

Protein Concentrate from Shark

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A simple method of leaching the minced muscle with water repeatedly followed by cooking, pressing, drying the cake and powdering has been described for the preparation of fish protein concentrate (FPC) from shark without the use of solvents. The FPC thus prepared had a high protein content and was completely free of urea. It contained all the essential amino acids in a balanced proportion with a high lysine content and had a storage life upto 12 months. This product can be used for the fortification of bread, biscuits and 'chappathis' respectively at 10, 5 and 2% levels.

A large proportion of the population in the developing countries suffers from malnutrition including protein deficiency as they subsist on starchy foods of poor quality and low protein content. One way to combat the problem of protein gap is to tap the fishery resources of the seas around us, which according to experts are very much under-exploited at present. Fish proteins are highly nutritive and fairly well balanced with respect to the essential amino acids and rich in lysine unlike most cereals and other staple food items. Supplementation of starchy foods with fish and fishery products even at low levels, greatly improves their overall growth promoting property. Being a highly perishable commodity, fish has to be processed and utilised as a source of animal protein, if not consumed immediately in the fresh state.

Drying, salting and drying, ensiling or preparation of hydrolysates, sauces and pastes are some of the methods of processing fish for long term preservation. Another method of using fish for supplementing the cereal diet would be to convert them, especially the low priced varieties, into fish flour or fish protein concentrate (FPC). This can be conveniently used, stored for long periods and has a high protein content of good biological value. This paper deals with the preparation of FPC from shark, its nutritive value and storage characteristics.

Materials and Methods

Shark (*Carcharias sp.*) was used for the study in view of its fair availability,

characteristic white meat and low fat content. The protein content in the edible portion of the wet fish is high (21.59%) and the fat is 0.42% on a moisture basis of 75.95% (Chari, 1948). Flesh was separated from the fish, urea removed and used for the preparation of FPC. The urea-free material was cooked in water for 15 min, pressed, dried in air oven at 60-65°C, pulverised, kept sealed in polythene bags at ambient temperature and storage life studied over a period of one year.

Moisture, crude protein, fat and ash were determined according to AOAC (1960). Urea was estimated using the water extract of the fish or the FPC with urease solution in phosphate buffer of pH 6.2 by the Conway microdiffusion method (Conway, 1947) and the total volatile base nitrogen (TVBN) by the microdiffusion method using water extract. The amino acid analysis of FPC was done by microbiological assay (Shockman, 1963).

Results and Discussion

The flesh of sharks possesses a peculiar odour and flavour which is largely attributed to various non-protein nitrogenous constituents occurring to the extent of about 30% of the total nitrogen (Velankar & Govindan, 1958). Urea is a major constituent of the non-protein fraction and its elimination from the flesh is desirable before proceeding to prepare FPC. Earlier methods of removal of urea from shark, namely, salting out (Kandoran *et al.*, 1965) and acetic acid treatment (Revankar *et al.*, 1965) were not

Table 1. *Removal of urea from shark muscle*

	Urea per cent Initial	Urea per cent After treatment	Urea reduction %
Fillets kept in water for 30 min at room temperature with intermittent stirring	1.62	0.875	45.98
Fillets kept in water for 30 min at 10°C with intermittent stirring	1.62	0.950	42.10
Fillets in 5% solution of jackbean powder	1.62	0.471	71.20
Fillets in 5% solution of horse gram powder	1.77	0.494	72.22
Fillets boiled in water twice for 10 min	1.22	0.064	94.75
a) Minced flesh kept in water for 15 min at room temperature with intermittent stirring	1.07	0.192	82.17
b) Minced flesh kept in water for 15 min at room temperature with intermittent. The above repeated for the second time	1.07	0.064	94.02
c) Minced flesh kept in water for 15 min at room temperature with intermittent stirring. The above repeated for the third time	1.07	Nil	100.00

tried in view of the introduction of NaCl to the product by the former process and slight acid taste in the case of the latter. Enzymatic removal of urea from the flesh was tried using horse gram and jack bean flour preparations. Since urea is water soluble, leaching of the muscle with water in the fillet form and in the minced form was tried. The results are presented in Table 1. In the case of fillets, the removal of the urea by simple soaking in water at room temperature or at reduced temperature was only upto 46%. But boiling the fillet twice had a pronounced effect and urea could be brought down to 94.75%. Enzymatic removal of urea from shark fillet was only upto 72%. It can be seen from Table 1 that 94.02% of the urea was removed by keeping and stirring the minced muscle of the shark in water twice and complete removal was achieved by repeating the treatment for a third time.

The methods of preparation of FPC using solvent extraction do not remove the lipids and odoriferous compounds completely and their last traces are very difficult to be removed at the end of the process. They also form toxic compounds or destroy some amino acids in the material (Moorjani & Lahiry, 1962; Morrison & Munro, 1965). In our studies, urea free minced shark flesh was utilized for the preparation of FPC and no solvent was used for the removal of lipids.

The yield of FPC prepared using urea-free minced muscle was 16% on the basis of the shark flesh and the chemical composition of FPC is given in Table 2. The FPC was almost white in appearance with high protein content. Fat content has not been reduced to any appreciable extent probably because no solvent extraction has been attempted to. But when compared

Table 2. *Chemical composition of FPC*

Moisture %	5.54
Crude protein %	87.60
Fat %	1.03
Ash %	2.09
Urea %	Nil

Table 3. *Essential amino acid composition of FPC*

Amino acids	% of N x 6.25
Isoleucine	6.10
Leucine	9.11
Lysine	7.37
Methionine	3.01
Cystine	0.70
Phenylalanine	4.82
Tyrosine	2.90
Threonine	4.11
Valine	6.11
Tryptophan	0.91

Table 4. *Storage characteristics of FPC*

Period of storage months	Moisture %	TVBN mg/100g	Organo-leptic score
0	5.5	2.7	15
1	5.2	4.5	15
2	5.7	4.9	15
3	5.5	8.2	15
6	5.8	7.7	14
9	5.6	7.9	14
12	5.9	11.2	13

Score: colour 5, odour 5, flavour 5, total 15

to FAO specification of 0.75% for "Type A" FPC (Protein Advisory Group 1971) about 1% fat in the shark FPC may not be objectionable especially when it is to be used for fortification of other foods. The essential amino acid composition of the FPC is given in Table 3.

The FPC kept well for a period of one year (Table 4). There was no deterioration in the odour and flavour but for slight yellow discolouration appearing in the product. Air tight storage coupled with low moisture and fat contents have contributed to the preservation of the product over a long period.

FPC is generally used for protein supplementation of foods and is not consumed as such. It was used in the preparation of biscuits, bread and 'chappathis' at 2, 5, 7.5 and 10% levels in the flour mix and the products evaluated by a taste panel. Biscuits with FPC upto 5% did not reveal any change with respect to appearance or taste. Bread with 10% FPC showed no changes in loaf size and colour, but a faint fishy odour was perceptible. In the case of 'chappathis' fortified with 2% and more FPC, the product had a darker appearance with pronounced flavour. Incorporation of FPC did not affect the normal storage of 'chappathis' at room temperature.

The authors are grateful to Shri M. R. Nair, Project Co-ordinator, Central Institute of Fisheries Technology, Cochin for the microbiological assay of essential amino acids.

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