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COMPARATIVE QUALITY ASSESSMENT OF WILD AND CULTURED NILE TILAPIA (TILAPIA NILOTICUS) STORED AT 4 °C.

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SUMMARY

Sixty Nile (Tilapia nilotica)fish of about 200 – 250 gm [30 wild and 30 aquacultured] were collected alive and transported directly to the laboratory surrounded by ice bags in an ice box. Organolyptic, bacteriological and chemical examination to estimate the freshness rating and the quality parametrs were carried out directly after fish arrival to the laboratory and periodically during chilling storage at 4°C. The mean (± St. Error) Demerit scores of wild and aquacultured (Tilapia niloticus) fish were 0.0 ± 0.0 and 0.0 ± 0.0 at zero time and increased gradually during the storage time till it reaches 16.8 ±1.37 and 18.2 ±1.41 respectively at the end of the storage period. The mean (± St. Error) Aerobic bacterial counts of wild and aquacultured (Tilapia niloticus) fish were (<102 and 0.4X10^2 ±0.13X10^2) and (<3 and <3) respectively at zero time and increased gradually during the storage time till it reaches (6.8X10^5 ± 7.85X10^2 and 6.1X10^6 ±9.70 X 10^2) and (0.85 X102 ±0.12 X10^2 and 0.94X10^2 ±0.14X10^2) respectively at the end of the storage period and there was a significant difference (P> 0.05) between the means of both aerobic plate counts and coliforms counts of the wild and aquacultured (Tilapia niloticus) fish during all storage period. The mean values (± St. Error) of Total Volatile Bases - Nitrogen (mg/100g) and Thiobarbituric acid number (mg Mal./ Kg) of the wild and aquacultured (Tilapia niloticus) fish samples were (3.16 ±0.05 and 3.58 ±0.07) and (0.036 ±0.003 and 0.081±0.009) respectively at zero time and increased gradually during the storage time till it reaches (32.83 ±1.17 and 33.72 ±1.21) and (2.164 ±0.168 and 2.535 ±0.195) respectively at the end of the storage period and there was no significant difference (P> 0.05) be-

tween the means of both TVB-N and TBA of the wild and aquacultured (Tilapia niloticus) fish.

INTRODUCTION

The greatest increase in human population with the parallel shortage of animal protein allover the world directed the attention to fish as rapid and healthy compensatory source of good quality animal protein.

A variety of fish and shellfish species available for today's consumer offers generous amounts of complete protein (i.e. all essential amino acids are present at required levels), a variety of vitamins, essential minerals, and health-promoting fatty acids accompanied by low total fat and low total calories (Jobling, 2001).

Fish oils containing high amount of n-3 polyunsaturated fatty acids such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) may be responsible for preventing atherosclerosis, aging and certain forms of cancer Carroll (1992), Umemura et al. (2000), Iso et al. (2001), Siddiqui et al. (2004), Eilat-Adar et al. (2004) and Wolk et al. (2006) beside Long chain PUFA are now considered "conditionally essential" for infant growth and development, Simopoulos, (1997).

Seafood is more perishable than other high-protein products due to the high level of soluble nitrogen compounds in the tissue. Microbial activity is responsible for changes in flavor, odor, texture, and color that reflect the extent of decomposition. The numbers and types of indigenous microorganisms on freshly harvested fish, crustaceans, and mollusks depend on the geographical location of the harvest site, the season, and the method of harvest [ICMSF, 1998].

Chemical deteriorative criteria are used to determine the freshness rating of fish. TVB-N determination is of somewhat wider application and can be used for products not containing TMA, beside its determination is relatively simple, cheap and rapid. The most important cause of deterioration in the quality of fish oils, which contains high levels of PUFA, is autoxidation by atmospheric oxygen. This reaction produces flavour deterioration in food fats, destruction of vitamins, possibly loss of amino acids and potentially toxic and unsafe materials during processing and cooking. Moreover, lipid peroxidation in tissues levels causes vitamin E deficiency and damage to membranes and proteins Connell (1995).

World wide aquaculture has been growing at an average compounded rate exceeding the growth rate of capture fisheries and farmed terrestrial animals (Hector, 2005).

This study was planned to investigate if there is any difference in quality attributes between wild and aquacultured Tilapia nilotica fish during chilling at 4°C.

