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USING OF GARLIC AS A NATURAL PRESERVATIVE IN MINCED CATFISH, (*CLARIAS GARIEPINUS*) DURING COLD STORAGE

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Abstract

The objective of the present study was to investigate the antioxidant as well as the antimicrobial effectiveness of two garlic preparations (fresh and powder garlic) at different concentration, in preserving minced catfish flesh during refrigerated storage at 4 °C ±1 for 12 days. Different concentrations, of fresh garlic (1; 2 and 4%) or powder garlic (0.3; 0.6 and 1.2%) was added to minced catfish mince. Physical (pH), chemical {total volatile basis nitrogen (TVBN); (TMA) trimethyle amine and (TBA) thiobarbituric acid} microbiological (total bacterial count (TBC); psychrophilic bacteria and total mold and yeast) and organoleptic evaluation were conducted during cold storage period at 4 ^{o} C**.**

The results indicated that Addition of either fresh or powder garlic significantly delayed lipid oxidation and microbial growth when compared with control and subsequently, the shelf-life of catfish mince was extended to eight days for samples treated with 1% fresh garlic and 0.3% powder garlic and ten days for samples treated with 2 and 4% fresh garlic and 0.6 and 1.2 % powder garlic as compared with two days for control samples, regarding to sensory assessment it is obvious that high concentration of garlic may not be acceptable by the panelists because of its strong flavor. So it could be concluded that addition of fresh garlic at 2% or garlic powder at 0.6 %, did not result in a strong flavor and, at the same time, they produced significant antioxidant and antimicrobial effects and extended the shelf-life of minced catfish up to ten days. Therefore, it is suggested that garlic, as a natural herb could be used to extend the shelf-life of catfish mince, providing the consumer with food containing natural additives, which might be seen more healthful than those of synthetic origin.

Key words: catfish; garlic; antioxidant; antibacterial; shelf – life.

INTRODUCTION

Consumers are concerned about the safety of synthetic food additives. This concern has led to arouse a great interest in natural additives (Pokorny, 1991). Natural agents possessing antioxidant and antimicrobial properties have the advantage of being readily accepted by consumers, as they are considered natural**,** as a consequence, natural antimicrobials are receiving a good deal of attention for a number of microorganism control issues. Reducing the need for antibiotics, controlling microbial contamination in food, improving shelf-life extension technologies to eliminate undesirable pathogens and/or delay microbial spoilage, decreasing the development of antibiotic resistance by pathogenic microorganisms or strengthening immune cells in humans are some of the benefits (Abou-taleb and Kawai, 2008) and (Fisher and Phillips, 2008).

Garlic is one of the most commonly used ingredients as a flavor enhancement. In addition to flavoring the foods, garlic is appreciated for its medicinal properties. Garlic has a wide spectrum of actions; not only antibacterial, antiviral, antifungal and antiprotozoal, but also has beneficial effects on the cardiovascular and immune systems (Harris *et al.,* 2001). During the last decade, the antimicrobial activity of garlic and garlic-derived organo sulfur compounds was widely investigated against both food spoilage bacteria and food-borne pathogens (Leuschner and Ielsch, 2003; Naidu, 2000 and Unal *et al.,* 2001). Besides its antimicrobial effect, garlic showed effective antioxidant activity in vivo and in vitro (Jackson *et al.,* 2002; Prasad and *et al.,* 1995). Garlic-rich organosulfur compounds and their precursors (allicin, diallyl sulfide and diallyl trisulfide) are believed to play a key role in these biological effects (Ankri and Mirelman, 1999 and Kumar and Berwal, 1998)

Garlic contains nearly three times as much sulfur-containing compound as onion (11–35 mg/100 g fresh weight) (Lawson, 1996).

The African catfish *(Clarias gariepinus)* is among the most widespread freshwater fishes in Africa. It inhabits tropical swamps, lakes and rivers**.** During the last decade *C. gariepinus* was even introduced in Europe, Asia and Latin America for farming purposes**.** This fish constitutes the largest group of cultured species after carp, salmonids and tilapia, and it grows well under various culture systems. Besides being an excellent candidate for aquaculture, *C. gariepinus* has also been used in fundamental research and for ecotoxicological studies Nguyen *et al.,* (1997); Nguyen and Janssen (2002) and Osman *et al.* (2008).

Nowadays, African catfish, *Clarias gariepinus*, are considered as valuable species not only in Egypt, but also in many other parts of the world because of their high growth rates, tolerance of a wide range of temperature and dissolved oxygen levels. In addition, catfish have a good palatability and therefore are preferable type of fish in many countries (Rad *et al.,* 2003; Soltan and Tharwat, 2006 and Amisah *et al.,* 2009).

African catfish *Clarias gariepinus* is a lean and highly nutritious fish that is rich in vitamins, proteins and minerals, has little or no saturated fat and is low in carbohydrates (Ersoy and Yılmaz, 2003). Catfish is generally consumed fresh and is relatively cheap. It is an important source of cheap, high-quality protein in developing countries.

The majority of locally caught karmout (catfish) is distributed in ice and mainly sold fresh. Karmout has low market value as compared to other species of fresh water fish. It has many undesirable characteristics such as rapid development of rancid off-flavour and changes in colour, (Thed *et al*., 1993).

