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Suitability Of Largehead hairtail (*Trichiurus lepturus*) Fish For Hot Smoking

Attia, R. S.
Food Science & Technology Dept., Fac. of Agric.(El-Shatby, 21545), Alexandria Univ., Alexandria, Egypt

ABSTRACT

Largehead hairtail fish(*Trichiuru lepturus*) used in the present study has no industrial use in Egypt up to now. The study aimed to investigate the suitability of this fish for preparing hot smoked steaks. Physical, chemical, and technological characteristics of fresh and smoked fish were studied. Two trials were done for preparing smoked fish steaks, skin-on and skin-off. The hot smoked (skin-off) steaks were highly accepted by panelists because of its pleasant flavor and good golden brown color. The results of the chemical analysis of fresh and skin-off flesh showed that the hot smoking process lowered the moisture content of the fresh sample from 73.15 to 66.68%, a relative decrease in both crude protein and total lipids, while an increase in ash, Na, Mg and slight decrease in other minerals content of fresh fish steaks. The total essential amino acids in the fresh and smoked fish represented 46.05 and 43.21 g/100g protein, respectively.Triacylglycerols fraction considered the main compound of total lipids of both fresh and smoked steaks. Monoacylglycerols, and hydrocarbons appeared and a slight increase in diacylglycerols and free fatty acids fractions were noted in smoked steaks of smoked flesh. The level of saturated fatty acids (SFA) of smoked fish was relatively increased, while, the polyunsaturated fatty acids(PUFA) were relatively decreased. Docosahexaenoic acid (DHA)and eicosapentaenoic acid (EPA) were found to be the major n-3 PUFA.The ratios of n-3/n-6 were 7.64 and 6.53 of fresh and smoked largehead hairtail fish (LHF) steaks, respectively.

Keywords: Largehead hairtail, physical properties, chemical composition, amino acids, fatty acids, hot smoking, sensory evaluation.

INTRODUCTION

The largehead hairtail (*Trichiurus lepturus*) fish is a member of the cutlassfish family, Trichiuridae. This fish is a marine carnivorous fish found worldwide in tropical and sub-tropical regions, and is an important fishery resource. The largehead hairtail fish (LHF) has an elongated to compressed body that tapers to a pointed tip. Therefore the Arabic name of this fish is Suyuf. It has a large mouth with barbed fangs on the jaws. In life, the fish is steel blue to silver colored, which makes it very difficult to photograph under water due to reflection from the camera flash (Sparre and Venema, 1998; Hoese *et al*., 2006). LHF can grow to 2.34 m in length. The large recorded weight is 5 kg and the oldest recorded age is 15 years. They are found at depth of 0 to 589 m with most record between 100 and 350 m (Chen and Lee, 1982). The world annuls catches of LHF were reportedly about 1.3 million ton in 2013 (FAO, 2014). Whereas, in Egypt, cross domestic catch was 1812 tons from the Mediterranean Sea in 2010, and the highest amount of catch per month was 195 tons(General Authority of Fish, 2010).

The flesh of the LHF is firm, get tender when cooked, with a moderate level of "fishiness" to the smell and a low level of oiliness. It is also notable for being fairly easy to debone (Nakamura and Parin, 1993; Martins and Haimovici, 1997). It is also considered an excellent source of animal protein, essential amino acids (EAA), polyunsaturated fatty acids (PUFA), vitamins and minerals (Usydys et al., 2011).

To the best of our knowledge, this type of fish did not subject for any type of an industrial processing in Egypt. Cold and hot smoked fish and their products are usually popular in many parts of the world due to their attractive color and flavor(Steiner-Asiedu *et al*., 1991; Stolyhwo and Sikorski, 2005). Till now the production of smoked fish in Egypt depends mainly upon imported frozen herring and mackerel (Arafa-Fatma, 2005; Abou-Sayed, 2011).Not all fish species are suitable for smoking purposes, depending on their chemical composition, different fish species react to the smoking process in different ways (Bannerman, 1980).

Therefore, the main objective of the present research was to evaluate the suitability of the largehead hairtail fish for preparing lightly salted hot smoked steaks as a new fish product in Egypt. Technological, sensorial and characteristics in addition to proximate composition, amino acids, minerals, lipid classes and fatty acids were studied before and after smoking process.

