Effect of Fenugreek Seeds By-produced meal on Growth Performance, Feed Utilization, Body Composition and Some Physiological Traits for Common Carp (Cyprinus Carpio).

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ABSTRACT

This study was performed to investigate the effect of dietary supplementation with fenugreek seeds by-produced meal (FSM) on growth performance, feed utilization, body composition and some physiological traits of Common carp (Cyprinus carpio) with an average 10.6 ± 0.15g weights and 8.78 ± 0.14cm length. A 12-week feeding trial was conducted in 12 aquariums (75 – 60 – 45cm in diameters). Four experimental diets were formulated to containing 0% (Commercial diet), 10, 20 and 30% FSM by-produced. The results revealed that fenugreek seeds meal supplementation significantly enhanced the fish growth over the control group. Also, condition factor and survival rate were significantly increased with increasing FSM percentage in the diets up to 20%. Feed conversion ratio was significantly improved with increasing FSM up to 20% inclusion level. Fish feeding diets containing 20% FSM had significant increase in PER, whereas there was no significant difference in feed intake. Body protein and dry matter content was significantly increased with increasing FSM percentage in the diets until 20%, while the higher value of fat content was recorded with diet contained 10% fenugreek seeds. The higher significant plasma protein and lysozyme and lower plasma glucose was obtained in diet containing 20% FSM. Fish fed control diet gave the higher value of plasma glucose and the lower value lysozyme, while Fish fed 30 % FSM provided the lower value plasma protein. It could be concluded that the dietary addition of 20% of fenugreek seeds by-produced meal enhanced the growth performance of Common carp.

Key words: Common carp, fenugreek seeds by-produced, growth performance.
Introduction

Carp species are widely cultivated freshwater fish family in worldwide. They are third only to tilapia and mullet as the most widely farmed fish in Egypt (GAFRD, 2018). Carp species have become important species in fish culture systems because of their tolerance of wide differences in pond temperature and water quality, ease of management, reproduction, high growth rates, high conversion of artificial feed and resistance to disease (Syeed et al., 2018). Common carp, *Cyprinus carpio*, is one of the most widely cultured carp species.

Several feed supplements have been used to improve growth performance and health status in various fish. Recently, research has increased on the supplementation of medicinal plants in trial to produce organic fishes. Fenugreek (*Trigonella foenum-graecum*) seed meal (FSM) has been reported to produce various beneficial effects, including growth promotion, immunostimulation and antimicrobial effects in fish. It is rich in protein (20-30%) high in lysine and tryptophan; carbohydrates (45-60%). Fenugreek seeds contain high phytonutrients, minerals, and vitamin contents. They have high amount of non-starch polysaccharide (NSP) fibers. Major NSP’s are tannins, saponins, hemicelluloses, mucilages and galactomannans. Non-starch polysaccharides enhance bowel movement, support in smooth digestion and also help in decreasing LDL cholesterol level in the blood through binding. NSPs also capture toxic substances present in food and act as a shield for the colon mucosal layers against cancers. Fenugreek seeds also contain amino acid 4-hydroxyisoleucine, which boosts insulin secretion. Other essential phytochemicals present in fenugreek seeds (including trigonelline, gitogenin, yamogenin, diosgenin, choline and trigogenin) play important therapeutic roles, such as being anti-anorexic, anti-oxidant, anti-carcinogenic, antihyperlipidemic, anti-inflammatory, and antidiabetic uses. (Blumenthal et al., 2000 and Riaz et al 2020)

