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EFFECT OF GREEN SEAWEED (*ULVA SP.*) AND PROBIOTIC (*LACTOBACILLUS* SP.) AS DIETARY SUPPLEMENTS ON GROWTH PERFORMANCE AND FEED UTILIZATION OF RED TILAPIA (♀ *O. MOSSAMBICUS* × ♂ *O. NILOTICUS*)

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Abstract

This experiment was carried out to study the effect of green seaweed (*Ulva sp.*) and dried probiotic bacteria (*Lactobacillus sp.*) as dietary supplements on growth performance, body composition and feed utilization of red tilapia (*Oreochromis sp.*) (1.07 g initial body weight). Four practical diets containing 28% crude protein and 242 kcal metabolizable energy /100 g diet were used. Diets were: T_1 without seaweed or probiotic supplements (control); T_2 contained 10% seaweed (SW); T_3 contained 0.5% probiotic (P) and T_4 contained both of 10% seaweed and 0.5% probiotic (SW + P). Red tilapia fed the practical diets for 70 days in triplicate recirculating aquaria. The results showed that final body weight (FBW), weight gain (WG) and specific growth rate (SGR%/day) of fish maintained at (SW) or (P) were better significantly ($P \leq 0.05$) than fish maintained at control diet or (SW + P) diet. On the other hand, feed utilization parameters were affected significantly by different treatments. The best significant values ($P \leq 0.05$) of feed conversion ratio (FCR), protein efficiency ratio (PER), protein productive value (PPV %), and energy retention (ER %) were found with fish maintained at (SW), (P) and (SW + P) diets, while control diet had the lowest significant ($P \leq 0.05$) values. Insignificant differences ($P > 0.05$) were observed in fish body moisture, crude fat and crude protein contents among treatments. Therefore, it could be concluded that the addition of green seaweed (*Ulva sp.*) or probiotic (*Lactobacillus* sp.,) as feed supplements to red tilapia (*Oreochromis sp.*) diets have a positive effect on growth performance and feed utilization of fish.

Keywords: Red tilapia *Oreochromis sp.*, probiotic (*Lactobacillus sp.*); seaweed (*Ulva sp.*), growth performance, feed utilization.

INTRODUCTION

One of the main challenges in fish production industry is to improve feed formulation with natural feed ingredients in order to maximize nutrient retention, feed conversion ratio, nutrient digestibility, and dietary nutrient balance and minimize fish mortality (Reza *et al.*, 2009). Also, growth enhancement and disease resistance of aquaculture organisms are two of the most important concerns in aquaculture (Li *et al.*, 2005 a & b).

Probiotics are defined as live microbial feed supplements that beneficially affect the host by the production of inhibitory compounds, competition for chemicals and adhesion sites, immune modulation and stimulation, and improving the microbial balance (Fuller 1989; McCracken and Gaskins, 1999 and Verschuere *et al.*, 2000). This leads to increased in growth rate (improvement of nutritional metabolism) and a better health of the host (Gibson *et al.*, 2004). In addition, prebiotics promote the growth of "healthy" lactic acid bacteria (LAB) that are able to reduce the proliferation of pathogenic micro-organisms (Roberfroid and Slavin, 2000). Use of prebiotics, that beneficially affect the host by selectively stimulating the growth and/or activating the metabolism of health-promoting bacteria in the intestinal tract, is a novel concept in aquaculture (Gibson *et al.,* 2004). One possible means of accomplishing this is to introduce supplements of probiotics into the diet (Reza *et al*., 2009).

The increase of productivity in aquaculture has been accompanied by ecological impacts including emergence of a large variety of pathogens and bacterial resistance. These impacts are in part due to the indiscriminate use of chemotherapeutic agents as a result of management practices in production cycles (Balca´zar *et al.,* 2006). In previous studies, authors reported that probiotics can be provided to the host or added to its aquatic environment in several ways: (i) addition via live food (Gomez-Gil *et al.,* 1998); (ii) bathing (Austin *et al.*, 1995 and Gram *et al.,* 1999); (iii) addition to culture water (Moriarty, 1998 and Spanggaard *et al.,* 2001) and (iv) addition to artificial diet (Rengpipat *et al.*, 2000).

