EJAR

Relationship between frozen pre-storage period of raw tilapia and mullet fish and quality criteria of its cooked products

S. A. El-Sherif, S. M. aIbrahim* and Mohamed Abou-Taleb

National Institute of Oceanography and Fisheries, Fish processing technology Laboratory, Cairo, Egypt.
**Corresponding Author: E. Mail: Ibrahim_NIOF@Yahoo.Com*

Received 13th January 2010, Accepted 27th February 2010

Abstract

This investigation was carried out to study the effect of frozen pre-storage for 60, 120 and 180 days at -18ºC and cooking methods (frying, grilling and boiling) on biochemical analysis, physical properties, sensory attributes as well as microbiological aspects of tilapia fish (*Oreochromis niloticus*) and mullet fish (*Mugil cephalus*) commonly consumed in Egypt. Total volatile bases nitrogen (TVB-N), trimethylamine nitrogen (TMA-N), thiobarbituric acid (TBA), pH value and cooking loss (%) were increased with increasing frozen storage period. Upward trends were shown of total viable count (TVC) for tilapia and mullet fish until the end of second month of frozen storage to 5.75 and 4.32 (log_{10} cfu per g) then the downward was taken place until the end of storage period to 2.95 and 2.65, respectively. Furthermore, the highest scores of sensory evaluation had been given for fried samples in tilapia fish and for grilled samples in mullet fish than other cooked samples. A significant decrease in sensory scores was attributed to increase in frozen storage period.

Keywords: Tilapia, Mullet, Frozen storage, Cooking, Quality criteria.

1. Introduction

Fresh fish is a highly perishable product due to its biological composition. The main cause of deterioration is the activity of typical spoilage seafood microorganisms. Provoking loss of essentially fatty acids, fat-soluble vitamins, protein functionality, and production of biogenic amines and formation of off-odors are resultants of spoilage (Gram and Dalgaard, 2002). Freezing is a usual method to preserve commercial fish since it stops chemical and microbiological degradation, and is an excellent method of preserving the organoleptic attributes of fish flesh during prolonged periods of time (Careche *et al.,* 1999). However, fish and fish products can undergo undesirable changes during frozen storage and deterioration may limit the storage time. These undesirable changes result from protein denaturation (Benjakul *et al.,* 2005) and lipid oxidation (Richardes, 2002). The effects of various processing methods employed in preparing them for consumption are almost importance factors. Some of the processes that include boiling, frying, roasting and smoking could have varying effects on their nutrient contents, texture and flavor (Oluwaniyi *et al.,* 2010). Therefore, heating is applied to food to enhance its flavor, inactivate pathogenic microorganism and increase shelf life (Bognar, 1998). The effects of different cooking methods (baking, pan frying and deep fat frying) on the lipid content and composition of breaded and non-breaded fillets of lake trout, white sucker and bluegill were studied by Mai *et al*. (1978). Also, Abdallah *et al*. (1991) determined the protein solubility, total volatile bases nitrogen (TVB-N), trimethylamine nitrogen (TMA-N), ammonia nitrogen (NH_3-N) and free amino acids for smoked, fried and grilled samples prepared from frozen bolti and mackerel fishes during storage at -18ºC for 180 days. The aim of this study was designed to investigate the effect of frozen pre-storage for 60, 120 and 180 days at -18ºC and cooking methods (frying, grilling and boiling) on volatile compounds, TBA value, physical properties, sensory attributes as well as microbiological quality of tilapia fish (*Oreochromis niloticus*) and mullet fish (*Mugil cephalus*).

2. Materials and methods

2.1. Materials

Tilapia fish *Oreochromis niloticus* about 130g and mullet fish *Mugil cephalus* about 250 g were landed in July, 2010 from Wadi El-Rayan Lake, El-Fayoum government. All fish samples were placed in ice boxes after washed by tap water with crushed ice and transferred to fish processing technology Laboratory, in El-Qanater El-Khiria Station for fish Research, National Institute of Oceanography and Fisheries. Samples were gutted, washed in chilled water and drained. Gutted fish samples were divided into four groups, packed in polyethylene bags and then stored at -18ºC for different periods. The different ingredients

(sunflower oil, table salt, wheat flour, wheat bran, garlic, black pepper, cumin and red pepper) were obtained from local market.

