EFFECT OF DIETS INOCULATED WITH *LACTOBACILLUS PLANTARUM* DSMZ 20191 ON GROWTH PERFORMANCE AND QUALITY PARAMETERS OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*) FINGERLINGS

G.D.I. Hassanen[1]; D.H. Hanafy[2]; M.A. Ibrahim[3] and Salha S.M. Gaber[4]

[1]Dep. of Fisheries and Aquaculture, Faculty of Environmental Agricultural Sciences, El-Arish, Suez Canal Univ., Egypt.

[2]Fish Nutrition Lab., Aquaculture Division, and [3] Fish Processing Technology, Fisheries Division, National Institute of Oceanography and Fisheries, Cairo, Egypt.

[4]Dep. of Botany and Microbiology, Faculty of Science, Suez Univ., Egypt.

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SUMMARY

This study was designed to investigate the effect of diets inoculated with antifungal metabolites of *Lactobacillus Plantarum* DSMZ 20191 on growth performance and quality parameters of the Nile Tilapia fingerlings (*Oreochromis niloticus*). Fish diets; animal, plant and mixed were sprayed with the antifungal metabolites levels of (1, 2, 3, 4 and 5 ml/100g for each diet); packed using polyethylene bags and stored under room temperature for 90 days. Tilapia fingerlings were fed on diets inoculated with 5% of the metabolites extract for 180 days. Water quality, growth performance (GP) parameters and quality criteria of Tilapia treatments were determined. Results showed that *L. Plantarum*e specially at 5% had a high activity against molds contaminated animal fish diet, moderate in plant and low in mixed diets. Also, the growth promoters (probiotic) improved GP and reduced mortality rate, mixed and plant diets increased weight gain (WG) while animal diet gave the best protein efficiency ratio (PER).Concerning quality criteria, the metabolites of *Lb. plantarum* could slightly decrease the pH value in fish fed on treated diets compared with control sample, while total volatile bases (TVB), trimethylamine (TMA) and thiobarbituric acid (TBA) values of fish fed on mixed protein diet were lowered compared with the control sample. Finally, it could be concluded that the inoculated fish diets by metabolites improved the growth rate, chemical composition and quality criteria of Tilapia fish flesh compared with control sample and this leads to extend shelf-life for these fish.

Keywords: *Lactobacillus Plantarum, different protein sources diets, quality criteria, the Nile tilapia (Oreochromisniloticus).*

INTRODUCTION

Studies on the effect of lactic acid bacteria (LAB) on fungi are complicated by the fact that some fungi are sensitive to the normal by-products of LAB metabolism, most notably lactic and acetic acids (Bonesteroo *et al.,* 1993). *Penicillum* and *Aspergillus sp.* have been reported as spoilage organisms during storage of food and feeds and *Fusarium sp*. are often found on cereal grains, where they might produce mycotoxins (Filtenborg *et al*., 1996). Aflatoxins, part of a large group called mycotoxins, are toxic substances produced as a result of mold growing on grain, feedstuff and other foods.Mycotoxigenic fungi such as Fusarium and Penicillium are serious hazard for human health (Dalie *et al.,* 2009). Filamentous molds and yeasts are common spoilage organisms of food products as stored crops, bread and feed such as hay and silage (Bullerman, 1977), and between 5 and 10% of the world's food productions lost is due to fungal detonation (Pitt and Hocking, 1999). During the last few years there has been a growing interest in biopreservation to

prevent spoilage and extend the shelf life of foods (Stiles, 1996). Lactic acid bacteria (LAB) have a long history in preserving foods from .spoilage microorganisms, they are commonly used in food fermentation, many produce several metabolites with beneficial health effects and are generally recognized as safe. Nowadays, the application of LAB with the simultaneous control of factors that affect the fungal growth can help to minimize food spoilage (Muhialdin *et al.*, 2013). Therefore, the effect of antifungal metabolites produced by *Lactobacillus plantarum* DSMZ 20191 on molds contaminated plant, animal and mixed fish diets and its role in improving the growth performance and quality criteria of fingerlings were investigated.

