EFFICIENCY OF MINT OIL (*MENTHA PIPERITA*) FOR PROLONGING THE SHELF-LIFE OF TILAPIA (*OREOCHROMIS NILOTICUS*) FILLETS

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Abstract

The aim of the present study is direct to evaluate the impacts of mint oil (1% and 2%) on the microbiological, chemical and sensory characteristics of Tilapia (*Oreochromis niloticus*) fillets to extending their shelf life at 4±1°C. Fresh fish weighting about 250 – 275 g. was eviscerated, washed and filleted, then the fish fillets were immersed in mint oil solution [zero (control); 1% and 2%] stored at 4±1°C. The storage samples were examined periodically for microbiological; chemical and sensory properties. The results indicated that total bacterial count, total psychrophillic bacteria, total mould, *Enterococci* sp, *Staphylococci* sp and *Bacillus cereus* were $2.7x10^4$, $2.2 x10^4$, $1.0x10$, $4.8x10^2$, $5.6 x10^2$ and $3.8x10^2$ cfu/g, respectively. Moreover, the results showed that the chemical quality properties of fresh tilapia fillets such as pH, TVBN and TBA were 6.54, 8.48 mg.N/100g and 0.014 OD (Optical Density). The result showed that storage at 4°C±1 considerably increased the total microbial counts in control samples which reached around 10^7 cfu/g (rejected) after 6 days. However, the total microbial count of treated samples with 1 and 2% Mint oil reached around 10^7 cfu/g after 10 days. Furthermore, mint oil solution caused decreasing in the count pathogenic bacteria *Enterococci* sp, *Staphylococci* sp and *Bacillus cereus* initially and during the cold storage period. The result of chemical analyses of treated samples with 0 (control); 1% and 2% mint oil showed that the pH value, TVBN and TBA were increased with increasing the cold storage period. Sensory evaluation results showed that the overall- acceptability at zero time were 98.60;

94.60 and 93.0% for control; and treated with 1% and 2% mint oil, respectively. During cold storage period a significant decrement in the appearance; odor; texture and overall acceptability was recorded for all treatments under investigation as the storage period increase which the panelists rejected the samples at 6th; 10th and 10th for control; fillets immersed in 1% mint oil and fillets immersed in 2% mint oil, respectively during cold storage. Thus, mint oil can be used as a natural antimicrobial preservative and the proper good concentration was 1% mint oil which had good sensory properties and extended the shelf-life of tilabia (*Oreochromis niloticus*) fillets to 10 days as compared with 6 days for the control samples at cold storage (4±1 °c).
Key words: antimicrobial; mint oil, shelf life

INTRODUCTION

Methods to extend the shelf life of fresh fish are of great interest for a large number of participants in the fish chain, especially fish processors, all require reduction in bacterial numbers by reducing bacterial growth.

Essential oils have natural antimicrobial properties with the potential extend the shelf life of food when used alone or in combination with other preservation techniques (Mejlholm and Dalgaard, 2002 and El-Hanafy (2005)).

Mahmoud *et. al.* (2004) reported that essential oil constituents, especially carvacrol and thymol, have strong antibacterial activity against the dominant organisms comprising the microflora of carp.

Tassou *et al.* (1995) found that the Mint oil had an inhibitory effect on *Sallmonella enteritidis* and *Listeria monocytogenes* of the fish roe at 4°C and reported that the mint essential oil antibacterial action depended mainly on its concenteraton, food pH, temperature and the nature of the microorganism.

In recent studies Olivera *et al.*, (2006) and Yadegarinia *et al.*, (2006) found that Mint oil (*Mentha piperita*) was composed of 20 compounds (iso menthone, neomenthone , thymol, α- pinene, β- pinene, α- terpinene, 1,8- cineole, γ- terpinene, menth-8-ene, neoisomenthol, caryophyllene, α- terpineol, α- humulene, fenchol, germacrene D, piperitone, Δ- cadinene, α- famesene, trans-Anethole and

guaiol) and had antimicrobial activities against *Escherichia coli, Staphylococcus aureus* and *Candida albicans.*

Ozcan *et Al.* (2006) found that a series of essential oils of 11 Turkish plant spices (black thyme, cumin, fennel (sweet), laurel, marjoram, mint, oregano, pickling herb, sage, savory, and thyme) had antimicrobial effect against six Bacillus species (*Bacillus amyloliquefaciens , B. brevis , B. cereus , B. megaterium , B. subtilis* , and *B. subtilis*). All of the tested essential oils (except for cumin) showed antibacterial activity against one or more of the *Bacillus* species used in this study.

