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Fatty Acids Profile of Some Marine Water and Freshwater Fish.

ABOUEL-YAZEED, A. M.
Food Science and Technology Dept., Fac. Agric. (Saba Basha), Alex. Univ.
Alexandria, Egypt

ABSTRACT

Fish is one of the foods with significant nutritional value as they play a role in nutraceutical foods. The objective of this study was to investigate fatty acid composition of some marine water fish species; *Sparus aurata* (Sea bream), *Solea vulgarsis* (Common sole), *Epinephelus alexandrinus* (Golden groupers), *Mullus surmuleuts* (striped red mullet), *Pagrus pagrus*(Red porgy), *Pomatomus saltatrix* (Blue fish), *Sardinella aurita* (Sardinella) and *Dicentrachus labrax* (Seabass), as well as freshwater fish species;*Cyprinus carpio* (Common carp), *Mugil cephalus* (Grey mullet), *Clarias garipinus* (Catfish) and *Anguila anguilla* (Eel). The obtained results showed that total lipid contents of marine water species ranged from 0.57 % for *Solea vulgarsis* to 10.27 % for *Sardinella aurita* , while total lipid contents of freshwater fish species ranged from 3.05 % for *Cyprinus carpio* to 11.14 % for *Anguila Anguilla*. Fish contained reasonable amounts of essential polyunsaturated fatty acids (PUFAs); Eicosapentaenoic (EPA, 20:5 ω-3) ranged from 0.32% to 2.57% for marine water fish, while freshwater fish ranged from 0.20 % to 1.08%. Docosahexaenoic (DHA, 22:6 ω-3) ranged from 2.17% to 19.22% in marine water fish, whereas, ranged from 1.60% to 2.58 % in freshwater fish. The data revealed that marine water fish have regular pattern of fatty acids composition as a better sources of ω-3 essential fatty acids (ranged from 4.54 % to 25.61 %), while freshwater fish are good source of ω-6 essential fatty acids (ranged from 5.66% to 12.15%). Generally, the results showed that fatty acid compositions of marine water fish species are comparable to those of freshwater fish species as sources of polyunsaturated fatty acids (PUFAs).

Keywords: Fatty acid profile-- marine water fish- freshwater fish- Polyunsaturated Fatty Acids- Eicosapentaenoic acid- Docosahexaenoic acid-Omega-3- Omega-6.

INTRODUCTION

The nutritional importance of fish consumption is in great extent associated with its advantageous fatty acid profile (Sidhu, 2003). However**,** lipids are an important component in fish and human diets, both as energy and fatty acids (FA) sources (Sargent *et al.*, 2002). The fats are also needed in diets to absorb fat-soluble vitamins A, D, E and K from food; and for regulating body cholesterol metabolism (Connor, 2000; Kris-Etherton *et al.*, 2003).

It is important for human health, to increase the consumption of fish and its products (Burr, 1989; Sargent, 1997). The composition of fatty acids in fish is influenced by the environment and type of feed (Moreira *et al.*, 2001; Suzuki *et al.*, 1986). Increasing attention has been focused on the significance of polyunsaturated fatty acids (PUFAs) in human nutrition. In particular ω-3fatty acids eicoesapentaenoic acid (EPA) and docoesahexaenoic acid (DHA) which display several properties beneficial for human health. Different studies supported the beneficial activity of these ω-3 (PUFAs) as in the prevention of cardiovascular diseases (Alasalvar *et al.*, 2002 ; Sidhu, 2003).

The fish fats contain essential PUFA like eicosapentaenoic (EPA, C20:5 ω-3) and docosahexaenoic(DHA, C22:6 ω-3) acids which are not synthesised in the human body (Connor, 2000; Glogowski & Ciereszko, 2001;Alasalvar *et al.*, 2002; Kris-Etherton *et al.*,2003;Holub & Holub, 2004; Kolanowski& Laufenberg, 2006).

Pigott and Tucker (1990) suggested that the ω-3/ ω- 6 ratios is a useful indicator for comparing relative nutritional value of different fish 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 (Kinsella *et al.*,1990; Simopoulos, 2002). Also, ω-3/ ω- 6 polyunsaturated fatty acids are considered essential but since they cannot be synthesized in the human body, they must be obtained through diet (Mahan & Escott-Stump, 2005). Generally, Fish have been suggested as a key component for a healthy diet in humans (Abd Rahman *et al.*, 1995). Thus, this study was carried out to investigate the composition of fatty acids of some marine water species and freshwater fish species as well as to compare the nutritional quality of freshwater fish with that of marine fish species.

