*BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA*, June 2019. Vol. **16**(2), p. 477-481

# Analysis of Fatty Acid Composition in the Flesh of Boal (*Wallagu attu)*

**Pinak Dutta[1]* and Mita Dutta[2]**

[1]Department of Chemistry, Bejoy Narayan Mahavidyalaya, Itachuna, Hooghly, 712147, India.
[2]Department of Chemistry, Sreegopal Banerjee College, Bagati, Magra, Hooghly, 712148, India.

http://dx.doi.org/10.13005/bbra/2762

(Received: 24 March 2019; accepted: 03 May 2019)

**The fatty acid composition of the muscle tissue of *Wallagu attu* found in Gangetic West Bengal, India was investigated to get an insight of its nutritional capacity. The fish muscle proved to be a rich source of both mono and poly unsaturated fatty acids. Of the saturated fatty acids Palmitic and Heneicosanoic acid is detected in considerable amount. Of the MUFA's present Palmetoleic acid, Elaidic acid, Oleic acid and nervonic acid is found in good amount. Nutritionally important ù-6 PUFA's like Linoleic acid and Arachidonic acid are found in the fish. EPA and DHA the two star ù-3 PUFA's whose health benefits are beyond doubt are also detected in the fish. *Wallagu attu* is generally not farmed as it devours other fishes but considering its nutritional capacity and high market demands, its farming may prove beneficial for consumers and producers.**

**Key words:** *Wallagu attu*, fatty acid profile, PUFA, MUFA, nervonic acid, arachidonic acid.

The most popular animal food source of the people of West Bengal is beyond doubt fish. The state possess abundant and diverse aquatic resources which houses 267 fresh water fresh species[1]. Fish fats are rich in ù-3 fatty acids, ù-6 fatty acids and mono unsaturated fats all of which are very much essential in our diets. Understanding the science behind this will prove useful to fish producers, sellers and of course consumers. Though all fatty acids are essential there is a lot of ongoing research as to which fatty acid (or which group of fatty acid) is more beneficial and whose consumption should be restricted as they are hazardous to health. The beneficial and curative properties of fatty acids[2-9] are so well established that doctors prescribe fatty acids in form of supplements. However in a developing country like India where a huge percentage of population is below or just around the poverty line the concept of food supplement is a fantasy. But choice of diet with fish (rather right type of fish) which is abundantly available in West Bengal can save millions from malnutrition. In our laboratory we have taken up the task of screening fishes[10-12] for their fatty acid content. In this article we wish to report the fatty acid profile of *Wallagu attu* (Boal), a fresh water fish of the silurid catfish family. We have reported monthly and seasonal variation of total lipid and fatty acid in the muscle of the same fish[11]. For determination of the nutritional capacity of *Wallagu attu* in terms of fatty acid content we have been collecting boal for the past three years

*Corresponding author E-mail: pimidu@yahoo.com

(2016 – 2018) at the time when its fatty acid concentration was found to be least (April)[11] i.e. when the fish was in its least nutritive state.

Fatty acid profile of *Wallagu attu* from Bramhaputra river[13] (India), Indus river[14-15] (Pakistan), locally procured from Jammu[16] and that obtained from Indian Ocean[17] (Sri Lanka) has been studied. However, there is no report to our knowledge of fatty acid profile of the fish obtained from Ganges in West Bengal though the fatty acid profile of eggs of *Wallagu attu* obtained from the Ganges is studied[18].

## MATERIALS AND METHODS

Fish samples were obtained from a beel in Jirat, Hooghly, West Bengal between 5th and 15th of April 2016 and April 2017 and April 2018. Average weights of the fish were 1050 ± 51.908 gms. The fishes were killed by hitting in their head and stored at -30°C in the laboratory according to the procedure laid down in AOAC[19]. The proximate compositions of the fishes were analyzed. The muscle tissues were separated from head, skin and viscera and then deboned. Then they were cut into small pieces and blended for 30 seconds in a sterilized mixer grinder. 5 gms of the blended pieces were used for extraction of total lipids according to the method of Folch *et al.*[20] using chloroform-methanol mixture. The crude lipid thus obtained was esterified using $BF_3$-MeOH and the methyl esters formed was recovered in heptanes[19]. The analysis of the mixture of the fatty acid methyl esters (FAME) was done in a Shimadzu Gas Chromatograph (model: GC-2010 Shimadzu, Japan) with a flame ionization detector (FID) on a split injector capillary column SP-2560 (100m long x 0.25 mm internal diameter) was used for the FAME analysis. As carrier gas, oxygen free nitrogen was used at a flow rate of 33.9 ml per minute. The oven temperature was held at 140°C for 5 minutes initially which was gradually raised to

