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PROXIMATE COMPOSITION AND STATUS OF SOME SMALL INDIGENOUS FISH SPECIES IN BANGLADESH

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Abstract: Twelve freshwater small indigenous fish species of Bangladesh were included in the study. These specimens were collected from three local markets of Khulna, Bangladesh. These fishes were used for proximate analysis in order to obtain and evaluate their nutritive value and the status in comparison with large fish species in Bangladesh. All fresh fish had high protein content (14.82-18.95%). The lipid content among the species ranged from 4.26 to 12.01%. The moisture content varied between 63.20-77.13%. The ash content ranged from 2.33 to 8.19%, which showed the inverse relationship with the moisture content. Market value of the studied fish species varied between 40-300 Tk./kg. This variation might be due to the demand, size, taste and availability of fishes in the market. At present, the price and demand of these indigenous fish species are increasing compared to other large fish. The study reveals that emphasis should be given for culturing and producing of these demanded indigenous fish species.

Key words: Small indigenous fishes species, Moisture, Protein, Lipid, and Ash.

Introduction

Small indigenous fish species (SIS) have high nutritional value in regard to protein, micro-nutrients, vitamins and minerals compared to other commonly available foods. Since these whole fishes are normally cooked and served, their nutritional effects on the diet is further enhanced because, the bones also provide as source of calcium (Felts *et al*., 1997; Hossain *et al.,* 1999 and Kohinoor, 2000). Their high nutritional value triggered some initial research works.

The small indigenous fish species of Bangladesh are generally considered to be those fish, which grow to a length of about 25 cm or 9 inches at maturity (Felts *et al*., 1996; Hossain *et al.*, 1999). Of the 260 species (Rahman, 1989) of fresh water fish in Bangladesh, over 140 species have been categorized as "Small Indigenous Fish Species'', critically or somewhat endangered. These fishes are commonly referred to as 'Chhotomach' in local language and are available in smaller water bodies like drains, ditches, ponds, lakes, beels, haors, baors, rivers, stream, ephemeral water bodies of the inland and estuarine areas and can withstand harsh environmental conditions. They are able to reproduce and grow rapidly in favorable conditions.

The poor people of our society cannot afford to buy large fish due to high market price and they try to fulfill their protein demand by buying these small fishes. Small fishes provide supplemental income to a substantial portion of people of the country particularly the poor and disadvantage groups (Felts *et al*., 1997; Hossain *et al.,* 1999). In the past, such species of fish have had a low market value due to their abundance and was not purchased by the elite group of people. For these reasons, little attempts were taken to raise and culture these fish species commercially. At present, the change in demand of these species has put emphasis for large scale culture and production.

The present investigation provides data of representative mean values regarding nutrients of different species of fish which can serve as a baseline for further research works on this species. The purpose of this study was to determine the proximate composition of some small indigenous fish species, in particular, to know moisture, protein, lipid and ash content and also to observe the present status of these species regarding price, demand and acceptability.

Materials and Methods

Twelve small indigenous fish species were purchased from three local markets (Gallamary bazar, New market and Shandha bazar) of Khulna City during the month of January 2002. These species were Magur (*Clarias batrachus*), Shing (*Heteropneustes fossilis*), Koi (*Anabas testudineus*), Foli (*Notopterus notopterus*), Royna (*Nandus nandus*), Kholisha (*Colisa fasciata*), Taki (*Channa punctatus*), Kakila

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(*Xenentodon cancila*), Tit Puti (*Puntius ticto*), Sharputi (*Puntius sarana*), Pabda (*Ompok pabda*) and Tengra (*Mystus vittatus*).

Proximate Composition:The samples were analyzed immediately after they were brought to Fish Nutrition Laboratory, Khulna University. Fresh fishes were washed with tap water several times to remove adhering blood and slime. For the proximate composition, three replications were conducted in each species according to Analysis of Official Analytical Chemistry (AOAC, 1990). Prior to analysis, entire fish was cut into small slices and was homogenized in a microcutter. Between each species, the microcutter was cleaned, washed and dried.

Moisture: Moisture content was determined by drying the sample in a hot air oven at 105^{0}C until constant weight was gained.

