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Full Length Research

Proximate composition and nutritional value of fish powder composition (FPC) from different dried SIS fishes in Bangladesh

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ABSTRACT: The biochemical compositions and nutritional value of Small Indigenous Species (SIS) fishes were analyzed using analytical techniques. Proximate composition of five dried fish species viz. *Glossogobius giuris, Colisa fasciata, Puntius ticto*, *Eutropiichtheys vacha, Corica soborna* and a group of mixed SIS fishes viz. *Chanda nama, Chanda ranga, Amblypharyngodon mola, Mastacembelus pancalus, Xenentodon cancila* were selected for preparation of powder (FPC) which can be preserved for a time period. The fishes were sun dried or oven-dried. Quality of the oven-dried fish was better than that of the sun-dried fish, but sun drying process is easy and can be used in large scale. The fish powder remained in good condition up 7 to 9 months at normal room temperature, but at -18°C the powder was in good condition throughout the year. Highest quantity of powder from 1 kg of fish was obtained in *C. soborna* (25.80%) and the lowest in *G. giuris* (11.72%). Biochemical analysis showed that the maximum moisture are found was 14.28% in *G.giuris* and minimum was 12.05% in *C. soborna*. Maximum protein content was recorded in *G. giuris* (73.32%) and minimum was 58.06% in mixed SIS fishes. The maximum fat content of selected dried fish was 23.63% in *C. soborna* and minimum was 1.29% in *E. vacha*. The maximum calcium content was found was 2.53% in *P. tic*to and minimum was 1.66% in *G. giuris*. Maximum phosphorus content was 2.93% in *C. fasciata* and minimum was 1.85% in some mixed fishes. Maximum iron content was found as 32.00 mg/100g in mixed SIS fishes and minimum was found as 20.25 mg/100g in *P. ticto*. The results indicate that SIS fishes has high nutritional value in terms of protein, fat, and minerals.

Key words: Biochemical analysis, dried SIS fish, fish powder, nutrient.

INTRODUCTION

Fish is an essential and irreplaceable food item in the rural Bangladeshi diet. Fish is inseparable part of the Bangladesh economy and it plays a vital role in nutritional balance as an important source of protein (Ahmed et al., 1993). Besides protein, fish is a good source of carbohydrate, fat, vitamin and mineral (Falls, 2012). The analysis of proximate composition (four basic constituents: water, protein, fat, ash (mineral)) of fish muscle/flesh is often referred to as 'proximate analysis'. Fish flesh contains of water (70 to 80%), protein (20 to 30%) and 2 to 12% of lipid (Ali et al., 2005). In terms of weight of food consumed, fish ranks third after rice and vegetables (Minkin et al., 1997; Hels et al., 2002). The protein content of fishes ranges from 14 to 18 g/100g raw edible parts (Darnoton Hill et al., 1988). From the last national survey in rural Bangladesh, the mean total protein intake was 48 g/person/day, of which fish contributed 3 g (Ahmad and Hassan, 1983). Besides protein source, SIS of fishes are also rich source of vitamins and minerals, which is often overlooked in developing countries (Hossain and Afroze, 1991; Roos et al., 2007). Dried fishes are also rich in other nutritional components (Basu and Gupta, 2004).

The Small Indigenous Species (SIS) of fishes in Bangladesh are generally considered to be those which grow to a length of approximately 5 to 15 cm at maturity (Felts et al., 1996). The SIS fishes have short life cycle and can grow in all types of inland water bodies. Because of

overfishing in inland water bodies and habitat destruction, a number of small fishes are now under the threat of extinction. In Bangladesh, 143 freshwater fish species are categorized as small indigenous fishes. In the past, these fishes were abundant in the rivers, beels, canals, streams and ponds. So, presently there is an urgent need to conserve the SIS fish and to increase their production through proper management of the water bodies of Bangladesh.

Thilsted et al. (1997) and Roos et al. (2007) reported that vitamin A, calcium, iron and zinc are present in commonly consumed small fish species of Bangladesh. Very high content of vitamin A (500 to 1500 µg RE/100g raw edible parts) are obtained from Dhela (*Osteobrama cotio cotio*), Darkina (*Esomus danricus*), mola and chanda (*C. baculis*) (Roos et al., 2003). The sun-dried SIS fishes contain up to 60 to 80% protein (Hoq, 2004). A good number of works on nutrient composition of freshwater fishes of Bangladesh have been done by different researchers (Gheyasuddin et al., 1979; Rubbi et al., 1987; Naser et al., 2007; Kamal et al*.,* 2007; Majunder et al*.,* 2011; Sabinaet al*.,* 2011; Flowra et al*.,* 2012; Begum and Minar, 2012; Mahfuj et al*.,* 2012; Ali, 2014) but very little attention has been paid on the proximate composition of nutrients which are present in dried fishes or dry fish dust. The present work was aimed at estimating the nutritional value of the dried fish powder of some selected SIS fishes of the Bangladesh.

