قسم : علم الحيوان.
كلية : العلوم ـ جامعة أسيوط.
رئيس القسم : أ.د/ محمد حسين.

تأثير الأختلافات الفصلية على المكونات الليبيدية في ثلاثة أصناف من الأسماك النيلية

خديجة حسن ، محمد بسام

أجريت دراسة تفصيلية على ثلاثة أصناف من الأسماك النيلية وهي على وجه التحديد : البلطي ، القرموط ، الشال.

تم تقدير المكونات الليبيدية بواسطة طريقة الكروماتوجرافيا على الطبقة الرقيقة اثناء موسم الصيد ١٩٨٥/٨٤.

وقد أظهرت الكروماتوجرامات وجود ٧ تجزوءات ليبيدية متميزة وهي: الفوسفوليبيدات أحادى الجليسريدات ، الكوليسترول ، ثنائي الجليسريدات ، الأحماض الدهنية الحرة ، ثلاثي الجليسريدات ، الهيدروكربونات في الثلاثة أصناف المدرسة من الأسماك.

وقد اتضح من التحليل الاحصائي للنتائج وجود فروق عالية المعنوية بين الأصناف في التجزوءات الليبيدية التالية: الفوسفوليبيدات ، ثلاثى الجليسريدات ، الكوليسترول الهيدروكربونات ، بينما لم تكن هناك فروق معنوية في الأحماض الدهنية الحرة والجليسريدات الأحادية بين أصناف الأسماك المدروسة.

ومن جهة أخرى ، وجدت فروق عالية المعنوية بين فصول السنة (الخريف ، الربيع الشتاء، الصيف) في الهيدروكربونات ، الفوسفوليبيدات ، ثنائي الجليسريدات فقط ، بينما لم تكن هناك فروق معنوية في ثلاثي الجليسريدات ، أحادى الجليسريدات ، الأحماض الدهنية الحرة بين فصول السنة.

Dept. of Zoology,
Faculty of Science, Assiut University,
Head of Dept. Prof. Dr. M. Hussein.

EFFECT OF SEASONAL VARIATIONS ON LIPID COMPONENTS IN THREE NILE FISH SPECIES

(With 3 Tables & 4 Figs.)

By
KHADIGA A. HASSAN and M.B. EL-SALAHY
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SUMMARY

A comparative detailed study was carried out on three Nile fish species, namely: Tilapia nilotica, Clarias lazera and Synodontis schall.

Lipid components were determined by thin layer chromatography (TLC) during the fishing season 1984/1985.

The chromatograms revealed that seven lipid fractions; namely: phospholipids, monoglycerides, cholesterol, diglycerides, free fatty acids, triglycerides and hydrocarbons were identified in the three studied fish species. The statistical analysis indicated that there were high significant differences between species in the lipid fractions: phospholipids, triglycerides, cholesterol and hydrocarbons. While, insignificant differences were detected in free fatty acids and monoglycerides between species.

On the other hand, high significant differences between seasons (autumn, winter, spring and summer) were recorded in hydrocarbons, phospholipids, and diglycerides only. While insignificant differences were detected in triglycerides, monoglycerides, and free fatty acids between seasons.

INTRODUCTION

The distribution of fish lipids was studied by several authors, i.e. EL-MAGRABY, et al. (1972), YANNI (1972), ROBINSON and MEAD (1973), HELMY, et al. (1974), ABD-ALLA (1980), and SHERIDAN, et al. (1983). Likewise, according to YOUSSEF, et al. (1974), FOAD (1976), HUSSIEN, et al. (1976), PEKKARINEN (1980), SHRENI and KALPANA (1980) and SHERIDAN, et al. (1983) lipid components of fish exhibited some seasonality. Since the energy demands associated with reproduction may exceed the energy supplied by the available food, the fish utilize reserves accumulated when food supply is in excess of the energy demand (SHULMAN, 1974). Large stores of triglycerides in the parr's mesentric fat, dark muscle and liver implicate these tissues as lipid depot organs (SHERIDAN, et al. 1983). Therefore, the seasonal variations in lipid components may be of value in tracing the physiological status of the fish throughout the year. This investigation was carried out to assess the effect of seasonal variations on the lipid components of three Nile fish species, namely: Bolti (Tilapia nilotica), Karmout (Clarias lazera), and Schall (Synodontis schall).

