Studies on Two Unexploited Fish Species: *Peristedion adeni* and *Peristedion weberi*

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The chemical composition and nutritional quality of *Peristedion adeni* and *Peristedion weberi,* two unexploited fish species available in abundance in the Exclusive Economic Zone of India are reported. Size of the fish is small and separation of edible meat is difficult. Best method of utilization of the fish is conversion into meal. Meals having crude protein content varying from 55.0 to 57.0%, ash content from 17.0 to 19.6% and fat content from 17.7 to 18.1% can be prepared from the two species of fish. PER values of the meals are lower than that of casein. Amino acid analysis showed that isoleucine, leucine and valine are not present in the meals in adequate quantities compared to the FAO/WHO (1973) prescribed pattern.

India has a very long coastline and is one of the largest fish producing countries in the world. However, efforts to relieve pressure on the depletion of the existing stocks of the traditional fishery resources have been made only recently. The possibilities of fish available in our Exclusive Economic Zone (EEZ) have to be explored in detail, if over-exploitation of our commercially important fishery resources is to be prevented. This requires an indepth study on the availability, catching techniques, maximum sustainable yield, biology, quality, processing techniques, product development, marketing and consumer response on the many new varieties of fishes that are abundantly available in the EEZ. Moreover, information on the biochemical and nutritional quality of new under/non-exploited fish species is limited.

In this study, the proximate composition of two species of unexploited fish *Peristedion adeni* and *Peristedion weberi* (sea robin) is presented. Results of the studies on product development from the two fishes and the biochemical, bacteriological and nutritional quality evaluation of meals prepared from the two fishes are also reported.

Materials and Methods

Two species of deep sea fishes collected from the EEZ along the east and west coast of India, *P. adeni* and *P. weberi* were used for these studies. The fishes were caught in the trawl nets operated from FORV 'Sagar Sampada' of the Department of Ocean Development, Government of India during July, 1985. The fishes were washed well, frozen immediately after catch on board the vessel and stored for two weeks at a frozen storage temperature of –18°C in the vessel. The frozen blocks of fish were transferred to the cold storage of the laboratory at the end of the cruise and stored at –23°C.

Representative samples of the two fishes were blended well in a homogeniser and aliquots were taken for analysis. Moisture, crude protein and ash were determined on the whole minced fish according to the AOAC (1975) procedure. Lipid was extracted by the Bligh & Dyer (1959) method.

The ash from each sample was dissolved in 1 N hydrochloric acid and made up to volume. Calcium, sodium and potassium were estimated by flame photometric measurements using a Systronic flame photometer. The micro-elements were determined using Atomic Absorption Spectrophotometer Model GBC 902.

The whole fish was converted into meal by cooking the fish, removal of stick water by filtration and drying the residue in a tunnel drier at 45–50°C. The dried meals were powdered and used for further analysis. Bacteriological quality of the meals was assessed as per APHA (1966) methods.

The defatted meals were hydrolysed with 6 N hydrochloric acid in a sealed tube at 110°C for 22 h. The hydrolysed samples were filtered, freed of acid using a rotary vacuum evaporator, made upto volume with citrate buffer pH 2.0. The amino acid analysis was carried out on a Technicon NC 2P amino acid analysing system (Single column). The area of each peak was integrated using spectraphysics computing integrator.

Protein efficiency ratio (PER) of the meals was determined by the method of Chapman *et al.* (1959) with ten male weanling rats (Wistar strain) for each test diet. Necessary adjustments for the fat and ash contents of the meals were done during the formulation of experimental diets so as to conform to the diet composition prescribed in the method (Chapman *et al.*, 1959). Daily intake of food and weekly gain in weight of the rats were recorded for 4 weeks. The rats were sacrificed after the experimental period and liver, kidney and spleen samples were collected. The organ weights were recorded and nitrogen content of the samples were determined by the microkjeldahl method (Hawk, 1971). Day to day visual observations were also made on the general condition and appearance of the rats consuming the experimental diets.

