DISTRIBUTION OF PANTOTHENIC ACID IN FISH

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The distribution of pantothenic acid in free and bound forms in various fish species is reported. It is observed that the fish muscle contains on an average about 12.0μ g. pantothenic acid per g. About 60% of the panthothenic acid is present in the bound form as coenzyme A in the fish skeletal muscle.

INTRODUCTION

Pantothenic acid is an important water soluble vitamin of the B-complex group. It is a growth factor for most animal species and microorganisms (Chow, 1964). Deficiency of pantothenic acid is generally not observed in humans. However, in other animals its deficiency causes the arrest of growth, dermetitis, greying and alopecia and lesions of the spinal cord.

Pantothenic acid is present in the tissues as coenzyme A (Lipmann *et al.*, 1947). It is not broken down to release pantothenic acid by any means except autolysis, treatment with alkaline phosphatase or an avian liver extract. Treatment of tissues with both the enzymes is necessary to determine the total amount of pantothenic acid since it has been shown that 20 to 30% of pantothenic acid is released by dephosphorylation and 70% by the action of liver enzyme (Novelli, Kaplan and Lipmann, 1949).

Ives *et al.* (1945) found that pantothenic acid ranges from 2.6 to 3.9μg. per gram of the muscle. Neilands, Strong and Elvehjem(1947) reported between 2.5 and 8.0 μg. pantothenic acid in fish. Braekkan and Probst (1953) showed that herring contains 9.5μg. and mackerel, 10.3μg. pantothenic acid. Hoogland (1953) determined pantothenic acid in cod and haddock. Briggs and Deft (1954) found 7.5 μg. pantothenic acid in carp. Braekkan, Hanson and Skoglund (1955) analysed meat from different parts of tuna and found on an average 6.6 μg. of pantothenic acid. Stansby (1962) indicates that fish contains on an average 5.0μg. pantothenic acid.

Braekkan (1959) made a comparative study of vitamins in meat of 15 species. Tarrland *et al.* (1958) have compiled data for pantothenic acid in Norwegian fishes. Loughlin and Terri (1960) analysed pantothenic acid content of salt water fishes commonly consumed in England. Pantothe-

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nic acid content of Japanese fishes have been reported by Higashi *et al.* (1959). However, no information is available regarding the occurrence of pantothenic acid in Indian fishes.

The present communication reports the distribution of various forms of pantothenic acid such as free pantothenic acid and pantothenic acid present in the bound form as coenzyme A in the skeletal muscle of several fish species.

Materials And Methods

Fresh specimens of fish (Table I) were collected from Sassoon dock and Versova landing sites in Bombay. Anterior dorsolateral white muscle of fish was taken for assay of pantothenic acid.

Alkaline phosphatase was obtained from Miles laboratories, England. Pigeon liver enzyme was prepard and purified using Dowex-1 resin as described by Chhatbar (1975).

Pantothenic acid was extracted from the tissue by incubating the tissue homogenate with alkaline phosphatase and pigeon liver enzyme at pH 8.8. After incubation at 37°C overnight, the pH of the homogenate was adjusted to 6.8 and boiled to inactivate the enzymes. The homogenate was diluted appropriately for the assay (Chhatbar, 1975). Pantothenic acid was assayed microbiologically using *Lactobacillus arabinosus* ATCC 8014 as the test organism, method employed being essentially as described in the handbook of A.O.V.C. (1966).

Total pantothenic acid was determined after treatment of the muscle with enzymes Non enzymic extraction of the tissue was followed to find out amount of free pantothenic acid present in the tissue. The difference between the total and free pantothenic acid corresponds to the amount present in the bound form. The amount of pantothenic acid in bound form was divided by 0.6 to convert it into units of coenzyme A since 1 Kaplan-Lipmann unit of coenzyme A is equal to 0.6 μg. of pantothenic acid.

Results And Discussion

Table I presents the distribution of pantothenic acid in the skeletal muscle of the fish species studied. The pantothenic acid content is expressed in microgram per gram fresh weight of the tissue.

The results indicate that the fish muscle contains on an average about 12.0 μg. pantothenic acid. The range is between 4.0 and 22.0 μg. Marine fishes such as sardine, jew fish, horse mackerel, ray and the freshwater fishes studied have significant amounts of pantothenic acid.

