Journal of Advances and Scholarly Researches in Allied Education

Vol. IX, Issue No. XVIII, April-2015, ISSN 2230-7540

STUDY OF NUTRITIONAL BEHAVIORS OF FRESH WATER TELEOSTEAN FISH MASTACEMBELUS ARMATUS (LAC)

AN INTERNATIONALLY INDEXED PEER REVIEWED & REFEREED JOURNAL

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Study of Nutritional Behaviors of Fresh Water Teleostean Fish Mastacembelus Armatus (LAC)

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Abstract – In female Mastacembelus armatus, nutritional and energy quality in form of protein glycogen and fat, along with the moisture content of tissues, liver and ovary, have been studied in relation to the menstrual cycle. In the muscle and liver, the material of protein glycogen and lipid have been recorded maximum in the resting phase compared to the other phase. In the spawning process, they were located high in ovary relative to the other process. Similarly, the muscle and liver energy content were also found high in the rest phase. In the spawning season, the energy content of ovaries was found to be highest in comparison with the other reproductive phases. There is a decline in muscle and liver nutrients in the spawning phase, which can be attributed to less feeding and a diversion of body reservoirs into gonad development during the spawning phase.

Keywords: Nutritional Behaviors, Mastacembelus Armatus, Teleostean Fish

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INTRODUCTION

The eating of fish, creeks and seafood supplies a vast number of citizens worldwide with essential nutrients and allows a huge contribution to nutrition. The overall food supply from marine and domestic sources will have an evident availability for each resident in the world as a live weight of around 13 kg per year. In developed countries this is 27 kg per capita, while in developing countries it is only 9 kg per capita. India is an agro-based country blessed with huge inland waterways in the form of lakes, rivers, lakes and water reservoirs which is a very eco-friendly environment for aquaculture. Biochemical analysis is an index of nutritive value since of certain biomolecules are associated with some of the properties of species that are nutritionally important. Precise calculation of biochemical composition and freshness are essential for the economy as well as processing. Fish may be regarded as a biological organism in laboratories.

Mastacembelus armatus, is a freshwater spiny angel of strong economic importance in India in particular. Mastacembelidae are an elongated, medium-sized angel, or spiny angels, to large enantiomorphic teleost's in tropical Africa and Middle East Asia. The declining wild population has given this fish urgent attention. The reduction in population is due to habitat destruction, foreign species intoxication, viruses, deforestation, siltation, poisoning, dynamite and other harmful fishing activities. Just recently numerous workers have studied biological studies on the reproduction, reproductive capacity, reproductive activity and economic potential of this fish.

MATERIAL AND METHOD

Solubility

The solubility of protein was determined accordingly to the method with modifications. The fish were excised, 1 g of muscle was taken, homogenised and centrifugated in 100ml of cooled distilled water for 10 minutes at 4oC. Aliquot 10ml was moved to the test tube and the pH of the test tube was changed to 2,4,5,6,7,8,10, and 12 to 0.1N NaOH and 0.1N HCl respectively. Following Lowry's, the protein level was estimated.

The precise protein content in the supernatant has been measured using the Bovine increased serum norm curve. The solubility profile is expressed as a protein solubility percentage. At pH 12, pH solubility was taken as 100%. Protein solubility percentage was evaluated according to the following equation;

$$\text{Percent protein solubility} = \frac{\text{Amount of Soluble Protein}}{\text{Total amount of protein}} \times 100$$

Foaming properties

Fish with a 0.5 g sample was whipped with 50ml of purified water (pH set to 8) at high speed with a grinder (Ken star) mixer for two minutes. The whipped mixture is immediately transferred into 250ml graduated cylinder. The foaming capacity was assessed on the basis of percent foam volume increase calculated according to the following equation

$$\%\ \text{volume increase} = \frac{\text{total volume after whipping} - \text{Volume before whipping}}{\text{Volume before whipping}} \times 100$$

To determine foam stability, the total volume at time intervals of 0, 2.3.4.5, 10, 15, 20,25 and 30 minutes was noted. The whipped sample was allowed to stand at 25ºC for 30 minutes and the volume of whipped sample was then recorded. Foam stability was calculated by following method as described

$$\text{Foaming stability}\ (\%) = \frac{\text{Volume after standing} - \text{Volume before Whipping}}{\text{Volume before whipping}} \times 100$$

