

EFFECT OF SALTING AND STORAGE ON CHEMICAL COMPOSITION OF SOME FISH SPECIES

Alsaban, W. A¹; S. H Abou - El-Hawa,²; Manal. A. M Hassan² and AbdEL-Rahman, M.A²

1. Food & Fish Technology Department, Faculty of Environmental Science and Marine Biology, Hadhramut University, Yemen

2. Food Science & Technology Department, Faculty of Agriculture, Assiut University, Egypt

ABSTRACT

The effect of salting and storage for three months on chemical composition in whole and cleaned of three fish species namely: Bolti (*Tilapia nilotica*), Karmout (*Clarias lazera*) and Kannome (*Mormyrus kannume*) were studied.

The results show that moisture and protein contents of fresh Bolti were higher than Karmout and Kannome, while lipid and ash contents of fresh Kannome were higher than Karmout and Bolti.

Salting and storage processes decreased the moisture and protein contents, while ash content was increased in each of whole and cleaned three fish species. Meanwhile, lipid content was increased after 10 days salting in cleaned of three fish species, then decreased at the end of storage time. On the other hand, the results revealed that lipid content was increased during salting and storage in whole of three fish species.

The results reported that, such change in chemical composition during salting and storage in whole and cleaned of three fish species gave rise to recommend that salting of whole fish was better than cleaned fish.

INTRODUCTION

Fish is considered an important source of protein which has a great nutritional value and contain all the essential amino acids, which are very important for human health. It is also a satisfactory source of simple and compound lipids which contain a large amount of the essential fatty acids, and minerals especially phosphorus, magnesium, calcium, sodium, potassium, iron and copper (Zaitsev *et al.*, 1969; Oyedapo *et al.*, 2005 and Adeniyi *et al.*, 2012).

Salting is a popular procedure for preserving fish. Salting methods are simple and involve salt crystals or brine. There are three types of salting of fish: dry salting, wet salting and combination of the two methods. Length of salting time as well as salt concentration depends on the expected final product. The theoretical foundation sodium chloride diffuses to the outside from muscles due to difference in osmotic pressure between the brine and fish muscle this process does not continue indefinitely: sodium and chlorine ions form a water binding complex with protein which itself exerts an osmotic pressure and eventually equilibrium is reached (Horner, 1997 and Bellagha *et al.*, 2007).

Hernandez-Herrero (1997) found that after salting process of anchovy, the moisture content decreased from 75.5% to 54.0% on wet weight basis

and the loss moisture content was accompanied by increases in the salt and ash contents. The same author reported that after salting process of anchovy the ash content increased from 1.6% to 21% of wet weight.

El-Sebaiy and Metwalli (1989) found that the crude protein content in fresh Bouri (*Mugil cephalus*) decreased from 82.5% to 71.1% after salting and fermenting process. El- Sharnouby (1989) found that the crude protein in grey mullet decreased from 77.73% in fresh fish to 49.91- 62.36% after 4 weeks salting.

Cha *et al.*, (1983) found little differences in total lipids due to salt concentration and the time of salting within the same fish species. While Abou-El-Hawa *et al.*, (1978) found that lipid content of fresh Bolti , Labes , Karmout and Kannome were 9.35% , 10.00% , 17.50% and 19.30% of dry weight , respectively, then decreased during salting and storage 4°C for 6 months to 8.45% , 9.05% , 15.45% and 16.70% of dry weight , respectively at the end of storage.

Badawy (1979) mentioned that lipid content of fresh (*Tilapia nilotica*) , (*Clarius lazera*) and (*Angulla vulgaris*) were 9.13%, 18.12% and 58.67 % of dry weight , respectively , then lipid content increased after 5 days salting to 10.29% , 19.85% and 60.09% of dry weight , respectively.

The brine concentration showed an important effect on the rate of diffusion in to the muscle and weight changes during the salting processing. Solute diffuses from the salting agent into fish muscle and water diffuses out of the fish, due to the differences in osmotic pressures between inter-cells and salting agent. Salt uptake depends on many factors including species, muscle type, fish size, fillet thickness, weight and composition, physiological state, salting method, brine concentration, fish-to-salt ratio and temperature (Raoult-Wack, 1994 and Gallart- Jornet *et al.*, 2007).