The objective of the present study was to investigate the antioxidant as well as the antimicrobial effectiveness of two garlic preparations, (fresh and powder garlic) at various concentrations in preserving minced catfish flesh during refrigerated storage at 4 °C ±1.

MATERIALS AND METHODS

Materials.

Catfish was obtained from the production ponds of Central Laboratory for Aquaculture research and transported in ice box to the laboratory**.** Fresh garlic (FG) bulbs (*Allium sativum*) were purchased from a local market. The dry skins of the bulb were removed before use and then the cloves were peeled and crushed finely, using a kitchen hand held grater. Powder garlic was purchased from the super market at Zagazig city.

Methods.

Fish was washed carefully and manually filleted, the fillets were minced using meat mincer with 4 mm hole plate. Catfish mince was divided into 7 batches, which were contain either fresh garlic (FG) (1, 2, or 4 %), or garlic powder (GP) (0.3, 0.6, or 1.2 %), or no additives (control). Fish samples were thoroughly mixed by hand; each sample was packaged in a sterile polyethylene bag, labeled, and stored at 4°C ±1. Catfish mince was sampled at 0, 2, 4, 6, 8, 10 and 12 days of storage for chemical, physical, microbiological analysis and organoleptic evaluation. Analyses were conducted in triplicate.

Physical and Chemical Analysis.

The moisture, protein, fat and ash contents were determined according to A.O.A.C. (2002). pH value was assessed using a pH meter as described by Carballo *et al.,* (1995). The total volatile basic nitrogen and trimethylamine were determined according to the method of AMC (1979). Thiobarbituric acid was determined according to the method described by Tarladgis *et al*. (1960).

Microbiological analysis.

Total bacterial count (TBC) and psychrophilic bacteria were determined by plating on plate count agar medium and incubation at 30 °C for 3 days and 7 °C for 7 days, respectively, total molds and yeasts were enumerated on Oxytetracycline glucose yeast extracts agar (Oxoid CM 545) medium after incubation at 22 °C for 3 – 5 days as described by the (APHA, 1992).

Organoleptic evaluation.

Organoleptic evaluation and overall acceptability of catfish mince were assessed by a panel of six experienced panelists on the basis of a 10-point scale of each sample. Organoleptic characteristics studied included general appearance, odor and texture of fish. Scale employed for evaluating sensory quality developed based on the guidelines given by Lima dos Santos *et al*. (1981). The scores were given in the decreasing order scale with 10–9 for excellent, 8–7 for good, 6–5 for fair and acceptable, 4–3 for poor and 2–1 for very poor. The mean of the scores given by the panel represented the overall sensory quality (Huss, 1995). A score less than 4 indicate that the fish is rejected.

Statistical Analysis.

One-way analysis of variance (ANOVA) was used and means comparison was performed by Duncan's multiple range tests (Steel and Torrie, 1980). Statistical analysis was carried out using SPSS statistic program (Version 10.0) for Windows (SPSS Inc. Chicago, IL).

RESULTS AND DISCUSSION

Chemical composition of catfish mince.

Mean values for the proximate chemical composition of raw catfish mince was 77.03; 4.86; 17.56 and 0.55% (on wet weight basis)

respectively, for moisture, fat, protein and ash respectively, these results agree with those found by Gomma (2005).

Physical and Chemical Analysis as affected by adding different concentrations of fresh or powder garlic during cold ^{o} C ± 1.

The initial pH values were ranged from 6.59 to 6.69 for control and samples treated with different concentration of fresh or powdered garlic, The pH of fresh fish is often between 6.0 and 6.5 (Kilinc and Cakli, 2005), there was no significant effect for treatment with fresh or powder garlic on the pH of catfish mince at zero time while during refrigerated storage at 4 ^{o}C ±1 the pH values of all samples increased significantly reaching to 7.01± .02; 7.00± 02; 6.99± 0.03; 6.95±0.04; 6.94± 0.05; 6.86± 0.04 and 6.85± 0.03, at the days 4; 10,12; 12; 10; 12; and 12 of storage for control; catfish mince treated with fresh garlic (1 , 2 and 4%) and catfish mince treated with garlic powder (0.3, 0.6 and 1.2 %) respectively. This increase in the pH may be due to the enzymatic degradation of the fish muscle. This result is in agreement with Gheisari and Ranjbar (2012).