MATERIALS AND METHODS

Materials:

Ten kilogram of fresh largehead hairtail *(Trichiurus lepturus)* fish were purchased from the landing fish center of Alexandria, Egypt in March, 2014. It was transported directly in an insulated ice box to Alexandria Fish Technology Center (AFTC), Faculty of Agriculture(El-Shatby), Alexandria, Egypt. Figure (1) shows the fresh and dressed LHF steaks. Refined iodized common salt and low density polyethylene (LDPE) bags were brought from local market at Alexandria city, Egypt.

Methods:

Technological Methods: The length measurements, thickness, weight composition and specific area were carried out according to Zaitsev *et al.* (1969). After washing, draining, beheading, gutting and rewashing, the dressed fish were cutted into 17-20±2 cm steaks with or without skin. The obtained steaks were first salted in 15% (w/w) sodium chloride solution for 10 min, then washed and drained for about 5 min before placing on clean metallic racks inside a stainless steel semi-automatic (AFOS, England) smoking kiln.

Fig. (1): General appearance of whole fresh (A) and dressed (B) largehead hairtail fish.

The smoking program included three stages drying at 30°C for 30 min, cooking at 50°C for 45 min and intensive hot smoking at 85°C for 50 min. The obtained smoked steaks were cooled at room temperature, packed in low density polyethylene bags, heat sealed under vacuum, quick frozen in an air blast freezer at -30°C and finally stored at -18°C until used.

Analytical Methods: Samples of both fresh and smoked (skin-off) steak fillets were separately chopped twice using an electric meat (Black & Decker Type, England) chopper. The minced samples were kept in an air tight glass jar at -18°C until analysis. Proximate chemical composition of fresh and smoked steaks including moisture, crude protein (N ×6.25) and total ash contents were carried out according to the AOAC (2005)Total lipids were extracted and gravimetrically determined using the method of Bligh and Dyer (1959).The carbohydrates were calculated by difference. The pH value was measured after homogenizing with distilled water (1: 1 w/v) using pH-meter type Orion Rearch Digital Lonalyzer 1501, England (Pacheco-Aguilar *et al.*1989)while salt content (as % NaCl) was determined by Mohr's titration method as described by Woyewoda *et al.,* (1986).Minerals including Ca, Mg, Fe, Zn, Mn and Cu were determined using Perkin Elmer Atomic Absorption Spectrophotometer (Model 2380, USA). Meanwhile Na and K were determined using Flame Photometer (Gallenkamp, Germany) according to the procedure of AOAC (2005). Amino acid composition was determined using a Beckman Model 119 CL analyzer after hydrolyzing with 6 N HCl containing 0.1% mercaptoethanol at 100°C for 24 hrs as described by Spackman *et al.* (1958).Total lipids were separated into different classes using thin layer chromatography (TLC) technique using the method of Mangold and Malins (1960)on glass plates (20 × 20 cm) precoated with 0.25 mm silica gel, G254, total lipids were developed using petroleum ether: diethyl ether: glacial acetic acid (70: 30: 2, v/ v/ v). After running, the plates were air dried and the separated spots were visualized by iodine vapour. Total lipid fractions were identified by their R_f values, using cottonseed oil as a reference (Bakr, 1972). Preparation of fatty acid methyl esters was performed according to the procedure of Radwan (1978), using 1% sulphuric acid in absolute methanol. Gas chromatographic analysis was carried out using (Young LIN instrument Co., Korea) ACME, model 6100 GC fitted with a split/ splitless injector and FID detector. Nitrogen was used as a carrier gas with a 0.5 ml/ min flow rate. The components were separated on a 30 m Sp-2380 fused – silica capillary column with a 0.25 mm i.d. and 0.2 μm film thickness (Supel co, Bell efonate, PA). The injector and detector temperature were set at 220°C and 260°C, respectively, the column was initially maintained at 140°C for 5 min and the temperature was subsequently increased to 240°C at a rate of 4°C/ min. Standard fatty acid methyl esters were used for identification and the retention times of the unknown sample of methyl esters were compared with those standards. The percentage of each fatty acid was expressed with regard to the total area.

Sensory analysis: Color, taste, odour, texture, appearance and overall acceptability of hot smoked steaks (skin-on and skin-off) of largehead hairtail fish were subjected to sensory evaluation using 10 trained panelists from Food Science and Technology Dept., Faculty of Agriculture, Alex. University and nine point scale whereas, 9=like extremely and 1=dislike extremely as mentioned by Huss (1995).

Statistical analysis: The results are expressed as the mean values ± standard deviation (SD) as described by Steel *et al.* (1997).Statistical analysis of data was done using a Co-Stat Software (2004) computer program and Student-Newman-Keuls test was used for testing the mean differences at 5% probability level.