On the present study *Oreochromis niloticus* (Tilapia fish) was chosen to represent the fresh water fish because it is widely spread and preferred in Egypt on view of its special flavor. The aim of the present study is direct to evaluate the impacts of mint oil (1% and 2%) as a natural antibacterial on the microbiological ,chemical properties and organoleptic evaluation of Tilapia (*Oreochromis niloticus*) flesh to extending their shelf life at 4±°C.

MATERIAL AND METHODS

1. Material

1.1. Fish

This study was carried out in Central Laboratory for Aquaculture Research at Abbassa, Sharkia Governorate, Agriculture Research Center, Ministry of Agriculture.

Fresh *Oreochromis niloticus* fishes (250-275g) were obtained from the production ponds of Central Laboratory for Aquaculture at Abbassa, Abu-Hammad district, Sharkia Governorate, Egypt. The fish was transported directly after catching to the laboratory.

1.2. Antimicrobial

Natural antimicrohial (Mint oil) was obtained from El-Gomhoria Company in Zagazig, Sharkia Governorate, Egypt.

2- Methods

2.1. Processing methods

2.1.1. Preparation of fish fillets

The whole tilapia fish were immediately washed by running cold water to remove the surface slime, dirt, then the tilapia fish were filleted (skin was removed from the fillet) and washed again with tab water to remove any residual blood. The tilapia fillets were packaged in polyethylene bags.

2.1.2. Immersing of fish fillets in Mint Oil

Tilapia fish fillets were divided into three parts, the first was immersed in sterilized 0.2% agar solution as a control, while the second part was immersed in a sterilized 0.2% agar solution containing 1% (v/v) mint oil and the last part was immersed in a sterilized 0.2% agar solution containing 2% (v/v) mint oil in a sterilized 1–L flask at room temperature (23°C) for 15 min. After draining off the excess liquid, samples were packed in sterile polyethylene bags and stored at 4 °C±1 and periodically subjected to analysis. Sampling for analysis was stopped with the rejection of samples if one or more of the following signs had been observed: visual observation of mold spots, total bacterial count exceeded 10^7 cfu /g or off odor (Mahmoud *et al.,* 2004).

3. Analytical Methods

3.1. Microbiological examination

3.1.1. Total viable bacterial count and psychrophillic bacterial count

Total viable bacterial count and psychrophillic bacterial count per one gram fish samples were enumerated on Tryptone-glucose yeast agar medium as recommended by APHA (1985).

3.1.2. Enterococci bacteria

Enterococci bacteria were counted on Macconkey agar medium. Plates were incubated at 37°C for 24 hours Oxoid Manual, (1982).

3.1.3. Staphylococci bacteria

Staphylococci were enumerated on Staphylococci medium No.110. Incubation was carried out at 37 °C for 48 hours Oxoid Manual, (1982).

3.1.4. *Bacillus cereus*

Bacillus cereus was counted in *Bacillus cereus* selective agar. Plates were incubated at 37 ° C for 24 hours. As recommended by ISO (1987).

3.1. 5. Salmonella and Shigella

Salmonella and *Shigella* were counted using Salmonella and Shigella medium agar (S.S agar), plates were incubated at 37°C 48 hours according to the methods describe by Harrigan and McConce (1966).

3.1.6. Total mould and yeast

Mould and yeast were counted on oxytetracycline glucose yeast extract agar (Oxoid CM545) medium as described by Oxoid Manual, (1982).

3.2. Freshness Tests

3.2.1. Total Volatile Basic Nitrogen (TVBN)

TVBN was determined according to Mwansyemela (1973).

3.2.2. Thiobarbituric acid (TBA) Value

TBA Value colorimetrically measured at 538 nm using Boush & lomb colorimeter spectronic 20, according to the method described by Siu and Draper (1978).

3.2.3. PH Value

The pH was assessed using a pH meter on a homogenate consisting of 5 g. Fish flesh sample in 50 ml of distilled water as described by Carballo *et al.* (1995).

4- Sensory evaluation

Samples used in this investigation were sensory tested for their appearance; odor, texture and overall acceptability according to the DLG method (1973). Sensory evaluation of each treatment was carried out after treatments and periodically during cold storage period by a panel of 10 Judges numerical system and grading system (table 1).