MATERIALS AND METHODS

Used fish species

Five small fish species: *Glossogobius giuris, Colisa fasciata, Puntius ticto*, *Eutropiichtheys vacha, Corica soborna* and a group of mixed SIS fishes viz *Chanda nama, Chanda ranga, Amblypharyngodon mola, Mastacembelus pancalus, Xenentodon cancila* were used in the experiment.

Sample collection

Samples were collected from different spots of river bank (The Padma) and fish landing centers of Rajshahi city, during the period from July 2009 to June 2012. After collection, the fishes were brought to the Fishers Research Laboratory, Department of Zoology, Rajshahi University. The fishes were washed carefully with tap water and the waste materials were discarded and washed again for the second time. Then, the fishes were separated depending on size, sun-dried between 4 to 7 days under fly nets. Using an electric blender, the dried fishes were then powdered (species wise) and kept in separate airtight glass with propel label.

Experimental place

The dried samples were taken to the Bangladesh Council for Scientific and Industrial Research (BCSIR) Laboratory, Rajshahi, for the biochemical analysis.

Parameter estimation

The following components were determined for assessment of biochemical composition of fish species:

Proximate composition analysis

Moisture content of the fishes were determined by automatic moisture analyzer No. MAC 50/NH, RADWAG at 1100 C. Quantitative determination of protein was extracted by Kjeldahl method using automatic nitrogen analyzer model No. P SELECTA, Spain. Fat was done following the methods described by Cocks and Van Rede (1966) and Mehlenbacher (1960).

Mineral analysis

Mineral analysis of fish sample was done according to the AOAC method (AOAC, 1990). Calcium and Iron was determined by AAS (Atomic Absorption Spectrophotometer), Model No. AA-6800 SHIMADZU (Japan). Phosphorus was determined by measuring calorimetrically using a Vis-Spectrophometer Model No. GENESYS ™ 20, Thermospectronic, USA.

Statistical analysis

Statistical analysis was performed by using the SPSS (Statistical package for social science, evaluation version 16). Significance was assigned at the 0.05% level. The mean values also compared to see the significant difference through DMRT (Duncan Multiple Range Test). Data were presented as mean ± SD.

RESULTS AND DISCUSSION

The results showed composition variation of protein, fat, moisture and minerals (calcium, phosphorus and iron) of dried fishes (Figures1a to 1f). The result indicated a wide variation in proximate composition depended on the species. Among the mineral contents, calcium was found to range from 1.66% in *G. giuris* to 2.53% in *P. ticto*. The higher amount of phosphorus was found in *C. fasciata* (2.93%) and the lowest was found in mixed fishes (1.85%). Maximum amount of iron was found in mixed fishes (32.00 mg/100g) and least amount was found in *P. ticto* (20.25 mg/100g). Moisture content was high in *G. giuris* (14.28%) and low in *C. soborna* (12.05%). The highest percent of protein was found in *G. giuris* (73.32%) and lowest was found in *C. fasciata* (57.76%). The fat content was maximum (23.63%) in *C. soborna* and minimum was (1.29%) in *E. vacha.*

