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Fatty acids profile of some Egyptian fish species.

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Abstract

Four species of fish reared in southern border of coastal waters in fish farm of Kafer El Shik government (Brullous Lake, Egypt) were studied. Forty of Tilapia, (*Oreochromis niloticus)*; catfish, *(Clarias gariepinus)*; grey mullet, *(Mugil cephalus)* and thinlip mullet, *(Liza ramada)* fish were examined for their fatty acid composition under Egyptian breeding conditions.

The isolation, identification and characterization of these fatty acids were carried out by gas chromatography (GC). Most of the fish contained less than 20% lipid by weight. A large variation was observed between tilpia liver and catfish liver and between catfish muscle and grey mullet and thinlip mullet muscle. Thirty seven individual fatty acids from the muscle and liver from fish were analyzed. Fatty acid composition was analyzed and quantified using gas chromatography after being converted into fatty acid methyl ester (FAME).

The most prominent muscle fatty acids detected were Oleic acid and Myriotoleic acid in tilapia, grey mullet, catfish and thinlip mullet muscles. Additional amounts of Tricosinoicc acid, Myriotoleic acid, Henoisoanioic acid were observed. Detectable amount of Cis,4, 7, 10, 13, 16, 19 Decsahexaonic acid were present. In additions, the most redominant liver fatty acids detected were Myrisitic acid, Pentdecanic acid and Linolonic acid in tilapia, (*Oreochromis niloticus)*; catfish, *(Claries gariepinus)*; grey mullet, *(Mugil cephalus) and* thinlip mullet *(Liza ramada),*respectively. Additional high presence of Palmetic acid and Myriotoleic acid were found. Detectable amountd of Cis, 13, 16 Decosadonic acid and Cis 11,,14 Eicosoadadieonic acid were observed.

The saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), poly-unsaturated fatty acids (PUFA), w-3, w-6, w-7, w-9, EAA, DAA, EAA, EPA, EPA and DHA were illustrated and detailed discussed in muscle and liver of tilapia, (*Oreochromis niloticus)*; catfish, *(Claries gariepinus)*; grey mullet, *(Mugil cephalus) and* thinlip mullet *(Liza ramada).* In addition medicinally important polyunsaturated fatty, acid eicosapentaenoic and docosahe aenoic acids were also identified.

Key Words: Tilapia , (*Oreochromis niloticus)*; Catfish *(Clarias gariepinus),*; Grey Mullet, *Mugil cephalus)* and Thinlip Mullet *(Liza ramada) FA; fatty acid*., SFA: short chain saturated FA, MUFA; monounsaturated FA, and PUFA; polyunsaturated FA, fish, liver, Muscle, Fatty acid composition, Gas chromatography GC.

Introduction

Fats are the fatty acid esters of glycerol and are the primary energy depots of animals. These are used for long-term energy requirements during periods of extensive exercise or during periods of inadequate food and energy intake (**Saify et al.**, **2000)**. Fish have the unique capability of metabolizing these compounds readily and, as a result, can exist for long periods of time under conditions of food deprivation **(Abd. Rahnan et al., 1995).**

Fatty acids can exist as straight chain or branch chain components; many of the fish fats contain numerous unsaturated double bonds in the fatty acid structures ***(*Gonnerman, et al., 1988).**

In a study of both freshwater and ocean fish, it was observed that fish oil preparations from ocean fish contained 35 unsaturated fatty acids with 1-6 double bonds. In contrast, freshwater fish contained 14 unsaturated fatty acids having 1-5 double bonds **(Dillon, 1997*)***. Ocean fish contained considerable amounts of unsaturated fatty acids of ≥= 20 C, such as C20:5 and C22:6, whereas all freshwater fish fatty acids showed a chain length of < 20 of carbon atoms ***(*Zhiquan et al., 1982).** Fatty acids except 20:1 and 22:1, which are of exogenous origin, are a basic composition fish from temperate and northern atitudes, with similar totals for saturated (14:0 and 16:0), monounsaturated (16:1 and 18:1) and polyunsaturated (primarily ω-3) fatty acids **(Ackman et al., 1988).**

The fatty acid pattern of triacylglycerol and phospholipids of various fish was also assessed, showing that they contained highly unsaturated fatty acids. The polyunsaturated fatty acids of triacylglycerol and lecithin were preferentially located in the β-position 11. Various scientists have studied the composition of fish liver fatty acid and found that 91-99% of the fatty acids in the β-position are unsaturated and 36-86% of the fatty acids in the ∝-position are saturated **(Menzel, and Olcott, 1964).**

Several factors affect fatty acids compositions including environmental factor (salinity,'**(Saify**, **2000)**, water and environment temperature, **(Sinnhuber,1969);** diet, **(Meed and Kayama,1967)** and seasonal variations, **(Cowey and Sargent, 1977).** Rainbow trout have an essential fatty acid (EFA) requirement for the linolenic of ɯ 3 series rather than for linolenic or ɯ 6 as required by most mammals **(Castell, 1979)**. The main emphasis on lipid requirements has been on EFA and on the energy value of lipids.

Muscle was lower fatty acid content compared with liver which has high lipid content and traditionally **(Castell, 1979).** The muscle and liver of the Tilapia, (*Oreochromis niloticus)*; catfish, *(Claries gariepinus)*, Grey Mullet, *(Mugil cephalus)* and Thinlip Mullet,*(Liza ramada)* have been used in feeding, other used their oil preparations to relieve muscular pain as well as arthritis **(Ackman, 1967).** Various reports on the study and identification of fish liver having high pharmacological activity potential as a

hypolipidemic agent **(De Vlijmen, et al., 1998)**, an antiarthritic agent ***(*Gonnerman et al., 1988)** and preventing an agent renal damage **(Dillon, 1997).**

Inspired us to undertake the present study, beside the rare information was available about fatty acids profile in brackish water fish. The present paper reports on the differences in the quantitative and qualitative compositions of fatty acids in the amounts of saturated, monounsaturated, and polyunsaturated Omega-3and Omega-6 fatty acids between some freshwater fishes. This investigation deals with the fatty acid profile characterization of fish muscle and liver from four local fish species tilapia, (*Oreochromis niloticus)*; catfish, *(Clarkes gariepinus),* grey mullet, *(Mugil cephalus)* and thinlip mullet, *(Liza ramada)* available in the coastal waters in breeding farms in Kafr ElShik under (Brullous Lake) under breeding farm conditions, Egypt.

