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INFLUENCE OF ESSENTIAL OILS IN IMPROVING THE QUALITY OF CATFISH FINGERS DURING FROZEN STORAGE

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ABSTRACT:

The study aimed to determine the effect of coriander, cumin and parsley essential oils addition to catfish finger on protein, fat and some quality attributes during frozen storage. The essential oils were added to fish finger at (0.05, 0.1 and 0.15%) and stored at -18°C for 6 months. The study indicated that no changes were detected in protein and fat content for all samples treated with different essential oils. It also showed that, no significant differences were detected in total volatile basis nitrogen (T.V.B.N), trimethylamine nitrogen (T.M.A.N) and thiobarbituric acid value (T.B.A) both in control and treated samples with essential oils. Likewise, the results showed that coriander oil was the most effective in improving the quality attributes followed by cumin oil, while parsley oil gave less effect. Generally, all treatments of fish finger as well as control were acceptable at the end of storage period.

Keywords: fish finger, quality attributes, coriander oil, cumin oil, parsley oil.

INTRODUCTION:

Fish are very susceptible to both microbiological and chemical deterioration, due to large amounts of free amino acids, volatile nitrogen bases, highly unsaturated fatty acids and higher final pH, (Razavi Shirazi, 2001). Chemical, enzymatic and microbial activity caused loss of fish quality during storage (Özogul *et al*., 2006 & Özyurt *et al*., 2009). Lipid oxidation is one of the major problems encountered in fish processing which have high content of polyunsaturated fatty acids.

Recently, increasing attention has been focused on the use of natural antioxidants, such as essential oils. Essential oils possess antibacterial, antioxidant, antiviral and anti-mycotic properties (Burt, 2004).

Coriander (*Coriandrum sativum L.*) which also called ‘‘cilantro” is an annual herbaceous plant originally from the Mediterranean and Middle Eastern regions, is cultivated for its culinary, aromatic and medicinal use (Mildner-Szkudlarz *et al*., 2009). This plant is of an economic importance since it has been used as a flavoring agent in food products, perfumes, cosmetics and drugs. This culinary and medicinal plant widely distributed and mainly cultivated for the seeds which contain an essential oil, (Neffati *et al.,* 2011). The essential oil and various extracts from coriander have been shown to possess antibacterial, antidiabetic, anticancerous, antimutagenic, antioxidant and free radical scavenging activities, (Sreelatha *et al.,* 2009) and (Zoubiri and Baaliouamer, 2010).

Cumin (*Cuminum cyminum* L.) is a small annual plant belonging to the Apiaceae family, and is native to the Mediterranean region, where it is cultivated extensively. It is one of the popular spices regularly used as a flavoring agent, (Thippeswamy and Naidu, 2005). Cumin’s distinctive flavor and strong, warm aroma are due to its essential oil content that may be considered as an interesting source of antibacterial, antifungal and antioxidant components, which are used as potent agents in food preservation and for therapeutic or nutraceutical industries (Hajlaoui *et al*., 2010).

Parsley (*Petroselinum sativum* L.*)* is a member of Apiaceae family that has been employed in the food, pharmaceutical, perfume, and cosmetic industries, (Lopez *et al.,* 1999). Many investigations point out the antioxidant properties of parsley. The flavonoid apigenin is one of the components of parsley plant, which shown to express strong antioxidant effects by increasing the activities of antioxidant enzymes and related to that, decreasing the oxidative damage of tissues (Kinoshita *et al.,* 2006).

The objective of the present study was to investigate the effect of essential oils in improvement of some quality attributes of catfish finger during frozen storage at -18ºC up to 6 months.