Emulsifying properties were calculated using the process, with slight improvements as defined below. Emulsion behavior index (EAI) and emulsion stability index (ESI) An emulsion was formed in a high-speed homogenizer (REMI) for around 1 minute by homogenizing 1 ml base nut oils and 3 ml of 0.1percent fish muscle solution in a sodium phosphate buffer pH 7.4. The bottom of the test tank, with 100µl emulsion, was drawn, with 0,1,2,3,4,5,10,15,20,25,30,40,45 and 50 minutes and with 5ml of 0,1 percent of sodium dodecyl in sulphate diluted. Diluted emulsion absorption was measured at 500 nm. The relative emulsification was then estimated at 500 nm at the time of emulsion forming (0). Following emulsion forming, the sample used to measure the emulsion activity index (EAI) and the emulsion stability index (ESI) using the formulation EAI=2Tć Where, T is turbidity (T=2.303A500 / I; A500 is 500 nm absorbent; I is a longitudinal path); F is oil volume fraction (0.25) and C is a protein amount.

$$\text{EAI}\ (m^2/g) = \frac{2 \times 2.303 \times Abs_{500nm}}{0.25 \times \text{Protein Weight (g)}}$$

$$\text{ESI (min)} = \frac{A_0 \times \Delta t}{\Delta A}$$

Where,

$$\Delta A = A_0 - A_{10} \text{ and } \Delta t = 10\text{min.}$$

Capacity of Water and Oil Binding The absorption capacity of water and oil was calculated by following equation. The findings are measured as grimes of water or groundnut oil consumed by grimes of water and oil.

RESULTS

Protein solubility

Fish Protein Solubility Profile, M. Armatus showed an overall solubility of 77,94 ± 0,325 at pH 10 and 53,29 at pH 2. The minimum solubility of 29.4±1.035 was located at pH 6. Figure 1 indicates the solubility profile of the fish protein solution at various pH levels. Fish muscle protein concentration was 0.307g / ml. The solubility of the protein demonstrated a large difference {F(1,10)=24.65;P<0.05 cri4.96} with pH.

pH impacts the charges on the acid and basic groups of the side chain. Reported that the variations in solubility are due both to the net load of peptides, which is increased as pH moves from pI and hydrophobic surface interaction. The need for sufficient solubility to distinguish muscle proteins from insoluble content, which would contribute, for example, to the highest protein recovery in the iso-electric precipitation of neutral solutions. A related process can occur in this study.

Foaming capacity and stability

Protein fumigation power and stability are seen in (Figure 2). The observed foaming power was 13.67%

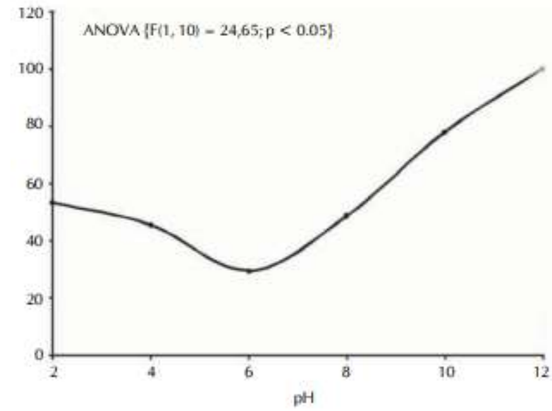

Figure 1: Curve of solubility proportion of M. armatus Muscle protein

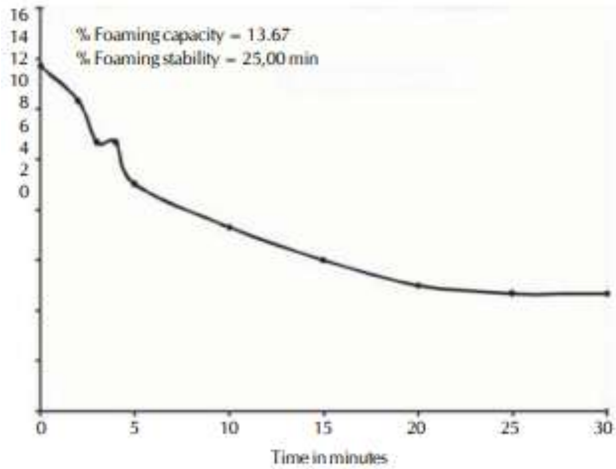

Figure 2: Capacity of foaming and resilience. Muscle protein M. armatus

The stability of the foaming was 25 minutes. The capacity for foaming showed a decrease with time increase. The foaming characteristics of protein forming and stabilising foams constitute significant physicochemical characteristics. The foaming is an essential functional property of proteins, creating a versatile and cohesive film to capture air bubbles. The protein quickly adsorbed during bubbling at the freshly formed air liquid interface, three factors regulating foam creation, viz. Transport, penetration and reorganization at air-water interface of protein molecules. Good movement of protein on the interface induces good moisture. The protein type, degree of derivation, pH, temperature and whipping methods used are significant influences of this phenomena. Based on studies, low moaning capacity may be due to the protein present in this fish, which slowly adsorb and resist the interface unfolding. Inadequate electrostatic repulsion, decreased solubility and unnecessary protein-protein interactions, may be related to low foaming capacities. Numerous workers claim that weight and pH often affect a rise in the formation of spum. The low moam behavior observed at 13.67% could be induced by insufficient electrostatic repulsion and less solubility, as multiple workers have indicated.