Table 1. Numerical and grading systems used for sensory evaluation.

Numerical system	Order	Excellent	V. good	Good	Acceptable	Bad
	Value	8.5-10.0	7.5-8	6.5-7	5.0-6.0	4.5-5
Grading system	Grade	Fancy	V. good	Medium	Standard	Sub standard
	Least score%	90	80	70	60	50

N.B. Less than 50% score is rejected

Statistical analysis

Statistical analysis was performed using the analysis of variance (one way ANOVA and t-test) to determine differences between treatments mean at significance level of 0.05. Standard errors were also estimated. All statistics were run on the computer using the SAS program (SAS 2000).

RESULTS AND DISCUSSION

Microbial load and chemical properties of fresh *Oreochromis niloticus* flesh

The shelf-life of fresh water fish fillets is strongly influenced by the initial microbial quality. Data represented in Table (2) showed the microbial load of fresh tilapia, the results indicated that the total viable bacteria count and psychrophillic bacteria were $2.7x10^4$, $2.2x10^4$ cfu/g respectively. The initial counts of pathogenic microorganisms *Enterococci* sp, *Staphylococci* sp, *Bacillus cereus* were $4.8x10^2$, $5.6x10^2$ and $3.8x10^2$ cfu/g respectively. It could be noticed that the fish samples were found to be free from *Salmonella* and *Shigilla*. The total yeast and mould were 1.0x10 cfu /g.

The chemical properties of fresh tilapia were cited in Table (2). The result indicated that the pH-value, total volatile basic nitrogen and thiobarbutaric acid were 6.54, 8.48 mg.N/100g, and 0.014 OD respectively.

Table 2.Microbial load and chemical properties of fresh *O. niloticus* flesh

Microbiological load	
Total viable count (cfu/g)	$2.7x10^4$
Psychrophillic bacteria (cfu/g)	$2.2x10^4$
Enterococci sp (cfu/g)	$4.8x10^2$
Staphylococci sp (cfu/g)	$5.6x10^2$
Bacillus cereus (cfu/g)	$3.8x10^2$
Salmonella and Shigella (cfu/g)	ND
Total mould and yeast (cfu/g)	1x10
Chemical properties	
Total volatile base nitrogen (mg.N/100g)	8.48
Thiobarbituric acid (OD)	0.014
pH- value	6.54

OD: optical density , cfu: Colony Forming Unit, ND: not detected

Effect of Mint oil on the total viable bacterial count, Psychrophillic and total yeast and mould of *O. niloticus* flesh during cold storage

Data in Table (3) indicated that there was a significant increase in the total viable count, psychrophillic bacteria and total yeast and mould, for the control which were 2.7×10^4; 2.2×10^4 and 10 cfu/g respectively and reached to 2.2×10^7 , 3.3×10^7 and 30 cfu/g after 6 days of cold storage period. It is generally agreed that the spoilage of fresh water fish occurs within 5 - 8 days under refrigerated temperatures (Przbylski *et al.*, 1989 and Kim *et al.*, 1995). it could be noticed that treating fish samples with 1 and 2% v/v Mint oil solution caused significant reduction in the initial total viable count to 1.3×10^4; 1.1×10^3 cfu/g respectively and the Psychrophillic bacteria decreased significantly to 1.5×10^4, 1.1×10^3 cfu/g

respectively. Regarding to the effect of 1% Mint oil on the total yeast and mould decreased significantly reached to 5 cfu/g meanwhile using 2% Mint oil completely inhibited the total yeast and mould. These results might be attributed to essential oil compounds exert antimicrobial activity, first, by interfering with the phospholipids bilayer of the cell membrane, which causes an increase in permeability and loss of cellular constituents; second, by impairing a variety of enzyme systems, including those involved in the production of cellular energy and the synthesis of structural components and /or third, by inactivating or destroying genetic material as reported by Conner and Beuchat, (1984); Kim *et. al.* (1995) and Mahmoud *et. al.* (2004).

During cold storage, the total viable bacterial count for fish samples treated with 1% and 2% mint oil increased significantly with increasing the storage period and reached to 3.6×10^7 and 1.7×10^7 cfu/g respectively at the end of cold storage (10 days) respectively, the maximum acceptable count for fresh water fish is10^7 cfu/g as recommended by ICMSF. (1978).. The same trend was also obtained for psychrophillic bacteria, which increased significantly with increasing the storage period for treated samples with 1% and 2% Mint oil reached to 3.7×10^7 and 1.8×10^6 cfu/g respectively at the end of cold storage after 10 days. Moreover, the total yeast and mould count for fish samples treated with 1% Mint oil solution increased to be 15 cfu/g after 10 days compared with 5 cfu/g for zero time while it was undetected after dipping in 2% Mint oil and during cold storage period.