The use of FSM from 5 to 15 g/kg in the diets of common carp Cyprinus carpio and Striped Catfish led to significantly improved growth compared to a control diet (FSM free) (Roohi et al., 2015 and Syeed et al., 2018). Similarly, incorporation of FSM at levels of 1% in tilapia diets have effects a positive on growth performance, nutrient utilization and physiological parameters in Nile tilapia (Mostafa et al., 2009 and Tonsy et al., 2011). Also the inclusion of FSM at 50 g/kg also improved the growth of gilthead seabream Sparus aurata as well as some immunological responses (Bahi et al., 2017 and Guardiola et al., 2017). Moustafa et al (2020) found that the optimum growth performance, feed
conversion, immune response and antioxidant capacity compared other groups could be reached with the inclusion of (3%) FSM in the diet of Nile tilapia. Abbas et al., 2019 revealed that the inclusion of 5 % of crude fenugreek seeds or 3 % of an alcoholic fenugreek seed extract as a feed additive enhances fish growth and immunity of Nile tilapia fish. Sheikhlar et al., 2017 stated that the inclusion of FSM at 180 g/kg to replacement of FSM of African catfish improved the growth compared to a control diet However no previous study has been conducted on FSM by-produced as a partial replacement for diet protein.

The aim of this study was to evaluate the feasibility of including FSM by-produced in the diets of Common carp, Cyprinus carpio on the growth performance, feed utilization, whole- body composition and physiological traits.

Materials and Methods

Fish experimental:

Common carp (Cyprinus carpio) fingerlings with an average 10.6 ± 0.15g weights and 8.78± 0.14cm length was obtained from the fish hatchery, Central Laboratory for Aquaculture Research, Abbassa. They kept for 2 weeks in indoor tank as an acclimation period to the laboratory conditions. Fish fed on a commercial diet containing 30% crude protein.

Fenugreek seeds meal

Fenugreek seeds meal (FSM) was obtained from local market; it's prepared as by-product of oil extraction from fenugreek seeds by mechanical extraction as traditional method

Feed preparation

Four experimental diets were prepared in the laboratory. A control diet consisted from standard commercial diet without any treatment. The second, third and fourth diets containing fenugreek seeds meal (FSM by-produced) at a concentration of 10, 20 and 30% of the ration respectively, were mixed with the commercial diet. The ingredients of each diet were separately blended with additional 100 ml of water to make a paste. The pastes were separately passed through a grinder, and pelleted in a modified paste extruder to form the tested diets. The pellets were dried in a drying oven (Fisher oven 13 – 261 – 28A) at 85°C for 24 hours and stored in plastic bags and finally kept in a refrigerator at -2°C for further use. Experimental diets were formulated to meet the nutritional requirement of fish (NRC, 1993). The proximate chemical composition of the experimental diets is shown in table (1).
Table (1): Proximate chemical analysis (% on dry matter basis) of the experimental diets containing different levels of FSM by-produced meal.

<table>
<thead>
<tr>
<th>Items</th>
<th>Control (Commercial diet)</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter</td>
<td>92.33</td>
<td>92.22</td>
<td>92.01</td>
<td>92.05</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>25.32</td>
<td>25.588</td>
<td>25.856</td>
<td>26.124</td>
</tr>
<tr>
<td>Crude Fat</td>
<td>8.01</td>
<td>7.343</td>
<td>6.676</td>
<td>6.009</td>
</tr>
<tr>
<td>Ash</td>
<td>5.62</td>
<td>5.758</td>
<td>5.896</td>
<td>6.034</td>
</tr>
<tr>
<td>Fiber</td>
<td>7.68</td>
<td>7.712</td>
<td>7.744</td>
<td>7.776</td>
</tr>
<tr>
<td>(^1)NFE</td>
<td>53.37</td>
<td>53.599</td>
<td>53.828</td>
<td>54.057</td>
</tr>
<tr>
<td>(^2)G.E.(Kcal/100g)</td>
<td>437.8</td>
<td>433.9</td>
<td>430.1</td>
<td>426.0</td>
</tr>
</tbody>
</table>

\(^1\)NFE (nitrogen free extract) = 100 – (protein % + lipid % + ash % + fiber %);  
\(^2\)GE (gross energy) was calculated after NRC (1993) as 5.64, 9.44 and 4.11 Kcal/g for protein, lipid and NFE, respectively.

