Effect of four different commercial diets on growth performance of the cichlid fish, *Oreochromis niloticus* fingerlings

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ABSTRACT

The present study deals with the effect of four commercially prepared diets on the length-weight relationship, condition factors, growth performance and feed utilization of the cichlid fish, *Oreochromis niloticus* fingerling reared in glass aquaria. The major components of diets included proteins, fats and carbohydrates of each feed type. The diets were analyzed for verification of values written on its commercial label. Data showed that, the standard length of the fish fed on the different diets did not vary significantly where it ranges between 6.28 ± 0.9 cm in diet II to 6.66 ± 0.8 cm in diet I. The same pattern of change was also noticed in comparing the weight of fishes fed on the four diets. Data indicated that, fish feeding on diet IV demonstrate the lowest weight being on the average of 8.86 ± 1.97 gm, while, fish feeding on diet I showed the highest weight being averaged 10.37 ± 3.2 gm. The growth of fish is nearly isometric in the first three diets and negative allometric in the fourth one. The values of condition factors are slightly differences among different diets. The highest value (3.46) of coefficient of condition (k) was recorded in the fish fed on diet II and the lowest value (3.09) in the fish fed on diet III. The highest average value (1.07) of the relative condition factor (kn) and the lowest (0.90) were recorded in the fish fed on diet III. The lowest value of total weight gain, average daily gain and specific growth rate were detected in the fish fed on diet IV. The value of feed intake of diet I is better than the values obtained from the other feed diets. The best feed conversion ratio (1.87) was recorded in the fish fed on diet II. The lower protein efficiency ratio (0.25) was recorded with diet IV and the higher protein efficiency ratio (0.53) was recorded with diet II.

Keywords: Dietary composition; growth performance; *Oreochromis niloticus*

INTRODUCTION

The aquaculture industry currently accounts for over 45% of all sea food consumed. That will have been projected to increase to 75% over the next 20 years (FTU, 2007). In Egypt, the production of fish coming from aquaculture represented about 70% of the total fish production source (GAFRD, 2010). Fish importance as food source increases with the increase in demands, especially in animal protein (El-Kalla et al., 2001 and Azab et al., 2005). In the recent years, a great attention has been paid to establishment of fish farms. These farms could contribute partially in producing the demanded on animal protein sources consumed by human (Azab et al., 2005).

Tilapia is an ideal candidate for warm water aquaculture. They spawn easily in captivity, use a wide variety of natural foods as well as formulated feeds, tolerate poor water quality and grow rapidly at warm temperatures. These attributes, along with
relatively low input costs have made tilapia widely cultured freshwater fish in tropical and subtropical countries (Biswas et al., 2005; Fasakin et al., 2005; El-Saidy and Gaber, 2005; Borgeson et al., 2006; Tsadik and Bar, 2007; Tahoun, 2007 and Al-Abssawy, 2010).

The feeding of prepared diets is a principal factor in aquaculture to increase growth and production of reared fish (Thankur et al., 2004; Liti et al., 2005 and Abdel-Tawwab et al., 2007). Dietary protein is an important aspect in achieving efficient fish production and should accommodate fish requirements due to age/weight. Because protein is the most expensive ingredient in commercially prepared feeds and thus it should be carefully formulated to meet the needs of the cultured organism. Understanding the fish's protein requirement during the growth period is fundamental in fish culture management leading to maximized feed conversion efficiency, cost savings, and reduced nutrient loading into the aquatic ecosystem (Abdel- Tawwab & Ahmad, 2009 and Al-Abssawy, 2010).

Nile tilapia, Oreochromis niloticus (L.) accepts artificial feeding from hatching and typically shows high survival rates and fast growth (El-Sayed, 2006). The optimum feeding regimes / schedules of cultured fish is an important aspect in achieving efficient production and also could lead to a significant saving in diet cost. The feeding schedule concept was developed taking in to account the changes in the protein requirement and digestibility of cultured fishes (Thoman et al., 2004; Wu et al., 2004; Hossain et al., 2006 and Al-Abssawy, 2010).

Therefore, the aim of the present work is to evaluate the effect of four different commercially prepared diets on some biological aspects of Oreochromis niloticus fingerling reared in glass aquaria including length-weight relationship, condition factors, growth performance and feed utilization.