MATERIAL and METHODS

a. Materials:

Three Nile fish species; namely: Bolti (Tilapia nilotica), Karmout (Clarias lazera), and Schall (Synodontis schall), 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, spring and summer (1985), respectively. These species were transported immediately to the laboratory. The period elapsing from catching to sampling was minimized as much as possible.

b. Methods:

Samples of trunk skeletal muscle (myotomal musculature) beneath the dorsal fin were taken from female fish of the studied species. The muscles were thoroughly mixed, and promptly analyzed.

i- Total lipid determination:

10 g. muscle samples were extracted by chloroform: methanol (2:1) according to the method described by FOLCH, et al. (1957).

ii- Fractionation of lipids:

Total lipids were dissolved in chloroform and thin layer chromatography method (TLC) was used to estimate lipid fractions qualitatively and quantitatively as described by STAHL (1969). Silica gel G plates, 9x11 cm precoated (ca. 250 micron thickness) were used for this purpose. Spectrophotometer apparatus 0035-0020 model 35 at wave length 500 nm was used for quantitative determination of lipid fractions.

iii- Statistical analysis:

Data were statistically analyzed applying analysis of variance according to the method described by SNEDECOR (1962).

RESULTS

The data of the effect of seasonal variations on the lipid fractions in Tilapia nilotica, Clarias lazera and Synodontis schall are represented in tables (1-3) and Figs. (1-4). The chromatograms revealed that 7 lipid fractions; namely:

Table (1)
Effect of seasonal variations on lipid fractions of Tilapia nilotica*

Lipid fraction	Season			
	Autumn 1984 %	Winter 1985 %	Spring 1985 %	Summer 1985 %
Phospholipids	18.8	18.9	22.8	21.5
Monoglycerides	0.4	0.4	0.2	0.4
Cholesterol	3.3	2.9	3.1	3.2
Diglycerides	2.2	3.2	3.1	3.1
Free fatty acids	4.2	4.2	4.2	4.3
Triglycerides	70.9	69.2	66.1	67.4
Hydrocarbons	0.2	0.7	0.5	0.1

* Each figure given in this table and Tables 2 and 3 is a mean of 5 determinations.

Table (2)

Effect of seasonal variations on lipid fractions of Clarias lazera

Lipid fraction	Season			
	Autumn 1984 %	Winter 1985 %	Spring 1985 %	Summer 1985 %
Phospholipids	12.9	13.2	14.5	14.1
Monoglycerides	1.2	1.1	0.8	1.2
Cholesterol	4.4	4.3	3.9	4.1
Diglycerides	3.1	4.3	4.1	4.2
Free fatty acids	4.9	4.2	4.3	4.9
Triglycerides	70.9	70.7	71.8	71.3
Hydrocarbons	0.6	0.8	0.6	0.2

phospholipids, monoglycerides, cholesterol, diglycerides, free fatty acids, triglycerides and hydrocarbons were identified in the three fish species. The muscle fibre of these species contained comparatively large percentages of triglycerides and phospholipids.

Table (3)

Effect of seasonal variations on lipid fractions of Synodontis schall

Lipid fraction	Season			
	Autumn 1984 %	Winter 1985 %	Spring 1985 %	Summer 1985 %
Phospholipids	13.1	13.5	13.9	13.8
Monoglycerides	0.3	0.3	0.1	0.3
Cholesterol	3.4	2.5	2.4	2.6
Diglycerides	2.8	3.2	3.3	2.5
Free fatty acids	4.6	4.5	4.6	4.6
Triglycerides	75.5	75.4	75.2	76.1
Hydrocarbons	0.1	0.6	0.4	0.1

Moreover, the data revealed that the triglyceride level of Synodontis schall (75.4-76.1%) is higher than that of Clarias lazera (70.7-71.8%) and the latter is still higher than that of tilapia nilotica (66.1-70.9%). Meanwhile, the statistical analysis indicated that there were high significant differences between species as well as significant differences between seasons. Whereas, rather low interaction between species and seasons was noted. Rather similar trend

was recorded for the phospholipid fraction, except that the interaction between species and seasons was high.

Furthermore, cholesterol, diglycerides and hydrocarbons fractions almost exibited a rather similar trend with regard to species and seasons, except that the interaction between species and seasons was insignificant.

On the contrary, the free fatty acids fraction recorded insignificant differences between species, between seasons and interaction between species and seasons as well. SHERIDAN, et al. (1983) reported that nonestrified fatty acids were detected only in serum of steelhead trout in minute amounts.

Furthermore, the data revealed that there were high significant differences between species. However, insignificant differences between seasons as well as insignificant interaction between species and seasons were noted. Likewise, minute traces of monoglycerides appeared in the chromatograms.