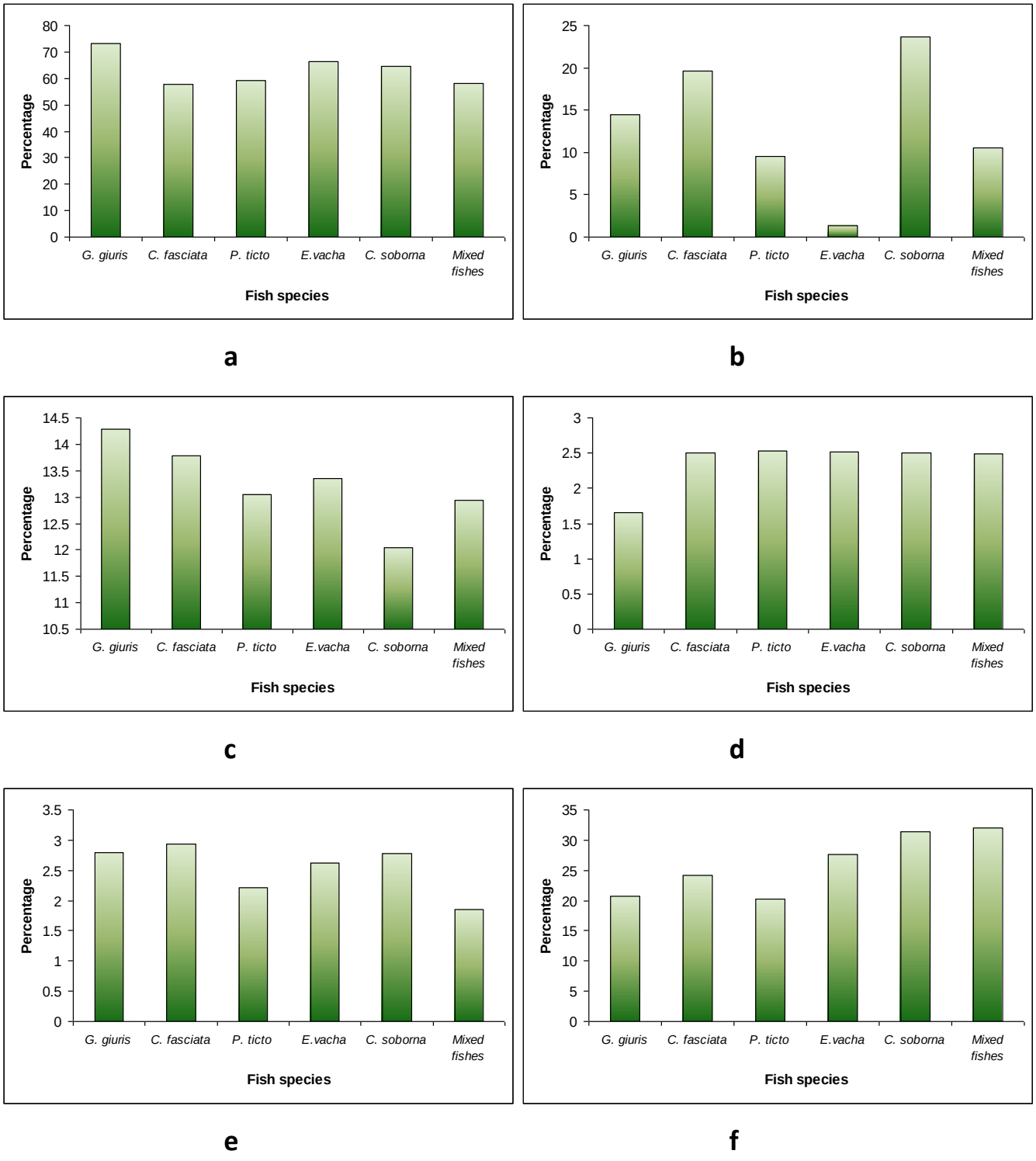

Figure1. Percentage of: **a.** protein; **b**. fat; **c**. moisture; **d**. calcium; **e.** phosphorous; **f.** iron of the studied small indigenous fish species (SISF).

The result revealed that *E. vacha* contained less fat and other species *C. fasciata*, *P. ticto, E. vacha, C. soborna* and mixed fishes were rich in calcium. Phosphorus was maximum in mixed fishes whereas iron was less in *P. ticto* compared to others. The percentage of moisture was also more or less same in all the experimental fishes.

According to the works of Kamal et al. (2007), Mazumder et al. (2008) and Musa (2009), the nutritional values of the

small fishes are rich compared to the larger fish species. Similar findings reported by Sultana et al. (2011) for small indigenous fish species.

The biochemical composition (protein, fat, moisture, calcium, phosphorous and iron) of the dried fish powder were recorded. The analysis of nutrient composition shows that the dried small fishes used in the experiments are rich in protein containing 57.76 to 73.32%. The percentages of fat ranged from 1.29 to 23.63%. These dried fishes were also rich in iron and contain good amount of calcium and phosphorous. Calcium plays essential role in human body for the formation of bones, muscle tone and nervous impulse (Mollah et al., 1998). It has been reported that *Cirrhina reba* contains 822 mg calcium/100g of fish (Islam et al., 2003). Species like *Gudusia chapra*, *Channa punctatus* and *Amblypharyngodon mola* contain 1063, 1093 and 1171 mg Ca/100g, respectively of raw edible parts (Roos et al., 2003). As SIS are consumed totally along with bones, so there is no wastage of calcium from these fishes. Phosphorous is another essential nutritional element for human, which is also present at a high percentage in the tested fishes.