Results and Discussion

Peristedion adeni and *Peristedion weberi* were small bony fishes and had an average length of 8.6 ± 0.7 and 5.8 ± 0.5 cm and an average weight of 6.0 ± 0.4 and 4.8 ± 0.2 g respectively. The edible portion of the fishes is comparatively small and head, bones etc. constitute the major components of the body. Moisture content of the sea robin samples is high compared to the moisture content observed by Kutty Ayyappan *et al.* (1976) in 17 species of fish. Protein content is extremely low and the fat content is high. Both fishes belong to the low protein high fat group. Ash content of the two fishes is also high, probably due to the high percentage of bones present in the fish.

The meals prepared from the two fishes had unappealing brown to blackish brown colour. The conversion ratio of *P. adeni* and *P. weberi* into meal was 6.2 and 7.8 respectively which is better than the conversion ratios for small fishes (Lekshmy Nair *et al.*, 1983). Data on the biochemical characteristics of the meals is shown in Table 2. Crude protein content of the meals was around 55% which is the protein content of grade 2 fish meal (IS: 4307–1973). Though the ash content was very high, the acid insoluble ash was quite low. The high ash content of the meals is a result of the small size and high bone content of the two fishes. Similar high crude ash has been reported for different types of fish meal by Murayama & Yanase (1962) and by Satoh *et al.* (1987). Both meals contained fat in amounts higher than the prescribed standards (IS: 4307–1973). Recent studies have disproved the belief that growth is depressed in chicks fed on fish meals of high fat content and have shown that poultry can utilize fat efficiently, provided the diet has the correct ratio of vitamin (March, 1962). The excessive fat content of the meals, therefore, need not be taken as a disadvantage, when their utilization aspects are considered. Meals with similar low protein, high fat and high ash contents have been reported by Murayama & Yanase (1962).

The bacteriological analysis of the meals prepared from *P. adeni* and *P. weberi* showed that the total viable counts were 5.4×10^2 and

Table 1. *Proximate composition of sea robin*

	P. adeni	*P. weberi*
Moisture %	79.68	81.22
Crude protein %	12.47	11.76
Ash %	3.80	3.12
Fat %	3.16	3.05

Table 2. *Proximate composition of sea robin meals*

	Meal from	
	P. adeni	*P. weberi*
Moisture %	5.53	5.26
Crude protein %	55.13	57.05
Ash %	19.58	16.94
Acid insoluble ash %	0.08	0.04
Fat %	18.13	17.68

Table 3. *Mineral composition of sea robin meals (mg/100 g)*

	Ca	Na	K	Mn	Cd	Cu	Zn	Fe
P. adeni	4540	830	920	2.39	Nil	0.20	6.87	17.25
P. weberi	4280	780	860	1.89	Nil	0.20	11.67	16.67

6.8×10^2/g respectively. Coliforms, faecal streptococci and coagulase positive staphylococci were not detected.

The mineral composition of the meals is reported in Table 3. Five micro elements (Mn, Cd, Zn, Cu & Fe) and three macro elements (Ca, Na & K) were determined. Level of manganese, which plays an important role in metabolic processes (O' Dell & Campbell, 1971) were 2.39 and 1.89 mg%. Cadmium was not detected in the samples. The meals contained 6.87 and 11.67 mg% of zinc, an important trace element in human nutrition (Burch *et al.*, 1975). This is comparable to the values for zinc reported by Murayama & Yanase (1962). Copper level averaged 0.2mg% in both species. The iron contents of the two meals were also similar. Iron content reported by Murayama & Yanase (1962) for various types of fish meals is about 1½ tmes the iron content of sea robin meals. The values for zinc and iron are considerably lower than those reported for sardine meal (Ammu *et al.*, 1986). It may be seen from the Table that both meals were rich in calcium, sodium and potassium. Calcium and potassium were present in higher amounts than sodium. The meals, therefore, constitute a good source of macro as well as micro elements studied.

The amino acid profile of the two meals is shown in Table 4. Glutamic acid is the major constituent in both meals. Lysine content of *P. adeni* is high compared to FAO/WHO (1973) reference protein while it is adequate in *P. weberi*. Leucine and valine are the first and second limiting amino acids for *P. adeni* meal, the amino acid score being 95.5 and 96.0 respectively. Three essential amino acids isoleucine, leucine and valine are not present in adequate amounts in *P. weberi* meal, the amino acid score being 83 and leucine is the first limiting amino acid in this meal also. In order to make the meals nutritionally whole they will have to be supplemented with the limiting amino acids in quantities required to bring up the limiting amino acids content to the prescribed levels. All other essential amino acids are present in adequate to more than the prescribed levels.