2.2. Treatments

Fried, grilled and boiled fish used in this investigation were prepared from the fresh and frozen samples for 60, 120, and 180 days. Fried fish was prepared by frying raw samples (soaked in a saturated salt solution for two minutes, then, spices mixture were put in body cavity and rubbed with flour) in sunflower oil at 180 ºC for 10 minutes using frying pan. Grilled fish was prepared by grilling raw samples (rubbed with wheat bran) at 260 ºC for 20-35 minutes. using stainless steel griller. The obtained grilled fish samples were spiced for 1 minute using a special spiced solution containing black pepper, cumin, red pepper and garlic. Boiled fish was prepared by cooking raw fish samples in boiling water for 15 min.

2.3. Analytical methods

Total volatile basic nitrogen (TVB-N), thiobarbituric acid value (TBA) as well as pH value were determined as described by Pearson (1991). Trimethylamine nitrogen **(**TMA-N) was determined according to A.O.A.C. (2002). Percentage of cooking loss was estimated according to Roland *et al.* (1981) where:

Cooking loss % = (raw weight – cooked weight) × 100 / raw weight.

Total bacterial count was carried out according to Oxoid Manual (1979). Sensory evaluation was carried out according to the procedure of Fey and Regenstein (1982). The data were exposed to proper statistical analysis mentioned by Snedecor and Cochran (1969). L.S.D. at 5% level of significance was used to compare between means.

3. Results and discussion

3.1. Total volatile basic nitrogen (TNBN)

Table (1) illustrates the changes occurring in TVB-N by cooking methods (frying, grilling and boiling) of tilapia and mullet fish samples pre- stored at -18 ºC for different periods. Fresh tilapia samples contained 14.31 mg TVB-N/100g flesh, while fresh mullet samples contained 12.90 mg TVB-N/100g flesh. Progressively increase in TVB-N value was attributed with increase of frozen pre-storage period up to 180 days. Values reached to 29.31 and 27.0 mg TVB-N/100g flesh for raw tilapia and mullet fish, respectively after 6 months of storage at -18 ºC. This may be due to the activity of proteolytic enzymes by bacterial action which produced some volatile compounds (Nunes *et al*., 1992). These results are in agreement with those of Mohamed (1991) and Ibrahim and El-Sherif (2008). Concerning the effect of applied cooking methods (fried, grilled and boiled), TVB-N content was low in all samples. Such reduction occurred at a higher rate in boiled sample followed by fried and grilled samples. The loss of TVB-N content is due to the heating effect of cooking process that may be related to the volatilization of the volatile nitrogen (frying) or to its separation with dripping (grilling) and escape of such nitrogen fraction in the boiling water (boiling). In addition, TVB-N was found to be low of raw fish samples until the end of pre-storage period (180 days) and these processed samples where a level of 30 mg /100g TVB-N in the muscle has been considered as the upper limit, above which some fishery products are considered as spoiled and unfit for human consumption. Similar observation was reported by El-Akeel (1983) and Abou-Taleb (1993).

3.2. Trimethylamine nitrogen (TMA-N)

The effect of both frozen storage and different applied cooking methods (fried, grilled and boiled) on TMA-N values of tilapia and mullet samples are given in Table (2). TMA-N values were markedly increased of frozen tilapia and mullet fish samples from 0.92 and 0.68 mg/100g flesh at zero time of storage (fresh samples) to 3.98 and 3.72 mg/100g flesh at the end of storage for 180 days at -18 ºC, respectively. Such developed of trend TMA-N during frozen storage might be attributed to the conversion of TMAO to TMA by non enzymatic process, or by native tissue enzymes or by bacterial enzymes (TMAase) which are not completely inactivated by low temperature (Haard, 1990). This increase in TMA-N content of fish during frozen storage at -18 ºC was reported by El-Tanahy *et al*. (1990) and Abo-Zeid (1995). Also, TMA-N content was reduced in all cooked samples as influenced by thermal process of each applied cooking methods; frying, grilling and boiling. These results are in agreement with those reported by Mohamed (1991**)** and Abou-Taleb (1993)**.**

