FAT QUALITY OF FISH ROES AND CAVIARS COLLECTED FROM DIFFERENT SUPERMARKETS IN ALEXANDRIA GOVERNORATE

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ABSTRACT

A total of 100 samples (25 of each) of herring fish roes (raw, smoked) and caviars (red,black) were collected from different retail stores in Alexandria governorate to evaluate their fat quality which include fat,cholesterol contents, acid number, free fatty acids,conjugated dienes, thiobarbeturic acid ,and polyene index . The results revealed that fat content in smoked herring fish roes showed the highest concentration among the examined products with a mean value of 29.7% . Concerning cholesterol, black caviar showed the highest mean concentrations (254.2mg/100gm) while raw herring eggs showed the lowest (8.280 mg/100gm). In case of acid number and free fatty acids ,the highest mean concentrations(6.542 mg KOH/g of fat and 3.271ml/gm., respectively) were found in smoked herring roes and the lowest(4.124 mg KOH/g of fat and 2.062 ml/gm., respectively) were in raw herring eggs . Regarding conjugated dienes and polyene index, the highest values(0.523n mole/mg, 1.542 ml/gm) were detected in smoked herring roes . At the same time, black caviar showed the highest level of thiobarbeturic acid value (4.689 mg/kg) while raw herring eggs had the lowest level (2.124mg/kg).

INTRODUCTION

Fish eggs are commenly called roc particularly when they are present in skeins. Roe prodncts are usually refrigcrated or frozcn although some are shelf stable as a result of thermal processing, pickling, salting or dehydration **(Hui., 2006)**. The caviar is the salted roe or eggs of certain large fish species, especially members of sturgeon family. They are either black or slate gray, depending on the species. Caviar with commercial names "Paradise", "Heaven" and red eaviar is made from the roc of salmon. products from other spccies have to hc labelled "imitation caviar" or include the name of the fish before the word caviar in most markets sueh as "lump fish caviar" and capelin caviar . Imitiation caviar is defined as roe or eggs that comes from a fish other than sturgeon, is not true caviar,and it is classifiable as a caviar substitute. Lump fish caviar was originally an imitiation of caviar because the eggs are of similar size to those of sturgeon and they were coloured black or red. Caviars are generally made after thc eggs have been singled by sereening or other wise., separated from any supporting conneetive tissue out. The eggs are then brined, cured and sometimes eoloured or flavoued **(FAO, 2006)**.

Fish eggs (roes) and caviars have a high nutritive value because their high content of omega 3 polyunsaturated fatty acids. They are known to be good source of protein and essential polyunsaturated fatty acids (PUFA) and other nutrients **(Hartmut., et al., 2009, Miguel., et al., 2009)**. Further, studies suggested that polyunsaturated fatty acids (PUFA) help in reducing diabetes risk, reducing the risk of incidence of Alzheimer disease, cancer and in preventing heart arrhythmias that can lead to sudden cardiac death **(Lichtenstein, 2003., Morris, 2003 and Minh Dieu etal., 2007)**. Therefore as a result of the importance of fish roes and caviars to human health and due to the possibilities of lipid oxidation and hydrolysis, the purpose of this search is to give an idea on fat quality of fish roes and caviars and to discuss its impotance to human health .

MATERIALS AND METHODS

Sampling :

A total of 100 samples of fish roes (raw herring fish roes and smoked herring fish roes) and caviars(red and black) (25 for each) were collected randomly from Alexandria retail stores. Samples were transported in an insulated ice box to the laboratory to be analyzed for fat quality parameters.

1- **Fat content:** It was determined according to folch method 1957.
2- **cholesterol content :** It was determined using a colourimetric method as described by **Bohac., et al., (1988)**.
3- **Acid number:** It is defined as the number of milligrams of potassium hydroxide required to neutralize the free acid in 1 gm of the sample. It was determined According to **Pearson 1970**.
4- **Free fatty acids :** It was estimated according to Pearson 1970.
5- **Conjugated dienes:** it can be determined using ultraviolet (UV) -vistble spectrophotometer. **(Sanitago., etal., 1997)**.
6- **Thiobarbeturic acid substances (TBA):** It was determined using cold extraction method aecording to **(Li, et al., 2001)**.
7- **polyene index (PI) :** It was determined according to **Willy., et al., 2009**.

RESULTS

Fat quality of the examined herring fish roes (raw,smoked) and caviars(red, black) are showed in Tables 1-3 .