Material and Methodes

1. **Sample collection:** fourty of Tilapia, (*Oreochromis niloticus)*; Catfish *(Clarias gariepinus),* grey mullet, *(Mugil cephalus)* and thinlip mullet, *(Liza ramada)* of both sexes were collected from the local fish farm, (consists of polyi-culture bonds) from farm in southern part of Kafr E;l-sihik government. They received a unbalanced ration including breed, maize, rice hey, agriculture product etc…, during the whole period of farming. The fish received food twice a day.
2. **Fish preparation:** fish were collected in selling season conditions (April—May 2015) with marketing weights of farm. The Mean, average weight and length was were in Tilapia, (*Oreochromis niloticus):*200±20 gm (180-220); 23±3 cm(18-**25)**; Catfish *(Claries' gariepinus):*300**±**15 gm(270 -320),30**±2** cm(28-32), grey mullet, *(Mugil cephalus):* 200±35 gm(170 –250); 27**±3** cm(24-29) and thinlip mullet, *(Liza ramada)* 150±30 gm (130-180); 25±2cm (23-27) tabulated in (table 1) from a local supplier of breeding farm in Kafr El-Shik and stored at -20◦C until used for assay. Fish were dissected and the muscles and livers were collected and soaked on filter paper to remove moisture and weighed.
3. **Sample preparation:** The fishes were weighed, beheaded, eviscerated and cleaned prior to freezing. In an attempt to obtain a homogeneous sample from each species, their fleshes were removed from their backbones, minced, blended and immediately extracted using chloroform-methanol mixture in the ratio of 2:1.
4. **Lipid extraction:** A homogenizer, (Janke and Kunkel IKA Wert Ultra Turax Type TP 18/10 (Germany), was used to homogenize the muscle and livers of

species of each fish separately.

5. **Lipid methylation:** The homogenized tissues were shaken vigorously with chloroform: methanol (CHCl3:MeOH) (2:1, v/v) **(Folch et al.,1957)** and the combined extract was fractionated and washed with distilled water to remove the impurities. The solvent layer was evaporated in vacuo, which in turn became enriched with the oil components**.**
6. **Lipid Esterification:** A 10 gm from dorsal muscle and 1 gm from the liver of the fish which fatty acid were obtained by Folish methods and esterified with methanolic hydrolic acid (92:8, v/v). The reaction mixture in vials was heated at 60 ◦C for 14 h in an water bath, cooled and then diluted with water, extracted with n-Hexan and analysed by gas chromatography (GC***)***.
7. **Gas chromatography analysis**: The methylated esters of fatty acids, were analysed by Gas Chromatography using(Hewlett Packard, Palo Alto, CA, USA) (HP 6890) and (FID) detector was used at 250 °C . The fatty acid methyl siloxane capillary column HP-5 (30m x 0.32 mm I.D.× 0.25 μm film thickness) was used. Nitrogen was used as the carrier gas (0.8 m / min gas flow). The injection temperature was 220 °C splitless mode. The temperature program was 200°C for zero hold min (10°C/ min) until 250°C (5°C/min) and held at this temperature for 9 minute total run time was 9 min.
8. **Fatty acid identifications**: A standard mixture of methyl esters was analyzed under identical condition prior to running the samples. The retention times of the unknown samples of methyl esters were compared with those of standard.
9. **Fatty acid characterization:** Identifications of fatty acid using fatty acid standard (sigma company, St Lous, USA) using chemi-stations version 3 The fatty acids peaks were identified using Agilent Technologies software 5988-5871EN. (USA).
10. **Ststistical analysis**: The results were statistically compared using ANOVA (analysis of variance test (one way ANOVA). Using SAS statically program (version 14), USA **(SAS, 2006)**

Results and discussions

The present paper deals with fatty acids profile in both muscle and liver for their economical and feeding consumptions purpose due to their metabolically importance in fat metabolism, the Tilapia, (*Oreochromis niloticus)*; catfish, *(Clarias gariepinus)*; grey mullet, *(Mugil cephalus)* and thinlip mullet, *(Liza ramada)* were the most popular and economical important fish in breeding, market and human consumptions in Egypt. As seldom research in brackish water

fishes especially in Brullous Lake in Kafer El Shaik governorate where the salty water of Mediterranean sea mixed with water of agriculture and industrial waste pipes especially in the southern part of the Lake where the most fish farms were present. The present paper observed that most of the examined fish contained less than 20% lipid by weight. A large variation was observed between fish species and also, inside the same species even inside the same fish pond. So, we select fish in similar weight, regardless to other determined factors due to difficulty practical purpose, the present results were illustrated in table 2 and 3.

37 thirty seven standard fatty acids were detected, only in The muscle content of fatty acids (Table 2) was 31, 30, 28 and 27 fatty acids in Tilapia , (*Oreochromis niloticus)*; catfish, *(Claries gariepinus),* grey mullet, *(Mugil cephalus) and Thinlip Mullet, (Liza ramada)*, respectively.

In Tilapia,(*Oreochromis niloticus)* muscle, the most prominent fatty acids were Oleic acid, Tricosinoicc acid, Myriotoleic acid and then Trideconic acid, while cat fish,*(Claries gariepinus),*the most prominent fatty acid was Myriotoleic acid, Oleic acid, Cis,4,7,10,13,16,19 Decsahexawnic acid, Tricosinoicc acid, while in grey mullet, *(Mugil cephalus)* muscle, the most prominent fatty acids was Myriotoleic acid, Oleic acid. Henoisoanioic acid followed by Cis,4,7,10,13,16,19 Decsahexawnic acid. In thinlip mullet, *(Liza ramada)* muscle, the most prominent concentrations of fatty acids were Myriotoleic acid, Henoisoanioic acid followed by Cis,4,7,10,13,16,19 Decsahexawnic acid.

