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INFLUENCE OF USING BY-PRODUCT ROCKET SEED MEAL (*ERUCA SATIVA MILLER*) IN NILE TILAPIA (*OREOCHROMIS NILOTICUS*) DIETS ON GROWTH PERFORMANCE AND FEED UTILIZATION.

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Abstract

This study was carried out to determine the effect of different by-product rocket seed meal (BRSM) (*Eruca sativa Miller*) levels as a feed additive in fish diets on growth performance, feed utilization and economic efficiency of Nile tilapia (*Oreochromis nilotcus*) fingerlings (4.1±0.05g/fish). Six experimental diets were formulated to contain 0.0 (control), 0.1, 0. 2, 0.3, 0.4 and 0.5 % by-product rocket seed meal (BRSM). Diets were isonotrogenous (30% crud protein), isolipidic (7.5% total fat) and isocaloric (4.48kcal/100g). Each diet was fed in triplicate groups two times a day for 12 weeks at feeding level of 4% of fish body weight. Results revealed that final weight, weight gain and growth rate (g/day) increased significantly ($p<0.05$) with increasing BRSM levels in diets. Highest growth was obtained in fish fed at diets containing 0.4 and 0.5% BRSM without significant differences, while the lowest growth was obtained in fish fed at control group diet. Survival rate slightly enhanced with the addition of inclusion of BRSM in fish diets without significant differences ($p<0.05$) among treatments. Highest feed intake and best FCR value were obtained at fish fed at diets containing 0.4 and 0.5% BRSM without significant differences. Protein efficiency ratio (PER), Feed efficiency ratio (FER), Apparent protein utilization (APU), Specific growth rate (SGR) and Energy utilization (EU) values were improved significantly ($p<0.05$) with the addition of inclusion of BRSM in fish diets, maximum values were obtained at fish fed at diets containing 0.4 and 0.5% BRSM without significant differences, while the lowest were obtained at control group. Dry matter, crud protein and total lipids improved significantly ($p<0.05$) with increasing BRSM levels in fish diets. There was a reduction in feed cost to produce 1kg of fish gain with 16.84 % & 16.94% in fish fed at diet containing 0.4 and 0.5% BRSM without significant differences compared to control diet. In conclusion the result of the present work suggest that supplementing diets with By-product rocket seed meal at the level of 0.4% improved growth performance, feed utilization and reduction the feed cost of Nile tilapia fingerlings.

Key words: By-product rocket seed meal, Nile tilapia, growth performance, feed utilization.

INTRODUCTION

There is a shortage in animal protein in Egypt, fish could participate in solving this problem, but feed cost of fish production is expensive .There are a large amount of crops, vegetables and fruits residues could be a new source of feedstuff with low price and high quality proteins which can be used to solve feed shortage and produce least cost diets for fish. In Egypt, production of Radish (*Raphanus sativus*), Rocket (*Eruca sativa*) and black cumin (*Nigella sativa*) meals has been steadily increasing for the strong demand to volatile oils for pharmaceutical purpose. Those plants were found to incarnate natural substances that ameliorate health and promote the body condition to counteract the stress of illness (Eisenberg *et al*., 1993).

Rocket seeds contain a wide range of health-promoting phytochemicals including carotenoids, vitamin C, poly phenols, flavonoids such as appiin and luteolin and glucosinolates the precursors of isothiocyanates and sulfaraphene (Talalay and Fahey, 2001). There were found to have several biological activities including anticarcinogenic, antifungal, and antibacterial plus their antioxidant action (Kim *et al*., 2004; Leumg and Foster, 1996). They also contain Zn, Cu, Fe, Mg, Mn and other elements which increase immune response and the reproductive performance (Abdo, 2003). El-Nattat and El-Kady (2007) stated that rocket seed meal (RSM) after oil removal, could be used as a protein rich meal. This product is expected to increase in near future due to high demand of the extracted oil; consequently utilizing the by-product may cause some environmental problems if not adequately utilized. When adequately supplemented, RSM may constitute a good vegetable protein source for use in fish diets in region where RSM is readily available and relatively inexpensive. It may use in reduces the cost of fish feed. El-Marakby *et al*. (2014) reported that dry rocket leaves meal enhance Nile tilapia growth rate, feed utilization, biochemical and hematological parameters and immunity.

