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European Journal of Experimental Biology, 2014, 4(6):118-123

ISSN: 2248 –9215
CODEN (USA): EJEBAU

Edible fishes of Krishnapatnam fish landing centre, Andhra Pradesh, India, as nutritional supplement

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ABSTRACT

The study focuses on total protein and total lipids – cholesterol, High Density Lipoprotein (HDL), Very Low Density Lipoprotein (VLDL), Low Density Lipoprotein (LDL) and Triglycerides (TGL) in ten fishes of Krishnapatnam fish landing centre. The edible tissues; muscle and brain were subjected for investigation. The muscle of Rastrelliger kanagurta and the brain of Arius caelatus found to be rich in protein content. The highest cholesterol value was recorded in the muscle of Sardinella longiceps, and in the brain of Arius caelatus. The lowest cholesterol was recorded in the muscle of R. kanagurta and in the brain of Saurida tumbil. The muscle of Nemipterus japonicus and the brain of A. caelatus revealed high HDL and it was low in the muscle of Mugil cephalus and in the brain of S. tumbil. More VLDL was observed in the muscle of Sardinella longiceps and in the brain of R. kanagurta and low VLDL was observed in the muscle of N. japonicus and in the brain of Spyraena obtusata. The muscle of A. caelatus and the brain of Pampus niger were rich in LDL and very meager LDL was observed in muscle of Anchoviella indica and in the brain of S. obtusata. The muscle of S. longiceps and the brain of R. kanagurta showed more amount of TGL and the muscle of N. japonicus and the brain of P. niger showed the least amount of TGL. The results emphasize the importance of food value among the fishes of Krishnapatnam fish landing centre and it picturizes the consumer a better awareness about the nutritive value of fishes in selection process of edibility and health concern as nutritional supplement.

Key words: Protein, Lipid, HDL, LDL, VLDL, TGL.

INTRODUCTION

The advent of Blue Revolution has become one of the man's great hopes for future food supplies as the human population multiplies and industrialization increases the problem of environmental pollution. These activities are however of major concern in creating a situation of xenobiotics overload in aquatic ecosystems. The most prevalent xenobiotics arising out of industrial and agricultural activities are pesticides and heavy metals where the stress response mechanisms have been widely addressed in vertebrates in general and fish in particular [1].

Fish is highly nutritious, tasty and easily digestive. It is much sought after by a broad cross-section of the world's population, particularly in developing countries. It is estimated that around 60 percent of people in many developing countries depend on fish for over 30 percent of their animal protein supplies. However, with the increased awareness of the health benefits of eating fish and then ensuing rise in fish species these figures keep changing.

Fish also contains significant amounts of all amino acids particularly lysine. Fish protein can be used therefore to complement the amino acid pattern and improve the overall protein quality of mixed diet [2]. In recent years the nutritional importance of aquatic food has increased substantially because of scientifically recognized beneficial effects of eating aquatic food, fats and oil. Fish contributes enormously to the supply of both macro and micro nutritients in our diet [3].

Fish protein contains all the essential amino acids in required proportions and hence has a high nutritional value, which contribute to their high biological value. Fish is highly proteinous food consumed by the populace. A larger percentage of consumers do eat fish because of its availability, flavoring and palatability while fewer do so because of its nutritive valve [4].

Lipids and their components play vital role in the biochemical adaptations of living organism that dwell in the severe and unique conditions of the Northern latitudes. These lipids are of major importance in the ecological and biochemical monitoring and testing of aquatic organisms. The role of lipids in cellular metabolism is versatile, although three main functions have been indentified: energetic, structural and bioeffector roles (*i.e.* lipids acting as messengers) [5]. Fish lipid contains long-chain n3 (omega-3) PUFA, particularly EPA and DHA. Consumptions of these PUFA's have been perceived to be important in human nutrition, health and disease prevention. World fish lipid request continue to increase. Cholesterol is undoubtedly the most publicized lipid in nature, because of the strong correlation between high levels of cholesterol in seasonal differences and significant losses may occur during processing and storage of foods [6].

MATERIALS AND METHODS

Ten fishes *namely Anchoviella indica, Arius caelatus, Mugil cephalus, Nemipterus japonicus, Pampus niger, Rastrelliger kanagurta, Sardinella longiceps, Saurida tumbil, Spyraena obtusata and Upeneus sulphureus* were selected from Andhra Pradesh, Krishnapatnam fish landing centre. Total Protein, Total Lipid – Total Cholesterol, High Density Lipoprotein (HDL), Very Low Density Lipoprotein (VLDL), Low Density Lipoprotein (LDL) and Triglycerides (TGL) contents were studied.