The summations of saturated fatty acids (SFA) were 36.65552, 66.693, 39.332 and 33.4116 in muscle of Tilapia, (*Oreochromis niloticus)*; catfish, *(Claries gariepinus),* grey mullet, *(Mugil cephalus) and* thinlip mullet, *(Liza ramada)*,, respectively (table 2). The summation of monounsaturated fatty acids (MUFA) was in muscle of was 35.116567, 35.11657, 35.11657 and 35.11657 in Tilapia , (*Oreochromis niloticus)*; catfish, *(Claries gariepinus),* grey nullet, *(Mugil cephalus) and* thinlip mullet, *(Liza ramada),* respectively. While the summation of w-3, w-6, w-7 and w-9 were illustrated (table 2) which catfish *(Claries gariepinus)* has higher content of previous items followed with grey mullet**,** ***(****Mugil cephalus****)*** and thinlip mullet ***(Liza*** *ramada)* finally Tilapia**,** (*Oreochromis niloticus)* fish. Also summation of EAA–DAA, EAA–EPA were illustrated which higher content in Tilapia, (*Oreochromis niloticus)* followed with grey mullet, *(Mugil cephalus) and* thinlip mullet ***(****Liza ramada****)*** and finely catfish *(Claries*

gariepinus), and EPA-DHA content was higher in Catfish followed with tilapia and finely grey nullet and thinlip mullet (table 2). The summation of the polyunssaturated fatty acids (PUFA) was 9.051653, 17.32583, 17.88066 and 20.25055 in muscle of Tilapia , (*Oreochromis niloticus)*; catfish *(Claries gariepinus),*; grey mullet, *(Mugil cephalus) and* thinlip mullet ***(****Liza ramada****)*** fish (table 2).

The liver content of fatty acids (Table 3) were 33, 32, 28 and 30 fatty acids in Tilapia, (*Oreochromis niloticus)*; catfish, *(Claries gariepinus);* grey mullet, *(Mugil cephalus) and* thinlip mullet *(Liza ramada),* respectively (table 3). The first observations is detected of presence Butyric acid (C4:0); Capryllioic acid (C8:0) and Caprc acid (C10:0) which is short fatty acids (SFA) in the liver of different species of fish but it is not detected in muscle of the same fish, the only explanations that the fish liver capability in synthesis and metabolism of this short chain fatty acids, this observations is associated with the observations of work of **Saif et al., (2003)** that the liver of marine fish liver has ability for synthesis of very short fatty acids. SFA is also observed also in Catfish ***(*Hassan et al., 2010)**

In liver of Tilapia**, (***Oreochromis niloticus****),*** the most prominent fatty acids were Myrisitic acid, Linolonic acid and Palmetic acid while in cat fish, *(Claries gariepinus),*liver the most prominent fatty acids content were Myrisitic acid, Pentdecanic acid, Myriotoeic acid and Linolonic acid. In liver of Grey Mullet, *(Mugil cephalus),* the most prominent fatty acids was Myriotoleic acid, Palmetic acid and Linolonic acid. In thinlip mullet *(Liza ramada)* fish liver the most prominent fatty acids content were Pentdecanic acid, Myrisitic acid, Myriotoleic acid, Palmetic acid, Linolonic acid and Cis,13,16 Decosadonic acid and Cis11,,14 Eicosoadadieonic acid (table 3) this values were different than that illustrated with **Alasalvar et al., (2002) and Aidos, et al., (2007),** this difference may due to the difference on seasonal variations**.**

The summations of saturated fatty acids (SFA) were 82.175273, 53.253311, 77.013507 and 57.7387923 in tilapia, (*Oreochromis niloticus),* catfish, *(Claries gariepinus),* grey mullet, *(Mugil cephalus) and* thinlip mullet, *(Liza ramada)* liver fish, respectively (table 3). The summation of monounsaturated fatty acids (MUFA) were 67.541996,, 61.149526, 72.12226 and 41.945478 in tilapia , (*Oreochromis niloticus)*; catfish *(Claries gariepinus)*; grey mullet, *(Mugil cephalus) and* thinlip nullet *(Liza ramada)* liver fish, respectively. While the

summation of w-3 was higher inn Tilapia **, (***Oreochromis niloticus***)** followed by catfish *(Claries gariepinus),* and finny grey mullet, *(Mugil cephalus) and* thinlip mullet *(Liza ramada)* fish in contrast, the amount of w-6, w-7 and w-9 were higher in grey mullet, *(Mugil cephalus)* followed with thinlip mullet *(Liza ramada)* and catfish *(Claries gariepinus),* and in the last Tilapia**, (***Oreochromis niloticus***),** liver which was illustrated (table 3). Also, the summation of EAA–DAA, EAA–EPA and EPA-DHA content in liver was higher in catfish ***(****Claries gariepinus***),** followed by grey mullet**, (***Mugil cephalus***)** *and* thinlip mullet *(Liza ramada)* and at the last Tilapia, (*Oreochromis niloticu)* liver were demonstrated (table 3). The summation of of the polyunssaturated fatty acids percentage (PUFA) were 3.662628, 3.846328, 8.355981 and 3.087416 in liver of Tilapia**,** (*Oreochromis niloticus)*; catfish *(Claries gariepinus),;* grey mullet**,** *(Mugil cephalus)* and thinlip mullet ***(****Liza ramada****)***, respectively (table 3). This results was agree partially with the results of **Tamás et al., (2012)**

The value of SFA, MUFA, and PUFA were detected and indicated that the composition of fatty acids showed that total monounsaturated fatty acids values were the highest, followed by saturated and polyunsaturated, spicily in liver than in muscle of fish regardless to fish species and in catfish *(Claries gariepinus),* especially than in the other species. The total ω-6 and ω-9 fatty acids were found to be higher than the ω-3. Most of the fish had an ω-3/ω–6 ratio of less than except for catfish *(Claries gariepinus)* and grey mullet**,** *(Mugil cephalus)* and Tilapia, (*Oreochromis niloticus).*

The previous profile is somewhat different from that reported by **Ozogul, and Ozogul, (2007) and Diraman, and Dibeklioglu, (2009)**, the difference may originated due to different in environmental, seasonal and technical .