MATERIALS AND METHODS

Fish sample:

Approximately 25 kilograms of catfish (*Clarias garipinus*) were obtained during 2013 winter season from River Nile (Assuit region) and directly transported after fishing into ice box surrounded with crushed ice to laboratory. The obtained fresh fish were immediately weighted and washed with tap water. Samples were scaled, gutted and cleaned thoroughly to remove remained blood and black spots. Fins were removed and fish fleshes were splitted by cutting from the ending of the dorsal fin to the beginning of the same fin towards the head. The back bone was cut behind the head to the beginning of the anal fin and discarded. The skin was removed and the fillets were obtained. Some of samples were directly used for the chemical analysis at zero time and the others were prepared for processing products.

Essential oils:

The chosen essential oils which selected to use in fish products formula, are namely: coriander (*Coriandrum sativum*), cumin (*Cuminum cyminum)* and parsley (*Petroselinum sativum*). These were obtained from the Kato Aromatic Company -Giza, Egypt.

Preparation of fish fingers from catfish:

Fresh fish finger samples were prepared as described by (Long *et al*., 1983 & USDA, 2001). All ingredients were homogenized with a kitchen blender for 2 min. After mincing, the fish mixture was shaped manually, the total weights of catfish fingers were 25 gm. Fingers were packaged in polyethylene bags (in foam dishes). The fingers were stored in a deep freezer at -18±2ºC.

The basal constituents of fish finger were prepared as follows:

The catfish finger mince included 93.508% fish mince, 1.5% salt, 1% sugar,3% wheat flour, 0.243% cumin, 0.243% onion, 0.243% garlic powder, 0.243% pepper and 0.020% thyme. These ingredients were mixed together, divided to four equal portions. The first portion was remained without any addition (control) and the three reminder portions were individually mixed with different concentration of each essential oils (0.05%, 0.1 and 0.15%) to give nine treatments. All fish finger treatments and control were freeze stored at -18±2ºC up to 6 months and the tested samples were conducted at zero time, 2, 4 and 6 months of frozen storage.

Chemical analysis:

1. The crude protein and crude fat content: Total nitrogen and crude fat content were measured outlined in the (A.O.A.C. 2005).
2. Total volatile nitrogenous compounds: Total volatile nitrogenous basis compounds were determined as the method described by (Malle and Tao, 1987).
3. Thiobarbituric acid value (T.B.A): Thiobarbituric acid value was determined as according to the method described by (Kirk and Sawyer, 1991).

Statistical analyses:

The data obtained from the three replicates were analyzed by ANOVA using the SPSS 20.0 software statistical package program, and differences among the means were compared using the Duncan's Multiple Range test (SPSS, 2011). A significance level of 0.05 was chosen and continuous variables described by mean and standard deviation (Mean, SD).

RESUTLS AND DISCUSSION

1- Crude protein content:

The result given in Table (1) showed protein contents in different fish finger treatments during frozen storage at -18ºC up to 6 months. Data indicated that, protein gradually decreased throughout the storage period with a significant difference $P<0.05$ in all tested samples.

From these results, it could be noticed that, no considerable significant changes were observed between control and samples treated with essential oils at 0.05% in protein contents before and during frozen storage. Moreover, it is interested to indicate that addition of essential oils to fish finger formula minimized the observed decrease in protein contents compared with control sample. These results are in agreement with those obtained by (El-Harery, 1997). Also, from the same data, it could be observed that there were losses in protein contents of different treatments as long as extend freezing storage period. These results were in agreement with (Abd-El-Qader, 2003).

Generally, the decrease in crude protein contents in different treatments during the storage period might be due to the changes of the proportion of chemical composition and protein breakdown. It is not desirable to have low protein content owing to long-term storage, causing a decrease in the nutritional value of fish meat (Beklevik *et al*.,2005).

In this concern, (El-Magoli, 1972 & Losty *et al*., 1973) indicated a continuous reduction in the total protein content during frozen storage, due to partial breakdown of proteins by proteolytic enzymes which were not completely inactivated during freezing storage.