MATERIAL AND METHODS

A total of 500 specimens of Nile Tilapia, Oreochromis niloticus fingerling, obtained from fish Hatchery at Abbash of the General Authority for Fish Resources Development during the September, 2010. Fishes were transported to the animal facility at Faculty of Science; Al-Azhar University in large plastic bags and then acclimatized for one week in well aerated stock aquaria of 250 liters capacity. Fishes were fed daily on a commercial fish diet and any fish with abnormal appearance or behavior was excluded.

In the laboratory fishes were grouped randomly in 12 groups of 30 fish each. Each fish group was separated in experimental aquarium 90 liters capacity (100X40X30 cm). Four different commercial diets (I, II, III and IV) were used in feeding fishes three tanks each. The basic diets were obtained from El-Morshedy factory (feed Diet I, II), Berseq factory (feed Diet III), El-Sayieda Aisha market (feed Diet IV). The tanks were provided with aeration, change of water weekly was carried out and the aquaria were cleaned regularly with add one drop per liter of 1% methylene blue for each tank. After adaptation was completed, fish in each aquarium were weighed and their initial weights were recorded. Fish in each aquarium were fed twice daily, six days a week. Fish were fed at a rate of 3 % of fresh body weight. The experiment was conducted for 12 weeks and fishes were weighed and measured weekly.

Proximate analysis of protein and lipid in each of the experimental diets were performed according to standard AOAC (2000) methods.
Biological data:

Length-weight relationship:
Standard lengths of ten samples of each aquarium were measured weekly to the nearest millimeter using Varner caliper. The body weight of the same samples was also determined to the nearest 0.1 gram and recorded. Length-weight relationship was determined by using power equation or its logarithmic modification according to the followings methods as the follows:

\[ \log W = \log a \pm b \log L \]  
(Lagler, 1956)

Where:
- \( W \) = Weight of the fish in gram.
- \( L \) = standard length in centimeter.
- a and b = constants, whose values are estimated by the least square method. By grouping the fish in 10mm length groups the empirical and calculated were determined.

Condition factor:
Condition factor (k), which measures the well-being of fish was calculated from equation proposed by Hile (1936) as the follows:

\[ K = 100 \frac{W}{L^3} \]

Where:
- \( W \) = fish weight in gram.
- \( L \) = fish length in centimeter

The relative condition factor (Kn) was determined by the following formula:

\[ Kn = \frac{W}{w} \]

Where:
- \( W \) = fish weight in gram.
- \( w \) = calculated weight estimated from the length-weight relationship.

Growth performance:
Total weight gain, average daily gain, specific growth rate, feed conversion ratio protein and energy utilization was determined according to Recker, (1975) and castell & Tiews, (1980) as follow:

1. Total weight gain (g/fish) = (WT-WI).
   Where:
   - \( WT \) = final means weight of fish in grams.
   - \( WI \) = initial means weight of fish in grams.

2. Average daily gain (ADG) (g/fish/day) = total gain/duration period.

3. Specific growth rate (SGR) % / day) = \( 100 \times \frac{\text{Ln} WT - \text{Ln} WI}{\text{duration period}} \).
   Where: \( \text{Ln} = \) Natural log and \( n \) is the duration period in days.

Nutrient utilization parameters:
1. Feed conversion ratio (FCR) = dry matter intake (g)/total gain (g).
2. Protein efficiency ratio (PER) = total gain (g)/protein intake (g).
3. Protein productive value (PPV%)= (PT-PI) \times 100/protein intake (g).
   Where:
   - \( PT \) = protein content in fish carcass at the end.
   - \( PI \) = protein content at the start.

RESULTS

Results of the analysis of the composition and characteristics of ingredients of the four tested diets are given in Table (1). Data showed that, the percentage of crude
protein varied from 27.7 to 30.7% in diet I and IV respectively. In addition, the amount of fats present in the experimental diets expressed as ether extract (mg/g) ranged between 5.02 to 19.64 % in diets number I and IV respectively.

Table 1: Percentage composition and proximate analysis of the experimental diets contain different dietary composition.

