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تأثير الاختلافات الفصلية على التركيب الحامضي الدهني لثلاثة أصناف من الأسماك النيلية

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تناول البحث دراسة التركيب الحامضي الدهني لثلاثة أصناف من الأسماك النيلية وهي على وجه التحديد: البلطي ، القرموط ، الشال المصيدة في موسم ١٩٨٥/٨٤ ومدى تأثير فصول السنة الأربعة على محتوياتها من الأحماض الدهنية المشبعة وغير المشبعة.

وتم تقدير الأحماض الدهنية باستخدام طريقة التحليل الكروماتوجرافي الغازى .

وقد اظهرت النتائج أن ليبيدات الأسماك الثلاثة المدروسة قد احتوت على ١٨ حامض دهني ذات سلسلة كربونية تتراوح مابين ك ٤ ، ك ١٨ وكان معظمها على صورة أحماض دهنية غير مشبعة.

وقد اتضح من نتائج البحث أن مستوى كلا من الأحماض الدهنية المشبعة والاحماض الدهنية غير المشبعة تتفاوت بدرجة ملموسة في فصول السنة الأربعة. نظرا لأن درجة تشبع ليبيدات الأسماك تتباين تبعا لفصول السنة ايضا.

هذا الى أن النتائج قد اظهرت أن المحتوى النسبي للأحماض الدهنية غير المشبعة زاد بدرجة ملموسة في فصل الربيع في الثلاثة أصناف المدروسة من الأسماك.

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EFFECT OF SEASONAL VARIATIONS ON THE FATTY ACID COMPOSITION IN TRUNK SKELETAL MUSCLE OF THREE NILE FISH SPECIES

(With Two Tables)

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SUMMARY

The effect of seasonal variations on the fatty acid composition of three Nile fish species; Tilapia nilotica (LINNAEUS, 1757), Clarias lazera (CUVIER and VALENCIENES, 1840) and Synddontis scall (BLOCH-SCHNEIDER, 1801) was studied. The determination of fatty acids was carried out applying gas liquid chromatographic analysis.

The data revealed that lipids of the three studied fish species were found to contain 18 fatty acids with carbon chains ranging from C_4 to C_{18}, most which were unsaturated fatty acids. Both saturated and unsaturated fatty acids varied markedly due to seasonality, since the percentage of saturation of fish lipid varies according to season.

The data revealed that the relative content of unsaturated fatty acids increased markedly in spring in the three studied fish species.

INTRODUCTION

Several workers reported that the fatty acid composition differs greatly from one fish species to another, for the same species during the different seasons of the year according to the different fish localities depending on food, age and spawning conditions (BORGSTROM, 1961; JANGAARD, et al. 1967; WORTHINGTON, et al. 1972; FOUAD, 1976 and VISWANATHAN and GOPAKUMAR, 1978.

On the othe hand, the effect of seasonal variations on the fatty acid composition of some fish species were reported by ABD-ALLA, 1980; PEKHARINEN, 1980; POLLERO, et al. 1981; JEZIERSKA and HAZEL, 1982; GARLI, et al. 1983 and HIRANS and SUYAMA, 1983.

The present study was carried out to assess the effect of seasonal variations on the fatty acid composition of certain three Nile fish species; namely: Tilapia nilotica, Clarias lazera, and Synodontis schall.

MATERIAL and METHODS

a. Materials:

Three Nile fish species; namely: Tilapia nilotica (LINNAEUS, 1757), Clarias lazera (CUVIER and VALENCIENNES, 1840) and Synodontis schall (BLOCH-Schneider, 1801) were selected for the present study. Fish species were obtained immediately after catching from the Nile river at Assiut region at the end of autumn (1984), winter (1985), spring (1985) and summer (1985), respectively. The total lengths of samples of Tilapia nilotica, Clarias lazera and Syndontis schall ranged between 21-32 cm. 35-36 cm. and 30-36 cm. while their weights were 195-244 grams, 340-397 grams and 388-501 grams, respectively. Then the fish were dissected and sex was determined. Samples of trunk skeletal muscle (myotomal musculature) under the dorsal fin were taken from each female species of selected fish. Whole muscles were removed and minced three times. The well mixed samples of fish were kept in tightly closed containers for analysis.