3.3. Thiobarbituric acid (TBA) value

TBA values of fresh tilapia and mullet fish samples were 0.55 and 0.95 (as mg malonaldhyde/ kg sample) at the beginning of storage and then increased to 1.92 and 2.30 (as mg malonaldhyde / kg sample), respectively after 180 days of frozen storage indicated a progressive oxidation of lipids. This increase of TBA values may be due to the ice crystals formed which could injure the cell and cause the release of pro-oxidants for lipid oxidation, especially free iron (Benjakul and Baucr, 2001). These results are in agreement with reported by (Youssof, 1995 and Sarhan, 2003). Also, the higher TBA value of mullet fish samples than tilapia fish samples at any given time of storage was noticed. This is may be due to their higher lipid or that tilapia fish lipids are less liable for oxidation possibly because of the presence of more saturated fatty acids (Mohamed, 1991). TBA values decreased in all cooked samples which pre-frozen for

different periods. The lowest TBA value was observed in boiled samples followed by grilled samples, respectively. Bosund and Ganrot (1970) also observed the decrease in TBA value of frozen fish followed by cooking. The lower TBA values during cooking processes are may be due to the formation of secondary products of lipid oxidation, which do not reaction with the TBA reagent or to the reaction of malonaldhyde with protein (Gokalp *et al.,* 1983). On the other hand, fried tilapia and mullet fish samples recorded the highest TBA values. Therefore, temperature and time of heating are important factors which influencing the production of the TBA- reactive substances.

3.4. pH value

The pH values of fresh tilapia and mullet fish slightly increased during frozen storage periods. The pH values were 6.07 and 5.94 of fresh tilapia and mullet fish increased to 6.37 and 6.58 after 180 days, respectively (table 4). This increase may be due to the deterioration of fish proteins and liberated ammonia and other volatile bases (Khallaf, 1986). These results are in agreement with those obtained by Abo-Zeid (1995) and Ibrahim and El-Sherif (2008). In addition, pH values of tilapia fish samples were higher than that of mullet fish samples. There was a slight increase of pH values in processed tilapia and mullet fish samples as a result of frying, grilling and boiling processes. This increase may be due to the formation of some basic compounds as a result of amino acid degradation (Hafez, 1982). In addition, from the same table, it was noticed that at any time of storage at -18 ºC, the highest pH values recorded for the fried samples followed by grilled and boiled samples, respectively of tilapia and mullet fish.

3.5. Cooking loss

The effect of both frozen storage and different applied cooking methods (fried, grilled and boiled), on the cooking loss (%) values of tilapia and mullet fish samples are given in Table (5). Cooking of tilapia and mullet fish samples by different cooking methods caused loss of weight. Frying process caused a higher loss in weight (19.55% and 16.30%), while boiling gave the lowest one among the used cooking methods (9.90% and 8.22%) of tilapia and mullet, respectively. In addition, the cooking loss of all cooked samples prepared from pre-frozen tilapia and mullet was increased by prolong of storage period. The main factors of the loss of weight were water evaporation, fat loss by dripping and escaping during cooking processes (El-sharnouby and Attia, 2003). In addition, it could be noticed that the cooking loss of all cooking methods in tilapia fish was increased than that of mullet fish. Finally, these data suggest that cooking loss is related to fish size (based on total fish weight) and its composition. These results are in a close agreement with those reported by Ez-El-Rigal, *et al.* (2004).

