount at all the stages while Sodium and Fluorine are present in traces. Crude fat, total Nitrogen and crude Protein show continuous decrease with increasing age. Likewise, amino acids also decrease in their content with increasing age.

Index Terms- Aluminium Cup, Ash, Channa striatus, Petroleum Ether , Soxhlet Extractor

I. Introduction

The term ageing denotes the continuity of the changes in biochemical processes which determine structural and functional variations in the cells and non-cellular tissues with the growing age. Overall changes in the whole organism are the result of ageing.

Connective tissues of animals viz bones, teeth, tendons cartilage etc. undergo obvious changes with growing age with regard to the chemical constituents and physical states. Gerontologists have reported their findings with special reference to variation in mineral composition, crude fat, crude protein and component amino acids and their sequence in these proteins in different connective tissues. Arthritis is a common disease of connective tissues in the aged living being. On ageing, collagen becomes more rigid as lipofuscin begins to accumulate in cells. Deposition of collagen results in wrinkled skin. Age is also an important factor effect in basal metabolic rate. A newborn baby produces 600-700 cal/m^2 of surface per day, as compared to 1000 calories for an adult during the first few years of life.

Connective tissues are of mesodermal origin and develop from the mesenchyme. The principle function of connective tissues is to bind other tissues together and to give support to various structures in the body. *Chibnall* and his coworkers carried out precise quantitative investigation on the composition of component proteins of connective tissues.

The problems of ageing, wound healing, uterine desorption, rheumatism and other diseases of connective tissues are now being widely investigated. Therefore, chemical investigation of these tissues will decide merit of, the attention of technologists and chemists associated with it. This study deals chemical investigation of bones of fish Channa striatus at three different stages of growth.

II. Material and Methods

Ten fishes C. striatus of each growth group were taken out. The bones of the fishes were taken out by dissection, washed thoroughly with distilled water, then 80% ethanol. Cut the bones into small blocks and then small pieces. Cleaned bone fragments were defatted in a mixture of equal parts of ether and absolute ethanol for two days and dried in an air oven at 105˚C for 24 hours. A suitable portion (0.10 – 1.00 gm) is placed in a dry, weighed silica disc (7.5 cm diameter). The disc supported by a silica triangle, is heated with a small non-luminous Bunsen flame protected from droughts by an iron cone. Some protein swell bubble and evolve large volume of gas. When all the material is dull black, the dish is transferred to an electric ruffle furnace controlled at 550˚C. Heating is continued until no black patches are bledded in the ash. The ash and material transferred to a desiccator which may conveniently contain self-indicating silica gel. Total Nitrogen was determined by Kjeldhal methods. Crude protein was determined with the help of total N. Crude fat is extracted in a Soxhlet extractor using petroleum ether (40˚C - 60˚C). Amino acids were determined with the help of paper chromatography. Calcium was precipitated as calcium oxalate and then determined volumetrically using standard $KMnO_4$, after liberating free oxalic acid by dissolving the precipitate in dil H_2SO_4. Magnesium was determined calorimetrically after removing calcium as calcium sulphate precipitate using the reagent Eriochrome Black T. Sodium was determined by flame photometer.

Table 1: Mineral composition of bones of Fish C. striatus at three different stages of growth (Values are expressed as g/100g of the dry material)

Stages of Growth	Average age of 10 fishes			Moisture	Ash	Mineral	Values	Mineral Oxides	Values	Ash Unaccounted for
	Length (cm)	Girth (cm)	Weight (g)							
I	30.0	15.0	1000	9.0	82.01	Ca)a Mg)s Na)h P)i F_2 n	31.55 0.18 0.0016 16.30 0.04	CaO MgO Na_2O P_2O_5 Total	44.18 0.30 0.0024 37.36 81.83	0.18
II	50	20.2	1500	8.6	84.53	Ca)a Mg)s Na)h P)i F_2 n	32.54 0.186 0.0018 16.80 0.044	CaO MgO Na_2O P_2O_5 Total	45.52 0.31 0.0025 38.49 82.32	0.21
III	72.0	30.0	3200	8.0	86.90	Ca)a Mg)s Na)h P)i F_2)n	33.38 0.19 0.0019 17.31 0.05	CaO MgO Na_2O P_2O_5 Total	46.70 0.32 0.0026 39.66 86.68	0.22

III. Results & Discussion

Table no. 1 indicates that the ash content increases with age. Amounts of all the minerals increase with age. Amount of Ca and P are found in major quantity. Amount of Na and F_2 is found in traces at all the stages. Ash unaccounted for increases with age and it is 0.18, 0.21 and 0.22 at stage I, II and III respectively. Moisture content decreases from Stage I to III.

Table 2: Organic composition of connective tissues of Fish C. striatus at three different stages of growth. (Values are expressed as g/100g of the dry material)

Stages of Growth	Average age of 10 fishes			Crude fat	Total N	Bones Crude Protein (N x 6.25)
	Length (cm)	Girth (cm)	Weight (g)			
I	30	15.0	1000	0.27	2.83	17.66
II	50	20.0	1500	0.25	2.43	15.16
III	72	30.0	3200	0.22	2.06	12.85

Table 2.0-a: Bones

Stages of Growth	Total of ash, crude fat and crude protein
I	99.94
II	99.94
III	99.97

Table 3: Amino acid composition of bones of Fish Channa striatus at three different stages of growth. (Values are expressed as g/100g of the dry material)

Sl. No.	Amino Acid	Stage I	Stage II	Stage III
1.	Alanine	0.43	0.33	0.21
2.	Arginine	1.36	0.19	0.67
3.	Aspartic Acid	0.15	0.33	0.16
4.	Cystine	1.16	0.55	0.63
5.	Glutamic Acid	0.67	0.35	0.39
6.	Glycine	1.47	1.30	0.77
7.	Histidine	0.31	0.21	0.14

8.	Isoleucine	0.23	0.25	0.18
9.	Leucine	0.44	0.34	0.09
10.	Lysine	-	0.18	0.12
11.	Methionine	0.43	-	-
12.	Phenyl alanine	0.34	-	-
13.	Proline	1.04	0.09	0.09
14.	Serine*	0.95	0.73	1.14
15.	Threonine*	1.09	0.32	0.61
16.	Tryptophan	0.21	0.18	0.03
17.	Tyrosine	0.38	0.24	0.18
18.	Valine	0.10	0.19	0.16
19.	Hydroxy proline	1.33	0.28	0.39
20.	Cysteine	0.50	0.19	0.14
21.	Hydroxy lysine	0.10	0.08	0.06
	Total	12.77	7.05	6.16

N – Terminal residue not determined.
- $CONH_2$ group not determined.
*- Corrected for the loss during hydrolysis.

Table no.2 shows that the fat content decreases from stage I to stage III. Total N and crude protein also decrease with increase in the age.

According to Table no. 3, total of amino acids at the stage I, II and III are 12.77, 7.05 and 6.16 respectively. It shows that the values decreases from stage I to stage III. Twenty amino acids are present in stage I, but 19 amino acids are present in stage II and stage III. Lysine is absent at stage I, while Methionine and Phenyl alanine are absent at stage II and stage III. At stage III, Serine has the maximum amount and Glycine follows it. It shows that amino acids decrease with increase in the age.

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