Abbassa Int. J. Aqua., V0l.9 No.(1) 2016. *48-65*

EFFECT OF DIETARY BAKER YEAST (*SACCHAROMYCES CEREVISIA*) AS A FEED ADDITIVE ON GROWTH PERFORMANCE AND HEALTH STATUS OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*).

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Received 8/ 3/ 2016 *Accepted 15/ 4/ 2016*

Abstract

This study was carried out to evaluate the adding baker yeast (*Saccharomyces cerevisae*) as a feed additive on growth performance and health status of Nile tilapia, *Oreochromis niloticus* cultured in earthen ponds. Average of fish (20.8 g) fed on artificial diet (25% crude protein) enriched with baker yeast at levels of 0.0, 0.1, 0.2 and 0.3% (T1, T2, T3, and T4, respectively) in duplicates for 20 weeks. Each earthen pond (1 feddan) was stocked with 12000 fingerlings. The obtained results showed that the highest growth performance, survival and fish yield were obtained at T3, while T1 recorded the lowest fish growth, survival and production. Feed intake increased significantly, while FCR decreased significantly with increasing yeast levels in fish feed. Concerning the proximate chemical composition of whole-fish body, there were no significant differences in contents of dry matter and total lipids among the different treatments, while the highest protein and lowest ash contents were obtained at T3 and T4. The lowest protein and highest ash contents were found in T1. The economic evaluation revealed that optimum economic return was obtained at T3, which contained 0.2 % baker yeast. It is suggested that high fish mortality in T1 was due to the natural infection by pathogenic bacteria *Flavobacterium columnare*, which was isolated from different sites of skin ulcerations in fish. Many of the fish showed signs of hole-in-the head like lesions and some others exhibited severe form of saddle back like ulcer. These infections decreased as yeast levels incresaed suggesting that feeding yeast inhanced the fish resistance against *F. columnare* infection leading to high fish survivability. Based

on the obtained results in this study it can be concluded that adding 0.2 % yeast to fish diet optimized Nile tilapia growth, survival, and production. Also, fish health against possible bacterial infection was improved when fed on a diet enriche with baker yeast.

Keywords: Nile tilapia, baker yeast, Probiotic,Fish performance, Fish health, *Flavobacterium columnare*.

INTRODUCION

Globally, aquaculture is expanding into new directions, intensifying and diversifying. This expansion has inevitably generated disease problems that are now a primary constraint to the culture of aquatic species affecting both economic and social development (Bondad-Reantaso *et al*., 2005). At present, the most effective means of controlling bacterial infection is the antibiotic treatment. However, there is widespread concern that antibiotics used in aquaculture have led to the emergence and selection of resistant bacteria (Teuber, 2001). Therefore, alternative methods of disease prevention have been investigated to minimize such risks (Sanders, 2003). Among these, the use of probiotics in aqua-feeds has received interest especially for protection against infectious diseases (Gopalakannan and Arul, 2010; Merrifield *et al*., 2010 and Reyes-Becerril *et al*., 2011). The use of probiotics is a strategy that has shown promising results as a complementary tool for the management and improvement of the nutrition of aquatic animals (Wang *et al.*, 2008; Watson *et al*., 2008 and He *et al.*, 2011). In the last decade, the scientific community examined roles and effects of probiotics as an alternative to antimicrobial drugs, demonstrating positive effects on fish growth (Burr *et al*., 2005), stress resistance (Rollo *et al*., 2006 and Abdel-Tawwab *et al.*, 2010), immune system enhancement (Picchietti *et al*., 2007).

Baker yeast (*Saccharomyces cerevisiae*) is a fungus used in baker industry and has been used as a feed supplement for various animals and could be used in fish diets. With excellent nutrient profiles and capacity to be produced economically, yeasts have been used in aquaculture diets as a probable immuno-stimulant where it improves fish growth (Lara-Flores *et al*.,

2003; Ghosh *et al*., 2005; Waché *et al.*, 2006; Abdel-Tawwab *et al*., 2008; Gopalakannan and Arul, 2010; Dhanaraj *et al*., 2010; Reyes-Becerril *et al.*, 2011 and Abdel-Tawwab 2012).