Table 3. Effect of mint oil on the total viable bacterial count, psychrophillic bacteria and total yeast and moulds of *O. niloticus* during cold storage 4°C±1:

Storage period / days	Total viable bacterial count			Psychrophillic bacteria			Total yeast and mould		
	control	Mint Oil 1%	Mint Oil 2%	control	Mint Oil 1%	Mint Oil 2%	control	Mint Oil 1%	Mint Oil 2%
0	$2.7x10^4$ $\pm2.3x10^3$ Aa	1.3 $x10^4$ ±1.1Ba	1.1 $x10^3$ ±5.7Ca	$2.2x10^4$ $\pm1.1x10^3$ Aa	1.5 $x10^4$ ±5.7Ba	1.1 $x10^3$ ±6.6Ca	1.0x10 ±0.00Aa	0.5x10 $\pm2.8^{Ba}$	ND $\pm0.00^{Ba}$
3	$7.2 x10^6$ ±1.4 $x10^5$ Ab	2.9 $x10^6$ ±1.1Ba	4.5 $x10^4$ ±2.3Ca	$2.8x10^6$ ±2.3 $x10^5$ Ab	1.9 $x10^6$ ±5.7Ba	2.3 $x10^4$ ±5.7Ca	1.5x10 ±2.8Aa	1x10 ±0.00Aab	ND ±0.00Bb
6	$2.2 x10^7$ ±1.7 $x10^6$ Ac ®	9.2 $x10^6$ ±1.7Ab	2.3 $x10^6$ ±1.7Bb	$3.3x10^7$ ±5.7 $x10^6$ Ac ®	8.9 $x10^6$ ±1.7Bb	3.2 $x10^5$ ±1.1Cb	3.0x10 ±5.7Aa ®	1x10 ±0.00Bab	ND ±0.00Bc
10		3.6 $x10^7$ ±5.7*c ®	1.7 $x10^7$ ±1.1*c ®		3.7 $x10^7$ ±1.7*c ®	1.8 $x10^6$ ±1.1*c ®		1.5x10 ±2.8*b ®	ND ±0.00*d ®

ND Not detected ®Rejected

A-C increasing→ a-c increasing ↑ * significant

Means carrying different superscripts are significant at ($p \leq 0.05$)

Table 4. Effect of mint oil on the *Enterococci* sp, *Staphylococci* sp, *Bacillus cereus* (cfu/g) count of *O. niloticus* flesh during cold storage at 4°C±1:

Storage period / (Days)	Enterococci			Staphylococci			*Bacillus cereus*		
	control	Mint oil 1%	Mint oil 2%	control	Mint oil 1%	Mint oil 2%	control	Mint oil 1%	Mint oil 2%
Zero time	4.8 x10 ^{2} ±3.4x 10 Aa	3.2 x10 ^{2} ±5.7 Ba	1.5 x10 ^{2} ±1.1 x10 ca	5.6 x10 ^{2} ±5.7 Aa	4.8 x10 ^{2} ±1.7x 10 Ba	2x10 ±2.8 Ca	3.8 x10 ^{2} ±2.3 x10Aa	1.5 x10 ^{2} ±2.3 x10Ba	4.5x10 ±1.7 Ca
3	4 x10 ^{4} ±1.1x 10^{3}Aa	1.6 x10 ^{3} ±3.3x 10 Ba	6.5 x10 ^{2} ±1.7 x10 Ca	4.3x10 ^{3} ±4x10 ^{2} Ab	8.2 x10 ^{2} ±5.7 Ba	4x10 ±1.2 Ca	1.1x10 ^{4} ±5.7x 10^{2}Aa	7.1 x10 ^{3} ±8.8 x10Ba	3 x10 ^{2} ±5.7 Ca
6	1.6 x10^{6} ±1.1x 10 ^{5} A b ®	2.2 x10 ^{5} ±1.1x 10^{4} Bb	2.1 x10 ^{4} ±5.7 x10 ^{2} Cb	1.2x10 ^{4} ±1.1x10 ^{3} Ac ®	8.8 x10 ^{3} ±2.3x 10 ^{2} Bb	6.6 x10 ^{2} ±5.8 Cb	3.5 x10 ^{5} ±1.1x 10 ^{4} Ab ®	8.7 x10 ^{4} ±1.1 x10 ^{3} Bb ®	7.9x10 ^{3} ±2.9x 10^{2} Cb ®
10		5.6 x10 ^{6} ±5.7x 10 ^{4} *c ®	1.1 x10 ^{5} ±5.8x10 ^{3} *c ®		5.4 x10 ^{4} ±1.4x 10 ^{3} *c ®	9.7 x10 ^{3} ±1.2x 10 ^{2} *c ®		1.6 x10 ^{5} ±5.8x 10 ^{3} *c ®	1.1 x10 ^{4} ±1 x10 ^{3} *c ®