2- The crude fat:

Crude fat contents for all fish finger samples were determined during freezing storage at -18ºC up to 6 months. The obtained results are recorded in Table (2). Detectable significant differences were observed among some samples in their crude fat contents

From these results, it could be noticed that during frozen storage there were slight increase with a significant difference $P<0.05$ in crude fat contents of all different fish finger treatments under investigation. These increments in crude fat contents of fish finger during frozen storage might be due to the decrease of the moisture and crude protein contents during storage. These results are in accordance with the findings of (El-Harery, 1997, El-Saftey, 1998, Abd-El-Qader, 2003, Hegazy, 2004 and Ali, 2008).

3- Total volatile nitrogenous compounds

3.1. Total volatile bases nitrogen (T.V.B.N):

Total volatile bases nitrogen (T.V.B.N) and trimethyleamine nitrogen could be used as indicators of fish spoilage and protein degradation (El-Saaid Basuni, 1993). The changes of total volatile base nitrogen are mainly correlated with trimethylamine, and dimethylamine and ammonia as well as, the ammonium nitrogen derived from deamination of adenosine monophosphate (Sakaguchi *et al*., 1982).

Total volatile bases nitrogen contents (T.V.B.N) were determined for fish finger treated and untreated (as a control) as mg N/100 g samples.

Table (1): Changes in crude protein contents of different fish fingers treatments during frozen storage at –18^{o}C for 6 months. (on dry weight bases

Time of storage (months)	Control	Coriander oil			Cumin oil			Parsley oil		
		0.05%	0.10%	0.15%	0.05%	0.10%	0.15%	0.05%	0.10%	0.15%
0	69.66+ 0.126^{Aa}	69.45+ 0.168^{Ab}	69.18+ 0.042^{Aca}	68.64+ 0.087^{Ada}	69.48+ 0.312^{Ae}	69.15+ 0.122^{Afa}	68.68+ 0.267^{Aga}	69.48+ 0.107^{A}	69.13+ 0.458^{A}	68.63+ 0.248^{Aa}
2	68.8+ 0.053^{BAa}	68.6+ 0.175^{BAb}	68.33+ 0.167^{BAca}	67.66+ 0.036^{BAda}	68.68+ 0.118^{BAe}	68.34+ 0.059^{BAfa}	67.62+ 0.087^{BAga}	68.65+ 0.122^{BAe}	68.37+ 0.087^{BAa}	67.64+ 0.208^{BAa}
4	67.94+ 0.187^{CABa}	67.85+ 0.152^{CABb}	67.45+ 0.036^{CABc}	66.53+ 0.175^{CABda}	67.82+ 0.203^{CABea}	67.45+ 0.036^{CABfc}	66.54+ 0.191^{CABga}	67.83+ 0.116^{CAB}	67.52+ 0.218^{CAB}	66.59+ 0.308^{CABa}
6	67.19+ 0.116^{ABCa}	66.94+ 0.146^{ABCb}	66.45+ 0.114^{ABCca}	65.75+ 0.359^{ABCda}	66.95+ 0.087^{ABCe}	66.49+ 0.245^{ABCf}	65.74+ 0.091^{ABCga}	66.93+ 0.215^{ABCa}	66.46+ 0.031^{ABCa}	65.79+ 0.087^{ABCa}

^{A,B,C} The same upper letters indicated a significant difference between means according to time of storage (P<0.05). ^{a}The same lower letters indicated significant difference between means according to control and treatments (P<0.05). ^{b,c,d,e,f,g,} The same lower letters indicated significant difference between means according to other treatments (P<0.05). Data are expressed as means± standard deviation (n=3).

