CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

Available online at: http://www.iajps.com Research Article

PROXIMATE COMPOSITION, MINERALS, AMINO ACIDS AND FATTY ACIDS STATUS OF SOME FRESHWATER FISHERIES WASTES

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Abstract:

The Present study measurement of proximate composition profiles such as a mineral, amino acid and protein contents in fish by-products is often necessary to ensure that they meet the requirements of food regulations in nutrition aspects and social economic commercial specifications. Minerals are essential nutrients they are components of many enzymes and metabolism and contribute also to the growth of the fish. The human body usually contains a small quantity of these minerals and the deficiency in these principal nutritional elements induces a lot of not working as it reduces productivity and causes diseases. Present studies fish conventional greater than before concentration as a potential foundation of animal protein and essential nutrients for a human being. It should be well thought-out that fish tissue presents elevated nutritional significance and therefore is a particularly optional dietary module. The objective of this work was to analyze the proximate and mineral composition of pre treatment and treatment cultivable fish Labeo rohita.

Keywords: *Proximate composition, Minerals, Amino acids and Fatty acids status, Fisheries wastes.*

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Please cite this article in press R. Rathika and Pugazhendy K., ***Proximate Composition, Minerals, Amino Acids and Fatty Acids Status of Some Freshwater Fisheries Wastes,*** *Indo Am. J. P. Sci, 2017; 04(12).*

INTRODUCTION:

Aquaculture plays a significant role in global food production and economy. According to the [1] China holding the first rank in aquaculture production with annual production of 58.8 million metric tons, followed by Indonesia, India, Vietnam, and the Philippines with annual production of 14.4, 4.9, 3.4 and 2.3 million metric tons respectively during the year 2014. Fish processing is a regular work at the time of marketing and selling to the consumers and it leads to the production of fisheries wastes. It originates almost entirely from land-based processing operations. These wastes must be stored so as to prevent contamination to the environment and should be disposed of in a manner that is not detrimental to the receiving environment.

Water pollution is usually caused by various human sources, typically (point and non-point) industrial facilities and agrochemicals especially in the aquatic ecosystem, has grown up to be a serious environmental problem nowadays. Adversely human activities are directly or indirectly affect the environment. Developed and developing which are progressing rapidly in the field of agriculture, technology and industries are continuously releasing numerous kinds of harmful substances into the biosphere and thereby causing a severe threat to the environment [2]. Natural characteristics of pond waters can greatly limit possibilities for fish culture. One naturally occurring water quality imbalance is the case of pond waters with high total alkalinity and low calcium concentration. Such waters often have excessively high pH, which can limit fish culture. Many times site water quality limitations may be alleviated through management, for example alleviating the problem of high pH and low calcium by applying calcium sulfate (gypsum) to the water to increase calcium concentration. Moreover, some pond water quality variables are strongly influenced by pond bottom soil characteristics. Fish do not grow well in ponds with acidic water, which usually are located on acidic soils, but acidity in ponds can be corrected by liming [3].

Fish processing discards nearly 70 - 85 % of the total weight of the catch and these are generally dumped into land or hauled into the ocean which creates harmful impacts on the environment. Fish processing industries release 32000 thousand tonnes of waste every year in the world [4]. Whereas India generates greater than 2000 thousand metric tonnes of fisheries wastes per year [5] Fish heads, viscera (gut) gills, skin, and fins are discarded as fish waste. Dumping of these waste creating both disposal and pollution problems to the environment [6]. This processing discards the major valuable components, such as nutrients (protein) and enzymes [7].

The majority of these poisonings occur in developing countries where less protection against exposure is made. Knowledge of health risk and safety use is limited or even unknown [8]. Fisheries waste can also be used for the production of various value-added products (proteins, fatty acids, amino acids, minerals, enzymes etc.). Fisheries wastes have been used in food, cosmetics, pharmaceutical, agricultural and aquaculture industries for the production of fishmeal, fish oil, animal feed, pigments, fertilizer, composting, fish protein hydrolysate and fish protein concentrate. The natural compounds including chitin, chitosan, glue, fine Fishes are widely used to evaluate the health of aquatic ecosystems because pollutants build up in the food chain and are responsible for adverse effects and death in the aquatic systems [9]. The random use of different pesticides often causes a lot of damage to the non-target organism. Organophosphate pesticides constitute a large proportion of the total synthetic chemicals employed for the control of pests in the field of agriculture, veterinary practices and public health [10] Nicolas, collagen, gelatin and pearl essence have been prepared from the fisheries wastes.