ND Not detected ® Rejected

Means carrying different superscripts are significant at ($p \leq 0.05$)

A-C increasing→ a-c increasing ↑ * significant

Effect of mint oil on Enterococci *sp*, Staphylococci *sp* and *Bacillus cereus* of *O. niloticus* flesh during storage at 4°C±1

Data presented in Table (4) showed the count of *Enterococci* sp, *Staphylococci* sp, and *Bacillus cereus* of fish samples as affected by dipping in Mint oil. The initial *Enterococci* sp count of control fish samples was 4.8 x 10^2 cfu/g then decreased significantly after dipping in 1 and 2% mint oil solution reached to 3.2 x 10^2 and 1.5 x 10^2 cfu/g respectively and the initial of *Staphylococci* sp count of control fish was 5.6x10^2 cfu/g then decreased significantly after dipping in 1 and 2% Mint oil solution to 4.8 x 10^2 and 20 cfu/g respectively and the same in the initial count of *Bacillus cereus* for control samples was 3.8 x 10^2 cfu/g then decreased after dipping in 1 and 2% mint oil solution to 1.5 x 10^2 and 45 cfu/g respectively. Yadegarinia *et al.* (2006) found that the essential oil of (mint oil) *mentha piperita* had antimicrobial activities against *Staphylococcus aureus*. Ozcan *et. al.* (2006) described that 11 Turkish plant spices such as mint had antimicrobial effect against six Bacilli *sp* such as *Bacillus cereus*.

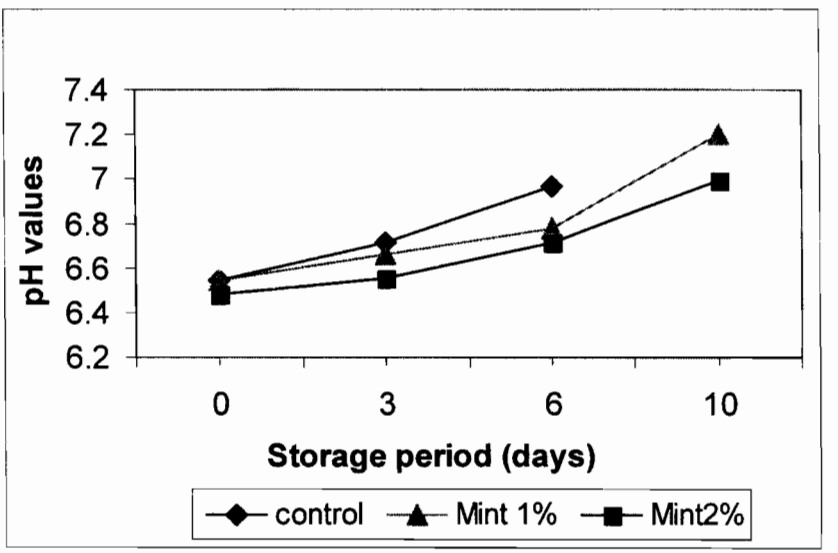
During cold storage, the count of *Enterococci* sp for treated fish samples with 1 and 2% mint oil solution increased gradually significantly from 3.2 x 10^2 and 1.5 x 10^2 cfu/g respectively at zero time reached to 5.6 x 10^6, 1.1 x 10^5 cfu/g respectively at the end of cold storage period (10 days) and the count of *Staphylococci* sp for samples immersed in 1% and 2% Mint oil solution increased significantly from 4.8 x 10^2 and, 20 cfu/g respectively at zero time reached to 5.4 x 10^4 and 9.7 x 10^3 cfu/g respectively at the end of storage (10 days). In addition, *Bacillus cereus* count of fish samples treated with 1% and 2% mint oil solution increased significantly during the cold storage from 1.5 x 10^2 and 4.5x10 cfu/g respectively at zero time and reached to 1.6 x 10^5 and 1.1 x 10^4 cfu/g respectively at the end of cold storage (10 days).