Lipid extraction was carried out as described by FOUAD (1976).

b. Methods:

The methyl esters of extracted fish lipids were prepared according to VERISHAGEN, et al. (1963). Gas liquid chromatographic analysis was carried out in the Central Laboratory, Faculty of Agriculture, Cairo University, using a Pye Unicam gas liquid chromatograph Model 104 equipped with a dual flame ionization detector and dual channel recorder. The fatty acids were identified according to VERISHAGEN, et al. (1963). While, the calculations of fatty acids were computed from the peak area as described by STAHL (1969).

RESULTS and DISCUSSION

Results of the effect of seasonal variations on the fatty acid composition of the three studied fish species are presented in tables 1-2. Gas liquid chromatograms revealed that fish lipids of the three studied species contained 18 fatty acids in different and variable concentrations. The saturated fatty acids amounted to 46.15 to 49.91% including $C_{4:0}$, $C_{6:0}$, $C_{7:0}$, $C_{8:0}$, $C_{9:0}$, $C_{10:0}$, $C_{11:0}$, $C_{12:0}$, $C_{13:0}$, $C_{14:0}$, $C_{15:0}$, $C_{16:0}$, $C_{17:0}$ and $C_{18:0}$. While, the monounsaturated fatty acids constituted (43.86 to 51.74%), including $C_{11:1}$, $C_{16:1}$ and $C_{18:1}$. On the other hand, the polyunsaturated fatty acids ranged from 1.99 to 7.35% including $C_{18:2}$.

In general, the data given in table 1 indicated that $C_{18:1}$ and $C_{16:0}$ were the major dominant fatty acids among the saturated and unsaturated fatty acids in the three studied fish species.

Such data are in agreement with those reported by ACKMAN and EATON (1966) in Atlantic herring oil, ACKMAN (1967) in some fresh water fish oils, MAI and KINSELLA (1967) in white sucker (Castomus commersoni), VISWANATHAN and GOPAKUMAR (1978) in 15 species of fish from tropical waters (five species of fresh water fish, three marine fish and seven brachish water fish), ABD-ALLA (1980) in Bagrus bayad and Latus niloticus and HIRANS and SUYAMA (1983) in wild cultured ayu.

However, $C_{16:0}$ and $C_{16:1}$ and $C_{18:1}$ were found to be the dominant ones in Tilapia nilotica. On the other hand, $C_{18:1}$ was the major fatty acid amongst all saturated and unsaturated fatty acids in Clarias lazera and Synodontis schall, in agreement with NAIR and GOPAKUMAR (1978), who found that $C_{18:1}$ reached 31.98% in Waigue snapper.

Moreover, the data indicated that the level of saturated fatty acids reached its maximum (49.91%), (49.85%) and (48.70%), in autumn for the three studied fish species. The major saturated fatty acid in the three species was $C_{16:0}$, which is in agreement with that reported by ACKMANN and EATON (1966). The variation in the level of fatty acid might be due to type of food and algae as reported by HIRANO and SUYAMA (1983) in wild and cultured Ayu. They noted that the composition of fatty acids differed slightly during the maturation period after summer. $C_{16:0}$ is considered the greatest energy producer in fish species. However, ACKMAN and EATON (1966) reported that $C_{16:0}$ is a key metabolite in fish and its level is not influenced by the diet.

In addition the monoenoic fatty acids reached the maximum of 48.70% (Winter), 44.24% (Spring) and 51.74% (Spring) in Tilapia nilotica, Clarias lazera and Synodontis schall, respectively. While, the polyenoic fatty acids reached the maximum level of 3.25%, 7.35% and 3.61% in summer in Tilapia nilotica, Clarias lazera and Synodontis schall, respectively. According to JEJIERSKA, et al. (1982) during starvation $C_{18:2}$ accumulated in muscles and liver in salmon. The maximal level of $C_{18:2}$ might be due to unsufficient level of food present. In conclusion,the fatty acid composition of aquatic animals depend on many factors, such as diet and the proportions of different lipid classes in tissue, which coincide with PEKKARINEN (1980).

It is interesting to note that according to ABD-ALLA (1980) in case of Bagrus bayad and Latis niloticus the female attains maximum protein content at a younger age than the male. Similar trend is recorded for fatty acids. Therefore, from an ecological point of view this may refer to an earlier maturity of the female than male, which gives rise to recommed preventing brother sister corssing to allow for greater individual variation and better chance for natural selection.