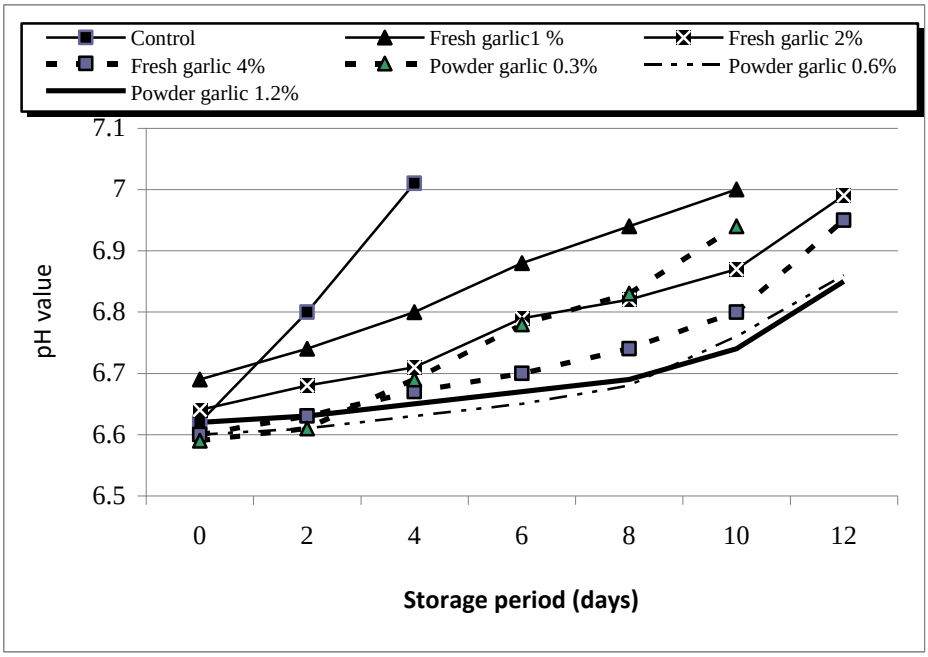

Fig. (1). Effect of different concentrations of fresh and powder garlic on the pH value of minced catfish during cold storage at 4 ^{o} C ± 1.

Total Volatile Basis Nitrogen (TVBN) is well documented as a good index of the quality of fresh or frozen fish because its increase is related to spoilage by the activity of endogenous enzymes and bacterial growth. Changes in the total volatile basis nitrogen are shown in Fig (2). As the results shows, the initial TVBN increased gradually in all samples during cold storage and differences in TVBN levels could be observed between control and treated samples. The TVBN level of the control samples reached 40.13±0.08 mg N/100 g at the fourth day of storage and this means that these samples are considered unfit to human consumption according to Dalgaard (2000) who stated that TVBN content of 25–35 mg/100 g has been established as critical limits for the acceptability of fish. These values could be varying depending on whether the fish is fresh or processed**.** Meanwhile, the TVBN levels of catfish mince samples treated with fresh garlic and powder garlic reached the upper limits at the 10th day of cold storage for samples with 1% fresh garlic and 0.3%

powder garlic and at 12th day of storage for samples with 2, 4% fresh garlic and 0.6 , 1.2% powder garlic, respectively. It is obvious that samples treated with either fresh garlic or powder garlic were significantly difference from the control sample to reach the upper limit of TVBN this phenomenon could be contributed to the antimicrobial activity of garlic and garlic-derived organosulfur compounds as reported by Leuschner and Ielsch (2003) and Unal *et al.* (2001).

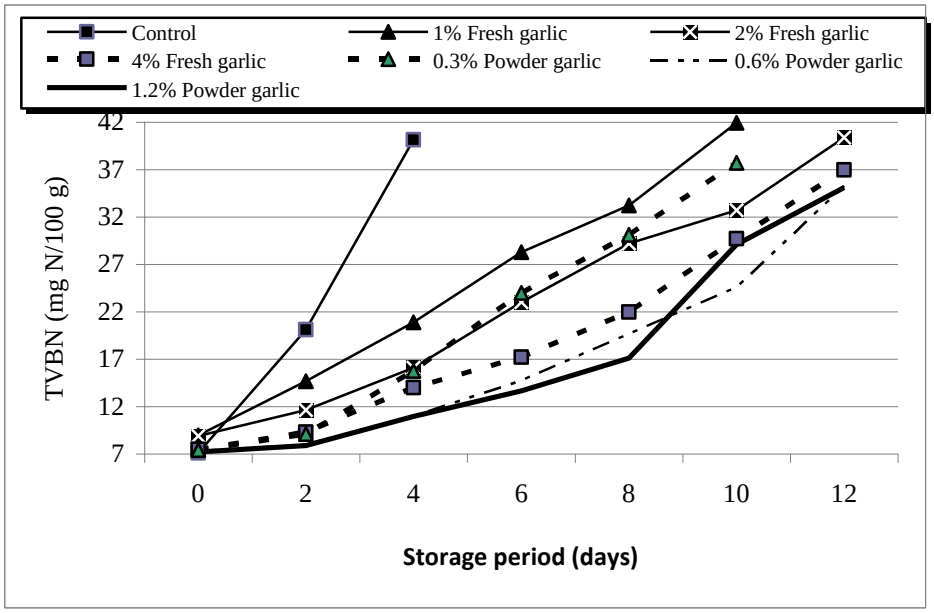

Fig. (2). Effect of different concentrations of fresh and powder garlic on the TVBN (mg N /100g) of minced catfish during cold storage at 4 ^{o} C ± 1.

Changes in trimethylamine nitrogen (TMAN) contents of catfish mince treated with different concentrations fresh; powder garlic or no treated during cold storage at 4 °C ±1 were presented in Fig. (3). Initial TMAN content (approximately 0.39 mg N/100 g fish muscle) indicates that fish samples were in good quality according to Kilinc and Cakli (2005) who stated that in fresh fish, the TMA-N value is about 1 mg/100 g. During cold storage period TMA-N of all samples under investigation was significantly increase however; TMA-N production for garlic treated

samples was significantly lower than control sample, this result could be attributed to the antimicrobial activity of garlic and garlic-derived organosulfur compounds as reported by Leuschner and Ielsch (2003) and Unal *et al.* (2001).