Feeding experiment

After 15 days of acclimation period in the stock culture tanks, clinically healthy \((Cyprinus carpio)\) were divided into four equal groups at a rate of 10 fish/aquarium \((75 – 60 – 45cm in diameters)\). Each aquarium was filled with dechlorinated tap water supplied with continuous aeration via air-stones using aquarium air pumps and a natural photo-period. About half of the water was changed daily in all experimental aquaria. Fecal matters were siphoned out once daily. The biomass of fish in each aquarium was measured at the beginning of experiment and after each sampling; thereby the daily ration was adjusted. Dead fish were daily recorded and removed. Fish were fed with their respective diets at the rate of 3% of their body weight per day for the period of the experiment. The daily ration was subdivided into two feeds. At the end of the experimental period (3 months), the following parameters will be measured:

Chemical analysis of diets and fish

The tested diets and whole-fish body from each group at the beginning and at the end of the experiment will be analyzed according to the methods of (AOAC, 1990 and NRC, 1993).

Growth performance
Weight Gain (WG) = W2-W1.
Where: W1 = Initial body weight (g) and W2 = Final body weight (g).

Specific Growth Rate (%) (SGR) = [(Lnw1–Lnw0) ÷ T] × 100.
Where: Ln = Natural log, W0 = Initial body weight (g), W1 = Final body weight (g) and T = Time (day).

**Feed utilization parameters**

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

Protein Efficiency Ratio (PER) = gain in weight (g) / protein intake in feed (g).

Condition factor (K)

\[ K = \frac{\text{weight}}{\text{length}^3} \times 100 \]

Fish survival (%) = 100 (final fish number/initial fish number).

**Physiological traits**

Plasma was obtained by centrifugation of the blood at 3000 rpm for 15 min and the non haemolyzed plasma was stored in a deep freezer at -20°C till analysis. Total serum protein was determined following the protocol of Lowry (Lowry et al., 1951) using standard protein estimation kit. Glucose concentration was measured according to Trinder (1969) using Boehring Mannheim kits. Lysozyme activity of fish plasma was determined by turbidometric assays as described by Caruso et al. (2002).

**Statistical analysis**

Statistical analysis was performed using the Analysis of variance (ANOVA) tow way classification and Duncan’s multiple Range Test, (Dunkan, 1955) to determine differences between treatments means at significance rate of P < 0.05. The standard errors of treatment means were also estimated. All statistics were carried out using Statistical Analysis System (SAS) program (SAS, 2000).

**Results and Discussion**

**Growth performance and feed utilization:**

Fenugreek is "generally recognized as safe" (GRAS) as a flavoring by the U.S. Food and Drug Administration. Recent research demonstrated that FSM is a good source of compounds with a positive impact in human health.

**Chemical analysis of seeds by-produced meal.**

The chemical analysis of seeds by-produced meal was illustrated in (Fig. 1). In this connection Tonsy et al., (2011) found that proximate analysis of Fenugreek indicated high crude protein (26.2%), crude fiber
(4.8%), fat (8.1%), ash (3.12) contents. Also Mostafa et al (2009), reported that the ash and crude lipids contents for Fenugreek meal were 4.5% and 6.22%, respectively, while the crude protein and fiber contents were 29.11% and 9.31 %, respectively. FSM was found to be rich in protein, fat, total carbohydrates and minerals such as calcium, phosphorous, iron, zinc and magnesium (Gupta et al., 1996 and Sheikhlar et al., 2017).

