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Proximate and fatty acid compositions of different body portions in cultured *Pangasianodon hypophthalmus* (Sauvage, 1878)

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ABSTRACT

The present study compared proximate composition and fatty acid profiles of three different body portions viz., dorsal, caudal and belly regions, in cultured *Pangasianodon hypophthalmus* procured from farms in Andhra Pradesh. The proximate composition revealed significant ($p \leq 0.05$) variation in total fat with belly portion having 22.32% compared to 0.41 and 2.54% in dorsal and caudal portions respectively. The protein content was higher (18.97%) in caudal region, whereas ash (1.19%) and moisture (78.18%) contents were higher in dorsal portion. A total of 27 fatty acids were unveiled by fatty acid profiling, of which saturated fatty acids were the major contributors with a higher concentration of 66.45% in belly portion. Health beneficial n-3 polyunsaturated fatty acids (PUFA) like eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) were found in the range of 0.19 to 0.45% and 0.56 to 2.02% respectively. Relatively higher amounts of n-9 fatty acids were also observed indicating deficiency of dietary essential fatty acids (EFA).

Keywords: Body portions, Fatty acid, Nutrient composition, *Pangasianodon hypophthalmus*

Pangasianodon hypophthalmus (Sauvage, 1878) commonly known as sutchi catfish (family Pangasidae), is a native of Mekong River Delta in Vietnam and Chao Phraya Basin in Thailand. Vietnam can be considered as the world leader in production of the species (Globefish, 2012). It is a fast growing and widely cultured species in the inland sector, mainly in the states of Andhra Pradesh and West Bengal in India. However, presently there is a major challenge of steep decline in farm-gate price to below ₹50 per kg (Padiyar *et al.*, 2014) owing to limited demand, coupled with surplus production. Alternative marketing solutions are sought in order to help the industry to curtail price fluctuation and to cope up with the considerable financial losses incurring to the farmers. The fillets are characterised by white or pale pink coloured flesh, absence of fishy odour, small bones, delicate and firm texture. These attributes help in the preparation of value added products which can considerably enhance the market acceptability (Orban *et al.*, 2008). In this backdrop, nutrient profiling of *P. hypophthalmus* cultured in Andhra Pradesh was done. The objective of the study was to analyse the proximate composition and fatty acid profile of the dorsal, belly and caudal regions of *P. hypophthalmus* to develop appropriate processing methods for its utilisation.

A total of 6 nos. of freshly caught *P. hypophthalmus* (mean weight 1 ± 0.4 kg) were procured from farms in Andhra Pradesh, stored in iced condition and transported to the laboratory within 48 h. Meat was sampled separately from dorsal, belly and caudal regions (Fig. 1) from all the 6 fishes and pooled. Proximate composition of the samples were determined by the method as described in AOAC (2000). Moisture content was determined using automatic moisture analyser (model IR 120, Denver, Germany). Crude protein and crude fat contents were determined by Kjeldahl method and Soxhlet extraction method respectively. Extraction of lipid from the samples was done following Folch method (Folch *et al.*, 1957) with slight modifications as described in Ramesh *et al.* (2013). The extracted lipid was used for fatty acid methyl ester (FAME) preparation (AOAC, 2000), which was subsequently analysed using a Shimadzu QP 2010 quadrupole Gas Chromatograph Mass Spectrometer (GC-MS) equipped with a carbowax (30 m \times 0.25 mm ID; 0.25 μ m film thicknesses) capillary column (Cromlab, S. A). Statistical analyses of data were carried out using statistical package for social science software (SPSS VERSION 16.0, Chicago IL. USA).

