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Biochemical composition of *Cyprinus carpio* var. *specularis* on the basis of sex and seasonal variation in Atrai River

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Abstract: Fish play an important role in Bangladeshi diet, constituting the main and often irreplaceable animal source food in poor rural households. The study was focused on the seasonal variation of biochemical composition of *Cyprinus carpis* var. *specularies* (Mirror carp) for a period of 12 months (January-2014 to December-2014) in the Atrai river of northwestern (Naogaon district) Bangladesh. The percentage of moisture, ash, lipid, protein and carbohydrate content were determined which was 72.54±0.551 to 74.53±1.078 in Male and 73.32±0.778 to 75.42±0.538% in Female; 3.02±0.637 to 3.44±0.536 in Male and 2.64±0.393 to 3.77±0.766 % in female; 3.36±0.400 to 4.19±0.231 in male and 2.95±0.349 to 4.08±0.400 in female; 18.25±1.189 to 20.07±0.190 in male and 17.03±0.925 to 19.56±0.538 in female; and 0.035±0.002 to 0.042±0.005 in male and 0.037±0.004 to 0.042±0.003% in female respectively. An increasing trend of moisture, ash and carbohydrate were found both males and females in winter season whereas lipid and protein content showed a decreasing trend in both sexes in winter season. In case of male protein and lipid content was higher than female fishes in all seasons. The result indicates variation in biochemical composition on the basis of sex and season.

Key word: Biochemical composition, seasonal variation, Mirror carp.

Introduction

Fresh water fishes are the most important sources of fish in Bangladesh. These fishes are either wild or farmed. The annual fish production in Bangladesh was 3548115 metric tons and fish contributed about 58% to the nation's animal protein intake (DoF, 2015; Islam *et al.,* 2012). Fish is an essential and irreplaceable food item in the rural Bangladeshi diet. Fish body composed of mainly water, lipid, ash and protein though small amounts carbohydrates and non-protein compounds are present in a small amount (Cui and Wootton, 1988; Siddique *et al.,* 2012; Azim *et al.,* 2012). Most of fish usually consists of water (70-80%), protein (20-30%) and 2-12% of lipid (Ali *et al.,* 2005). But it may change within and between species and also with size, sexual condition, feeding, time of the year, seasonal change and physical activity (Weatherley and Gill, 1987).

Many studies have done on the biochemical and nutritional status of freshwater fish, prawn and shrimp species of Bangladesh (Ali, 2014; Kamal *et al.,* 2007; Mahfuj, *et al.,* 2012; Rubbi *et al.,* 1987; Naser *et al.,* 2007; Mansur *et. al.,* 2004). Studies on biochemical composition on the basis of sex and season has also been carried out on *Anabus testudineus* (Nargis, 2006); and *Labeo gonius* (Begum *et al*., 2013). But no attempt has been found to determine the biochemical composition of exotic fish like *Cyprinus carpio* var. *specularis* (Mirror carp) regarding sex and season in Bangladesh. Therefore this study was under taken to know the biochemical composition of *C. carpio* var. *specularis*.

Materials and Methods

Sample Collection

Samples of *C. carpio* var. *specularis* were collected from different landing centers in Atrai river (Naogaon District) of Bangladesh for a period of 12 months (January to December 2014). 10 fish samples (5 male and 5 female) were collected in each month. A total of 120 fishes were used for the present study. The specimens were collected during the early hours of the day and carried to the laboratory in ice box. Specimens were properly cleaned and preserved in the deep freezer before analysis. Sex was determined by Aceto Carmine Squash method (Rafael *et al*. 1974).

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Experimental place

The whole experiment was conducted at the Protein and Enzyme Research Laboratory, Department of Biochemistry and Molecular Biology, University of Rajshahi, Bangladesh and the Fish Nutrition Laboratory, Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Parameter estimation

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

Moisture and Ash content of the fishes were determined by AOAC method (AOAC, 1990). The estimation of lipid content of experimental raw fish had been accomplished by Bligh and Dryer method (Bligh and Dyer, 1959). Water-soluble protein of the fish content was determined by Lowry method (Lowry *et. at*., 1951). Carbohydrate content of the fish was determined calorimetrically by Anthrone method (Loomis and Shall, 1937).

Statistical analysis:

Data were analyzed using one factor ANOVA through computer software package (SPSS 20 version) and the significant results were further tested to identify significant difference between means using DMRT at 5% probability level. Data were presented as mean±SD.