**Table 1.** Fatty acid profile in muscle tissues of *Wallagu attu*

| FAME | *Wallagu attu* |
|---|---|
| Caproic acid (C6:0) | 1.28 ± 0.01324 |
| Caprylic acid (C8:0) | 3.24 ± 0.01772 |
| Capric acid (C10:0) | 0.42 ± 0.01090 |
| Myristic acid (C14:0) | 2.96 ± 0.03309 |
| Palmitic acid (16:0) | 9.96 ± 0.04847 |
| Heptadecanoic acid (C17:0) | 1.28 ± 0.01084 |
| Stearic acid (C18:0) | 0.90 ± 0.00998 |
| Heneicosanoic acid (C21:0) | 6.01 ± 0.04432 |
| Lignoceric acid (C24:0) | 0.81 ± 0.01182 |
| Σ SFA | 26.84 ± 0.18787 |
| Palmitoleic acid (C16:1) | 26.50 ± 0.01219 |
| Cis-10-Heptadecenoic acid (C17:1) | 1.98 ± 0.00691 |
| Elaidic acid (C18:1 n9E) | 7.20 ± 0.01124 |
| Oleic acid (C18:1 n9Z) | 9.86 ± 0.01277 |
| Nervonic acid (24:1) | 5.89 ± 0.03331 |
| Ó MUFA | 51.42 ± 0.06807 |
| Linolelaidic acid (C18:2 n6) | 3.51 ± 0.01440 |
| Linoleic acid (C18:2 n6) | 5.66 ± 0.02102 |
| *Cis*-11,14-Eicosadienoic acid (C20:2 n6) | 1.23 ± 0.01639 |
| Cis-8,11,14-Eicosatrienoic acid (C20:3 n6) | 1.93 ± 0.02662 |
| Arachidonic acid (C20:4 n6) | 4.90 ± 0.02115 |
| Σ n-6 PUFA | 17.23 ± 0.09370 |
| Cis-5,8,11,14,17-Eicosapentaenoic acid (C20:5 n3) | 1.14 ± 0.02116 |
| *Cis*-4,7,10,13,16,19-Docosohexaenoic acid (C22:6 n3) | 1.59 ± 0.02205 |
| Σ n-3 PUFA | 2.73 ± 0.04314 |
| n-3 / n-6 | 0.16 ± 0.00182 |
| n-6/n-3 | 6.33 ± 0.07654 |

240°C (at a rate of 4°C per minute) and held for 20 minutes. The final injector and detector temperature was set at 260°C. Volume injected 1 ìl; split ratio 1:30. Identification of the peaks obtained was done by comparing their retention time with that of standard FAMEs. The percentage composition of the individual fatty acid methyl esters were computed from the area of the GC peaks. The results obtained were placed in the Table 1.

## RESULTS AND DISCUSSION

The fatty acid analysis of *Wallagu attu* reveal that it contains 26.84% fatty acids (SFA), 51.42% monounsaturated fatty acids (MUFA) and 19.96% of polyunsaturated fatty acids (PUFA) of which ù-6 FAs accounts for 17.23% and ù-3 FAs accounts for 2.73%.

Of the saturated fatty acids Palmitic acid (16:0) is the most abundant (9.96%). Heneicosanoic acid (C21:0) the fatty acid found in human milk too is present in considerable quantities (6.01%).

The MUFAs identified in significant amount are Palmitoleic acid (C16:1) 26.50%, Elaidic acid (C18:1 n9E) 7.20%, oleic acid (C18:1 n9Z) 9.86% and Nervonic acid (C24:1) 5.89%. Palmitoleic acid (common constituent of glycerides of adipose tissues) is a beneficial fatty acid in several ways. It not only inhibits destruction of insulin secreting pancreatic â-cells and suppresses inflammation which helps increasing insulin sensitivity[21]. It possibly also has a role as a signalling molecule affecting body weight[22] and may be useful in obesity control. Elaidic acid being a *trans* monounsaturated fatty acid is known to be hazardous for heart health[23]. However its *cis* isomer oleic acid is strongly associated with reduced risks of heart diseases, diabetes, obesity and high blood pressure. It also lowers cholesterol, improves mood and decreases age related cognitive decline. Nervonic acid is another monounsaturated fatty acid that is very much important for human health. Nervonic acid may enhance the brain functions and prevent demyelination. There is evidence that dietary supplementation with Nervonic acid is healthy for babies and infants during the early stages of brain development. Besides being used to fortify infant formula it is also known to treat symptoms of neurological diseases such as Alzheimer's and Parkinson's[24, 25].

Of the ù-6 fatty acids found in the fish linoleic acid, linolelaidic acid and arachidonic acid accounts for the most. Linoleic acid which accounts for 5.66% of total fatty acids is known to reduce risk of cardio vascular diseases, promote healthy brain function, support skin and hair health, improve reproductive health boost immune function and protect bone density. Linolelaidic acid is another fatty acid essential for mammalian nutrition. It is used for the biosynthesis of prostaglandins and cell membranes. It is however also known to be responsible for heart diseases (from Stedman, 26th edition). Arachidonic acid has a role to play in the neurological development, normal growth and development of infants[26- 30].

*Wallagu attu* has EPA and DHA present in it as ù-3 fatty acid. These fatty acids are very much beneficial for human health. DHA is an important brain food as 60% of the fatty acids which make up the membrane in the brain is DHA. So DHA is adequately required when the brain is forming in the womb. DHA is one of the lipids in the protective cell membrane of the special cells of the retina – the rods and cones which enable us to see. DHA is also helpful in preventing cancer. Though DHA can be synthesized in our body from EPA but the enzymes which convert EPA to DHA is slow and inefficient. So it is absolutely necessary to get DHA from the diet.

The n6:n3 of *Wallagu attu* is 6.33:1. Research has shown that consumption of PUFAs are beneficial for health but ù-6 fatty acid inspite of reducing blood cholesterol, lipoproteins and being preventive of atherosclerosis and heart diseases, they also increase platelet activities which are directly linked to blood clotting. Increased probability of blood clotting directly increases the risk of heart diseases. So lesser consumption of ù-6 fatty acids are recommended than ù-3 fatty acids[31]. But in a developing country like ours where its masses even die of malnutrition, *Wallagu attu* is definitely a good source of protein and fatty acids.

## CONCLUSION

*Wallagu attu* is generally not farmed as it is a voracious eater and kills other fish. However, considering both its nutritional capacity and popularity as tasty fish, the farming of this fish through proper implementation of various modern

farming technologies can prove beneficial for both producers and consumers.

## ACKNOWLEDGEMENT

P. Dutta and M. Dutta thanks UGC, New Delhi, India for the financial assistance for running the project and they are also thankful to their respective institutes for the infrastructural and intellectual support.

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