Proximate composition showed significant ($p \leq 0.05$) variations in all the three body portions (Table 1). Protein, moisture and ash contents were inversely proportional to

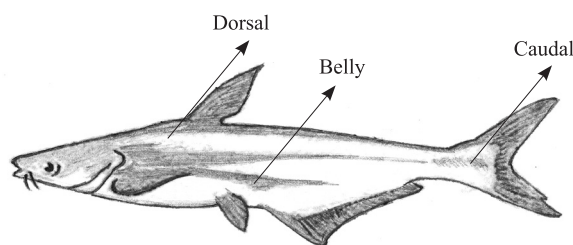


Fig. 1. Picture showing different portions of *P. hypophthalmus* used for analysis (Source: www.fao.org)

Similar pattern of SAFA distribution was reported by Men *et al.* (2005) for *P. hypophthalmus* in Vietnam. The total PUFA content was higher in the dorsal portion (20.82%), followed by caudal (16.61%) and belly (14.39%) portions. The maximum amount of PUFA obtained in the present study is higher than the previous reports of 17.74% in Tra catfish fillets from Vietnam (Ho and Paul, 2009) and 12.5-18.8% in Vietnamese sutchi catfish (Orban *et al.*, 2008), but lesser when compared to reports of PUFA (24%) in Asian catfish *Pangasius bocourti* (Thammapat *et al.*, 2010).

Table 1. Proximate composition (%) of different portions of *Pangasianodon hypophthalmus*

Proximate composition (%)	Dorsal	Caudal	Belly
Moisture	78.18±0.83 ^b	77.83±2.01 ^b	66.99±1.14 ^a
Crude Protein	18.23±0.73 ^b	18.97±0.73 ^b	11.67±1.12 ^a
Crude fat	0.42±0.07 ^a	2.54±0.55 ^a	22.32±1.32 ^b
Ash	1.19±0.02 ^c	1.06±0.01 ^a	0.41±0.01 ^b

the fat content. Moisture content was higher in the dorsal (78.18%) than in the belly portion (66.99%). Ash content varied significantly, with a higher proportion in dorsal (1.19%) followed by caudal and belly portions. There was considerable variability in lipid content amongst all portions, ranging from 0.42% in dorsal followed by 2.54% in caudal to 22.32% in belly. Crude protein was found more concentrated in caudal portion (18.97%) than in belly (11.67%). The results are consistent to those of Rao *et al.* (2013) who studied the proximate composition of *Pangasius* fillets and reported a moisture content of 78.2%, crude fat 2.84% and ash content of 1.3%. Generally, the protein and fat contents of cultured fish are dependent on movement of fish muscle and also feeding (Thammapat *et al.*, 2010). Murthy *et al.* (2012) also reported similar observations in yellow fin tuna with a high fat content of 7.52% in the belly flap compared to other parts. This variation demonstrates the need for utilisation of different body portions of fish for different types of products, for *e.g.*, protein-rich portion can be utilised for production of surimi and fatty portions can be used for preparation of products like sausages.

Table 2 shows significant ($p \leq 0.05$) variation in the distribution of fatty acids amongst different body portions. Saturated fatty acids (SAFA) were most predominant in all tissues, with 66.45%, 53.53 and 45.05% in belly, caudal and dorsal regions respectively. Similar results have been reported for Tra catfish fillets from Vietnam (Ho and Paul, 2009). Palmitic acid (C16:0) was the predominant fatty acid among SAFA in all the body portions analysed, which is consistent with that of freshwater channel cat fish (*Ictalurus punctatus*) (19.2%) (Sathivel *et al.*, 2002), and freshwater rainbow trout (*Oncorhynchus mykiss*) (21.3%) (Haliloglu *et al.*, 2004). Next to palmitic acid, stearic acid (C18:0) was the dominant SAFA, constituting 28.94% in belly region.

Table 2. Fatty acid profiles (%) of total lipids in different body portions of *P. hypophthalmus*