The physicochemical changes of tilapia muscle during salting depended on the salting method and salting time (Chaijan, 2011). The biochemical processes that cause the changes in chemical and histological properties of the salted fish named ripening .The ripening of salted product begin with the breakdown of proteins and lipids by proteolytic and lipolytic enzymes. Generally, the quality of the salted fish depends on the quality and chemical composition of raw material. Freshness is an important parameter that affects the quality of salted cod during the salting process, as the freshest raw material gives the lowest overall yield and the lowest salt uptake (Vaskresensky, 1966 and Barat *et al.*, 2006).

The objective of this study was to investigate the effect of salting and storage on chemical composition of three fish species, namely: Bolti (*Tilapia nilotica*), Karmout (*Clarius lazera*) and Kannome (*Marmyus kannome*), and distinction between salting whole fish and salting cleaned fish knowing which of them is the best.

MATERIALS AND METHODS

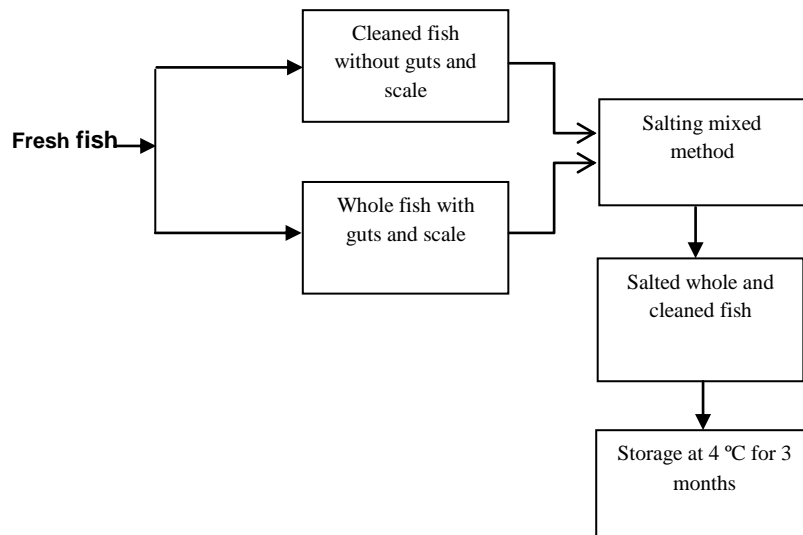
Materials

The selected species of fish whole and cleaned used in this investigation were: Bolti (*Tilapia nilotica*), Karmout (*Clarius lazera*) and

Kannome (*Mormyrus kannume*). The previous fish samples were obtained as soon as possible after catching from local markets of Assiut Governorate and transferred directly to the laboratory. The average weight of individual fish was about 500 grams for Bolti, Kannome while the individual Karmout weight was 850 grams.

Technological treatment:

Salted fish species were prepared as follow



Analytical Methods:

Gross chemical composition: Moisture, protein and Ash contents were determined according to the methods of A.O.A.C (1994).

Lipid content was determined according to the method described by Folch *et al.*, (1957).

RESULTS AND DISCUSSION

Change in gross chemical during salting and storage.

1. Moisture content

Results of the effect of salting and storage on moisture content in muscles of studied fish species are tabulated in Table (1). Moisture content of fresh Bolti was higher than Karmout and Kannome where reached to 77.13%, 76.35% and 74.65% on wet weight; respectively. During salting and storage the moisture content was decreased in both whole and cleaned of fish species, where moisture content of whole is higher than that of cleaned of fish species. Where reached of whole and cleaned Bolti to 66.44% and 66.22% on wet weight; respectively at the end of storage time. While whole and cleaned Karmout reached to 64.35% and 63.92% on wet weight; respectively at the end of storage time. Whole and cleaned Kannome reached to 63.80% and 63.65% on wet weight; respectively at the end storage time. Because in decrease moisture content high osmotic pressure

lead to diffuses salt into the fish tissues, but at the same time water moves by osmosis from the fish at a high speed into the surrounding brine and the fish declines in weight (Voskresensky, 1965). The results are in accordance with those of Badawy (1979); Hernandez-Herrero (1997) and Ahmed *et al.*, (2010).