Oleic acid became predominant fatty acid in tilapia**,** (*Oreochromis niloticus)*; and grey mullet**,** *(Mugil cephalus)* difference and catfish *(Claries gariepinus),* liver. On the other side, thinlip mullet**,** *(Liza ramada)* and catfish *(Claries gariepinus)* were rich in DHA (24.56%), while grey nullet**,** *(Mugil cephalus****)*** and thinlip mullet, *(Liza ramada)* liver was rich in EPA. Among those the palmitic acid was a major saturated fatty acid while stearic acid was the other major constituent. Among unsaturated fatty acids, monoenoic e.g. oleic and palmitoleic acids were the constituents. These results were agree with **Kris-Etherton et al.,(2012).** On the other hand, the present results were lower than that

reported by **Tocher et al., (2001)** and **Hassan et al.,(2010)** due to the different fish localization.

The present results is higher than that demonstrated by **Abou E;-Yazeed, (2013)**, their data revealed lower values of saturated fatty acids (SFA), monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs) for marine and fresh water fish. A minimum value of PUFA//SFA ratio was observed in our result than that mentioned with **Abou E;-Yazeed, (2013)** study, where in their survey on freshwater fish, the ratio of ω 6/ ω 3 was found to be 0.38, 0.62 and 1.08 for Carp, Mullet, Catfish,, respectively, which this ratio was (0.4), recommended by **(HMSO, 1994)**, which was recorded values approximately lower than those obtained from all fresh water and marine water fish species. **Pigott and Tucker (1990)** suggested that the ω-3/ω- 6 ratio is a useful indicator for comparing relative nutritional value of fish of different species. An increase in the human dietary ω-3/ω-6 fatty acid ratio helps to prevent coronary heart disease by reducing plasma lipids and to reduce cancer risk ***(*Simopoulos, 2002).** Also, it was suggested that a ratio of 1:1–1:5 would constitute a healthy human diet **(Osman et al., 2001).** All examined fish species studied had the ω3: ω6 ratio within the recommended ratio. The results of ω-3/ω-6 FA ratio were similar to the findings of other studies **(Diraman & Dibeklioglu, 2009 and Usydus et al., 2011).** Values higher than the maximum value are harmful to health and may promote cardiovascular diseases **(Moreira et al.,2001 and Breslow, 2006).**

The Total Unsaturated Fatty Acids (TUFA), Total Saturated FattyAcids (TSFA); (TUFA/TSFA) ratio and Eicosapentaenoic acid (EPA, C20:5 ω 3) , Docosahexaenoic acid (DHA, C22:6 ω 3) of some marine fish species. Data revealed that the ratio of (TUFA/TSFA) was lower than that mentioned by others **Abou E;-Yazeed, (2013)**. Data also revealed that eicosapentaenoic acid (EPA, C20:5) was higher and docosahexaenoic acid (DHA, C22:6) is higher than that previously mentioned. Among (EPA, C20:5 ω 3) and (DHA, C22:6 ω 3) ranged from0.19% to 1.08% and 1.60% to 2.63%, respectively. Similar results were found by **Ackman et al.,(1986)**. The examined fish contain higher levels of TUFA and PUFAs especially DHA and EPA. However, fish were good sources of EPA and DHA. The present results were similar partially to the results obtained by **Rasoarahona et al.,(2005*).***

Apart from that, size, age, reproductive status of fish, environmental conditions, especially water temperature influence lipid content and fatty acid composition of fish muscle to a certain extent **(Saito et al., 1999)**. Differences in fatty acids of fish species should not only be considered with respect to species habitat but also based on their natural diet especially whether a species is herbivorous, omnivorous or carnivorous (**Sargent et al., 1995 and 1999)**. The fatty acid pattern should not be thought of same as one but changing from species to species and/or from season to season and/or from one geographical location to another; but rather the patterns conform to a large extent to the type and amount of feed available and its fatty acid content and fish surrounding environment **(Graham,1982)**.

There are many factories affecting in the lipid content of fish as seasonal effect, different provisioning origins or a reproduction period. The effect of season in lipid and nutrient compositions have been studied for some fish, in particular oily fish, but interpretation is difficult and depends on numerous factors (**Ozyurt et al., 2005, Karapanagiotidis et al., 2006 and Nazeer and Sampath 2012).**

On the other hand, the fatty acids in the present study is higher than that reported by **Abou E;-Yazeed, (2013*)***, which reported in freshwater fish species where myristic acid ranged between (C14:0, 0.21 – 0. 22%), palmitic acid (C16:0, 21.30 – 28.25%), stearic acid (C18:0, 0.20–0. 21%), palmitoleic acid. The difference may due the change in location.

The present values were lower than that reported by **(Ugoala et al., 2014)**. There are unique in their variety of fatty acids (Table 2 and 3) of which they are composed and their degree of unsaturation of the fatty acids. There are high levels of Omega-9 fatty acids. Varieties as well as the quantity and quality of fatty acids noticed are due to differences in species, diet, spawning cycle, season and environment. The monounsaturated fatty acids (MUFA), Polyunsaturated fatty acids (PUFA) attained the highest value. The branched chain fatty acids identified were C15:0, C16:0, C17:0, C18:2 and C20:0 (Table 2 and 3). This high level of branched chain fatty acids in cat fish,*(Claries gariepinus)***,**and grey mullet, *(Mugil cephalus)* and thinlip mullet *(Liza ramada)* species has an important advantage. Branched chain fatty acids influence lower melting point, lower cholesterol levels, provide energy, and form an integral part of bio-membranes **(Viijmen, et al., 1988).** Esterification of branched chain fatty, in all the fish species analyzed,

Catfish**,** *(Claries gariepinus)* was the dominant in PUFA, which found chiefly in C18:2 fatty acids. The essential fatty acids compositions showed prominence in C18:3n-3, C18:2n-6 and C22:6n-3 were noted in the tilapia species. *Clarias gariepinus* have more of saturated fatty acids than other fish species. *Clarias gariepinus* have more MUFA than PUFA im the present results. These results is disagree with **Van de Werf, et al.,(2003) and Usydus et al., (2011).** The difference may originated from the breeding or feeding conditions **(Havekes, 1998).**