Moisture

The moisture content of all living systems contributes as much to the essential properties of life. After drying, the moisture remained in the fish powder ranged from 12.05 to 14.28% in different species. The highest moisture content was found as 14.28% in dry *G. giuris* and the lowest was found as 12.05% in *C. soborna*. Azam et al. (2003) reported the range of fourteen selected dried fishes and observed that moisture content range from 18.23 to 23.61% which are more or less similar to the values obtained in the present study. However, Saha (1999) reported that sundried SIS fishes contained 36.50 to 82.80% moisture. Bhattacharyya et al. (1985) reported that sun-dried *G. chapra* contained 9.61 to 18.64% moisture. Nurullah et al. (2003) reported that moisture content ranged from 72.97 to 76.35% in six SIS fishes. The highest moisture content was recorded in *G. chapra* and the lowest in *P. sarana*. Hoq (2004) reported that sundried fishes contain an average of 10 to 20% moisture. Sabinaet al. (2011) also reported that moisture content of 7 dried fish species varied from 10.30 to 13.50%. Flowra et al. (2012) reported the highest moisture content of 24.58% in *C. soborna* and lowest in *T. haumela* (14.06%). The variation in moisture contents that was observed previous studies and present results might be due to amount of fat present in the species as fat content was inversely correlated with moisture contents.

Protein

Protein is the major nutrient in fish, and the levels help to define their nutritional status. Protein composition ranged from 57.76 to 73.32%. *G. giuris* contained the highest percentage of protein (73.32%). Among the tested fishes *C. fasciata* contain the lowest percentage of protein (57.76%). Protein content varies among the species according to their food habit, amount of skeleton (Mazumder et al., 2008), size as well as expression of results such as dry weight basis/wet weight basis. Azam et al. (2003) found that the values ranged from 6.52 to 40.69% in 14 species of dried fishes. Hoq (2004) concluded that normally the sun-dried fishes contain 60 to 80% protein. Hussain et al., (1992) reported that protein content varied widely from 17.2 to 78% in 23 different dried species. Ali et al., (1992) found that the protein content of sun dried mola ranged from 59.6 to 61.2%. Sabinaet al., (2011) reported that the protein content of 7 dried fishes ranged from 52.65 to 72.45%. Flowra et al. (2012) also reported that the protein content of five dried fishes ranged from 44.08% (*M. vittatus*) and 65.65% (*T. haumela*).

Fat

Fat content also varies greatly among the dried SIS fishes. Among the six experimental SIS fishes, fat content ranged from 1.29 to 23.63%. The highest fat content was found in *C. soborna* as 23.63% and the lowest was 1.29% in *E. vacha*. Hussain et al. (1992) reported 3.7 to 17.8% fat content in 23 sundried fishes. Sabinaet al., (2011) also found the fat content of *C. soborna* which was 12.66%. Begum and Minar (2012) reported fat content of *G. chapra*as 4.55%. Dried *Rita rita* contains 13.72% lipid (Mollah et al., 1998) and Flowra et al., (2012) also reported dried *M. vittatus* contain 17.76% fat which are more or less similar to the present findings as fat was inversely correlated with moisture content.

Iron

In present experiment, six experimental dried fishes were found to contain iron ranging from 20.25 mg/100g fish in *P. ticto* to 32.00 mg/100g fish in mixed species. Nurullah et al. (2003) reported that iron ranged from 14.50 to 42.20 mg/100 g of raw fish, and Chapila (*G. chapra*) contained the highest amount of iron among the studied small indigenous fish species (SIFS) which is somehow higher than the present studied results. Roos et al. (2003) reported that *Esomus danricus* was rich in iron (12 mg/100g fish) and among the other iron rich species were *A. mola*, *G. chapra* and*M. vittatus*. However, Roos et al. (2003) also indicated that the small fishes present in the fish culture ponds are low in iron and calcium, and NCR (Nutrient Contribution Ratio) value of these fishes were all low as <5%. The present findings more or less varied from the reported studies which may be attributed to lesser amount of skeleton (Mazumder et al., 2008), size as well

as expression of results such as dry weight and basis/wet weight.

Conclusion

The results showed that dried or powdered SIS fishes are equally nutritive as they are in fresh condition. The Protein content was more than 50%, with rich supply of iron, calcium and phosphorus (the essential minerals for human growth and life). These fishes can be sun dried and stored, and consumed for longer period. From these results, it can be concluded that dried SIS fishes, both fresh water and marine can provide nutritional security of the nation.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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