MATERIALS AND METHODS

***Culture and metabolites extraction**:*

Bacterial strain (*Lactobacillus plantarum*DSMZ 20191) was obtained from Food Science Department, Faculty of Agriculture, Ain Shams University. The culture was activated on MRS broth medium. This strain was cultivated on 2000 ml of de Man, Rogosa and Sharpe (MRS) (de Man *et al.*, 1960) broth medium, divided into 20 ml flasks, each flask contained 100 ml, inoculated with 2% of the bacterial cells suspension, and then incubated at 32° C for 48h. After that, a cell free extract was obtained by centrifugation at 10.000 rpm at 4° C for 20 min., the extract was adjusted at pH 7.0 by 1M NaOH to exclude the effect of organic acids. The extract was filtrated through a 0.2 mm pore size cellulose acetate filter (Schillliner *et al.*, 1989), and dialyzed for 12 h.

Determination of the metabolites most active concentration:

The activity of the different concentration of the antifungal metabolites (1-2-3-4 and 5%) obtained from *Lb. plantarum* DSMZ 20191 were tested and used for inhibition of fungal growth in different fish diets (animal- plant and mixed). The concentration of 5% was selected for its good activity not only in preservation of the fish diets but also for its probiotic effect in promotion of growth rate and also improvement of fish quality, so fish diet supplemented with 5% of the antifungal metabolites for feeding of tilapia fingerlings during the breeding period to was used illustrate the probiotic effect and how it improve the fish health.

Experimental diets:

Three diets were formulated (Table 1); the first diet was the dietary protein derived mostly from animal sources (fish meal, meat, bone meals and poultry by product meal). The second diet was derived from plant sources (soybean meal, sunflower meal and corn gluten meal). Finally the third diet was a mixture of animal and plant. All ingredients were prepared by successive grinding through a commercial feed grinder (1/16 mesh). 5% antifungal supernatant was added to all diets. Then diets were mechanically mixed by horizontal mixer, the feed mixture was processed by California pellet meal (CPM) machine. The pellets were 2 mm diameter 4 mm length. All diets were isonitrogenous (30±0.43) and isocaloric (GE= 4102 ± 36). All diets were inoculated by different levels (1, 2, 3, 4 and 5ml/100 g diet) and then stored at 4° C. The results showed that diets treated with 5% antifungal metabolites and stored for 90 days gave the best results in inhibition of fungi and hence these diets were used for tilapia feeding. Amino acid of the experimental diets were determined by using amino acid analyzer according to methods described by Ibrahim (1974), tryptophan was determined calorimetrically in alkaline hydrolysate according to methods described by Blauth *et al.* (1963). Table (2) show the essential amino acid of the experimental diets.

Fish samples:

Juvenile Nile Tilapia (*Oreochromsniloticus*)samples **(**30 ±1.73g weight and 10 ±1.04 cm length) were obtained from fish farm of El-Kanater El-Khayria Fish Research Station belonging to the National Institute of Oceanography and Fisheries(NIOF), transferred to experimental concrete ponds and fish stock rate was 12 unit\m^3. Fish samples were acclimatized for ten days and then were fed using 3% of the body weight per day. The daily ration was offered two times a day; 9 AM and 3 PM in two equal portions. The experimental diets were fed to 3 replicates groups. Fish weights of each treatment were measured biweekly intervals.

Table (1): Formulation and proximate composition of the experimental diets containing animal and /or plant protein sources (means ± SE).

