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Variation of Lipid and Carbohydrate Content in *Schizothorax esocinus* from Dal Lake of Kashmir Valley

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Abstract: The present study was designed to measure the monthly and seasonal variation in the lipid and carbohydrate content of *Schizothorax esocinus*. Total lipid content of the fish was measured by Folch's method and the carbohydrate content was evaluated by Dubois method. The lipid content of *Schizothorax esocinus* varied seasonally, with maxima and minima in a year. The highest lipid content (0.45 g g^{-1}) was measured in the July and the lowest lipid content (0.25 g g^{-1}) in November. Evaluating the proximate composition of fish is important aspect in fish nutrition. The carbohydrate does not vary so much with a slight increase in spring (0.18%) and a slight decrease in autumn season (0.10%) with an average value of 0.14%.Total protein profile was also carried out in different organs of the fish by using SDS PAGE. The fish is a good source of lipid, carbohydrate and proteins, required for the balanced diet of human consumption.

Key words: Lipid content, carbohydrate content, SDS PAGE, *Schizothorax esocinus*

INTRODUCTION

Fish is considered as one of the main food constituents in human diet, because it contains essential fatty acids, amino acids, vitamins and minerals in sufficient amounts for healthy living (Borgstrom, 1961). Fish oil is one of the most important natural sources of polyunsaturated fatty acids including Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA), which have been proven to have useful effects on human health (Saoud *et al*., 2008; Rafflenbeul, 2001). Fish oil is also a rich source of vitamins like vitamin A, D, E and K, taken on a regular basis because they play an important role in human health and metabolism (Kinsella, 1987).The balance between the lipid and carbohydrate content is important in assessing the flesh quality and seasonal cycles of reproduction and feeding (Clay, 1988). During starvation periods, fish uses the energy in the form of lipids and proteins, thus, depletion of these reserves results in a general diminution of biological condition (Huss, 1995). Ke and Burns (1987) reported that one of the ways of measuring fish quality is through the estimation of its biochemical composition or proximate analysis. The exact composition of fish depends on the species of fish, (which is related to its feeding habit) and source of fish (habitat).

The main objective of this study was to investigate the seasonal variation in the lipid and carbohydrate content in the muscle of *Schizothorax esocinus* from the Dal lake of Kashmir valley and to identify the total protein profile of the fish tissue.

MATERIALS AND METHODS

The current research has been carried out in the year 2011-2012. The lipid and carbohydrate content of *Schizothorax esocinus* was investigated. We have also analyzed the total protein profile of the fish by polyacrylamide gel electrophoresis. The fish were purchased from local fish market of Hazratbal Srinagar. Before taking the muscle tissue the total weight of the fish was recorded. The muscle tissue was weighed and then homogenized in a buffer.

Estimation of carbohydrate: The total carbohydrate content of fish was estimated by using the method of DuBois *et al*. (1956).

Estimation of lipid: The total lipid content of fish was estimated by using Folch *et al.* (1957) method.

Protein isolation: Proteins were isolated from different tissues by salting out method.

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Sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE): SDS-PAGE was performed as described by Laemmli (1970). Ten percent polyacrylamide gel in a vertical slab gel apparatus was used. Protein samples (Tris buffer 0.5M PH 6.8) were then loaded into the wells of polymerized gel. Electrophoresis was performed at a constant voltage of 200 volts when samples were loaded in the wells. At the completion of the electrophoresis the gel was stained using Coomassie Brillant blue. After one hour the protein bands were analyzed by using the gel doc system.

Statistical analysis: The values are expressed as mean±standard deviation (SD). The results were evaluated by using the SPSS (version 12.0) and Origin 6 softwares and evaluated by one-way ANOVA followed by Bonferroni t-test. Statistical significance was considered when value of p was at <0.05.

