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PROXIMATE AND MINERAL COMPOSITION OF NATIVE AND HYBRID CLIMBING PERCH, *ANABAS TESTUDINEUS*

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Abstract

Climbing perch (*Anabas testudineus*) of native and hybrids were selected for this study which was conducted during January, 2017 and December, 2017. The objective was to compare the proximate composition and the effect of cooking methods on the nutrient components *viz.* protein, fat, ash, moisture, minerals of the fish. The native samples were collected from two different points of the Meghna River at Chandpur and Bhairab Bazar and hybrids were from two culture ponds of Gazipur and Narshingdi. Natives contained less amount of protein than hybrids where minerals were vice versa in both raw and fried stage. Hybrids contained higher amount of average protein (20.80% and 26.30%), fat (13.10% and 20.90%) and energy (203.50Kcal and 304Kcal) than native samples at both raw and fried stages. But natives had slightly higher amount of average minerals in per 100 g of fish *viz*. Na (128.95 mg and 134.84 mg), Ca (251.03 mg and 242.80 mg), Mg (30.86 mg and 27.95 mg), P (158 mg and 161.90 mg), Fe (2.13 mg and 1.99 mg), Zn (1.16 mg and 1.09 mg) and Cu (0.46 mg and 0.42 mg) than hybrids in both stages. Cooking method specially the fried method has impact on fish nutrition concentration because of removal of moisture.

Key words: *Native, hybrid, Anabas testudineus, proximate composition, mineral composition, raw stage, fried stage.*

Introduction

Fish is an integral part of life of the people of Bangladesh from time immemorial, and play a major role in employment, nutrition, wage earnings and other aspects of the economy. It is a nutritious food and an excellent source of the much needed animal protein in the human diet, also being rich in essential vitamins and minerals (Marimuthu *et al.,* 2012).It is a natural complement to rice in the national diet. Fish consumption has undergone major changes in the past four decades. Nowadays hybrid fish are more popular among the consumer for their availability, nutrition value and cheaper price. The value of fish protein is very high. It is better than meat protein and, although inferior to milk and egg protein, has a stable composition of essential amino acids, with slight

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deficiencies of methionine and threonine, and an excess of lysine very important if we take into account the fact that this latter amino acid is lacking in cereals (Lozano *et al.* 2003). The proximate and mineral composition analysis is important because it provides useful information to the nutritionists concerned with readily available sources of low-fat but high-protein foods and to the food scientist who are interested in developing them into high-protein foods while ensuring their finest quality, flavour, colour, odour, texture and safety for the consumers (Jabeen and Chaudhry, 2011). Wild and farmed fish vary in nutrients (Netteton & Exler, 1992).They also varied in sensorial, chemical and physical properties (Lindsay *et al*. 1980). Sometimes there is a common myth present at our country that hybrid species contain lower nutritive values and natives are always rich in nutrition good in taste and flavour. But for the vast population, we have to rely on hybrid species nowadays, as it is fast growing and can be cultured in pond.

In traditional method fishes are fried before cooking. Several steps are followed to cook the fish *viz.* boiling, deep frying with edible cooking oil, grilling, and/or roasting over fire. However, the fact that cooking alters the nutrient content in foods underscores the need to understand nutritional effects of different food cooking methods. Literatures on the composition of fish in different methods of cooking are reviewed. For example, Gonzalez *et al.* (2006) had studied on the composition of mineral, fatty acid and amino acid contents, proximate composition, texture, colour and sensory analysis of farmed and wild yellow perch (*Perca flavescens*). Rahman *et al.* (2012) studied on the effect of deep frying on proximate composition and micronutrient of Indian mackerel (*Rastrellige kanagurta*), eel (*Monopterus albus*) and cockle (*Anadara granosa*) and found high protein content in Indian mackerel and eel. Wahengbam and Sarojnalini (2012) worked on the impact of different cooking method on proximate and mineral composition and sample species was *Amblypharyngodon mola*. On the basis of consumer's top preference of the fish it was selected for the study whether native or hybrid climbing perch (*Anabas testudineus*) is better in nutritional composition. This study evaluated the effects of cooking both native and hybrid fish by frying on its proximate (protein, fat, ash and moisture) and minerals (calcium, magnesium, zinc, iron and phosphorus) composition.