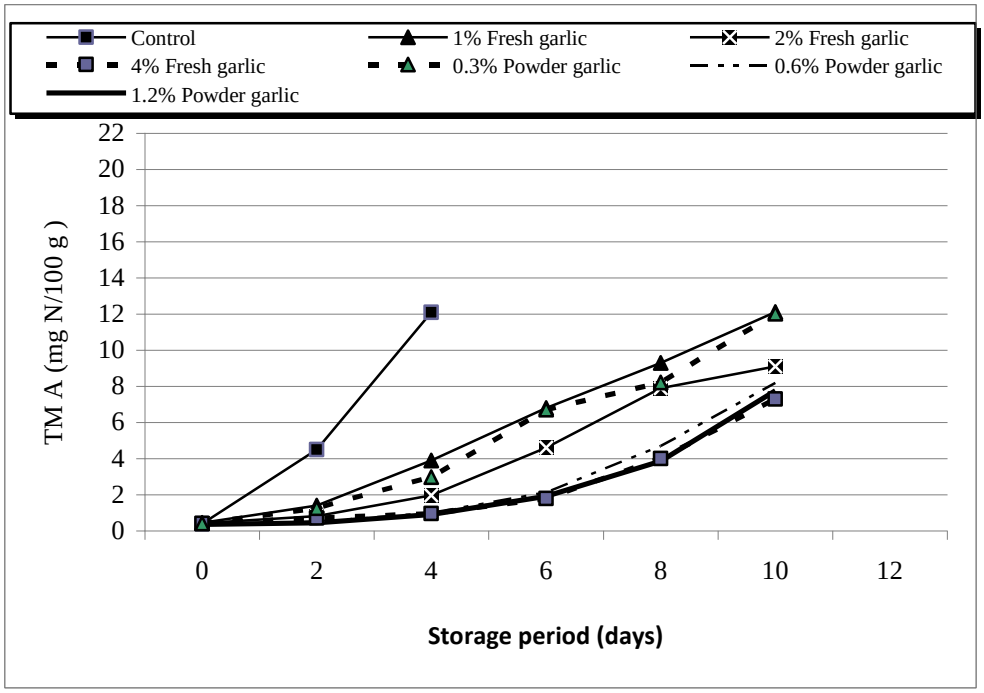

Fig. (3). Effect of different concentrations of fresh and powder garlic on the TMA (mg N /100g) of minced catfish during cold storage at 4 ^{o} C ± 1.

Fig. (4) Shows the effect of different concentrations of fresh or powder garlic on TBA values of catfish mince during cold storage at 4°C**±1**. TBA values increased over the storage time ($P < 0.05$). The initial TBA values ranged from 0.39 to 0.52 mg malonaldehyde/kg. There was a significant increase in lipid oxidation in both control and those treated with different concentrations of fresh or powder garlic. However, the increase rate of TBA values of treated fish with different concentrations of fresh or powder garlic was lower than the control throughout the

period of cold storage this may be due to the antioxidant activity of garlic, Jackson *et al.* (2002) reported that besides its antimicrobial effect, garlic showed effective antioxidant activity in vivo and in vitro. The TBA value of the control reached 5.90±0.12 mg malonaldehyde/kg at the 4th day of cold storage, While TBA values of fresh garlic treated samples (1, 2 and 4%) which were 4.92 ± 07; 4.60 ± 0.03 and 4.08 ± 0.03mg malonaldehyde/kg at the 10, 12 and 12th day of cold storage respectively, the same trend also observed with samples treated with powder garlic (0.3; 0.6 and 1.2%) respectively, which reached to 4.40 ± 0.23 ; 4.36 ± 0.21 and 3.90 ± 0.12 mg malonaldehyde/kg at 10; 12 and 12th day of storage respectively. Lipid oxidation represented by TBA was reduced with higher concentrations of each of fresh or powder garlic samples (P <0.05). This result was in accordance with that of Yang *et al.* (1993), who noted that the antioxidant activity of several compounds of garlic and garlic extracts was concentration dependent.

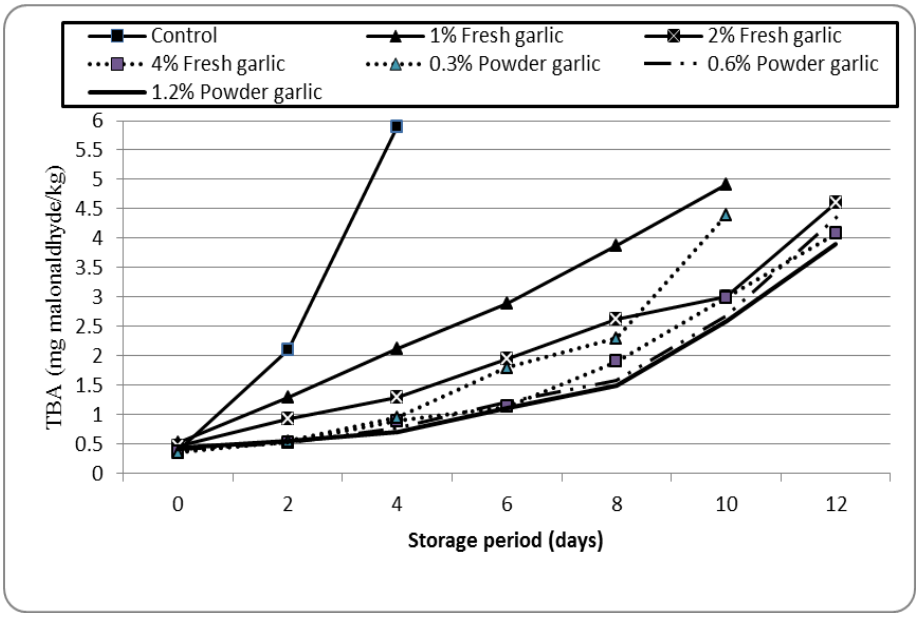

Fig. (4). Effect of different concentrations of fresh and powder garlic on the TBA (mg malonaldhyde /kg) of minced catfish during cold storage at 4 ^{o}C ± 1.

