

## Biochemical composition of fish eggs from local water reservoirs around Amravati city

Akarte S R and M. B. Mudgal\*

Department of Zoology Vidya Bharati Mahavidyalaya, Amravati University, Amravati, India

### ABSTRACT

Nutritional requirement of human is predominately fulfilled by the animal meat; however it is found that the source is inadequate due to various factors like, economy, environmental condition etc. In view of finding the higher nutritional content we focus on especially the fish eggs. Fish is widely used throughout the world as besides being a good source of biologically high valued protein. Nutrient composition of fish eggs is one of the important factors in determining the quality of egg. Quality of egg in freshwater fish and marine water fish can be determined for different types of nutrients such as essential fatty acid, vitamins, and some trace minerals. In the present study nutritional evaluation of fresh water fish eggs were carried out. *Pangus and Hilsa* were selected for the study purpose and eggs were collected from the local market of the Amravati city. Along with protein, carbohydrate, lipid, minerals like sodium and potassium were also determined. RNA and DNA values were also determined as it is considered as the most prominent factor or the development. Findings of the study reveals higher value of nutritional content compared with the previous findings of different fish tissue especially muscle.

**KEY WORDS:** FISH, EGGS, LIPID, PROTEIN, CARBOHYDRATE, RNA, DNA, SODIUM, AND POTASSIUM

### INTRODUCTION

Fish is widely used throughout the world, as a good source of high value protein; it is also useful in lowering of blood cholesterol level. Fish contain significant amounts of essential amino acids, especially lysine. Therefore, fish protein may be used to complement important amino acids and also to improve overall protein quality of a mixed diet (FAO, 2005). Fish products comprise an

important ingredient in the human diet to upgrade their nutritional standards. Nutritional value of fish obviously depends on their biochemical composition (Prado, *et al.*, 2009). The health benefits of fish oils in prevention of cardiovascular diseases through modifications of risk factors like hyperlipidemia, hypertension, and secondary prevention following myocardial infarctions have been reviewed (Calder, 2004).

#### ARTICLE INFORMATION:

\*Corresponding Author:

Received 10<sup>th</sup> Feb, 2017

Accepted after revision 18<sup>th</sup> June, 2017

BBRC Print ISSN: 0974-6455

Online ISSN: 2321-4007 CODEN: USA BBRCBA



Thomson Reuters ISI ESC and Crossref Indexed Journal

NAAS Journal Score 2017: 4.31 Cosmos IF : 4.006

© A Society of Science and Nature Publication, 2017. All rights reserved.

Online Contents Available at: <http://www.bbrc.in/>

Fish eggs also have a good source for human nutrition due to their therapeutic role in reducing certain cardiovascular disorders (Stickney and Hardy, 1989). Varying egg quality is a limiting factor for successful mass production of fishes. The problem of varying egg quality, however, has received little attention. Appropriate quality of criteria has been difficult to identify because of limited knowledge (Kjorsvik *et al.*, 1990). The biochemical composition of eggs is one of the factors determining egg quality since eggs must contain all the nutrients required for normal development during embryonic and yolk-sac larval stages. Several nutrients such as vitamins and essential fatty acids (EFA) have been suggested to be related to egg quality in both freshwater and marine fishes (Takeuchi *et al.*, 1981; Watanabe 1985; Soliman *et al.*, 1986; Foley *et al.*, 2016).

More information on the relationship between egg composition and egg quality is needed for the improvement of egg quality (Watanabe *et al.*, 1984). Apart from this the study of RNA:DNA ratio of eggs is equally important to know the nutritional status of eggs as well as physiological condition of the fish itself in particular water body. Required optimum ratio of RNA: DNA present in fish body part or in spawned eggs is indication of good productivity of water body.