Brain and Muscle were taken from all the fishes selected and approximately 100 mg of tissues were weighed, homogenized in the saline medium and centrifuged. The supernatant was taken for further studies. The protein content was estimated by the dye binding method of [7], Total Cholesterol [8], Estimation of Lipoproteins [9], Estimation of Triglycerides [10], Estimation of HDL [11].

RESULTS AND DISCUSSION

Total protein content of the fishes namely *A. indica, A. caelatus, M. cephalus, N. japonicus, P. niger, R. kanagurta, S. longiceps, S. tumbil, S. obtusata* and *U. sulphureus* were represented in Table: 1 and Figure: 1. Total Cholesterol content in muscle and brain of ten fishes were pictured in Table: 2. The data of High Density Lipoprotein level in muscle and brain of ten fishes is furnished in Table: 3. Very Low Density Lipoprotein values of both the tissues are tabulated in Table 4 and Low Density Lipoprotein values of both the tissues are tabulated in Table 5. Information about Triglycerides in both muscle and brain tissues of ten fishes from Krishnapatnam fish landing centre is shown in Table: 6. The variations among the fishes with reference to different lipid parameters were represented in Figure: 2.

Table 1: Total protein content (µg/100 mg of tissue)

FISHES	MUSCLE	BRAIN
A. indica	1 118.27±1.40	14.07±3.04
A. caelatus	138.07±1.72	38.60±1.11
M. cephalus	139.47±0.72	20.47±1.30
N. japonicus	142.27±1.72	18.27±1.50
P. niger	116.40±5.10	13.53±0.95
R. kanagurta	180.07±1.89	24.93±1.72
S. longiceps	67.50±1.11	25.93±3.19
S. tumbil	99.47±0.70	24.6±1.94
S. obtusata	113.60±0.80	17.47±0.83
U. sulphureus	157.27±1.47	12.13±1.70

Figure 1: Total protein content (μg/100 mg of tissue)

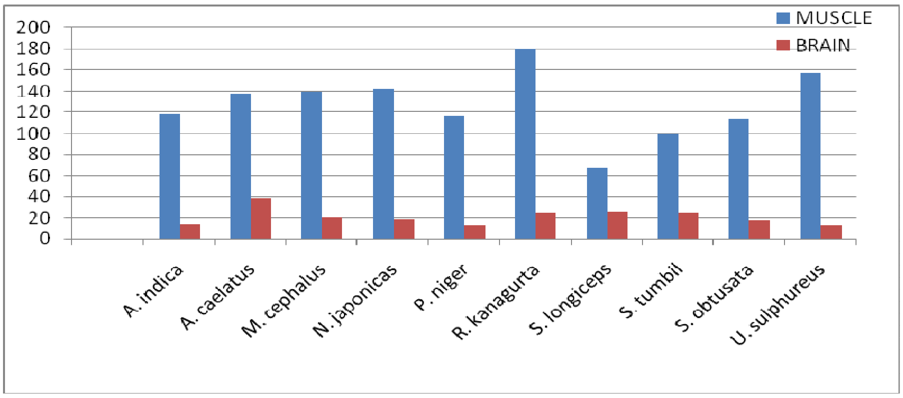


Table 2: Total cholesterol content (μg/100 mg of tissue)

FISHES	MUSCLE	BRAIN
A. indica	22.26±0.41	41.90±1.47
A. caelatus	26.80±0.72	86.40±1.31
M. cephalus	26.26±0.90	51.03±1.45
N. japonicus	22.86±1.30	53.20±0.80
P. niger	25.65±0.55	69.73±0.70
R. kanagurta	20.16±0.99	72.00±1.70
S. longiceps	27.20±0.87	53.53±1.13
S. tumbil	24.86±0.70	41.20±0.87
S. obtusata	27.20±0.81	54.83±0.77
U. sulphureus	20.53±0.70	41.56±1.76

Table 3: High Density Lipoprotein (μg/100 mg of tissue)

FISHES	MUSCLE	BRAIN
A.indica	12.12±1.37	28.22±1.66
A. caelatus	12.56±1.47	45.24±3.40
M. cephalus	1.73±1.22	29.53±1.07
N. japonicus	15.13±1.11	38.35±1.71
P. niger	13.24±1.24	38.27±1.19
R. kanagurta	11.71±1.86	38.04±1.74
S. longiceps	10.28±1.17	34.47±2.41
S. tumbil	12.37±1.21	2 2.85±1.18
S. obtusata	14.53±0.67	40.66±1.26
U. sulphureus	7.39±1.24	28.20±1.97