Material and Methods

Fish samples were collected from four different sites both native and hybrid species from January, 2017 to December, 2017. Native fishes were collected from two points the Meghna River, one from Chandpur point (Site 1) and other from Bhairab Bazar Point (Site 2). Hybrid fishes were collected from two different cultural fish ponds, one from Gazipur (Site 3) and other form Narsingdi (Site 4). Fresh fishes were shifted to the laboratory for analysis. The whole experiments were done at Fish Technology Research Laboratory, Institute of Food Science and Technology (IFST), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka. Fishes were transported to laboratory with isolated iceboxes. Samples were washed thoroughly with distilled water after

reaching to the laboratory. Then degutted and washed again. The edible parts were cut into small pieces for chopping and were used for the estimation of proximate composition. Mineral solution also made for essential minerals tests. For fried stage, the fishes were washed properly and degutted. The edible parts of fishes were fried with soybean oil for 4 minutes at 80° C and then other procedures were followed one by one as like the procedure of raw stage. All proximate analyses (moisture, ash, protein, lipid, energy and minerals) of raw and fried samples were done following the standard method described in the AOAC manual (AOAC, 2005).

Moisture content was determined in triplicate by using following formula:

$$\text{Moisture (\%)} = \frac{\text{Original sample weight (g)} - \text{Dried sample weight (g)}}{\text{Original sample weight (g)}} \times 100$$

The ash content was calculated and expressed as percentage of the original sample using the following formula:

$$\text{Ash(\%)} = \frac{\text{Weight of ash(g)}}{\text{Weight of sample(g)}} \times 100$$

Kjeldahl method was used to determine protein content of the fish samples. The data were obtained by duplicating analyses for protein. The following formulas were used to determine protein:

$$\text{Nitrogen (\%)} = \frac{\text{Milliequivalent of nitrogen}(0.014) \times \text{Titrant value(ml)} \times \text{Strength of HCl}}{\text{Weight of sample(g)}} \times 100$$

Crude protein (%) = 6.25 ×Nitrogen %

Lipid content was determined by Soxhlet apparatus using acetone as solvent. The percentage of total lipid was calculated using the following formula:

$$\text{Total lipid (\%)} = \frac{\text{Weight of lipid (g)}}{\text{Weight of sample (g)}} \times 100$$

The carbohydrate content of fish sample was calculated by subtracting the sum value (per 100 g) of moisture, ash, protein and fat from 100.

Carbohydrate (%) = 100 – (% of moisture + % of protein + % of ash + % of fat)

The energy of fish sample was calculated by multiplying carbohydrate, protein and fat by the factors 4.1, 4.1 and 9.1 respectively.

Energy = (% of carbohydrate × 4.1) + (% of protein × 4.1) + (% of fat × 9.1)

Calcium (Ca) and magnesium (Mg) were bring determined by titration method. Sodium (Na) was estimated through flame photometer. On the other hand, iron (Fe), phosphorus (P), zinc (Zn) and copper (Cu) were analyzed by spectrophotometric method.

Results and Discussion

At raw stage in native climbing perches found average moisture, protein, fat, ash and carbohydrate as 69.75%, 18.35%, 9.05%, 1.61% and 1.41%, respectively whereas in hybrids of same condition represents as 64.92%, 20.80%, 13.10%, 1.13% and 1.34%, respectively. Native fishes showed higher amount of moisture, ash and carbohydrates than hybrids. But hybrids on the other hand contained higher amount of protein and fat. The highest amount of protein (22.10%) and fat (13.50%) was found in raw stages of fish collected from site 3 and the lowest value of protein (17.40%) and fat (8.50%) were in fishes of site 2 (Table 1).

Same fishes after fried condition showed different result due to heat activity and removal of moisture. In these fish average moisture, protein, fat, ash and carbohydrate were found as 57.03%, 23.20%, 15.78%, 1.91% and 1.80%, respectively whereas hybrids carried as 49.65%, 26.30%, 20.90%, 1.61% and 1.65%, respectively (Table 2). Similar higher values of moisture, ash, and carbohydrate were reserved after fried stage of native and hybrids as like raw stage.

Hasan *et al.* (2018) worked on spotted snakehead and found 74.14% moisture, 17.75% protein, 2.8% fat, 2.89% ash. 0.73% carbohydrate and 101Kcal energy in raw condition. In the above result, the moisture content decreased at fried stage and the same result was reported by Bandarra (2009) in raw and cooked Black Scabbar fish *(Aphanopus carbo).* The fat value is very much higher than some other commercial native fish of Bangladesh like Shoal (*Channa striatus*), Lata (*Ophiocephalu spunctatus*) and Shingi (*Heteropneustes fossilis*) whose fat content was 0.64%, 1.08% and 1.23%, respectively estimated by Qudrat-I-Khuda *et al.* (1962). Usually moisture and lipid contents are inversely related and their sum is approximately 80% (FAO, 1999).The present study shows that hybrids contained higher amount of protein and fat than natives also coincides with preceding studies of Kamal *et al.* (2007).The ash content was 1.70% for natives and 1.21% for hybrids which were nearer to the result of Abimbola (2010) found in *Tilapia melanotheron* which contained 1.30% and 1.06%. Ali (1992) studied on different cooking methods affecting nutrients composition of fish and found higher fat, ash and carbohydrate contents and lower moisture content in fried stage than raw samples, support the above results. Adeyemi *et al.* (2013) found highest concentration of protein, fat (7.45 - 8.87%), ash (26.20%) and fibre (17.33%) in different processing methods of *T. trachurus* which was quite similar to the above results. Marimuthu *et al.* (2012) studied that fried striped snakehead contained highest amount of protein (17.30%), fat (10.70%) and ash (1.60%) and lowest amount of moisture (71.60%) than raw fish.