RESULTS AND DISCUSSION

Technological characteristics: The results in Table (1)show the length and weight composition as well as the specific area of largehead hairtail fresh fish. The fish has an elongated shape(Fig. 1), with 47 cm an average total length. Length of head, trunk and tail fin represented 12.87%, 67.19% and 19.94% of the total fish length, respectively. According to Nguyen (2005) and Pethiyagoda (2006)the total length of this type of fish caught from South China Sea and Sri Lankan costal water ranged from 14 to 110 cm and 35.5 to 95.5 cm, respectively.

This fish had 67.17g as average weights(Table 1). Head, trunk, viscera and fins weight represented 8.75%, 84.35%, 4.94% and 1.95% of average weight, respectively of this fish. The trunk or body of this fish is compressed, flattened and tapered. It had a relatively small thickness, 1.02 cm (Table 1). Such structure makes the fish firm, easily handling and packaging it likes Sword.

The results of Emokpae (1983) and Torry Research Station, Aberdeen, U.K. (1989) indicated that an edible flesh of LHF varied from 59.0 to 65.4%.

The primary trails made to prepared light salted hot smoked steaks from the fish trunk including both skin-in and skin-out salted steaks. The sensory evaluation of both products showed that the panelists preferred skin-off product(Table 2) for its attractive yellow brownish color and strong smoking flavor(Fig.

2). Abo-Zeed (2004) stated that the quality of smoked fish is affected by the interaction between fish surface and smoke compounds. The smoke components is first deposited on fish surface then penetrated into its flesh (Leroi *et al*., 2000).

Table (1):length weight composition and specific area of fresh largehead hairtail fish

Parameter	Value
Length measurements: (cm)	Average (cm)
Total length	47.0 ± 5.20
Length of head	6.05 ± 0.54
Length of trunk	31.58 ± 3.46
Length of tail fin	9.37± 0.89
Maximum thickness	1.02 ± 0.10
Weight composition: (g)	Average (g)
Total weight	67.17 ± 7.38
Head	5.88 ± 0.52
Trunk (skin-on)	56.66 ± 6.14
Viscera	3.32 ± 0.21
Fins (including tail fin)	1.31 ± 0.14
Specific area (cm^2/ g)	3.11 ± 0.32

Table (2):Sensory evaluation of hot smoked steaks of largehead hairtail fish.

Quality attribute	Trial 1 (skin-on)		Trial 2 (skin-off)	
	Description	Score	Description	Score
Color	Light yellow brownish, less homogenous.	7.14±0.21[a]	Homogenous golden light brownish.	8.43±0.16[b]
Odour	Moderate smoky odour.	7.50±0.22[a]	Pleasant strong smoky odour.	8.51±0.17[b]
Taste	Light salty, moderate smoky taste.	7.91±0.16[a]	Light salty and attractive smoky taste.	8.32±0.13[a]
Texture	Juicy and not chewy.	8.19±0.12[a]	Juicy and not chewy.	8.24±0.11[a]
Overall quality	Satisfactory.	7.62±0.24[a]	Satisfactory.	8.36±0.15[a]

Means in a row not sharing the same letter are significantly different at *P*≤0.05

Fig.(2):General appearance of smoked largehead hairtail fish.
(A) Trail 1 (skin on). (B) Trail 2 (skin off).

The yield of light salted hot smoked steaks from this type of fish ranged from 70.73%to 72.89% for skin-off and skin-on, respectively. It was slightly higher in skin-on smoked product than skin-off one (Table 3). This is due to the very low weight of the thin thickness of the fish skin. The main weight loss occurred during dressing then smoking process and lastly during brining, respectively. Abo-Zeed (2004) found that the yield of smoking lizard fish varied from 54.47% to 56.55%.

Table (3): Weight loss of hot smoked steaks of largehead hairtail fish due to the different processing operations.

Operation	Weight loss (%)	
	Trial 1 (skin-on)	Trial 2 (skin-off)
Dressing	18.80	20.05
Brining	0.21	0.32
Smoking	8.10	8.90
Total losses	27.11	29.27
Yield (%)	72.89	70.73

Chemical composition and pH of smoked product: In this part of the study, the physico-chemical characteristics and chemical composition were carried out on skin-off slightly salted hot smoked steaks product.