Ingredient (g/100 g)	Diet 1 Animal protein	Diet 2 Plant protein	Diet 3 Combined
Fish meal (62% CP)	9	0	5
Meat and bone meal (52% CP)	10	0	5
Soybean meal (44% CP)	0	40	17
Sunflower cake (33% CP)	0	17	10
Corn glutein meal (60% CP)	0	8	3
Poultry by product meal (60% CP)	26	0	13
Wheat bran (12.5% CP)	25.8	18	26.8
Yellow corn meal (7.5% CP)	18	6.8	10
Sunflower oil	0	5.4	2.6
Linseed oil	5.4	0	2.6
[1]Vitamins & Minerals premix	4	4	4
Lysine and Methionine	0.2	0.2	0.2
Carboxy-methyl cellulose	1.6	1.6	1.5
Total	100	100	100
Proximate analysis (on dry matter basis)			
Dry matter (DM)	96.77±0.39	97.08±0.69	96.55±0.57
Crude protein (CP)	30.88±0.77	30.30±0.88	30.11±0.67
Ether extract (EE)	6.90±0.55	6.44±0.57	6.88±0.64
Ash content	8.93±0.17	9.30±0.15	9.61±0.11
Crude fiber	9.69±0.11	10.09±0.32	9.91±0.21
[2]NFE	43.60±0.40	43.87±0.48	43.49±0.41
[3]Gross energy (Kcal/kg)	4140.77	4075.33	4090.98
P/E ratio	74.58	74.35	736

Table (2): Concentrations of essential amino acids (% of dietary protein) in diets containing animal and /or plant protein sources.

Amino acids	Requirements	Diet 1 Animal protein	Diet 2 Plant protein	Diet 3 Combined
Arginine	4.2(1.18)	5.78	6.838	6.438
Histidine	1.72(0.48)	2.303	2.524	2.437
Isoleucine	3.11(0.87)	3.560	4.244	3.921
Leucine	3.39(0.95)	7.430	7.522	7.827
Lysine	5.12(1.43)	6.026	6.584	5.491
Methionine	2.68(0.75)	2.815	1.047	3.207
Cystine	0.53	2.475	1.751	1.491
Phynile alanine	3.75(1.05)	3.887	4.846	4.327
Tyrosine	1.79	2.838	3.077	2.961
Threonine	3.75 (1.05)	2.885	3.675	3.291
Tryptophan	1.00 (0.28)	1.073	1.901	1.621
Valine	2.80	4.669	4.984	4.872
Total	32.84	45.741	48.993	47.884

Santiago & Lovel (1988).

Analytical methods:

Water quality parameters:

Physico–chemical characteristics (temperature, pH value, ammonia, nitrate and nitrite) of ponds water were determined as mentioned by APHA (1992).

Table (3): Physico-Chemical characteristics of water quality parameters during the experimental period (6 months) (Means ± SE).

Parameters	Diet 1 Animal protein	Diet 2 Plant protein	Diet 3 Combined
Water Temperature (ºC)	25.10±1.27	25.81±2.11	25.62±1.59
pH value	7.52± 0.18	7.32±0.21	7.68±0.09
Dissolved oxygen (DO) mg/L.	6.68±1.33	6.81±1.17	6.77±1.54
Ammonium (NH_3) mg /L .	0.30 ±0.05	0.27±0.07	0.29±0.02
Nitrite (NO_2) mg./L	0.33±0.01	0.37±0.06	0.39±0.04
Nitrate (No_3) mg/L. .	0.36±0.03	0.31±0.06	0.34±0.05

** All values are mean of triplicate feeding groups.*

Growth performance parameters:

Live weight, gain in live weight, specific growth rate, feed consumption, feed conversion, protein efficiency ratio (PER), protein retained and lipid retained were collected and calculated throughout the whole experimental period (180 days).Moisture, crude protein (N×6.25), fat, ash and fiber content were determined according to (AOAC, 2000) for diets and fish samples.

Quality criteria:

The pH value, total volatile bases nitrogen (TVB-N) content and thiobarbituric acid (TBA) value for adult fish samples were measured as the methods described by Pearson (1991), while trimethylamine nitrogen (TMA-N) content was determined according to the procedures of AOAC (2000).