Tilapia culture especially Nile tilapia, *Oreochromis niloticus*, is becoming an important part of fish culture industry in Egypt and worldwide. But as it continues to intensify, outbreaks of tilapia diseases have been observed to cause considerable financial and economical losses. Fish loss due to bacterial diseases is now important problem that affect aquaculture venture and threaten the sustainability of the industry as a whole (Lavilla and Cruz-Lacierda, 2001). Many bacteria including *Flavobacterium columnare* is commonly found in the aquaculture facilities and causes fish mortalities (Plumb, 1997). Therefore, this study was carried out to evaluate the potential benefits of adding baker yeast (*S. cerevisae*) as a feed additive for improving the total yield of monosex males of Nile tilapia, *O. niloticus*.

MATERIALS AND METHODS

Ponds preparation and fish culture:

The study had been done in a private farm at Tollumbat No. 7 in Riyad City, Kafr El-Sheikh Governorate. Eight earthen ponds with equal dimensions (42 x 100 m per each) having the same average water depth of 125 cm were used in this study. Each pond was stocked with 12000 fingerlings on 17th of June and lasted for after 20 weeks. Fish with average (20.8 g) fed on artificial diet (25% crude protein) enriched with baker yeast at levels of 0.0, 0.1, 0.2, and 0.3% (T1, T2, T3, and T4, respectively) in duplicates. Fish were fed the tested diets at a feeding rate of 3% of the estimated fish-weight in equal portions twice daily at 9.00am and 15.00; six days a week during the experimental period. Fish feed was applied by broadcasting over pond water surface at the same place. Every two weeks, 30 fishes were siened from each pond and were returned again to their corresponding pond after measuring the individual weight and length. After that, feed quantity was adjusted accordingly.

Analyses of water quality parameters:

Water samples for physico-chemical analyses were collected biweekly with a water column sampler between 08:30 and 09:30 am at 30 cm depth from each pond. Water temperature and dissolved oxygen were measured in sites at 30 cm depth with an oxygen meter (YSI model 5, Yellow Spring Instrument Co., Yellow Springs, Ohio). Water transparency was measured with a Secchi disk. The pH degree was measured by a pH-meter (model Corning 345). Unionized ammonia, nitrate, total alkalinity, and total hardness were determined by the methods as described by Boyd (1984).

Fish harvesting:

At the end of the experiment (4^{th} of November, 2014), ponds were gradually drained from the water and fish were harvested and transferred to fiberglass tanks and carried to the processing centre where fish washed, sorted, and collectively weighed. At the end of the experiment, the ponds were drained and fish were harvested, counted, and weighed. Growth performance was calculated as:

Weight gain (g/fish) = $W_2 - W_1$;

Daily weight gain (g/fish/day) = $(W_2 - W_1) / T$;

Specific growth rate (SGR; %g/day) = $100 (\text{Ln } W_2 - \text{Ln } W_1) / T$, where W_1 and W_2 are the initial and final weights, respectively, and T is the number of days.

Feed Conversion Ratio (FCR) = feed intake / weight gain.

Proximate chemical analysis of diets and fish:

The tested diets and fish from each treatment were analyzed according to the standard methods of AOAC (1990) for moisture, crude protein, total lipids, and total ash. Moisture content was estimated by heating samples in an oven at 85 ^{o}C until constant weight and calculating weight loss. Nitrogen content was measured using a microkjeldahl apparatus and crude protein was estimated by multiplying the nitrogen content value by 6.25. Total lipids

content was determined by ether extraction and ash was determined by combusting samples in a muffle furnace at 550 ^{o}C for 6 hours.