RESULTS AND DISCUSSION

Lipids: The lipid content ranged from 0.30-0.45 g g^{-1}. The highest content is seen in the month of July (0.45 g g^{-1}) and lowest in Nov. (0.25 g g^{-1}). Our results indicate that highest lipid content was observed in summer and lowest in autumn season (Table 1). The amount of total lipids obtained from various species and subspecies of fresh water fish was investigated and it was observed that the values were between 0.6-30% (Farkas and Csengeri, 1976; Farkas *et al*., 1978). The amount of total lipids in muscle has shown different variation by months. The fish generally store lipids in liver and muscle tissues, but during the process of storage which tissues are important varies according to the fish species. It was reported that active fish stored their lipids in muscle tissues; but the inactive fish, living at the bottom of water, store their lipids in liver (Castell *et al*., 1972). Storage lipids vary during reproduction and nutrition periods. It was observed that in reproduction period, the lipids are mobilized from the liver and muscle to the gonads for their development (Castell *et al*., 1972). The cycles of storing lipid are directly connected with food abundance. If there is scarcity of food in their environment the variation is low, but if it is abundant, the variation is higher during the year (Mute *et al*., 1989). Much more energy is needed during the development of gonads; so plenty of food must be available in that period (Wang *et al*., 1990). The decrease in the amount of total lipid in the muscle of fish during the periods of gonad development and reproduction shows that fish supply the required energy from the stored lipids during this period (Aggelousis and Lazos, 1991). It was determined that reproduction season of the *Schizothorax esocinus* is between April and May. According to our results, the amount of total lipid in muscle has reached its maximum level in summer and minimum in autumn season. Similar results were reported by Vlaming *et al*. (1978) that decrease of lipid amount in autumn season is because of the increase of reproduction functions. It was expressed that in a study carried out on *Schizothorax esocinus* the storage lipids were consumed during gonadal developments.

Table 1: Monthly variation in total lipid content of *Schizothorax esocinus* (% of tissue)

Month	Species *Schizothorax esocinus*
January	$0.36\pm0.01^{\$\#bcC}$
February	$0.31\pm0.03^{\$\#@ABe}$
March	$0.35\pm0.05^{\$\#@cdC}$
April	$0.38\pm0.023^{\$abBC}$
May	$0.33\pm0.012^{\$\#@ABe}$
June	$0.39\pm0.013^{\$aABC}$
July	$0.45\pm0.034^{\#@ABC}$
August	$0.40\pm0.023^{\$@ABC}$
September	$0.35\pm0.056^{\$\#bcdC}$
October	$0.30\pm0.035^{\$\#@ABC}$
November	$0.25\pm0.053^{\$\#@ABC}$
December	$0.30\pm0.026^{\$\#@ABC}$

Each value represents the mean±SD of 3 separate experiments. $; p<0 .001, as compared with July month, #; p<0.001 as compared with August, @; p<0.001 as compared with June, a; non significant as compared with August, b; non significant as compared with June, A; p<0 .001, as compared with April month, c; non significant as compared with April, B; p<0 .001, as compared with January month, d; non significant as compared with January, C; p<0 .001, as compared with March month, e; non significant as compared with March. The data were presented as means±S.D of three parallel measures and evaluated by one way ANOVA followed by the Bonferroni t-test to detect inter group differences. Differences were considered to be statistically significant if p<0 .05

Table 2: Monthly changes in carbohydrate content of *Schizothorax esocinus* (gms/gram of tissue)

Month	Species *Schizothorax esocinus*
January	$0.0022\pm0.0013^{ns\#@Ae}$
February	$0.0019\pm0.0002^{\$\#@ABC}$
March	$0.0023\pm0.0003^{ns\#@Ad}$
April	$0.0011\pm0.00005^{\$\#bBC}$
May	$0.0009\pm0.00004^{\$\#@ABC}$
June	$0.0011\pm0.00034^{\$\#cBC}$
July	$0.0022\pm0.00018^{\#@Ade}$
August	$0.0009\pm0.00027^{\$@ABC}$
September	$0.0005\pm0.00021^{\$\#@ABC}$
October	$0.0013\pm0.0003^{\$\#@ABC}$
November	$0.0012\pm0.00011^{\$\#bcBC}$
December	$0.0016\pm0.0009^{\$\#@ABC}$

