Utilization of Fish Bone as Calcium Supplement

K.A. MARTIN XAVIER, UMESH A. PRABHU,
K.G. R.AMACHANDRAN NAIR and P.T. MATHEW
Central Institute of Fisheries Technology
P.O. Matsyapuri, Cochin - 682 029, India

Fish bone is a good source of high quality calcium and phosphorous, which is being wasted nowadays. Tuna canning industry generates substantial quantity of fish bone as waste. Fish bone collected from canning plant was deproteinized using papain and fat content was removed either by KOH treatment or extraction using petroleum ether. It was dried and pulverised. The powder thus obtained had calcium content of 43.2% and 38.2% respectively. The solubility of the calcium from these powders in HCl was very high.

Key words: Fish bone, calcium supplement

Fish processing industries turn out large quantities of fishery waste, accounting for more than fifty thousand tonnes annually in India. The best quality table fish has, even at the highest level, only fifty percent edible flesh (Balachandran, 2001). The remaining part consisting of bones, head and viscera are inedible and a meagre of this is used for fish meal to use in animal feeds and the rest is converted to organic manure or thrown out in to water body, which causes serious pollution problems. Judicious and economic utilisation of fish should have a programme of proper disposition of such fishery waste by processing them into different products intended for human consumption, animal nutrition or industrially useful products (Balachandran, 2001). Usually the fish contains 5-8% bone. Fish bone is rich in calcium as "dicalcium phosphate", which has the ideal calcium phosphorus ratio 2:1 (Chatterjee and Shinde, 1995). Fish calcium is natural, microcrystalline and easily absorbable. The mineral content of fish usually has 70-80% calcium and phosphorus, two essential minerals required for human body.

In this paper, a method to recover calcium and phosphorous from the tuna bone is reported.

Materials and Methods

Backbone from Tuna is collected from the canning plant of Integrated Fishery Project, Cochin. Moisture, ash and calcium content of the sample

were determined following AOAC (1984) methods. Total Nitrogen content of the bone was determined by Micro Kjeldahls method. Inorganic phosphorus was determined by the method of Fiske and Subba Row (1925). Fat content was determined by solvent-extraction method. The backbones were separated and washed.The washed bones were deproteinised with commercial papain in the ratio 1:100 (papain to bone) at 55°C for two hours. The enzyme was then inactivated by boiling the contents for 10 min.

De-proteinised bones were washed thoroughly and sun dried. It was separated into two parts. One part was defatted using petroleum ether for 24 hours and then sun dried. The other part was boiled in 1% KOH solution for 15 min, washed to remove the alkali and sun dried. Treated and dried bones were pulverised to fine powder.

A part of the powder was dried at 100±2°C till they were completely free from moisture. Moisture free samples were analysed for ash content by the method of AOAC (1984) and Total Nitrogen by Kjeldahl's method. The samples were also analysed for calcium (AOAC, 1984) and phosphorous (Fiske and Subba Row, 1925)

Sensory quality of the product was also assessed. In order to understand the solubility of the powder in gastric juice, weighed quantity of the two samples were treated with 0.1N HCl. This solution was filtered after 3 hours and insoluble matter was determined.

Results and Discussion

The proximate composition of cooked tuna backbone is given in Table 1 and the characteristics of calcium powder are given in Table 2. Fat content in the raw material was high (13.94%). It had a protein content of 21.37%. The calcium prepared by KOH treatment was found to be better in sensory qualities. The ash content of the KOH treated sample was high compared with the samples prepared by solvent extraction method. This might be due to the formation of some potassium salts and also removal of more protein from the bone by alkali treatment. The amount of calcium and phosphorus was higher in KOH treated sample. Protein content of the powder was found to be less in KOH method, compared to solvent extraction method. Similar results were reported by Sada (1984). The samples had bland taste.

Solubility of calcium prepared by KOH treatment in 0.1N HCl solution was higher than that prepared by Solvent Extraction method i.e. 83.3 % for

KOH treated calcium powder and 78.6% for the other one. The results indicated better absorption properties for the former sample.

Table 1. Proximate composition and calcium and phosphorous content of tuna backbone from a canning factory

Moisture	37.5%
Fat	13.94%
Protein	21.37%
Ash	26.28%
Calcium	13.64%
Phosphorus	6.8%

Table 2. Characteristics of calcium powder prepared from tuna backbone

	KOH method	Solvent extraction method
Protein*	17.94%	27.00%
Ash*	73.46%	65.23%
Calcium*	43.20%	38.20%
Phosphorus*	21.30%	18.90%
Ca soluble in 0.1N HCl*	83.30%	78.60%
Ca Insoluble*	16.70%	21.40%
Colour	Off white	Ivory
Smell	No fish odour	Slight fishy odour
Taste	Bland	Bland

* dry weight basis

Since the calcium powders prepared in the present experiment have bland taste and imparted no smell, they can be incorporated to fish preparations without altering the sensory characteristics. Also they have high solubility in dilute HCl, the calcium in these samples will be easily dissolved in the acid in the stomach and be absorbed. So this can function as a good alternative for calcium supplementation.

The authors are thankful to Dr. K. Devadasan, Director, Central Institute of Fisheries Technology, Cochin for permission to publish this paper. The authors also wish to thank Dr. Jose Joseph, Mr. T.S. Unnikrishnan Nair and Ms. R. Thankamma for their valuable suggestions in preparing this paper.

References

AOAC (1984) *Official Methods of Analysis*, 14th edn, Association of Official Analytical Chemists, Washington, DC

Balachandran. K.K. (2001) *Post Harvest Technology of Fish and Fish Products*. Daya Publications, New Delhi 110035

Chatterjee, M.N., and Shinde, R. (1995) *Text Book of Medical Biochemistry*. Jaypee Brothers Medical Publishers, New Delhi

Fiske and Subba Row (1925) *J. Biol. Chem.* **66**, 375

Sada, M. (1984) *Infofish International* **1**, 29