Results and Discussion

Moisture

In the present investigation, the moisture content was found as one of the major component. The moisture content varied from season to season as well as in case of sexes. The male fishes carried moisture 72.54±0.551% in summer whereas at winter season it rises up to 74.53±1.078%. In case of female fishes, percentage at summer, rainy and winter season the moisture was found 73.32±0.778, 74.13±1.146 and 75.42±0.538 respectively (Fig. 1, Table 1). The moisture content was respectively high in female at winter season and low in male at summer season. It was observed that the moisture content of both sexes were relatively low at summer season and higher moisture content recorded at winter season. Moisture content was significantly different ($P < 0.05$) in summer and winter season whereas there was no significant difference was found in rainy season. In both male and female fishes, the highest value of moisture was obtained in winter season. The finding is more or less similar to other fishes as well as in other vertebrates due to maturation of gonads (Dembergs, 1964; Marais and Erasmus, 1977). The low value of moisture during certain seasons have been observed in several other fishes by various authors Nabi and Hossain (1989), Osako *et al.* (2002) and Mahfuj *et al.* (2012). The moisture content was lower in summer and higher in winter. The similar findings was also found in Gobi fish (Ahmed *et al*., 1977), *Anabas testudineus* (Bloch) (Nargis, 2006), *Glossogobius giuris* (Islam and Joadder, 2005). In the present study moisture content varied from 72.54 to 75.42%. Which is more or less coincide with the findings of Ali *et al.* (2005) who found that the water content of some other fish species namely *Labeo rohita*, *Cirrhinus mrigala* and *Catla catla* was 72.10, 69.50 and 68.84%, respectively, similar findings was also found by Mansur *et al.,* (2004) who recorded the moisture content in *C. carpio* var. *communis* was 76.86%.

Ash

The percentage of ash content at summer, rainy and winter season of male fishes were recorded 3.02±0.637, 3.13±0.423, 3.44±0.536 respectively and female fishes the percentage values were 2.64±0.393, 3.41±0.630 and 3.77±0.766 respectively (Fig. 2, Table 1). Highest and lowest ash content was found in winter and summer season at both male and female fishes. No significant difference ($P < 0.05$) was found in ash content of both male and female fishes. The fluctuation of ash content made difficult to show any relationship with the season and sex. During the present study, ash content varied from 2.64 to 3.77%. Which is more or less coincide with the findings of Ali (2014) and Chakwu and Shaba (2009) who found ash content of *T. alalunga* and *C. gariepinus* were 3.27% and 3.06% respectively.

Lipid and Protein

The mean value of lipid was found 4.19±0.231, 3.80±0.362, 3.36±0.400% in male fishes and 4.08±0.400, 3.58±0.684 and 2.95±0.349% in female fishes at summer, rainy and winter season respectively (Fig. 3; Table 1). Maximum lipid content was (4.19±0.231%) found in male fishes at summer and minimum was (2.95±0.349%) recorded in female fishes at winter season. The lipid content showed decreasing trend from

summer to winter season (Fig. 3). In both male and female fishes lipid content significantly different (P <0.05) among summer and winter season (Table 1).

The average protein content for male fishes at summer, rainy and winter season was 20.07±0.190, 18.71±1.074, 18.25±1.189 % and for female fishes it was found 19.56±0.538, 17.99±1.226 and 17.03±0.925% respectively (Fig. 4; Table 1). The highest protein content was found in male (20.07±0.190%) at summer season and the lowest was found in female (17.03±0.925%) of winter season. In case of both sexes the protein content reached at its higher value in summer season and lower values was obtained at winter season. No significant differences (P < 0.05) were found in case of both sexes in summer and rainy season but significant differences were observed among both males and females protein content at winter season (Table 1). During the present study the maximum protein and lipid values recorded in male and female during summer season coincide with a period of intense feeding and pre-breeding season of this fish. This intense feeding perhaps is more in the months, i.e., immediately after spawning as the fish while spawning incurs energy expenditure along with the loss of gonadal elements and recoups to compensate the expenditure through vigorous feeding activity, Stansby (1954) observed the similar findings in certain freshwater fishes. In the present study protein and lipid content varied from (17.03 to 20.07%) and (2.95 to 4.19%) which is more or less similar to the findings of Mansur *et al.,* (2004) and Mahfuj *et al.,* (2012) who found protein and lipid contents of *C. carpio* var. *communis* (19.21% and 4.18%) and *L. bata* (18.51% and 3.79%) respectively.