Catfish, *(Claries gariepinus)* fish has highest concentrations in PUFA contents. The tilapia species (*Oreochromis niloticus)* contain more of saturated lipids but comparable amounts of *Clarias gariepinus*, Catfish, *(Claries garepinus)* have detectable levels of omega-7 and w-9 fatty acids while omega-9 fatty acids were not detected in *Clarias gariepinus*, Wild fish has low omega-3: omega-6 ratios. This is needed to reduce high levels of omega-6: omega-3 in most human diets. The essential fatty acids were lacking n *Clarias gariepinus*, The Omega-3 fatty acid, 4,7,10,13,16,19-docosahexaenoic acid (DHA) were absent in all the species except the Tilapia, (*Oreochromis niloticus) and* catfish *(Claries gariepinus)***.** The present results was agree with the work of **Sargent, (1997)** that fish oils contains high amount of DHA **.**

The Tilapia**, (***Oreochromis niloticus)***,** contain all the essential fatty acids although they vary in composition. The degree of unsaturation fatty acids in fish was vary with species. It rises as the water temperature increase and vice versa ***(*Usydus et al., 2011).** Increase amount of 9, 12-octadecdienoic acid contents was observed in grey mullet**,** *(Mugil cephalus*) well as thinlip mullet**,** *(Liza ramada)* were high in that order. The present results were did not agree with **Hossain, (2011),** the difference may originated from the differ in fish location.

Detailed information about lipid components and their fatty acids constituents is needed to understand how to diminish oxidative or hydrolytic factors which affect quality of fish. The nature, proportion, and degree of unsaturation of the fatty acids in the lipids are all closely related to the oxidation of the fatty acids. However, the fatty acids composition of the muscle and hepatic cell content are especially important factors in determining the stability and quality because oxidative changes are initiated from the membrane components of muscle **(Bandarra et al., 1997).** Rancidity development is a vital concern to the food industry because it may be used for indexing and assisting in technology

development. Fatty acids profile analysis also provide information about the essential fatty acids requirements of fish which would aid the compounding of adequate protein-to-fat ratios feed that would balance energy requirements with caloric intake

CONCLUSION:

The fatty acids is very important for both the fish health as the long standing source of energy to fish and health and for human consumption as fish is factory for the essential fatty acid that human body cannot synthesized. The overall significance of this study based on the fatty acid composition of the fish species revealed that although the local breed fish have irregular content of fatty acid, they are however, good source of omega-6, 7 and 9. These natural resources as regard their contents of 5,8,11,14-eicosatetraenoic acid (EPA) and 4,7,10,13,16,19-docosahexaenoic acid (DHA). The high percent of SFA, MUFA, PUFA and branched and saturated fatty acid in local Tilapia, (*Oreochromis niloticus)*; Catfish, *(Clarias garepinus)*, grey mullet, *(Mugil cephalus),*and thinlip *mullet*, *(Liza ramada)* gives them an advantage in curing processing. The local breed fish have also good quality because of the high content of 18:2n-6 and 20:4n-6 Fatty acids in their muscle and livers with different in concentrations differ from one species to other.

Table (1): Average fish marketing weights and length.

Fish species	Tilapia, (*Oreochromis niloticus*	(Cat fish) (Claries garipinus)	(Grey Mullet Fish, (Mugil cephalus)	(Thinlip Mullet), (Liza ramada)
Weight (gm)	**200±20 (180—220)**	**300±15 (270 -320)**	**200±35 (170 –250)**	**150±30 (130-180)**
Length (cm)	**23±3 (18 - 25)**	**30±2 (28 - 32)**	**27±3 (24 - 29)**	**25±2 (23 - 27)**

Mean ± standard Error.

Table (2) : The Fatty acid profile is in Muscle of Tilapia , (*Oreochromis niloticus)*; Catfish *(Claries garepinus)*; grey mullet *(Mugil cephalus)* and thinlip *mullet (Liza ramada)*

Fatty acids % compositions /species	Tilapia, *(Oreochromis niloticus)*	Cat fish *(Claries garepinus)*	grey mullet, *(Mugil cephalus)*	Thinlip Mullet, *(Liza ramada)*
Butyric acid (C4:0)	**N.D.**	**N.D.**	**N.D.**	**N.D.**
Caproic acid (C6:0)	**N.D.**	**N.D.**	**N.D.**	**N.D.**
Capryllioic acid (C8:0)	**N.D.**	**N.D.**	**N.D.**	**N.D.**
Caprc acid (C10:0)	**A 0.961471 ±0.192**	**B 4.807355 ±0.7211**	**N.D.**	**N.D.**
Unidecanoic acid (C11:0)	**C 0.97685 ±0.195**	**A 4.88425 ±0.73264**	**B 3.9074 ±0.977**	**B 3.256167 ±1.14093**
Lauric acid (C12:0)	**A 0.15379 ±0.031**	**B 0.076895 ±0.01153**	**N.D.**	**N.D.**
Trideconic acid (C13:0)	**A 10.8702 ±2.174**	**B 9.9351 ±1.49027**	**C 6.6234 ±1.656**	**D 4.96755 ±1.73864**
Pentdecanic acid (C15:0)	**D 0.18839 ±0.038**	**A 0.694195 ±0.10413**	**B 0.462797 ±0.116**	**C 0.347098 ±0.12148**
Myrisitic acid (C14:0)	**B 6.481 ±1.296**	**A 8.2405 ±1.23608**	**C 5.493667 ±1.373**	**D 4.12025 ±1.44209**
Myriotoleic acid (C14:1)	**D 12.54** ±2.508	**C 21.7** ±3.255	**A 44.2** ±11.06	**B 39.7** ±13.9125
Cis 10 Pentadeconic acid (C15:1)	**C 1.2545** ±0.2509	**B 2.54789** ±0.3821835	**A 3.6542** ±0.91355	**B 2.5244** ±0.88354
Palmetic acid (C16:0)	**B 0.710409** ±0.1420818	**A 1.28628** ±0.192942	**C 0.355205** ±0.08880125	**B 0.64314** ±0.225099

Table (2) : continue.