Microbiological characteristics as affected by different concentration of fresh or powder garlic during cold storage at 4 ^{o} C ± 1.

Total Bacterial count (TBC); psychrophilic bacterial count and total mold and yeast count of minced catfish either treated with different concentration of fresh garlic, powder garlic or no treated were depicted in Figs. (5; 6 and 7)**.** The initial TBC of the control sample was 4.85 ± 0.02 $\log_{10}$ cfu/g (Fig. 5). Storage considerably raised the total microbial counts in control sample which reached 9.95±0.03 $\log_{10}$ cfu/g at 4th day of cold storage. The maximum acceptable count for fresh water fish is 10^7 cfu/g (7 $\log_{10}$) as recommended by ICMSF (2011). Treating catfish mince with fresh or powder garlic at different concentrations had no significant effect on the initial TBC. Meanwhile, during storage period of treated samples the TBC were significantly increased reaching 8.62 ± 06, 7.94 ± 0.02 and 7.09 ± 0.05 $\log_{10}$ cfu/g, for catfish mince treated with 1, 2 and 4% fresh garlic respectively, at 10, 12 and 12th day of storage, respectively and were 8.13 ± 0.09, 7.82 ± 0.01 and 7.76 ± 0.03 $\log_{10}$ cfu/g for 0.3, 0.6 and 1.2 % powder garlic samples at 10, 12 and 12th day of storage, respectively which reached the upper limits for total bacterial counts at these periods according to ICMSF (2011). This result could be attributed to the antimicrobial activity of garlic and garlic-derived organosulfur compounds as reported by Leuschner and Ielsch (2003) and Unal *et al.* (2001). It could be noticed that garlic powder showed activity close to fresh garlic.

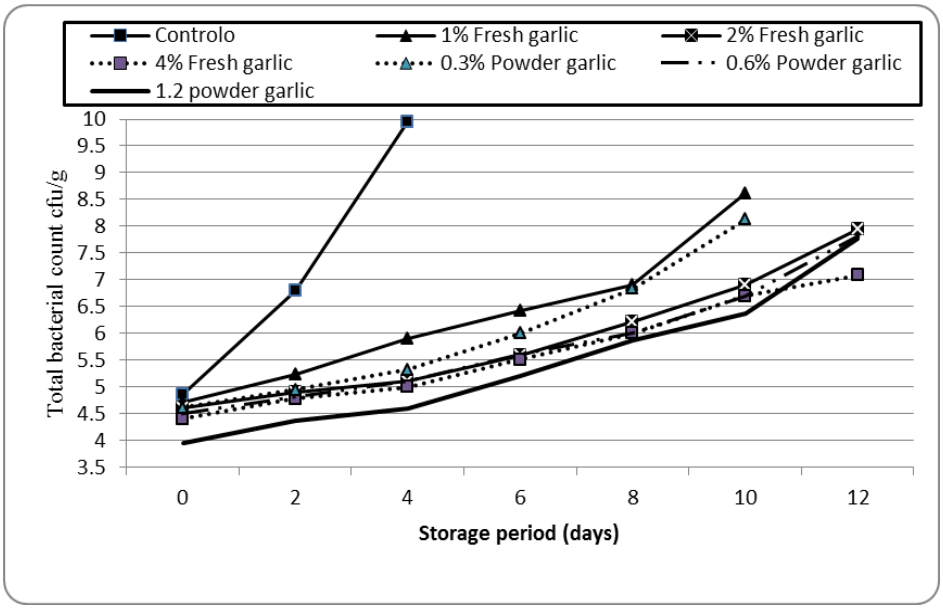

Fig. (5). Effect of different concentrations of fresh and powder garlic on the total bacterial count (TBC) cfu/g of minced catfish during cold storage at 4 ^{o}C ± 1.

The total counts of psychrophilic bacteria in catfish mince treated with different concentration of fresh garlic, powder garlic or no treatment were presented in (Fig. 6). The initial total psychrophilic count ranged from 1.90 to 2.71 $\log_{10}$ cfu/g for control and samples treated with fresh and powder garlic there was no significant differences at zero time between all treatments. There was a significant increase in total psychrophilic bacterial in both control and those treated with different concentrations of fresh or powder garlic. However, the increase rate of psychrophilic bacteria of treated fish was lower than the control throughout the period of cold storage this may be due to the antibacterial activity of garlic Leuschner and Ielsch (2003) and Unal *et al.* (2001).

