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Utilization of Frog Waste

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Commercial frog waste samples have been converted into meals by cooking at 0.7 kg/sq. cm for 30 min, draining off the stick water and drying the press cake either in the sun, tunnel dryer under controlled conditions or hot air oven. Yield of the meal varied between 18.6 to 21.5 per cent of the fresh frog waste. Chemical analyses of the meals have shown that the meals prepared from frog waste conform to standards prescribed for fish meal and livestock feed and can therefore be used for supplementation of poultry/animal feed.

Hind legs of certain varieties of frogs are an item of luxury food and a delicacy in western countries. Frog meat is also consumed by the poor and tribal people in certain other parts of the world. The common edible species available in India and mainly distributed in Kerala, Tamil Nadu, Assam, Orissa, West Bengal and U. P. are *Rana hexadactyla* LESSON, *Rana trigrina* DAUD and *Rana trigrina* CRASSA-JERD. Although the industry in the initial stages was mainly concentrated in and around Cochin, it has now been established in different parts of the country. Total export of frozen frog legs from India has shown a steady increase from 840 tonnes valued at Rs 1.18 crores in 1969 to 3510 tonnes valued at Rs. 8.42 crores in 1978 (Anon, 1979). Since only hind legs of frogs are used for processing, the front legs and other body portions are disposed off as waste. On an average these portions constitute about 65 per cent by weight of the whole frog. Considering the vast quantity of frozen frog legs exported at present, about 5400 tonnes of frog wastes are discarded annually on an average. If proper methods of utilization of this waste could be developed, it would add significantly to the returns from the industry as well as help in solving in part the protein shortage in the country.

Reports on the quality characteristics of frog legs or frog waste are limited. The proximate composition and nutritive value of leg meat of two edible species of frogs *R. hexadactyla* and *R. trigrina* have been reported by Dani *et al.* (1966). Rao & Kamasastri (1963) have reported the yield of oil and meals prepared by the wet reduction and dry reduction methods from the waste material in the frog leg processing industry, their chemical composition and storage changes. The present communication is a report of the investigations carried out by the authors to evolve suitable methods for proper utilization of the wastes from the frog leg processing industry.

Materials and Methods

Frog waste was collected from various frog cutting centres near Cochin. This was washed well with water to remove dirt and other extraneous matter sticking to the material and processed either immediately or frozen and stored at –25°C until taken out for further processing. Live frogs were also procured, the hind legs cut off according to the method of Iyer & Chaudhuri (1968) and the residual waste used for extraction of oil and preparation of meal. The raw waste was cooked in steam at 0.7 kg/sq. cm for 30 min, the stick water was drained off and the press cake dried in the sun for 20–24 h or in a tunnel dryer under controlled conditions at 45–50°C. To study the effect of different types of drying on the nutritive quality of the frog meals, the cooked residue from the same batch was dried (i) in the sun (ii) in tunnel dryer at 50°C (iii) in air oven at 70°C and (iv) in air oven at 98 to 100°C for 24, 18, 14 and 10 h respectively. The material was turned from time to time to prevent scorching during the drying process. The dried product was powdered in a mechanical pulveriser, sieved through 40 mesh sieve and analysed. The

meals were stored in bakelite capped glass bottles at room temperature for storage studies.

Moisture, fat, crude protein, ash and acid insoluble ash were estimated according to AOAC (1975). Total volatile bases were determined by distillation of the trichloracetic acid extract with saturated sodium borate, followed by absorption in boric acid and alpha amino nitrogen by the method of Pope & Stevens (1939). The ash was dissolved in 1 N hydrochloric acid and used for the estimation of calcium using Systronics flame photometer and phosphorus by the method of Fiske & SubbaRow (1925). Estimation of available lysine was carried out according to the modified Carpenter procedure (Booth, 1971). Amino acid composition was determined by standard microbiological assay methods (Shockman, 1963).

Results and Discussion

The yield of frog meal was found to range from 18.6 to 21.5% of the original fresh weight of the waste in the various experiments. The results of chemical analyses of five frog meal samples prepared from commercial waste are presented in Table 1. The crude protein value in the different meals ranged from 62.6 to 72.3% with ash ranging from 14.7 to 22.6% .The acid insoluble ash varied between 0.3 and 0.5%, the fat between 6.8 to 12.3 % and the available lysine from 7.4 to 8.1 g/16 g N_2 in the various samples tested. This is in accordance with the chemical characteristics of the meal prepared by wet reduction process by Rao & Kamasastri (1963) except for the available lysine. Such variations in the quality of commercial fish meal samples have been observed by Mac Intyre (1957), Srinivasan (1966) and Mathen *et al.* (1975). Factors like differences in the size and quality of the initial raw waste, the season at which the meals are prepared and varying degrees of removal of stick water during preparation of the meal probably accounted for such wide fluctuations in the crude protein of the samples prepared from commercial waste. Samples prepared from waste obtained after removal of legs in the laboratory showed a more uniform pattern in the chemical indices (Table 2). Usually fish meal is graded on its protein content. The prescribed maximum limit for moisture in fish meals is 10%, for fat and acid insoluble ash 10% and 5% respectively and the minimum limit for crude protein 50% according to the relevant specifications (IS: 4307–1973). Except for one sample (Table 1) which showed a higher fat content, all samples tested conformed to the prescribed standards. The excessive fat in this sample may have been due to incomplete pressing and removal of stick water from the cooked waste. Recent studies have disproved the belief that growth was depressed in chicks fed on fish meals of high fat and have shown that poultry can utilise fat efficiently, provided the diet has the correct ratio of protein to calorific value and is adequately fortified with vitamins (March, 1962).