MATERIALS AND METHODS

Materials

Fish

Marine water and freshwater fish species were caught from two different sources during March 2012. Marine water fish species (10 kg); (*Sparus aurata* (Sea bream), *Solea vulgarsis* (Common sole), *Epinephelus alexandrinus* (Golden groupers), *Mullus surmuleuts* (striped red mullet), *Pagrus pagrus*(Red porgy), *Pomatomus saltatrix* (Blue fish), *Sardinella aurita* (Sardinella (Sardine)) and *Dicentrachus labrax* (Seabass) were obtained in the early morning from Al-Anfoshy , Alexandria Governorate ,Egypt.

Freshwater fish species(5 kg); (*Cyprinus carpio* (Common carp), *Mugil cephalus* (Grey mullet), *Clarias garipinus* (Catfish) and *Anguila anguilla* (Eel) were also obtained in the early morning from Rasheed , El-Behara , Governorate ,Egypt.

Fish Transportation

Fish were transported in ice boxes to the Laboratory of Food Science Department, Faculty of Agriculture (Saba-Basha), Alexandria University within two hours.

At laboratory, All fish were removed from ice boxes cleaned ,washed with fresh tap-water to remove all the adhering sand and dust and freeze at - 18 °C until analysis .

Methods

Fish samples preparation

Fresh fish samples were gutted, filleted and muscle tissue (edible muscle) were minced for analyses.

Chemical analysis

Total Lipid

Samples were minced using a mincer (Mincy meat mincer Rigamontr Art-125 made in Italy). Total lipids were extracted from minced samples according to Folch Method (Folch et al., 1957) using chloroform: methanol (2:1,v/v).

Methylation of fatty acids and Gas Chromatography (GC)

Fatty acids methyl esters (FAMEs) were performed according to the procedure of (Radwan, 1978). A sample of fish oil (50 mg) was transferred into screw-cap vial. 2 ml benzene and 10 ml sulfuric acid (1%) in absolute methanol were added. The vial was covered under a stream of nitrogen before heating in an oven 90 °C for 90 minutes. Ten ml of distilled water were added to the cooled vial and the methyl esters in each vial were extracted with 5 ml of petroleum ether for three times. The three petroleum ether extracts were

combined and concentrate to its minimum volume by using a stream of nitrogen. Analysis of fatty acids methyl ester (FAMEs) was carried out 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. 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.

RESULTS AND DISCUSSION

Total lipids are presented in Table (1) . It shows that the lipid content of a range of of marine water and freshwater fish species. the lipid content of marine water species ranged from 0.57 % for *Solea vulgarsis* to 10.27 % for *Sardinella aurita* , While lipid contents of freshwater fish species were between 3.05 % for *Cyprinus carpio* and 11.14 % for *Anguila Anguilla*. There are many factors effect 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 (Bandarra *et al.*, 1997; Orban *et al.*, 2002; Aidos *et al.*, 2002; Hamre *et al.*, 2003; Ozyurt *et al.*, 2005, Nazeer and Sampath 2012).

A regional effect may also explain the difference observed for the sardine composite sample in Toulon given that this comprised 80% of Mediterranean sardines (diet, etc.). Indeed, the French food composition database indicates a wide variation range for total lipids in sardines (Sardina pilchardus) caught along the European coasts as well: from 0.4 to 18.4 g of total lipids/100 g of edible portion (Bandarra 1997) for sardines. More over, The lipid content of fish changes due to species, diet,gender, geographical origin and season(Rasoarahona *et al.*, 2005).

Fish are often classified on the basis of their fat content according to Bennion, (1980). Based on this classification, lean fish have lower than 5% fat fat by weight. The medium fat fish instead have 5-10% fat whereas the fatty fish have more than 10% fat by weight. Another classification has been proposed by Ackman (1990) . lean fish (less than 2% fat) , low fat (2-4% fat) , medium fat (4-8%fat) and high fat (more than 8%) . And also, classification described by Greenfield and Southgate (2003), lean fish (less than 1% of total lipids), medium fat fish(1–5% of lipids) and fatty fish (more than 5% of lipids).