The stability of the foam was observed in 25 minutes. the improved foam resilience may be attributed to the development of stiffer foams and is promoted by compact protein domains, aqueous phase viscosity and protein concentrations. The function of high molecular weight peptides and the surface hydrophobicity of the unfolded protein is responsible for the stability. In the present research, the high molecular protein in the fish muscle will sustain the consistency of the molecular foam. The possible mechanism observed for foam stability may rely on the right combination of resilience, protein rigidity at the air-water interface, and the capacity for forming a cohesive film with strong shear deformation resistance.

The low solubility and enhanced hydrophobicity are responsible for lower stability. The properties of foaming are controlled by molecules being transferred, penetrated and rearranged at the air interface. The adsorption at the air water interface is calculated in the hydrophobic regions of molecules. The degree of protein / protein association in the matrix influences the existence and the consistency of foaming of the film forming at the interface. In the current inquiry, At 25 minutes, armatus fish displayed foam stability. Smoothness, lightness, dispersal and palatability relate to the durability of foam.

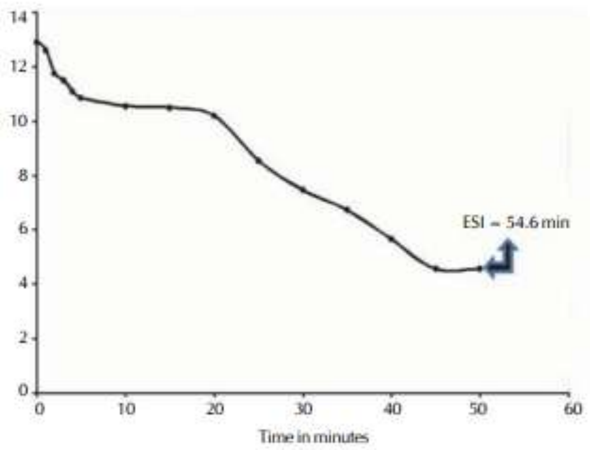

Figure 3: Percentage of operation emulsifying index and stability (arrow indicated) emulsifying index in minutes of Muscle protein M. armatus

Emulsifying the EAI and ESI stability and behavior index of M. Figure 3 displays armatus. IAE was 8,96 percent, 8,60 percent, 8,12 percent, 7,75 percent, 7,27 percent, 6,78 percent, 5,93 percent, 5,81 percent, 4,49 percent, 3,99 percent, 2,54 percent, and 2,54 percent, respectively, of m2/g. ESI's been 41.11 minutes EAI is a function of the fraction of oil volume and the concentration of protein, depending on the type of device used to produce the emulsion. In M thus, the reduction in the emulsifying activity index (EAI) was observed with a rise in time. Armatus is because of an excellent hydrophobicity of the protein which stabilizes emulsions at the interface. Emulsion stabilization is achieved by an interaction in the sample of the protein matrix with fat and by the interaction between protein and protein in fat globules, leading to the formation of an interfacial protein layer surrounding and stabilizing fat globules. The strong electrostatic repulsion of oil droplets is sometimes more constant. Related pathways can occur with fish muscle protein in the current research. Instability can occur under pH conditions near the isoelectric (or high ionic) droplets of the protein when flocculation / agglomeration prevails leading to coalescence and instability. The protein section radiating from the interface is made up predominantly of hydraulic amino acids that induce steric stabilization, and therefore physically restricts outlets from falling together as different staff say. The involvement of protein in the continuous process often raises the viscosity of emulsion and thus decreases the emulsion mobility and disseminates oil droplets.

low EAI value for hydrolysates was attributable to the lack of potential for peptides at the interface of oil and water to lower interfacial stress. The residues of hydrophobic and hydrophilic amino acid are surfactants and promote the stability of oil in water emulsion. Peptides are stated to have at least 20 residues for surface-active properties. M's Poor EAI. Low amino acid residues can be attributed to armatus and may lead to lower EAI. The disparity contained in

