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Research Note

Nutritional and Protein Quality Studies of Textured Protein Concentrate Prepared from *Saurida tumbil*

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Fish protein has high digestibility and it contains most of the essential amino acids in adequate amount, apart from being a valuable source of lysine and methionine. Nutritional studies have proved that fish proteins rank in the same class as chicken protein and are superior to milk, beef protein and egg albumin. The nutritional value of fish protein and fish flour has been proven through the nutritional studies in children (Johnson *et al*., 1962). Nair *et al.* (1988) evaluated the nutritional quality of textured protein concentrate prepared from pink perch and opined that its protein efficiency ratio (PER) and net protein utilization (NPU) are comparable to that of casein. The low priced fish from trawl nets can be effectively utilized for preparation of fish protein concentrate. The development and commercialization of the process for preparation of fish protein concentrate having meat like texture were extensively reviewed by Suzuki (1981) and Liu *et al*. (1990). Shenoy *et al*. (1988) made a comparative study of the suitability of different species of non commercial fish for the production of textured meat.

Consumer demand is expected to be high, for ready-to-use convenient products that require minimal processing before consumption. Edible fish powder and concentrate prepared from small fish are in high demand (Chattopadhyay *et al*., 2004, 2008). Several new products in the form of edible fish protein concentrate and protein powder have been studied by Joseph (2002). The present study was carried out to evaluate the textured protein concentrate (TPC) prepared from lizard fish in terms of its protein efficiency ratio, pepsin digestibility and available lysine.

Fresh prime quality lizard fish (*Saurida tumbil*) of the trawl catch obtained from Mangalore landing centre, Karnataka was used for the studies. Fishes were with an average weight and length of 109.9 g and 19.5 cm respectively. The dressed fish was frozen immediately in a plate freezer at -40°C and stored at -20°C. The following day it was thawed, split opened and meat was separated using a pounding type meat picking machine (Model S. G., Toyo Seikan Kaisha Ltd. Japan). The meat was picked twice. The mechanically deboned meat was subjected to water washing. As the meat recovered through the second picking was slightly dark in colour, washing was repeated. The washed meat was squeezed in a cloth to reduce the moisture content to around 80% and mixed with 0.5% sodium bicarbonate. pH was around 7.5. This was passed through a meat extruder and the extruded meat was mixed with ethanol in the ratio 3:1 (material:alcohol). It was stirred

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well and kept at 0 to 5°C for 30 min. After the resting period, the alcohol was separated by filtration through a muslin cloth. The defatted and partially dehydrated meat was kept overnight under fan in thin layer. The material was further dried to a moisture content of around 8-10% in an air oven at around 40°C. Two different diets were prepared using textured protein concentrate and milk powder and the percentage composition of the ingredients is given in Table 1. Products thus prepared were packed in 200 gauge HDPE packets, heat sealed and stored at room temperature.

Table 1. Ingredients used for the preparation of diets for animal experiment

Ingredients	% composition	
	Diet based on textured protein concentrate	Diet based on milk powder
Milk powder	-	10
Textured Protein Concentrate	10	-
Oil	10	10
Vitamin mineral mixture*	4	4
Sugar	10	-
Starch	66	76

* Thaimin HCl 120 mg kg^{-1}, vitamin B_2 40 mg kg^{-1}, pyridoxine HCl 120 mg kg^{-1}, nicotinic acid 150 mg kg^{-1}, calcium pantothenic 100 mg kg^{-1}, folic acid 5 mg kg^{-1}, biotin 1 mg kg^{-1}, vitamin B_{12} 0.02 mg kg^{-1}, Inositol 4000 mg kg^{-1}, choline chloride 1200 mg kg^{-1}, sodium ascorbate (Vit. C) 5000 mg kg^{-1}, vitamin E 200 mg kg^{-1}, vitamin K 40 mg kg^{-1}, vitamin A 5000I.U., vitamin D 1000 I. U. Trace mineral dissolved in distilled water with 0.5% HCl and supplied as 10 ml kg^{-1} dry diet containing; Fe: (as $FeSO_4 7H_2O$) 115 mg; I (as KI) 1.9 mg; Mn: (as $MnSO_4 4H_2O$) 32.5 mg; Se: (as Na_2SeO_3) 4.2 mg; Mg (as $MgSO_4$) 2.0 mg: Co (as $CoC1_2 6H_2O$) 4.0 mg; Cu (as $CuSO_4 5H_2O$) 11.8 mg; Mg : Zn (as $ZnSO_4$ $7H_2O$) 88.0 mg.