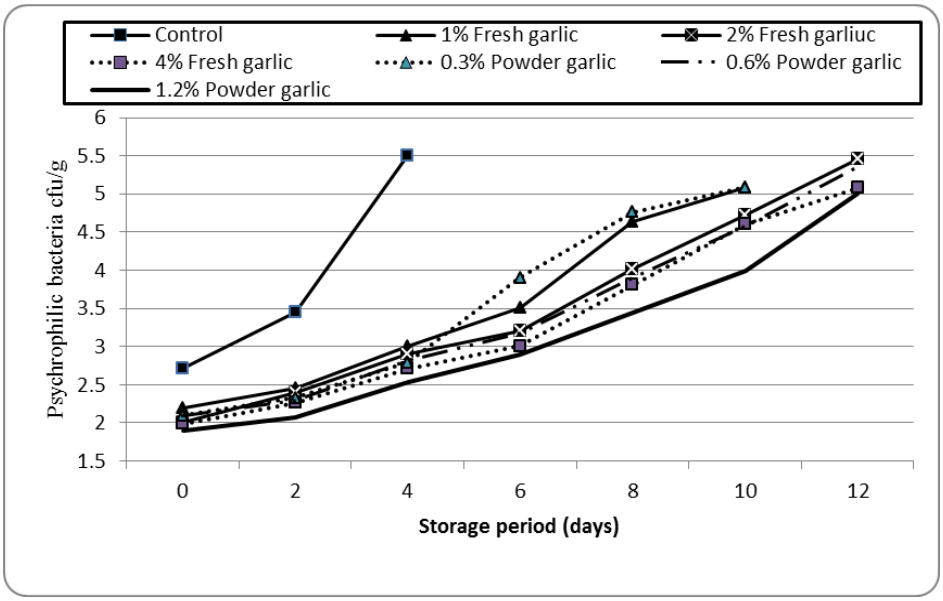

Fig (6). Effect of different concentrations of fresh and powder garlic on the Psychrophilic bacteria of minced catfish during cold storage at 4 ^{o}C ± 1.

The results in (Fig 7) showed that the total mold and yeast count at zero time were 2.30 ± .02; 1.97 ± .02; 1.96 ± .03; 1.95 ± .12; 2.00 ±0.14; 1.93 ± 0.06 and 1.92 ± 0.01 $\log_{10}$ cfu/g for control; catfish mince treated with fresh garlic (1 , 2 and 4%) and catfish mince treated with powder garlic (0.3; 0.6 and 1.2 %) respectively. Regarding to cold storage, there was a gradual increase in total mold and yeast counts reaching 4.92 ± .02 ($\log_{10}$ cfu/g) at the fourth day of storage for the control sample whereas the panelists completely rejected this sample because of the visual appearance of mold spots on its surface. It is obvious that total mold and yeast counts of catfish mince treated with fresh garlic or powder garlic during the storage period were gradually increased during cold storage which is completely rejected by the panelists because of the visual appearance of mold spots on its surface at days between 10 and 12th day of storage period, this result agree with those reported by Fani *et al.* (2007) they stated that garlic (*Allium sativum*) extract has been known to have inhibitory activity on various pathogenic bacteria, viruses and fungi. It could be noticed that garlic powder showed activity close to fresh garlic.

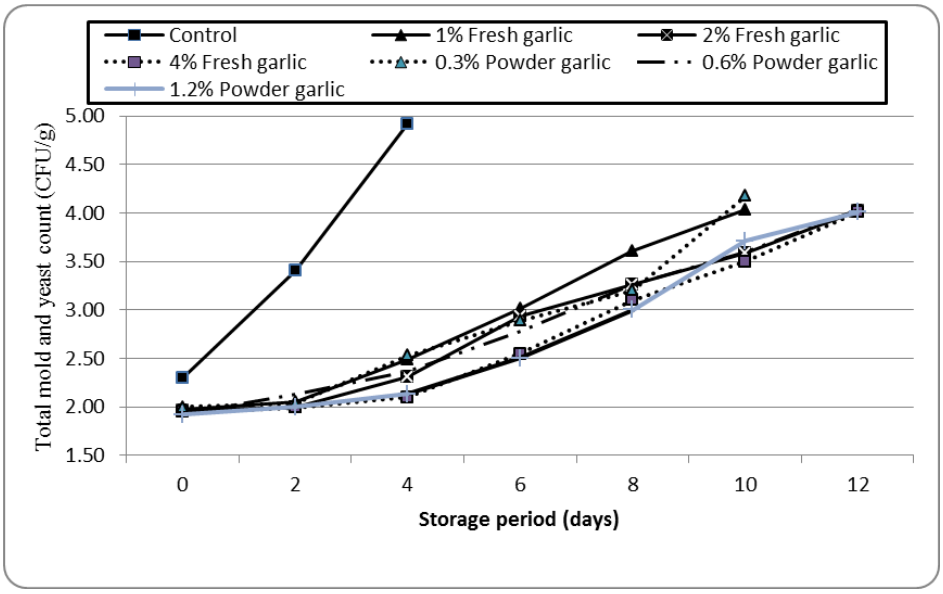

Fig (7). Effect of different concentrations of fresh and powder garlic on the Total mold and yeast count of minced catfish during cold storage at 4 ^{o}C ± 1.

Organoleptic evaluation of catfish mince as affected by different concentration of fresh garlic during cold storage at 4^{o} C ±1.