DISCUSSION

lipid and cholesterol contents (mean±SE) of fish roes (raw and smoked herring fish roes) and caviars (red and black) were recorded in Table (1). Results showed that the highest pereent of fat was found in smoked herring fish roes (29.7 %) while the lowest was in red caviar (18.27%). There was a significant difference in percent of fat between herring fish roes and caviars at $p \leq 0.05$. The increase in fat content of smoked herring fish roes might be refered to the decrease in moisture content in smoke cured product.

The fat contents of several species of fish were studied and the fat contents of their roes were determined. It was reported that the fat content of salted mullet roe was 25.7%. **(LU., et al., 2006)**. Furthermore, **Minh Dieu., et al., 2007.**, found that the fat content of roe of herring fish was 28.1±0.75. **(Minh Dieu., etal., 2007)**. Fat content of Fresh roes from four Indian inland fish species viz., Catla

catla (catla), Cyprinus carpio (carp), Labeo rohita (rohu) and Channa striatus (murrel) were 3.9 %,3.2%,5.3% and 9.5%., respectively. **(Balaswamy., et al., 2009). Lu., et al., 1979** found that the fat content in unprocessed grey mullet egg was 13.7%. **(Lu., et al., 1979)**. The raw fat content of pacific grey mullet caviar is 11.063 % in raw egg of paeific grey mullet and 39.906% in dried pacific grey mullet caviar **(Singor., et al., 2002, Hunkar., et al., 2008). Eun, et al., 1994.**, repoted that the fat content of channel catfish roe was 8.0% .

Souci., et al., 2000., found that the crude fat content of caviar was calculated as 15.5%. Moreover, Fat content of caviar from farmed sturgeon was 10.9% (wet weight) **(Wirth, et al., 2000)**.

Results of Table (1) indicated that Black caviar showed the highest mean concentrations of cholesterol (254.2mg/100gm) while raw herring eggs showed the lowest concentration (8.2802mg/100gm) Table (1).

It was reported that cholesterol content of smoked herring eggs was 26.6 mg/100g while that of mullet roe was 387.5 mg/100g. **(FAO., 2006)**.

Table (2) illustrated lipid hydrolysis and lipid oxidation indicators (mean±SE) in fish roes(raw and smoked herring roes) and caviars (red and black). Results of lipid hydrolysis showed that the highest mean values of acid number and free fatty acids (6.542 mg KOH/gm of fat, 3.271 ml/gm) were in smoked herring roes and the lowest (4.124 mgKOH/gm of fat, 2.062 ml/gm) were in raw herring eggs. In case of conjugated dienes and polyene index, the highest values (0.523 n mole/mg, 1.542) were in smoked herring roes. At the same time, black caviar showed the highest level of thiobarbeturic acid value (4.689 mg/kg malondialdhyde) while raw herring eggs had the the lowest level (2.124 mg/kg malondialdhyde).

Fish lipids are subjected to two main changes after fish death ,lipid hydrolysis (lipolysis Auto-oxidation) and lipid oxidation. The main reactants in lipid hydrolysis involves atmospheric oxygen and fish lipid but the reactions are initiated and accelerated by heat, light (espeelally ultra violet light) and several organic and inorganic substances like copper and iron ions **(Mayer and Ward, 1991)**. The end products of lipolysis is liberation of the free fatty acids . In case of lipid oxidation, the primary produets of auto-oxidation of lipids is peroxides . Almost immedialely after peroxides are formed, the non conjugated double bonds (c=c-c-c=c) that are present in the natural unsaturated lipids are converted to conjugated double bonds (c=c-c=c). Conjugated dienes absorb ultraviolet radiation strongly at 233nm. Thus oxidation can be followed by dissolving the lipids in a suitable organic solvent and measuring the change in its absorbance with time using ultra violet spectrophotometer **(Santiago., et al., 1997)**. During storage, in later stages of lipid oxidation, secondary lipid oxidation products will usually be present thus be indicative of a history of auto-oxidation. These products comprise aldhydes, ketones, short chain fatty acids and others, many of which have very unpleasant odours and flavours, Thiobarbeturic acid value(TBA) is a

parameter to measure the secondary lipid oxidation products.