Table (1): The effect of salting and storage at 4°C on moisture content in muscles of fish species (% on wet weight basis)*

Treatments	Bolti		Karmout		Kannome	
	Whole	cleaned	whole	cleaned	whole	cleaned
Fresh	77.13	77.13	76.35	76.35	74.65	74.65
After 10 days salting	71.70	70.30	69.95	68.57	68.25	67.65
After 20 days salting	70.99	70.26	68.95	67.75	67.65	66.90
After 30 days salting	69.63	69.19	67.75	66.70	66.38	65.15
Storage 1 month	68.29	67.90	66.79	65.42	65.50	64.60
Storage 2 months	67.63	67.15	65.78	64.77	64.86	64.25
Storage 3 months	66.44	66.22	64.35	63.92	63.80	63.65

* Each value given in table is a mean of three determination

2. Protein content

Results of the effect of salting and storage on protein content in muscles of studied fish species are presented in Table (2). Protein content of fresh Bolti was higher than that of Karmout and Kannome with values: 81.81%, 71.71% and 64.67% on dry weight; respectively. During salting and storage the protein content decreased in each of whole and cleaned of fish species. Where the protein content of whole was higher than cleaned fish, it reached of whole and cleaned Bolti to 46.25% and 45.38% on dry weight; respectively at the end of storage time. While whole and cleaned Karmout reached to 45.27% and 42.96% on dry weight; respectively at the end of storage time. Also whole and cleaned Kannome reached to 44.14% and 42.17% on dry weight; respectively at the end of storage time. As a result of decreasing in protein content salt penetrates the tissue, it alters the colloidal properties of the proteins and changes the nature of the water/protein relationship (Zaitzev *et al.*, 1969). This finding can be explained as a result of the denaturation of both sacoplasmic and myofibrillar proteins due to the effect heavy salting on fish muscle. These results are in accordance with El-Sharnouby (1989) and Ahmed *et al.*, (2010)

Table (2):The effect of salting and storage at 4°C on protein content in muscles of fish species (% on dry weight basis)*

Treatments	Bolti		Karmout		Kannome	
	whole	cleaned	whole	cleaned	whole	cleaned
Fresh	81.81	81.81	71.71	71.71	64.67	64.67
After 10 days salting	64.17	61.08	56.24	53.20	53.10	51.56
After 20 days salting	59.39	57.30	54.11	51.63	51.81	50.15
After 30 days salting	56.27	55.21	51.94	49.85	49.67	47.78
Storage 1 month	52.79	51.37	49.98	47.43	48.12	46.33
Storage 2 months	48.69	46.67	47.93	44.53	46.67	45.17
Storage 3 months	46.25	45.38	45.27	42.96	44.14	42.17

* Each value given in table is a mean of three determination

3. Lipid content

Results of the effect of salting and storage on lipid content in muscles of studied fish species are shown in Table (3). Lipid content of fresh Kannome was higher than Karmout and Bolti, where reached to 22.09%, 19.20 % and 9.79 % on dry weight; respectively. After 10 days salting, the lipid content was increased in cleaned fish, where the lipid content of Kannome, Karmout and Bolti reached to 22.38%, 19.60% and 9.90% on dry weight; respectively. The increase in lipid, content may be attributed to breakdown of lipoprotein during salting and liberation of lipids to tissue muscles (Voskresensky, 1966). After that the lipid content decreased at the end of storage time in cleaned Kannome, Karmout and Bolti, where reached to 19.67%, 16.91% and 8.35% on dry weight; respectively. The decreasing in lipid content, may be attributed to their insolubility in water, which diffusion throughout the cell walls to the brine solution and the hydrolysis of triglycerides and phospholipids, which is catalyzed by lipases and phospholipases and release of free fatty acids that is soluble in water, then leaching into the drip (Voskresensky, 1966; Aman and Shehata, 1978 and Al-Habib and Al-aswad, 1985). Lipid content of whole Kannome, Karmout and Bolti during salting and storage increased, reached to 24.89%, 22.22% and 13.20 % of dry weight; respectively at the end of storage time. The increase in lipid content of whole fish species during salting and storage may be due to its migration lipid from viscera to tissue during preparation and storage and breaking lipoprotein during salting and liberalization lipids to tissue muscles (Voskresensky, 1966; Abou-El-Hawa, 1970 and Fouad, 1976). The results are in agreement with Badawy (1979); El-Sharnouby (1989) and Ahmed *et al.*,(2010).

Table (3): The effect of salting and storage at 4°C on lipid content in muscles of fish species (% on dry weight basis)*.

Treatments	Bolti		Karmout		Kannome	
	whole	cleaned	whole	cleaned	whole	cleaned
Fresh	9.79	9.79	19.20	19.20	22.09	22.09
After 10 days salting	12.01	9.90	21.13	19.60	23.78	22.38
After 20 days salting	12.50	9.75	21.64	19.03	24.17	21.84
After 30 days salting	12.97	9.41	21.95	18.41	24.42	20.72
Storage 1 month	13.09	8.97	21.98	17.70	24.55	20.40
Storage 2 months	13.16	8.65	22.06	17.17	24.84	20.14
Storage 3 months	13.20	8.35	22.22	16.91	24.89	19.67

* Each value given in table is a mean of three determination.