Based on the classification by Greenfield and Southgate (2003), the fish studied were ranged between lean fish as (*Solea vulgarsis* , *Pagrus pagrus*) and The medium fat fish as (*Epinephelus alexandrinus*, *Pomatomus saltatrix*). whereas the fatty fish as (, *Sardinella aurita* , *Anguila Anguilla*).

Fatty acid compositions of marine water fish is shown in Table (2). The values of proportions marine water fish species for myristic acid ranged between (C14:0, 0.20 – 0.27%), palmitic acid (C16:0, 20.40 – 26.83%), stearic acid (C18:0, 0.20 – 0.49%), palmitoleic acid (C16:1, 2.21 – 10.46%), oleic acid (C18:1, 23.31 – 45.43%), linoleic acid (C18:2, 2.90 – 9.27%), Eicosapentaenoic acid (EPA, C20:5 ω-3, 0.32 – 2.57%) and docosahexaenoic acid (DHA, C22:6 ω-3, 2.17 – 19.22%). Similar results were found by (Luzia *et al*., 2003; Ozogul & Ozogul, 2007).

On the other hand, Table (3) shows that the fatty acids of 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

Table (1) ***Total lipid contents and lipid classification of some marine water and freshwater fish species (Mean values of three determinations).***

Fish species	Total lipid content (%)	Classification of fish
Marine water		
Sparus aurata (Sea bream)	3.86	medium
Solea vulgarsis (Common sole)	0.57	lean
Epinephelus alexandrinus (Golden groupers)	2.24	medium
Mullus surmuleuts (striped red mullet)	6.51	fatty
Pagrus pagrus(Red porgy)	0.86	lean
Pomatomus saltatrix (Blue fish)	2.03	medium
Sardinella aurita (Sardinella)	10.27	fatty
Dicentrachus labrax (Seabass)	2.71	medium
Freshwater		
Cyprinus carpio (Common carp)	3.05	medium
Mugil cephalus (Grey mullet)	5.28	fatty
Clarias garipinus (Catfish)	3.81	medium
Anguila anguilla (Eel)	11.14	fatty

Classification according to Greenfield and Southgate (2003)

Table (2) ***Fatty acid composition of some marine water fish species (Mean values of three determinations).***

Fatty acids (%)	Sea bream	Sole	Golden groupers	Strip red mullet	Red porgy	Blue fish	Sardine	Sea bass
C14:0	ND	0. 20	0.23	0.27	ND	0.08	0. 21	ND
C15:0	0.42	0.50	0.62	0.92	0.63	0.62	0.60	0.82
C16:0	24.42	23.03	24.17	21. 59	20.55	26.83	25.58	20.40
C17:0	0.70	0.62	0.85	1.57	0.80	0.88	0.84	0.82
C18:0	0.37	ND	0.23	0.49	0.26	0.24	0.23	0.20
C20:0	ND	0.31	ND	0.20	0.20	ND	0.22	0.22
C22:0	0.40	0.23	0.28	0.43	0.21	0.21	0.24	0.20
∑SFA	**26.31**	**24.89**	**26.28**	**25.47**	**22. 74**	**28.78**	**27.92**	**22.66**
C14:1	2.87	2.09	2.71	2.43	4.32	2.54	1.97	2.91
C15:1	ND	0.20	ND	ND	0.31	ND	0.23	0.40
C16:1	7.07	3.79	5.35	5.03	9.95	3.24	2.21	10.46
C17:1	0.72	0.31	0. 31	0.59	0.26	0.25	0.27	0.52
C18:1	38.91	45.43	30.62	23.31	31.57	37.90	27.59	28.66
C20:1n9	1.22	1.35	1.63	3.84	0.20	1.93	1.31	0. 21
C20:1n7	3.74	1.93	3.88	7.03	8.78	2.46	3.04	1.00
C22:1	3.80	0.23	0.47	0.43	ND	ND	0.22	0.45
∑MUFA	**58.33**	**55.33**	**44.97**	**42.66**	**55.39**	**48.32**	**36.84**	**44.61**
C18:2	8.37	6.89	7.36	7.19	7.20	9.27	7.40	2.90
C20:2	0.67	2.56	1.09	3.25	1.46	0.50	2.54	3.15
C20:4	1.79	1.28	1.32	0.75	1.51	0.61	1.71	0.96
∑ ω-6	**10.83**	**10.73**	**9.77**	**11.19**	**10.17**	**10.38**	**11.65**	**7.01**
C18:3	0.30	0.39	1.86	0.65	0.20	0.21	0.24	5.28
C20:3	0.85	0.40	0.31	1.89	2.84	0.49	1.07	10.64
C20:5	0.92	0.35	0.32	0.38	0.43	2.36	2.57	1.84
C22:5	0.30	1.35	0.78	0.81	0.97	2.13	0.54	0.45
C22:6	2.17	6.58	15.74	16.93	7.33	7.34	19.22	7.40
∑ ω-3	**4.54**	**9.07**	**19.01**	**20.66**	**11.77**	**12.53**	**23.64**	**25.61**