The utilization of fisheries wastes can help to eliminate harmful effects on the environment and improve the fish processing quality [11-13]. Hence, present study was performed to analyze the proximate composition (crude protein, fiber, lipid, nitrogen-free extract, ash, moisture, and energy), minerals (Na, K, Ca, Mg, Fe and Zn) amino acid and fatty acid contents of four different fisheries wastes, such as *L. rohita, C. catla, C. brachypomum* and *C. batrachus*.

MATERIALS AND METHODS:

Collection and processing of fisheries waste

The wastes including head, skin, viscera, fin, and tail of fish *Rastrelliger kanagurta*, (Indian mackerel) and *Sphyraena barracuda*(Great barracuda and head, legs and shell of shrimp, *Fenneropenaeus indicus* (Indian white shrimp)were collected from Ukkadam fish market in Coimbatore, Tamil Nadu. The waste materials of each species packed in a separate polythene bags and transported to the laboratory. The collected fisheries wastes were sundried for 2 weeks to remove the moisture. Further, the dried waste materials were powered finely using mixer grinder and stored individually in airtight plastic containers at -20˚C until further analysis.

Analysis of proximate components of fisheries waste

Analysis of the proximate composition of fisheries waste is potentially important to serves as a feed ingredient for animals. The proximate composition of fisheries waste including crude protein, lipid, fiber, carbohydrates, ash, moisture, and energy levels were analyzed according to standard procedures.

Heavy trace elements and other mineral salts

Analysis of trace elements, such as Zn, Cu, Cd, Pb and Al, and other mineral salts like Na and K of shrimp species were analyzed according to standard procedures. Briefly, 1 g of each fish was digested separately using 10 ml 9:2:1 ratio of HNO_3, H_2SO_4, and $HClO_4$in a hot plate at 80℃. Further ,the volume was made up to 25 ml, followed by filtered using Whatman filter paper No. 45.T he heavy metals and other minerals were analyzed using Atomic Absorption Spectrometry (GBCHG 3000; Sens AA, Australia 2009) and results were expressed as mg/kg

Estimation of amino acid

From each group, 1 g of fish tissue was accurately weighed and homogenized individually with 2 ml distilled water, to this 1 ml of sodium tungstate and 1 ml 2/3N H_2SO_4 were added. This mixture was then centrifuged at 3000 rpm for 10 minutes and the supernatant was collected. Three test tubes were taken and labeled as blank, test, and standard. 0.5 ml supernatant was added to the test tube 'test', 0.5 to 'standard' and 4.5 ml distilled water was added to both test tubes. 5 ml distilled water was added to the blank. 0.5 ml ninhydrin was pipetted to all test tubes and were cotton plugged. The tubes were kept in boiling water bath until blue color developed. The tubes were cooled and the intensity of the color developed was measured with UV spectrophotometer at 540 nm. Amino acid present in the sample (mg/g) = OD of the sample/ OD of the standard × Conc. of the std. (mg).

Determination of Free fatty acids

Free fatty acids in crude and refined oils were determined by the AOAC method (Association of Official Analytical Chemists) 28.029. This method measures the amounts of sodium hydroxide that is required to neutralize the acids that are formed during oil extraction and refining processes.

Statistical Analysis

All the data were expressed as mean ± SD. The data were analyzed by one-way analysis of variance (ANOVA), followed by Duncan's multiple range test (DMRT) using SPSS (16.0) software to compare the differences among treatments, and differences were considered significant when $P < 0.05$.