MATERIALS and METHODS

Sixty Nile Tilapia (Tilapia niloticus) fish of about 200- 250 gm [30 wild and 30 aquacultured] were collected alive and each sample (fish) was placed in an individual sterile plastic bag surrounded by ice bags in an ice box and transported immediately to the laboratory.

Organolyptic, bacteriological and chemical examination to estimate the freshness rating and the quality parameters were carried out directly after fish arrival to the laboratory and periodically during chilling at 4°C.

1. Organolyptic Examination:

Quality assessment scheme used to identify the quality index demerit score (Larsen et al. 1992).

2. Bacteriological analysis:

To analyze the samples the methods stated in Compendium of Methods for the Examination of Foods (Vanderzant and Splittstoesser, 1992) and Food and Drug Administration (FDA) (Anonymous, 1998) were used.

Twenty five gm from each sample were blended in a sterile stomacher bag containing 225 ml of 0.1% (wt/vol) peptone water for 2 minutes. Decimal dilutions were carried out using the same diluents.

Aerobic plate count (APC) were determined using Plate Count Agar, plates incubated at 35 oC for 24-48 h.

Coliforms were determined by separately inoculation 0.1 ml of the food homogenate and its decimal dilution into each of 3 Lauryl Sulphate Tryptose (LST) broth tubes supplemented with inverted Durhamís tubes incubated at 35°C for 48 hours. Tubes showing acid (turbidity) and gas (in the inverted Durham's tubes) were considered positive.

3- Chemical examinations:

Preparation of the test sample:

Fish sample was rendered in to a uniform mass after removal of head, fins, tail, gut and bones.

- Determination of Total Volatile Bases Nitrogen (TVB-N): Reference Procedure (EC: 1995)

The Total Volatile Bases Nitrogen (TVB-N) were extracted from a sample by a solution of 0.6M perchloric acid. after alkalinization, the extract is submitted to steam distillation and volatile base components are absorbed by an acid receiver. The TVB-N concentration is determined by titration of the absorbed bases.

- Determination of Thiobarbituric acid num-

ber (TBA): Aqueous Extraction Method [pikul et al., 1989]

TBA-RS were extracted from a sample by extracting solution of (4% perchloric acid and 0.75 ml BHT in ethanol). 5ml of the filtrate mixed with 5 ml of 0.02M TBA reagent and immersed in a boiling water bath for 1h. After cooling the optical density of sample against the blank at a wave length of 532 nm were measured and the reading were Multiplied by a constant coefficient (K factor).

RESULTS AND DISCUSSION

1. Organolyptic :

The presented data in table and fig. (1) revealed

Table (1): Mean values of Organolyptic demerit scores of the wild and aquacultured (Tilapia niloticus) fish samples during chilling at 4°C.

Time of storage in days	Wild		Aquaculture	
	Average	St. Error	Average	St. Error
0	0.0*	±0.0	0.0*	±0.0
3	2. 9*	±0.19	3.3*	±0.11
6	5.7*	±0.36	6. 2*	±0.36
9	8.4*	±0.54	8.1*	±0.49
12	10.9*	±0.72	10.6*	±0.79
15	12.5*	±0.98	12.7*	±0.87
18	14.1*	±1.07	15.4*	±0.92
21	16.8*	±1.15	18.2*	±1.14