D = Not determined.

Table (3) ***Fatty acid composition of some freshwater fish species (Mean values of three determinations).***

Fatty acids (%)	Carp	Mullet	Catfish	Eel
C14:0	0.21	0.21	0.22	0.20
C15:0	0.53	1.18	0.94	0.73
C16:0	22.58	28.25	21.30	25.02
C17:0	0.74	0.72	1.16	0.68
C18:0	0.21	0.20	0.21	0.21
C20:0	0.20	0.39	0.29	0.20
C22:0	ND	0.22	ND	ND
∑SFA	**24.47**	**31.17**	**24.12**	**27.04**
C14:1	2.17	4.42	2.74	3.05
C15:1	0. 20	0.36	0. 20	0.21
C16:1	4.87	9.37	6.69	7.42
C17:1	0.74	0.23	0.54	0.61
C18:1	48.63	34.26	38.13	40.50
C20:1n9	1.56	7.03	1.49	3.07
C20:1n7	2.13	0.69	1.95	0.46
C22:1	0.29	3.30	0.20	0.21
∑MUFA	**60.55**	**59.66**	**51.94**	**55.53**
C18:2	5.08	2.60	3.15	4.91
C20:2	3.23	1.61	6.51	5. 80
C20:4	2.58	1.45	1. 86	1.44
∑ ω-6	**10.89**	**5.66**	**11.52**	**12.15**
C18:3	0.41	0.20	7.21	0.20
C20:3	0.74	0.85	1.04	2.07
C20:5	0.70	0.49	1.08	0.20
C22:5	0.65	0.28	0.58	0.25
C22:6	1.60	1.68	2.53	2.58
∑ ω-3	**4.10**	**3.50**	**12.44**	**5.30**

ND = Not determined.

acid (C16:1, 4.87 – 9.37%), oleic acid (C18:1, 34.26 – 48.63%), linoleic acid(C18:2, 2.60 – 5.08%), linolenic acid (C18:3, 0.20 – 7.21%), Eicosapentaenoic acid (EPA, C20:5 ω-3, 0.20 – 1.08%) and docosahexaenoic acid (DHA, C22:6 ω-3, 1.60 – 2.58%). These results are in agreement with previous studies on FA of other species by(Suzuki *et al.*, 1986 ;Vlieg and Body1988 and Fajmonova 2003).

With regard to Tables (4 and 5), data revealed that saturated fatty acids (SFA) ranged between 22.66 – 28.78 %, whereas monounsaturated fatty acids (MUFAs) 36.84 – 58.33% and 15.37 – 35.29% polyunsaturated fatty acids (PUFAs) for marine water fish species . Whereas the fatty acid compositions of freshwater fish consisted of 24.12–31.17% Saturated (SFA), 51.94–60.55% Monounsaturated (MUFAs) and 4.99–23.96% polyunsaturated acids (PUFAs). Similar result was found by (Chen *et al.,* 1995). The proportions of PUFAs- ω3 of marine water fish (ranging from 4.54% to 25.61%) were higher than those of PUFAs- ω3 of freshwater fish (ranging from3.5% to 12.44%). However, the levels of PUFAs- ω6 of marine water fish (ranging from 7.01% to 11.65%) were lower than those of PUFAs- ω6 of freshwater fish (ranging from5.66 % to 12.15%). These results agreed with(Abd Rahman *et al.*, 1995 and Vlieg & Body1988).