DISCUSSION

Lipids in fish are of particular importance because they present the bulk of stored energy-producing food in the body. No doubt that the diet, the amount and composition of consumed fat, periods of starvation, reproductive cycle, season and the environmental temperature are very important factors which affect the make up of fish body levels. The data obtained herein revealed that the three studied fish species contained rather high levels of triglycerides and phospholipids, which is in good agreement with DITTMER (1962), BADAWY (1979), and SHERIDAN, et al. (1983) findings. Besides, the seasonal variations in triglycerides might be due to the fact that increased catabolism is the cause of loss of body fat as the depletion of lipid occurred primarily in the triglycerides fraction (SHERIDAN, et al. 1983).

On the other hand, the seasonal variations in phospholipids, cholesterol, diglycerides and hydrocarbons are in accordance with that reported by DITTMER (1962) and FOUAD (1976). However, they are contradicted by SHERIDAN, et al. (1983), who reported that the phospholipid fraction exibited no definite seasonality in steelhead trout fish. Moreover, the variations in cholesterol levels in the three studied fish species might be due to the decrease in membrane cholesterol or removal from other storage sites, which in turn might be a reflection of cellular growth which yields fewer cells per gram of tissue, and hense less memberane cholesterol. Such growth effects should also influence phospholipids concentration as reported by SHERIDAN, et al. (1983).

In conclusion, all lipid fractions have important roles in animal nutrition.

REFERENCES

Abd Alla, S. (1980): Nutritive value of the flesh of different ages of some fishes in High Dam Lake, M.Sc., Faculty of Science, Aswan, Assiut University.

Badawy, R. (1979): Chemical and technological studies on lipids of some local smoked fish, M.Sc., Faculty of Agriculture, Assiut University.

Dittmer, J.C. (1962): Distribution of phospholipids in comparative bicohemistry (M. Florkin and H. Mason, eds.) Vol. 3, 231-266. Academic Press.

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El-Maghraby, A.M.; Ezzat, A. and Salah, H.H. (1972): Fat metabolism in Tilapia zillii gerv. in relation to feeding and breeding activities, Bull. of Inst. Oceanography and Fishers., Vol. 2, Cairo.

Fouad, A.A. (1976): Chemical and technological studies on phospholipids in Nile bolti Fish, Ph.D., Faculty of Agriculture, Assiut University.

Folch, J.; Less, M. and Stanely, G.H.S. (1957): Simple method for the isolation and purification of total lipids from animal tissues, J. fo Biol. Chem., 2225, 497.

Helmy, A.H.; Badawi, H.K. and El-Bishary, A. (1974): Serum lipids of Anguilla vulgaris lin and Mugil cephalus lin., Bull. Inst. Ocean. and Fish., Vol. 4, Cairo.

Hussien, M.A.; Youssef, K.E.; Abou-El-Hawa, S.H. and Foad, A.A. (1976): Effect of prolonged storage on moisture, lipid contents and moisture-lipid contents and moisture-lipid relationship of salted dried Tilupia nilotica, J. Agric. Sci. Mansura Univ., 1 (1), 225-234.

Pekkarinen, M. (1980): Seasonal variations in lipid content and fatty acids in the liver, muscle and gonads of the eel pout, zoorces viviparous (Teleostei) in brackish water, Ann. Zool. Fann/7 (4): 249-254.

Robinson, M.T. and Mead, J.F. (1973): Lipid absorption and deposition in rainbow trout (Salmo gaidneri, Can. J. Biochemis, 51, 1050-1058.

Sheridan, K.A.; Allen, W.V. and Kerstetter, T.H. (1983): Seasonal variations in lipid composition of the steelhead trout, Salmo gairdneri richardson, associated with pour-smolt transformation, J. Fish Biol., 23, 125-134.

Shreni, A. and Kelpana, D. (1980): Seasonal variations in chemical composition of the cat fish, Heteropneustes Fossilis, Proc. Indian Acad. Scianim Sci., 89 (2): 191-196.

Shulman, G.E. (1974): Life cycle of fish physiology and biochemistry, 258, New York and Toranto.

Snedecor, G.W. (1962): Statistical methods, the Iowa State Univ. Press, Ames.

Stahl, E. (1969): Thin layer chromatography, A laboratory hand book, nd. ed., Academic Press, New York.

Yanni, M. (1972): Biochemical studies on some Nile fish. I. Fat and water contents of Anguilla vulgaris, Synodontis schall and Clarias lazera, Zool. Soc. Egypt. Bull., 23, 90-101.

Youssef, K.E.; Hamadi, K.A. and El-Deeb, A.A. (1974): Studies on the Nile Fish. I- Effect of seasonal variations on weight and proximate composition of bolti and karmout, Minya J. Agr. Res. & Dev., No. 1, 115-125.