Palmetioleic acid (C16:1)	**B** **0.172145** ±0.028429	**B** **0.086073** ±0.01291095	**C** **0.057382** ±0.0143455	**A** **0.043036** ±0.0150626
Heptadecanoic acid (C17:0)	**B** **0.321257** ±0.0642514	**A** **0.642514** ±0.0963771	**D** **0.214171** ±0.05354275	**C** **0.160629** ±0.0561015
Cis-10 Heptadecanoic acid (C17:1)	**A** **3.550564** ±0.7101008	**A** **1.775282** ±0.2662923	**A** **1.183521** ±0.29588025	**A** **0.887641** ±0.31067435
Stearic acid (C18:1)	**C** **1.5025** ±0.3005	**A** **4.863** ±0.72945	**B** **3.4652** ±0.91	**B** **3.75175** ±1.31285
Eliadic acid (C18:1n9t)	**B** **0.10552** ±0.021104	**C** **0.07621** ±0.0105315	**A** **0.21104** ±0.05276	**B** **0.15242** ±0.053347
Oleic acid (C18:1n9c)	**C** **15.6542** ±3.13084	**B** **23.45222** ±3.517833	**B** **27.555** ±6.88875	**A** **33.552** ±11.7432
Lienoeliadic acid (C18:2n6t)	**A** **0.205942** ±0.0411884	**B** **0.102971** ±0.01544565	**C** **0.068647** ±0.01716175	**C** **0.051485** ±0.01801975
Linolonic acid (C18:2n6c)	**A** **0.637605** ±0.127521	**B** **0.318802** ±0.0478203	**C** **0.255042** ±0.0637605	**C** **0.212535** ±0.07438725
Arachidic acid (C20:0)	**C** **1.069268** ±0.2138536	**C** **1.42569** ±0.2138535	**B** **2.138535** ±0.53465875	**A** **4.27707** ±1.4969745
Cis8,11,14 Eicosatilenoic acid (EAA)(C20:3n6)	**1.119945** ±0.223989	**N.D.**	**N.D.**	**N.D.**
y Linolenic acid (C18:3n6)	**B** **0.050678** ±0.0101356	**B** **0.056023** ±0.00840345	**A** **0.101355** ±0.02533875	**A** **0.112045** ±0.03921575
Cis,13,16 Decosadonic acid (DAA)(C22:2)	**A** **0.585311** ±0.1170622	**B** **0.292656** ±0.0438975	**B** **0.234125** ±0.05853125	**C** **0.195104** ±0.0682864

Table (2) : continue.

Cis11,Eicosenoic acid (C20:1)	**A** **0.317994** ±0.0635968	**B** **0.158997** ±0.02384955	**B** **0.127198** ±0.0317995	**B** **0.105998** ±0.0370993
Linolenic acid (C18:3n3)	**A** **0.451653** ±0.0903306	**B** **0.225826** ±0.0338739	**B** **0.180661** ±0.04516525	**B** **0.150551** ±0.05269285
Henoisoanioic acid (C21:0)	**N.D.**	**B** **2.9** ±0.435	**A** **33** ±0.825	**B** **2.97** ±10.395
Cis11,,14 Eicosoadadieonic acid (EDA)(C20:2)	**A** **0.872744** ±0.1745488	**B** **0.436372** ±0.0654558	**B** **0.349098** ±0.0872745	**B** **0.290915** ±0.10182025
Bemhanic acid (C22:0)	**A** **10.49487** ±2.032308	**B** **5.247433** ±0.78711495	**C** **4.197947** ±1.04948675	**D** **3.498289** ±1.22440115
Eruclic acid (C22:1n9)	**B** **0.245489** ±0.0490978	**A** **0.490977** ±0.07364655	**C** **0.163659** ±0.04091475	**C** **0.122744** ±0.0429604
Cis11,,14,17 Eicosapenitionic acid (EPA)(C20:3n3)	**20.11699** ±4.023398	**N.D.**	**N.D.**	**N.D.**
Tricosinoicc acid (C23:0)	**A** **19.8715** ±3.9743	**B** **9.93575** ±1.4903625	**C** **6.623833** ±1.65595825	**D** **4.967875** ±1.73875625
Arachidonic acid (C23:4n6)	**D** **0.0054** ±0.00108	**A** **0.2555** ±0.038325	**B** **0.0987** ±0.024675	**C** **0.0525** ±0.018375
Lingocetic acid (C24:0)	**A** **2.15** ±0.43	**B** **1.754** ±0.2631	**A** **2.555** ±0.63875	**C** **0.4525** ±0.158375
Cis5,8,11,,14,17 Eicosapenitionic acid (EPA)(C20:5n3)	**A** **0.2** ±0.04	**B** **0.185** ±0.02775	**N.D.**	**N.D.**
Nervonic acid (C24:1)	**N.D.**	**B** **7.848** ±1.1772	**A** **8.888** ±2.222	**C** **5.41** ±1.8935

Table (2) : continue

Cis,4,7,10,13,16,19 Decsahexawnic acid (DHA)(C22:6)	**C** **8.4** ±1.68	**A** **16.8** ±2.52	**A** **17.5** ±4.375	**A** **19.9** ±6.965
∑ Saturated fatty acid (SFA)	**C** **36.65552** ±7.331104	**A** **66.693** ±10.00395	**B** **39.332** ±9.838	**D** **33.4116** ±11.69406
∑ Monounsaturated Fatty Acid (MUFA)	**D** **30.167** ±6.0334	**B** **35.116** ±5.2674	**A** **3/.657** ±9.41425	**C** **34.600** ±11.9
∑ ω-3unsaturated	**A** **0.843547** ±0.1687094	**B** **0.42177** ±0.0632655	**C** **0.32369** ±0.0809225	**D** **0.26402** ±0.092407
∑ ω-6 unsaturated	**A** **0.693683** ±0.1387366	**C** **0.380225** ±0.05703375	**B** **0.455097** ±0.11377425	**C** **0.37708** ±0.131978
∑ ω -7 unsaturated	**A** **0.172145** ±0.034429	**B** **0.086073** ±0.01291095	**C** **0.057382** ±0.0143455	**D** **0.043036** ±0.0150626
∑ w-9 unsaturated	**D** **15.95101** ±3.190202	**B** **31.8152** ±4.72728	**A** **36.2927** ±9.073175	**C** **29.8852** ±10.45982
∑ EAA – DAA	**A** **1.458055** ±0.291611	**B** **0.729028** ±0.1093542	**C** **0.583223** ±0.14580575	**D** **0.486019** ±0.17010665
∑ EAA –EPA	**A** **21.287613** ±4.2575226	**C** **0.056023** ±0.00750345	**B** **0.101355** ±0.02533875	**B** **0.112045** ±0.03921575
∑ EPA-DHA	**D** **8.6** ±1.72	**C** **16.985** ±2.54775	**B`** **17.5** ±4.375	**A** **19.9** ±6.965
∑ Polyunsaturated fatty acid (PUFA)	**D** **9.051653** ±1.8103306	**C** **17.32583** ±2.5990245	**B** **17.88066** ±4.4700165	**A** **20.25055** ±7.0876925
Unidentified peaks	**3.3442809**	**6.6303162**	**4.5730882**	**5.5541383**

