Some Biochemical Constituents And the Calorific Values of Different Regions of the Body Musculature of Pond Murrel *Channa punctatus* Bloch

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A study of the distribution of some chemical constituents in the musculature of *Channa punctatus* Bloch showed it to be fairly heterogeneous. The increase in the levels of protein, fat, ash, total carbohydrates, glycogen, RNA, DNA and cholesterol towards the posterior region of the fillet was the result of increase in the number of cells per unit weight of the sample and in the concentration of myocommata. The distribution of water in the musculature was inversely related to that of the fat. The concentration of protein appeared to be associated with the RNA level. The posterior region of the fillet exhibited more calorific value than the anterior region.

Although literature pertaining to the variations in the biochemical composition of the edible portion of fish flesh in relation to size, sex, season, stage of maturity and habitat as reviewed by Love (1970), is fairly extensive, there seem to be relatively fewer satisfactory accounts dealing with the differences in the chemical composition of meat in different parts of an individual fish (Brandes & Dietrich, 1953; Olley & Lovern, 1960; Mannan *et al.* 1961a, b; Karrick & Thurston, 1964 and Jafri, 1973). The present report is based on the quantitative estimation of protein, fat, water, ash, total carbohydrates, glycogen, RNA, DNA, cholesterol and calorific value in the anterior and posterior sections of the fillet of *C. punctatus*, an economically important fresh water fish.

Materials and Methods

Specimens of *C. punctatus* of total length 18–20 cm were captured from the fresh water ponds at Aligarh (Lat. 27° 34′30″N, Long. 78° 4′ 26″ E) and maintained live in the laboratory aquaria (25 ± 2°C). The dissolved oxygen of the water varied from 4–8 p. p. m. The fishes were allowed to rest for 24 hours before sampling, after which they were removed from the aquaria, killed by decapitation and the tissues taken out from the apex of the anterior (trunk) and posterior (tail) regions separately. Water and ash contents were determined by the methods of A. O. A. C. (1960), protein by Wong's (1923) modification of the microkjeldahl method and fat by Soxhlet extraction method, using petroleum ether (B. P. 40–60°C). Procedure used for the estimation of total carbohydrate content was the same as suggested by Jafri *et al.* (1964). Energy value (in terms of calories) was assessed by the method followed by Jafri (1965). Glycogen was extracted by the method of Ashman and Seed (1973) and its concentration determined according to the technique of Montgomery (1957). Method of Reinhold and Shiels as given by Hawk *et al.* (1954) was followed for the estimation of cholesterol. Procedures used for the quantitative determinations of RNA and DNA were the same as described in earlier communications (Jafri & Mustafa, 1976 and Mustafa & Jafri, 1976 a). The colour intensity was read on a Bausch and Lomb Spectronic-20 Spectrophotometer.

Results and Discussion

The concentrations of the various chemical constituents and the energy value of the anterior (trunk) and posterior (tail) regions of *C. punctatus* have been presented in Table 1. It would be evident from the data that the various constituents investigated were not distributed homogeneously in the body musculature. With the exception of water, the occurrence of which was in inverse relation to that of fat, all the other constituents were more concentrated in the muscle at the tail end. The differences, though less marked for some constituents, were quite noticeable for the others. With the higher levels of energy substances, namely protein, fat and carbohydrate, the tail region had obviously more calorific value.

The coincidence in the pattern of variation in the levels of both protein and RNA revealed the importance of this nucleic acid in protein synthesis. Increases in RNA and protein concentrations towards the tail end of the musculature have been reported by Edstrom (1964) and Brandes & Dietrich (*locc it.*) respectively. The positive quantitative correlations between the two organic constituents in different anatomical structures have been reviewed by Brachet (1955).

A progressive decline in the thickness of myotomes towards the tail end of the musculature as observed in *C. punctatus* (Mustafa, 1976) resulted in a close set up of the DNA rich connective tissue septa (myocommata) and this apparently increased the DNA concentration of the tail muscle as observed by Love (1958). In addition to this, the slower growth rates of the posteriorly located myotomes (Mustafa & Jafri, 1976 b) and hence of the muscle cells contained in them, as compared to the anterior ones, caused a larger number of cells to be sampled in a unit weight of the muscle tissue from the tail region. This might also account for higher DNA concentration of this muscle, since it is directly related to the number of cells present in it (Hotchkiss, 1955; Leslie, 1955; Bulow, 1970 and Mustafa & Jafri, 1976 a).

Higher concentration of fat observed in the tail region of the fillet appeared to correspond to the concentration of myocommata in these regions. That the myocommata contain greater fat content in comparison to the myotomes has been authenticated by Love (1970). The decline in the water content towards the tail end of the musculature was the result of its reciprocal correlation with the fat.

Greater ash values of the tail muscle were perhaps due to its larger contents of some of the major inorganic substances, including sodium and potassium as reported by Thurston & MacMaster (1960) and Thurston (1962). Kruchakova (1952) correlated this increase in the minerals with increase in the metabolic activity of the tail muscle. Some other biochemical and physiological investigations, however, did not indicate that muscles at the tail end possess higher metabolic activity. Studies on the distribution of energy-rich phosphate compounds in different sections of fish musculature revealed no preferential accumulation of these substances in any one part (Nagayama, 1961). The observations of Amano *et al.* (1953) showing lowest pH as a consequence of con-

Table 1. *Concentrations of some chemical constituents and energy value of the meat in the trunk and tail regions of C. punctatus* (WWB)

Regions of musculature	Protein %	Fat %	Water %	Ash %	Total carbohydrate %	Glycogen mg/100g	Cholesterol mg/100g	RNA µg/100 mg	DNA µg/100 mg	Energy value Calories/100 g
Trunk	18.489	1.040	76.933	1.200	2.337	160.366	114.000	100.672	12.213	95.060
	±	±	±	±	±	±	±	±	±	±
	(0.406)	(0.101)	(0.314)	(0.152)	(0.898)	(6.585)	(19.425)	(2.476)	(0.464)	(2.646)
Tail	19.739	1.706	73.433	1.533	3.587	233.325	156.823	23.469	23.469	111.510
	±	±	±	±	±	±	±	±	±	±
	(0.137)	(0.146)	(0.523)	(0.176)	(0.535)	(9.362)	(12.005)	(3.855)	(1.113)	(2.231)

Each value is a mean of 12 estimations.
Number in parenthesis refer to the standard error of the mean

siderable accumulation of lactic acid through the breakdown of glycogen, in the middle and not the tail section provided no indication of any greater physiological role of the muscle at the tail region. This was supported by the subsequent investigations carried out by Black *et al.* (1962), documenting a decline in the lactic acid to glycogen ratio towards the tail end following muscular activity.

It can be concluded that the observed increase in the concentrations of total carbohydrates, glycogen, cholesterol, DNA and the other constituents with the exception of water, towards the tail region of the musculature was due mainly to an increase in the number of cells per unit weight, as also in the proportion of connective tissue. This is in agreement with the conclusion drawn by Love (1970) with respect to some biochemical constituents. The increase in energy substances at the tail region obviously made it more calorific.

This study also brings out the need to select some particular myotomes for chemical analysis, preferably by dissecting them free from the myocommata, to eliminate the sources of error related to the anatomical specificity in the levels of the chemical constituents.

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