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Proximate composition of *Pangasiodon hypophthlamus* surimi prepared by different extraction methods

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Abstract
The high nutritional value aquatic foods and its importance in the world, has proved for human. Surimi production is a process that has achieved success in recovering fish protein. Surimi is a stabilized, wet concentrate of myofibril protein of the fish muscle. A variety of tropical marine fish species are utilized for preparation of surimi in India. With the increase in demand of surimi in national and international markets the production is also increased and overexploitation of marine catches has observed. To fulfil the demand and there is need of raw material for the production of surimi. Therefore, freshwater fish muscle can also be used to prepare surimi. The striped catfish (*Pangasianodon hypophthalmus*) muscle protein was extracted using conventional method, alkaline-saline washing method and pH-shift processing and then the biochemical and functional characteristics were compared with conventional surimi prepared marine tropical fish. With regard to proximate composition highest moisture content was observed in alkaline-saline washing method 83.64±0.71%, while highest protein content was observed in conventional method 14.36±0.17%, lipid and ash content were low in all the surimi samples.

Keywords: Surimi, pH-shift processing, proximate composition

Introduction
Fish is consumed in many developing countries as a primary source of protein. As per FAO estimates, in year 2017, about 17% of total animal protein and 7% of all proteins consumed globally were contributed by fish species. The global fisheries and aquaculture production has reached to 178.5 million tonnes showing an increasing trend in aquaculture production. Statistically, during last five decades, the global food fish consumption has increased at the average annual rate of 3.1 percent and almost twice compared to 1.6 percent annual world population growth rate (FAO, 2020) [6]. Fish is a valuable source of fatty acids (including the omega-3 polyunsaturated fatty acids (n-3 FAs), micronutrients (P, I, Zn, Fe, and Se) vitamins (D, A, and B) with variations among species due to habitat, trophic level, diet, etc. Fish is deemed as one of the best foods for kids and convalescents owing to a range of micronutrients. In the global market, fish and fishery products are the most traded food commodities in different continents of the world. In 2018, about 88 percent (156 million tonnes) of world fish production was utilized for direct human consumption while, 67 million tonnes, or 38 percent of total fisheries and aquaculture production, were traded internationally

Lifestyle changes, lack of time and working environment have forced to divert towards preference of ready to cook products. The growth of the ready meals market is governed by convenience, timesaving, and less effort required for the preparation of these meals.

Therefore, demand for such products by the working population has increased which has trigged the manufacturers to focus on developing innovative products to capture the market demand. Surimi is produced by repeatedly washing of mechanically separated fish flesh with chilled water (5 °C) until most of the water-soluble proteins were removed. As stated by Lanier and Lee (1992) [11], the washing process has its own importance for maintaining quality of surimi because it removes fat and undesirable materials (blood, pigments and odorous substances) and increases the concentration of myofibrillar protein, thereby improving gel-forming ability. Textural properties of muscle protein-based gel and emulsion type comminuted products depends on the myofibrillar proteins (Fukazawa *et al*., 1961) [7].

To improve quality of Surimi an alternative method was introduced by Hultin and Kelleher, (2000) [9] the pH-shift processing, the major aim of this method, a large amount of sarcoplasmic proteins are recovered and which leads to increase in yield. Methodologically, the major difference has been noticed in washing process. In conventional method, repeated washing is carried out while in pH-shift processing, alternate acid and alkaline wash is given. According to the research studies, Hultin and Kelleher, (2000) [9] stated that pH-shift method gives higher percentage protein than conventional method. Using pacific whiting fillets, a conventional three-washing cycle surimi processing yielded only 40% recovery compared with 60% recovery using acid-aided processing (Choi and Park, 2002) [4]. So, pH-Shift processing can be considered as a potential alternative method for recovery of protein in surimi preparation. The extraction mechanism of these two processes is to dissolve muscle protein at low or high pH by centrifugation to separate soluble protein, bone, skin, connective tissue, cell membrane and neutral lipid. Collect and recover the solubilized protein by isoelectric precipitation to provide a functional and stable fish protein isolate (FPI) (Kristinsson *et al*., 2006) [10]. So, the objective of the present study, examine the nutritional composition of the surimi extracted by different methods.

Material and Methods

Material

Raw material

Freshly caught sutchi catfish (*Pangasianodon hypophthalmus*) with the size of 1-1.5 kg were procured from local aquaculture farm located, Chiplun, Maharashtra and transported to laboratory of College of Fisheries, Ratnagiri in polystyrene foam boxes filled with ice (1:1).