Statistical analysis:

Analysis of variance, Duncan test and the estimation of least significant differences were carried out according to Snedecor and Cochran (1974).

RESULTS AND DISCUSSION

Figure (1) illustrates the most active metabolites concentrations of the lb. platarum DSMZ 20191 during different storage periods at dilution of 10-2 (from the results of the previous trial No. 1; under press). Fig. 1 illustrated that, concentration of 5% of the antifungal metabolites obtained from Lb. plantarum DSMZ 20191 gave the most active results for inhibition of fungal growth at concentration of 10-2 in different fish diets during 90 days of storage. In animal protein source (fish meal)the antifungal activity recorded 100% which means complete inhibition for fungal growth in fish diet during 60 days of storage and then, the activity lowered to 92% at 75 days, then 88% at 90 days. For plant protein source the antifungal activity was 85% at zero time, then rose to 89% during 30 days and gradually lowered to (84, 81, 78, and 75%) at the end of the storage period. Finally in mixed protein sources the activity recorded 88% at zero time, then up to 90% after that down to 21% after 45 days and again lowered to 80 and 74% at 90 days of storage. Due to these results we only used fish diet inoculated with 5% of the antifungal metabolites of Lb. plantarum DSMZ 20191 in trial 2 for feeding of Tilapiafingerlings during the whole breeding period to demonstrate the probiotic effect on growth rate of fingerlings and also its effect on chemical composition of fish muscles.Lactic acid bacteria (LAB) are known to produce different antimicrobial compounds and are important in the biopreservation of food and feed (Messens and de Vuyst, 2002) and (lindgren, 1990). Lavermicocca et al. (2000) reported production of the antifungal compounds phenyllactic acid and 4-hydroxyphenyllactic acid by sourdough *Lactobacillus plantarum* strain. According to (Sib et al., 2013), administration of Lb. plantarum VSG3 for 60 days of feeding had significant effects ($P \leq 0.05$) on the specific growth rate (SGR) and feed utilization efficiency of fish. Dietary administration of Lb. plantarum significantly increased the serum lysozyme and alternative complement pathway (ACP) activities, phagocytosis and also increased survival rate (77.7).

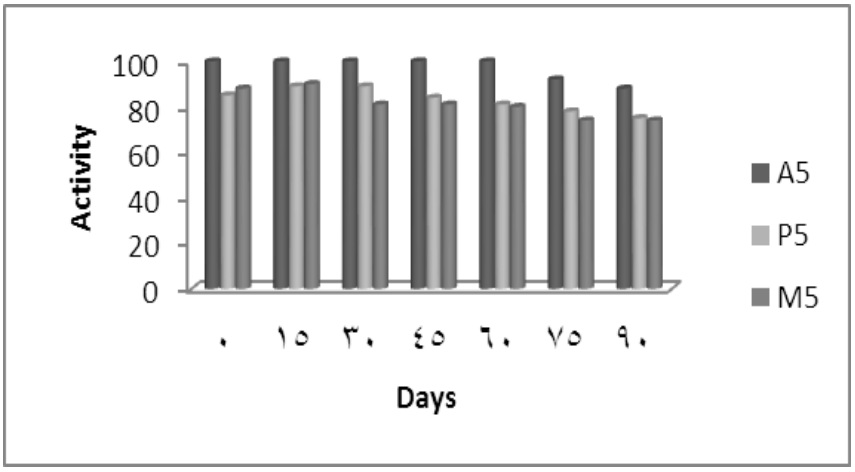

Fig. (1): The activity\ days of the antifungal metabolites (1, 2, 3, 4 and 5%) obtained from *Lb. plantarum* DSMZ 20191. Where: A5: Animal fish diet (5% of antifungal metabolites), P5: Plant diet (5%) and M5: Mixed fish diet (5%).