Crude protein: Homogenized samples (0.5g) were digested in digestion unit for 45 minutes. The digesta was then distilled in distillation unit. Finally, it was titrated with 0.2 N HCl and crude protein was obtained by multiplying the total nitrogen content by a conversion factor of 6.25 (AOAC, 1990).

Crude lipid: Crude lipid was determined by extracting sample with acetone in Sox lets Fat Extractor.

Ash: Ash content was determined by igniting fish samples in a muffle furnace at 550 ^{0}C for 6 hours.

***Status of Small Indigenous Fish species*:** Market value, sources and availability of twelve such species were recorded. The relevant information was collected from the sellers' through questionnaire survey. Five to seven questionnaires were provided in each market. The parameters included the questionnaire were, category of small fishes, supply, demand, marketing source, price etc.

Results

The proximate composition of some small indigenous fish species is shown in Fig.1. The moisture, protein, lipid and ash ranged between 63.20 to 77.13%, 14.82 to 18.95%, 4.26 to 12.01% and 2.93 to 8.49%, respectively.

Moisture Content: The highest moisture content was observed in Pabda, *O. pabda* (77.13%) and the lowest value was found in Koi, *A. testudineus* (63.20%). The moisture content in Magur (*C. batrachus*), Shing (*H. fossilis*), Foli (*N. notopterus*), Royna (*N. nandus*), Kholisha (*C. fasciata*), Taki (*C. punctatus*), Kakila (*X. cancila*), Tit Puti (*P. ticto*), Sharputi (*P. sarana*) and Tengra (*M. vittatus)* were 71.49, 77.06, 72.68, 72.85, 72.68, 75.75, 73.08, 67.68, 66.69 and 75.67%, respectively (Fig.-1a).

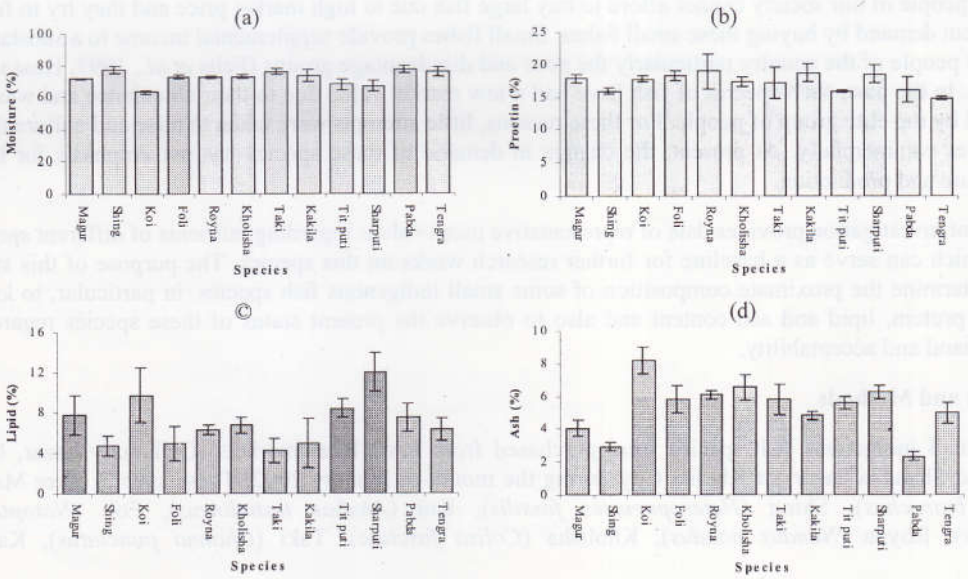

Fig 1. Moisture (a), protein (b), lipid (c) and ash (d) content of some small indigenous fish species (error bar indicates standard deviation).

Protein Content: All fishes were found to be rich sources of protein. The protein content among the species ranged from 14.82% to 18.95%. The highest protein value was found in Royna, *N. nandus* (18.95%) while the lowest value was found in Tengra, *M. vittatus* (14.82%). Protein content in Magur (*C. batrachus*), Shing (*H. fossilis*), Koi (*A. testudineus*), Foli (*N. notopterus*), Kholisha (*C. fasciata*), Taki (*C. punctatus*), Kakila (*X. cancila*), Tit Puti (*P. ticto*) and Sharputi (*P. sarana*) was 17.87, 15.93, 17.79, 18.3, 17.37, 17.13, 18.7, 15.92, 18.49, and 16.11 %, respectively (Fig.-1b).