NO = Number of fish equals 10/species Mean ± standard Error.

N.D.: non detected DHA:Cis,4,7,10,13,16,19 Decsahexawnic acid (C22:6); EPA: Cis11,,14,17 Eicosapenitionic acid (C20:3n3); EAA: Cis5,8,11,,14,17 Eicosapenitionic acid (C20:5n3); EDA:; Cis11,,14 Eicosoadadieonic acid (C20:2); DAA:Cis,13,16 Decosadonic acid (C22:2); ETA: Cis8,11,14 Eicosatilenoic acid (C20:3n6).

Table(3) : The Fatty acid profile is in liver of Tilapia , (Oreochromis niloticus); Catfish) (Claries garepinus),; grey mullet (Mugil cephalus) and Thinlip Mullet (Liza ramada).

Fatty acids % compositions /species	Tilapia, *(Oreochromis niloticus)*	Cat fish, *(Claries garepinus)*	grey mullet *(Mugil cephalus)*	Thinlip Mullet, *(Liza ramada)*
Butyric acid (C4:0)	C 0.699545 ±0.17488625	C 0.932726 ±0.0932726	A 2.798178 ±0.8394534	B 1.399089 ±0.62959005
Caproic acid (C6:0)	N.D.	N.D.	N.D.	N.D.
Capryllioic acid (C8:0)	B 0.702816 ±0.175704	A 2.27822 ±0.227822	C 0.351408 ±0.1054224	C 0.113911 ±0.05125995
Caprc acid (C10:0)	B 0.732466 ±0.1831165	A 1.141968 ±0.1141968	B 0.270969 ±0.0812907	B 0.5714603 ±0.25715713
Unidecanoic acid (C11:0)	A 0.762116 ±0.190529	B 0.571587 ±0.0571587	C 0.190529 ±0.0571587	C 0.381058 ±0.1714761
Lauric acid (C12:0)	C 0.086977 ±0.02174425	B 0.11597 ±0.011597	A 0.347909 ±0.1043727	B 0.173955 ±0.07827975
Trideconic acid (C13:0)	D 0.234155 ±0.05853875	A 1.72079 ±0.172079	B 1.2717 ±0.38151	C 0.63585 ±0.2861325
Pentdecanic acid (C15:0)	C 11.2898 ±2.82245	C 45.1592 ±1.21592	B 22.5796 ±6.77388	A 33.1592 ±14.92164
Myrisitic acid (C14:0)	B 46.72975 ±11.6824375	A 93.4595 ±9.34595	C 31.15317 ±9.345951	D 23.36488 ±10.514196

Table (3) continues.

Myrioto,eic acid (C14:1)	**B** **24.1381** **±6.034525**	**A** **27.11636** **±2.711636**	**C** **16.73641** **±5.020923**	**D** **12.26235** **±5.5180575**
Cis 10 Pentadeconic acid (C15:1)	**B** **1.54644** **±0.38661**	**C** **0.77322** **±0.077322**	**A** **2.31966** **±0.695898**	**B** **1.15983** **±0.5219235**
Palmetic acid (C16:0)	**A** **17.3873** **±4.346825**	**C** **10.5811** **±1.05811**	**B** **12.4004** **±3.72012**	**D** **6.2002** **±2.79009**
Palmetioleic acid (C16:1)	**C** **3.185199** **±0.796299**	**B** **7.962998** **±0.7962998**	**A** **10.61733** **±3.185199**	**B** **7.962998** **±3.5833491**
Heptadecanoic acid (C17:0)	**C** **0.19917** **±0.0497925**	**D** **0.099585** **±0.0099585**	**A** **0.843293** **±0.2529879**	**B** **0.421646** **±0.1897407**
Cis-10 Heptadecanoic acid (C17:1)	**B** **0.462854** **±0.1157135**	**A** **0.925707** **±0.0925707**	**B** **0.47296** **±0.141888**	**C** **0.23648** **±0.106416**
Stearic acid (C18:1)	**C** **0.130122** **±0.0325305**	**C** **0.260243** **±0.0260243**	**B** **1.481117** **±0.444351**	**A** **4.38033** **±1.9711485**
Eliadic acid (C18:1n9t)	**A** **8.479262** **±2.1198155**	**B** **4.239631** **±0.4239631**	**B** **4.81212** **±1.443636**	**C** **2.00606** **±0.902727**
Oleic acid (C18:1n9c)	**B** **0.92735** **±0.2318375**	**D** **0.13161** **±0.013161**	**A** **1.8547** **±0.55641**	**C** **0.26322** **±0.118449**
Lienoeliadic acid (C18:2n6t)	**A** **0.45112** **±0.11278**	**B** **0.351084** **±0.0351084**	**B** **0.255677** **±0.0776031**	**C** **0.127839** **±0.05752755**
Linolonic acid (C18:2n6c)	**A** **41.9418** **±10.48545**	**B** **34.9515** **±3.49515**	**C** **27.9612** **±8.38836**	**D** **13.9806** **±6.29127**

Table (3) continues.