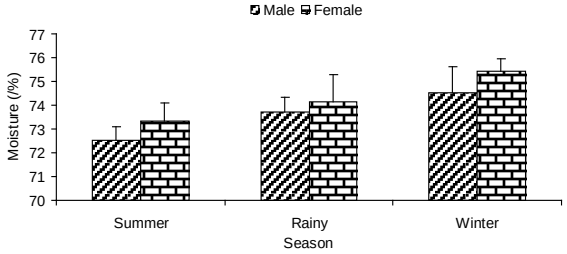

Fig. 1. Seasonal variation in biochemical composition of Moisture (%) content of *Cyprinus carpio* var. *specularis* in both male and female fishes.

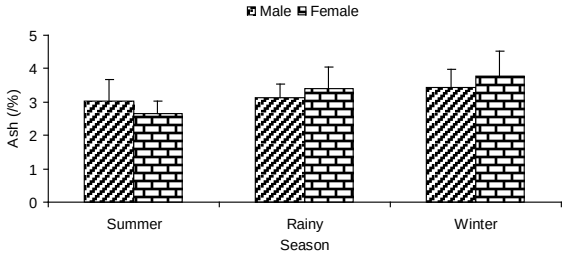

Fig. 2. Seasonal variation in biochemical composition of Ash (%) content of *Cyprinus carpio* var. *specularis* in both male and female fishes.

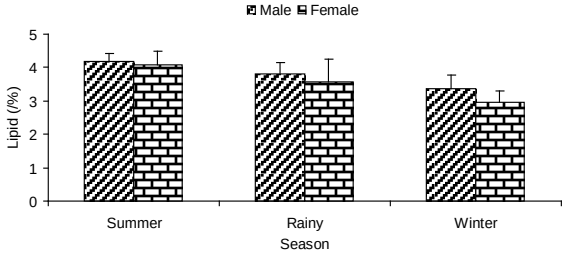

Fig. 3. Seasonal variation in biochemical composition of lipid (%) content of *Cyprinus carpio* var. *specularis* in both male and female fishes.

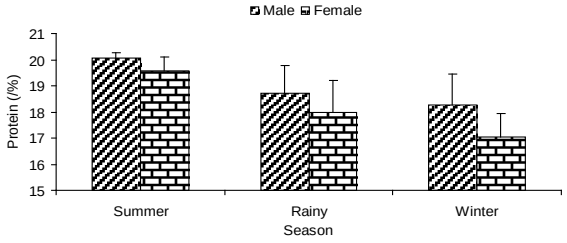

Fig. 4. Seasonal variation in biochemical composition of Proten (%) content of *Cyprinus carpio* var. *specularis* in both male and female fishes.

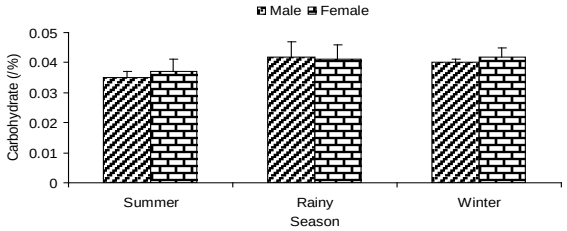

Fig. 5. Seasonal variation in biochemical composition of Carbohydrate (%) content of *Cyprinus carpio* var. *specularis* in both male and female fishes.

Table 1: Seasonal variation in biochemical composition of male and female *C. carpio* var. *specularis* in three seasons.

Seasons	Sex	Biochemical composition (%)				
		Moisture (g)	Ash (g)	Lipid (g)	Protein (g)	Carbohydrate (g)
Summer	Male	72.54±0.551^{b}	3.02±0.637^{a}	4.19±0.231^{a}	20.07±0.190^{a}	0.035±0.002^{a}
	Female	73.32±0.778^{b}	2.64±0.393^{a}	4.08±0.400^{a}	19.56±0.538^{a}	0.037±0.004^{a}
Rainy	Male	73.70±0.630^{ab}	3.13±0.423^{a}	3.80±0.362^{ab}	18.71±1.079^{a}	0.042±0.005^{a}
	Female	74.13±1.146^{ab}	3.41±0.630^{a}	3.58±0.684^{ab}	17.99±1.226^{ab}	0.041±0.005^{a}
*Winter	Male	74.53±1.078^{a}	3.44±0.536^{a}	3.36±0.400^{b}	18.25±1.189^{a}	0.040±0.001^{a}
	Female	75.42±0.538^{a}	3.77±0.766^{a}	2.95±0.349^{b}	17.03±0.925^{b}	0.042±0.003^{a}

Figures bearing common letter(s) in a column as superscript do not differ significantly (P <0.05)
*Winter season is the spawning period of the species.