Lipid Content: The lipid content among the species ranged from 4.26% to 12.01%. The highest lipid value obtained in Sharputi, *Puntius sarana* (12.01%) while the lowest value in Taki, *Channa punctatus* (4.26%). The amount of lipid in Magur (*Clarias batrachus*), Shing (*Heteropneustes fossilis*), Koi (*Anabas testudineus*), Foli (*Notopterus notopterus*), Royna (*Nandus nandus*), Kholisha (*Colisa fasciata*), Kakila (*Xenentodon cancila*), Tit Puti (*Puntius ticto*), Pabda (*Ompok pabda*) and Tengra (*Mystus vittatus)* was 7.46, 4.72, 9.73, 4.98, 6.34, 6.77, 4.98, 8.4, 7.48, and 6.32%, respectively (Fig.-1c).

Ash Content: The ash content in the present study ranged between 2.93 and 8.19 % (Fig.-1d). The lowest ash content was found in Pabda, *O. pabda* (2.93%) and the highest value was found in Koi, *A. testudineus* (8.19%).

Status of Small Indigenous Fish Species: Market price and status of studied fish species obtained from the three local markets is presented in Table 1. The prices of the studied fish species varied widely (44.79 ± 10.11 – 263.81 ± 36.23 Tk./Kg.). The highest price was observed in Sharputi (263.81 ± 36.23 Tk./Kg.). The lowest price was found in Taki, Kakila, and Tit puti (44.79 ± 10.11 Tk./Kg.).

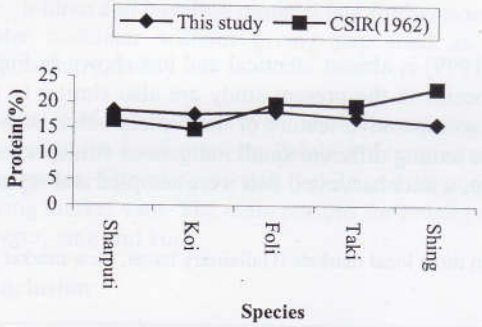

Fig -2. Comparative feature of protein value between CSIR (1962) report and the present study.

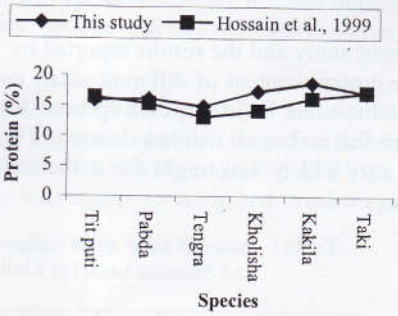

Fig.-3. Comparative feature of protein value between the report of Hossain *et al.*, 1999 and the present study.

Discussion

The moisture, lipid, ash and protein content of some small indigenous fish species were determined. The fishes were analyzed and the results have shown in Fig.-1. The proximate composition of fish varied widely from species to species and even within the same species from one individual to anther (Stansby, 1962). This variation occurred due to various reasons. Philips *et al.*, 1996; Graves, 1970; Love, 1970 and 1974; have reported that body composition of fish depends on age, sex, season and diet. Others authors mentioned that starvation alters body constituents. They observed that lipid and protein are used as a source of energy and decreases progressively during starvation while water content increases proportionately (Parkar and Vanstone, 1966; Niimi, 1972).

Wide variation of moisture between species was observed in some small indigenous fish species. Moisture content of various species has previously been reported (Chowdhury, 1981; Hossain *et al.* 1999) and the values stated are similar to those observed in the present study. The average moisture content among the experimented species was 72.16 ± 4.13%.