## MATERIALS AND METHODS

The two species of genus, Pangus (*Pangasius buchmanani*) and Hilsa (*Tenulosa ilisha*) respectively, were considered for study of biochemical compositions of its eggs. The eggs of fish Pangus and Hilsa were collected for study from the fish market of Amravati city. 250 grams of eggs were collected from each fish. Then the eggs were stored in deep freezer at -15°C in separate plastic bottles and

out of these some were kept in 1ml tubes, which were stored in quick freezers up to -20°C. The samples were taken accordingly from sample tubes at the time of biochemical experimentation. Total protein was estimated by Lowry *et al.*, (1951). Total carbohydrate by Bligh and Dyer (1959) and total lipid by Dubois *et al.*, (1956). Extraction of RNA and DNA was done by the procedure of Halliburton *et al.*, (1965) method. Estimation of RNA was done by orcinol method of Ashwell (1957) and estimation of DNA was done by diphenylamine method of Burton (1956). Values are expressed in mg/100mg for protein, carbohydrate, and lipid and µg/100mg for RNA and DNA. Estimation of minerals (Sodium and Potassium) was done with the help of flame-photometer

## RESULTS AND DISCUSSION

An egg needs all the necessary information to direct the development; it needs all the amino acids, lipids and carbohydrates, together with calcium (for bones), vitamins and metals for enzyme and other metabolic actions. These specialized materials are derived from number of maternal sources and are incorporated during the growth of the oocyte in the ovary. If an egg does not contain a particular compound, or contains an inappropriate amount of the compound, it will not be able to sustain development of a viable embryo. Hence mature egg contains these essential compounds in high amount.

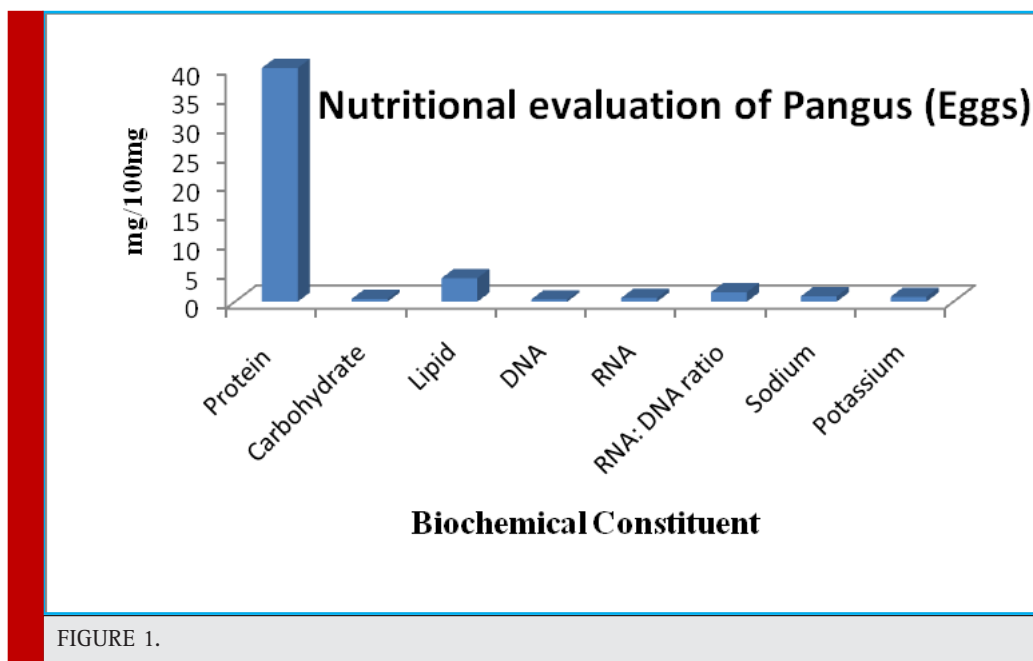
RNA-DNA ratio can be considered as a measure of the amount of protein synthetic machinery per cell, since the DNA content of an organism is an indicator of cell number. Therefore, the direct positive relationships between, RNA-DNA ratio and growth rate observed in this study is as per expectation. Positive correlations

Table 1. Biochemical Composition of Macromolecules

Sr. No.	Name of species	Protein mg/100mg	Carbohydrate mg/100mg	Lipid mg/100mg
1	<i>Pangus</i> (Eggs)	40	0.49	4.02
2	<i>Hilsa</i> (Eggs)	27.7	0.35	5.24