Arachidic acid (C20:0)	**B** **0.074042** **±0.0185105**	**C** **0.049361** **±0.0049361**	**C** **0.037021** **±0.0111063**	**A** **0.148083** **±0.06663735**
Cis8,11,14 Eicosatilenoic acid (C20:3n6)	**C** **0.297272** **±0.074318**	**C** **0.297276** **±0.0297276**	**A** **0.758934** **±0.2276802**	**B** **0.379467** **±0.17076015**
y Linolenic acid (C18:3n6)	**B** **1.06963** **±0.2674075**	**A** **1.6963** **±0.16963**	**C** **0.812622** **±0.2437866**	**C** **0.737972** **±0.3320874**
Cis,13,16 Decosadonic acid (C20:2)	**C** **4.487325** **±1.12183125**	**C** **5.9831** **±0.59831**	**B** **8.97465** **±2.692395**	**A** **17.9493** **±8.077185**
Cis11,Eicosenoic acid (C20:1)	**C** **0.297275** **±0.07431875**	**C** **0.227975** **±`0.0227975**	**A** **11.83623** **±3.550869**	**B** **1.747** **±0.78615**
Linolenic acid (C18:3n3)	**C** **0.148638** **±0.0371595**	**C** **0.143886** **±0.0148638**	**A** **5.918115** **±1.7754345**	**B** **0.8735** **±0.393075**
Henoisoanioic acid (C21:0)	**N.D.**	**N.D.**	**N.D.**	**N.D.**
Cis11,,14 Eicosoadadieonic acid (C20:2)	**D** **0.367977** **±0.09199425**	**B** **6.920244** **±0.6920244**	**C** **3.6134** **±1.08402**	**A** **27.9018** **±12.55581**
Bemhanic acid (C22:0)	**A** **3.147014** **±0.7867535**	**A** **3.756425** **±0.3756425**	**A** **3.288213** **±0.9864639**	**B** **1.543241** **±0.69445845**
Eruclic acid (C22:1n9)	**A** **5.92605** **±1.4815125**	**B** **5.05926** **±0.505926**	**C** **2.963025** **±0.8889075**	**D** **2.006025** **±0.90271125**
Cis11,,14,17 Eicosapenitionic acid (C20:3n3)	**A** **0.367977** **±0.09199425**	**B** **0.367** **±0.0367**	**N.D.**	**N.D.**
Tricosinoicc acid (C23:0)	**N.D.**	**N.D.**	**N.D.**	**N.D.**
Arachidonic acid (C23:4n6)	**B** **0.15255** **±0.0381375**	**A** **0.2444** **±0.02444**	**N.D.**	**N.D.**

Table (3) continues.

Lingocetic acid (C24:0)	**N.D.**	**N.D.**	**N.D.**	**N.D.**
Cis5,8,11,,14,17Eicosapenitionic acid(C20:5n3)	**D 0.059205 ±0.01480125**	**B 0.284305 ±0.0284305**	**C 0.118409 ±0.0355227**	**A 0.568611 ±0.2556495**
Nervonic acid (C24:1)	**0.136 ±0.03375**	**N.D.**	**N.D.**	**N.D.**
Cis,4,7,10,13,16,19 Decsahexawnic acid (C24:6)	**B 0.12541 ±0.0313525**	**A 0.3617 ±0.03617**	**C 3.68E-02 ±0.001104**	**A 0.367977 ±0.16558965**
∑ Saturated fatty acid (SFA)	**A 82.175273 ±20.5439325**	**C 53.253311 ±5.3253311**	**B 77.013507 ±23.1040521**	**C 57.7387923 ±25.9824564**
∑ Monounsaturated Fatty Acid (MUFA)	**B 67.541996 ±16.885499**	**B 61.149526 ±6.1149526**	**A 72.12226 ±21.636678**	**C 41.945478 ±18.8754651**
∑ ω-3unsaturated	**A 42.39292 ±10.59823**	**B 35.302584 ±3.5302584**	**C 28.216877 ±8.4740631**	**D 14.108439 ±6.34879755**
∑ ω-6 unsaturated	**B 1.370818 ±0.3427045**	**B 1.462668 ±0.1162668**	**A 6.730737 ±2.0192211**	**B 1.611472 ±0.7251624**
∑ ω -7 unsaturated	**A 31.85199 ±7.9629975**	**B 7.962998 ±0.7962998**	**C 10.61733 ±3.185199**	**B 7.962998 ±3.5833491**
∑ ω -9 unsaturated	**C 15.468662 ±3.8671655**	**D 10.297291 ±1.0297291**	**A 44.938925 ±13.4816775**	**B 23.286845 ±10.478900**
∑ EAA – DAA	**C 4.855302 ±1.2138255**	**B 12.903344 ±1.29035344**	**B 12.58805 ±3.776415**	**A 20.73948 ±9.332766**
∑ EAA –EPA	**B 0.427182 ±0.1067955**	**A 0.651305 ±0.0651305**	**C 0.118409 ±0.0354627**	**B 0.568611 ±0.25587495**
∑ EPA-DHA	**C 0.184615 ±0.04615375**	**B 0.646005 ±0.0646005**	**C 0.155209 ±0.0465627**	**A 0.936588 ±0.4214646**
∑ Polyunsaturated fatty acid (PUFA)	**B 3.662628 ±0.915657**	**B 3.846328 ±0.3846328**	**A 8.355981 ±2.5067943**	**B 3.087416 ±1.3893372**
Unidentified peaks	**0.4074119**	**0.7838609**	**0.307904**	**0.4877466**

NO = Number of fish equals 10/species.

Mean ± standard Error. N.D.: non detected

DHA:Cis,4,7,10,13,16,19 Decsahexawnic acid (C22:6); EPA: Cis11,,14,17 Eicosapenitionic acid (C20:3n3); EAA: Cis5,8,11,,14,17 Eicosapenitionic acid (C20:5n3); EDA:; **Cis11,,14 Eicosoadadieonic acid (C20:2); DAA:Cis,13,16 Decosadonic acid (C22:2); ETA: Cis8,11,14 Eicosatilenoic acid (C20:3n6).**

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