<table>
<thead>
<tr>
<th>Items</th>
<th>Diets</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
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<tbody>
<tr>
<td>Fish meal</td>
<td></td>
<td>30</td>
<td>25</td>
<td>30</td>
<td>10</td>
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<tr>
<td>Wheat bran</td>
<td></td>
<td>15</td>
<td>20</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Yellow corn</td>
<td></td>
<td>25</td>
<td>25</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>meet &amp; bone meal</td>
<td></td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Gelatian</td>
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<td>0</td>
<td>4</td>
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<tr>
<td>Glutofed</td>
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<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Molath</td>
<td></td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Vitamin mixture</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Mineral mixtur</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
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</table>

Proximate analysis (%dry weight)

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>94.11</td>
<td>94.36</td>
<td>95.83</td>
<td>96.34</td>
</tr>
<tr>
<td>Crude protien</td>
<td>27.74</td>
<td>27.87</td>
<td>28.45</td>
<td>30.77</td>
</tr>
<tr>
<td>Ether extract</td>
<td>5.02</td>
<td>6.99</td>
<td>12.77</td>
<td>19.64</td>
</tr>
</tbody>
</table>

Growth studies:

A- Length-Weigh relationship

Results of length weight relationship of *O. niloticus* fingerling reared in glass aquaria and fed with diet I, II, III and IV are graphically represented in figure (1A, B, C & D).

1- Length-Weigh relationship of *O. niloticus*, fed on ration I:

Data in figure (1A) show that, the weight of the fish increases gradually with the increasing length of the fish. From the other angle, the length-weigh relationship of the fish was logarithmically transformed to give the straight-line relationship. Consequently, the values of a and b were -1.38 and 2.89 respectively. Thus, the length-weight relationship of this treatment is expressed by the following equation:

$$\log w = -1.38 + 2.89 \log L$$

From the above-mentioned equation, it is clear that, the growth of fish is nearly isometric. The b value is around the ideal. The correlation coefficient (r) is statistically highly significant (0.996).

2- Length-Weigh relationship of *O. niloticus*, fed on ration II:

Data in figure (1B) show that, the weight of the fish increases gradually with the increasing length of the fish. From the other angle, the length-weight relationship of the fish was logarithmically transformed to give the straight-line relationship. Consequently, the values of a and b were -1.32 and 2.83 respectively. Thus, the length-weight relationship of this treatment is expressed by the following equation:

$$\log w = -1.32 + 2.83 \log L$$

From the above-mentioned equation, it is clear that, the growth of fish is nearly isometric. The b value is around the ideal. The correlation coefficient (r) is statistically highly significant (0.9968).

3- Length-Weigh relationship of *O. niloticus*, fed on ration III:

Data in figure (1C) show that, the weight of the fish increases gradually with the increasing length of the fish. From the other angle, the length-Weigh relationship
of the fish was logarithmically transformed to give the straight-line relationship. Consequently, the values of \( a \) and \( b \) were -1.39 and 2.88 respectively. Thus, the length-weight relationship of this treatment is expressed by the following equation:

\[
\log w = -1.39 + 2.88 \log L
\]

From the above-mentioned equation, it is clear that, the growth of fish is nearly isometric. The \( b \) value is nearly ideal. The correlation coefficient (\( r \)) is statistically highly significant (0.993).

4- Length-Weigh relationship of *O. niloticus*, fed on ration IV:

Data in figure (1D) show that, the weight of the fish increases gradually with the increasing length of fish. From the other angle, the length-Weigh relationship of the fish was logarithmically transformed to give the straight-line relationship. Consequently, the values of \( a \) and \( b \) were -0.91 and 2.31 respectively. Thus, the length-weight relationship of this treatment is expressed by the following equation:

\[
\log w = -0.91 + 2.31 \log L
\]

From the above-mentioned equation, it is clear that, the growth of fish is negative allometric. The \( b \) value is more less than the ideal. The correlation coefficient (\( r \)) is statistically highly significant (0.993).

![Fig. 1: Length-Weigh relationship of *O. niloticus* reared in glass aquaria and fed on ration I (A), ration II (B), ration III (C), ration IV (D).](image)

B- Condition factors of *O. niloticus*, reared in glass aquaria:

Results of the composite coefficient of condition (\( k \)) and the relative condition factor (\( k_n \)) of *O. niloticus* fingerling as affected with type of diets are given in (Fig. 2).

Data revealed that, the values of condition factors are slightly different among different feed rations. The highest value (3.46) of coefficient of condition (\( k \)) was recorded with the fish fed on ration II and the lowest value (3.09) with the fish fed on ration III. The coefficient of condition (\( k \)) average values were slightly decreased among different treatments; being 3.46, 3.36, 3.34 and 3.28 respectively in the fish fed on ration II, ration I, ration IV and ration III respectively (Fig. 2).

