ON THE PRODUCTION AND NUTRITIVE VALUE OF FISH MEAL FROM SILVER BELLY *(LEIOGNATHUS SPP.)* LANDINGS AT RAMESWARAM

R. SRINIVASAN
Fisheries Technological Station, Tuticorin.

Silver belly *(Leiognathus Spp.)* forms a major fishery in recent years in the Rameswaram island but fetches for the fishermen very low prices ranging from Rs. 0.03 to 0.12/Kg. only, there being practically no demand for the fish. The possibilities of utilizing this cheap fish in the round for large scale production of fish meal are discussed and the processing method described. During the glut season the cost of production of Silver belly fish meal works out to competitive prices of Rs. 500 to Rs. 700/tonne. The silver belly fish meal is of high quality with good protein content averaging 57.71% in commercial samples and 61.90% ie laboratory samples and with a high pepsin digestability of 90.0% to 92.5%. The essential amino acid composition of the Silver belly fish meal compares very favourably with other round fish meals, with high contents of lysine, leucine, arginine, isoleucine, methionine, phenyl alanine, threonine and valine. Since there is good demand for fish meal as poultry and and cattle food both in the internal and external markets, there is good scope for large scale production and sale of fish meal.

INTRODUCTION

The Rameswaram island is a compartively small 165.8 square kilometer area lying about 5 kilometers off the coast of Mandapam in the Ramnad district. It is one of the important fishing centres of Madras State, fisherman forming the major portion of the popuiation and fishing the main occupation. It is bounded by the Palk Bay on the north and Gulf of Manner on the south. It is exposed to both the North-East and South-West monsoons, the Palk Bay being affected during the North-East monsoon and the Gulf of Mannar during the South-West monsoon. However fishing operations in the island are conducted right through the year, the fisherman switching over to the side where it is calm. Though nearly 30 and odd species constitute the commercial fishery of this island, Silver belly (*Leiognathus Spp.*) accounts for nearly 40% to 45% of the

total catches and in 1952–53 the total landings of this species were 629.36 tonnes and in 1953–54, 739.66 tones (Krishnamoorthy, 1957). As a result of the successful introduction of trawling technique by the Madras State Fisheries Department in this coast, there has been a phenomenal increase in the landings of Silver belly at Rameswaram during the past 3 years. As much as 80 tonnes / day of this fish have been recorded in this area during the peak season. It is estimated that about 7,000 tonnes of Silver belly are now annually landed in the area. Though this fish is caught right through the year, the catches are peak from April to Auguat, moderate during the months of September to November and poor in the months of December to March. There is at present practically no demand for this fish excepting for a small market in Kerala State for the dried salted Silver belly during the South–West monsoon Season. The entire catches are therefore salted and dried, but fetch for the fishermen very low prices ranging from Re. 0.03 to 0.13/Kg. only. In fact, there is scope for greater landings of Silver belly than at present, but the fishermen have to restrict their catches because of uneconomic and unsteady prices and no demand for their catches. With a view to find out better methods of utilization of the Silver belly catches and to ensure a steady price for the fishermen for their catches, studies were conducted by the author on the production of fish meal from this fish. The chemical composition and nutritive value of the fish meal produced were also studied by the author and the results are presented in this paper.

Materials And Methods.

The commercial fish meal samples from the Silver belly were mainly produced at the departmental fish meal centre at Rameswaram utilizing the catches of departmental boats of the Inshore Fishing Station, Rameswaram. Samples of fish meal produced by some private parties at Rameswaram were also collected and examined for the study. The chemical composition of fish meal samples was estimated according to A. O. A. C. Methods (1945). The amino-acid composition was ascertained by the paper chromatographic technique.

Processing Method, Yield And Cost Of Production

The catches of Silver belly in the round form are washed in clean fresh or sea water immediately after landing. The fish is then cooked in boiling water just enough to immerse all the fish in open aluminium or tin costed copper vats. The cooked fish is removed by a perforated laddle and then pressed in cloth bags under a screw press to remove the water and oil. The pressed cake is spread well on palm mats or concrete platform and sun-dried until completely dry. The dried product is then finely powdered by hand pounding or in a mechanical disintegrater, sieved to pass through a 40 mesh size sieve and the resulting fish meal powder packed in polythene or alkathene lined hessian bags. The laboratory samples of fish meal were prepared by drying the pressed cake in ovens at controlled temperatures.

The yield of fish meal was found to range from 16% to 20% of the original wet weight of fish in the various experiments. The cost of production works out to Re. 0.90/Kg. or Rs. 900/- Tonne at the prevailing market rate of Rs. 0.07/Kg. for Silver belly. During the glut season, it may be possible to get the fish at very cheap prices of Re.0.03 to Re.0.05/Kg. and the cost of production then will work out to Rs. 500 to 700/- tonne only.

Quality of the Product

The results of chemical analysis of six fish meal samples produced from Silver belly on a commercial scale by the method described above are shown in Table I in annexure. The nutritive value and essential amino acid composition of 4 fish meal samples prepared in the laboratory from Silver belly were also determined and the results are shown in Table II in annexure.

