DISTRIBUTION OF PHOSPHORYLASE IN SOME FISH AND SHELL FISH

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Phosphorylase content in the muscle of some fish and shell fish were estimated. Jew fish (*Johnius dussumeri*) and 'sea naran' (*Penaeus indicus*) recorded the highest enzyme content among the fish and shell fish studied. As phosphorylase is the key enzyme in glycogenolysis, which is the energy source of fish for muscular activity, the possible role of phosphorylase content as an index of muscular capacity and post-mortem autolysis is discussed.

INTRODUCTION

The information on fish muscle enzymes and their distribution in different species of fish is scanty. Among the muscle enzymes, those involved in the carbohydrate metabolism are very importtant when the life of fish, its post-mortem flavour development and, later on, spoilage are considered. Phosphorylase, the first enzyme involved in glycogenolysis, has been studied in detail in some animals (Cori, 1955 and Maddiah and Madsen, 1966) and insects (Applebaum and Schlesinger, 1973). The same has been studied in crude extracts of cod (*Gadus callarias*) (Burt, 1966). Mukundan and Nair (1977) have purified and characterised phosphorylase from tilapia (*Tilapia mosambica*) muscle. However there is practically no information on phosphorylase content in different species of fish. The following is the summary of a study on the distribution of phosphorylase in a few species of fish and shell fish.

MATERIALS AND METHODS

Live adult fish were used for the study. Jew fish *(Johnius dussumeri)*, lactarius *(Lactarius lactarius)*, threadfin bream *(Nemipterus japonicus)* and three species of prawns *viz.*, 'sea naran' *(Penaeus indicus)*, 'karikkadi' *(Parapenaeopsis stylifera)* and 'poovalan' *(Metapenaeus dobsoni)* were collected from the waters off Cochin. Tilapia (*Tilapia mosambica*) was collected from Malampuzha reservoir and crab (*Scylla serrata*) from backwaters near Cochin. The fish and shell fish were killed and the muscle excised immediately. Only the claw muscle was used in the

TABLE I
PHOSPHORYLASE CONTENT IN FISH AND SHELL FISH

Name of fish	Activity in micromoles of p_i/min./g. wet wt. at 27°C
Jew fish *(Johnius dussumeri)*	75.2
Lactarius *(Lactarius lactarius)*	71.15
Threadfin bream *(Nemipterus japonicus)*	60.05
Tilapia *(Tilapia mosambica)*	26.4
'Sea naran' *(Penaeus indicus)*	13.95
'Karikkadi' *(Parapenaeopsis stylifera)*	6.97
Crab *(Scylla serrata)*	5.2
'Poovalan' *(Metapaneous dobsoni)*	4.1

case of crab. The muscle was ground to a fine paste at 0°C. Ten g. of the ground muscle was extracted with 100 ml. phosphorylase extraction buffer at 0°C as described by Crabtree and Newsholme (1972). The extract was centrifuged at 8000 rpm. in a high speed refrigerated centrifuge (International Equipment Company) at 0°C for 10 minutes. The centrifugate was used for the study. The enzyme was assayed by the method of Cori (1955).

RESULTS AND DISCUSSION

The results of the enzyme analysis for each fish and shell fish are shown in Table I. The values are the average of three determinations using fish of almost identical size.

From the Table, it is evident that among the fish analysed phosphorylase content is more in jew fish followed by lactarius, threadfin bream and tilapia. Among crustacea 'sea naran' shows a high concentration of the enzyme, more than double that of other shell fishes *viz.*, 'karikkadi', 'poovalan' and crab.

Fish and other animals use glycogen as a fuel for muscular activity (Edith Gould, 1965 and Opie and Newsholme, 1967). Since muscle phosphorylase catalyses the first step in glycogenolysis, through which fish derives energy for muscular activity, the amount of the enzyme present in the muscle can be considered as an index of muscular ability. Generally fish are comparatively fast swimmers and are capable of continuous efforts for fairly long periods. So their carbohydrate metabolic demand and hence the content of the enzymes of the respective metabolism must be more than that in crustacea which show generally slow and discontinuous movements. The data in the Table for animals of both these groups support this view. From the results obtained it may be presumed that jew fish

is a fast swimmer among the fish and shell fish analysed. Similarly in the crustacea listed, 'sea naran' is the fastest swimmer.

Another important point to be considered is the effect of the phosphorylase content on the extent of the pre - and post-mortem glycolysis and the consequent autolytic spoilage. Fish which contain more of the enzyme is subject to undergo rapid glycolysis resulting in high rate of hydrolytic spoilage. Thus jew fish will be more susceptible to autolytic spoilage, provided other factors contributing to spoilage are equal for the fishes tested. Similarly among crustacea studied, 'sea naran' will undergo autolytic spoilage at a higher rate than 'poovalan' or 'karikkadi' or crab.

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