Clinical examinations of fish:

Fish samples from each pond were clinically examined according to Stoskopf (1993) for skin darkening, discoloration, paleness or presence of any cloudiness, skin congestion, ragged or torn fins, raised scales, haemorrhage, erosions or ulcers and or sunken eyes. The abdomen was examined for enlargement and or distention. Mouth and gills were examined too. Lesions were photographed and bacteriological examinations were done according to (Bullock *et al*., 1986). Bacterial isolates were identified using both cultural characteristics and conventional biochemical tests recommended by Griffin (1992).

Statistical analysis:

The obtained data were subjected to one-way ANOVA to test if differences among yeast levels were significant at $P < 0.05$. Mean separations were determined by using Duncan's multiple range test. All statistical analysis was carried out by applying the computer program (SAS, 1996).

RESULTS

Water quality parameters:

Results of water quality parameters of the experimental ponds during the experimental period were monthly averaged and summarized in Table (1). No significant differences ($P > 0.05$) were observed in all water parameters except dissolved oxygen, which decreased significantly ($P < 0.05$) with increasing yeast levels. The lowest value of dissolved oxygen was observed at T4 (3.9 mg/L), whereas its highest value was observed at T1 and T2 with the same value (4.2 mg/L). On the other hand, NH_3 concentrations increased significantly ($P < 0.05$) with increasing yeast level and its highest value was obtained at T4 (0.41 mg/L). In general, water temperature values in all treatments showed appoximately the same value and its range was 26.9 - 27.0 °C. Seechi disk

readings were 23.2, 22.8, 22.5 and 22.7 cm for T1, T2, T3 and T4, respectively. The pH values were 8.16, 8.19, 8.17 and 8.09 for T1, T2, T3 and T4, respectively. The concentrations of nitrate seems to be constant among treatments (1.03, 0.99, 0.98 and 1.01 mg/L for T1, T2, T3 and T4, respectively). The values of total alkalinity and total hardness were approximatly the same among al treatments and their ranges were 433.0 - 431.9 mg/L as $CaCO_3$ and 242.0 - 250.0 mg/L as $CaCO_3$, respectively (Table 1).

Table 1. Water quality parameters of earthen ponds stocked with Nile tilapia fed on different levels of baker yeast for 20 weeks.

Variable	T1	T2	T3	T4
Temperature (˚C)	26.9±0.74 [a]	27.0±0.74 [a]	27.0±0.74 [a]	27.0±0.74 [a]
Dissolved oxygen (mg/L)	4.2±0.21 [a]	4.2±0.21 [a]	4.0±0.21 [b]	3.9±0.21 [b]
Seechi disk (cm)	23.2±0.39 [a]	22.8±0.39 [a]	22.5±0.39 [a]	22.7±0.39 [a]
pH	8.16±0.16 [a]	8.19±0.16 [a]	8.17±0.16 [a]	8.09±0.16 [a]
NH_3 (mg/L)	0.32±0.01 [b]	0.34±0.01 [b]	0.34±0.01 [b]	0.41±0.01 [a]
NO_3 (mg/L)	1.03±0.006 [a]	0.99±0.006 [a]	0.98±0.006 [a]	1.01±0.006 [a]
Total alkalinity (mg/L)	431.9±22.1 [a]	423.0±22.1 [a]	431.9±22.1 [a]	423.0±22.1 [a]
Total hardness (mg/L)	250.0±13.1 [a]	250.0±13.1 [a]	250.0±13.1 [a]	242.0±13.1 [a]

Means with the same letter in each row are not significantly different at $P<0.05$.