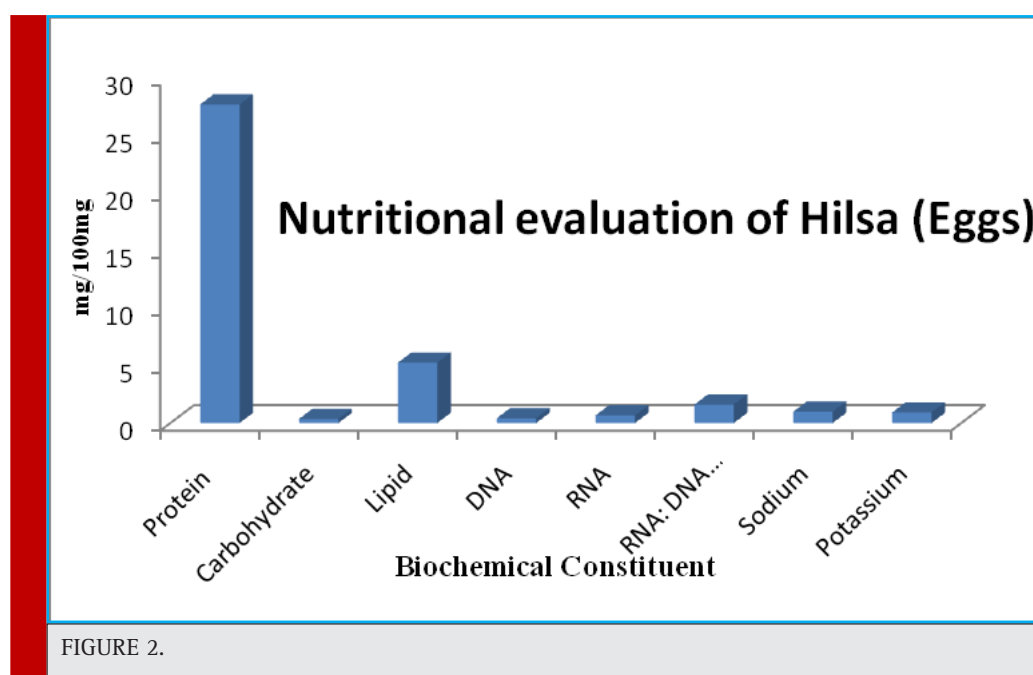
Table 2. Biochemical Composition of Micromolecules

Sr. No.	Name of species	DNA µg/100mg	RNA µg/100mg	RNA: DNA ratio	Sodium µg/100mg	Potassium µg/100mg
1	<i>Pangus</i> (Eggs)	0.39	0.63	1.61	0.91	0.84
2	<i>Hilsa</i> (Eggs)	0.41	0.66	1.6	0.98	0.91



between RNA-DNA ratio and growth rate have also been observed for adult (marine fish), golden shiners (Bulow, 1970). RNA:DNA analyses may be most useful for assessing the condition of fish larvae susceptible to entrainment, evaluating whether fish larvae are likely to die from natural processes independent of entrainment, or assessing the relative condition of fish larvae which are still alive immediately following entrainment (Foley *et al.*, 2016).

Higher RNA tissue concentrations at lower temperatures may be a compensatory mechanism for lower RNA activity, (Goolish *et al.*, 1984). In this study it was seen that RNA/DNA ratio of fish eggs were comparatively more than 1.5. It indicates that there will be the need of large amount of proteins for the hatching of eggs and the production of healthy new young ones. These results show that there would be the good food availability for these fishes. Protein relation to RNA/DNA ratio derived



from present study indicate good development. Response of the protein and RNA/DNA ratio to the feeding conditions was significantly observed (Akarte *et al.*, 2014).

Determinations of RNA and DNA can be used as biochemical indicators of recent growth rates of fish within each time period; RNA concentrations increased somewhat with higher feeding rate and faster growth. DNA concentration, however, increased with greater weight loss and longer periods of food deprivation. The slight decrease in DNA with increased growth and the slight increase in DNA with increased weight loss were probably due to changes in cytoplasmic volume. It was observed that food deprivation, other cellular constituents are metabolized and DNA is preserved (Leslie, 1955).

In the current study, the biochemical composition of fish eggs of *Hilsa* and *Pangus* were observed. The biomolecules of these eggs which were being under consideration were proteins, carbohydrates, lipids, minerals, and nucleic acids (RNA and DNA). These bimolecular components show the status and productivity of an organism. In this study, it was shown that the concentration of protein was in the range of 27.7mg/100mg for *Pangus* fish and 40.0mg/100mg tissue in *Hilsa* fish. Amount of protein shows the availability of food through productivity of water to the organism. Finding which is at variance with a recent suggestion are free amino acids may serve as the sole substrate for aerobic energy metabolism during embryogenesis in species, (Fyhn *et al.*, 1986). So, higher values of protein quantity suggest good nutritional quality of fish eggs as human food.