![Chemical composition of FSM by-produced meal.](image)

**Growth performance**

The growth performance and survival rates of the fish at the end of the experimental period are presented in Table 2. At the end of feeding trial, body weight gain was significantly high in all fish groups than in the control group. The body gain, condition factor and specific growth rate showed significant increase in the fed supplemented diets groups compared with control group. The positive growth promoting effects of FSM may be due to their chemical and physical properties. In this connection Syeed et al., 2018 found that fenugreek seeds also improves the digestive enzyme activity and low metabolic needs, he add that fenugreek seed as an additive significantly improved weight gain and specific growth rate as well as reduced mortalities of Common carp in the treated groups as compared to the control. Furthermore Roohi et al. (2015) studied fenugreek effect on common carp (Cyprinus carpio) and reported significant higher weight gain specific growth rate, and condition factor in treated than control, he add that no mortality was recorded during the feeding trial. Also these results are completely agreement with those obtained by Basha et al., 2018 who stated that Fish O. niloticus fed on FSM showed significant increase ($P < 0.05$) of all growth
parameters (ABW, WG, SGR, and L). Moustafa et al., (2020) found that fenugreek supplemented diets could significantly increase the growth performance parameters of Nile tilapia as compared to the non-supplemented groups (P < 0.05).

Table (2): Growth performance and survival rates for Common carp fingerlings fed on different levels of FSM by-produced meal.

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Weight</td>
<td>10.36±0.46a</td>
<td>10.54±0.23a</td>
<td>10.72±0.22a</td>
<td>10.78±0.34a</td>
</tr>
<tr>
<td>Initial length</td>
<td>8.8 ± 0.42a</td>
<td>8.73±0.33a</td>
<td>8.67±0.09a</td>
<td>8.93±0.19a</td>
</tr>
<tr>
<td>Final Weight</td>
<td>28.68±0.23b</td>
<td>32.07±0.43a</td>
<td>34.4±0.23a</td>
<td>32.5±1.5a</td>
</tr>
<tr>
<td>Final length</td>
<td>12.54±0.09a</td>
<td>12.67±0.14a</td>
<td>12.97±0.03a</td>
<td>12.68±0.15a</td>
</tr>
<tr>
<td>Weight gain</td>
<td>18.32±0.23c</td>
<td>21.52±0.21b</td>
<td>23.68±0.01a</td>
<td>21.72±1.14b</td>
</tr>
<tr>
<td>SGR</td>
<td>1.13±0.04b</td>
<td>1.24±0.01a</td>
<td>1.3±0.02a</td>
<td>1.23±0.01a</td>
</tr>
<tr>
<td>Condition Factor</td>
<td>1.46±0.04b</td>
<td>1.58±0.03a</td>
<td>1.58±0.02a</td>
<td>1.49±0.02a</td>
</tr>
<tr>
<td>Survival Rate</td>
<td>90c</td>
<td>95b</td>
<td>100a</td>
<td>100a</td>
</tr>
</tbody>
</table>

The same letter in the same row is not significantly different at P < 0.05.

In the current study fish survival in all fed supplemented diets groups was significantly high and ranged from 95 to 100% compared with control (90%), the increase in fish survival among the treated groups as compared to the control could be the result of immune system activation against various pathogens as well as opportunistic bacterial invaders (Syeed et al., 2018). Similar results were obtained by Sheikhlar et al., 2011 who reported that adding FSM to diet up to 30 % as substituted amounts with fishmeal showed significant optimum growth performance by African catfish. Also Tonsy et al., 2011 studied the effects of diets supplemented with six different medical plants for Nile tilapia fry they found that supplementation level of 1 % FSM revealed significantly (P≤0.05) the highest growth performance parameters. Mehboob et al., 2018 showed that Striped Catfish fry fed on diet containing FSM showed the highest final weight, weight gain, final body length and survival rate in comparison to control diet. On other hand Abdelhamid and Soliman, 2012 stated that no significant differences in final fish weights, weight
gain. Specific growth rate and survival rate of Nile tilapia fry (0.28 g) due to the dietary inclusion of fenugreek.