Growth performance:

The initial fish weights were 20.3, 20.9, 20.1 and 20.6 g for T1, T2, T3, and T4, respectively; no significant differences between groups were observed (Table 2). At the end of the experiment, final fish weight, weight gain, daily weight gain, and SGR values increased significantly ($P < 0.05$) with increasing yeast levels and the highest growth values were observed at T3. However, fish fed on feed enriched with 0.2 % yeast (T3) resulted in highest final weight (239.5 g), weight gain (219.4 g), daily weight gain (1.57 g/fish/day), and SGR (1.770 %g/day). Fish fed the contro diet (T1) produced the lowest final weight, weight gain, daily weight gain and SGR (173.5 g, 153.2 g, 1.09 g/fish/day, and 1.533 %g/day, respectively). Fish survival, at the end of the experiment, increased with increasing yeast levels and the highest survival rates were

observed at T3 and T4 with the same value (94.5%), whereas the loest fish survival was observed at the control group (88.0%: Table 2).

Table 2. Growth performance of Nile tilapia fed on different levels of baker yeast for 20 weeks.

Parameter	T1	T2	T3	T4
Initial weight (g)	20.3±1.30 [a]	20.9±1.30 [a]	20.1±1.30 [a]	20.6±1.30 [a]
Final weight (g)	173.5±3.24 [c]	202.9±3.24 [b]	239.5±3.24 [a]	237.9±3.24 [a]
Weight gain (g)	153.2	182.0	219.4	217.3
Daily weight gain (g/fish/day)	1.09±0.23 [c]	1.30±0.23 [b]	1.57±0.23 [a]	1.55±0.23 [a]
SGR (%g/day)	1.533±0.14 [c]	1.624±0.14 [b]	1.770±0.14 [a]	1.748±0.14 [a]
Survival (%)	88.0	93.8	94.5	94.5

Means with the same letter in the same row are not significantly different at P< 0.05.

Table 3. Fish production and feed utilization by Nile tilapia fed on different levels of baker yeast for 20 weeks.

Parameter	T1	T2	T3	T4
Initial fish weight (kg/pond)	252.0	252.0	252.0	252.0
Final fish weight (kg/pond)	1831.4	2284.7	2717	2697.1
Net yield (kg/pond)	1579.4	2032.7	2465	2445.1
Feed intake (kg/pond)	3861.4	4588.4	5530.1	5477.5
Pond FCR	2.44	2.26	2.24	2.24

Means with the same letter in the same row are not significantly different at P<0.05.

Table (3) showed that the highest fish yield and net fish yield were obtained at T3 (2717.0 and 2465.0 kg/pond, respectively) and T4 (2697.1 and 2445.1 kg/pond, respectively), while the lowest fish yield and net yield were obtaine in the control group (T1; 1831.4 and 1579.4 kg/pond, respectively). It is noticed that feed intake increased significantly (P < 0.05) with increasing yeast

levels in fish feed and the highest feed intake was obtained at T3 (5530.1 kg feed/pond), while the lowest feed intake was observed at T1 (3861.0 kg feed/pond). Subsequently, FCR decreased significantly ($P<0.05$) with increasing yeast levels in fish feed with approxmately the same values (2.26, 2.24, and 2.24 for T2, T3, and T4, respectively), while the highest FCR value was observed at T1 (2.44).

Chemical composition:

Table (4) indicated that there are no significant differences in contents of dry matter and total lipids indicated by ether extract in whole-fish body and their ranges are 28.6 – 29.1 % and 2.2 – 23.9%, respectively. Meanwhile, crude protein contents in whole-fish body increased significantly ($P<0.05$) and the highest protein level was observed at T3 and T4 with the same value (64.7%), while the lowest one was observed at the control group (T1; 60.2%). Ash content decreased significantly ($P<0.05$) with increasing yeast levels and the lowest value was obtained at T3 and T4 with same value (12.0%), whereas the highest ash contents was observed in fish fed the control feed (14.1%: Table 4).

Table 4. Proximate chemical analysis (%; on dry weight basis) of whole body of Nile tilapia fed on diets containing different levels of baker yeast for 20 weeks.