Table (1)

Effect of seasonal variations on fatty acid composition of total lipid of Tilapia nilotica (T.N), Clarias lazera (C.L) and Synodontis schall (S.S).* (% of the total)

Fatty acids (%)	Autumn 1984			Winter 1985			Spring 1985			Summer 1985		
	T.N	C.L	S.S	T.N	C.L	S.S	T.N	C.L	S.S	T.N	C.L	S.S
$C_{4:0}$	2.22	5.05	0.76	2.57	4.91	0.51	2.36	5.63	0.88	1.91	5.27	0.63
$C_{6:0}$	0.09	1.20	2.66	0.08	1.32	1.77	0.08	1.43	1.28	0.10	1.42	1.81
$C_{7:0}$	5.83	3.38	0.09	5.29	3.08	0.08	5.03	3.18	0.07	4.99	3.93	0.10
$C_{8:0}$	0.46	0.71	1.33	0.36	0.62	1.02	0.58	0.51	1.09	0.49	0.72	1.12
$C_{9:0}$	4.55	5.83	0.14	4.15	5.38	0.09	4.66	4.99	0.06	5.37	4.10	0.06
$C_{10:0}$	0.09	0.30	0.57	0.10	0.81	0.86	0.07	0.23	0.65	0.09	0.43	0.73
$C_{11:0}$	1.29	1.72	1.11	1.08	2.23	1.26	1.33	1.91	1.03	1.26	2.01	1.93
$C_{11:1}$	6.18	4.49	5.70	6.38	4.55	4.63	5.91	4.91	5.28	4.58	4.11	5.33
$C_{12:0}$	2.03	1.90	1.52	2.13	2.00	1.03	2.13	1.61	1.22	1.98	1.50	1.86
$C_{13:0}$	0.18	0.09	2.66	0.16	0.08	2.45	0.22	0.13	2.13	0.31	0.02	2.81
$C_{14:0}$	1.11	2.59	0.57	1.41	1.98	0.49	1.21	2.33	0.31	1.34	2.01	0.56
$C_{15:0}$	1.29	1.38	1.33	1.41	1.48	1.66	1.31	1.36	1.31	1.53	1.62	1.61
$C_{16:0}$	22.92	17.10	29.64	23.01	16.90	30.90	21.01	16.01	29.31	21.35	17.50	28.57
$C_{16:1}$	20.74	14.34	4.75	21.19	15.59	6.88	19.59	15.20	6.66	21.31	14.92	6.16
$C_{17:0}$	4.62	2.46	1.71	4.02	2.51	1.63	5.48	3.21	1.95	5.03	3.05	1.86
$C_{18:0}$	3.14	5.57	4.56	3.54	6.10	5.56	2.91	5.91	4.86	3.31	5.21	4.63
$C_{18:1}$	20.40	24.84	38.00	21.13	23.91	37.10	22.90	24.13	39.80	21.80	24.83	36.62
$C_{18:2}$	2.77	6.48	2.85	1.99	6.51	3.08	3.22	7.32	2.11	3.25	7.35	3.61

* Each figure is an average of two determinations.

Table (2)

Effect of seasonal variations on saturated and unsaturated Fatty acids of Tilapia nilotica (T.N), Clarias lazera (C.L) and Synodontis schall (S.S)*. (% of the total)

Fatty acids (%)	Autumn 1984			Winter 1985			Spring 1985			Summer 1985		
	T.N	C.L	S.S	T.N	C.L	S.S	T.N	C.L	S.S	T.N	C.L	S.S
Saturated Fatty acids	49.91	49.85	48.70	49.31	49.44	48.31	48.38	48.44	46.15	49.06	48.79	48.28
Monoenoic Fatty acids	47.32	44.07	48.45	48.7	44.05	48.61	48.40	44.24	51.74	47.69	43.86	48.11
Polyenoic Fatty acids	2.77	6.48	2.85	1.99	6.51	3.08	3.22	7.32	2.11	3.25	7.35	3.61
Unsaturated Fatty acids	50.09	50.15	51.30	50.69	50.56	51.69	51.62	51.56	53.85	50.94	51.21	51.72

Besides, the data revealed that seven odd fatty acids of single carbon numbers including $C_{7:0}$, $C_{9:0}$, $C_{11:0}$, $C_{11:1}$, $C_{13:0}$, $C_{15:0}$ and $C_{17:0}$ were detected in rather low levels in the three studied fish species. Such data support Holman (1956) findings, who found some fatty acids of single carbon numbers in fish.

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