Table (2): Changes in crude fat contents of different fish fingers treatments during frozen storage at – 18oC for 6 months. (on dry weight bases)

Time of storage (months)	Control	Coriander oil			Cumin oil			Parsley oil		
		0.05%	0.10%	0.15%	0.05%	0.10%	0.15%	0.05%	0.10%	0.15%
0	24.45+ 0.11^{Aa}	24.65+ 0.243^{Ab}	25.14+ 0.164^{Aca}	25.45+ 0.168Ada	24.55+ 0.351^{Ae}	25.05+ 0.071^{Afa}	25.4+ 0.111^{Aga}	24.71+ 0.114^{Aa}	25.09+ 0.015^{Aa}	25.41+ 0.105^{Aa}
2	24.93+ 0.098^{BAa}	25.13+ 0.015^{BAb}	25.39+ 0.08^{BAca}	25.92+ 0.522^{Bd}	25.06+ 0.243^{BAe}	25.45+ 0.074^{Bfa}	25.98+ 0.171^{BAga}	25.08+ 0.081^{BA}	25.42+ 0.047^{BAa}	25.95+ 0.18^{BAa}
4	25.52+ 0.101^{CABa}	25.71+ 0.042^{CABb}	25.95+ 0.049^{CABca}	26.54+ 0.07^{CABda}	25.59+ 0.108^{CABe}	25.93+ 0.11^{CAfa}	26.54+ 0.171^{CABga}	25.46+ 0.072^{CABbe}	25.77+ 0.078^{CABaf}	26.51+ 0.211^{CABa}
6	26.2+ 0.06^{ABCa}	26.41+ 0.04^{ABCba}	26.56+ 0.119^{ABCca}	26.82+ 0.095^{ABda}	26.12+ 0.053^{ABCeb}	26.38+ 0.58^{ABf}	26.87+ 0.111^{ABCga}	25.8+ 0.081^{ABCabe}	26.13+ 0.071^{ABCac}	26.82+ 0.102^{ABCa}

^{A,B,C}The same upper letters indicated significant differences between means according to time of storage (P<0.05). ^{a}The same lower letters indicated significant differences between means according to control and treatments (P<0.05). ^{b,c,d,e,f,g,} The same lower letters indicated significant differences between means according to other treatments (P<0.05). Data are expressed as means± standard deviation (n=3)

Table (3) showed that there were slight significant increments $P<0.05$ of total volatile bases nitrogen production throughout frozen storage periods at -18ºC of all treatments.

The data obtained in Table (3) revealed that the increases of T.V.B.N values in the control samples during storage may be attributed to the breakdown of some protein nitrogenous substances by microbial and enzymatic activities. While addition of essential oils significantly declines the increasing in T.V.B.N during frozen storage, this indicated the importance of essential oil agents to maintain fish quality. These results are in agreement with those found by (Mohamed, 2013).

The lowest of (T.V.B.N) values during and after storage periods (6 month) were noticed in samples formulated with essential oils at level 0.1% than other treatments, followed by samples formulated with essential oils at level 0.05%. Meanwhile, the production of (T.V.B.N) was higher in the samples treated with 0.15% than other treatments.

On the other hand, during frozen storage the samples formulated with coriander oil showed lower T.V.B.N content followed by samples treated with cumin oil, and then samples formulated with parsley oil. The decreases in (T.V.B.N) contents in samples treated with coriander and cumin oils might be attributed to the antimicrobial effect of these volatile oils which caused inhibiting the growth of all microorganisms. These results are in agreement with (Nezhad *et al*., 2012) Meanwhile, the less inhibitory effect on microbial growth were noticed in parsley oil Similar results were obtained by (Elgayyar *et al*., 2001).

Generally, it could be noticed that the (T.V.B.N) concentrates in different treatments after 6 months of storage were acceptable according to (E.O.S, 1991), which reported that 30 mgN /100 g sample is the allowed upper limit of T.V.B.N as an index of fish quality during frozen storage of fish.

3.2. Trimethylamine (T.M.A.N):

Trimethylamine nitrogen has been used as a freshness index for the salt-water fish quality (Krzymien and Elias, 1990). The data presented in Table (4) indicated that there was a continuous and sharp significant increases $P<0.05$ in the amount of T.M.A.N in the control sample during frozen storage. While, T.M.A.N in samples treated with essential oil increased to a lower extent.