Treatments	T1	T2	T3	T4
Dry matter	29.1±0.71 [a]	29.1±0.71 [a]	28.6±0.71 [a]	28.8±0.71 [a]
Crude protein	60.2±1.89 [c]	61.7±1.89 [b]	64.7±1.89 [a]	64.7±1.89 [a]
Ether extract	23.9±0.94 [a]	23.7±0.94 [a]	23.2±0.94 [a]	23.2±0.94 [a]
Ash	14.1±0.79 [a]	13.3±0.79 [b]	12.0±0.79 [c]	12.0±0.79[c]

Means with the same letter in the same row are not significantly different at $P<0.05$.

Clinical examinations of fish:

Clinical examination of the harvested fish showed external clinical abnormalities including skin darkening and corneal pacity (Fig 1-a). Ulcerative degeneration and depigmentation of the skin as typical signs of saddle back like

ulcer on the dorsal part of the fish near the head (Fig 1-b). Moreover signs of fin and anal rot was recorded (Fig 1-c).

a- Skin darkening and corneal pacity. **b**- Ulcer on the dorsal part of the fish.

c- Fin and anal rot.

Figure 1. Some infectious symptoms in Nile tilapia naturally infected by *F. columnare.*

Microscopical examination of unstained wet mounts made from the lesions revealed the presence of piles of very long bacteria resembling *F. columnare*. Gram stained smears from the same skin ulcers and underlying musculatures revealed the presence of long gram negative rods. Neither external nor parasites were found in any of examined fishes. Bacterial isolates were closely identified as *F. columnare.*

Economic evaluation:

Table 5. Economic efficiency (LE/Feddan) of yeast addion to Nile tilapia diet for 20 weeks.

Item	T1	T2	T 3	T4
A- Variable costs (LE/Feddan)				
1- Fish production				
a. Fingerlings	2220	2220	2220	2220
b. Feeds	14094.1	16747.72	20185.01	19993.66
c. Yeast a	0	205.62	244.52	242.74
Total variable costs (LE/Feddan)	16314.1	19173.34	22649.53	22456.4
B- Fixed costs (LE/Feddan)				
a. Materials and others (10%)	400	400	400	400
b. Taxes	500	500	500	500
Total fixed costs (LE/Feddan)	900	900	900	900
Total operating costs (variable and fixed costs)	17214.1	20073.34	23549.53	23356.4
Interest on working capital *	990.40	1154.90	1354.90	1343.79
Total costs	18204.50	21228.25	24904.43	24700.19
% of the smallest value	100	117%	137%	136%
Returns				
Total return (LE) **	18971.42	22846.49	29383.15	29128.70
Net return (LE/Feddan)	766.92	1618.24	4478.72	4428.51
% of the smallest value of net return	100%	211.0	584.0	577.4
% Net returns to total costs	4.21%	7.62%	17.98%	17.93%

* 15% × total operating costs × 140/365 days.

** The economical evaluation of results was carried out according to market prices in 2014 in LE (fish = LE 185 /1000 fry, yeast = LE 90/kg, and artificial feed = LE 3650 /ton).

Results of costs including variable, fixed and interest on working capital for the treatments applied are shown in Table (5). Results revealed that costs of fish stocking at initial are the same in all treatments; however, feed costs differed according to changes in fish weight and yeast addition to diets. The interest on working capital was lowest at T1 (990.40 LE/feddan) and increased to 1154.90, 1354.90 and 1343.79 LE/feddan for other T2, T3 and T4, respectively. Total costs per feddan increased for T1 (18204.50 LE; 100%) and increased to (21228.25 LE; 117%), (24904.43 LE; 137%) and (24700.19 LE; 136%) for T2, T3 and T4, respectively. Differences in total costs were attributed to the differences in feed and yeast costs. Total returns in LE/feddan

for T1, T2, T3 and T4 were 18971.42, 22846.49, 29383.15, and 29128.70LE, respectively (Table 5). Net returns/pond in LE were found to be 766.92, 1618.24, 4487.72 and 4428.51LE for T1, T2, T3 and T4, respectively. The percentage of net return to total costs were 4.21, 8.62, 17.98 and 17.93% for T1, T2, T3 and T4, respectively.