**Feed utilization**

Feed utilization of Common carp fed on different levels of FSM by-produced meal are shown in Table 3. Feed intake (FI) increased significantly, (P<0.05), while FCR improved significantly in diets supplemented with different levels of FSM by-produced (Table 3). These results may be due to, the fenugreek seeds have a bitter taste (Billaud and Adrian, 2001), which might increase feed palatability and thus feed intake in fish. This is supported by Syeed et al., 2018 and Roohi et al. 2015 they suggested that PER and FCR were significantly (p<0.05) improved in Common carp groups fed with fenugreek based diet compared to the control. Similar results were recorded by Tonsy et al., 2011, Basha et al., 2018 and Moustafa et al., 2020 they found that fenugreek supplemented diets could increase PER and decrease FCR of Nile tilapia as compared to the non-supplemented groups (P < 0.05), feed consumption was higher in the FSM-fed Nile tilapia throughout the experimental period and the control group exhibited the lowest feed intake. In the present study fish fed 10 and 20% FSM by-produced gave significant increase in protein intake and PER than control diet. These results are in agreement with those obtained by Sheikhlar et al., 2011 who reported that adding FSM to diet up to 20 % as substituted amounts with fish meal considering high nutritive value of FSM in compared to fish meal for African catfish. Tonsy et al., 2011 indicated that supplementation level of 2 % medicinal plant revealed significantly the best feed and nutrient utilization parameters but feed intake was not significantly difference by all medicinal plant levels for mono sex Nile tilapia. More nearly results were obtained by Antache et al., 2013 who stated that the best FCR and higher values PER were found by fenugreek (Trigonela foenum graecum), as compared to control diet at Oreochromis niloticus, with an average initial weight of 125.41±34.33g/fish. Abdelhamid and Soliman, 2012 confirmed that Fenugreek Seeds had significantly (and proportional to the increase in its addition level) improved the feed utilization in form of protein productive value and energy retention.
Table (3): Feed utilization of Common carp fed on different levels of FSM by-produced meal.

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Intake</td>
<td>44.82±0.21a</td>
<td>47.28±0.81a</td>
<td>46.74±1.21a</td>
<td>47.43±1.38a</td>
</tr>
<tr>
<td>FCR</td>
<td>2.45±0.25a</td>
<td>2.2±0.21b</td>
<td>1.97±0.08c</td>
<td>2.19±0.18b</td>
</tr>
<tr>
<td>Protein Intake</td>
<td>11.35±0.11b</td>
<td>12.1±0.23a</td>
<td>12.09±0.51a</td>
<td>12.39±0.81a</td>
</tr>
<tr>
<td>PER</td>
<td>1.62±0.05c</td>
<td>1.78±0.18b</td>
<td>1.96±0.11a</td>
<td>1.75±0.23b</td>
</tr>
</tbody>
</table>

The same letter in the same row is not significantly different at P < 0.05.

Body composition

Table 5. shows the whole-body composition of Common carp at the end of the experiment. No significant difference was observed in moisture contents for Common carp fed diets contains different levels of FSM by-produced. A significant increase in crude protein was noticed in the groups fed supplemented diets with FSM by-produced compared with the control one. A significant reduction in body fat contents was recorded in the fed supplemented diets groups compared with the control group, while ash content was not significantly differences between all diets groups or control diet. This improve in body composition may be due to the enhancement of fish health by FSM fed. Similar results were finding by Mehboob et al., 2018 revealed significant differences among FSM and control groups for crude protein contents while non-significant differences observed in crude fat, moisture, ash and fiber contents of Striped Catfish fry.. Also Abdelhamid and Soliman, 2012 confirmed that fenugreek Seeds (at 2% addition level) had significantly increased Nile tilapia carcass protein percent. Tonsy et al., 2011 indicated that supplementation level of 1% different six medical plants for mono six Nile tilapia revealed significantly the highest CP %, EE % and energy content (Kcal /100g). On the other side, who added that the analysis of variance for all medicinal plant levels was not significantly differed in DM %. On other hand Sheikhlar et al., 2017 reported that adding FSM to diet up to 260 g/kg as substituted amounts with fish meal did not showed any significant difference on carcass composition of African catfish. Similarly Mostafa et al., 2009 showed that dry matter, crude protein, fat and ash in Nile tilapia body did not be affected by different FSM levels.
Table (4): Proximate chemical composition (% on dry matter basis) of Common carp fed diets containing different levels of FSM by-produced meal at the end of the experiment period.