The increases of T.M.A.N might be due to the enzymatic breakdown of trimethylamine oxide (T.M.A-O) to T.M.A.N and formaldehyde (Simpson& Haard, 1987). These results suggested that treated samples with essential oil were effectively retarded the spoilage or preserve protein from breakdown during frozen storage.

From the same Table it could be observed that, T.M.A.N also took the same trend of T.V.B.N in different fish finger treatments during storage period. According to the (EOS, 1991), 10mg/100g sample is the allowed upper limit of T.M.A.N as an index of fish quality during storage of fish.

4- Thiobarbituric acid value (T.B.A):

Thiobarbituric acid value was used as an index for lipid oxidation taking place in fish and fish products. Such products of good quality will have a T.B.A. value less than 2.0 mg malonaldeyde/kg sample, while spoiled fish will have a T.B.A. value between 3.0 and 27.0 mg malonaldehyde/kg sample (Bonnell, 1994).

Table (5) illustrates the changes occurred in T.B.A. value of frozen fish fingers treated with the essential oils and stored at -18°C for 6 month. From the obtained results, it is clear that T.B.A. value of control sample was sharply increased during frozen storage at – 18°C. While, samples treated with essential oils gradually increased to a lower extent.

This increase in T.B.A. value could be due to the activity of lipase enzyme and/or due to further oxidation and hydrolysis of lipid which convert part of lipids into aldehydes and ketones (Ibrahim, 1980). From these results, it could be observed that, essential oils treatments may be significantly declines the increasing percentage of T.B.A. values compared with control sample. These results are in agreement with those obtained by (Ozogul *et al*., 2010).

On the other hand, treatments contained essential oils at levels 0.1% showed slight decrease in T.B.A values compared with the control. Treatments contained essential oils at level 0.05 and 0.15% .Where the higher concentration of essential oil caused to reverse effect of oxidation, which causes increasing oxidation. Similar results are obtained by (Darughe *et al*., 2012).

However, the samples formulated with coriander oil at contained lower T.B.A values compared with samples containing cumin and parsley oil. These results are in line with the findings of (Hinneburg *et al*., 2006). Generally (EOS, 1991), reported that, the allowed upper limit of T.B.A. as an index of fish quality during storage of fish is 4.5 mg malonaldehyde/kg sample.

CONCLUSIONS:

Results of the present study demonstrate the positive effects of essential oils, added with three concentrations on improving quality attributes of fish fingers during frozen storage (-18ºC) for 180 days. The best results were obtained with the concentration of essential oils at level 0.1% to improve preservation of fish fingers. The highest essential oils effect was recoded for coriander, followed by cumin, and parsley. Essential oils (EOs) are used by the food industry as natural agents for extending the shelf life of foods. A variety of plant- and spice-based antioxidants and antimicrobials is used for reduce oxidation, eliminating pathogenic bacteria, and increasing the overall quality of food products.

Table (3): Changes in total volatile bases nitrogen (mg N/100g sample) of different fish finger treatments during frozen storage at– 18^{o}C for 6 months.