The highest average value (1.07) of the relative condition factor (\( k_n \)) and the lowest (0.90) were recorded in the fish fed on Ration III. The average value of relative
condition factor \((k_n)\) were slightly decreased among different treatments; being \((1.00, 0.99, 0.99 \text{ and } 0.97)\) respectively in the fish fed on ration III, ration II, ration I and ration IV (Fig. 2).

**Fig. 2:** Effect of different rations on the condition factors of *O. niloticus*, reared in glass aquaria.

**C- Growth performance and nutrient utilization parameters:**

Effect of tested rations on initial and final body weight, total weight gain, average daily gain (ADG \(\text{g/fish/day}\)), specific growth (SGR\%\text{/day}), feed intake(FI \(\text{gm/fish}\)), feed conversion ratio (FCR), protein efficiency ratio (PER), and protein productive value (PPV\%) are shown in Table (2).

Table 2: Growth performance and nutrient utilization parameters of *O. niloticus*, fed on different feed rations.

<table>
<thead>
<tr>
<th>Item</th>
<th>Feed rations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ration I</td>
</tr>
<tr>
<td>Initial live weight (g/fish)</td>
<td>4.41 ± 1.95</td>
</tr>
<tr>
<td>Final live weight (g/fish)</td>
<td>13.37±4.67</td>
</tr>
<tr>
<td>Weight gain (g/fish)</td>
<td>8.96±3.31</td>
</tr>
<tr>
<td>Average daily gain (g/day/fish)</td>
<td>0.10</td>
</tr>
<tr>
<td>Specific growth rate (%/day)</td>
<td>1.32</td>
</tr>
<tr>
<td>Feed intake (FI)</td>
<td>28.16</td>
</tr>
<tr>
<td>Feed conversion ratio (FCR)</td>
<td>3.14</td>
</tr>
<tr>
<td>Protein efficiency ratio (PER)</td>
<td>0.38</td>
</tr>
<tr>
<td>Protein productive value (PPV %)</td>
<td>13.31</td>
</tr>
</tbody>
</table>

Data show that, the total weight gain of Nile tilapia, *O. niloticus*, fingerling improved in general with the increasing dietary protein level up to ration III compared with fish group fed on diet I, diet II and diet IV; being 10 ± 2.85 in the former and 8.96± 3.31, 9.87± 4.35 and 6.99±2.11 respectively in the latter. The lowest value of total weight gain \((6.99 \pm 2.11)\) was detected in the fish fed on diet IV. The same trend was observed with average daily gain and specific growth rate.
The value of feed intake (g/fish) of ration I is better than the values obtained from the other rations. The best feed conversion ratio (1.87) was recorded in the fish fed on ration II. The higher protein efficiency ratio (PER) was recorded with ration II (0.53) and the lower protein efficiency ratio (0.25) was recorded with ration IV. Efficiency of protein utilization in terms of protein productive values (PPV %) recorded among ration I, ration II, ration III and ration IV were 13.31, 4.27, 7.45 and 17.26 respectively.

**DISCUSSION**

Tilapia, are considered as the best species for culture, because of their high tolerance to adverse environmental conditions, ease of reproduction, their fast growth and potential for domestication (El-Sayed, 1999).

Fish growth has long been an interesting subject for aquaculturists and fisheries. Consequently most researches, experimental approach and that of field studies, have been concentrated on commercially important species. The condition factors are based on the hypothesis that, the heavier fish of a given length is in better condition. They are often used to compare the differences related to ecological and biological factors such as fatness, sex, mortality, feeding conditions and gonad weight (Bagenal and Tesch, 1978; Al-Abssawy, 2010 and Basusta et al., 2013). Mahdi et al., (1973) studied the length-weight relation of Tilapia in saline, fresh and brackish water ponds and stated that, the length-weight relationship was found to be the best method for studying age groups.

The present study showed that, the weight of the fish *O.niloticus* increases to power greater than the -cube of the length and this indicates that, the shape change rapidly with the increasing length. There is a close fit between the actual and calculated weights. Similar observations were detected by Khalaf and Alne-na-ei (1995) who studied age and growth of *O. niloticus* in Bahr shebeen Canal and showed that, the value of condition factor increased with increasing fish length which differs with the present study. It may be due to location and environmental conditions between Bahr Shebeen Canal and laboratory conditions.