<table>
<thead>
<tr>
<th>Item</th>
<th>Start</th>
<th>Control</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>19.55</td>
<td>25.54±0.7b</td>
<td>27.12±0.1a</td>
<td>28.88±0.1a</td>
<td>25.15±0.3ab</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>62.36</td>
<td>64.01±1.0b</td>
<td>65.95±1.0ab</td>
<td>67.89±1.2a</td>
<td>64.54±1.1b</td>
</tr>
<tr>
<td>Ether Extract</td>
<td>17.61</td>
<td>18.09±0.1a</td>
<td>16.59±1.3b</td>
<td>17.29±1.2a</td>
<td>17.31±0.3a</td>
</tr>
<tr>
<td>Ash</td>
<td>16.83</td>
<td>15.89±0.3a</td>
<td>15.51±0.2a</td>
<td>14.69±0.1a</td>
<td>15.53±0.1a</td>
</tr>
</tbody>
</table>

The same letter in the same row is not significantly different at P < 0.05.

Physiological traits closed

The most portion of serum synthesizes in the liver and it can be used as an indicator of liver dysfunction. Also the determination of glucose concentration in blood serum is widely used as an indicator of stress in fish. Changes in levels of glucose in blood can be due to malnutrition or an injured kidney (Jacobson-Kram & Keller 2001). Lysozyme have important roles in the nonspecific immune defense system and it plays a major role in mediating protection against bacterial invasion (Saurabh and Sahoo 2008). Plasma glucose, plasma protein and lysozyme of Common carp as affected by different levels of FSM by-produced meal are shown in Table 5. The higher significant plasma protein (8.65) and Lysozyme (0.85) and lower plasma glucose (80.83) was obtained in diet containing 20% FSM by-produced. Fish fed control diet gave the higher value of plasma glucose (114.13) and the lower value Lysozyme (0.53), while Fish fed 30% FSM by-produced provided the lower value plasma protein (3.93). These results are in agreement with the results of Syeed et al., 2018 who reported that significantly higher (p<0.05) serum protein and globulin levels were observed in treated fish groups over the control. Moreover, feeding fenugreek based diet resulted in a reduction in serum glucose in treated Common carp fish. Additionally, Roohi et al. (2015) studied fenugreek effect on common carp (Cyprinus carpio) and demonstrated that protein in the FSM groups increased significantly in comparison to the control group (P < 0.05). Furthermore, glucose levels were lower insignificant in fish fed on FSM compared to the control group (P > 0.05). The results of present study are in a partial agreement with results of Mostafa et al., 2009 they stated that increased of plasma protein, while plasma glucose was no significant difference in the groups.
fed supplemented diets with FSM compared with the control one for *O.niloticus*. Basha *et al.*, 2018 showed that decreased of Plasma glucose, while Plasma protein was no significant difference in the groups fed supplemented diets with FSM compared with the control one for *O.niloticus*. In respective to lysozyme activity the results of current study are in supported by Moustafa *et al.*, 2020 they found that fish fed fenugreek supplemented diets showed improved immune (lysozyme, immunoglobulin, and respiratory burst activity) and antioxidant parameters (superoxide dismutase and glutathione peroxidase and malondialdehyde). Moreover, Sheikhhlar *et al.*, 2011 found that lysozyme in catfish was only significantly increased \( (p < 0.05) \) in the FSM 180g/kg treatment, while plasma protein was no significant difference among the different treatments.