M. Armatus fish may be clarified on the basis of residue.

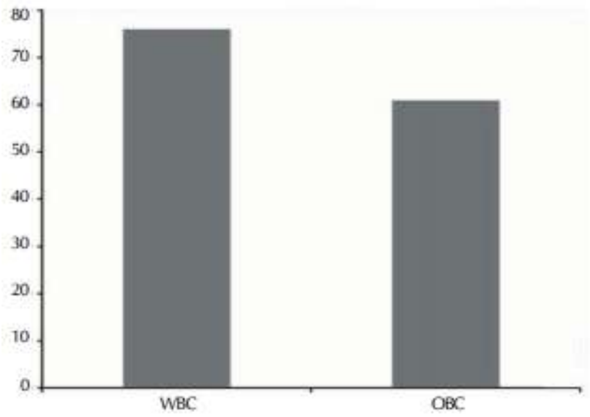

Figure 4: Water binding and Oil binding capacity of M. armatus muscle protein

Water and oil binding capability Figure 4 indicates water and oil binding capacity. The binding potential for water and oil was 76% and 61% respectively. The present research found that the fish muscle preserves water in the muscle protein. This may be due to the three-dimensional filament network in myofibrils, which offers an open space between thick and then filaments, most water between thick and thin filaments is preserved, which also imparts a strong electric charging of acidic and simple amino acids to these proteins resulting in high water binding capacities. The degree of protein molecular hydration is essentially the amount of the amino acid side chain hydration. Myosin is associated with large quantities of polar amino acids containing large quantities of aspartic and glutamic acid residues.

Myosin 's water binding ability is correlated with significant concentrations of polar amino acids with a strong concentration of glutamic and aspartic acid residues. The greater ability for water attachment in M muscles. A large number of polar amino acids may clarify armatus in the muscle. Proteins have hydrophilic as well as hydrophobic properties and can also communicate with food with water and oil. The functional properties of proteins in the food system rely primarily on the relationship between water and protein. PH and ionic strength (i.e. salt) are affected by WBC. WBC represents the degree of protein denaturation.

M 's oil binding power. The muscle protein of Armatus was lower than the binding capacity of Water. The indicated M. More hydrophilic amino acids can be produced by muscle protein Armatus. High lipid binding hydrophobic proteins. Protein OBC is an essential functional attribute, as it stimulates the mouth sensation and preserves the scent of a meal. The OBC relies on the quantity of non-polar amino acids in the side chain and protein composition. The structure of hydrophilic and hydrophobia elements influences the ability of oil to consume the protein. The fat absorption process is primarily due to the physical entanglement of oil and the binding of fat through the polar protein chain. Thus, it is inferred from the present studies that M. At intense pH with lower solubility at pH 6, armatus muscle protein displayed strong solubility. Other properties such as emulsion and foaming have also shown a good value making muscle protein a potential source of useful food ingredients.

NUTRITIONAL AND ENERGY CONTENT OF MASTACEMBELUS ARMATUS

Centered on Mastacemblelus armatus histology, fish seem to breed in the Marathwada area from July to September. The biochemical composition shows an analogue profile in the female muscle spawning season. From the rest period (December to June) the protein and fat content steadily decrease during the spawning period (June to September). The glycogen content was observed in the highest phase (December-January), which is gradually decreased in Table 1.

Phase	Muscles				Liver				Ovaries			
	Moisture	Protein	Glycogen	Fat	Moisture	Protein	Glycogen	Fat	Moisture	Protein	Glycogen	Fat
Resting (Dec.-Jan.)	75.30	19.10	3.12	3.79	74.23	18.51	4.18	4.82	71.31	13.34	1.38	1.20
Calories		78.31	12.79	35.21		45.89	17.13	44.82		54.69	5.65	11.19
Preparatory (Feb.-April)	75.58	15.03	2.01	3.20	74.80	14.34	3.25	4.11	70.63	14.06	1.02	2.84
Calories		61.62	8.24	29.76		58.79	13.73	38.22		57.72	4.18	26.41
Pre spawning (May-June)	73.38	13.02	0.36	2.18	75.01	12.68	1.02	3.06	69.78	16.18	3.12	4.01
Calories		53.38	1.47	19.99		51.98	4.18	28.45		66.33	12.79	37.29
Spawning (July-Sept.)	75.28	12.72	0.30	1.81	74.40	11.28	1.08	2.10	69.08	20.21	4.68	3.87
Calories		52.15	1.23	16.33		46.24	4.42	19.53		82.86	19.18	35.99
Post Spawning (Oct.-Nov.)	74.80	16.84	0.51	2.64	72.38	14.33	0.98	3.08	70.62	14.43	1.05	2.09
Calories		69.04	2.09	24.55		58.75	4.01	28.64		59.16	4.30	19.43

Table 1: Variation in nutrients (mg/g) and energy content (Cal./100g) of female M. armatus.