DISCUSSION

In the present study, no significant differences ($P > 0.05$) were observed in all water parameters except dissolved oxygen, which showed lowest value at T4 (3.9 mg/L), whereas its highest value was observed at T1 and T2 with the same value (4.2 mg/L). On the other hand, NH_3 concentrations increased significantly ($P < 0.05$) with increasing yeast level and its highest value was obtained at T4 (0.41 mg/L). These results may be attributed to the high fish biomass at T3 and T4, which uptaked more dissolved oxygen for growth metabolism. Also, the high fish biomass in T3 and T4 produced more NH_3 as a result of protein metabolism. Generally, there are a negative relationship between dissolved oxygen and NH_3 concentrations. Additionally, Abdel-Tawwab *et al.* (2014) found that Nile tilapia could grow better at 3.5 mg DO/L without stress. Diana and Lin (1998) reported that NH_3 concentration of 0.374 – 0.410 mg/L was tolerable in Nile tilapia ponds. Boyd (1984) reported that water with a pH range of 6.5 – 9.0 are the most suitable for fish production. Generally, all water quality parameters in the present study are in the suitable range (Boyd, 1984).

In the present study, the growth performance, feed utilization, and production of Nile tilapia were significantly improved by supplementing live bakery yeast. Similar results showed that the incorporation of *S. cerevisiae* in the basal diet significantly improves growth performances of Nile tilapia (Lara-Flores *et al.*, 2003; Abdel-Tawwab *et al.*, 2008 and Abdel-Tawwab, 2012), Galilee tilapia, *Sarotherodon galilaeus* (Abdel-Tawwab *et al.*, 2010), koi carp, *Cyprinus carpio* (Dhanaraj *et al*., 2010), and beluga, *Huso huso* (Hoseinifar *et al.*, 2011). The obtained results are in agreement with Czerucka *et al*. (2007) who found positive effect of yeast (*S. Cerevisiae*) used as a feed additive on

growth performance and survival of Nile tilapia. Pooramini *et al*. (2014) studied the effects of different concentrations of yeast, *S. cerevisia* on growth performance and survival rate of rainbow trout (*Oncorhynchus mykiss*) fry and their resistance against salinity. They found that, fish fed with different yeast levels had a higher growth rate than those fed with normal artificial diet. Researches on the effects of S. cerevisiae and rearing conditions in rainbow trout revealed that supplementation of trout starter diet with S. cerevisiae may be particularly useful to increase fish growth.

Concerning the proximate chemical composition of whole-fish body, there were no significant differences in contents of dry matter and total lipids among the different treatments, while the highest protein and lowest ash contents were obtained at T3 and T4. The lowest protein and highest ash contents were found in T1. Pooramini *et al*. (2014) found higher crude protein contents in trout fed diets containing on 1% and 5% yeast (*S. Cerevisae*) than fish fed yeast-free diet. The obtained results herein may be because the changes in body constituents such as protein contents could be linked with changes in its synthesis, deposition rate in muscle and/or different growth rates (Fauconneau, 1984 and Abdel-Tawwab *et al*., 2006).

Clinical examination of the harvested fish showed external clinical abnormalities including skin darkening and corneal pacity (Fig 1-a). Ulcerative degeneration and depigmentation of the skin as typical signs of saddle back like ulcer on the dorsal part of the fish near the head (Fig 1-b). Moreover signs of fin and anal rot was recorded (Fig 1-c). Microscopical examination of unstained wet mounts made from the lesions revealed the presence of piles of very long bacteria resembling *F. columnare*. Gram stained smears from the same skin ulcers and underlying musculatures revealed the presence of long gram negative rods. Neither external nor parasites were found in any of examined fishes. Bacterial isolates were closely identified as *F. columnare*. These remrks came close to the results of Plumb (1997) who stated that bacterial diseases are among the most important causes of economic losses in

cultured tilapia. *Aeromonas* spp., *Pseudomonas fluorescens, Vibrio anguillarum, Flavobacterium columnare, Edwardsiella tarda,* Streptococcus spp. and Enterococcus sp. are commonly found in the facilities.