On an average about 5.0 g. of pantothenic acid occurs in the fish muscle. The range for free pantothenic acid may be placed between 1.0 and 10.0 μg. It can be seen that on an average about 60% of the pantothenic acid is present in the bound form as coenzyme A. The fish muscle contains on an average about 12 units of conezyme A.

The direct comparison of the present finding with those reported by earlier workers is difficult since the extraction methods followed in each case varies. Higashi *et al.* (1959) extracted the tissue with mylase P enzyme treatment. However, the values reported by them are low compared to those reported

TABLE I

PANTOTHENIC ACID CONTENT OF DIFFERENT FISHES

	Species and common name	Total μg./g.	Free μg./g.	Bound % of total	Coenzyme A Units
1.	*Sardinella fimbriata*. Sardine	12.55	3.70	67.20	13.74
2.	*Caranx kalla*. Golden scad	10.30	7.74	42.20	9.81
3.	*Parastromateus niger*. Black pomfort	5.86	1.33	76.40	7.48
4.	*Harpondon nehereus*. Bombay duck	4.33	2.12	54.20	4.27
5.	*Ilisha motius*. Indian herring	7.76	1.50	78.00	10.40
6.	*Otolithes argenteus*. Doma	19.68	3.70	84.30	27.60
7.	*Megalaspis cordyla*. Horse mackerel	12.85	5.19	57.60	9.64
8.	*Sillago sihama*. Lady fish	13.40	3.40	71.00	16.15
9.	*Arius sp*. Catfish	22.27	7.76	83.60	24.10
10.	*Coilia dussumieri* Golden anchovy	11.84	4.28	63.60	12.56
11.	*Rastrelliger kanagurta*. Mackerel	8.84	3.57	73.00	10.72
12.	*Stroghlura strongylura*. Gar fish	9.96	4.58	49.60	9.83
13.	*Thrissocles mystax*. Anchovy	12.80	2.99	73.00	16.42
14.	*Otolithoides breuneri*. Dori	7.90	1.23	77.50	11.10
15.	*Therapon jarbua*. Perch	11.90	4.34	56.50	11.20
16.	*Liza parsia*. Mullet	10.72	9.67	10.60	1.74
17.	*Aetomysus milus*. Ray	14.75	8.64	45.50	10.95
18.	*Eleutheronema tetradectylus*. Salmon	8.64	4.39	49.00	7.00
19.	*Penulirus sp*. Lobster	16.00	7.73	51.00	13.78
20.	*Metapenaeus sp*. Prawn	3.91	2.30	39.30	2.66
21.	*Cyprinus carpio*. Common carp	15.67	7.96	45 00	12.60
22.	*Labeo rohita*. Rohu	11.41	11.17	2.65	00.40
23.	*Cirrhina rebe*. Reba	13.06	8.73	27.00	7.10
24.	*Chela bacila*. Chela	12.58	6.18	49.00	10.30

here. Braekkan and Probst (1953) found that extraction with papain and taka-diastase gave equally high value as alkaline phosphatase plus chicken liver extract. Neilands and Strong (1948) showed conclusively that extraction with alkaline phosphatase and chicken liver enzyme is necessary to achieve maximum liberation of pantothenic acid. The values reported by them for canned sardines, tuna, salmon and mackerel are in accordance with the present findings. The data indicate that as much as 75% of pantothenic acid present in fish muscle is in the bound form.

It is interesting to note that fishes like sardine, mackerel, horse mackerel and other species which live near the surface or are more active in their movements have greater concentrations of pantothenic acid whereas fishes such as pomfret and Bombay duck which are comparatively less active have lesser amount of pantothenic acid. Higashi *et al.* (1959) observed that fishes such as ayu, sardine, saury and mullet which are more vigorous in the behaviour than others hold greater quantities of pantothenic acid. Braekkan (1959) also found that pelagic and active fishes such as tunny, mackerel and herring have greater amounts of pantothenic acid than slow-moving bottom fishes.

As per the data of McCance and Widdowson (1960) bacon, beaf, ham, mutton, pork and veal contain on an average about 5.0 μg. pantothenic acid. Compared to this value, it can be seen that fish has significantly higher content of pantothenic acid.

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