Fatty acids	Dorsal	Caudal	Belly
C12:0	0.36±0.10	0.19±0.13	0.14±0.06
C14:0	4.13±0.42	6.15±0.09	7.21±1.59
C15:0	0.26±0.05	0.28±0.08	0.34±0.12
C16:0	30.95±1.23	30.08±3.84	29.18±1.65
C16:1(n-9)	0.70±0.02	0.38±0.04	1.38±0.23
C16:1(n-7)	1.62±0.40	1.58±0.19	1.21±0.11
C17:0	0.25±0.10	0.28±0.08	0.36±0.19
C18:0	8.91±0.23	16.13±8.67	28.94±4.56
C18:1(n-9)	31.4±4.6	26.4±4.12	13.16±1.93
C18:2(n-6)	7.88±1.48	8.39±2.60	8.69±1.73
C19:0	ND	0.08±0.02	0.13±0.01
C18:3(n-3)	0.39±0.01	0.67±0.30	1.15±0.02
C20:0	0.19±0.01	0.24±0.13	0.41±0.10
C20:1(n-9)	1.22±0.11	1.86±0.52	2.59±0.31
C20:2(n-9)	0.47±0.13	0.47±0.14	0.55±0.04
C20:3(n-9)	1.98±0.88	1.42±0.63	1.13±0.11
C20:3(n-7)	1.89±0.39	1.19±0.36	0.94±0.18
C20:4(n-6)	2.78±0.90	1.46±1.28	0.56±0.01
C20:3(n-3)	ND	0.05±0.01	0.09±0.02
C20:4(n-3)	0.17±0.01	0.09±0.01	0.11±0.01
C20:5(n-3)	0.45±0.40	0.28±0.25	0.19±0.15
C22:0	ND	0.14±0.01	0.19±0.02
C22:1(n-9)	ND	0.25±0.01	0.33±0.10
C22:4(n-6)	0.60±0.01	0.3±0.01	0.14±0.01
C22:4(n-3)	0.63±0.01	0.23±0.14	0.13±0.01
C22:5(n-3)	1.59±0.50	0.78±0.54	0.22±0.12
C22:6(n-3)	2.02±1.6	1.05±0.94	0.56±0.13
Σ SAFA	45.05±0.43	53.53±2.98	66.45±1.59
Σ MUFA	34.94±2.22	30.45±1.77	18.67±0.78
Σ PUFA	20.82±0.57	16.61±0.71	14.39±0.47
Σn-3/ Σn-6	0.46	0.31	0.29

The major contributor of PUFA was linoleic acid (C18:2, n-6), with values ranging from 7.88% in dorsal to 8.69% in belly region, followed by arachidonic acid (C20:4, n-6). The major health beneficial PUFA like EPA and DHA were found to be in the range of 0.19 to 0.45% and 0.56 to 2.02% respectively in the belly and dorsal

regions. The EPA content observed is relatively higher when compared to the levels reported previously (0.31%) for the same fish from Vietnam by Ho and Paul (2009) and in Asian catfish (0.30%) by Thammapat *et al.* (2010). On the whole, a higher proportion of n-6 PUFA content and low n-3/n-6 ratio values (0.29-0.46) were observed for *P. hypophthalmus*, an attribute common to most of the freshwater species (Henderson and Tocher, 1987). Relatively higher amounts of n-9 poly unsaturated fatty acids like C20:1, n-9 (1.22 to 2.59%) and C20:3, n-9 (1.13 to 1.98%) were observed. Presence of these n-9 fatty acids in fish muscle indicates deficiency of dietary essential fatty acids (EFA) such as linoleic acid and alpha linolenic acid (Olsen *et al.*, 1990). The ratio between C20:3, n-9 and arachidonic acid (C20:4, n-6) can be used as indicator for EFA deficiency. A ratio more than 0.4:1 indicates EFA deficiency (Masson, 1981). The ratio obtained in the present study is 0.71:1, which coupled with the relatively high levels of n-9 fatty acids observed, gives an indication that the fish is deficient in EFAs. Further, the low levels of EPA and DHA also support the status of feed given to the fish, as the lipid profile of fish muscle varies depending on the diet administered, apart from species-specific genetic factors (Orban *et al.*, 2008). These findings point towards the need for appropriate feed formulation for *P. hypophthalmus*, taking into consideration the essential fatty acid requirements.

The data obtained from the study throws light on the nutritional composition of various body parts of the sutchi catfish. The results indicate that the proximate composition and fatty acids distribution in *P. hypophthalmus* varied markedly in different regions of the body. The presence of higher amounts of n-9 fatty acids and lower amounts of EPA and DHA, indicate essential fatty acid deficiency in *P. hypophthalmus*. Hence there is need for appropriate feed formulation strategies for its farming. The dietary supplementation of these fatty acids would result in quality improvement of the fish. The baseline data generated on nutritional composition of different portions of the fish would be of use for both the consumers as well as processors in utilising different body portions of the fish appropriately.

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