Effect of Mint oil on the chemical properties of *O. niloticus* flesh during storage at 4°C±1:

The effect of mint oil on pH value was presented in Fig (1) in which the pH value of the control sample was 6.45 at zero time while the pH of the treated

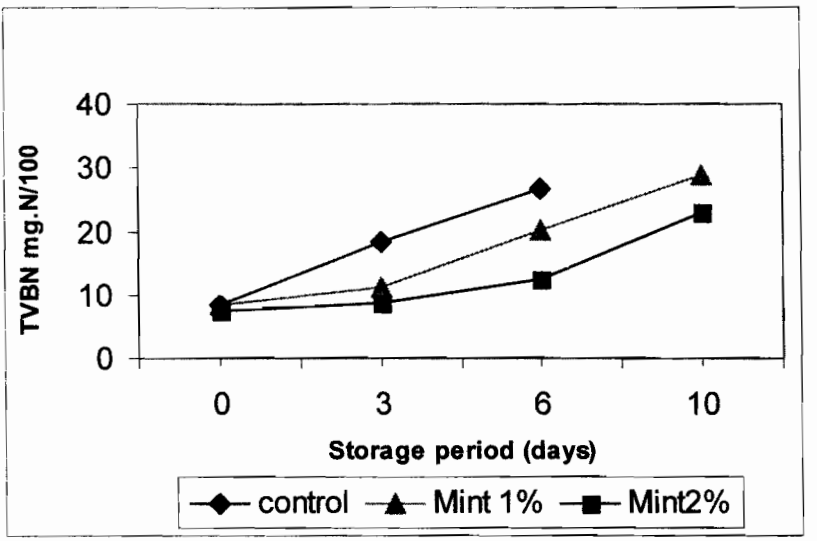
samples with 1% and 2% mint oil were 6.54 and 6.48 at zero time respectively. During cold storage period the pH value were increased significantly reached to 6.97, 7.20 and 6.99 at the end of the storage period.

Figure 1. Effect of mint oil on the pH value of O. niloticus flesh during storage at 4° C±1:



Data in Fig (2) indicated also that TVBN of the control fish samples was 8.48 mgN/100g compared with 8.25 and 7.57 mg.N/100g for fish samples treated with 1% and 2% Mint oil solution respectively. During cold storage, the amount of TVBN increased significantly in all samples which the TVBN of control samples and that affected with 1% and 2% Mint oil solution reached 26.77; 28.84 and 23.10 mg.N/100g respectively after 6, 10 and 10 days of cold storage period.

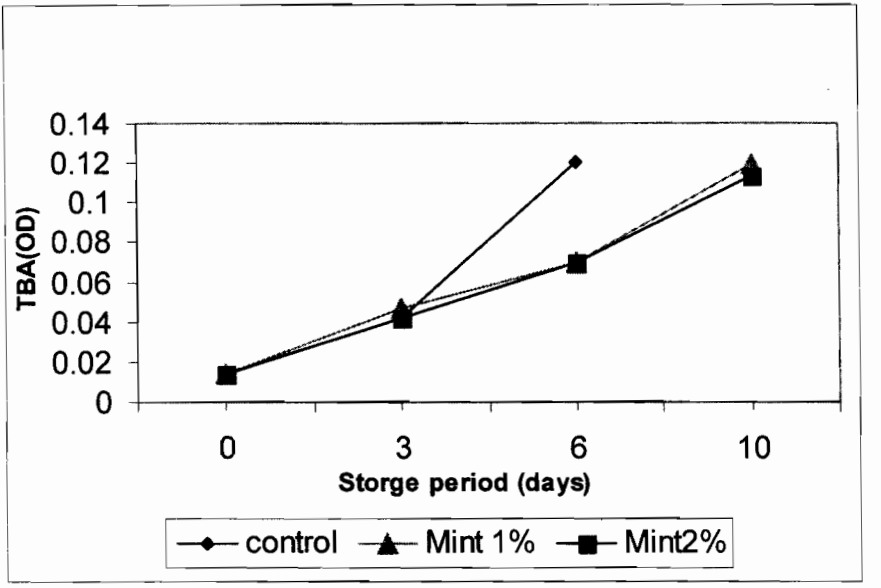
Figure 2. Effect of mint oil on TVBN (mg.N/100g) of O. niloticus flesh during storage at 4 C±1



These result agreed with Harpaz *et al.* (2003) and Mahmoud *et al.* (2004) reported that a level of 30 mg /100g TVBN is considered to be the upper limit, above which fishery products are considered unfit for human consumption.