Changes in the overall freshness and acceptability scores of catfish mince treated with different concentration of fresh garlic (1, 2 and 4%) compared with control (catfish mince without any treatment) during storage at 4^{o} C ± are shown in Table (1). All the samples at zero time were in fresh manner and had high scores, which means that all samples at zero time were in excellent quality where overall acceptability for control samples at zero time was 9.57 and was slightly decreased at high concentration of fresh garlic (2 and 4%) which were 9.48 and 9.33 this may be due to the strong garlic flavor. During the storage period, there was a significant loss in the fish quality for all samples, which were rejected by the panelists at the days 4, 10, 12 and 12, for control sample and samples treated with different concentrations of fresh garlic (1, 2 and 4%) respectively.

Table (1). Sensory analysis of minced catfish during cold storage at 4 ^{o}C ± 1 as affected by treatment with different concentration of fresh garlic.

Treatments	Storag period (days) / Sensory Parabmeters	0	2	4	6	8	10	12
Control	Appearance	9.82 ±.04a	6.53 ±0.18 b	4.33 ±0.26c				
	Odour	9.80 ±0.06 a	6.20 ±0.06 b	3.73 ±0.12 c				
	Texture	9.63 ±0.09 a	5.37 ± 0.15b	3.47 ±0.12c				
	Overall acceptability	9.75	6.03	3.84 ®				
Fresh garlic 1%	Appearance	9.60 ± 0.06 a	8.9 ±0.06b	8.0 ±0.06c	6.93 ±0.09d	5.90 ±0.06e	3.90 ±0.06f	
	Odour	9.60 ±0.06a	8.90 ±0.06b	6.90 ±0.06c	6.05 ±0.03d	5.35 ±0.03e	3.97 ±0.03f	
	Texture	9.50 ±0.06a	8.92 ±0.04 b	6.85 ±0.09c	6.25 ±0.14d	5.53 ±0.09e	3.97 ±0.03f	
	Overall acceptability	9.57	8.91	7.25	6.41	5.59	3.95®	
Fresh garlic 2%	Appearance	9.50 ±0.06a	9.30 ±0.06b	8.8 2±0.04c	7.93 ±0.04d	6.75 ±0.03e	3.97 ±0.03f	4.00 ±0.06g
	Odour	9.45 ±0.09a	9.00 ±0.06b	8.53 ±0.03c	7.92 ±0.04d	6.70 ±0.06e	5.77 ±0.09f	3.97 ±0.03g
	Texture	9.50 ±0.06a	9.10 ±0.06b	8.60 ±0.06c	7.90 ±0.06d	6.73 ±0.03e	5.55 ±0.03f	3.90 ±0.06g
	Overall acceptability	9.48	9.13	8.65	7.92	6.73	5.10	3.95®
Fresh garlic 4%	Appearance	9.50 ±0.06a	8.83 ±0.09b	8.503 ±0.06c	7.60 ±0.06d	6.80 ±0.06e	5.60 ±0.06f	3.98 ±0.02g
	Odour	9.10 ±0.06a	8.92 ±0.06b	8.45 ±0.03c	7.70 ±0.06d	6.58 ±0.04e	5.60 ±0.06f	3.75 ±0.03g
	Texture	9.40 ±0.06a	8.80 ±0.03b	8.48 ±0.06c	7.90 ±0.03d	6.82 ±0.07e	5.85 ±0.03f	3.95 ±0.03g
	Overall acceptability	9.33	8.85	8.48	7.73	7.09	5.68	3.89®

Means in raws with different superscripts are significantly different ($p<0.05$). by Duncan's multiple range test.

® rejected

Changes in organoleptic properties of catfish mince samples treated with different concentration of powder garlic were tabulated in Table (2) which indicated that all samples at zero time were in good sensory quality which the overall acceptability ranged from 9.75 for control to 9.19 for catfish mince treated with 1.2% powder garlic this slightly decrease in overall acceptability for samples treated with powder garlic may be due to the strong garlic effect. During storage period all sensory characteristics and overall acceptability significantly decrease which the panelists reject them at days 10; 12 and 12 for samples treated with 0.3; 0.6 and 1.2 % powder garlic respectively, compared to 4 days for control samples.

From aforementioned data, it is obvious that fresh and powder garlic treated samples could be retaining their good quality characteristics during cold storage in terms of sensory assessment but high concentration may not be acceptable by the panelists because of its strong flavor. These conclusions were also supported by the results for chemical, microbiological quality analyses.

Table (2). Sensory analysis of minced catfish during cold storage at 4 ^{o}C ± 1 as affected by treatment with different concentration of powder garlic.