Since skimmed milk already contains sugar, the diet using milk powder was prepared without sugar. Nutritional studies of the products on rats were conducted and protein efficiency ratio was calculated using the method of Osborne & Ferry (1919). Six groups of albino rats (21 days old, 7 rats in each group) were fed for a period of four weeks on the two different diets (*viz*., based on test protein and milk protein). The diets contained 10 percent protein and were complete with all other dietary essentials such as minerals, fat, sugar and starch. The gain in body weight was recorded and protein efficiency ratio was calculated.

$$\text{PER} = \frac{\text{Gain in body (g)}}{\text{Protein intake (g)}} = \text{Gain in weight per g of protein intake.}$$

Pepsin digestibility was determined as per AOAC (1975) method and available lysine as per Carpenter (1960). The data was subjected to statistical analysis as per Snedecor & Cochran (1967).

The results showed that PER of the diet based on textured protein concentrate was 3.2 while that of milk powder based diet was 1.91. The feeding experiments showed that the increase in weight of rats fed with textured protein concentrate was higher than that of the group fed with milk powder. The results agree well with the work of Nair *et al.* (1988) and Suzuki (1981). As far as carbohydrate is concerned, diets containing TPC (Sugar 10% and Starch 66%) and milk powder (Starch 76%) have similar carbohydrate content (76%). In the investigation by Nair *et al.* (1988) the group of rats fed with milk powder had PER of 2.50. The PER of raw fish meat and partially hydrolysed and deodorized (PHD) fish flour using pink perch was found to be 2.68 and 2.32 respectively (Shetty *et al*., 1977).

Changes in pepsin digestibility and available lysine during storage are shown in Table 2. The availability of lysine is a good index of the availability of other amino acids of the protein (Lovern, 1964).

Pepsin digestibility value decreased from 92.75 to 89.90%, by six months storage which was insignificant. The available lysine content also decreased from 9.81 to 8.5%. Both pepsin digestibility and available lysine were within the limit (92% and 6.5%

Table 2. Changes in pepsin digestibility and available lysine of textured protein concentrate during storage

Storage period (Months)	Pepsin digestibility (%)	Available lysine (%)
0	92.75 (±0.75)*	9.81 (±0.78)
2	91.30 (±0.5)	9.45 (±0.94)
4	90.25 (±0.86)	8.98 (±1.0)
6	89.90 (±1.2)	8.50 (±0.72)

* Results are presented as the mean ± standard deviation (SD) of 3 replications.

respectively) specified for the fish protein concentrate (FAO, 1961) indicating that the quality of the protein was not affected by processing and storage of protein concentrate. Low temperature drying generally produces products of a higher quality than drying at high temperature (Olley & Watson, 1961). The present study showed that destruction of lysine had not taken place during processing as the product was subjected to alcohol treatment at low temperature (0 to 5°C) and drying at 40°C. However, the slight decrease in lysine during storage might be due to maillard reaction between carbonyl compounds and amines of the product.

The study showed that the increase in weight of rats fed with textured protein concentrate was higher than that fed with milk protein. There was only a marginal decrease in pepsin digestibility and available lysine of textured protein concentrate during six months of storage. Both the parameters were found optimum and similar to that of a balanced protein diet.

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