* There was no significant difference (P> 0.05) between the means

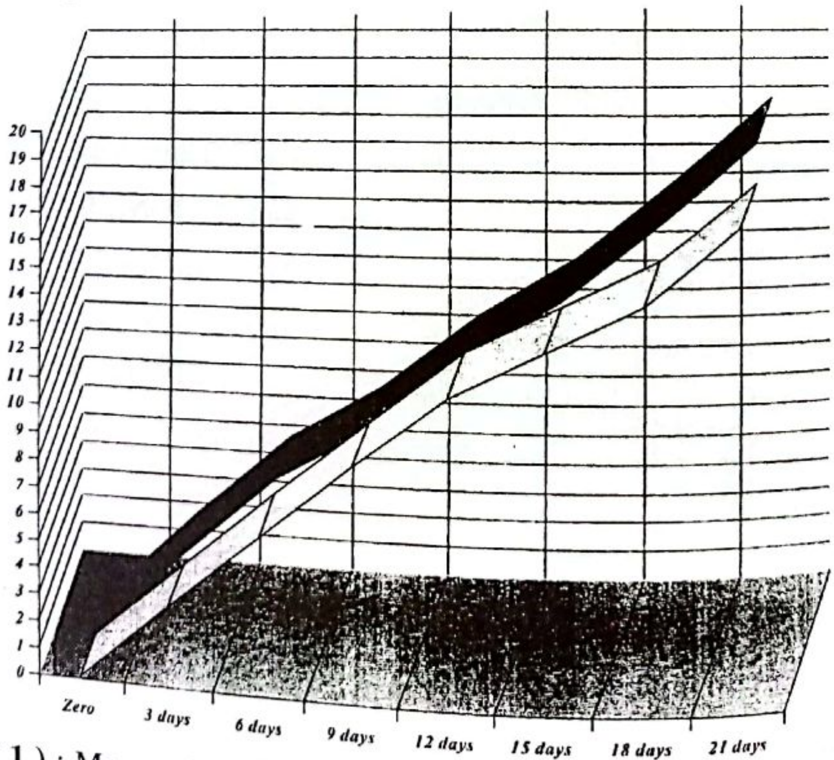

Fig. (1) : Mean values of Organolyptic demerit scores of the wild and aquacultured Tilapia niloticus fish samples during chilling at 4°C.

that the limit for acceptability of chilled cultured and wild Tilapia niloticus stored at 4°C was approximately 18 days and the mean (± St. Error) of the demerit scores of the wild and aquacultured (Tilapia niloticus) fish were 0.0 and 0.0 at zero time and increased gradually during chilling till it reaches 16.8 ±1.15 and 18.2 ±1.14 respectively at the end of the storage period when the fish became unfit for human consumption and there was no significant difference (P> 0.05) between the means of the demerit scores of the wild and aquacultured (Tilapia niloticus) fish during all chilling storage period.

Nearly same results published by Potsompong et al. (1991) which found that fresh cultured seabass fish could be kept at 0-3 degree C for 16 days; Yasmin et al. (2001) which stated that the genetically improved farmed tilapia (Tilapia niloticus) during ice storage were organoleptically in acceptable conditions for 16 days; Baixas-Nogueras et al (2002) which reported that the sensory analysis of hake stored in ice was inedible after 29 days and the figure for refrigerated hake (6-8 degrees C) being 20 days and Shahidi et al. (2002) which found that the limit for acceptability of chilled cultured and wild sea bream stored in ice was approximately 16-18 days and the texture of cultured and wild sea bream decreased throughout the storage period, and they were not significantly ($p > 0.05$) different.

Lower results showed by Antoine et al. (2004) which obvious that the sensory scores were 6 to 6.5 (10 very fresh and 1 very spoiled) for odor, appearance, texture, and color for mahi-mahi fillets On the 3rd day of refrigeration at 7°C.

2- Bacterial results:

The general microbial quality differed significantly ($P < 0.05$) among the production systems (recirculating and nonrecirculating water systems) Pullela et al. (1998).

Table (2): The means of the aerobic plate counts (cfu/g) and coliforms counts (MPN/g) of the Wild and Aquacultured Tilapianiloticus fish samples during chilling at 4°C.

Time in Days	Aerobic plate counts (cfu/g)				Coliforms counts (MPN/g)			
	Wild		Aquaculture		Wild		Aquaculture	
	Average	St. Error	Average	St. Error	Average	St. Error	Average	St. Error
0	$<10^2$*	-	$0.4X10^2$*	$\pm0.13X10^2$	<3	-	<3	-
3	$3.2X10^2$*	$\pm0.60X10^2$	$3.8X10^2$*	$\pm0.57X10^2$	<3**	-	$0.09X10^2$**	$\pm0.01X10^2$
6	$7.4X10^2$*	$\pm0.78X10^2$	$2.6X10^3$*	$\pm0.81X10^2$	$0.13X10^2$**	$\pm0.02X10^2$	$0.28X10^2$**	$\pm0.03X10^2$
9	$4.5X10^3$*	$\pm1.21X10^2$	$7.4X10^3$*	$\pm1.52X10^2$	$0.24X10^2$**	$\pm0.04X10^2$	$0.37X10^2$**	$\pm0.05X10^2$
12	$9.7X10^3$*	$\pm1.29X10^2$	$4.7X10^4$*	$\pm2.38X10^2$	$0.40X10^2$**	$\pm0.06X10^2$	$0.53X10^2$**	$\pm0.09X10^2$
15	$3.9X10^4$*	$\pm1.83X10^2$	$5.3X10^5$*	$\pm3.04X10^2$	$0.51X10^2$**	$\pm0.09X10^2$	$0.76X10^2$**	$\pm0.11X10^2$
18	$8.4X10^4$*	$\pm3.54X10^2$	$8.9X10^5$*	$\pm6.84X10^2$	$0.69X10^2$**	$\pm0.10X10^2$	$0.81X10^2$**	$\pm0.12X10^2$
21	$6.8X10^5$*	$\pm7.85X10^2$	$6.1X10^6$*	$\pm9.70X10^2$	$0.85X10^2$**	$\pm0.12X10^2$	$0.94X10^2$**	$\pm0.14X10^2$

