SHORT COMMUNICATION

ACETYLCHOLINE CONTENT OF THE BRAIN AND VISCERAL ORGANS OF THE TELEOSTEAN FISH; *HETEROPNEUSTES FOSSILIS AND CLARIAS BATRACHUS*

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Summary: The acetylcholine content of various organs of two teleostean fish, *Heteropneustes fossilis* and *Clarias batrachus* has been estimated biologically on the eserinized frog rectus muscle. The acetylcholine content in the stomach of both the fish was 0.341 and 0.22 $\mu g/g$, respectively. Values were lower than those of other parts of the alimentary tract. The ilia contained the most acetylcholine, being 0.644 and 0.551 $\mu g/g$ respectively, for the two fish. In the brain, heart, kidney and liver of both the fish, a considerable amount of acetylcholine was detected. Acetylcholine was not found in the spleen of *Clarias batrachus*, but it was present in the spleen of *Heteropneustes fossilis*.

Key words: Fish acetylcholine brain visceral organs

INTRODUCTION

There are various reports on the acetylcholine content and cholinesterase activity in different organs of mammalian species (1,7,8, 10). However, availability of similar data in fish is limited to those which possess electric organs (3,9,11) having cholinergic innervation.

Acetylcholine plays an important role in adrenergic transmission in mammals (5) and a teleost (*Gadus morhua*). Nilsson & Fange (12) found that the action of electricals stimulation of vagus nerve to the stomach and of applied adrenergic drugs is also mediated through cholinergic nerves. The present investigation aims to provide a quantitative evidence to the presence of cholinergic innervation in organs of fish.

MATERIALS AND METHODS

Living specimens of both sexes of *Heteropneustes fossilis* and *Clarias batrachus* ranging in weight from 50 to 125 *g* were procured from the local fish market. They were kept in an aquarium from 24 - 48 hours without food prior to study. The fish were decapitated and tissues were removed immediately. Extraction and identification of acetylocholine was done using the method described by Klinge (10). Acetylcholine (ACh) estimations were made using a method described by Bose and Gupta (4) in which the effect of tissue extract on the responce of eserinised rectus abdominus muscle of frogs was used for bioassay. The investigations were carried out during the months of April to June , 1973.

RESULTS

Table I shows the ACh content of the brain, heart and other visceral organs of the two fish. The ACh content of the stomach in both the fish was lowest compared to that of the other

portions of the alimentary tract, and was maximal in the duodenum and ileum. The liver of the *H. fossilis* contained very small amount of ACh as compared to *C. batrachus*, while in the *C. batrachus*, the lowest amount of ACh was found in the kidney. No ACh could be detected in the spleen of *C. batrachus* while it was present in the spleen of *H. fossilis*.

TABLE I: Acetylcholine content in various organs of the teleostean fishes *Heteropneustes fossilis* and *Clarias batrachus* in μg/g of wet tissue ±S.E. Number in parenthesis refer to the number of test animals.

Organ	*H. fossilis*		*C. batrachus*	
Oesophagus	0.549 ± 0.074	(4)	0.328 ± 0.053	(3)
Stomach	0.341 ± 0.049	(10)	0.220 ± 0.019	(10)
Duodenum	0.850 ± 0.138	(10)	0.425 ± 0.074	(10)
Ileum	0.644 ± 0.084	(10)	0.551 ± 0.058	(10)
Rectum	0.422 ± 0.085	(5)	0.477 ± 0.093	(7)
Brain	0.297 ± 0.040	(5)	0.348 ± 0.028	(5)
Heart	0.595 ± 0.040	(5)	0.474 ± 0.062	(5)
Kidney	0.291 ± 0.055	(3)	0.081 ± 0.001	(3)
Liver	0.06 ± 0.017	(4)	0.183 ± 0.035	(4)
Spleen	0.327 ± 0.054	(3)	Nil	(3)

DISCUSSION

Nilsson & Fange (12) observed that all the excitatory responses elicited by adrenergic or cholinergic drugs or by the electrical stimulation of vagus nerve of the stomach of the cod (*Gadus*) were abolished by atropine and they concluded that the effects probably were mediated through cholinergic neurons. Campbell (6) suggested that the sympathetic supply to all regions of the gut in selachians and teleosts contain a mixture of excitatory and inhibitory nerve fibres and that the excitatory nerve fibres are cholinergic in nature. This clearly shows that acetylcholine has an important role in the autonomic transmission in fishes. Present results show that a considerable amount of ACh is present in gastrointestinal tract and in other organs which may act as a local hormone or may be released through autonomic innervation of the organ. Thus Ach concentration in the gastrointestinal tract in the two fishes has been found to be similar to the values we have observed in our control experiments on rats i.e., 0.323±0.06, 0.412±0.06 and 0.545±0.06 μg/g of ACh in stomach, duodenum and in the ileum respectively. These values significantly differ from the values reported for the intestinal portions of other mammalian species (7,8,10).

The quantity of ACh in the heart and brain of the two fishes is however, many times less than that is mammals (4), though, it is greater than that in the cyclostomes. It should be noted

that the teleostean fish heart has a rich vagal innervation in contrast to the myxinid heart which is supposed to be non-innervated. There is no available physiological or histochemical data on the innervation of the liver and kidney in fishes. However, the present investigation suggests that the visceral organs except the spleen of *C. batrachus* may be cholinergically innervated.

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