3.6. Bacteriological aspects

Bacterial aspects of tilapia and mullet fish samples as affected by frozen storage periods for 180 days at -18 ºC and different cooking methods are shown in Table (6). The counts of total viable (TVC) were 2.35 and 2.01 (log_{10} cfu per g) of tilapia and mullet fish samples at the beginning of storage, respectively. Upward trends were shown until the end of second month of frozen storage to be 5.75 and 4.32 and then the downward was taken place until the end of storage period to reach 2.95 and 2.65, respectively. The increase of TVC may be due to the multiplication of microbial counts that can able to grow under freezing condition (Sarhan, 2003). While the reduction in TVC may be due to the damage of bacterial cells caused by grown ice crystals (Allam, 2001). These results are in harmony with Abd-El-Rahman (2002). Concerning the effect of cooking processes, after cooking, TVC was sharply reduced in all processed fish products. This reduction was influenced by its original count and cooking method. Therefore, the highest reduction rate was observed in fried samples as compared with raw frozen fish followed by grilled and boiled cooked sample. This destruction occurred in TVC may be due to thermal processing during applied cooking methods.

3.7. Sensory evaluation

Table (7) shows the effect of both frozen storage and different applied cooking methods (fried, grilled and boiled), on sensory evaluation of tilapia and mullet fish samples. Generally, overall acceptability represented the colour, flavour and texture scores of cooked samples prepared from fresh and frozen pre-stored tilapia and mullet fish had score value over 7.0 (moderately like). According to the panelist's scores, the cooked samples could be arranged according to their acceptability in the following order: fried, grilled, and boiled cooked samples of tilapia fish and order: grilled, fried, and boiled cooked samples of mullet fish. From this order, it could be observed that both colour and flavour of cooked fish were the most important parameters, which determine the consumer acceptance (Sawyer *et al.*, 1988). On the other hand, it could be noticed that cooked mullet products were higher acceptability from panelists than the same products of tilapia fish; this may be due to the high fat and quality properties of mullet fish. In addition, the overall acceptability scores of samples prepared frozen pre-stored tilapia and mullet fish was decreased by prolonging of storage period, this due to the low of quality parameters during freezing until the end of storage period.

Table (1): Effect of frozen storage period and different cooking methods on Total volatile basic nitrogen (TVB-N) content of tilapia and mullet fish samples (on wet wt. basis).

Storage period days	Tilapia fish				Mullet fish			
	Frozen raw fish	Fried	Grilled	Boiled	Frozen raw fish	Fried	Grilled	Boiled
Fresh	14.31	13.12	14.05	12.82	12.90	12.05	12.35	11.30
60	18.08	16.02	17.80	15.15	14.56	13.45	13.80	12.95
120	21.20	20.88	22.10	18.65	19.20	16.62	18.20	15.00
180	29.31	26.36	28.13	25.72	27.00	24.70	25.15	23.90

Table (2): Effect of frozen storage period and different cooking methods on Trimethylamine nitrogen (TMA-N) content of tilapia and mullet fish samples (on wet wt. basis).

Storage period days	Tilapia fish				Mullet fish			
	Frozen raw fish	Fried	Grilled	Boiled	Frozen raw fish	Fried	Grilled	Boiled
Fresh	0.92	0.85	0.90	0.55	0.68	0.42	0.45	0.40
60	1.08	0.95	1.00	0.87	0.85	0.51	0.68	0.49
120	2.65	2.05	2.15	1.45	2.10	1.05	1.76	0.93
180	3.98	2.95	3.12	2.88	3.72	2.12	2.86	1.46

Table (3): Effect of frozen storage period and different cooking methods on Thiobarbituric acid (TBA) value of tilapia and mullet fish samples (on wet wt. basis).

Storage period days	Tilapia fish				Mullet fish			
	Frozen raw fish	Fried	Grilled	Boiled	Frozen raw fish	Fried	Grilled	Boiled
Fresh	0.55	0.43	0.28	0.09	0.95	0.88	0.70	0.22
60	0.78	0.87	0.67	0.55	1.42	1.35	1.06	0.60
120	1.65	1.45	1.30	1.21	1.88	1.57	1.75	1.08
180	1.92	1.92	1.60	1.42	2.30	2.15	1.93	1.28

Table (4): Effect of frozen storage period and different cooking methods on pH value of tilapia and mullet fish samples (on wet wt. basis).