Hamauzu and Yamanaka (1997) demonstrated that early feeding trials with macro-algal meal predicted improvement of fish vitality, disease resistance and carcass quality. Moreover, addition of a very small amount of algal meal has produced a significant increase in fish growth and feed utilization (Mustafa *et al.*, 1994, 1995 a & b). Supplementation of seaweeds in the fish diet in the previews studies was ranged between 2% up to 28%. Differences between adequate levels of seaweeds may be variable depending on the feeding habits, age and the species of both algae and fish (Guroy *et al.*, 2007; Nakagawa and Montgomery, 2007; Ergun *et al.,* 2008; Elmorshedy, 2010 and El-Tawil, 2010).

Ulva is a genus of algae that includes species that look like bright green sheets and live primarily in marine environments. They can also be found in brackish water, particularly estuaries and *Ulva* is usually seen in dense groups (Burtin, 2003). El-Tawil (2010) concluded that marine green seaweeds (*Ulva sp.)* can be supplemented to red tilapia (*Oreochromis sp.*) diet at an optimum level of 15% to produce considerable improvement of growth performance without any adverse effect on feed efficiency or survival rate. Guroy *et al.* (2007) found that highest values for weight gain of Nile tilapia fed on diet supplemented with various level of *Ulva* meal were at fish fed the 5 to 10% *Ulva* diet. Yone *et al*. (1986) interpreted the effect on growth as due to an acceleration of nutrient absorption by dietary algae. Nakagawa *et al.*

(1993) reported that optimum feed efficiency and protein efficiency were attained in black sea bream when the supplementation level of *Ulva sp*. meal was 2.5–5.0 % of the diet.

Red tilapia (*Oreochromis sp.*) hybrid (descended of an original cross of female *O. mossambicus* x male *O. niloticus*) has become objects of interest for culturist and researchers throughout the world. Many efforts were done in recent years to improve growth performance, body composition, feed utilization and other quantitative traits of it (Watanabe *et al.*, 1990; El-Zaeem *et al.*, 2009; El-Tawil, 2010 and El-Tawil and Amer, 2010).

Knowledge concerning seaweeds and probiotics in fish culture is to some limited (Mahious *et al.*, 2007 and Reza *et al.*, 2009). The goals of the present work were to study the effect of green seaweed (*Ulva sp.*) and probiotic (*Lactobacillus* sp.) as dietary supplements on growth performance and feed utilization of red tilapia (♀ *O. mossambicus* × ♂ *O. niloticus*).

MATERIALS AND METHODS

The Experimental Fish:

Red tilapia, *Oreochromis sp.* fry used in this study were obtained from the Marine fish hatchery 21 Km, Alexandria, Egypt. Fry were acclimatized to laboratory conditions for two weeks. Red tilapia with an initial body weight of (1.07 g) were divided randomly to 4 groups in triplicate recirculating aquaria (10 fish/ aquarium). The aquarium of dimensions 100 x 34 x 50 cm were filled with 100 liter of water for each and supplemented with continuous aeration. Nearly half of water was exchanged daily by freshly stocked tap water and the aquaria were cleaned every day before feeding. During the course of the experiment, all fish from each aquarium were collected every two weeks and collectively weighed. Fish were fed the experimental diets twice daily to apparent satiation for 70 days.

Probiotic and seaweeds (*Ulva sp.)* additives:

The probiotic used in this study was a commercial formulation of dried probiotic bacteria (*Lactobacillus* sp., producted by Pura 2A. Company, Cairo, Egypt) containing *Lactobacillus plantarum, Lactobacillus fermentum, Lactobacillus delbrueckii, Bacillus subtilis, Saccharomyces cerevisiae, Rhodopseudomonas palustris* & especial active additives.

Seaweeds (*Ulva sp*.) were collected from Alexandria city coast (attached to rocks) and prepared as described by El-Tawil (2010). Seaweeds were rinsed with fresh water then distributed on plastic sheet and left to dry in the sun, then put in oven drying at (60 -70 °C) to be dried. After that, it was crushed and grinded through a food grinder mixer and kept dry until it used in diets formulation.