Table (4) shows the average of feed efficiency for investigated diets. The average of feed efficiency (FE) for group 1, 2 and 3 were 0.44, 0.37 and 0.42, respectively. The analysis of variance of data showed that differences in this trait among the groups were significant for the favor or animal protein diet (diet 1) and combined protein (diet 3). These results may indicate that diet containing animal protein gave the best (FE) value during the experimental period. FE for the fish fed plant protein diet (diet 2) and combined protein diets (3) was significantly lower than that of in animal protein diet. However, the diet containing combined protein sources was better than diet containing plant protein. The palatability of tested diet based on feed consumption and feed conversion ratio, was of interest, since a low intake of feed containing high levels of some vegetable foodstuff has been reported by several authors (Robaina *et al*., 1995 and Roselund, 1986). This observation seems to be associated with high sensitivity of fish to the organoleptic properties of their diet (Bone and Marshall, 1982) in juvenile Chinook salmon. Extremely low feed intake levels of diet 2 (Plant protein only) was observed in this study which containing 40% soybean and 17% sunflower cake and 8% corn gluten meal were related to the poor palatability of these products. These results are in agreement with those findings by Hajen *et al*. (1993) and Hassanen (1998). The poor palatability of soybean meal has also been reported in other fish species (Fowler, 1980). Diet containing animal protein (Fish meal and meat and bone meal) was likely superior because of high digestibility and well-balanced indispensable amino acid composition.

The result of the feed intake and feed conversion ratio that enhanced is due to probiotic effect of LAB added to the diets by concentration of 5% was better with blackberries protein diet containing mixed (animal + vegetable), followed by the diet containing animal protein and then a bush vegetable protein and that during the period of the experiment (180 days). These results are in agreement with that reported by Abdel-Hakim *et al*. (2006) who showed that the Nile tilapia diets supplemented with Biogen, Biovit or Bioaction improved feed intake and feed conversion ratio compared with control diet. The results showed also that addition of growth promoters, the antifungal metabolites to the diet which contained a mixture of protein sources (animal + plant) gave 100% survival rate for the fish, while it was 94.44% of diet contained animal protein sources however; it was 91.7% of plant diet (Table 4). High survival rate is due to use of growth promoters (probiotic) that lead to produce various beneficial effects as enhancement of growth performance and reduction in mortality as reported by Chang and Liu (2002); Abo-State (2005); Keysami *et al*. (2007); Eid and Mohamed (2008). With respect to total weight gain and SGR (%/day), the highest gain in weight was observed in fish fed combined protein diet (diet 3 – Table 4) being significantly higher than that of fish fed animal protein was obtained by the group fed on plant protein diet (diet 2). Protein utilization parameter calculated as protein efficiency ratio (PER) obtained on testing the different diets (Table4), revealed greater value for diet containing animal protein followed by the combined protein diet and then followed by the diet containing plant protein. As show in Table (4) results of energy intake have almost the same trends as in feed intake. The imbalance between isoleucine and leucine in the plant protein diet (Table 2) was more likely to be responsible

for the slightly lower protein utilization of plant protein than animal or/and combined protein diets. Hassanen (1997) showed that a mixture of protein sources with an amino acid profile was similar to that of requirement significantly improved the growth of gilthead sea bream (*S. aurata*). In general, growth performance parameters of Nile tilapia (*O. nilioticus*) were improved by supplementing the fingerlings diets with probiotic incorporated at the higher levels. These results are in accordance with findings by Jena *et al*. (1996) who indicated that Catla and Rohu fry fed on the experimental diet with a probiotic supplement showed significant increases in length and weight at different stages of the experiment compared with those fed on the control diet. In this connection, Bogut *et al*. (1998) studied the influence of probiotic (*Streptococcus faecium*M74) on growth and content of intestinal microflora in carp (*Cyprinuscarpio*). Fish was fed on subjected to two experimental diets either containing zero (control) or 1gm probiotic/100 kg feed from July to August, 1996. The experimental group had higher average individual weight by (12.42%), better feed conversion (by 17.37%) and higher specific growth rate (by 10.20%) compared to the control group. Moreover, *E. coli* was completely eliminated from the intestine after 14 days of probiotic feeding.