## REFERENCES

- Ashwell, G. (1957) Colorimetric analysis of sugars: cystine reaction of DNA. In Colowick, S.P. and N.O. Kapla, eds.: Methods in enzymology. Vol. 3. Academic Press, New York, 1154. 10.
- Bligh, E. G., & Dyer, W. J. (1959). A rapid method of total lipid extraction and purification. Canadian journal of biochemistry and physiology, 37(8), 911-917.
- Burton, K. A.(1956).Study of the conditions and mechanism of the diphenylamine reaction for the colorimetric estimation of deoxyribonucleic acid. The Biochemical Journal, 62(2):315-323
- Calder, P. C. (2004). N-3 Fatty acids and cardiovascular disease: evidence explained and mechanisms explored. Clinical science, 107(1), 1-11.
- Ching, F. F., Nakagawa, Y., Kato, K., Murata, O., & Miyashita, S. (2012). Effects of delayed first feeding on the survival and growth of tiger grouper, *Epinephelus fuscoguttatus* (Forsskål, 1775), larvae. Aquaculture Research, 43(2), 303-310.
- DuBois, M., Gilles, K. A., Hamilton, J. K., Rebers, P. A. T., & Smith, F. (1956). Colorimetric method for determination of sugars and related substances. Analytical chemistry, 28, 350-356.
- FAO, (2005). United Nations Food and Agriculture Organization, Nutritional elements of fish. FAO Rome.
- Foley, C. J., Bradley, D. L., & Hook, T. O. (2016). A review and assessment of the potential use of RNA: DNA ratios to assess the condition of entrained fish larvae. Ecological Indicators, 60, 346-357.
- Halliburton, I.W. and Thomson, R.Y.(1965). Chemical aspect of compensatory renal hypertrophy. Cancer. Res., 25: 1882-1987. 9.
- Kjørsvik, E., Mangor-Jensen, A., & Holmefjord, I. (1990). Egg quality in fishes. Advances in Marine biology, 26, 71-113.
- Lowry, O. H., Rosebrough, N. J., Farr, A. L., & Randall, R. J. (1951). Protein measurement with the Folin phenol reagent. J Biol Chem, 193(1), 265-275.
- Prado, R., Rioboo, C., Herrero, C., & Cid, A. (2009). The herbicide paraquat induces alterations in the elemental and biochemical composition of non-target microalgal species. Chemosphere, 76(10), 1440-1444.
- S.R. Akarte, and M.B. Mudgal (2014). Tissue Specific Variations in protein and RNA: DNA ratio of Freshwater fish *Channa punctatus* Adv. Biores., Vol 5 [4] December: 35-38. DOI: 10.15515/abr.0976-4585.5.4.3538
- Soliman, A. K., Jauncey, K., & Roberts, R. J. (1986). The effect of dietary ascorbic acid supplementation on hatchability, survival rate and fry performance in *Oreochromis mossambicus* (Peters). Aquaculture, 59(3-4), 197-208.
- Stickney, R. R., & Hardy, R. W. (1989). Lipid requirements of some warm water species. Aquaculture, 79(1-4), 145-156.
- Takeuchi, M., Ishii, S., & Ogiso, T. (1981). Effect of dietary vitamin E on growth, vitamin E distribution, and mortalities of the fertilized eggs and fry in ayu, *Plecoglossus altivelis*. Bulletin of Tokai Regional Fisheries Research Laboratory (Japan).
- Watanabe, T. A. K. E. S. H. I. (1985). Importance of the study of brood stock nutrition for further development of aquaculture. Nutrition and feeding in fish, 395-414.
- Watanabe, T., Ohhashi, S., Itoh, A., Kitajima, C., & Fujita, S. (1984). Effect of nutritional composition of diets on chemical components of red sea bream (*Chrysophrys major*) brood stock and eggs produced. Bulletin of the Japanese Society of Scientific Fisheries (Japan).