Thiobarbeturic acid value (TBA) is a good indicator to determine the quality of the fish if it was frozen , chilled or stored with iced **(Tarladgis et al., 1960, Vareltzis et al., 1988)**. It has been suggested that maximum level of TBA value indicating the good quality of the fish frozen, chilled or stored with ice is 5 mg malonaldehyde /kg, while the fish may consume up to the level of 8 mg malonaldehyde / kg **(Schormuller, 1969)**. TBA value of processed salted caviar was found as 4.8 mg/kg malonaldehyde. The reason of this increase in TBA value is the effect of salt which increases oxidation. In eonsumable fishery products TBA value is reported as 5-8 mg /kg malonaldehyde **(Schormuller, 1968, Ozden and Gokoolu 1997)**. Lipid oxidation(TBA) varies according to time of storage, storage temperature, level of fatty acids and the existence of antioxidants, prooxidants in the environment **(Serdaroolu and Felekoolu , 2005)**.

It was found that T B A (mg/kg malondialdhyde) of raw egg of grey mullet was 2.08 mg/kg malondialdhyde and 4.80 mg/kg malondialdhyde of processed egg of grey mullet **(Hunkar., et al., 2008)**.

Polyene index, PI (C20:5 + C22:6/C16:0) might provide a meaningful tool to measure oxidative rancidity in fishery product because it includes only 2 major polyenoic fatty acids that the levels of which, can be measured with reasonable accuracy as they are the larger fatty acids among the large gas chromatography peaks. **(Willy Pranata., et al., 2009)**.

Perez-Mateos et al. (2004) found that the ratio of total unsaturated to total saturated fatty acid in sardinops sardines declined during 90 day's storage at -22.3°C and then stabilized **(Perez-Mateos et al. ,2004)**.

It was reported that the amount of the polyene index PI in Bagridae Catfish (Mystus nemurus) decreased in value throughout the storage period and temperature. At ambient temperature, PI decreased from the initial value of 3.70-3.67 after 24 h storage, to 3.64 after 10 days storage at 10°C and to 3.55 after 20 days at iced storage. The initial value of sardines (1.50) was much higher than that of sardinops sardines (0.88-0.93). The PI decreased during storage, but remained nearly stable after 6 weeks storage **(Willy Pranata., etal., 2009)**.

Comparison between fat quality (mean± SE) of fish roes and caviars were recorded in Table (3). herring fish roes showed higher levels of fat contents than caviars and the vise versa for cholesterol content. Our results also showed that herring fish roes had higher levels of lipid hydrolysis and lipid oxidation parameters than caviars .

Several studies were carried out on fat content of fish roes and caviars. It was reported that the total lipid content (on a fresh weight basis) of the aquatic eggs (Canned eggs of lumpfish (Cyclopteris lumpus), Atlantic salmon (Salmo salar), trout (Oncorhynchus mykiss), smoked herring (Clupea harengus), and sea urchin, fresh sea urchin eggs, and Avgotaracho i.e. salted and waxed mullet (Mugil cephalus) roes were ranged from 4.2% in lumpfish to13.8% in mullet roe **(FAO, 2006)**.

Moreover, **Sengor., et al., 2002** found that the fat content of mullet roe was 8.4% . At the same time, crude fat of Sea Urchin (Paracentrotus lividus) Roe was 3.05 ± 0.50%,. **(Sühendan., et al., 2008, Liyana-Pathirana., et al., 2002, George., 1990)**.

The oxidative stability of lipids from salmon roe and herring roe was compared with those of commercial fish oils originated from sardine and tuna. On the basis of oxygen consumption, fish roe lipids showed the higher oxidative stability than both fish oils. cholesterol content in fish roe lipids were 6.3% and 9.7% of total lipids for salmon roe and herring roe **(Fukunaga.,et al., 2007)**.

CONCLUSIONS

In conclusion,the present study indicated that herring fish roes and caviars marketed in Alexandria are of good keeping quality from the point of view of fat quality. Moreover , the fat quality examination revealed that processing and smoking of frozen herring fish increase the susceptibility of lipid hydrolysis and lipid oxidation and hence increase the levels of lipid hydrolysis and lipid oxidation parameters in smoked herring fish products (roes).

Table (1) : Lipid and cholesterol contents (mean±standard error) of fish roes and caviars.

Type of samples	Total lipids % Min.	Max.	Mean ± SE	Cholesterol (mg/100gm) Min.	Max.	Mean± SE
Raw herring eggs	29.82	31.80	29.7*± 0.261	7.821	8.58	8.28**± 0.118
Smoked herring eggs	23.24	25.6	24.61*±0.376	24.703	26.063	25.3**±0.191
Total	23.24	31.80	27.16±0.319	7.821	26.063	16.79±0.155
Red caviar	18.27	18.6	18.37*± 0.209	212	214	213.2**±0.335
Black caviar	23.2	24.4	23.77*± 0.196	254	255	254.2**±0.325
Total	18.27	24.4	21.07 ±0.203	212	255	233.7 ±0.330

* significant at P≤ 0.05 ** Highly significant at P≤ 0.05

Table (2) : lipid hydrolysis and lipid oxidation indicators (mean± SE) in fish roes(raw and smoked herring roes) and caviars (red and black).