Generally, fresh LHF steaks contained high level of crude protein (17.43%), medium in lipids (6.82%) and relatively low values of ash (1.35%),as wet weight basis (Table 4). Similar results were stated by Ali *et al*. (2013) they found that the average of moisture, crude protein, total fat and ash contents of various species of cutlass fish family in Oman ranged from 67.0%-78.2%, 19.1%-26.1%, 0.6%-6.2% and 1.1-1.5%on wet weight basis, respectively.

Hot smoking process caused lower in moisture from 73.15% to 66.68%, and an apparent increase in crude protein, total lipids and ash on wet weight basis(Table 4). Meanwhile on dry weight basis, a relative decrease in crude protein and total lipids, and an increase in other compounds were noticed. Similar trend was more or less noted concerning to the effect of smoking operation on the proximate composition of the fresh muscle (Bittar *et al*., 2012, Adeyemi *et al.,* 2013 and Rahayu *et al.,* 2014). Salt content of fresh fish steaks was proportionally increased after smoking process from 0.68% to 2.12% on wet weight basis. This is mainly due to the brining process in addition to the moisture loss after smoking process. Slight drop in pH of LHF after smoking process was recorded from 6.6 in fresh fish to 6.45 after smoking(Table 4).

Mineral content: As shown in Table (4), fresh LHF steaks had high content of K and Na, relatively low values of Ca, Mg and trace amount of Mn and Cu. Yousuf, *et al.* (2013) found that the concentrations of Fe, Zn, Mn and Cu in fresh muscles of largehead hairtail ranged from 1.8-4.26, 0.49-1.68, 0.09-0.33 and 0.17-0.66 mg/100g, respectively. Hot smoking of steaks caused high increase in Na, slight rise in Mg and slight decrease in all other minerals content(Table 4). The sodium content in smoked steaks was nearly three-fold higher than in fresh one. Generally, changes in minerals

content in fish during processing are mainly due to leaching effect through brining step and water losses during heat treatment(Polak-Jusczczak (2016).

Table (4): Proximate composition, pH value, salt and mineral contents of fresh and smoked largehead hairtail fish steaks.

Constituent	Wet weight		Dry weight	
	Fresh	Smoked	Fresh	Smoked
Moisture content (%)	73.15± 0.34	66.68± 0.36	-	-
Crude protein (%)	17.43 ± 0.12	19.85 ± 0.11	64.92 ± 0.31	59.57 ± 0.30
Total lipid (%)	6.82 ± 0.09	7.68 ± 0.10	25.40 ± 0.23	23.05 ± 0.22
Total ash (%)	1.35 ± 0.05	2.89 ± 0.06	5.03 ± 0.12	8.67 ± 0.14
Carbohydrates* (%)	1.25 ± 0.05	2.90 ±0.05	4.65 ± 0.20	8.71 ± 0.21
Salt content (NaCl %)	0.68 ± 0.10	2.12 ± 0.1	2.53 ± 0.11	6.36 ± 0.12
pH value	6.60	6.45	-	-
Element (mg/100g)				
Na	90.52	267.89	337.13	803.99
K	178.14	202.97	663.46	609.15
Ca	29.27	34.62	109.01	103.90
Mg	14.32	18.94	53.33	56.84
Fe	0.86	1.02	3.20	3.06
Zn	0.68	0.80	2.53	2.40
Mn	0.23	0.27	0.86	0.81
Cu	0.17	0.20	0.63	0.60

*** Calculated by difference**

Amino acid composition: The effect of hot smoking process on the amino acid composition of LHF steaks was presented in Table (5). Both fresh and the hot smoked steaks had the same patterns of amino acids. The major amino acids were glutamic acid, aspartic acid, lysine and leucine. Also, considerable amounts of alanine, arginine, glycine, valine, isoleucine and threonine were detected. Comparing with the FAO/WHO/UNU (1985) pattern, all the essential amino acids in fresh and hot smoked steaks were higher than the recommended levels. The total essential amino acids represented 46.05 and 43.21 g/100 g protein in fresh and hot smoked steaks, respectively. Some amino acids such as leucine, isoleucine, cysteine, phenylalanine, threonine and valine were decreased after smoking process. The same observation was stated by Steiner–Asiedu *et al*. (1991) and Abu-Tor *et al*. (2011) for the effect of smoking process on amino acid composition of flat sardine, sea bream, tilapia and bissaria.