Time of storage (months)	Control	Coriander oil			Cumin oil			Parsley oil		
		0.05%	0.10%	0.15%	0.05%	0.10%	0.15%	0.05%	0.10%	0.15%
0	8.568+ 0.057^{Aa}	7.932+ 0.087^{Aba}	6.888+ 0.097^{Aca}	7.728+ 0.049^{Ada}	7.56+ 0.043^{Aeab}	7.056+ 0.065^{Afac}	7.896+ 0.075^{Agad}	7.56+ 0.066^{Aabe}	7.244+ 0.048^{Aacf}	8.064+ 0.057^{Aadg}
2	14.62+ 0.094^{BAa}	10.752+ 0.046^{BAba}	10.248+ 0.088^{BAca}	11.256+ 0.059^{BAda}	10.92+ 0.087^{BAeab}	10.416+ 0.088^{BAfac}	11.424+ 0.098^{BAgad}	11.088+ 0.045^{BAabe}	10.584+ 0.086^{BAacf}	11.76+ 0.087^{BAadg}
4	21.84+ 0.056^{CABa}	14.784+ 0.070^{CABba}	13.944+ 0.066^{CABca}	15.288+ 0.086^{CABda}	14.952+ 0.054^{CABeab}	14.28+ 0.087^{CABfac}	15.456+ 0.086^{CABgad}	15.12+ 0.085^{CABabe}	14.616+ 0.077^{CABacf}	15.792+ 0.097^{CABadg}
6	28.56+ 0.084^{ABCa}	18.144+ 0.085^{ABCba}	17.472+ 0.086^{ABCca}	18.984+ 0.081^{ABCda}	18.48+ 0.083^{ABCeab}	17.64+ 0.084^{ABCfac}	19.32+ 0.057^{ABCgad}	18.816+ 0.066^{ABCabe}	17.976+ 0.087^{ABCacf}	19.656+ 0.077^{ABCadg}

[A,B,C]The same upper letters indicated significant differences between means according to time of storage (P<0.05). [a]The same lower letters indicated significant differences between means according to control and treatments (P<0.05). [b,c,d,e,f,g,] The same lower letters indicated significant differences between means according to other treatments (P<0.05). Data are expressed as means± standard deviation (n=3). * Egyptian standards (2005) for TVBN contents of fish (30mgN/100g).

Table (4): Changes in trimethylamine (mg N/100g sample) of different fish finger treatments during frozen storage at -18°C for 6 month.

Time of storage (months)	Control	Coriander oil			Cumin oil			Parsley oil		
		0.05%	0.10%	0.15%	0.05%	0.10%	0.15%	0.05%	0.10%	0.15%
0	5.376+ 0.047^{Aa}	4.368+ 0.067^{Aba}	3.864+ 0.037^{Aca}	4.704+ 0.085^{Ada}	4.536+ 0.086^{Aeab}	4.032+ 0.083^{Afac}	4.872+ 0.082^{Agad}	4.536+ 0.084^{Aabe}	4.200+ 0.066^{Aacf}	5.04+ 0.055^{Aadg}
2	7.056+ 0.043^{BAa}	5.208+ 0.065^{BAba}	4.704+ 0.087^{BAca}	5.712+ 0.098^{BAda}	5.376+ 0.054^{BAeab}	4.872+ 0.053^{BAfac}	5.88+ 0.084^{BAgad}	5.544+ 0.081^{BAabe}	5.04+ 0.085^{BAacf}	6.048+ 0.076^{BAadg}
4	8.4+ 0.077^{CABa}	6.216+ 0.082^{CABba}	5.376+ 0.087^{CABca}	6.72+ 0.064^{CABda}	6.384+ 0.077^{CABeab}	5.712+ 0.073^{CABfac}	6.888+ 0.045^{CABgad}	6.552+ 0.066^{CABabe}	6.048+ 0.027^{CABacf}	7.224+ 0.037^{CABadg}
6	9.744+ 0.067^{ABCa}	7.392+ 0.057^{ABCba}	6.72+ 0.084^{ABCca}	8.064+ 0.077^{ABCda}	7.56+ 0.085^{ABCeab}	7.056+ 0.073^{ABCfac}	8.232+ 0.069^{ABCgad}	7.896+ 0.083^{ABCabe}	7.224+ 0.088^{ABCacf}	8.568+ 0.086^{ABCadg}

^{A,B,C}The same upper letters indicated significant differences between means according to time of storage (P<0.05). ^{a} The same lower letters indicated significant differences between means according to control and treatments (P<0.05). ^{b,c,d,e,f,g,} The same lower letters indicated significant differences between means according to other treatments (P<0.05). Data are expressed as means± standard deviation (n=3). * Egyptian standards (2005) for TMAN contents of fish (10mgN/100g).