Table 4: Very Low Density Lipoprotein (μg/100 mg of tissue)

FISHES	MUSCLE	BRAIN
A. indica	10.43±0.90	11.13±0.27
A. caelatus	8.49±0.71	13.04±0.20
M. cephalus	9.19±0.95	12.01±0.15
N. japonicus	7.12±0.98	11.45±0.85
P. niger	10.11±0.35	11.51±0.63
R. kanagurta	8.05±1.31	16.20±0.49
S. longiceps	12.56±0.93	14.30±0.62
S. tumbil	8.75±0.31	14.62±0.60
S. obtusata	10.23±0.18	1 0.47±1.08
U. sulphureus	7.72±0.62	11.14±1.50

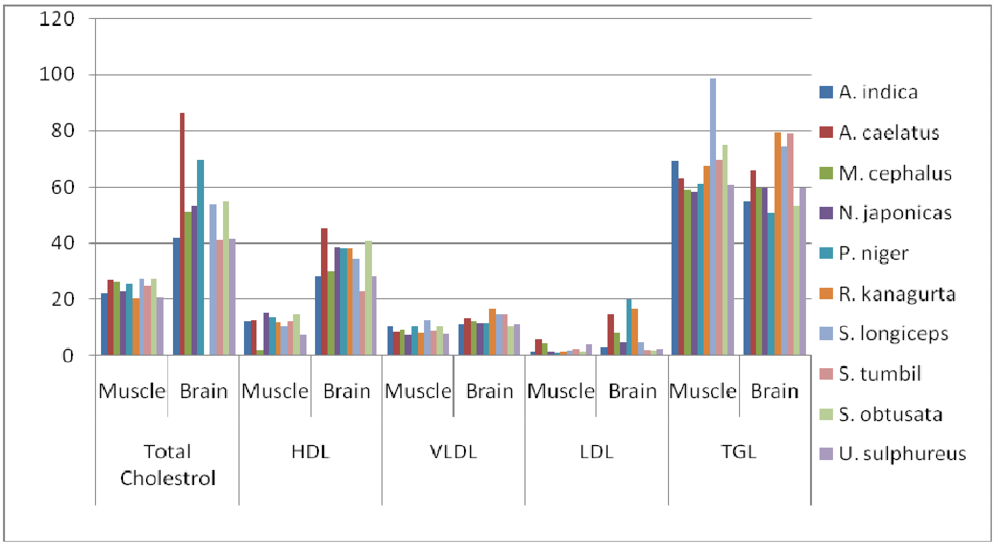
Table 5: Low Density Lipoprotein (μg/100 mg of tissue)

FISHES	MUSCLE	BRAIN
A. indica	0.99±0.34	2.52±0.80
A. caelatus	5.73±0.80	14.49±1.32
M. cephalus	4.29±0.65	7.96±1.85
N. japonicus	1.22±0.37	4.64±0.86
P. niger	0.93±0.41	19.86±1.26
R. kanagurta	0.99±0.24	16.49±1.24
S. longiceps	1.46±0.60	4.45±1.05
S. tumbil	2.38±0.59	1.91±1.03
S. obtusata	1.16±0.23	1.56±0.47
U. sulphureus	3.99±0.78	2.31±0.40

Table 6: Triglycerides (µg/100 mg of tissue)

FISHES	MUSCLE	BRAIN
A. indica	69.29±0.73	54.86±0.30
A. caelatus	63.32±1.13	65.77±0.33
M. cephalus	59.13±1.76	59.63±0.86
N. japonicus	58.22±1.55	59.63±0.86
P. niger	61.10±0.96	50.58±0.68
R. kanagurta	67.33±1.42	79.50±1.57
S. longiceps	98.55±1.59	74.43±0.77
S. tumbil	69.54±1.04	79.36±1.02
S. obtusata	75.11±1.18	53.36±1.32
U. sulphureus	60.47±1.01	59.84±1.16

Figure 2: Variations in lipid content in muscle and brain of ten fishes from Krishnapatnam fish landing centre (µg/100 mg of tissue)



Biochemical studies are very important from the nutritional point of view. Protein is essential for the sustenance of life and accordingly exists in the largest quantity of all nutrients as a component of the human body [12]. In various fish species, proteins are of important as structural compounds, biocatalysts and hormones for control of growth and differentiations [13]. Protein in fish is a main component constituent of tissue and organs. They are precursors of other nitrogen compounds (enzymes, hormones, slurry, neurotransmitters, cofactors, etc) and constitute an important energy source. The effect of dietary lipid levels on fish growth performance varies considerably within species, size, age, diet and composition, range of lipids level tested and rearing conditions [14]. Inadequate protein levels in the diets result in a reduction of growth and loss of weight. However, when an excess of protein is supplied in the diet, only part of it is used for protein synthesis (growth) and the remaining is transformed into energy [15].