In the present study the (b) value was around 3 except feed ration IV. Similar observations were noticed for the same species by Mosaad (1990) at Lake Qarun (2.9); El-Zarka (1961) at Lake Edku (3.06) and Lake Qarum (3.09); and differ at Lake Borollus (3.21).

The present study indicated that, the weight increases with the increasing length of this fish. This result was nearly similar to Khalaf-allah (2001), who studied the length-weight relationship and condition factors and approved that, all fishes; the exponent "b" in the fish is around the ideal. Composite coefficient "k" and the relative condition factor "kn" are varied significantly with the fish size.

In the present study, the highly best growth is recorded in the fishes fed on ration I (b= 2.89). It may be due to decrease of lipid level in the diet. In this connection, Soliman (2005) and Al-Abssawy (2010) revealed that, the correlation coefficient "r" was statically highly significant; being 0.9097 for *O. niloticus*, which uncompleted agreement to the current study results.

The condition factors are based on the hypothesis that, the heavier fish of a given length is in better condition. They are often used to compare the differences related to ecological and biological factors such as fatness, sex, mortality, feeding conditions and gonad weight (Bagenal and Tesch, 1978 and Al-Abssawy, 2010).
However, the annual condition factor reported by Soliman (2005) for the four species can be arranged in the following sequence, *T. zilli* (2.05) > *S. galilaeus* (2.05) > *O. niloticus* (2) > *O. aureus* (1.73). These results are lower than that recorded in the current study. It may be due to the variations of environmental conditions between natural habitat and laboratory.

Optimization of feed quality for fish farming is important for economical assessment as well as biological, environmental and health reasons. The impact of feed on growth and feed conversion will mainly depend on the used ingredients and on their quality (Tacon, 1994). Also, processing of food plays an important role in food quality, safety, storage and characteristics of specific food item (Chen *et al.*, 1999). Feeding represent over 50% of the operational costs of aquaculture (Jauncey & Ross, 1982; Tacon, 1993 and El-sayed, 1999).

In the present study, the best feed conversion ratio (1.87) was recorded in fish fed on ration II. This result was higher than that recorded in the same species in other farms, El-Shebly (1991& 1998) recorded food conversion of 1.8 in Serow Fish-Farm and 1.21 in fresh water fish farm at Manzalah region which indicates the bad foods are used in the present experiment. The diet of fishes must be balanced and contain the primary or basic food components including protein, carbohydrates and lipids. The amounts of these substances were differences for different species of fishes. Vitamins and minerals are also required for growth, sustenance and replacement of tissues as well as for normal metabolism (Villegas, 1975).

The present study revealed that, the average values of final body weight, total weight gain and average daily gain (ADG g/fish/day) increases with the increasing dietary protein levels except in ration IV. It may be due to the pad source of protein in the feed ration IV. Results came in close disagreement with those obtained by Shiau and Hung (1990), who found that the protein energy ratio required for the better growth of hybrid Tilapia fed on a diet containing 21% crude protein attained 67.74mg protein/kcal.

In the present study, the feed intake and feed conversion ratio showed no significant differences. The tested diets tend to be very low benefits for growth of fish. This result is differs with observations detected by Khater and Dawah (2008) and in agreement with that of Al-Abssawy (2010). Who reported that growth of molds on stored grains reduces its quality because of diminished sprouting discoloration, changes in taste as well as loss in nutrient value. Also, these results are similar to those observed by many investigators on the growth suppression in fish fed rancid diets (Yildirim *et al.*, 2000; Tuan *et al.*, 2002 & 2003 and Manning *et al.*, 2003 and Azab *et al.*, 2005).

However, these results are in disagreement with El-Sagheer (2001) who reported that, the increasing dietary protein level from 25% to 32% increased growth performance and nutrient utilization of Tilapia. Bahnasawy (2009), however, found that, the diet containing 30% crude protein is considered optimal for growth of monosex Nile Tilapia of 2.5 g average initial weight.

In the present study, it was found that the feed rations III were improved weight gain. These results were similar to the recommended values (25% crude protein) for fresh water fish in several other countries (Clark *et al.*, 1990; Shiau and Hung., 1990 Khater and Dawah, 2008 and Al-Abssawy, 2010).