The protein content of Sharputi, Koi, Foli, Taki and Shing in the present study was 18.49%, 17.79%, 18.30%, 17.13% and 15.93%, respectively. In the same species, CSIR (1962) reported in India that the protein value should be 16.5%, 14.8%, 19.8%, 19.4% and 22.8%, respectively. The values of CSIR result widely differ to the values obtained in the present study, which is shown by Fig.-2. The probable reasons for this difference may be geographical distribution of the species. Protein level of some species between the

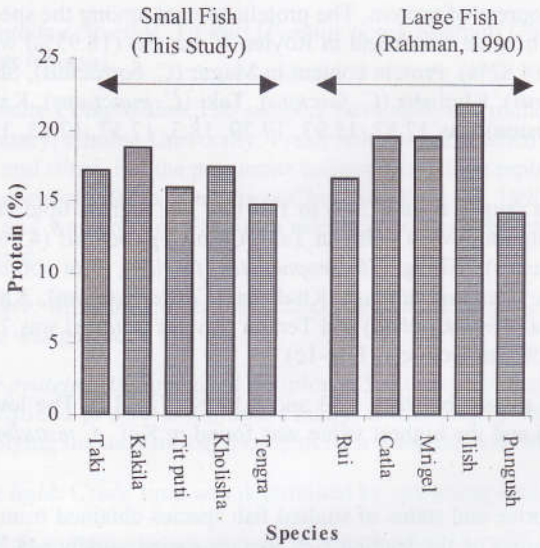

Fig -4. Comparative feature of protein value between some small and large fishes.

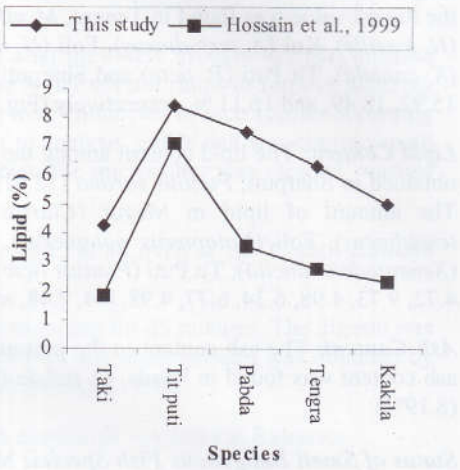

Fig.- 5. Comparative feature of lipid content between Hossain *et al.*, 1999 study and the present study.

present study and the results reported by Hossain *et al.* (1999) is almost identical and has shown in Fig.-3. The protein content of different small indigenous fish species in the present study are also similar to that found in other large carp fish species (Rahman, 1990). A comparative feature of the protein value between large fish and small fish has shown in Fig.-4. Protein value among different small indigenous fish species do not vary widely; this might due to the fact that only mature, winter harvested fish were sampled and reported here.

Table 1. Prices of some small indigenous fish species in three local markets (Gallamary bazar, New market and Shandha bazar) at Khulna district.

Sl. No.	Local Name	Scientific Name	Price (Tk/kg)	Source	Availability
1	Magur	*Clarias batrachus*	175.00 ± 31.22	Beel area in Khulna	Dec. - Feb.
2	Shing	*Heteropneustes fossilis*	158.75 ± 44.79	,,	,,
3	Koi	*Anabas testudineus*	169.52 ± 31.32	,,	,,
4	Foli	*Notopterus notopterus*	132.56 ± 25.21	,,	,,
5	Royna	*Nandus nandus*	115.10 ± 18.20	,,	,,
6	Kholisha	*Colisa fasciata*	107.15 ± 21.60	,,	,,
7	Taki	*Channa punctatus*	52.27 ± 13.21	,,	,,
8	Kakila	*Xenentodon cancila*	48.18 ± 12.14	,,	,,
9	Tit puti	*Puntius ticto*	44.79 ± 10.15	All over	,,
10	Sharputi	*Puntius sarana*	263.81 ± 36.23	Faridpur	,,
11	Pabda	*Ompok pabda*	135.44 ± 27.23	,,	,,
12	Tengra	*Mystus vittatus*	100.92 ± 20.12	,,	,,

It is known that, fat in fish varies by age, sex and reproductive status (Kinsella, 1988), seasons and geographic locations (Ackman, 1990). Fat value reported in this study is higher compared to report mentioned by Hossain *et al.*, 1999 (Fig.-5). Our experiment was brought about in January 2002 and Hossain *et al.*, conducted in August to September 1996 (Hossain *et al*, 1999). Seasonal variation might be one of the possible reasons for the variation of lipid content. The seasonal variation in water was inversely proportional to that of lipids and protein content of fish (Sultana, 1996). The fat content was inversely correlated with moisture content (Andrews and Stickney, 1972; Chowdhury, 1981 and Hossain *et al.*, 1999). Rahman *et al.*,

(1982) reported that, crude fat in some Bangladeshi zeol fish was 2.18 – 9.38%, which are also more or less similar to the result obtained in the present study.