4. Ash content

Results of the effect of salting and storage on ash content in muscles of studied fish species presented in Table (4). Ash content of fresh Kannome was higher than that of Karmout and Bolti where reached to 6.75%, 5.65% and 4.90% on dry weight; respectively. During salting and storage the ash content was increased in each of whole and cleaned of fish species, where ash content in cleaned was higher than whole fish species, reached of whole

and cleaned Kannome to 21.49% and 28.75% of dry weight; respectively at the end of storage time. While whole and cleaned Karmout reached to 23.87% and 31.54% on dry weight; respectively at the end of storage time. Also whole and cleaned Bolti reached to 30.31% and 36.20% on dry weight; respectively at the end storage time. The increasing in ash content during salting period may be due to effect of extracted lipid which helps to create a crusted surface on each dried fish (Mohammed, 2007) and effect of ground bones and scales in dried meat, also the presence of residues from salt during preparation of samples for analysis and this consequently lead to increase the ash content. These results were agreement with Hernandez-Herrero (1997) and Ahmed et al. (2010).

Table (4): The effect of salting and storage at 4°C on ash content in muscles of fish species (% on dry weight basis)*

Treatments	Bolti		Karmout		Kannome	
	whole	cleaned	whole	cleaned	whole	cleaned
Fresh	4.90	4.90	5.65	5.65	6.75	6.75
After 10 days salting	10.11	16.70	12.01	17.12	12.03	15.27
After 20 days salting	16.89	21.32	14.04	19.53	13.20	17.49
After 30 days salting	19.30	24.18	16.34	22.31	15.53	21.52
Storage 1 month	23.21	28.97	18.58	25.82	17.25	23.50
Storage 2 months	27.46	33.27	20.89	28.38	18.67	25.06
Storage 3 months	30.31	36.20	23.87	31.54	21.49	28.75

* Each value given in table is a mean of three determination.

In conclusion, from the above- motioned results it is quite clear that salting and storage of three studies fish species caused changes in chemical composition. Meanwhile the results revealed that the salting of whole fish was better than cleaned fish.

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تأثير التملح والتخزين على التركيب الكيميائي لبعض انواع الاسماك
وائل عبد الرحمن أبو بكر الصبان⁽¹⁾، صلاح حسنين محمد أبو الهوى⁽²⁾ ،
منال عبد الحميد محمود حسن⁽²⁾ و مخلص أحمد محمد محمد عبد الرحمن⁽²⁾
١) قسم تكنولوجيا الأغذية والأسماك - كلية علوم البيئة و الاحياء البحرية - جامعة حضرموت -
اليمن
٢) قسم علوم وتكنولوجيا الأغذية - كلية الزراعة - جامعة أسبوط - مصر

تم دراسة تأثير التملح والتخزين لمدة ٣ أشهر على التركيب الكيميائي لثلاثة أنواع من الأسماك (البلطي - القرموط - الأنومة) كاملة ومنظفة.
أظهرت النتائج أن محتوى الرطوبة والبروتين في أسماك البلطي الطازجة كانت أعلى من محتواها في أسماك القرموط والأنومة الطازجة . في حين ان محتوى الليبيدات والرماد في أسماك الأنومة كانت أعلى من محتواها في أسماك القرموط والبلطي.
خلال عملية التملح والتخزين انخفض محتوى الرطوبة والبروتين في حين زاد محتوى الرماد وذلك في كل من الأنواع الثلاثة من الأسماك - كاملة ومنظفة. بينما زاد محتوى الليبيدات بعد ١٠ ايام من التملح في الأسماك الثلاثة المنظفة ثم انخفض بعد ذلك حتى نهاية الحفظ. من ناحية أخرى أظهرت النتائج زيادة محتوى الليبيدات في الأنواع الثلاثة من الأسماك الكاملة خلال فترة التملح والتخزين.
أوضحت النتائج أن التغيرات في التركيب الكيميائي للأنواع الثلاثة من الأسماك الكاملة والمنظفة خلال عملية التملح والتخزين إلى التوصية بأن تملح الأسماك وهي كاملة أفضل من تملحها وهي منظفة.