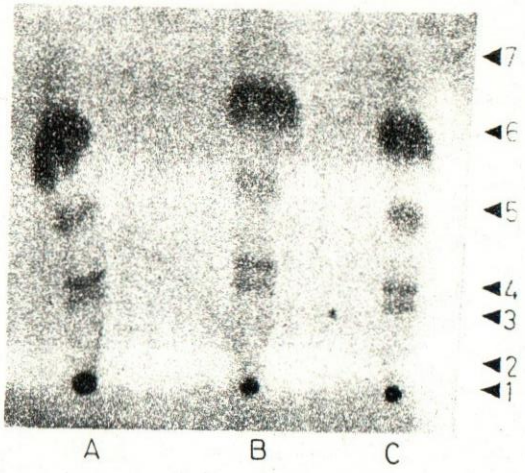

Fig. (1): Thin layer chromatograms of lipid fractions of synodontis schall. (A) Clarias lazera (B) And tilapia nilotica (C) In autumn (1984).
Fraction: 1. Phospholipids, 2. Monoglycerides, 3. Cholesterol, 4. Diglycerides, 5. Free fatty acids, 6. Trigcerides, 7. Hydrocabons.

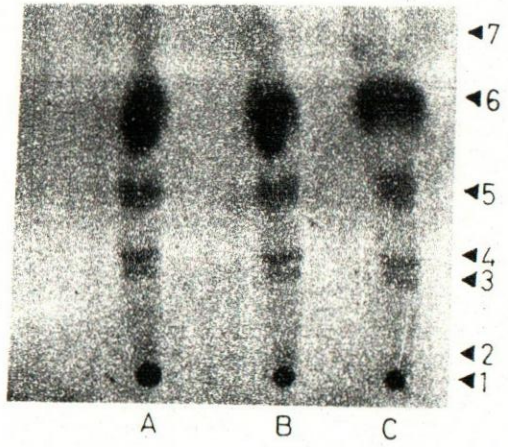

Fig. (2): Thin layer chromatograms of lipid fractions of synodontis schall (A) Clarias lazera (B) And Tilapia nilotica (C) In winter (1985)
Fractions: 1. Phospholipids, 2. Monoglycerides, 3. Cholesterol, 4. Diglycerides, 5. Free fatty acids, 6. Triglycerides, 7. Hydrocarbons.

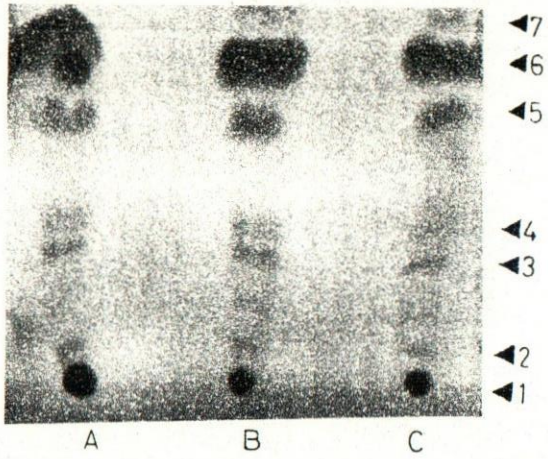

Fig. (3): Thin layer chromatograms of lipid fractions of synodontis schall (A) Clarias lazera (B) And Tilapia Nilotica (C) In spring (1985)
Fractions: 1. Phospholipids, 2. Monoglycerides, 3. Cholesterol, 4. Diglycerides, 5. Free fatty acids, 6. Trglycerides, 7. Hyrocarbons.

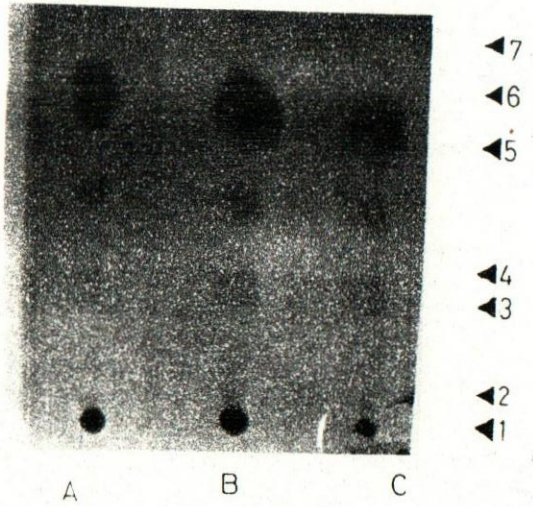

Fig. (4): Thin layer chromatograms of lipid fractions of synodontis schall (A) Clarias lazera (B) And Tilapia nilotica (C) In summer (1985)
Fractions: 1. Phospholipids, 2. Monoglycerides, 3. Cholesterol, 4. Diglycerides, 5. Free fatty acids, 6. Triglycerides, 7. Hydocarbons.