Diets formulation and preparation:

Four experimental diets were used in this study containing both animal and plant proteins sources. Table 1 presents the composition of the experimental diets. Diets were formulated from commercial ingredients of fish meal, wheat flour, wheat bran, soybean meal, yellow corn, bone meal, vitamins and minerals to achieve 28 % dietary protein level with metabolizable energy level 242 kcal/100 g diet based on feedstuff values reported by NRC (1993). Table 2 presented the proximate analysis of experimental diets used in the experiment. Experimental diets were as follows: T1 without seaweed or probiotic supplements (control); T2 contained 10% seaweed (*Ulva sp*.) (SW); T3 contained 0.5% probiotic (*Lactobacillus* sp.,) (P) and T4 contained 10% seaweed and 0.5% probiotic (SW + P). Dry ingredients were passed through a sieve (0.6 mm diameter hole) before mixing into the diets.

Mixtures were homogenized in a food grinder mixer. Water was then blended into the mixture at the ratio of 50% for pelleting. The diets were pelleted using meat grinder with a 1.5 mm diameter and kept dry until used.

Growth performance parameters:

Growth performance was determined, and feed utilization efficiency was calculated using the following equations:

Weight gain = $W_2 - W_1$;

Specific growth rate (SGR; % g/day) = 100 (Ln W_2 – Ln W_1) / T;

Where W_1 and W_2 are the initial and final fish weights, respectively, and T is the experimental period in days;

Feed conversion ratio (FCR) = feed intake / weight gain;

Protein efficiency ratio (PER) = Weight gain/protein intake;

Protein productive value (PPV%) = 100 (protein gain/protein intake);

Energy retention (ER%) = 100 (gross energy gain/gross energy intake).

Chemical analysis of diets and fish:

At the end of the feeding trial, five fish per aquarium were randomly selected, stored at -20 ˚C and pooled for analysis of whole-body composition. Moisture, crude protein (N X 6.25), crude fat, crude fiber and ash were determined for the feed ingredients, experimental diets and whole fish body (initial & final) according to the standard methods of Association of Official Analytical Chemists AOAC (1990) for moisture (oven drying), protein (macro-keldahl method), fat (ether extract method), crude fiber (fritted-glass crucible method) and ash (muffle furnace).

Table 1. Composition of experimental diets used in this experiment.

Ingredients	Experimental diets*			
	Control	SW	P	SW + P
Fish meal	15	15	15	15
Soybean meal	30	27	30	27
Wheat flour	24.5	23	24.5	23
Wheat bran	15.5	12	15	11.5
Yellow corn	12.7	10.7	12.7	10.7
Ulva sp.	0	10	0	10
Probiotic	0	0	0.5	0.5
Bone meal	2	2	2	2
Vit. & Min Mix**	0.3	0.3	0.3	0.3
Total	100	100	100	100

* Control: had no seaweed or probiotic supplements, SW: contained 10% seaweed, P: contained 0.5% probiotic, SW + P: contained 10% seaweed and 0.5% probiotic.

** Content/kg of Vitamin & minerals mixture (P- Fizer, Cairo, Egypt). Vitamin A, 4.8 MIU; Vitamin D, 0.8 MIU; Vitamin E, 4.0 g; Vitamin K, 0.8 g; Vitamin B_1, 0.4 g; Vitamin B_2, 1.6 g; Vitamin B_6, 0.6 g; Vitamin B_7, 20.0 mg; Vitamin B_{12}, 4.0 g; Folic acid, 0.4 g; Nicotinic acid, 8.0 g; Pantothenic acid, 4.0 g; Colin chloride, 200 g; Zinc, 22 g; Cooper, 4.0 g; Iodine, 0.4 g; Iron, 12.0 g; Manganese, 22.0 g; Selenium, 0.04 g.

Table 2. Proximate analysis of experimental diets.

Proximate analyses%	Control	SW	P	SW + P
Moisture	10.25	10.26	10.13	10.14
Crude protein	27.95	27.73	28.20	28.13
Crude fat	15.24	15.95	15.43	15.47
Crude fiber	4.89	6.95	5.24	7.21
Ash	9.64	11.42	9.62	11.03
NFE **	32.03	27.69	31.38	28.02

* Control: had no seaweed or probiotic supplements, SW: contained 10% seaweed, P: contained 0.5% probiotic, SW + P: contained 10% seaweed and 0.5% probiotic.