Samples	Acid number [mg KOH/g of fat]	Free fatty acids(ul/gm)	Conjugated dienes (n mole/mg)	Thiobarbeturic acid substances. (TBAmg/kg malonaldhyde)	polyene index (PI)
Raw herring eggs	4.124*±0.050	2.062*±0.126	0.462±0.061	2.124*±0.079	1.539 ±0.013
Smoked herring eggs	6.542*±0.038	3.271*±0.103	0.523±0.022	3.542*±0.022	1.542 ±0.067
Total	5.330 ±0.044	2.665±0.115	0.493 ±0.042	2.833±0.051	1.541±0.040
Red caviar	4.567 ±0.010	2.284± 0.028	0.399 ±0.017	4.567 ±0.023	1.508 ±0.010
Black caviar	4.689 ±0.045	2.345 ±0.026	0.312 ±0.010	4.689 ±0.025	1.489 ±0.014
Total	4.628 ±0.028	2.314 ±0.027	0.356 ±0.014	4.628 ±0.024	1.499 ±0.012

*Significant at P≤ 0.05

Table (3) : Comparison between fat quality(mean± SE) of fish roes and caviars .

Samples	Total lipids %	Cholesterol (mg/100gm)	Acid number [mg KOH/g of fat]	Free fatty acids (ml/gm)	Conjugated dienes (n mole/mg)	Thiobarbeturic acid substances. (TBAmg/kg malonaldhyde	polyene index (PI)
Herring fish roes	24.61*±0.319	8.28**±0.155	5.330 *±0.044	2.665±0.115	0.493 ±0.042	2.833*±0.051	1.541±0.040
caviars	17.9*±0.203	213.2**±0.33	4.628*±0.028	2.315±0.027	0.356±0.014	4.628*±0.024	1.499±0.012
Total	21.255 ±0.261	110.74 ±0.243	4.979 ±0.036	2.489 ±0.071	0.425 ±0.028	3.731 ±0.038	1.52 ±0.025

* significant at P≤ 0.05 ** Highly significant at P≤ 0.05

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الملخص العربى

جودة الدهون لبيض الأسماك والكافيار المجمعة من السوبر ماركت المختلفة فى محافظة الإسكندرية

مرفت كمال إبراهيم رجب

قسم صحة الأغذية - معهد الأبحاث البيطرية - الإسكندرية - القاهرة

لقد تم جمع ١٠٠ عينة من بيض سمك الرنجة المجمدة وبيض سمك الرنجة المدخنة والكافيار الأحمر والأسود (٢٥ عينة من كل نوع) من السوبر ماركت المختلفة بالإسكندرية وذلك لتقييم جودة الدهون وتشمل محتوى الدهون ومحتوى الكوليسترول والرقم الحمضى والأحماض الدهنية الحرة ومؤشوات تأكسد الدهون الابتدائية ومؤشرات تأكسد الدهون الثانوية، وقد أوضحت الدراسة النتائج الآتية : كان أعلى متوسط تركيز لمحتوى الدهون فى بيض سمك الرنجة المجمدة (29.7%) وكان أقل متوسط تركيز فى الكافيار الأحمر (18.27%) وفى حالة محتوى الكولسترول فكانت أعلى قيمة له فى الكافيار الأسود (254.2mg/100gm) وأقل قيمة له فى سمك الرنجة المجمدة (8.28mg/100gm) كما أن أعلى متوسط تركيز للرقم الحمضى كان فى بيض سمك الرنجة المدخنة (6.542mg KOH/g of fat) وأقل قيمة له فى بيض سمك الرنجة المجمدة ، كما أظهرت الدراسة أن بيض سمك الرنجة المدخنة سجل أعلى متوسط تركيز لمؤشرات تحلل الدهون الابتدائية والثانوية (0.523 n mole/mg, 1.542) وفى حالة الثيوبربيتيورك أسيد (4.689 mg/kg) فإن أعلى متوسط تركيز كان فى الكافيار الأسود وأقل متوسط تركيز كان فى بيض سمك الرنجة المجمدة (2.124 mg/kg) .