RESULTS AND DISCUSSION:

The proximate compositions of different fish wastes meal are shown in Table 1. The level of crude protein, fiber, lipid and gross energy were found to be significantly (P<0.05) higher in *C. batrachus* waste meal, followed by *C. carpio*, *C. catla* and *L. rohita* waste meal, whereas, nitrogen-free extract was found to be significantly (P<0.05) higher in *C. catla* waste meal. The total ash and moisture content were significantly elevated in *L. rohita* waste meal when compared to other fisheries waste meal. The mineral composition in the different fish wastes meal is represented in Table 2. The mineral composition detected were in the following order *C. batrachus*>*C. catla* >*L. rohita*>*C. carpio* meal. The mineral content of the different fish wastes meal was significantly (P < 0.05) difference in a row-wise. Sixteen amino acids were detected in the different fish wastes meal (Table 3). Among these, eight essential amino acids (isoleucine, leucine, lysine, methionine, phenylalanine, threonine, valine and histidine) and eight non-essential amino acids (cystine, tyrosine, arginine, glutamic acid, serine, proline, glycine and alanine) were observed. These essential and non-essential amino acids were found to be significantly (P < 0.05) higher in *C. batrachus* meal followed by *C. carpio*, *C. catla* and *L. rohita* meal.

Table 1. Mineral composition of different fish wastes meal

Mineral (mg/kg)	*L. rohita*	*C. catla*	*C. brachypomum*	*C. batrachus*
Na	154±2.55[b]	145±3.01[d]	149.25±1.45[c]	165.1±4.28[a]
K	168±3.01[b]	182.48±4.73[a]	153.25±3.25[c]	187.92±4.02[a]
Ca	87.56±2.74[b]	84.21±2.51[c]	80.74±3.44[d]	98.47±3.58[a]
Mg	125.98±3.21[a]	134.5±3.3[b]	120.52±3.46[c]	125.87±2.88[a]
Fe	40.12±2.0[a]	41.1±2.21[a]	39.54±1.65a[b]	40.0±2.53[a]
Zn	54.25±1.41[d]	65.21±2.8[a]	60.47±2.54[b]	59.28±2.37[c]

Means bearing different superscripts indicates significant differences in a row (P < 0.05)
Results are expressed as the mean ± standard deviation of three replicates

Table 2. Amino acids levels in different of fish wastes meal

Amino acid		*L. rohita*	*C. catla*	*C.brachypomum*	*C. batrachus*
Essential	*Isoleucine*	0.95 ± 0.01^{c}	1.27 ± 0.02^{b}	1.91 ± 0.07^{a}	2.49 ± 0.25^{a}
	Leucine	3.92 ± 0.02^{c}	4.86 ± 0.01b^{c}	5.26 ± 0.02^{b}	5.94 ± 0.02^{a}
	Phenylalanine	3.69 ± 0.44^{d}	4.85 ± 0.02^{c}	7.25 ± 0.05^{b}	8.15 ± 0.03^{a}
	Theonine	0.46 ± 0.06^{d}	1.16 ± 0.17^{c}	2.35 ± 0.02^{b}	3.15 ± 0.04^{a}
	Valine	2.47 ± 0.06^{d}	3.45 ± 0.43^{c}	4.38 ± 0.26^{b}	6.44 ± 0.72^{a}
	Histidine	1.27 ± 0.08^{d}	2.62 ± 0.32^{c}	3.17 ± 0.02^{b}	4.50 ± 0.27^{a}
Non-Essential	Cystine	0.16 ± 0.01^{d}	0.26 ± 0.02^{c}	0.87 ± 0.02^{b}	1.73 ± 0.03^{a}
	Tyrosine	3.24 ± 0.07^{d}	4.71 ± 0.33^{c}	5.53 ± 0.38^{b}	6.51 ± 0.35^{a}
	Serine	3.57 ± 0.21^{c}	3.67 ± 0.06^{c}	4.58 ± 0.29^{b}	5.95 ± 0.02^{a}
	Glysine	0.06 ± 0.04^{d}	0.16 ± 0.03^{c}	0.22 ± 0.06^{b}	0.96 ± 0.01^{a}
	Alanine	0.97 ± 0.02^{d}	1.33 ± 0.01^{c}	2.21 ± 0.07^{b}	3.29 ± 0.1^{a}

Means bearing different superscripts indicates significant differences in a row ($P < 0.05$)
Results are expressed as the mean ± standard deviation of three replicates