Table(4) ***Saturated Fatty Acids(SFA%) , Monounsaturated Fatty Acids (MUFAs%) , Polyunsaturated Fatty Acids (PUFAs%) and Ratios of P/S, ω3/ ω6 and ω 6/ ω 3 in some marine water fish species.***

Species	SFA%	MUFAs%	PUFAs%	P/S Ratio	ω3/ ω6 Ratio	ω 6/ ω 3 Ratio
Sea bream	26.31	58.33	15.37	0.58	0.42	2.38
Sole	24.89	55.33	19.80	0.79	0.84	1.18
Golden groupers	26.28	44.97	28.78	1.09	1.94	0.51
Strip red mulle	25.47	42.66	31.85	1.25	1.85	0.54
Red porgy	22.74	55.39	21.94	0.96	1.16	0.86
Blue fish	28.78	48.32	22.91	0.80	1.21	0.83
Sardine	27.92	36.84	35.29	1.26	2.03	0.49
Sea bass	22.66	44.61	32.62	1.44	3.65	0.27

SFA : Saturated Fatty Acids.
MUFAs: Monounsaturated Fatty Acids.
PUFAs ; Polyunsaturated Fatty Acids.
P/S : Polyunsaturated/Saturated fatty acid ratio.

Table(5) ***Saturated Fatty Acids(SFA%) , Monounsaturated Fatty Acids(MUFAs%) , Polyunsaturated Fatty Acids (PUFAs%) and Ratios of P/S, ω3/ ω6 and ω 6/ ω 3 in some freshwater fish species.***

species	SFA%	MUFAs%	PUFAs%	P/S Ratio	ω3/ ω6 Ratio	ω 6/ ω 3 Ratio
Carp	24.47	60.55	14.99	0.61	0.38	2.65
Mullet	31.17	59.66	9.16	0.29	0.62	1.62
Catfish	24.12	51.94	23.96	0.99	1.08	0.92
Eel	27.04	55.53	17.45	0.64	0.44	2.29

SFA : Saturated Fatty Acids.
MUFAs : Monounsaturated Fatty Acids.
PUFAs: Polyunsaturated Fatty Acids.
P/S : Polyunsaturated/Saturated fatty acid ratio.

A minimum value of PUFA/SFA ratio (0.45) recommended by (HMSO, 1994), which was approximately lower than those obtained from all freshwater and marine water fish species studied. 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 (Kinsella *et al.*, 1990; Simopoulos, 2002).

Also, the ω3: ω6 ratio has been suggested to be a useful indicator for comparing relative nutritional values of fish oils. It was suggested that a ratio of 1:1–1:5 would constitute a healthy human diet (Osman et al., 2001).

All freshwater and marine water 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; Usydus *et al.,* 2011).

Previous study showed similar results Manson (1985) Showed that the ratio of ω 3/ ω 6 was greater in marine water fish compared to freshwater fish .

Among the marine water fish species studied, the ratio of ω 6/ ω 3 was found to be 2.38,1.18, 0.51, 0.54,0.86, 0.83,0.49,0.27 for Sea bream,Sole, Golden groupers ,Stripred mullet, Red porgy,Blue fish, Sardine , Sea bass, respectively. As for freshwater fish, the ratio of

ω 6/ ω 3 was found to be0.38, 0.62 , 1.08 , 0.44 for Carp, Mullet, Catfish, Eel, respectively. The ratios of ω 6/ ω 3 found in this study were lower in both marine water fish and freshwater fish than the value (4.0 at maximum) recommended by UK Department of Health (HMSO, 1994). Values higher than the maximum value are harmful to health and may promote cardiovascular diseases (Moreira *et al.,*2001).

Table (6) shows that 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 between 2.47and 3. 41% . for marine water fish species. Data also revealed that eicosapentaenoic acid (EPA, C20:5) is 0.32 %-2.57% and docosahexaenoic acid (DHA, C22:6) is 2.17%-19.22% in the marine water fish species. As for freshwater fish Table (7), the ratio of (TUFA/TSFA) was found to be 2.21% -3.15%.And also, 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 & Takeuchi, (1986) and Chen *et al*.,(1995). Compared with freshwater fish, marine fish contain higher levels of TUFA and PUFAs especially DHA and EPA as found in this study. However, both marine water fish and freshwater fish were good sources of EPA and DHA. As a matter of fact , marine water fish species contained high level of ω 3, ranging from 4.54% to 25.61 % whereas the level of ω 3 of freshwater fish ranged from 3.5% to12.44. Similar results obtained by Rasoarahona *et al.,*(2005).