The ash content in the present study ranged between 2.93 and 8.19 %. The ash content of some selected small fishes reported by Hossain *et al.*, 1999 ranged between 2.08 and 5.22%, which is similar to the present study. The highest value was found in Koi, *A. testudineus* (8.19 ± 0.83%). Chowdhury, 1981 also found almost similar result (ash content 6.79 ± 1.26%) in Koi, *A. testudineus* among the five-selected zeol fishes. CSIR (1962) reported that the ash content of Sharputi, Koi, Foli, Taki and Shing in India ranged between 1.53 and 2.6% and widely differed with the result of present study. This variation might be due to the geographical distribution, size and sex of fish.

Table 1 shows the average price, source and availability of some small indigenous fish species obtained from three local markets at Khulna city. This table indicates the potentiality of small fish species compared to other large fishes that are available or commercially being cultured in Bangladesh. The prices of species varied widely (40-300 Tk./Kg). This variation mainly due to the availability tastes and sizes of the fishes. The price of *P. sarana* is about 200-300Tk./kg, which is surprisingly higher than other species due to their taste and unavailability in the market. At present this species is completely extinct (Rahman, 1989) and fish sellers collect it from Faridpur District. The far distance of its locality is also a reason for raising its price. Earlier, this species was available almost all over the country.

The market value of magur, shing and koi ranges from 120-200Tk/kg and is same as other large fishes like, rui, catla, hilish etc. Magur, shing and koi are available almost everywhere in Bangladesh. These three species are very much popular in Bangladesh for several reasons. Firstly, they are important part of the diet for children and lactating mothers and furthermore, the species can be kept alive for long time by storing in a water container without giving any food as the species bear special accessory respiratory organs (Chowdhury, 1981).

The price of pabda, foli, royna, kholisha and tengra are more or less same (100.92 ± 20.12 – 135.44 ± 27.23 Tk./kg) in the local markets. Pabda and tengra come from Faridpur District and pabda is rarely available in the market. The price of taki, kakila and tit puti seem very low (44.79 ± 10.11 – 52.27 ± 13.21 Tk./kg) during market visit. The main reasons for lower price is due to less tasty and bony compared to other species (magur, sing and koi).

Conclusion

Small fish supply higher protein and is relatively low in fat content. Regular consumption of fish is therefore, recommended for elderly and people with hypercholesterolemia and coronary heart diseases. Small fish also plays the most crucial role in the diet as a source of minerals and vitamins, essential for healthy growth and development. In addition to other nutrients, small fish is a rich source of vitamin-A, calcium, iron and zinc. Therefore, small fishes are important part of the diet for children and lactating mothers. Bangladesh has highest level of malnutrition in the Asia Pacific region (Das and Chowdhery, 1999). This affects 70-80% of the children in the country with a very high infant mortality rate (over 1 in 10 up to one year of age). Small indigenous fish play a key role in alleviating this malnutrition problem.

The main objective of the study was to determine the nutritional value and present status of small indigenous fish in Bangladesh. It was found that the chemical constituents of different fish species varied in different ways. The essential elements of nutrients at a substantial level were available in the fish species. However, changes in the environment are threatening for their existence. To ensure the continuity of the biodiversity and retain the species for future generation, the proper management and culture techniques of small indigenous fish species should be encouraged.

The price of smaller species is now competitive. Some species even exceeds the price of carp. However, to make these species more attractive to the consumer, research works must be undertaken to develop spawning techniques considering rapid growth characteristics and appropriate culture systems.

Considering the importance and demand of the people of the country, in-depth long-term investigation regarding nutritional value, price, conservation and cultivation techniques of small indigenous fish species is urgently needed to create awareness among the consumers, policymakers of the government, non-government and private organizations.

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