Table (4): Effect of feeding animal and /or plant protein sources on growth performance and feed utilization efficiency.

Items	Diet 1 Animal protein	Diet 2 Plant protein	Diet 3 Combined
Initial bodyweight (g)	30.29 ± 1.67	30.02±1.84	30,12±1.69
Initial body length(cm)	10.91±0.58	11.17±0.51	11.04±0.73
Final body weight (g)	217.85^{b}±4.7	183.47^{c}±4.3	234.45^{a}±3.7
Final body length (cm)	21.42±0.66	19.39±0.36	22.53±0.45
Weight gain (g/fish)[1]	187.56^{b}±4.11	153.45^{c}±3.98	204.33^{a}±4.07
Daily gain (g/fish/day)	1.36±0.07	1.11±0.05	1.48±0.08
Specific growth rate(SGR%/day)	1.06±0.02	1.19±0.02	1.24±0.03
Condition factor (K)	3.49±0.21	3.20±0.13	3.68±0.16
Feed conversion ratio (FCR)	2.21±0.07	2.52±0.09	2.05±0.06
Survival rate (%)	94.44	91.7	100
Feed consumption(Fc)	428.15±2.14	417.15±2.22	490.09±2.35
Protein efficiency ratio(PER)	1.42±1.8	1.21±1.5	1.38±1.7
Experimental period (days)	180	180	180
Protein intake (g)	11.024±0.25	10.532±0.31	12.317±0.28
Energy intake (Kcal/g)	1478.25	1416.58	1670.76

**All values are mean of triplicate feeding groups.*

1-Weight gain (%) = Final weight ⁄ Initial weight x 100; 2- (%/d) = (InW2 - InW1/ T2 -T1) × 100; 3-Food conversion ratio = food fed (g)/live weight gain (g); 4-Protein efficiency ratio = live weight gain (g)/protein fed (g); 5-Condition factor = W_2/ L^3

The results of Table (5) showed that the whole fishes were characterized by high moisture ranged between 24.97–25.13% in all treatments compared with untreated sample (25.43%). Total crude protein ranged from 64.11% to 65.11%, while it was 81.23% control sample. Therefore, it could be found that the effect of different protein sources (animal, plant and combined protein) diets didn't markedly affect tilapia flesh. High protein for fish fed on combined protein diet (diet 3), probably increased the greater weight gain compared to the other protein sources. Lipid ranged between 17.82-18.15% of the three treatments, while it was 18.48% in control sample. Ash content ranged 17.02% to 17.74% compared with 18.24% of control. Based on our results, it could be found that the effect of different protein sources in the diets didn`t appear on the chemical composition of tilapia flesh. The present results are localized with those finding by several studies (Tongnuanchan *et al*., 2011; Al-Souti *et al*., 2012 and Abdallah, 2013). In addition, results showed that LAB recorded superior dry matter and protein content in fish muscle which fed on diets containing combined protein sources compared with groups fed on plant and animal protein. As presented in the same Table (table 5) LAB increased lipid content in the fish muscle which fed on diet containing plant protein only. On the other hand, LAB decreased ash content in muscles of fish fed on animal protein diets. In this respect Abo State (2005) reported that incorporation of Biogen probiotic in diets of Nile tilapia (*O. niloticus*) at 2g/Kg diet increased crude protein content in whole bodies while decreased lipid. The same author added that lecture probiotic insignificantly increased crude protein content in fish bodies when fed to Tilapia fingerlings at

1g/Kg diet level, meanwhile, this level decreased lipid content and increased ash contents significantly ($P \leq 0.05$). Abdel Hamid *et al*. (2000) showed that the highest ash content of fish carcass resulted from feeding dry yeasture and lactosac. They added that the highest lipid content (31.99%) was found in fish fed the diet with yeasture at 2g/Kg.

Table (5): Composition of the whole fish feed on the experimental diets (g/100 dry weight).