Methods

Extraction methods of Surimi

Conventional method: Conventional surimi was prepared according to the method given by Chaijan *et al*. (2010) [3]. The fish mince was washed with cold water (4 °C), using water to mince ratio of 3:1 (v/w), the mixture was stirred gently for 10 minutes and the washed minced was filtered with a layer of cheese cloth, and dewater it by squeezing. Washing was preformed three times. Third washing step was carried out with 0.5% Nacl solution, the ratio of mince to Nacl solution was 1:3 (w/w). Cryoprotectants such as 0.2% sodium tripolyphosphate and 4% sucrose were added to washed mince. The surimi was frozen in plastic bag at -40 °C and stored at -20 °C.

pH-shift processing

The pH-shift processing involves, acid-alkali solubilization process which was performed as per the protocol given by Hultin and Kelleher (2000) [9]. The fish mince was homogenized at a 1:9 (w/v) ratio with cold distilled water (4 °C). The pH of the homogenate was adjusted to 11.2 by using 2N NaOH for alkaline and 2.5 by using 2N HCl for acid extraction process. The reaction was carried out for 40 minutes with frequent stirring, later centrifuge the homogenate at 6,000g for 20 min at 4 °C. The alkaline soluble fraction was collected and adjusted to isoelectric point of muscle protein (pH 5.5) by using 2N NaOH or 2N HCl respectively. After filtration water content of precipitate was removed by centrifugation at 6000×g for 20 min at 4 °C. Finally, pH of the sample was adjusted to 7.0 and mixed with cryoprotectants (4% sucrose and 0.2% tripolyphosphates) and mince was frozen at -40 °C and stored at -20 °C.

Alkaline-saline water washing method: For alkaline–saline washing process, surimi was prepared according to the method of Shimizu (1965) [15]. The mince was suspended in cold (4 °C) alkaline-salt solution (0.15% NaCl in 0.2% $NaHCO_3$) at a mince/solution ratio of 1:4 (w/w). The mixture was stirred gently for 15 min and washed mince was filtered using maslin cloth. The washing process was repeated thrice. For the fourth washing, cold 0.5% NaCl solution was used. Finally, the washed mince was subjected to centrifugation for 10 min. To the washed mince, cryoprotectants (4% sucrose and 0.2% tripolyphosphates) were added, packed in polyethylene bag and frozen at -40 °C and stored at -20 °C until further use.

Proximate composition

Moisture content, protein, lipid and ash content of conventional surimi was determined as per standard methods (AOAC, 2015) [1].

Result and Discussion

Proximate composition of surimi extracted by different extraction methods

In the present study, the proximate composition results of all the samples presented in table 1. The moisture was highest in ASW surimi (83.63%) followed by ACS (83.59%), ALS (82.78%) and CON (81.77%).

Table 1: In the present study, the proximate composition results of all the samples presented

	Extraction methods		Moisture	Protein	Lipids	Ash
1	Conventional method (CON)		81.77±0.45	14.36±0.17	2.49±0.24	0.52±0.26
2	pH-shift processed method	Alkaline-aided surimi (ALS)	82.78±0.35	13.82±0.28	1.83±0.06	0.76±0.21
		Acid-aided surimi (ACS)	83.59±0.17	13.12±0.50	1.55±0.21	0.78±0.12
3	Alkaline-saline washing method (ASW)		83.64±0.71	13.48±0.36	2.16±0.19	0.59±0.18

Values are mean±SD, n=3.

The increase in moisture content can be attributed to hydration of myofibrillar proteins due to washing (Suvanich *et al.*, 2000) [16] and due to the pH effect (Dawson *et al.*, 1988) [5], wherein as pH increases there would be an increase in the space between peptide chains resulting from repulsion between protein groups of like charges, allowing more water to enter and occupy the tissue. At a time of washing process, some amount of water was held by the meat which was responsible for increase in moisture content of washed meat compared to unwashed mince (Gaikwad *et al*. 2018) [8]. The highest moisture content was observed in acid surimi because the presences of active groups in protein structure which will attract more water (Shabanpour and Etemadian, 2016) [14]. Due to change in protein structure at

the pH 11.0, results in reduction of moisture content in alkali surimi (Shabanpour and Etemadian, 2016) [14]. The lowest moisture content was found in conventional surimi. The moisture content of conventional surimi is within the range which is suggested for surimi.
The protein content was observed highest in CON (14.36%), followed by ALS (13.82%), ASW (13.48%), ACS (13.12%). The higher protein content was in conventional surimi due to the lower moisture content. The highest was observed in CON can be due to the presence of calcium which might have improved protein–calcium–protein bonds during the production of thermal induced gels (Barrera *et al.*, 2002) [18].
The fat content was observed in the order of 2.49%, 2.16%, 1.83% and 1.55% in CON, ASW, ALS and ACS respectively. Rawdkuen *et al*. 2009 [13], observed in reduction of lipid content in washed fish muscle was due to washing and pH-shift processing. During the study it was observed that acid surimi followed by alkali surimi shows low fat values, it may be because of pH-shift processing the proteins are completely solubilized and separated from storage lipids and membrane of phospholipids due to low and high pH used for extraction (Panpipat and Chaijan. 2016) [12]. The first centrifugation step allowed the sedimentation of phospholipids at bottom layer and neutral lipids at top. The alkaline process showed lower removal of lipid due to the reaction between alkali and lipid to form soap (Hultin and Kelleher. 2000) [9]. In Alkaline-saline washing method the highest fat content was observed in mince (4.66%) whereas lowest for 1:4 mince: water ratio (2.66%), due to increase in washing cycles. With regard to ash content was observed higher in ACS (0.78%) followed by ALS (0.76%), AWS (0.59%) and CON (0.52%). The ash content in ACS was higher than the ALS, AWS and CON surimi. Marmon and Undeland (2010) reported that the amount of ash should be seen as a measure of impurities and it is of great importance to reduce it to concentrate the protein.