*There was significant difference (P> 0.05) between the means

** There was significant difference (P> 0.05) between the means

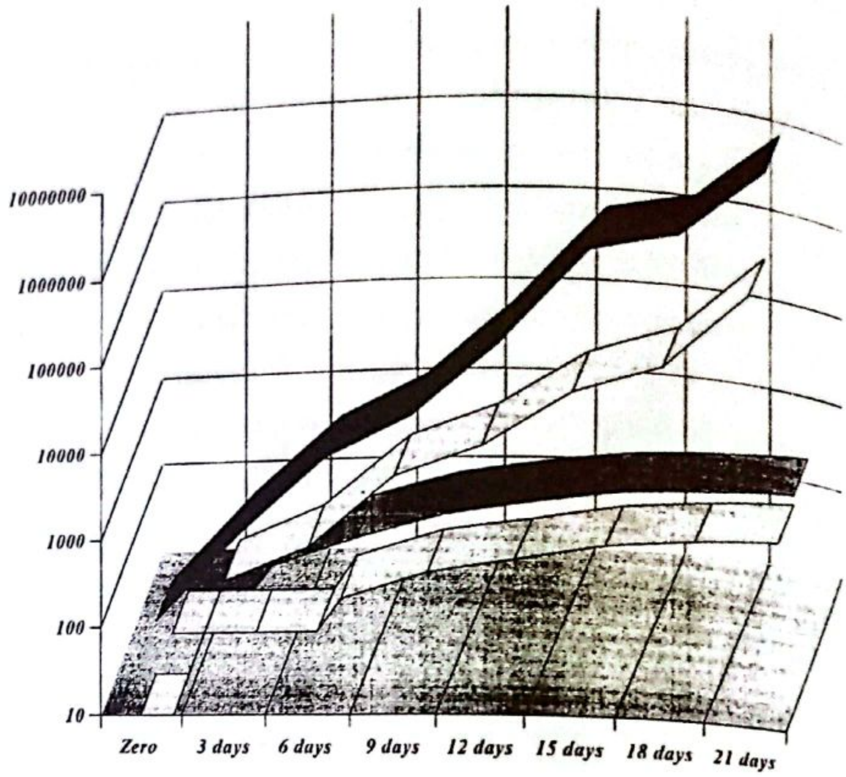

Fig. (2): The means of the aerobic plate counts (cfu/g) and coliforms counts (MPN/g) of the wild and aquacultured (Tilapia niloticus) fish samples during chilling at 4°C.

The presented data in table (2) and fig. (2) revealed that the means (± St. Error) of the aerobic plate counts (cfu/g) and coliforms counts (MPN/g) of the wild and aquacultured (Tilapia niloticus) fish were (<10^2 and $0.4X10^2 \pm 0.13X10^2$) and (<3 and <3) at zero time and these values increased gradually during the storage time till it reaches ($6.8X10^5$ $\pm 7.85X10^2$ and $6.1X10^6$ $\pm 9.70X10^2$) and ($0.85X10^2$ $\pm 0.12X10^2$ and $0.94X10^2$ $\pm 0.14X10^2$) respectively at the end of the storage period when the fish became unfit for human consumption and there was a significant difference (P> 0.05) between the means of both aerobic plate counts and coliforms counts of the wild and aquacultured (Tilapia niloticus) fish during all storage period.