Table (5): Changes in thiobarbituric acid values (mg malonaldehyde/kg) of different fish finger treatments during frozen storage at – 18^{o}C for 6 months.

Time of storage (months)	Control	Coriander oil			Cumin oil			Parsley oil		
		0.05%	0.10%	0.15%	0.05%	0.10%	0.15%	0.05%	0.10%	0.15%
0	0.216+ 0.096^{Aa}	0.192+ 0.09^{Ab}	0.187+ 0.088^{Ac}	0.200+ 0.083^{Ad}	0.195+ 0.081^{Ae}	0.19+ 0.085^{Af}	0.203+ 0.08^{Ag}	0.198+ 0.085^{A}	0.191+ 0.088^{A}	0.205+ 0.085^{A}
2	0.933+ 0.085^{BAa}	0.347+ 0.085^{Bba}	0.304+ 0.094^{Bca}	0.363+ 0.087^{BAda}	0.431+ 0.092^{BAeab}	0.404+ 0.09^{BAfac}	0.451+ 0.089^{BAgad}	0.532+ 0.087^{BAabe}	0.515+ 0.087^{BAacf}	0.559+ 0.092^{BAadg}
4	1.885+ 0.035^{CABa}	0.653+ 0.089^{CABba}	0.607+ 0.088^{CABca}	0.698+ 0.088^{CABda}	0.757+ 0.088^{CABeab}	0.714+ 0.09^{CABfac}	0.803+ 0.087^{CABgad}	0.843+ 0.09^{CABabe}	0.812+ 0.086^{CABacf}	0.873+ 0.09^{CABadg}
6	3.086+ 0.184^{ABCa}	1.025+ 0.086^{ABCba}	0.983+ 0.09^{ABCca}	1.064+ 0.085^{ABCda}	1.134+ 0.085^{ABCeab}	1.104+ 0.086^{ABCfac}	1.173+ 0.084^{ABCgad}	1.241+ 0.086^{ABCabe}	1.203+ 0.086^{ABCacf}	1.286+ 0.093^{ABCadg}

[A,B,C]The same upper letters indicated significant differences between means according to time of storage ($P<0.05$). [a]The same lower letters indicated significant differences between means according to control and treatments ($P<0.05$). [b,c,d,e,f,g,] The same lower letters indicated significant differences between means according to other treatments ($P<0.05$). Data are expressed as means± standard deviation (n=3). * Egyptian standards (2005) for TBA values of fish (4.5 mg malonaldehyde/kg).

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الملخص العربي

تأثير الزيوت العطرية في تحسين جودة أصابع اسماك القرموط اثناء التخزين بالتجميد.

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تهدف هذه الدراسة إلى تقدير تأثيراضافة الزيوت العطرية للكزبرة ،الكمون والبقدونس الى أصابع اسماك القرموط على البروتين، الدهون و بعض خصائص الجودة أثناء التخزين بالتجميد. و قد تم اضافة هذه الزيوت لإصابع الاسماك بالتركيزات(0.05، 0.1 و 0.15٪) و تم التخزين على درجة -18°م لمدة 6 أشهر. و أوضحت الدراسة انه لا توجد تغييرات فى محتوى البروتين والدهون لجميع العينات المعاملة بالزيوت العطرية المختلفة. و اوضحت كذلك انه لا تغيرات معنويه ملحوظة فى النيتروجين الكلى المتطاير، النتروجين ثلاثى المثيل و قيمة حامض الثيوباربيتوريك فى كلا من العينة الكنترول و العينات المعاملة بالزيوت العطرية. وقد أظهرت النتائج أن زيت الكزبرة كان الأكثر فعالية فى تحسين خصائص الجودة يليه زيت الكمون في حين أعطى زيت البقدونس تأثير أقل. و بصفه عامه فان جميع المعاملات من إصابع الأسماك وكذلك العينة الكنترول كانت مقبولة فى نهاية فترة التخزين.