treatments	Storage period (days) / Sensory parameters	0	2	4	6	8	10	12
Control	Appearance	9.82 ±.04[a]	6.53 ±0.18 [b]	4.33 ±0.26[c]				
	Odour	9.80 ±0.06 a	6.20 ±0.06 b	3.73 ±0.12 c				
	Texture	9.63 ±0.09 a	5.37 ±0.15b	3.47 ±0.12c				
	Overall acceptability	9.75	6.03	3.84 ®				
powder garlic 0.3 %	Appearance	9.60 ±0.06a	8.90 ±0.06b	8.00 ±0.06c	6.98 ±0.08d	5.95 ±0.09e	3.90 ±0.06f	
	Odour	9.40 ±0.06a	9.00 ±0.06b	6.97 ±0.07c	6.15 ±0.03d	5.45 ±0.03e	3.65 ±0.03f	
	Texture	9.50 ±0.06a	8.92 ±0.04b	6.87 ±0.07c	6.23 ±0.14d	5.60 ±0.06e	3.75 ±0.03f	
	Overall acceptability	9.5	8.94	7.28	6.45	5.67	3.77®	
powder garlic 0.6 %	Appearance	9.50 ±0.06a	9.40 ±0.06a	8.78 ±0.07b	7.92 ±0.04c	6.78 ±0.02d	5.77 ±0.04e	4.00 ±0.06f
	Odour	9.53 ±0.03a	8.90 ±0.06b	8.60 ±0.06c	7.90 ±0.03d	6.70 ±0.06e	5.78 0.04f	3.97 ±0.03 g
	texture	9.30 ±0.06a	9.08 ±0.08b	8.70 ±0.06c	7.92 ±0.06d	6.75 ±0.03e	5.58 ±0.04f	3.93 ±0.04g
	Overall acceptability	9.44	9.13	8.69	7.91	6.74	5.71	3.97®
powder garlic 1.2 %	Appearance	9.37 ±0.12a	8.93 ±0.04b	8.53 ±0.04c	7.62 ±0.04d	6.78 ±0.02e	5.91 ±0.04f	3.88 ±0.07g
	Odour	9.04 ±0.03a	8.80 ±0.06b	7.60 ±0.06c	6.97 ±0.03d	6.40 ±0.06e	5.35 ±0.07f	3.50 ±0.06g
	texture	9.17 ±0.12a	8.82 ±0.04b	8.45 ±0.03c	7.78 ±0.02d	6.87 ±0.04e	5.60 ±0.06f	3.87 ±0.09g
	Overall acceptability	9.19	8.85	8.19	7.46	6.38	5.62	3.75®

Means in raws with different superscripts are significantly different ($p<0.05$). by Duncan's multiple range test

® rejected

CONCLUSION

This study concluded that fresh garlic and garlic powder provide antioxidant and antimicrobial benefits to catfish mince during cold storage (4^{o} C ±1) and the effects are concentration dependent. fresh and powder garlic at 4% and 1.2% respectively, demonstrated the most potent effect, but such a high concentration may not be acceptable by the panelists because of its strong flavor, however, addition of fresh garlic at 2% or garlic powder at 0.6 %, did not result in a strong flavor and, at the same time, they produced significant antioxidant and antimicrobial effects and extended the shelf-life of the product up to 10 days. Therefore, it is suggested that garlic, as a natural herb, could be used to extend the shelf-life of catfish mince, providing the consumer with food containing natural additives, which might be seen more healthful than those of synthetic origin.

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استخدام الثوم كمادة حافظه طبيعيه فى مفروم سمك القراميط أثناء التخزين بالتبريد

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الملخص العربى

تم تقدير فاعليه التأثير المضاد للاكسده و المضاد للميكروبات للثوم الطازج و مسحوق الثوم المجفف وذلك لحفظ مفروم سمك القراميط أثناء التخزين بالتبريد على ٤ °م لمدة ١٢ يوم. حيث تمت اضافه تركيزات مختلفه من الثوم الطازج (١، ٢ ، ٤%) و مسحوق الثوم (٠.٣، ٠.٦ ، ١.٢ %) لمفروم سمك القراميط و قد تم اجراء الاختبارات الفيزيائية (درجة تركيز ايون الهيدروجين) و الكيميائيه (القواعد النيتروجينيه الكليه الطيارة – ثلاثى ميثيل الامين – حمض الثيوباربيتوريك) والميكروبيولوجيه (العدد الكلى للبكتريا – البكتريا المحبه للبرودة – العدد الكلى للفطريات و الخمائر) وكذلك التقديرات الحسيه . حيث أوضحت النتائج أن اضافه كل من الثوم الطازج أو مسحوق الثوم المجفف يؤدى الى التقليل من أكسدة الدهون والنمو الميكروبى بمقارنته باللعينات الغير معامله وباتالى زيادة مدة حفظ مفروم سمك القراميط لثمانيه أيام للعينات المعامله بتركيز ١% ثوم طازج و ٠.٢ % مسحوق الثوم المجفف و عشرة أيام للعينات المعامله بتركيزات ٢ ، ٤% ثوم طازج و ٠.٦، ١.٢ % مسحوق الثوم المجفف بالمقارنه ليومان للعينات الغير معامله. و قد اوضحت للتقديرات الحسيه ان التركيزات العاليه من الثوم لم تكن مقبوله من المحكمين بسبب نكهه الثوم القويه ولذلك يمكننا التوصيه بأن اضافه الثوم الطازج بنسبه ٢% او مسحوق الثوم المجفف بنسبه ٠.٦% لا ينتج عنها نكهه غير مرغوبه و فى نفس الوقت تؤدى الى تأثيرات معنويه مضادة للاكسدة ومضادة للميكروبات بالاضافه الى اطاله مدة الحفظ لمفروم سمك القراميط حتى عشرة ايام و لذا فان الدراسه توصى باستخدام الثوم كمادة حافظه طبيعيه لاطاله مدة حفظ مفروم القراميط حيث انها اكثر أمانا من المواد الحافظه الصناعيه.