Storage period days	Tilapia fish				Mullet fish			
	Frozen raw fish	Fried	Grilled	Boiled	Frozen raw fish	Fried	Grilled	Boiled
Fresh	6.07	6.21	6.16	6.09	5.94	6.12	6.04	5.99
60	6.12	6.38	6.23	6.16	6.10	6.20	6.16	6.12
120	6.36	6.48	6.45	6.40	6.24	6.36	6.30	6.28
180	6.58	6.81	6.65	6.56	6.37	6.61	6.48	6.39

Table (5): Effect of frozen storage period and different cooking methods on cooking loss (%) in tilapia and mullet fish samples.

Storage period days	Tilapia fish			Mullet fish		
	Fried	Grilled	Boiled	Fried	Grilled	Boiled
Fresh	19.55	14.60	9.90	16.30	13.85	8.22
60	21.05	15.95	10.65	16.80	14.20	8.75
120	23.25	17.05	12.08	18.05	16.05	9.60
180	26.05	17.80	12.95	21.20	17.95	10.85

Table (6): Effect of frozen storage period and different cooking methods on Total viable count (TVC) in tilapia and mullet fish samples (Log_{10} cfu / g sample).

Storage period days	Tilapia fish				Mullet fish			
	Frozen raw fish	Fried	Grilled	Boiled	Frozen raw fish	Fried	Grilled	Boiled
Fresh	2.35	1.95	2.10	2.15	2.01	1.70	1.72	1.95
60	5.75	3.55	3.75	4.20	4.32	3.00	3.25	3.85
120	4.15	2.30	3.80	3.50	3.05	2.12	2.35	2.90
180	2.95	2.05	2.55	2.70	2.65	1.85	2.33	2.75

Table (7): Effect of frozen storage period and different cooking methods on overall acceptability in tilapia and mullet fish samples.

Storage period days	Tilapia fish				Mullet fish			
	Fried	Grilled	Boiled	L.S.D. at 5%	Fried	Grilled	Boiled	L.S.D. at 5%
Fresh	9.0	8.0	7.5	0.24	9.0	9.5	8.0	0.24
60	8.8	7.5	7.5	0.28	8.5	9.3	8.0	0.30
120	8.5	7.5	7.2	0.32	8.2	9.0	7.6	0.28
180	8.0	7.2	7.0	0.23	7.7	8.5	7.5	0.40
L.S.D. at 5%	0.30	0.21	0.20		0.34	0.31	0.24	

4. Conclusion

In conclusion, it could be noticed that both pre-frozen storage and cooking methods of investigated fish samples are affected quality of its products. However, these changes were within the international recommended levels.

References

Abd-Allah, M.A.; Hassan, Y. M.; Abu-Salem, F.M. and Mohamed, G.F.:1991, Nitrogenous compounds of smoked, fried and grilled samples prepared from frozen Bolti and Mackerel fish. International Conference on Marine fisheries: Management and Development. Alexandria, Egypt 19-21 November, 1991.

Abd El-Rahman, A.E.I.: 2002, Changes in selected chemical, microbiological and sensory quality characteristics of common carp (*Cyprinus carpio* L.) Blocks during frozen storage. *Egyptian Journal of Agriculture Research*, 80(4):

Abo-Zeid, K.S.: 1995, Chemical and histological studies on carp fish preserved at low temperature. M. Sc. Thesis, Faculty of Agriculture, Cairo University, Egypt.

Abou-Taleb, M.: 1993, Effect of some processing treatments on the chemical compounds of some fish varieties. M.Sc. Thesis, Faculty of Agriculture, Ain Shams University, Egypt.

Allam, A.G.: 2001, Studies on storage ability of frozen bolti fish sample. *Al-Azhar Journal of Agriculture Research*, 14: 101-110.

AOAC: 2002, Official Method of Analysis of the Association of Official Analytical Chemists. International, "17th" Edition Revision 2002, Washington, Dc. U.S.A.