Data illustrated in Fig (3) showed that TBA value of control fish samples was 0.014 O.D at zero time of storage period, in addition, dipping on 1% and 2% Mint oil didn't affect this value at zero time. The TBA also followed during cold storage, in the control fish samples , 1% and 2% Mint oil treatment which it increased gradually during cold storage and reached 0.120, 0.119 and 0.113 OD after 6, 10 and 10 days of cold storage respectively. These results might be attributed to the antioxidant properties of mint oil (*Mentha piperita*) (Olivera *et al*, 2006).

Figure 3. Effect of Mint oil on TBA (OD) of *O. niloticus* flesh during storage at 4 C±1:



Sensory evaluation of *O. niloticus* fillets treated with 0 (control); 1 and 2% mint oil.

Tilapia fish fillets samples were submitted to panelists immediately after the treatments and periodically during cold storage at 4 ±1 °C to evaluate the changes in the sensory characteristics i.e. appearance, texture, odor and the overall acceptability. The degrees of the panelists are recorded in Table (5). The rejection of samples was based on the visual observation of mould growth on the surface of the fish samples or off odor and flabby texture.

The results showed that the over all acceptability at zero time were 98.60; 94.60 and 93.0 % for control; fillets immersed in 1% mint oil and fillets immersed in 2% mint oil, respectively. Regarding to mint oil treatment it was obvious that the overall acceptability for samples immersed in 2% mint oil at zero time was the lowest among the treatments. During cold storage period it could be noticed that there was a significant decrement in the appearance; odor; texture and overall acceptability for all the treatments under investigation as the storage period

increase which reached to 39.60% for control fish sample at 6th day of cold storage period where it was completely rejected by the panelists, this results are in agreement with El-Hanafy (2005). Meanwhile samples treated with 1 and 2% mint oil solutions were rejected by the panelists after the 10th days of cold storage period for these treatments whereas the overall acceptability of samples treated with 1% mint oil was higher than the overall acceptability of samples treated with 2% at zero time so using 1% mint oil could be recommended to be used in extending the shelf life as a natural preservation for *O. niloticus* fillets during cold storage.

Table 5. Effect of mint oil with different concentration 0% (control); 1% and 2% on the sensory properties *O. niloticus* fillets during storage at 4 ±1 °C

Treatment	Control			1% mint oil				2 % mint oil			
Storage period (days)	0	3	6	0	3	6	10	0	3	6	10
Appearance	9.8 ±0.002^{a}	6 ±0.005^{b}	3.8 ±0.007^{c}	9.4 ±0.23^{a}	6.1 ±0.0.05^{b}	4 ±0.11^{c}	3.8 ±0.004^{c}	9.3 ±0.05^{a}	9.3 ±0.11^{a}	6.3 ±0.07^{b}	4.1 ±0.004^{c}
Odor	9.9 ±0.003^{a}	5 ±0.028^{b}	3.7 ±0.005^{c}	9.3 ±0.05^{a}	6 ±0.008^{a}	4.3 ±0.12^{b}	4.9 ±0.05^{b}	9.2 ±0.11^{a}	9.1 ±0.13^{a}	6 ±0.17^{b}	4.9 ±0.17^{c}
Texture	9.9 ±0.00^{a}	5.9 ±0.008^{b}	4.4 ±0.11^{c}	9.7 ±0.005^{a}	5.8 ±0.11^{b}	4 ±0.28^{c}	3.8 ±0.05^{c}	9.6 ±0.17^{a}	9.3 ±0.05^{a}	5.4 ±0.14^{b}	4.1 ±0.008^{c}
Overall acceptability %	98.60% ±0.19^{a}	56.30% ±0.86^{b}	39.60% ±0.18^{c} ®	94.60% ±0.76^{a}	63% ±0.86^{b}	41% ±1.7^{c}	38.30% ±0.19^{c} ®	93% ±0.66^{a}	92% ±0.00^{a}	59% ±0.86^{b}	43% ±0.96^{c} ®