Also, the showed data in table (3) and fig. (5) revealed that the means (± St. Error) of the coliforms counts (MPN/g) of the wild and aquacultured (Tilapia niloticus) fish were <3 and <3 at zero time and these values increased gradually during the storage time till it reaches $0.85X10^2$ $\pm 0.12X10^2$ and $0.94X10^2$ $\pm 0.14X10^2$ respectively at the end of the storage period when the fish became unfit for human consumption and there was a significant difference (P> 0.05) between

...e means of the coliforms counts of the wild and ...cultured (Tilapia niloticus) fish during all ...ge period.

...her results for aerobic plate count and colif...ms count reported by Yasmin et al. (2001) ...h found that the bacterial loads in muscle of ...e stored genetically improved farmed tilapia ...apia niloticus) GIFT varied from 7.6 x 10^3 ...7.1 x 10^3 cfu/g at 2nd day of storage and then ...dually increased with storage period to be...me 3.8 x 10^8cfu/g at the end of storage after 18 ...ys that exceeded the acceptable recommended limit and Arannilewa et al. (2006) who found that the total coliform count of cultured Tilapia fish (Sarotherodun galiaenus) ranges between 3.0 x 10(3)-7.5 x 10(6) for the fresh samples with increasing values as the duration of storage increases

Egyptian Standards (2005) for chilled fish recommended that that the aerobic plate counts and Coliforms counts must not exceed 10^6 and 10^2 (cfu/g) respectively.

Table (3): The means of the Total Volatile Bases - Nitrogen [(TVB-N) (mg/100g)] and Thiobarbituric acid number [(TBA) (mg Mal./ Kg)] of the Wild and Aquacultured (Tilapia niloticus) fish samples during chilling at 4°C.

Time in Days	Total Volatile Bases – Nitrogen (mg/100g)				Thiobarbituric acid No. (mg Mal./ Kg)			
	Wild		Aquaculture		Wild		Aquaculture	
	Average	St. Error	Average	St. Error	Average	St. Error	Average	St. Error
0	3.16*	±0.05	3.58*	±0.07	0.036**	±0.003	0.081**	±0.009
3	5.89*	±0.15	6.95*	±0.11	0.321**	±0.009	0.412**	±0.028
6	8.54*	±0.30	9.32*	±0.18	0.539**	±0.018	0.606**	±0.053
9	13.96*	±0.61	14.18*	±0.32	0.965**	±0.037	1.110**	±0.074
12	17.66*	±0.76	18.62*	±0.51	1.373**	±0.045	1.548**	±0.116
15	22.75*	±0.93	24.74*	±0.77	1.778**	±0.067	1.908**	±0.148
18	27.09*	±1.01	29.11*	±0.96	2.008**	±0.106	2.241**	±0.169
21	32.83*	±1.17	33.72*	±1.21	2.164**	±0.168	2.535**	±0.195