The optimum concentration of probiotics is not only required for establishment and subsequent proliferation in the gastrointestinal tract, but also needs to exert various beneficial effects including immunostimulatory activity. In the present study, yeast addition enhanced fish resistance to natural infection by *F. columnare*. In this regard, Abdel-Tawwab *et al.* (2008) and Abdel-Tawwab (2012) found that baker yeast supplementaion reduced the artifial infection by *Aeromonas hydrophila*. The optimum dose of probiotics may vary with respect to host and also type of immune parameters. Brunt *et al*. (2007) determined that the effective dose of the probiotic to *Bacillus* species must be 2 × 10^8 cells, at which they have recorded the least percentage mortality in rainbow trout (*O. mykiss*) during challenge study.

CONCLUSION

Based on the obtained results in the present study and the economic evaluation, it can be concluded that feeding Nile tilapia on an artificial feed containing crude protein, 25% with 0.2% baker yeast leads to an increase in their growth, total production, survival rate and resistance to *F. columnare* infection.

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تأثير خميرة الخبز كمادة مضافة لعلائق الأسماك على أداء النمو والحالة الصحية لأسماك البلطى النيلى

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الملخص العربى

تهدف هذه الدراسة الى تقييم استخدام خميرة الخبز كإضافة غذائية لعلائق الأسماك على أداء النمو والمحصول الكلي والحالة الصحية لأسماك البلطي النيلي. تمت إضافة الخميرة لعلائق أسماك البلطي النيلى بتركيزات صفر، ٠.١ ، ٠.٢ ، ٠.٣٪ . تمت هذه التجربة فى أحواض ترابية مساحة الحوض واحد فدان و كان عمود المياه فى كل الأحواض ١٢٥ سم بواقع مكررين لكل معاملة. تم تسكين اسماك البلطى النيلى بمعدل ١٢٠٠٠ سمكة / حوض بمتوسط وزن السمكة ٢٠.٨ جم و تغذت على العلائق بمعدل ٣% من الوزن الحى على مرتين متساويتين يوميا ستة ايام اسبوعيا ولمدة ٢٠ اسبوع . كان افضل نمو للاسماك واستفادة من العلف المقدم و معامل تحويل العلف فى المعاملة الثالثة المغذاة على عليقة صناعية مضاف اليها ٠.٢٪ خميرة في حين سجلت المعاملة الكنترول أقل نمو واستفادة من العلف واعلى معامل تحويل للعلف . لم يلاحظ اى فروق معنوية فى نسبة الماده الجافة و محتوى الدهن الكلى فى جسم الاسماك فى المعاملات المختلفة بينما زادت نسبة البروتين و انخفضت نسبة الرماد فى جسم الاسماك كلما زادت نسبة الخميرة فى العلف حيث سجلت المعاملات الثالثة والرابعة أعلى معدل من نسبة البروتين واقل معدل من نسبة الرماد فى جسم الاسماك بينما سجلت المعاملة الأولى (الكنترول) اقل معدل من نسبة البروتين وأعلى معدل من نسبة الرماد فى جسم الاسماك. اظهر التحليل الاقتصادى ان افضل عائد اقتصادى قد تحقق فى المعاملات الثالثة و الرابعه. وبناء على النتائج المتحصل عليها في هذه الدراسة والتقييم الاقتصادي، فإنه يمكن استنتاج أن تغذية أسماك البلطي النيلي على تغذية صناعية تحتوي على ٢٥٪ بروتين خام مضاف اليها ٠.٢٪ من الخميرة أدى إلى زيادة وزن الجسم و انتاجية أسماك البلطي النيلي، وكذلك ادت الى قلة الاصابة بالامراض البكتيرية و تحسين الحالة الصحية بالإضافة إلى زيادة الكفاءة الاقتصادية مقارنة مع المعاملات الأخرى.