**NFE is nitrogen free extract is calculated by difference = 100-(protein+ fat+ fiber+ ash)

Values are average of triplicate analysis (N = 3).

Statistical Analysis:

All data were subjected to ANOVA according to Snedecor and Cochran (1981). When a significant treatment effect was observed, Duncan's multiple range test (Duncan 1995) was used to rank the groups. Treatment effects were considered significant at $P < 0.05$.

RESULTS

The results of the present study in Table 3 have shown that final body weight (FBW), weight gain (WG), Specific growth rate (SGR) of red tilapia (*Oreochromis* sp.) maintained at diet contained 10% seaweeds (*Ulva sp*.) (SW) or diet contained 0.5% probiotic (*Lactobacillus* sp.,) (P) were better than fish maintained at other treatments (control diet or SW + P diet).The highest significant ($P \leq 0.05$) values of FBW, WG and SGR%/day were obtained with fish maintained at (SW) diet they were 17.74 g, 16.71 g and 4.07, respectively. No significant differences ($P > 0.05$) were found in FBW and WG between fish maintained at (SW) or

(P) diets. However, the least significant values ($P \leq 0.05$) of FBW, WG and SGR (%/day) were found with fish maintained at the control diet or (SW + P) diet. Results also show that highest significant values ($P \leq 0.05$) of SGR (%/day) were found in fish fed at (SW) diet followed by fish fed at (P) diet while fish fed at control and (SW+ P) diets showed the lowest values ($P \leq 0.05$). They were 4.07, 3.97, 3.65 and 3.73, respectively. However, at the end of experiment, survival rate was ranged between 92 to 95 % showed insignificant differences ($P > 0.05$) among treatments.

Table 4 showed that, the highest feed intake was recorded by the fish fed control, (SW) and (P) diets, showing significant improvement ($P \leq 0.05$) compared with fish fed the (SW + P) diet. With respect of feed conversion ratio (FCR) in Table 4, the best values ($P \leq 0.05$) were obtained with fish maintained at (SW) and (P) diets, they were 1.46 and 1.48 respectively, while poor FCR values ($P \leq 0.05$) were achieved when fish maintained at the control diet or (SW + P) diet, they were 1.84 and 1.62 respectively. Moreover, insignificant differences ($P > 0.05$) were found between fish groups maintained at seaweed (SW), probiotic (P) or (SW + P) diets.

Data of Table 4 show also the values of protein efficiency ratio (PER), protein productive value percent (PPV %) and energy retention percent (ER %) of fish groups maintained at different treatments diets. The results of PER revealed that the highest significant values ($P \leq 0.05$) were found with fish maintained at SW or P diets. They were 2.45 and 2.43 respectively, while the fish fed at control and SW + P diets were the lowest with values of 1.95 and 2.22, respectively. With respect to PPV%, data in Table 4 indicated that best PPV% values ($P \leq 0.05$) were obtained by fish fed on SW, P, and SW + P diets, they were found to be 38.39, 37.95 and 36.02 %, respectively. The differences among the last groups were not significant ($P > 0.05$) while the lowest ($P \leq 0.05$) PPV% value was observed in fish fed on the control diet, it was 31.96 %. Same trend was found with ER% values, fish maintained at SW, P and SW + P diets were the higher significantly ($P \leq 0.05$) in ER% than fish maintained at the control diet , being 29.18, 27.08, 26.25 and 22.76 % respectively. Also, differences among fish maintained at SW, P and SW + P diets were insignificant ($P > 0.05$).

Results of body composition of red tilapia in Table 5 showed that no significant differences ($P > 0.05$) were observed in fish moisture, crude protein or crude fat contents at all treatments. They were ranged between 70.83% to 71.90%, 8.80% to 9.70%, and 15.34% to 15.94%, respectively.

Table 3. Means ± standard error (SE) of final body weight (FBW), weight gain (WG), specific growth rate (SGR) and survival rate % of red tilapia (*Oreochromis sp.*) fed at different diets contained seaweeds (*Ulva sp.*) and/or probiotic additives.