Means carrying different superscripts are significant at ($p \leq 0.05$)

A-C increasing→ a-c increasing ↑ ® Rejected

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فعالية زيت النعناع فى إطالة القدرة التخزينية لشرائح سمك البلطي النيلي

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٢ المعمل المركزي لبحوث الثروة السمكية- قسم تصنيع الأسماك و مراقبة الجودة

تهدف هذه الدراسة لتقييم تأثيرات زيت النعناع (١، ٢%) على الصفات الميكروبيولوجية و الكيماوية و الحسية لسمك البلطي و ذلك لإطالة مدة حفظها، حيث تم الحصول على سمك البلطي الطازج الذى يتراوح وزنة السمكة من ٢٥-٢٧٥ جم و تمت إزالة الأحشاء و الغسيل و الحصول على الشرائح و تم غمرها فى محلول زيت النعناع بتركيزات صفر (المقارنة)، ١، ٢% و تم التخزين على درجة حرارة ٥ ± ١°م. أجريت الاختبارات الميكروبيولوجية و الكيماوية و الحسية لتقدير القدرة التخزينية للعينات. و قد أوضحت نتائج الاختبارات الميكروبيولوجية أن الأعداد الكلية للبكتريا الحية و البكتريا المحبة للبرودة و العدد الكلى للفطريات والخمائر و ميكروب *Staph.aureus; B.cereus, Streptococcus faecalis* كانت كالتالى٢,٧ × ١٠^{٤} ، ٢,٢×١٠^{٤}، ١×١٠، ٤,٨×١٠^{٢}، ٥,٦×١٠^{٢}، ٣,٨×١٠^{٢}خلية/جرام على التوالى. و قد أظهرت النتائج أن خواص الجودة الكيماوية لشرائح سمك البلطى مثل درجة تركيز ايون الهيدروجين، القواعد النيتروجينية المتطايرة الكلية، قيمة حمض الثيوباربيتيوريك كانت ٦,٥٤، ٨,٤٨ ملجم نيتروجين/١٠٠جم، ٠,٠١٤ (كثافة ضوئية) على التوالى. و قد أشارت النتائج إلى زيادة الأعداد الكلية للميكروبات الحية أثناء التخزين بالتبريد حتى وصلت العينة المقارنة إلى ١٠^{٧} خلية/جرام بعد ٦ أيام من التخزين بالتبريد و تم رفضها بينما وصلت الأعداد الكلية للميكروبات الحية للعينات المعاملة بزيت النعناع بتركيزات ١، ٢% إلى قريبا من ١٠^{٧} بعد ١٠ أيام من التخزين بالتبريد. علاوة على ذلك فقد أدت المعاملة بزيت النعناع (١، ٢ %) إلى خفض أعداد الميكروبات المرضية بعد المعاملة و أثناء التخزين بالتبريد و قد أشارت النتائج الكيماوية إلى أن أنة قد حدثت زيادة فى كل من درجة تركيز ايون الهيدروجين، القواعد النيتروجينية المتطايرة الكلية، قيمة حمض الثيوباربيتيوريك للعينات المقارنة و العينات المعاملة بزيت النعناع بتركيزات ١، ٢% أثناء التخزين بالتبريد و لكن معدل الزيادة كان اقل فى العينات المعاملة بزيت النعناع. و بالنظر للاختبارات الحسية لهذه المعاملات وجد أن القابلية العامة كانت فى بداية التحليل

٩٨,٦، ٩٤,٦، ٩٣ % لكل من عينات المقارنة و العينات المعاملة بزيت النعناع ١ ، ٢ % على التوالى. و قد لوحظ حدوث انخفاض معنوى فى كلٍ من المظهر العام و الرائحة و القوام و القابلية العامة لجميع العينات تحت الدراسة أثناء التخزين بالتبريد حيث رفض المحكمين كل من العينات المقارنة و العينات المعاملة بزيت النعناع ١ ، ٢ % بعد مرور ٦، ١٠ ، ١٠ يوم على التوالى أثناء التخزين بالتبريد.

من هذه الدراسة يمكننا التوصية بإمكانية استخدام زيت النعناع كمضاد للميكروبات و لإطالة مدة حفظ شرائح سمك البلطى النيلى حيث زادت مدة الحفظ إلى ١٠ أيام بالمقارنة بـــ ٦ أيام للعينات الغير معاملة (المقارنة) أثناء التخزين بالتبريد.