Table 4. *Amino acid composition of sea robin meals (g amino acid/100 g protein)*

Amino acid	Meal from *P. adeni*	Meal from *P. weberi*
Aspartic acid	9.7	9.2
Threonine	4.3	6.2
Serine	4.1	3.8
Glutamic acid	16.1	15.6
Proline	6.1	5.2
Glycine	7.9	5.9
Alanine	6.2	5.8
Valine	4.8	4.3
Cystine	0.5	2.3
Methionine	4.2	3.1
Isoleucine	4.0	3.6
Leucine	6.7	5.8
Tyrosine	3.8	2.8
Phenylalanine	4.5	3.5
Histidine	2.4	1.9
Lysine	10.3	8.7
Arginine	7.2	6.9

The gain in weight, protein intake and PER of the meals are indicated in Table 5. The PER values of both meals are lower than that of reference protein, casein. Food intake was slightly lower in the group fed control diet. PER data confirm results obtained by amino acid analysis. Since all the essential amino acids are not present in required amounts, utilization of the higher amounts of lysine, aromatic amino acids etc. in the meals is probably impaired, leading to an overall lowering of the PER values. Since both meals possess high fat content the lower PER values can also be attributed to possible protein fat interactions and consequent

Table 5. *Protein efficiency ratios of sea robin meals*

Protein	Initial wt. g	Final wt. g	Weight gain g/28 days	Protein intake g/28 days	True PER	Adjusted PER
P. adeni meal	40.02± 3.00	111.08± 11.34	69.86± 12.00	26.76± 7.44	2.44± 0.13	2.16
P. weberi meal	43.12± 5.90	111.15± 16.40	68.03± 13.29	25.74± 0.17	2.41± 0.17	2.13
Casein	40.68± 3.50	105.98± 11.70	66.30± 12.23	23.68± 4.50	2.83 0.14	2.50

Table 6. *Relative organ weights and organ nitrogen levels of rats fed with experimental diets*

	Organ weight, g			Nitrogen content (mg N/g) of		
	Spleen	Kidney	Liver	Spleen	Kidney	Liver
P. adeni	0.29± 0.02	0.96± 0.02	3.54± 0.12	31.69± 1.34	31.26± 1.06	32.61± 4.32
P. weberi	0.30± 0.04	0.92± 0.09	3.39± 0.44	33.32± 1.23	31.70± 0.68	32.56± 5.11
Casein	0.33± 0.06	0.91± 0.09	3.44± 0.40	31.69± 1.11	30.31± 0.95	32.13± 4.58

decrease in the digestibility and utilization of protein. Devadasan *et al.* (1985) have shown that with increased lipid oxidation the protein quality in fish based diets decreases. However, conflicting findings regarding the impairment of the nutritive value of fish meals due to the presence of fat have been reported (Witting *et al.*, 1957; Oldfied *et al.*, 1957; Barlow & Pike, 1977). The exact nature of the reactions involved is not yet clear. However, after 28 days of feeding, the animals were observed to be in a healthy state, without any physiological disturbances. Adverse effects were also absent. This is also supported by the data on organ weights and organ nitrogen levels presented in Table 6.

The foregoing studies show that possible utilization of the two species of fish studied namely, *P. adeni* and *P. weberi* can be made by conversion into meal and that incorporation of the fish meals in animal feed will be possible only after suitable supplementation of the meals for their limiting amino acids.

The authors are thankful to Shri M.R. Nair, Director, Central Institute of Fisheries Technology for his permission to publish the paper. The authors are grateful to Dr. P.T. Lakshmanan and Dr. Nirmala Thampuran of CIFT for their help in the analysis. They thank Dr. K. Devadasan, CIFT for critically going through the manuscript and suggesting improvements. They also thank Shri Thomas J. Mammottil for technical assistance.

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