Table 1. *Composition of frog waste meal from commercial waste*

	Samples				
	1	2	3	4	5
Moisture %	8.3	6.5	6.2	6.5	7.4
*Crude protein % (TN x 6.25)	72.3	67.4	62.6	66.2	65.8
*Fat %	12.3	10.8	10.8	8.2	6.8
*Total ash %	14.7	18.4	22.6	21.8	22.4
*Acid insoluble ash %	0.4	0.3	0.5	0.4	0.4
TVN mg/100 g	26.1	29.0	27.7	24.8	26.6
Alpha amino N mg/100 g	50.1	52.5	48.8	48.8	50.5
*CaO %	6.2	7.1	6.2	7.8	8.0
*P_2O_5 %	5.4	6.4	5.4	6.5	5.8
Available lysine g/16 g N_2	8.1	7.6	7.6	7.4	7.6

*Moisture free basis

Table 2 summarises the analytical data of meals prepared by using various methods of drying. Meals dried in the sun and tunnel dryer have higher moisture content and TVN values, but the alpha amino nitrogen and available lysine are nearly the same in all the four meals. The loss in available lysine during hot air drying ranged from 0.2 to 0.3 g/16 g of N_2, showing that the decomposition during the drying process is not very significant. Rao *et al.* (1965) have also reported similar observations during their studies on nutritive value of proteins in fish meals. A loss of 0.6 to 0.7 g of available lysine per 16 g of N_2 was observed during storage of the frog meal for 10 months at room temperature.

It may be seen from Table 3 that the amino acid composition of the frog meal compares very favourably with that of fish meals prepared from sardine and miscellaneous fish (M. A. James, Central Institute of Fisheries Technology, Cochin—personal communication) and also silver belly (Srinivasan, 1966). With careful method of processing, meals from frog waste can therefore be used as a good substitute for fish meals for supplementation of poultry/animal feed. Recent work of Sulthan *et al.* (1980) has shown that the use of an artificial feed compounded by using frog flesh waste, groundnut oil cake, rice bran, molasses, seaweed powder, sun dried shrimp head meal, urea, polyphosphate and a few drops of acetic acid in definite proportions in the

Table 2. *Effect of different types of drying on composition of frog waste meals*

	Mode of drying			
	Sun	Tunnel	Hot air at 70°C	Hot air at 98–100°C
Moisture %	8.5	5.4	3.6	5.3
*Crude protein % (TN x 6.25)	67.1	67.5	68.3	67.3
*Fat %	7.6	7.1	7.5	7.2
*Total ash %	21.8	22.3	21.3	21.8
*Acid insoluble ash %	0.4	0.4	0.3	0.3
TVN mg/100 g	28.8	29.0	26.4	25.0
Alpha amino N mg/100 g	50.2	52.5	51.8	50.6
Available lysine g/16g N_2	8.0	8.1	7.9	7.8
Available lysine after storage for 10 months g/16g N_2	7.4	—	7.2	—

*Moisture free basis

Table 3. *Amino acids of frog meal and fish meal samples*

	Frog		Sardine	Miscellaneous fish			Silver belly
Amino acids	1	2		1	2	3	
Arginine	4.1	5.1	6.1	5.9	5.8	6.4	5.2
Histidine	2.4	2.3	3.1	1.8	1.8	2.0	2.4
Lysine	7.8	7.2	7.9	6.2	5.8	6.9	7.7
Tyrosine	2.9	2.4	3.1	2.6	2.6	2.8	—
Tryptophan	0.7	0.8	0.9	0.8	0.7	0.8	0.8
Phenylalanine	4.4	4.9	2.8	2.8	2.9	3.1	3.5
Methionine	2.4	3.2	2.4	2.3	2.1	2.8	2.2
Cystine	0.4	0.4	1.3	0.8	0.9	0.8	—
Threonine	3.4	2.9	3.8	3.1	2.8	3.5	2.9
Leucine	7.4	6.4	6.9	6.2	6.2	6.4	5.2
Isoleucine	5.3	5.2	4.1	3.6	3.4	3.7	4.6
Valine	3.8	4.2	4.9	5.0	4.9	5.1	4.2
Glutamic acid	11.6	10.4	11.4	12.4	11.9	12.7	—
Glycine	2.3	2.9	4.8	4.4	3.0	4.7	—

form of pellets gave encouraging results in the growth and survival of cage cultured prawns. The feed proved to be nutritious with high conversion value and was quite acceptable.

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