* There was no significant difference (P> 0.05) between the means

** There was no significant difference (P> 0.05) between the means

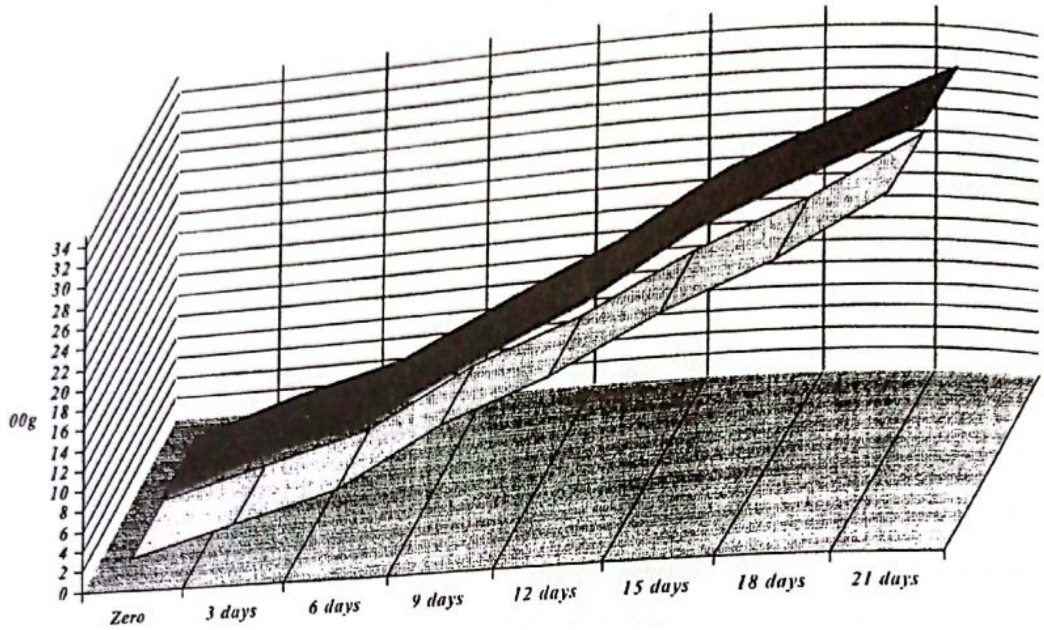

Fig (3): The means of the Total Volatile Bases - Nitrogen (mg/100g) of the wild and aquacultured Tilapia niloticus fish samples during chilling at 4°C.

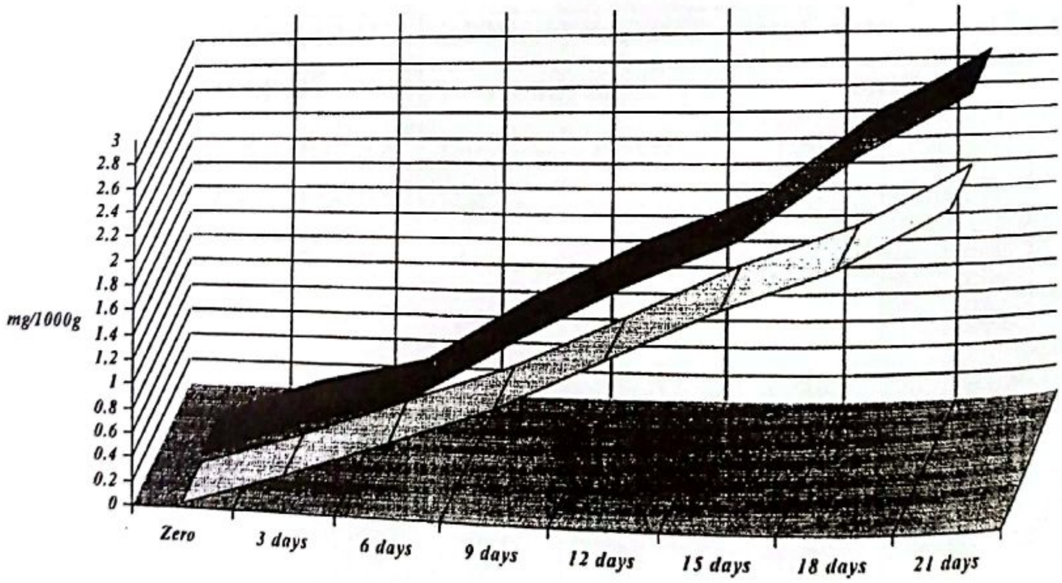

Fig (4): The means of the Thiobarbituric acid number (mg Mal./ Kg) of the wild and aquacultured Tilapia niloticus fish samples during chilling at 4°C.

3. Chemical results:

The presented data in table (2) and figures (2 and 3) revealed that the means (± St. Error) of the To- al Volatile Bases - Nitrogen (mg/100g) and Thi- obarbituric acid number) (mg Mal./ Kg) of the wild and aquacultured (Tilapia niloticus) fish were (3.16 ± 0.05 and 3.58 ± 0.07) and (0.036 ± 0.003 and 0.081 ± 0.009) at zero time and these values increased gradually during the storage time till it reaches (32.83 ±1.17 and 33.72 ±1.21) and (2.164 ±0.168 and 2.535 ±0.195) respective- ly at the end of the storage period when the fish became unfit for human consumption.

There was no significant difference (P> 0.05) be- tween the means of both total volatile bases - ni- trogen and thiobarbituric acid number of the wild and aquacultured (Tilapia niloticus) fish during all chilling storage period.

There was a significant correlation (p < 0.001) between volatile basic nitrogen and thiobarbituric acid number parameters and sensory analysis for fresh wild and aquacultured (Tilapia niloticus) fish samples throughout the storage time under refrigeration 4°C.

