EFFECT OF THYROXIN ON ACID PHOSPHATASE, CATALASE AND OXYGEN UPTAKE IN LIVER TISSUE OF A TELEOST, ANABAS TESTUDINEUS (CUV.)

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Activities of acid phosphatase (orthophosphoric monoester phosphohydrolase, E. C. 3.1. 3.1), catalase (hydrogen peroxide: hydrogen peroxide oxidoreductase, E. C. 1.11. 1.6) and oxygen uptake of hepatic tissue of Anabas testudineus in response to exogenous thyroxin hormone were studied. Fish exposed to exogenous thyroxine (Eltroxin) in water reduced the acid phosphatase activity, and enhanced the catalase activity and oxygen uptake ability significantly.

INTRODUCTION

The role of acid phosphatase (orthophosphoric monoester phosphohydrolase, E. C. 3.1. 3.1) and catalase (hydrogen peroxide: hydrogen peroxide oxidoreductase, E. C. 1.11. 1.6) have been extensively studied in higher animals. Although some of the activities of these enzymes, their localisation and distribution in different tissues of a few teleostean species have been reported from time to time (Suzuki et al., 1967; Dutt et al., 1975; Shaffi and Jafri, 1975; Thomas and Murthy, 1976 a, b, 1978; Mester and Scripacariu, 1979; Establier et al., 1984; Mester et al., 1985; Babo and Vesseur, 1992; Mohanty et al., 1995), experimental allocations are meagre. The present study, therefore, has been undertaken to elucidate the influence of the thyroid hormone (Eltroxin) on the activities of acid phosphatase and catalase, and oxygen uptake of the hepatic tissue in a teleost, Anabas testudineus (Cuv.).

MATERIAL AND METHODS

The 30 specimens used in this study were obtained from the local fishermen at Bhubaneswar, Orissa. The fish were acclimatised to the laboratory conditions for about two weeks.
A group of 15 fish was kept in water with 0.04 mg/l Eltroxin (thyroxin sodium; Allenburrys India Ltd, Bombay). Specimens were fed with freshwater shrimps from local market. Water was changed and fresh dose of Eltroxin was added daily. Another group of 15 fish was maintained as control. Both experimental and control fish were sacrificed after 7 months and the hepatic tissue was processed for the following studies:

**Acid phosphatase assay**

Acid phosphatase activity was estimated spectrophotometrically using buffered acid phosphatase substrate after Bodansky (1932, 1933). One enzyme unit was defined as the amount of enzyme responsible for the liberation of one microgramme inorganic phosphate from 100 mg fresh tissue.

**Catalase estimation**

Catalase activity was estimated using a Warburg's respirometer (Suzuki et al., 1967). Oxygen evolved from a reaction mixture containing 1 ml of phosphate buffer, 1 ml of substrate (0.3% H₂O₂) and 0.5 ml of homogenised mixture containing 0.5 mg hepatic tissue was measured as the homogenised tissue provides the enzyme. Oxygen was measured manometrically and catalase estimated as microlitres of oxygen evolved per milligramme tissue in one minute.

**Oxygen uptake**

The rate of oxygen uptake of the hepatic tissue was studied manometrically (Umbriet et al., 1964). The specimens were decapitated. Liver was removed into a physiological saline (Wolf, 1963) and weighed. The tissue was cut into thin uniform slices and transferred to Warburg's vessel containing 2 ml of physiological saline with 10% KOH in the central well. For each experimental vessel, a control was also prepared without tissue slices. The vessels were shaken at 110 to 115 oscillations per minute for 10 minutes in order to achieve temperature equilibration. Oxygen consumed in the vessels was ascertained from the graduated capillary tube at 10-minute intervals. The rate of oxygen uptake is expressed as microlitres consumed per milligramme dry tissue in an hour. The dry weight of the tissue was noted after drying the tissue in an oven at 100-105°C overnight. The values obtained for acid phophatase, catalase and oxygen uptake in both experimental and control tissues were tested for their significance by Student's 't' test (Snedecor and Cochran, 1961).
RESULTS AND DISCUSSION

Activities of acid phosphatase in different tissues have been studied in teleostean species and liver was found to be rich in the enzyme (Thomas and Murthy, 1976a). Mohanty et al. (1995) studied the effect of thyroid hormone on the acid phosphatase activities in ovarian tissue of *A. testudineus*. They have reported increased activity of the enzyme in fish exposed to Eltroxin for 7 months. In the present study, liver tissue showed a reduced activity of the enzyme (Table 1).

Table 1. Effect of thyroxin on acid phosphatase, catalase and oxygen uptake in *A. testudineus*

<table>
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<tr>
<th>Activity</th>
<th>Control (± SE)</th>
<th>Experiment (± SE)</th>
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<tr>
<td>Acid phosphatase [µg P/(100 mg·h)]</td>
<td>785.000 ± 135.000**</td>
<td>635.000 ± 90.000**</td>
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<tr>
<td>Catalase [µl O₂/(mg·min)]</td>
<td>161.670 ± 4.120*</td>
<td>169.550 ± 3.200*</td>
</tr>
<tr>
<td>Oxygen uptake [µl O₂/(mg·h)]</td>
<td>2.001 ± 0.066*</td>
<td>2.877 ± 0.900*</td>
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**p < 0.05; *p < 0.01

Similar tissue specificity exhibited by the enzyme to various other drugs has been attributed to the probable presence of different isoenzymes (Thomas and Murthy, 1976b). Catalase is found in peroxisomes which help in the decomposition of H₂O₂ produced in the cell as a result of the action of certain oxidases (de Duve and Baudhuin, 1966). Increased activity of catalase in liver in the present study may be due to the enhanced action of certain oxidases which produce H₂O₂. Liver is also known to be involved in the detoxification of several chemicals. Significant increase in liver catalase in response to toxic chemicals in *Heteropneustes fossilis* has been reported by Thomas and Murthy (1978). Leffert and Alexander (1976) have studied the role of hepatic cells in the regulation of thyroid hormone metabolism. Tata et al. (1963) in their review discussed that thyroid hormone administration increases basal metabolic rate and cellular respiration in liver tissue. The same has been confirmed by the reverse physiological action in several thyroidectomised and thiouracil-treated animals. Similar observations were also made by Packard et al. (1974), and Kasprzak and Obuchowicz (1980) in frogs, *Rana pipiens* and *R. esculenta*, respectively. Thyroid hormone administration augmented the mitochondrial enzyme activity in the hepatic cells of *A. testudineus* (Peter and Oommen, 1988). The increased oxygen uptake in the present study certainly supports the above observations.
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REFERENCES