Benjakul, S. and Bauer, F.: 2001, Biochemical and physicochemical changes in catfish (*Silurus glanis* Linne) muscle as influenced by different frozen-thaw cycles. *Food Chemistry*, 72: 207-217.

Benjakul, S.; Visessanguan, W.; Thongkaew, C., and Tanaka, M.: 2005, Effect of frozen storage on chemical and gel-forming properties of fish commonly used for surimi production in Thailand. *Food Hydrocolloids*, 19: 197-207.

Bognar, A.: 1998, Comparative study of frying to other cooking techniques. Influence of the nutritive value. Grasasy Aceites, 49: 250-260.

Bosund, I. and Ganvot, B.:1970, Effect of pre-cooking on lipid oxidation and storage life of frozen fish. Lenbensm Wiss U-Tecnol., 3(4): 71.

Careche, M.; Herrero A. M.; Rodrı´guez-Casado A.; Del Mazo M. L. and Carmona, P.: 1999, Structural changes of hake (*Merluccius merluccius* L.) fillets: effects of freezing and frozen storage. *Journal of Agricultural Food Chemistry*, 47: 952- 959.

EL-Akeel, A. T. :1983, The effect of processing and storage on fish quality. M. Sc. Thesis. Faculty of Agriculture, Cairo University,Egypt.

El-Sharnouby, S.A. and Attia, R.S.: 2003, Effect of cooking methods on ultra structure, some physical properties, chemical and nutritional properties of grey mullet (*Mugil cephalus*) fish. *Alexandria Journal Agricultural Research,* 48(2): 53-59.

El-Tanahy, H.H.; Bayoum, A.H. and Abo-Zaid, M.A.: 1990, Comparative study on some methods used for keeping fish quality during frozen storage. *Annals, Agriculture Science, Moshtohor,* 28(1): 501-512.

Ez-El-Rigal, A.I.; Zakkar, A.H. and Salama, M.I.: 2004, Evaluation of the nutritional quality of cooked fillets by different methods. *Egyptian Journal of Agriculture Research*, 82(2).

Fey, M.S. and Regenstein, J.M.:982, Extending shelf-life of fresh wet red hake and salmon using CO_2-O_2 modified atmosphere and potassium sorbate ice at 1˚C. *Journal Food Science*, 47: 1048-1054.

Gokalp, H.A.; Ockerman, H.W.; Plimpton, R.F. and Harper, W.J.: 1983, Fatty acids of neutral and phospholipids rancidity scores and TBA values as influenced by packaging and storage. *Journal Science Food Agriculture*, 44: 335.

Gram, L. and Dalgaard, P.: 2002, Fish spoilage bacteria-problems and solutions. *Current Opinion in Biotechnology*, 13: 262–266.

Haard, N.F.: 1990, Biochemical reactions in fish muscle during frozen storage. In N.F. Haard (Ed.), Seafood Science and Technology. (pp.176-209).Canada: Fishing News Books.

Hafez, N.E.: 1982, Chemical and physical studies on the fish flesh of Dolphin, Ph.D. Thesis, Faculty of Agriculture, Ain Shams University, Egypt.

Ibrahim, S.M. and El-Sherif, S.A.: 2008, Effect of some plant extracts on quality aspects of frozen

tilapia (*Oreochromis niloticus* L.) fillets. *Global Veterinaria,* 2(2): 62-66.

Khallaf, M.F.: 1986, Some changes that occur through the processing and storage of fish. Ph. D. Thesis, Faculty of Agriculture, Ain Shams University, Egypt.

Mai, J.; Shimp, J.; Weihrauch, J. and Kinsella, J.E.: 1978, Lipids of fish fillets: Changes following cooking by different methods. *Journal of Food Science*, 43: 1669.

Mohamed, G.F.: 1991, Technochemical comparison on some frozen fish. M.Sc. Thesis, Faculty of Agriculture, Ain Shams University, Egypt.