Conclusion
The production of surimi is an important technological advance considering the ease of storage in frozen conditions for preparation of imitation products. Striped catfish (*Pangasinodon hypophthalmus*) was selected for preparation of Surimi due to its easy availability and low cost. Proximate composition values suggest that surimi prepared from different extraction method gives promising results and useful to produce homogenous blends for the production of surimi products.

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References
1. AOAC. Official methods of analysis (17th Edn.). Washington, DC: Association of official Analysis Chemists, 2015.
2. Barrero M, Bello RA. Characterization of sardine minced flesh (*Sardinella aurita*) washed with different solutions. Journal of Aquat. Food Prod. Technol. 2000;9:105-114.
3. Chaijan M, Panpipat W, Benjakul S. Physicochemical and gelling properties of short bodied mackerel (*Rastrelliger brachysoma*) protein isolate prepared using alkaline-aided process. Food Bioproducts Process. 2010;88:174-180.
4. Choi YJ, Park JW. Acid-aided protein recovery from enzyme-rich Pacific whiting. Journal of Food Science. 2002;7(8):2962–2967.
5. Dawson P, Sheldon B, Ball H. Extraction of lipid and pigment components from mechanically deboned chicken meat. Journal of Food Science. 1988;53:1615–1617. doi:10.1111/j.1365-2621.1988.tb07798.x.
6. FAO. The State of World Fisheries and Aquaculture 2020 (SOFIA). Sustainability in action. Rome, 2000.
7. Fukazawa T, Hashimoto Y, Yasui T. Effect of storage conditions on some physico-chemical properties in experimental sausage prepared from fibrils. Journal Food Science. 1961;26:541.
8. Gaikwad BV, Pagarkar AU, Chogale ND, Mohite SA, Chaudhari KJ, Kudale AS, *et al*. Effect of washing processes on quality parameters of surimi prepared from lesser sardine (*sardinella spp.*). Journal of Entomology and Zoology Studies. 2018;6(5):2202-2208.
9. Hultin HO, Kelleher SD. High efficiency alkaline protein extraction. U.S. patent 6, 136, 959. University of Massachusetts, 2000.
10. Kristinsson HG, Theodore Ann E, Demir N, Ingadottir B. A comparative study between acid and alkali-aided processing and surimi processing for the recovery of proteins from channel catfish muscle. Food Chemistry and Toxicology. 2006;70(4):298-306.
11. Lanier TC, Lee CM. Surimi technology. New York: Marcel Dekker, 1992.
12. Panpipat W, Chaijan M. Biochemical and physicochemical characteristics of pH- shifted protein isolates from bigeye snapper (*Priacanthus tayenus*) head by-product. Turkish Journal of Fisheries and Aquatic Science. 2016;16:41-50.
13. Rawdkuen S, Sai-Ut S, Khamsorn S, Chaijan M, Benjakul S. Biochemical and gelling properties of tilapia surimi and protein recovered by acid-alkaline process. Journal of food chemistry. 2009;112(1):112-119.
14. Shabanpour B, Etemadian Y. Chemical changes and shelf-life of conventional surimi and proteins recovered using pH change method from common carp (*Cyprinus carpio*) muscle during 5 months storage at -18ºC. Iranian Journal of Fisheries Sciences. 2016;15(1):311-332.
15. Shimizu Y. Manufacturing method of leached meat, Japanese patent, Showa, 1965, 40-212224.
16. Suvanich V, Jahncke M, Marshall D. Changes in selected chemical quality characteristics of channel catfish frame mince during chill and frozen storage. Journal of. Food Science. 2000;65:24-29.
17. Undeland I, Kelleher SD, Hultin HO. Recovery of functional proteins from herring (*Clupea harengus*) light muscle by an acid or alkaline solubilization process. Agricultural and Food Chemistry. 2002;50:7371-7379.

18. McKay HG, Glasgow RE, Feil EG, Boles SM, Barrera Jr M. Internet-based diabetes self-management and support: initial outcomes from the Diabetes Network project. Rehabilitation Psychology. 2002 Feb;47(1):31.