From the previous results, it was clear that, using length-weight relationship, condition factors, growth performance and feed utilization is a must for determination of the quality of the fish feed. For example, the analysis of protein content alone is not enough, thus the 30% protein diet did not improve growth performance of *O.*
Effect of four different diets on growth performance of the *O. niloticus* fingerlings

*O. niloticus*. The protein quality and its amino acids profile as well as its contents of essential amino acids and its digestibility are more important parameters to judge the ration quality.

So it is recommended that a set of procedures applied in the present work should be used in testing the fish feed prior to application in the fish farms (aquaculture).

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Effect of four different diets on growth performance of the _O. niloticus_ fingerlings

different protein levels with natural food. Central Lab. For Aquaculture Research, Abbassa, Agricultural Research Center, Giza, Egypt.


ARABIC SUMMERY

تأثير أربع علاقات تجارية مختلفة على نمو واداء اصبعيات البلطي الأبيض (أوربوكروميس نيلوتيكوس).

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من اولى المشاكل الخطرة والواجبة في كثير من انماط العالم هي نقص البروتين الحيويون اللازم للغذاء، وسد الفجوة بين الكميات المطلوبة والمنتيجة من البروتينات حيوانية التي تزداد عما بعد عام، ولسبب في ذلك هو تزايد عدد السكان. إذا اجتذب جهود الدولة نحو الإرتفاع بقطاع الاستزراع السمكي، حيث أن عملية التغذية في المزارع السمكية تتمثل أكثر من 50% من النكهة الكلية لعملية الاستزراع، فما كان من الدراسة الحالية تهدف إلى توضيح تاثيرات علاقات مختلفة على علاقة الطول والوزن، معامل الحال، زيادة معدلات النمو والاستفادة الغذائية لاصبعيات البلطي النيلي المرء في أحماض زاجية.

أوضح الدراسة أن المكونات الرئيسية للغذاء المغذى يشمل البروتين والدهون والكربوهيدرات.

وبدوره الدراسة أظهر عدم صحة قيام البروتين والدهون المكتوبة على الكاربون الالي لكل علبة، تبين من الدراسة أنه لا يوجد فرق معنوي في النمو القياسي والوزن لأصبعيات البلطي النيلي المغذى على العلاق.

ووفق لجودة الدراس في مدي من 48-50 سم في العلبة الثانية الي 180 ± 0.80 سم في العلبة الأولى، أي 38 ± 0.80 جم ببنج عند تنمية الأسماك على العلبة الأولى أظهرت أن وزنه بمتوسط 32 ± 0.04 جم. بينت الدراسة أن نمو الأسماك المغذى على الثلاث علاقات الزمن كان متراقبًا لباشا، بينما الأسماك المغذى على العلبة.

أوضح الدراسة أن النتائج كانت متغيرة من النمو، في الدراسية توجد اختلافات طفيفة في قيام معدل الحال، ومعامل الحال النسبي للأسماك المغذى على العلبة المغذى.

وجملة في الدراسة المغذى على العلبة المغذى، سجلت أعلى قيمة لمعامل الحال (0.67) في الأسماك المغذى على العلبة النسبي (1000) وقل لقيمة (889) في الأسماك المغذى على العلبة الثالثة. سجلت أعلى قيمة لمعامل حال حال (1000) وأقل قيمة (889) في الأسماك المغذى على العلبة الثالثة. سجلت أعلى قيمة في معدل زيادة الوزن، في الدراسة البديلة في الوزن ومعدل النمو الخاص في الأسماك المغذى على العلبة النسبي. بينت الدراسة أن قيمة استهلاك الغذاء في العلبة الأولى أفضل من باقي العلاقات. سجلت النتائج على نسبة تحول غذائي (0.89) في العلبة الثانية. سجلت نسبة كفاءة الالترن النسبي (31 م) في العلبة الثانية (0.93) في العلبة الثانية.

يشكذا من هذا البحث أنه يجب تغيير أساسي في الاستفادة من الأسماك المغذى على علبة مغذى معلومة المصدر ومكانية حصول على نتائج متميزة في استفاده منها كاملة في نمو الأسماك. يجب أن تحتوي العلبة التي تغذي عليها الأسماك المغذى على الاحتياجات المئثرة من المكونات الغذائية لنويع هذه الأسماك عند الاستفادة الكاملة من حيث العائد الاقتصادي والقيمة الغذائية.