Parameters	Untreated Diet (Control)	Diet 1 Animal protein	Diet 2 Plant protein	Diet 3 Combined
Dry matter %	25.43±0.65	25.02±0.39	25.13±0.69	24.97±0.55
Crude protein (CP) %	63.23±0.37	64.73±0.77	64.11±0.88	65.11±0.58
Ether extract (EE) %	18.48±0.45	17.90±0.55	18.15±0.57	17.82±0.48
Ash content %	18.29±0.11	17.37±0.17	17.74±0.15	17.02±0.21
*Gross energy(Kcal /Kg)	5319	5349	5337	5287

** All values are mean of triplicate feeding groups.*

**Gross energy (Kcal /Kg) was estimated according to Jobling, (1983).Using the factor 5.65, 9.45 and 4 for crude protein, ether extract and carbohydrate, respective*

Results of Table (6) demonstrate the effect of different protein sources of diets incorporated with LAB on biochemical freshness tests of Nile tilapia (*O. niloticus*). After the end of the trial, the pH values of tilapia muscle ranged between 5.78-5.90 in all treatments compared with control (6.10). The pH value can be used as a good indicator for the evaluation of fish freshness and quality, mainly due to its influence on texture, water holding capacity, resistance of microbial growth and color of fish flesh as reviewed by Hultin (1985). Total volatile bases nitrogen (TVB-N) content ranged from 12.4 (mg/100g) in group of fish fed on diet plant protein to 15.2 (mg/100g) in group of fish fed diet animal protein, while it was 14.90 (mg/100g) of control sample. TVB-N content contains mainly of ammonia, (mono and di), and trimethylamine which occur normally after death of fish and due to the effect of microbiological activity on fish tissue. Based on analysis of variance, these results are not significantly different ($P \leq 0.05$). These results are in agreement with those reported by Shekib (1989). Trimethylaylamine nitrogen (TMA-N) content ranged between 0.74 – 0.78 mg/100 g in all treatments while it was 0.70 mg/100 g in control sample with non-significant differences. The TMA-N in fish tissues is an accepted measure of detritions; being good, test as quality indicator for fish and fishery products (Tonogai *et al*., 1984). Rodrigusez *et al*. (1999) reported that the levels of TMA-N depend on species, age, season, muscle type and diet of fish.

Table (6): Effect of different protein sources on quality criteria (means ± SE) of Nile tilapia (*O.niloticus*) muscles.

Freshness tests	Control	Different protein sources		
		Animal	Plant	Combined
pH value	6.10±0.01	5.78±0.02	5.90±0.02	5.90±0.01
*TVBN (mg\100g)	14.90±0.98	15.2±1.97	12.4±1.11	14.8±1.14
**TMAN (mg\100g)	0.70±0.03	0.78±0.02	0.74±0.01	0.75±0.02
***TBARS (mg MA\kg)	0.45±0.01	0.64±0.02	0.59±0.01	0.46±0.01

*Values indicate mean±SE (n=3).,*TVB-N: Total volatile basic nitrogen,**TMA-N: Trimethylamine nitrogen,***TBARS: thiobarbituric acid reactive substances.*

So in the present study there is no effect of protein sources and LAB on TMA content. Thiobarbituric acid (TBA) value is considered as an indicator for the amount of Malonaldhyde (MAD) which is the most predominant secondary oxidation products of feed lipids hence it is considered a good criterion for quality assurance the extent of the secondary oxidation of edible lipids during processing (Green and Cumuz, 1982). In this study, TBA values (Table 6) ranged between 0.46 – 0.64 mg MA/kg sample, while it was 0.45 mg MA/kg of control. Results indicated that TBA values in muscles of fish feed combined protein diet were lower (0.46 mg MA/kg) than other one and it was similar of control (0.45 mg MA/kg sample). The Egyptian Standard Specification (EOS, 1998) recommended that both TVB and TMA in fresh fish should not exceeding 30 and 5 mg/100 g, respectively, and 10g MAD/kg for (TBA) value. In general, the present results are localized with those finding by Abo-Taleb and Ibrahim (2002); Ibrahim and Desouky (2008); EL-Sherif

(2008); Ibrahim *et al*. (2008) and Abdallah (2013) who mentioned that range of freshness tests of Tilapiaflesh were pH 6.01 – 7.21; TVB 9.80 – 22.00 mg/100g; TMA 0.52 – 1.27 mg/100g and 0.042 – 4.29 mg MDA/kg sample.