A study of these data will show that the fish meal produced is of high quality with good protein content, averaging 57.71% in commercial samples and 61.90% in laboratory samples. The higher protein figure in laboratory samples show that there is scope for improving the quality of the commercial products by better handling and processing. However the quality of the commercial fish meal samples was well within the standards prescribed in the notification issued by the Ministry of Commerce and Industry (1959)

Discussion

Carver (1957) and Woodham (1958) have studied the composition of various types of fish meal and their use in animal feeding in United States and United Kingdom respectively. Though no such exhaustive studies of fish meal have been made in our country so far, the yield and chemical composition of the fish meals prepared from some fishes like mackeral, oil sardines, horse mackeral, anchovies, ribbon fish, sharks, skates, soles and prawn-shell have been described by Chari and Anatha Pai (1948). However there has so far been no large scale production of fish meal in our country from any of the fishes mentioned above, because of the prohibitive cost of those fishes. The large scale Silver belly *(Leiognathus Spp.)* landings in the Rameswaram island in recent years and their very cheap prices afford good scope for the commercial production of fish meal in our country utilizing this fish as raw material. The production of fish meal and the chemical composition and nutritive value of the fish meal produced from silver belly were therefore studied by the author.

Fish meal is purchased on the basis of its protien content. In the fish meal produced from Silver beliy the author found that in commercial samples the protien content varied widely from 48.42% to 62.73%. Similar wide variations in the protein content of commercial fish meal samples from white fish have also been observed by Mac Intyre (1957). He considers that "this variation may be due to differences in the nature of the raw material such that similar methods of processing result in meals of different composition or to processing procedures which differ sufficiently to produce difference in the composition of the final product or a combination of both". However the 4 samples of fish meal from Silver belly prepared in the laboratory under controlled conditions varied to a small extent only in protein content from 61.0% to 62.6%. The varying factors in commercial operations from batch to batch, like the size and qualtty of raw material, the season of the catches, the varying degrees of removal of stick waters in pressing, admixture of varying quantities of insolubles like sand during handling etc., may probably account for the wide variations in the protein content of the commercial samples. The commercial fish meals were found to be generally of poorer nutritive value than laboratory preparations as observed by Miller (1956) who explained the difference as chiefly due to the drying and consequent occurrence of Maillard reactions. The Silver belly fish meal

has also a high pepsin digestibility of 90 to 92.5%.

The protein and fat content of silver belly (*Leiognathus splendens*) have been estimated as 16.50% and 2.9% respectively by Jayachandran (1963) and so the fish silver belly can be classified as a fish of low oil and high protein content (Stansby, 1961). Being a low fatty fish, the Silver belly is best suited for the production of fish meal, since the fish meal produced is comparatively low in fat content and will keep for relatively longer duration without becoming rancid. The fat content of the fish meal samples prepared varied from 5.07% to 12.74%, high values being recorded for the laboratory samples, probably because of imperfect removal of oil content in the pressing process. In commercial samples the fat content ranged from 5.17% to 9.13% only. According to Borgstrom (1962), recent studies have disproved the belief that growth was depressed in chicks fed fish meals of high fat content and that poultry can utilize fat efficiently provided that the diet fed has the correct ratio of protein to caloric content and is adequately fortified with vitamins. Though the fat content in a fish meal may contribute to the over-all nutritive value of the product, low fat-content is preferable since oxidized and polimerized oils may contain toxic factors and may be poorly digested and since the fat content may exert an indirect effect on the nutritive value of meal through the activity of peroxides in destroying vitamins in the fish meal itself or in mixed rations to which the meal may be added.

The silver belly fish meal is found to be rich in calcium like other fish meals and so will help to reduce the use of bone-meal or calcium phosphate in the poultry ration.

The amino acid composition of the silver belly fish meal compares very favourably with fish meal prepared from herring, menhaden, sardines and white fish (Borgstrom, *loc. cit*) and is in correct balance to acheive optimum effect. Like other fish meals, the silver belly meal is poor in tryptophan and rich in lysine which is the primary limiating amino-acid when cereals are fed as the only source of protein. According to Evans (1959), a cereal diet supplemented with 7% white fish meal provides adequate amounts of supplemental lysins and methionine and so a similar dose of silver belly fish meal may be suggested in the rations. The amino-acids in the silver belly fish meal prepared by the process referred above might not have been destroyed and the protein and vitamins unimpaired during the entire processing, since the cooking as well as the drying temperatures have been kept below 100°C. (Bender *et al.*, 1953).