Table(6) ***Total Unsaturated Fatty Acids(TUFA) / Total Saturated Fatty Acids (TSFA) and percentage of Eicosapentaenoic acid (EPA, C20:5 ω-3) and Docosahexaenoic acid (DHA, C22:6 ω-3) in some marine water fish species.***

species	TUFA/TSFA	EPA, C20:5 ω-3%	DHA, C22:6 ω-3%
Sea bream	2.80	0.93	2.17
Sole	3.02	0.35	6.58
Golden groupers	2.81	0.32	15.74
Strip red mulle	2.92	0.38	16.93
Red porgy	3.40	0.40	7.33
Blue fish	2.47	2.36	7.34
Sardine	2.58	2.57	19.22
Sea bass	3.41	1.84	7.40

Total Unsaturated Fatty Acids (TUFA).
Total Saturated Fatty Acids (TSFA).
Eicosapentaenoic acid (EPA, C20:5 ω-3).
Docosahexaenoic acid (DHA, C22:6 ω-3).

Table(7) ***Total Unsaturated Fatty Acids(TUFA) / Total Saturated Fatty Acids (TSFA) and percentage of Eicosapentaenoic acid (EPA, C20:5 ω-3) and Docosahexaenoic acid (DHA, C22:6 ω-3) in some freshwater fish species.***

species	TUFA/TSFA	EPA, C20:5 ω-3%	DHA, C22:6 ω-3%
Carp	3.09	0.70	1.60
Mullet	2.21	0.49	1.68
Catfish	3.15	1.08	2.53
Eel	2.70	0.19	2.63

The level of ω 6 of marine water fish was found ranging from 7.01% and 11.65%. However, the content of ω- 6 of freshwater fish were found high than marine water fish. The highest value was obtained from 5.66% and12.15%. 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 (Ackman, 1989; Saito *et al.,* 1999). Differences in fatty acids of marine and freshwater fishes 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). The fatty acid pattern should not be thought of as changing from species to species or from season to season 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 (Graham,1982).

CONCLUSION

In conclusion, this study showed that marine water fish are better sources of ω-3 essential fatty acids while freshwater fish are good source of ω-6 essential fatty acids. Both marine water fish and freshwater fish were good sources of EPA and DHA. This study also present knowledge of fatty acid compositions of fish species fundamental importance in the application of different technological processes in fish preservation, nutritional processing, and product development of high added values. It means that Nutritionist (nutrition specialist) and consumers should make a conscious choice among the different species.

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الجوده التركيبيه للأحماض الدهنية لبعض اسماك المياه البحريه و المياه االعذبه

أيمن أبو اليزيد

قسم تكنولوجيا الأغذية ، كلية الزراعة – سابا باشا – جامعة الإسكندرية

تعتبر الاسماك من الاغذيه ذات القيمه الغذائيه الهامه حيث انها تلعب دورا فى الاغذيه العلاجيه. ويهدف هذا البحث الي التعرف على الأحماض الدهنية المكونه لبعض انواع الاسماك في مصر.وتم اختيار بعض الاصناف من اسماك المياه البحريه مثل الد نيس ، موسي، ا لوقار،ا لبربوني ، المرجان،ا لمياس، ا لسردين و القاروص. وكذلك بعض أنواع أسماك المياه العذبة مثل المبروك ،البورى ، القراميط والثعابين. وأوضحت النتائج المتحصل عليها أن الاحماض الدهنيه التى تم التعرف عليها من كلا النوعين من الاسماك تحتوى على نسب متفاوته من الاحماض الدهنيه عديدة عدم التشبع . وأوضحت النتائج ايضا محتوى هذه الاسماك من الاحماض الدهنيه المشبعه وأحادية عدم التشبع والاحماض عديدة عدم التشبع من النوع أوميجا -٣ وكذلك من النوع أوميجا-٦ والنسبه بينهما. وتميزت الاسماك البحريه بأنها تحتوى على أوميجا -٣ بنسبه أعلى من اسماك المياه العذبه.