CONCLUSION

It could be concluded that the inoculated fish diets by metabolites improved the growth rate, chemical composition and quality criteria of Tilapia fish flesh compared with control sample and this leads to extend shelf-life for these fish.

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تأثير بعض العلائق الملقحة بمستخلص بكتيريا *Lactobacillus plantarum* DSMZ 20191 على خصائص النمو ومعايير الجودة لسمك البلطى النيلى (*Oreochromis niloticus*)

جابر دسوقى ابراهيم حسانين[1]، محمد عبد المنعم حنفى[2]، سيد مكاوى ابراهيم[3]، صالحة جابر دسوقى[4]

[1]قسم المصايد والاستزراع السمكى – كلية العلوم الزراعية البيئية- العريش – جامعة قناة السويس – مصر.
[2]معمل تغذية الأسماك – شعبة تربية الأحياء المائية – المعهد القومى لعلوم البحار والمصايد – القاهرة- مصر.
[3]معمل تكنولوجيا تصنيع الأسماك – شعبة المصايد - المعهد القومى لعلوم البحار والمصايد – القاهرة- مصر.
[4]قسم النبات والميكروبيولوجى – كلية العلوم - جامعة قناة السويس – مصر.

يهدف هذا البحث الى دراسة تأثير تغذية اصبعيات سمك البلطي النيلى بعلائق سمكية ذات مصادربروتينية مختلفة (نباتى، وحيوانى، وخليط منهما) ملقحة بمستويات مختلفة (1، 2، 3، 4، 5%) من مستخلص بكتيرى مضاد للفطريات منتج بواسطة *Lactobacillus plantarum* DSMZ 20191 قد تم تخزينها لمدة 90 يوما علي خصائص النمو علاوة على تقديربعض معايير الجودة للأسماك محل الدراسة فى نهاية فترة التغذية (180 يوما) مقارنة بالمعاملة الضابطة (الكنترول).

وقد أوضحت النتائج المتحصل عليها ما يلى:

- اظهرالمستخلص البكتيرى بتركيز (5%) فاعلية عالية ضد الفطريات االملوثة للأعلاف الحيوانية المصدر ومتوسطة في الأعلاف النباتية بينما كانت ضعيفة في الأعلاف مختلطة المصدر.
- زيادة معدل نمو وانخفاض معدل نفوق الاصبعيات حيث أدت الأعلاف النباتية والمختلطة الى زيادة وزن الأصبعيات بينما ساهمت الأعلاف الحيوانية على تحسين محتوي العضلات من الأحماض الأمينية.
- وبالنسبة لجودة الأسماك فى نهاية التجربة فقد لوحظ حدوث انخفاض طفيف فى قيم رقم الأس الهيروجينى، وكذلك انخفاض محتوى عضلات الأسماك من القواعد النيتروجينية الكلية المتطايرة وثلاثى ميثايل ورقم حامض الثيوباربيوتيرك منخفضة في علائق البروتين المختلطة والمعاملة مقارنة بالغير معاملة مما يؤدى الى اطالة فترة صلاحية هذه الأسماك.

وبناءا على ماسبق توصى الدراسة بأهمية معاملة العلائق السمكية بمستخلصات بكتيرية آمنة مما لها من تاثير ايجابى على جودة الأسماك الناتجة الأمر الذى يؤدى الى اطالة فترة صلاحيتها.