Thus the silver belly fish meal is found to be one of the best sources of high quality protein with high pepsin digestibility and high biological values like other fish meals. It is fairly rich in all the essential amino-acids which are in balance and are not impaired by the process used in the preparation of the meal. Bacteriological examination of the sun-dried commercial samples tested by the author did not reveal the presence of *Salmonella* which may be expected in sun-dried products. Proper care in the handling of fish at every stage and drying on clean concrete platform or palm mats may ensure the absence of this bacteria. The process described in this paper may serve as a basis for the production of silver belly fish meal in the Rameswaram island on a cottage industry or small scale basis. However for large scale production of fish meal, it is desirable to put up a regular fish meal plant consisting of a rotary steam drier, a screw press and a pulverizer

TABLE I SHOWING THE RESULTS OF CHEMICAL ANALYSIS OF COMMERCIAL FISH MEAL SAMPLES PRODUCED FROM SILVER BELLY

Sl. No.	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Average
1. Original Moisture %	7.72	7.44	10.67	11.69	7.24	1.60	7.72
2. Ash %	30.96	39.06	30.41	36.18	28.84	33.21	33.11
3. Insolubles %	4.84	8.81	4.21	9.43	6.28	....	6.71
4. Ca0 %	14.03	13.28	9.43	11.99	11.51	9.49	11.61
5. $S0_4$ %	0.26	1.45	1.54	1.25	0.27	0.33	0.85
6. NaCl %	0.38	0.12	0.44	1.30	0.38	0.22	0.57
7. Protein %	61.28	48.42	57.48	58.03	62.73	58.35	57.71
8. Fat %	7.80	9.13	8.82	....	6.69	5.07	7.50

which will ensure adequate heat-processing of the product and complete absense of Salmonella.

The silver belly fish meal, because of its high protein content and biological value is in good demand by the Madras State Animal Husbandry Department for feeding poultry and cattle. The annual demand for fish meai from the State Animal Husbandry department alone being about 300 tonnes and there being a number of enquiries for fish meal supply from all over the country and from abroad, there is great scope for large scale production of silver belly fish meal in the Rameswaram island. Manufacture of silver belly fish meal will also be a profitable venture, since the Silver belly fish is available at very cheap prices.

ACKNOWLEDGEMENT

The author is thankful to Sri S. Durai Raj, for his help in carrying out the studies and also to Dr.V.K. Pillai, Central Institute of Fisheries Technology, Ernakulam for his help in determining the essential amino acids in the fish meal samples. The author is also thankful to the Director of Fisheries, Madras for his kind permission for publishing this paper.

TABLE - II. THE ESSENTIAL AMINO-ACID COMPOSITION AND NUTRITIVE VALUE OF FISH MEAL SAMPLES PREPARED IN THE LABORATORY FROM SILVER BELLY

	Sample Numbers.				
	I	II	III	IV	Average
Ash %	24.82	25.08	23.06	26.21	25.32
Moisture %	10.43	9.22	7.28	3.77	8.93
Fat % (D.W.B.)	12.74	11.0	11.85	11.71	11.98
Available Lysine (g/100g protiein)	5.86	6.1	6.3	6.54	7.20
Pepsin digestibility.	90.0	90.7	92.5	92.4	91.4
Silica	0.4684	0.4605	0.5650	0.3505	0.4611
Chloride	0.52	0.36	0.40	0.31	0.42
Protein (Nx6.25) D. W. B.	62.1	61.0	62.6	61.9	61.90
Arginine (as % of crude protein)	4.21	5.54	5.62	5.48	5.21
Histidine	1.61	2.57	2.84	2.41	2.36
Isoleucine	4·53	4.41	4.81	4.67	4.60
Leucine	4 65	5.65	5.33	5 18	5.20
Lysine	7.04	7.82	7.88	7.92	7.67
Methionine	1.22	2.74	2.12	2.86	2.16
Phenyl alanine	2.87	3.52	3.62	4.02	3.51
Threonine	3.47	3.26	4.14	4.65	2.88
Tryptophan	0.61	0.89	0.78	0.84	0.78
Valine	3.41	4.62	4.72	3.86	4.15

REFERENCES

Association of Official Agricultural Chemists. 1945. "Methods of Analysis"

Bendor, A. E., Miller, D. S. and Tunnah, E. J. 1953. *Proc. Nutrition*, Sec. **12**, ii

Borgstrom, G. 1962. "Fish as food" Vol. II, Academic Press New York and London.

Carver, J. H. 1957. *Comm. Fish Rev.* **19** (5a), 10–13

Chari, S. T. and Anata Pai. 1948. *Indian Farming*, 358–363.

Govt. of India. 1959. "Export Instruction Circular' No. 23/99 dt. 12–9–'59

Jayachandran P. 1963. *Madras J. Fish.* **1**, 1, 123–125

Krishnamoorthy, B. 1957. *Ind. J. Fish.* **4**, 2, 229–253.

MacIntyre, T. M. 1957. *Can J. Animal Sci.* **37**, 58–63

Stansby, M. R. 1962 "Fish in Nutrition" Eirik Heon and Rudelf Kreuzer, F. A. O., Part II, Sect. 1, 55–60.

Woodhan, A. A. 1958. *Proc. Nutrition Soc. Eng. and Scot.* **17**, 142–147.