Table 3. Fatty acids levels in different of fish wastes meal

Fatty acid		*L.rohita*	*C.catla*	*C.carpio*	*C.batrachus*
SFA	Lauric acid	0.52 ± 0.11^{b}	0.28±0.13^{b}	1.56±0.09^{a}	0.21±0.02^{b}
	Myristic acid	1.84 ± 0.14^{ab}	1.91±0.12^{a}	1.15±0.13^{c}	0.62±0.01^{d}
	Behenic acid	0.42±0.08^{b}	0.28±0.02^{c}	0.29±0.01^{c}	0.48±0.05^{a}
	Palmiotoleic acid	0.29±0.01^{b}	0.32±0.01^{b}	0.30±0.02^{b}	1.06±0.24^{a}
	∑	23.16	36.76	28.53	16.2
USFA	Oleic acid	7.51±0.85^{b}	9.36±1.02^{a}	6.74±0.92^{c}	6.51±0.58^{c}
	EPA	4.85±0.54^{b}	5.84±0.29^{a}	3.96±0.12^{c}	4.40±0.84^{b}
	DHA	4.72±0.61^{a}	4.01±0.21^{a}	2.16±0.19^{c}	3.83±0.14^{b}
	∑	20.57	21.91	15.72	18.5
∑ SFA and USFA		43.73	58.67	44.25	34.7

Means bearing different superscripts indicate significant differences in a row ($P < 0.05$)
Results are expressed as the mean ± standard deviation of three replicates
SFA: Saturated fatty acids; USFA: Unsaturated fatty acids

Current study, eleven saturated (lauric acid, myristic acid, palmitic acid, stearic acid, arachidic acid, undecylic acid, pentadecanoic acid, heptadecanoic acid, tridecylic acid, behenic acid and palmitoleic acid) and five unsaturated fatty acids (oleic acid, linoleic acid, linolenic acid, EPA and DHA) were observed in different fish wastes meal (Table 3). All these fatty acids were found to be significantly higher ($P < 0.05$) in following order *C. catla*>*C. carpio*>*L. rohita*>*C. batrachus* fish wastes meal. An investigation was conducted to determine the proximate composition of head, gills, and fins of four freshwater fish species are presented in (Table 1). The highest moisture and total ash content was noted 5.25%,34.17% *Labeo rohita*, maximum crude protein *was recorded in 38.92% Colossoma brachypomum* , maximum ether extract and gross energy 26.03%,4667kcal/kg *Clarias batrachus*, the crude fibre percentage was noted in the BDL OD 1.0 (*Labeo rohita*, *Catla catla*, *Colossoma brachypomum*, and *Clarias batrachus*) respectively.

The moisture content recommended by the Regulation of Industrial and Sanitary Inspection of Animal Products (Regulamento da Inspeção Industrial e Sanitária de Produtos de Origen Animal is 12% [14] In the present study the moisture values found for meals of all species were satisfactory. Fish wastes meal (FWM) prepared in the study contained 61.62% crude protein of (*Clarias gariepinus*) [13]. In the present study lower content of crude protein in all the fish species. [11] Found 6.0% moisture in the tilapia-head meal, while for protein and ash, the contents were 38.4 and 19.4%, respectively. In the present study, the fish waste meal presented higher contents of ash and protein. Various volatile compounds that have been detected on both fish species were derived from sample's components, mainly from proteins and lipid content, so that the wide variety of quantities and volatile compounds are related to the variation of chemical compounds contained in the samples. Most of those volatile compounds which contribute to commodities aroma were derived from the results of enzymatic reactions, microorganism activities, lipid auto-oxidation, resulting substance from various thermal involved reactions and environmental impacts [15]. More varieties of volatile compounds than fresh samples have been detected and identified in processed fishery samples and their types and composition would depend on the sample type, chemical composition, and processing methods [16].

Females and males fed diets containing fish residue oil (tilapia residue oil and salmon oil) had an n3/n-6 ratio higher than the minimum values (>0.25) recommended by the World Health Organization for the prevention of coronary heart disease. However, fish of both sexes fed soybean oil demonstrated lower values. Due to the nutritional importance of polyunsaturated fatty acids for humans, it is recommended to feed the fish with fish-oil-based diets, at least during the finishing period [17] in order to ensure appropriate levels of n-3 fatty acids in their organisms. In addition, the use of fish residue as an alternative ingredient to the nutrition of aquatic organisms adds value to the products generated by aquaculture and contributes to the sustainability of this activity.

ACKNOWLEDGEMENTS

The authors are thankful to Department of Zoology, Annamalai University, for the facilities provided to carry out this research work.

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