Lipids classes and fatty acid composition: Fig. (3) Illustrates the lipid classes of fresh and hot smoked LHF steaks by TLC technique. The chromatogram revealed that the total lipids of fresh steaks consisted of 5 fractions mainly polar lipids, diacylglycerols, free sterols, free fatty acids and triacylgylycerols. While the total lipids of smoked steaks consisted of 7 fractions mainly polar lipids, monoacylglycerols, diacylglycerols, free sterols, free fatty acids, triacylgylycerols and hydrocarbons. Slight differences were noted between fresh and smoked samples. This may due to the partial hydrolysis of triacylglycerols and phospholipids into diacylglycerols, monocylglycerols, and free fatty acids during the smoking process. Triacylglycerol fraction of fresh and smoked steaks was the major class of total lipids. The same trend was stated by Beltran and Moral (1989). While other workers have not found any appreciable variations in these constituents before and after smoking (Aminullah – Bhuiyan *et al*., 1986, Allam *et al*., 1988 and Emara, 2000).

Table (5): Amino acid composition of fresh and smoked largehead hairtail fishsteaks (g/100g protein).

Amino acid (g/100g protein)	Fresh	Smoked	FAO pattern*
Isoleucine	4.35	3.98	2.80
Leucine	8.52	7.50	6.60
Lysine	9.35	9.61	5.80
Methionine	2.15	2.23	-
Cystine	0.60	0.54	-
Total sulfur amino acids	2.75	2.77	2.50
Tyrosine	3.47	3.71	-
Phenyl alanine	4.29	4.15	-
Total aromatic amino acids	7.76	7.86	6.30
Threonine	4.33	3.78	3.40
Tryptophan	N.D.	N.D.	1.10
Valine	5.26	4.86	3.50
Histidine	3.73	2.85	1.90
Total essential amino acids	46.05	43.21	33.90
Arginine	6.13	6.61	-
Aspartic acid	9.81	10.74	-
Glutamic acid	14.83	14.65	-
Serine	3.87	3.70	-
Proline	2.89	3.01	-
Glycine	5.37	5.66	-
Alanine	6.15	7.39	-
Total non-essential amino acids	49.05	51.76	-

***FAO/WHO/UNU (1985).N.D. = Not determined.**

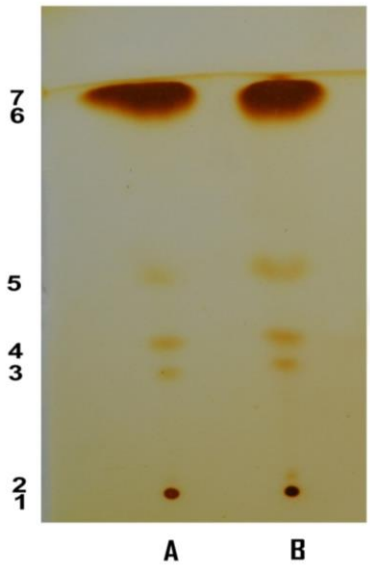

Fig. (3): TLC chromatogram of total lipid classes of fresh (A) and smoked (B) largehead hairtail fish steaks.

1- **Polar lipids(phospholipids)** **2- Monoacylglycerols**
1- **Diacylglycerols** **4- Free sterols**
2- **Free fatty acids** **6- Triacylglycerols**
7- **Sterol esters and hydrocarbons**

The data in Table (6) show that the total saturated fatty acids (SFA), total monounsaturated fatty acids (MUFA) and total polyunsaturated fatty acids (PUFA) were 39.39%, 36.2% and 22.58% in fresh steaks and 41.56%, 36.90% and 19.69% in smoked steaks of the total lipids, respectively. The dominant fatty acids in SFA, MUFA and PUFA were palmitic acid (C16:0), Oleic acid (C18:1) and docosahexaenoic acid (DHA, C22: 6), respectively. Both DHA and eicosapentaenoic acid (EPA, C20:5) were considered the major n-3 PUFA, while linoleic acid was the mainn-6 PUFA. Rahayu *et al.* (2014) found high DAH and EPA content (12.02% and 3.3%, respectively) in fresh muscle of pelagic fish. Smoking process caused a relative rise in SFA and slight lower in PUFA particularly DHA and EPA fatty acids as a result of their oxidation. This indicates that hot smoking process had little effect on the fatty acid composition of the LHF steaks. According to Steiner–Asiedu *et al.,* (1991)and Emara (2000)smoking exerted no practical effect on the fatty acids of fresh fish.Li *et al.* (2011) found that the total SFA, MUFA and PUFA of fresh largehead hairtail were 35.0%, 29.7% and 31.6%, respectively. The value of DHA in their study was higher (17.4%) than that stated in the present work (10.82%), while the value for EPA (6.80%) was confirmed the finding obtained here (5.81%). The ratio between n-3/n-6 was an excellent in both fresh and smoked steaks, 7.64 and 6.53, respectively (Table 6).World Health Organization recommends 4-10:1 ratio of n-6 to n-3 fatty acids (Richter, 2001).