Treatments*	FBW (g)	WG (g)	SGR % /day	Survival rate %
Control	13.90 ± 0.05 ^{b}	12.82 ± 0.04 ^{b}	3.65 ± 0.01 ^{c}	93.36 ± 0.13
SW	17.74 ± 0.36 ^{a}	16.71 ± 0.37 ^{a}	4.07 ± 0.05 ^{a}	95.12 ± 0.42
P	17.34 ± 0.46 ^{a}	16.26 ± 0.45 ^{a}	3.97 ± 0.03 ^{b}	94.26 ±0.05
SW + P	14.77 ± 0.05 ^{b}	13.69 ± 0.03 ^{b}	3.73 ± 0.03 ^{c}	92.10 ± 0.11

* Control: had no seaweed or probiotic supplements, SW: contained 10% seaweed, P: contained 0.5% probiotic and SW + P: contained 10% seaweed and 0.5% probiotic.

Means in each column followed by different letter are significantly different ($P < 0.05$).

Table 4. Means ± standard error (SE) of offered feed, feed conversion ratio (FCR), protein efficiency ratio (PER), protein productive value (PPV %) and energy retention (ER %) of red tilapia (*Oreochromis sp.*) fed at different diets contained seaweeds (*Ulva sp.*) and/or probiotic additives.

Treatments	Offered feed (g)	FCR	PER	PPV%	ER%
Control	23.50 ± 0.08 [a]	1.84 ± 0.02 [a]	1.95 ± 0.01 [b]	31.96 ± 0.87 [b]	22.76 ± 0.04 [b]
SW	24.49 ± 0.51 [a]	1.46 ± 0.07 [b]	2.45 ± 0.11 [a]	38.39 ± 2.38 [a]	29.18 ± 1.99 [a]
P	23.97 ± 0.27 [a]	1.48 ± 0.03 [b]	2.43 ± 0.04 [a]	37.95 ± 1.15 [a]	27.08 ± 0.32 [a]
SW + P	22.11 ± 0.39 [b]	1.62 ± 0.04[ab]	2.22 ± 0.05 [b]	36.02 ± 2.24 [a]	26.25 ± 1.25 [ab]

* Control: had no seaweed or probiotic supplements, SW: contained 10% seaweed, P: contained 0.5% probiotic , SW + P: contained 10% seaweed and 0.5% probiotic.

Means in each column followed by different letter are significantly different (P < 0.05).

Table 5. Means ± standard error (SE) of body composition (% wet basisof red tilapia (*Oreochromis sp.*) fed at different diets contained seaweeds (*Ulva sp.*) and/or probiotic additives.

Treatments	Moisture%	Lipid %	Protein%
Control	70.83 ± 1.00	9.17 ± 0.17	15.94 ± 0.51
SW	71.90 ± 2.00	8.81 ± 0.20	15.42 ± 0.29
P	70.94 ± 0.44	9.70 ± 0.30	15.34 ± 0.21
SW + P	71.10 ± 1.00	9.11 ± 0.10	15.83 ± 0.64

* Control: had no seaweed or probiotic supplements, SW: contained 10% seaweed, P: contained 0.5% probiotic , SW + P: contained 10% seaweed and 0.5% probiotic.

Means in each column followed by different letter are significantly different (P < 0.05).

DISCUSSION

The results of the present study have shown that fish diet contained 10% seaweeds (SW) and diet contained 0.5% probiotic (P) have a positive effect on growth performance parameters like final body weight (FBW), weight gain (WG), specific growth rate (SGR%/day) of red tilapia (*Oreochromis sp*). The positive effect of seaweeds addition in fish diets was noticed in the study conducted by El-Tawil (2010). He stated that marine green seaweeds (*Ulva sp.*) can be supplemented to red tilapia (*Oreochromis sp*.) diet up to 15% to produce considerable improvement of final body weight, weight gain and specific growth rate. Moreover, there were wide ranges of the percentage of seaweed additions in fish diets among the literatures. In previous studies supplementation of seaweeds in fish diets ranged between 2 to 28% (Xu *et al.*, 1993; Guroy *et al.*, 2007; Nakagawa and Montgomery, 2007; Ergun *et al.*, 2008; Elmorshedy, 2010 and El-Tawil, 2010). The differences between results and adequate levels of seaweeds may be variable depending on the feeding habits, age and the species of both algae and fish. However, the beneficial effects of probiotics on fish growth performance and feed utilization due to modifying the fish-associated (or ambient) microbial community of the gastrointestinal tract, thus promoting better feed utilization, enhancing the fish response towards disease and improving the quality of its ambient environment (Verschuere *et al.*, 2000).