Each value represents the mean±SD of 3 separate experiments. $; p<0 .001, as compared with July month, #; p<0.001 as compared with August, @; p<0.001 as compared with June, ns; non significant as compared with July, a; non significant as compared with August, b; non significant as compared with June, A; p<0 .001, as compared with April month, c; non significant as compared with April, B; p<0 .001, as compared with January month, d; non significant as compared with January, C; p<0 .001, as compared with March month, e; non significant as compared with March. The data were presented as means±S.D of three parallel measures and evaluated by one way ANOVA followed by the Bonferroni t-test to detect inter group differences. Differences were considered to be statistically significant if p<0 .05

Carbohydrate: The highest amount of carbohydrate is in the month of March (0.0023 g g^{-1}) and lowest in the month of September (0.0005 g g^{-1}) with an average value of 0.14% Table 2. It may be pointed out that carbohydrate did not show large seasonal variation as it is present in very small amount i.e., 0.5-1%. As for survival of this fish

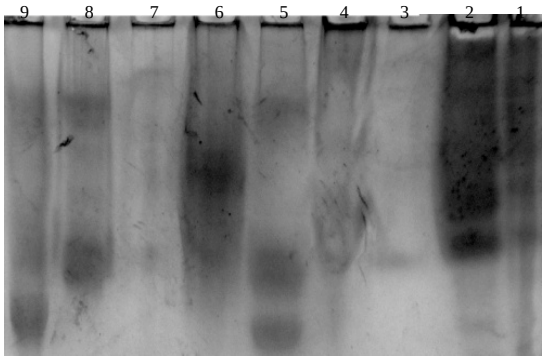

Fig. 1: Photo graphical representation of protein profile of liver, muscle, gonadal and intestine tissue of *Schizothorax esocinus* by using SDS polyacrylamide gel electrophoresis (Lane 1 and 2) Marker proteins; BSA, Hb, Pepsin and Ova albumin (Lane 3 and 4) protein profile of intestine tissue (Lane 5) protein profile of gonadal tissue (Lane 6) protein profile of muscle tissue (Lane 8 and 9) protein profile of liver tissue

it have to move fast in search of food and to avoid predation, for that it needs chemical energy which is stored in the form of muscle glycogen. Carbohydrates formed a minor percentage of the total composition of the muscle and do not show so much seasonal variation. The low values of carbohydrates recorded in the present study suggest that it does not contribute significantly to the total reserves in the body. It is further supported by Vijayakumaran (1979) who stated that carbohydrate plays a minor role in energy reserves of *Ambassisgymno cephalus* and its depletion during the spawning season is insignificant. In winter season which is resting period energy is reserved so carbohydrate content is more as compared to autumn season. In summer season feeding of fish is good so carbohydrate content is high. The depletion and mobilization of energy reserves from storage site to the activity site at the time of maturation and spawning is a proven fact. Chelappa *et al.* (1989) established that energy reserves in male three-spined stickle backs drops during growth and gonadal maturation. They also observed a drastic depletion of lipid, glycogen and protein during breeding activity and during the final development of secondary sexual characteristics. The present study revealed seasonal changes in biochemical composition of the muscle of *Schizothorax esocinus* associated with feeding, reproductive cycle, storage and utilization of reserves. Phillips *et al.* (1967) observed that carbohydrates were utilized for energy by trout and spared protein for body building.

Total protein profile: Total protein profile of the fish was carried out by using the SDS PAGE. We observe different concentrations of total proteins in different organs of the fish. High protein profile was seen in the muscle tissue followed by gonads and then in the liver tissue (Fig. 1). Most of the proteins in gonadal and liver tissue are below 30,000 Kd molecular weight because the bands in the lanes (5, 8 and 9) are below the bands of pepsin marker protein. Highest protein content was observed in muscle tissue as indicated by the intensity of the band (lane 6).

CONCLUSION

The results suggest that the lipid and carbohydrate content of fish greatly varies during the different season. This might be due to physiological reasons and changes in environmental conditions, i.e., spawning, migration, and starvation or heavy feeding. It is necessary to have the data on the composition of fish in order to make the best use of it as food and also to develop the technology of processing fish and fish products. From the present study we conclude that during autumn and spring season, especially until the process of reproduction is completed, the decrease of lipid amount in muscle tissues has been utilized for the reproduction purposes and storing lipid in summer season is necessary for winter season. Carbohydrate content does not show any significant variations.