Nearly same results reported by Stansby (1976); Oehlenschlaeger (1989); Connell (1995); Shalaby (1990); Udgata (1992); Raharjo et al. (1993); Hassan (1998); Kassem (2001); Yasmin et al. (2001) and Baixas-Nogueras et al.(2002).

Higher results reported by (Antoine et al., 2004) which found that TVB-N reached 30 mg/100g on the 3rd day of the storage of mahi-mahi (Cryphaena hippurus) fillets at 7°C

Egyptian Standards (2005) for chilled fish recommended that that the Total Volatile Bases - Nitrogen and Thiobarbituric acid number must not exceed 30mg/100g and 4.5mg Mal/Kg respectively.

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مقارنة دلالات الجودة لأسماك البلطي النيلي الحر والمستزرعة أثناء حفظها بالتبريد

رأفت عبدا لحميد محمد البسيوني ، جيهان محمد عوف و منال محمد علي

قسم فحوص صحة الأغذية - معهد بحوث صحة الحيوان -

الدقي - جيزه

إن الزيادة الكبيرة في تعداد سكان العالم مع النقص المستمر في البروتين الحيواني أدي إلي زيادة الاهتمام بالأسماك كمصدر سريع و بديل للبروتين الحيواني عالي القيمة الغذائية وكذلك لمحتواها من الدهون الغنية بالفيتامينات والأحماض الدهنية الأساسية وكذلك أنواع متعددة من الأملاح ولذلك أصبح الإنتاج التجاري للأسماك صناعة سريعة النمو و أصبحت المزارع السمكية واسعة الانتشار في جميع أنحاء العالم.

تم جمع٦٠ سمكة من أسماك البلطي النيلي بوزن يتراوح من ٢٠٠ – ٢٥٠ جرام للسمكة [٣٠ سمكة تربية حرة و ٣٠ سمكة من أحد المزارع السمكية] وتم وضع كل سمكة داخل كيس بلاستك معقم ونقلت الى المعمل على وجه السرعة داخل ثلاجة حيث أجريت عليها الأختبارات الحسية و البكتريولوجية و الكيميائية. بلغ متوسط ±الخطأ المعياري لمجموع علامات النقص في المظاهر الحسية للأسماك الحرة و الستزرعة (صفر) عند وقت الصفر (إستلام العينات) وأن مجموع علامات النقص تتزايد بأطراد أثناء فترة الحفظ بالتبريد حتى أصبحت (١٦,٨ ± ١,٣٧ و ١٨,٢ ± ١,٤١) على الترتيب في نهاية فترة الحفظ بالتبريد بينما تزايد العد الكلى للبكتريا الهوائية و العد الأحتمالي للمجموعة القولونية للأسماك الحرة و الستزرعة خلال فترة التخزين حتى بلغ بلغ متوسط ± الخطأ المعياري لها (٦,٨٠ × $١٠^{٥}$ ± ٧,٨٥ × $١٠^{٢}$ و ٦,١٠ × $١٠^{٦}$ ± ٩,٧٠ × $١٠^{٢}$) خلية / جرام على الترتيب في نهاية فترة الحفظ بالتبريد وكان هناك فرق معنوي بين قيم نتائج الفحص البكتريولوجي بين كلا من ا لأسماك الحرة و الستزرعة طوال فترة الحفظ كما أظهرت النتائج أن متوسط ±الخطأ المعياري لنسبة النتروجين الكلى المتطاير (مجم / ١٠٠جرام) و رقم حمض الثيوباربيتيورك (مجم مالونالدهيد / ١٠٠٠ج) للأسماك الحرة و الستزرعة (٣,١٦ ± ٠,٠٥ و ٣,٨٥ ± ٠,٠٧) و (٠,٠٣٦ ± ٠,٠٠٣ و ٠,٠٨١ ± ٠,٠٠٩) عند وقت الصفر و أن دلالات الجودة الكيميائية تزايدت بأطراد أثناء فترة الحفظ بالتبريد حتى أصبحت (٣٢,٨٣ ± ١,١٧ و ٣٣,٧٢ ± ١,٢١) و (٢,١٦٤ ± ٠,١٦٨ و ٢,٥٣٥ ± ٠,١٩٥) على الترتيب في نهاية فترة الحفظ بالتبريد و لم يكن هناك فرق معنوي بين قيم نتائج الفحص الكيميائي بين كلا من ا لأسماك الحرة و الستزرعة طوال فترة الحفظ.