Fish and shellfish are important source of protein and income for people in Southeastern Asia [16]. They are also increasingly marketed for the health benefits to consumers [17]. The requirement of nitrogen and sulphur is regulated by dietary protein. The protein immunoglobins act as prime defense against bacterial and viral infections. Proteins by means of exerting osmotic pressure help in maintenance of electrolyte and water balance in human system. Several studies show that protein derived from fish, balances many body regulatory factors.

It is well known that protein is the most important and expensive item that should be supplied in adequate amounts to support good growth with minimal cost [18], [19]. [20] determined the proximate composition and energetic values of selected marine fish and shellfish from West Coast of Peninsular Malaysia. This study has included 20 species of fish 10 pelagic fish and 10 demersal fish. The study revealed that Long tail shad (Terunk) contained high fat content. Long-tailed butterfly ray contained the highest protein. Similarly in our study the fish *Rastrelliger kanagurta* is found to be a healthy choice because it contains highest amount of protein and lowest quantity of cholesterol. The brain of *Arius caelatus* is found to be effective because it contains high protein content, high cholesterol value and high HDL. According to the work done by [21] in Catfish it is clear that antimicrobial proteins and peptides play key role in innate immunity and they had been observed from a wide variety of organisms in last few years. Hence, the fishes rich in protein will produce more innate immunity. *R.kanagurta* would be more useful in developing innate immunity.

In a lipid profile, total lipids are broadly as any fat soluble, naturally occurring molecules, such as fats, oils steroids, fat soluble vitamins etc. Cholesterol is an unsaturated steroid alcohol of high molecular weight [22]. This study reveals that consumption of brain of *A. caelatus* gives an enormous amount of unsaturated steroid alcohol which will be a healthy choice.

High Density Lipoprotein (HDL) transports cholesterol and its esters from peripheral tissues to the liver for its catabolism (scavenging action). Very Low Density Lipoprotein (VLDL) transports mainly endogenous triglycerides synthesized in hepatic cells from the liver to the extra-hepatic tissue including adipose tissue for storage. Low Density Lipoprotein (LDL) regulates cholesterol synthesis in extra-hepatic tissue. The elevated levels of LDH in the hemolymph might be due to the release of isozymes form the destroyed tissues. LDH is an important glycolytic enzyme in biochemical systems and is inducible by oxygen stress [23]. The triglycerides are the most abundant of all lipids. They constitute about 98% of total dietary lipids, the remaining 2% consists of phospholipids and cholesterol and its ester. They are major components of storage or depot fats in animal cells but not normally found in membranes. Triglycerides can be stored in quantities, sufficient to supply the energy needs of the body for many months as in the case of obese person. They are not only stored for longer duration but also yield over twice as much energy as carbohydrates.

Lipids and fatty acids play a significant role in membrane and have a direct impact on membrane mediated process such as osmoregulation, nutrient assimilation and transport. On the other hand, the nature and quantity of these lipids in fish vary according to species and habit [24]. Previous studies correlate with our present investigation pertaining to lipid observations.

CONCLUSION

Nutrition is core pillar of human development. High prevalence of low birth weight, high morbidity and mortality in children and poor maternal nutrition of the mother continue to be major nutritional concerns in India. Clearly, this situation emphasizes the need for examining several issues of nutritional significance. One among the issues is the dearth of information about the nutritional benefits of our food. Fish is mostly consumed for its delicacy with little knowledge of its nutritional wealth. The current examination on the nutritional profile of ten edible and economical fishes provides a substantial range of nutritional information, bringing to our attention the richness of healthy nutrients present in the eatable portion such as muscle and brain. Since it is an attempt on locally available and affordable fishes, a larger section of population of Coromandal coast can reap benefits out of this investigation. The study concludes that locally obtainable fish food can be a substantial aid in redressing the problems of malnutrition in our country.

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