In the present study, results show that fish maintained at the diet contained probiotic were better in growth performance and feed utilization than fish maintained at control diet. This agrees with results obtained by Essa *et al*. (2010). They recommended the incorporation of probiotics to Nile tilapia (*Oreochromis niloticus*) feed as supplements to stimulate fish growth and feed digestion. They also showed that growth and feed utilization of fish fed on diets containing different probiotic groups were improved significantly compared to fish fed on control diet which had no probiotic supplements. Also, Mahious *et al.* (2007) investigate the use of inulin and oligofructose as prebiotics at the level of 2% on turbot (*Psetta maxima*), siberian sturgeon (*Acipenser baeri*) and African catfish (*Clarias gariepinus*) diets. It has been demonstrated that oligofructose improved the final mean weight and SGR of turbot larvae at the weaning without any significant difference on survival between groups, while in Siberian sturgeon and African catfish, SGR and FCR were significantly improved by inulin and oligofructose. Li and Gatlin (2004) observed enhancement of growth performance and higher feed efficiency in hybrid striped bass, *Morone chrysops* × *M. saxatilis* fed with diet supplemented with 1 and 2% prebiotic or 1 and 2% brewer yeast.

The results of FBW, WG, SGR and FCR presented in Table 3 and 4 show that highest significant ($P \leq 0.05$) values were obtained with fish maintained at (SW) diet. At the same time insignificant differences were found in FBW and WG between fish maintained at (SW) or (P) diets. However, the least values ($P \leq 0.05$) of FBW, WG, SGR and FCR were found with fish maintained at the control and (SW + P) diets. These findings suggested that results obtained when fish diets were supplemented with seaweeds or probiotic only were better than fish diets supplementation with seaweeds and probiotic together. These results can be partly explained by the lack of palatability of diets containing seaweeds and probiotic together or the leaching of some dietary constituents of the artificial feeds into water due to the increase in microbial activity of the probiotic in presence of *Ulva* which released the homogenized formulated diet. These occurred losses raised the amount of offered feed without utilization which leads to poor results. This agrees with results obtained by El-Tawil (2010) on red tilapia. He explained the leaching effect when fish diets were containing 25% *Ulva* level and for juvenile Nile tilapia and common carp (Guroy *et al.*, 2007 and Diler *et al*., 2007) at the level of 20% *Ulva* meal in diets, respectively.

With respect to PER, PPV%, and ER %, data in Table 4 indicated that best PER, PPV%, and ER % values ($P \leq 0.05$) were obtained by fish fed on SW or P diets, followed by fish maintained at SW + P diet, while the lowest values were observed with fish maintained at the control diet which had no seaweed or probiotic supplements. Elmorshedy (2010) reported that there were positive trends between protein efficiency ratio (PER) and energy retention (ER %) on one side and seaweeds inclusion levels in the diet up to the level of 14% on the other side. Also, Diler *et al.* (2007) stated that PPV% improved significantly with increasing dietary *Ulva* inclusion rate up to 15%. The beneficial effects of probiotics on PER, PPV%, and ER % appear to be associated with colonization of favorable microbiota in the gut which produce enzymes that hydrolyze complex molecules facilitate better digestion and absorption of macronutrients resulting in higher protein and energy retention in the body (Essa *et al*., 2010). Reza *et al.* (2009) investigate the effect of dietary prebiotic inulin on growth performance, intestinal microflora, body composition and hematological parameters of juvenile beluga, *Huso huso* (one of the most frequently captive-bred species of sturgeon). Groups of fish were fed diets containing prebiotic inulin levels ranging from 1 to 3%. The author showed that, there was a negative relationship between PER, ER%, feed efficiency (FE), protein retention (PR) and supplementation level of inulin which indicated that inulin is not appropriate for supplementation in the diet of beluga. These changes were not, however, reflected in the survival rate of the fish, although survival was higher compared to other groups.