Table 1.Proximate composition of native and hybrid climbing perch at raw stage.

Proximate composition	Native fish			Hybrid fish		
	Site 1	Site 2	Average±SE	Site 3	Site 4	Average±SE
Moisture (%)	68.30	71.20	69.75±1.45	62.60	67.23	64.92±2.32
Protein (%)	19.30	17.40	18.35±0.95	22.10	19.50	20.80±1.30
Fat (%)	9.60	8.50	9.05±0.55	13.50	12.70	13.10±0.40
Ash (%)	1.70	1.51	1.61±1.05	1.05	1.21	1.13±0.08
Carbohydrate (%)	1.40	1.42	1.41±0.01	1.70	0.97	1.34±0.37
Energy (Kcal)	172	154	163.00±9.00	208.00	199.00	203.50±4.50

Table 2.Proximate composition of native and hybrid climbing perch at fried stage.

Proximate Composition	Native fish			Hybrid fish		
	Site 1	Site 2	Average±SE	Site 3	Site 4	Average±SE
Moisture (%)	55.35	58.70	57.03±1.68	48.20	51.09	49.65±1.45
Protein (%)	24.70	21.70	23.20±1.50	27.90	24.70	26.30±1.60
Fat (%)	16.05	15.50	15.78±0.28	20.30	21.50	20.90±0.60
Ash (%)	2.20	1.62	1.91±0.29	1.70	1.51	1.61±0.10
Carbohydrate (%)	1.70	1.90	1.80±0.10	2.10	1.20	1.65±0.45
Energy (Kcal)	254.00	237.00	245.50±8.50	307.00	301.00	304.00±3.00

Energy content

At raw stage, the average caloric value was estimated in hybrids as 203.50 Kcal which was higher than native one contained 163.00 Kcal (Table 1).The highest energy level 208.00 Kcal was estimated in fishes collected from site 3 where the lowest 154.00 Kcal was in fish of site site 2. In fried stage, hybrids contained highest amount of energy compared to all sites in both stages was 304 Kcal than natives (Table 2). The caloric values of native and hybrid climbing perch was not significantly differed from each other. The lowest energy was in the fish collected from site 2 as of the raw stage. It was observed that energy level was higher for same amount of fish at fried stage may due to decreasing of water content. Ali *et al.* (1992) found more or less similar caloric values in native climbing perch (*Anabas testudineus).*

Mineral content of native and hybrid climbing perch

At raw stage, mineral composition in the climbing perches of native and hybrids showed a phenomenal result. In per 100 g of fish the average amount of minerals *viz*. sodium (Na), calcium (Ca), magnesium (Mg), phosphorus (P), iron (Fe), zinc (Zn) and copper (Cu) contained as 128.95 mg, 251.03 mg, 30.86 mg, 158.00 mg, 2.13 mg, 1.16 mg and 0.46 mg, respectively. On the other hand in same condition, the hybrids contained the those minerals as 88.03 mg, 213.42mg, 21.26 mg, 140.52 mg, 1.92 mg, 0.72 mg and 0.30 mg, respectively (Table 3). All the minerals were higher in natives compared to hybrids in raw condition.

But at fried stages of natives in 100 g of fish contained average minerals of Na, Ca, Mg, P, Fe, Zn and Cu as 134.84 mg, 242.80 mg, 27.95 mg, 161.90 mg, 1.99 mg, 1.09 mg and 0.42 mg, respectively (Table 4). On the other side in the hybrids of same amount in same condition contained as 94.67 mg, 200.93 mg, 18.05 mg, 146.02 mg, 1.79 mg, 0.62 mg and 0.27 mg, respectively. The amount of the minerals in natives persisted the higher compared to the hybrids after fried stage. It is clear from the findings that natives are richer with minerals than hybrids. But in comparison with the same fish at raw and fried stages, the minerals are found as concentrated form due to reduction of moisture after being cooked.