Pollution Environment and Technology for Nature · Vol. 8. Preparatory stage No. 4, 2009 (February to April) and falls during the respawning phase (May to June) and subsequently in spawning phase (June to September). The decline in these amounts during the spawning period could be due to less body reservoirs being fed during the spawning and breeding season. The biochemical composition of the liver was also quite similar to that of the muscle. The protein, glycogen and fat contents in liver steadily decrease from the resting stage (December to January) up to the spawning period (June to September) and the increase is also recorded in the post-spawning stage (October to November). (Table 1 and Fig. 1). The ovary has distinct biochemical profiles contrary to muscle and liver. The amount of protein, glycogen and fat contents of ovary steadily increase from preparatory phase (February to April) and becoming important in the spawning phase (June to Sept.) but later dropping in the post spawning phase (October to November)

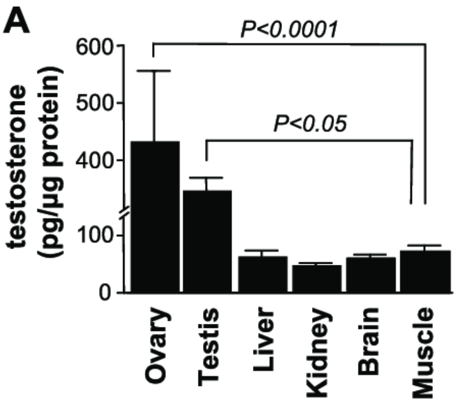

Figure 5: Variation in protein, glycogen and fat contents in muscles, liver and ovaries.

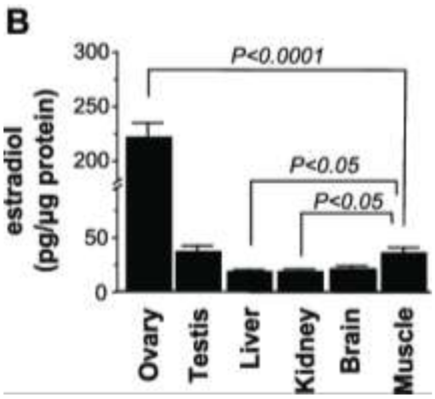

Figure 6: Variation in energy content in muscles, liver and ovaries

The percentage of muscle moisture was 73.38 to 76.28, in the liver between 72.30 and 75.01, and in the ovaries between 69.08 and 71.31. The muscle indicates that compared to liver and ovaries it is a rich store of nutrition. It is excellent food for a balanced weight reduction diet since it has 126 calories / 100 g (Table 1 & Fig. 2), far smaller than Caviar (268 Cal.); Shark (187 Cal.), Canned Anchovies (276 Cal.), Grilled Herrings (203 Cal.), Mackerel Fried (254 Cal).; Oil Sardine (220 Cal.), Fried Whiting (189 Cal.), Cat Fish (195 Cal.).

CONCLUSION

Several organisms were described which would greatly contribute to multiple public health nutrients' RNIs. Considering the position of fish in food and nutritional protection in recent decades, study, financing and interventions have concentrated on aquaculture production, especially of big carps and imported species, with an intended benefit to nutritional outcomes, although this correlation is doubtful. The figures presented here show that inland fishing species, especially small indigenous (SIS), have the potential, from a nutritional perspective, to contribute far greater to the intakes of micronutrients of the vulnerable populations than to common aquaculture species. This is probably partly because of the consumption of small fish, Teleostean Fish Mastacembelus Armatus, all head-and-bones. Further, the broad variety of nutrient composition of the different species mentioned here is expected to encourage a more all-inclusive intake of nutrients of fish consumption, especially the SIS. This supports the persuasive claim that in order to successfully target malnutrition, efforts should be geared toward maintaining a more equitable solution, including the creation of advanced aqua cultural technology including nutrient-rich organisms, in particular the SIS, both in sustainable fishing management and aquaculture. This paper expands the current knowledge of the nutritional value of a wide range of fish species significantly, demonstrating that many species, especially SIS and those from inland fishing, have the potential to contribute significantly to RNIs in a range of nutrients. It will be essential in future research to ascertain the true contribution of various organisms to the nutrient intake of vulnerable communities, to help educate efforts aimed at increasing access, affordability and nutrient food consumption.

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