In the present study, results show that insignificant differences ($P > 0.05$) were found in survival rate among fish maintained at different treatments. Survival rate in the present study ranged between 92 to 95 %. No significant differences ($P > 0.05$) were found in body composition of fish maintained at different treatments. The results of moisture, crude fat and crude protein in body content in the present study agree with those obtained by Elmorshedy (2010) with gray mullet and El-Tawil (2010) with red tilapia.

It could be concluded that the addition of green seaweed (*Ulva sp.*) and probiotic bacteria (*Lactobacillus* sp.) on fish diet have a positive effect on feed utilization and growth performance of red tilapia. This preliminary study should encourage further investigations into the potential of seaweeds and probiotics in fish compound diets.

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تأثير الأعشاب البحرية الخضراء (أولفا) و البروبايوتك (لاكتوباسيللس) كإضافات غذائية على أداء النمو وكفاءة الاستفادة من الغذاء لأسماك البلطي الأحمر

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الملخص العربي

أجريت هذه التجربة لدراسة تأثير إضافة كل من الأعشاب البحرية الخضراء (أولفا) والبروبايوتك (لاكتوباسيللس) كإضافات غذائية في علائق الأسماك على الأداء وكفاءة الإستفادة من الغذاء وتركيب الجسم لأسماك البلطى الأحمر ذات الوزن الابتدائى ١.٠٧ جم .غذيت الأسماك على أربع علائق متساوية في نسبة الطاقة (٢٤٢ كيلو كالورى طاقة ميتابوليزمية لكل ١٠٠ جم غذاء) ومتساوية في نسبة البروتين (٢٨ ٪). وكانت المعاملات كما يلى: المعاملة الاولي (كنترول) لا تحتوى على أى إضافات من الأعشاب البحرية الخضراء أو البروبايوتك، المعاملة الثانية عليقة تحتوى على ١٠% أعشاب بحرية خضراء، المعاملة الثالثة عليقة تحتوى على ٠.٥ % بروبايوتك، المعاملة الرابعة عليقة تحتوى على كل من ١٠% أعشاب بحرية خضراء و ٠.٥ % بروبايوتك. تم تغذية الاسماك على العلائق الغذائية فى ثلاث مكررات من الأحواض الزجاجية لمدة ٧٠ يوم. أوضحت النتائج زيادة كل من الوزن النهائى للأسماك و الوزن المكتسب وكذلك معدل النمو النوعى للأسماك التى تم تغذيتها على العليقة التي تحتوى على الاعشاب البحرية أو العليقة التي تحتوى علي البروبايوتك زيادة معنوية عن الأسماك التى تم تغذيتها على العليقة الكنترول أو على العليقة التى تحتوى على كل من الأعشاب البحرية و البروبايوتك. و من ناحية أخرى فإن قياسات الاستفادة من الغذاء قد تأثرت معنوياً باختلاف المعاملات الغذائية، حيث سجلت أفضل قيم معنوية لمعدل تحويل الغذاء و معدل الاستفادة من البروتين و معدل كفاءة البروتين و الطاقة المحتجزة في جسم الأسماك عند تغذية الأسماك على العلائق الغذائية التي تحتوى على الأعشاب البحرية أو البروبايوتك أو كلاهما معاً، بينما ظهرت أقل قيم معنوية مع العليقة الكنترول. لم تلاحظ أي اختلافات معنوية بين المعاملات فى محتوى جسم الأسماك من الرطوبة والدهون و البروتين. مما سبق وتحت ظروف التجربة الحالية يمكن

استنتاج أن إضافة الأعشاب البحرية الخضراء (أولفا) أوالبروبايوتك (البكتيريا المجففة لاكتوباسيللس) كإضافات غذائية فى علائق أسماك البلطى الأحمر لها تأثير إيجابى على أداء النمو واستفادة الأسماك من الغذاء.