**Table (5): Plasma glucose, plasma protein and Lysozyme of Common carp fed on ration containing different levels of fenugreek seeds by-produced meal.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma glucose</td>
<td>114.13±2.5(^{a})</td>
<td>91.07±2.5(^{b})</td>
<td>80.83±3.2(^{c})</td>
<td>104±2.4(^{b})</td>
</tr>
<tr>
<td>Plasma protein</td>
<td>4.73±0.57(^{bc})</td>
<td>5.83±0.21(^{b})</td>
<td>8.65±0.62(^{a})</td>
<td>3.93±0.27(^{c})</td>
</tr>
<tr>
<td>Lysozyme</td>
<td>0.53±0.09(^{b})</td>
<td>0.65±0.08(^{ab})</td>
<td>0.85±0.04(^{a})</td>
<td>0.65±0.06(^{ab})</td>
</tr>
</tbody>
</table>

The same letter in the same row is not significantly different at \( P < 0.05 \).

**Conclusion**

It could be concluded that, the use of fenugreek seeds meal in aquaculture can promote growth, feed utilization, body composition and physiological traits of fish. These benefits are important in aquaculture because it favor environmentally friendly organic production.

**REFERENCES**


Sheikhlar, A; Meng, G.Y.; Ebrahimi, M.; Romano, N.and Webster, C.D. (2018). Replacement of dietary fishmeal for fenugreek seed meal on the growth, body composition, innate immunological responses and
تأثير كسب الحلبة على معدل النمو واستعمال الغذاء وتركيب الجسم وبعض الصفات الفيسيولوجية لأسماك المبروك العادي.

محمد محمد زينهم و ابراهيم حسن ابراهيم
قسم تغذية الأسماك وقسم وراثة وتربيه الأسماك. المعمل المركزى لبحوث الثروة السمكية
بالعباسة. مركز البحوث الزراعية. مصر.

الملخص العربي
قد أجريت هذه الدراسة لمعرفة مدى تأثير المكملات الغذائية من كسب الحلبة على النمو والاستفادة من الغذاء وتركيب الجسم في اصابعيات أسماك المبروك العادي بمتوسط (10,6 جم ± 0,15) وذات طول (8,78 سم ± 0,14 سم). تم إجراء التجربة لمدة 12 اسبوع واستخدم 12 حوض زجاجي (إبعاد كل حوض 60×75×45 سم) تم عمل ثلاث مكررات لكل معاملة. تم تكوين أربعة علائق تجريبية تحتوي على 0 % ( العليقه تجاريه)، 10 %، 20 % و 30 % من كسب الحلبه . جميع العلائق تحتوي على 37 كيلو كالوري طاقة كلية لكل 100 جم.

اظهرت النتائج ان اضافة كسب الحلبة يحسن معانينا اداء النمو عن العليقه التجارية، معامل الحالة و معدل البقاء زاد معنوي بزيادة مستوى كسب الحلبه في العليقه حتى مستوى 20 %, أيضا معدل التحويل الغذائي تحسن معنوي بزيادة مسحوق كسب الحلبه في العليقه حتى مستوى 20 %. الأسماك المغذاة كسب حلبه 20 % حسن معنوي كفاءة البروتين ولكن لم يكن هناك اختلاف معنوي في الغذاء المستهلك محتوى الجسم من البروتين والمادة الجافة زاد معنوي بزيادة مسحوق كسب الحلبه في العليقه حتى مستوى 20 %, ولكن أعلى محتوى جسم من الدهن كان في العليقه المحتويه 10 % كسب الحلبه في العليقه, بينما محتوى الجسم من الرماد لم يتأثر معنوي باختلاف العليقه. أيضا المستوى 20 % كسب حلبه أعطى أعلى قيمة من البروتين البلازمي والبيوزيم وأقل قيمة من جلوكوز البلازمي. بينما العليقه التجارية أعطت أعلى قيمة من جلوكوز البلازمي وأقل قيمة من البروتين وال العليقه المحتويه 30 % كسب حلبه أعطت أقل قيمة من البروتين البلازمي. يمكننا التوصية بأن اضافة 20 % من مسحوق كسب الحلبه يحسن من اداء النمو والاستفادة من الغذاء, تركيب الجسم والحالة الفيسيولوجية لأسماك المبروك العادي.