It can be concluded from the present study that slight salted smoked LHF steaks can be was highly accepted due to its pleasant flavor, good nutritional value and high yield. This product considers as a good source of essential amino acids, minerals and n-3 PUFA. The n-3PUFA is able to lower the low density lipoprotein (LDL), triacylglycerols in blood, and risk of cardiac diseases in adults and support good health (Usydys *et al.,* 2011 and Mostafa *et al.,* 2013).

Table (6):Fatty acid composition of fresh and smoked largehead hairtail fish steaks.

Fatty acid (%)	Fresh	Smoked
14 : 0	6.62	6.85
15 : 0	0.85	0.87
16 : 0	23.20	23.72
17 : 0	1.16	1.19
18 : 0	6.48	7.18
20 : 0	1.08	1.75
SFA	**39.39**	**41.56**
15 : 1	0.12	0.13
16 : 1	9.14	9.06
17 : 1	1.35	1.33
18 : 1	25.23	25.98
20 : 1	0.36	0.40
MUFA	36.20	36.90
18 : 2 n-6	1.66	1.60
18 : 3 n-3	0.73	0.60
20 : 2	1.24	1.61
20 : 4 n-6	0.81	0.80
20 : 5 n-3	5.81	4.63
22 : 5 n-3	1.51	2.03
22 : 6 n-3	10.82	8.42
PUFA	22.58	19.69
Others	1.83	1.85
n-3	18.87	15.68
n-6	2.47	2.40
n-3/n-6	7.64	6.53

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مدى ملائمة سمك السيوف للتدخين على الساخن

رمضان شحاتة عطية

قسم علوم وتقنية الأغذية - كلية الزراعة (الشاطبي) - جامعة الإسكندرية – مصر

استخدم في هذه الدراسة سمك السيوف غير المستخدم في التصنيع حتى الآن في مصر. وكان هدف هذه الدراسة هو التعرف على مدى ملائمة هذا النوع من الأسماك لإعداد قطع السمك المدخن على الساخن. تم دراسة الخواص الطبيعية والكيماوية والتكنولوجية للسمك الطازج والمدخن ، وقد أجريت محاولتين لإعداد قطع السمك المدخن بالجلد أو بدونه. وكانت قطع السمك المدخنة منزوعة الجلد (المحاولة الثانية) هى الأعلى تقبلاً لدى المحكميين نظراً للنكهة المفضلة واللون الجيد (الذهبي المائل للبني). أوضحت نتائج التحليل الكيماوي لكل من لحم السمك الطازج والمدخن منزوع الجلد أن عملية التدخين أدت إلى انخفاض في المحتوى الرطوبي من ٧٣.١٥ % إلى ٦٦.٦٨ % وإنخفاض في محتوى كل من البروتين الخام والليبيدات الكلية وزيادة في نسبة الرماد والصوديوم والماغنسيوم وإنخفاض بسيط في محتوى باقي العناصر المعدنية المقدرة في لحم قطع السمك المدخن علي أساس الوزن الجاف. وكان محتوى الأحماض الأمينية الأساسية في لحم السمك الطازج والمدخن ٤٦.٠٥ و ٤٣.٢١ جم/١٠٠ جم بروتين على الترتيب. ويعتبر ثلاثي آسيل الجليسرولات هو المكون الرئيسي في الليبيدات الكلية لكل من قطع السمك الطازج والمدخن. كما لوحظ وجود أحادي آسيل الجليسرولات والهيدروكربونات مع زيادة بسيطة في ثنائي آسيل الجليسرولات والأحماض الدهنية الحرة لليبيدات قطع السمك المدخنة. كما حدثت زيادة نسبية في محتوى الأحماض الدهنية المشبعة ، بينما انخفضت الأحماض الدهنية عديدة عدم التشبع نسبياً في ليبيدات قطع السمك المدخن وكانت الأحماض الدهنية عديدة عدم التشبع أوميجا-٣ السائدة هي C20:5 وC22:6 كما كانت نسب الأحماض الدهنية عديدة عدم التشبع n-3/n-6 في السمك الطازج والمدخن هي ٧.٦٤ و ٦.٥٣ على الترتيب.