REFERENCES

Aggelousis, G. and E.S. Lazos, 1991. Fatty acid composition of the lipids from eight freshwater fish species froom Greece. J. Food Compos. Anal., 4: 68-76.

Borgstrom, G., 1961. Fish as Food, Production, Biochemistry and Microbiology. Academic Press, Inc., Volume I. London, pp: 725.

Castell, J.D., R.O. Sinnhuber, J.H. Wales and D.J. Lee, 1972. Essential fatty acids in the diet of rainbow trout (*Salmo gairdnerii*): Growth, feed conversion and some gross deficiency symptoms. J. Nutr., 102: 77-86.

Chelappa, S., F.A., Huntingford, R.H.C. Strang and R.Y. Thomson, 1989. Annual variation in energy reserves in male three-spined stickleback, *Gasterosteus aculeatus* L (Pisces, Gasterosteidae). J. Fish Biol., 35: 275-286.

Clay, D., 1988. Fat, water, protein and ash composition on blue fin tuna collected in the Gulf of St. *Lawrence*. ICCAT Collect. Sci., 28: 196-202.

DuBois, M., K.A. Gilles, J.K. Hamilton, P.A. Rebers and F. Smith, 1956. Colorimetric method for determination of sugars and related substances. Anal. Chem., 28: 350-356.

Farkas, T. and I. Csengeri, 1976. Biosynthesis of fatty acids by the Carp. *Cyprinuscarpio* L. in relation to environmental temperature. Lipids, 11: 401-407.

Farkas, T., I. Csengeri, F. Majors and J. Olah, 1978. Metabolism of fatty acids in fish.II. Biosynthesis of fatty acids in relation to diet in the carp. (*Cyprinus carpio* L.). Aquaculture, 14: 57-65.

Folch, J., M. Lees and G.H.S. Stanley, 1957. A simple method for the isolation and purification of total lipids from animal tissues. J. Biol. Chem., 226: 497-509.

Huss, H.H., 1995. Quality and Quality Changes in Fresh Fish. FAO., Rome, Italy, pp: 348.

Ke, P.J. and B.G. Burns, 1987. Biochemical Fish Quality Evaluation with Recommended Methods. Proceedings of the 12th Annual Tropical and sustainable Fisheries Technology Conference of America. November 9th-11th, 1987, Orlando, Florida, pp: 359-364.

Kinsella, J.E., 1987. Summary of Needs, in Sea Foods and Fish Oil in Human Health a Disease. Pub. Marcel Dekker, Inc., New York, pp: 234.

Laemmli, U.K., 1970. Cleavage of structural proteins during the assembly of the head of bacteriophage T4. Nature, 227: 680-685.

Mute, P., J.J. Agren, O.V. Lindovist and O. Hanninen, 1989. Fatty acid composition of vendace (*Coregonus albulan* L) muscle and its plankton feed. Comp. Bioche. Physiol., 92B: 75-79.

Phillips, A.M., H.A. Poston and D.L. Livingston, 1967. The effect of caloric sources and water temperature up on trout growth and body chemistry. Fish Res. Bull., 30: 25-34.

Rafflenbeul, W., 2001. Fish for a healthy heart. European J. Fat. Sci. Tech., 103: 315-317.

Saoud, I.P., M. Batal, J. Ghanawi, and N. Lebbos, 2008. Seasonal evaluation of nutritional benefits of two fish species in the eastern Mediterranean Sea. Int. J. Food Sci. Technol, 43: 538-542.

Vijayakumaran, M., 1979. Chemical composition and caloric content of *Ambassis gymno cephalus*. J. Marine. Biol. Assoc. India, 21: 182-184.

Vlaming, V.L.D., A. Kuris and F.R. Parker, 1978. Seasonal variations of reproduction and lipid reserves in some subtropical cyprinodantids. Trans. Am. Fish Soc., 107: 464-472.

Wang, Y.L., L.A. Miller, M. Perren and P.B. Addis, 1990. Omega-3 fatty acids in Lake Superior fish. Food Sci., 55: 71-73.