Carbohydrate

Carbohydrate content was lowest among all food nutrients. The amount of carbohydrate was 0.035±0.002, 0.042±0.005, 0.040±0.001% in male fishes and 0.037±0.004, 0.041±0.005 and 0.042±0.003% in female fishes in summer, rainy and winter season respectively (Fig. 5; Table 1). The highest and lowest carbohydrate content was found in male fishes, it was highest (0.042±0.005%) at rainy season and lowest (0.035±0.002%) at summer season (Table 1). No significant differences (P < 0.05) were observed in case of both sexes in three seasons. In the present study carbohydrate percentage ranged from 0.035-0.042%. The similar findings was also found by Mahfuj *et al.,* (2012) who recorded carbohydrate content of *L. bata* as 0.0454%.

Conclusion

The Mirror carp contains comparatively high amount of protein and lipid. The fish will be able to mitigate the nutrient demand of the poor people. These results also suggest that the biochemical composition of fish species greatly varies due to sex and seasonal changes in environmental conditions, i.e. spawning characteristics might greatly affect the biochemical composition. The results indicate the seasonal variation of moisture, ash, lipid, protein and carbohydrate of *C. carpio* var. *specularis.* The seasonal variation found in females fishes greater than the males. The variation of biochemical composition in season may be due to breeding period and availability of food. It was also observed that the fish have a good potential to serve protein and lipid for all the people being a source of animal protein. It can play a vital role in the commercial aspects also as a source of nutrition and income generation.

References

Ahmed, K., Malek, M.A. & Sanaullah. 1977. Deshio Khadyer Pustiman. Inst. Nutrition and Food Sci., Dhaka University, Dhaka.

Ali, A. 2014. Nutritional Properties of Some Novel Selected Fish Species In Khuzestan Province, IRAN, *J. of Food Technology Research,* **1**(2): 52-59.

Ali, M., Igbal, F., Salam, A., Iram, S. & Athar, M. 2005. Comparative study of body composition of different fish species from brackish water pond. *Int. J. Environ. Sci. Technol.,* 2: 229-232.

AOAC, 1990. *Official Methods of Analysis of the Association of Official Agricultural Chemist*. 15th Ed. Vol.2. Association of Official Analytical Chemists, Inc., Wilson Boulevard, Arlington, Virginia USA. p. 685-1298.

Azim, M.A., Islam, M.R., Hossain, M.B. & Minar, M.H. 2012. Seasonal variations in the proximate composition of Gangetic sillago, *Sillaginopsis panijus* (Perciformes: Sillaginidae). Middle-East *J. Sci. Res*., **11**: 559-562.

Begum, A., Minar. M.H., Mahfuj. M.S. & Begum. M. 2013. Monthly variation of biochemical composition of gonia (Labeo gonius) collected from Bangladeshi water. Int. J. LifeSc. Bt & Pharm. Res. **2**(2): 227-232.

Bligh E.G. & Dyer W. 1959. Total lipid Extraction & Purification. *Can. J. Bipchem. Physiol.* **37**:99-110 p.

Chakwu, O. & Shaba, I.M. 2009. Effect of drying method on proximate composition of cat fish *(Clarias gariepinus*). *J. World Agric. Sci*., **5**: 114-116.

Cui, Y. & R.J. Wootton, 1988. Effect of radiation, temperature and body size on the body composition, energy content and condition of the minnow, *Phoxinua phoxinus* (L.). *J. Fish Biol.*, **32**: 749-764.

Dembergs, N. 1964. Extraction of fish muscles, 4. Seasonal variation of fat, water soluble protein and water in Cod (*Gadno morlia*) fillets. *J. Fish. Res. Canada*, **21**: 705-709.

DoF, 2015. National Fish Week 2015 Compendium (in Bangla). Department of Fisheries, Ministry of Fisheries and Livestock, Bangladesh. 148pp.