Nunes, M.L.; Batista, I. and De-Campos, R.M.: 1992, Physical, chemical and sensory analysis of sardine stored in ice. *Journal of Science Food Agriculture*, 59: 37-43.

Peason, D.: 1991, The Chemical Analysis of Food. Churchill, NewYork, London, pp: 374 - 410.

Oluwaniyi, O.O.; Dosumu, O.O. and Awolola, G.V.: 2010, Effect of local processing methods (boiling, frying and roasting) on the amino acid composition of four marine fishes commonly consumed in Nigeria. *Food Chemistry,* 123: 1000-1006.

Oxoid Manual: 1979, The Oxoid manual of culture media and other laboratory services. Fourth Edition.

Richards, M.P.: 2002, Contributions of blood and blood components to lipid oxidation in fish muscle. Ph.D. Thesis, University of Massachusetts, Amherst, USA.

Roland, L.M.; Seideman, S.C.; Donnelly, L.S. and Quenzen, N.M.: 1981, Physical sensory properties of chicken patties made with varying proportions of white and dark spent fowl muscle. *Journal Food Science*, 46: 834.

Sarhan, A.M.M.: 2003, Quality aspects on some meat and fish products in local market. M. Sc. Thesis, Faculty of Agriculture, Al-Azhar University, Egypt.

Sawyer, F.; Cardello, A.V. and Prell, P.A.: 1988, Consumer evaluation of sensory properties of fish. *Journal of Food Science*, 53: 12-18.

Senedecor, G.W. and Cochran, W.G.: 1969, Statistical method 6th Ed. Iowa State University, Press, Ames. Iowa , U.S.A.pp. 23-29.

Youssof, G.H.A.:1995, Studies on storage ability and expiry-date of some frozen meat for human consumption. M.Sc. Thesis, Faculty of Agriculture, Al-Azhar University, Egypt.

العلاقة بين فترة التخزين المجمد لأسماك البورى والبلطى الخام وخواص جودة منتجاتها المصنعة

شعبان عبد الحليم عبد المجيد الشريف ـ سيد مكاوى إبراهيم ـ محمد أبوطالب

معمل تكنولوجيا تصنيع الأسماك – المعهد القومى لعلوم البحار والمصايد – القاهرة – مصر

أجرى هذا البحث لدراسة تأثير فترة التخزين المجمد على خواص جودة المنتجات النهائية المصنعة من أسماك البورى والبلطى سابقة التخزين. أستخدمت فى هذه الدراسة أسماك البورى والبلطى الطازجة منزوعة الأحشاء والمخزنة على –18 °م لمدة 60 ، 120 ، 180 يوما. وقد أجريت عليها العمليات التصنيعية مثل القلى فى الزيت والشى والسلق فى الماء المغلى. وتم تقييم المقاييس الكيميائية والطبيعية والبكتريولوجية بالإضافة إلى التقييم الحسى وقد أوضحت النتائج مايلى:

أرتفاع قيم كل من القواعد الكلية النيتروجينية المتطايرة وثلاثى ميثايل الأمين ورقم حامض الثيوباربيتيوريك ورقم الـ pH ونسبة الفقد فى الوزن نتيجة عملية الطبخ فى العينات المصنعة بزيادة مدة التخزين المجمد قبل التصنيع. أظهر العدد الكلى للبكتريا إرتفاعا تدريجيا بزيادة مدة تخزين العينات غير المصنعة حتى نهاية الشهر الثانى من التخزين المجمد ثم أخذ فى الإنخفاض التدريجى بزيادة مدة التخزين حتى نهاية مدة التخزين (180 يوم).

كما أوضحت القيم المتحصل عليها من التقييم الحسى للمنتجات المصنعة على حصول العينات التى تم قليها فى الزيت على أعلى القيم بالنسبة لأسماك البلطى يليها العينات المشوية وحصلت العينات المشوية على أعلى القيم بالنسبة لأسماك البورى يليها العينات المقلية. كما إنخفضت قيم التقييم الحسى إنخفاضا معنويا بزيادة مدة التخزين المجمد قبل التصنيع.