Present findings were supported by the findings of Windom *et al.* (1987) in which the sodium, calcium, magnesium and phosphorus concentrations were estimated for native and hybrid climbing perch 130.3, 255.45 mg/100, 32.4 mg/100, 155.7 mg/100 and 90.3 mg/100, 210.34 mg/100, 20.08 mg/100, 137.43 mg/100 respectively. The iron concentration of climbing perch varies from 1.9-2.15 mg/100 in this investigation. Iron plays an important role in oxidation- reduction reaction and electron transport associated with cellular respiration (Mukhopadhyay and Paul, 2001)**.** The data on iron level is less than the data reported by Paul *et al.* (2014). The study shows that both native and hybrid climbing perch is a good source of mineral which is also observed by Islam *et al.* (2012).

Table 3.Mineral composition of native and hybrid climbing perch at raw stage.

Minerals	Native fish, mg/ 100			Hybrid fish, mg/ 100		
	Site 1	Site 2	Average±SE	Site 3	Site 4	Average±SE
Sodium (Na)	130.30	127.60	128.95±1.35	90.30	85.76	88.03±2.27
Calcium (Ca)	255.45	246.60	251.03±4.43	210.34	216.50	213.42±3.08
Magnesium (Mg)	32.40	29.32	30.86±1.54	22.08	20.43	21.26±0.83
Phosphorus (P)	155.70	160.30	158.00±2.30	143.60	137.43	140.52±3.09
Iron (Fe)	2.15	2.10	2.13±0.03	1.94	1.90	1.92±0.02
Zinc (Zn)	1.12	1.20	1.16±0.04	0.74	0.69	0.72±0.03
Copper (Cu)	0.47	0.44	0.46±0.02	0.31	0.29	0.30±0.01

Table 4.Mineral composition of native and hybrid climbing perch at fried stage.

Minerals	Native fish, mg/ 100			Hybrid fish, mg/ 100		
	Site 1	Site 2	Average±SE	Site 3	Site 4	Average±SE
Sodium (Na)	137.20	132.48	134.84±2.36	97.03	92.30	94.67±2.37
Calcium (Ca)	246.40	239.20	242.80±3.60	197.21	204.65	200.93±3.72
Magnesium (Mg)	29.60	26.30	27.95±1.65	19.30	16.80	18.05±1.25
Phosphorus (P)	160.20	163.60	161.90±1.70	149.34	142.70	146.02±3.32
Iron (Fe)	2.05	1.93	1.99±0.06	1.82	1.76	1.79±0.03
Zinc (Zn)	1.05	1.13	1.09±0.04	0.63	0.60	0.62±0.02
Copper (Cu)	0.43	0.40	0.42±0.02	0.28	0.25	0.27±0.02

In native climbing perch, among other minerals highest amount of sodium (137.20 mg/100 in site 1 and 132.48 mg/100 in site 2) and phosphorus (160.20 mg/100 in site 1 and 163.60 mg/100 in site 2) were estimated at fried stage (Table 4).At raw stage, calcium (255.45 mg/100 and 246.60 mg/100), magnesium (32.40 mg/100 and 29.32 mg/100), iron (2.15 mg/100 and 2.10 mg/100), zinc (1.12 mg/100 and 1.20 mg/100) and copper (0.47 mg/100 and 0.44 mg/100) were found slightly higher than fried stage for both sites 1 and 2 respectively (Table 3).

In hybrid climbing perch, highest sodium (97.03 mg/100 in site 3 and 92.30 mg/100 in site 4) and phosphorus 149.34 mg/100 in site 3 and 142.70 mg/100 in site 4) were found than other minerals at fried stage which was like native one (Table 4). Other minerals were higher in both sites 3 and 4 at raw stage (Table 3).

Sainani and Kaptue (2017) found higher Ca (55 mg/100) and Mg (0.7 mg/100) in raw stage for Malawi tilapia which was quite support the above results. Marimuthu *et al.*

(2012) worked on different cooking process and their effects on stripped snakehead and found higher amount of Ca (290 mg/100), Fe (6.4 mg/100), Zn (5.1 mg/100) at raw stage and higher amount of Na (404 mg/100) was estimated at fried stage which is resembled with this observation.

The above observation showed that variations in concentrations of mineral elements from one to another in native and hybrid variety was due to the chemical forms of the elements and their concentrations in the local environment.

Conclusion

It can be concluded from the current study in general that the hybrid climbing perches are richer in protein and fat content than of natives where the reverse condition is observed in mineral composition in both raw as well as fried condition.

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