FAO, 1995. *Quality and changes in fish flesh*. FAO Fisheries Technical Paper. 195pp.

Islam, M. N. & Joadder, M. A. R. 2005. Seasonal variation of the proximate composition of freshwater gobi, *Glossogobius giuris* (Hamilton) from the river Padma. *Pakistan J. of Bio. Sci.*, **8**(4): 532-536.

Islam, M.R., Sultana, N., Hossain, M.B., & Mondal, S. 2012. Estimation of fecundity and gonadosomatic index (GSI) of gangetic whiting, *Sillaginopsis panijus* (Hamilton, 1822) from the Meghna River Estuary, Bangladesh. *World Appl. Sci. J.*, **17**: 1253-1260.

Kamal, D., Khan, A. N., Rahman, M. A. & Ahamed, F. 2007. Biochemical composition of some small indigenous fresh water fishes from the river Mouri, Khulna, Bangladesh. *Pakistan J. of Bio. Sci*, **10**(9): 1559-1561.

Loomis, W.E. & Shull, C.A. 1937. *Methods in Plant Physiology*, Ed. 1. McGrow-Hill Company, New York.

Lowry, O.H.; N.J. Rosebrough; N.J. Farr & Randall, R.J. 1951. Protein measuremrnt with the folin-Phenol reagent. *J. Biol.chem.* **183**: 265-275.

Mahfuj, M.S., Hossain, M., Belal Hossain, M. & Minar, M.H. 2012. Biochemical Composition of and Endangered Fish, *Labeo bata* (Hamilton, 1822) from Bangladesh Waters, *American J. of Food Tech.* **7**(10): 633-641.

Mansur, M.A., Chakraborty, S.C., Narejo, N.T., Haque, M.M., Hossain, M.I., Shikha F.H., & Kabir, M.S., 2004. A comparative study on freshness of fish at landing centre and in market of a peri-urban area of central north region of Bangladesh, *Sindh Univ. Res. Jour.* (Sci. Ser.). **36**(2) 11-20.

Marais, J.F.K. & Erasmus, T. 1977. Body composition of *Mugil cephalus*, *Liza domerle*, *L. richardsoni* and *L. tricaspidus* (Teleostei : Mugilidae) caught in the Swartkops estuary. *Aqua*, **10**: 75-86.

Nabi, M.R. & Hossain, M.A. 1989. Seasonal variation in the chemical composition and caloric content of *Macrognathus aculeatus* (Bloch) from the Chalon Beel waters. *J. Asiatic Soc. Bangladesh (Sci.)*, **25**: 103-110.

Nargis, A. 2006. Seasonal variation in the chemical composition of body flesh of Koi fish Anabas testudineus (Bloch) (Anabantidae:Perciformes). Bangladesh J. Sci. Ind. Res., **41**(3-4): 219-226.

Naser, M.N., Chowdhury, G.W., Befjum, M.M. & Haque, W. 2007. Proximate composition of prawn, *Macrobrachium rosenbergii* and shrimp, *Penaeus monodon.* Dhaka *Univ. J. Biol. Sci.*, **16**: 61-66.

Osako, K., Yamaguchi, A., Kurokawa, T., Kuwahara, K., Saito, H. & Nozaki, Y. 2002. Chemical components and body color of horse mackerel caught in different areas. *Fish. Sci.*, **68**: 587-594.

Rafael D. Guerrero III & William L. Shelton. 1974. An Aceto-Carmine squash method for sexing juvenile fishes. *The Progressive Fish-Culturist*., **36**(1): 56-56.

Rubbi, S.F., Rahman, M.M., Khan, A.R., Jahan, S.S., & Begum, M.1987. Proximate composition and quality of some commercial species of freshwater fish. *Bangladesh J. Sci.*, **5**: 1-20.

Siddique, M.A.M., Mojumder, P. & Zamal, H. 2012. Proximate composition of three commercially available marine dry fishes *(Harpodon nehereus, Johnius dussumieri* and *Lepturacanthus savala). Am. J. Food Technol*, **7**: 429-436.

Stansby, M. E. 1954. Composition of certain species of freshwater fish. *Food Res*., **16**: 231-234.

Weatherley, A.H. & Gill, H.S. 1987. The Biology of Fish Growth. Academic Press, London, 443pp.

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