Nile tilapia (*Oreochromis niloticus*) is one of the most important fish species for an economically successful aquaculture. In Egypt, *O. niloticus* is the most popular kind of fish (Abdelhamid *et al.*, 2010). In fact, Nile tilapia has become one of the most commonly farmed freshwater fish species throughout the world, in particular *Oreochromis niloticus* (Rana, 1997; Popma and Masser, 1999). Therefore, the objective of this work was to evaluate the use of by-product rocket seed meal (BRSM) as a feed additive in fish diets and its impact on growth performance, feed utilization, whole body composition and economic efficiency of Nile tilapia (*Oreochromis niloticus*) fingerlings.

MATERIALS AND METHODS

Diet preparation:

Six experimental diets were formulated (30%crude protein, isolipidic 7.5% total fat and 4.48 kcal /100g diet) to contain different levels of BRSM (Table 1). The diets contained control 0.0, 0.1, 0.2, 0.3, 0.4 or 0.5% BRSM. The ingredients of each diet were separately blended with additional 100 ml of water to make a paste of each diet .the pastes were separately passed through a grinder, and pelleted in a modified paste extruder to form the tested diet (1-mm diameter). The diets were dried in a drying oven model (Fisher oven 13–261–28A) for 24 hours at 65°C and stored in plastic bags which were kept dry until they were used.

Fish culture and feeding regime:

Nile tilapia, *Oreochromis niloticus* (L.) fingerlings were obtained from the fish hatchery, Central Laboratory for Aquaculture Research, Abbassa, Abo –Hmmad, Sharqia, Egypt. Fish were kept in an indoor fiberglass for two weeks as an acclimation period to the laboratory conditions. A 100 g weight of fish was frozen at –20°C for chemical analysis at initial. Fish were randomly distributed at a rate of 10 fish per 100- L aquarium. The initial body weight of fish was 4.1g. Each aquarium was supplied with compressed air via air–stones using aquarium air pumps. Settled fish wastes were cleaned daily by siphoned with three quarters of aquaria water, which was replaced by aerated tap water from the storage tank. Water temperature ranged between 25 to 27 °C. Fish were fed at feeding rate of 4 % of live body weight for experiment period. Each diet was fed to triplicate aquaria of Nile tilapia fingerlings twice daily six days a week for a period of 12 weeks. Fish in each aquarium were weighed biweekly and the amounts of feed given were readjusted according to the increase in body weight. Dead fish was daily recorded and removed.

Chemical analysis of diets and fish:

The feed stuff, fish from each treatment and tested material (BRSM) were obtained after cooled extraction of oils at a commercial supplier of AOAC (1995) for moisture, protein, fat, ash and fiber content was estimated by heating samples in an oven at 85 °C until constant weight and calculating weight loss. Nitrogen content was measured using a microkjeldahl apparatus and crude protein was estimated by multiplying nitrogen by 6.25. Total lipids content was determined by ether extraction and ash was determined by combusting samples in a muffle furnace at 550 °C for 6 hours. Crude fiber was estimated according to Goering and van Soest (1970). Gross energy was calculated according to NRC (1993).

Growth parameters:

Growth performance was determined and feed utilization was calculated as following:

Weight gain = final weight – initial weight;

Daily gain (DG) = $w_2 - w_1/t$;

Specific growth rate (SGR %) =100 x {(ln w_2 - ln w_1) / t} ;

Where w_1 and w_2 are the initial and final weight, respectively, and it is the number of days in the feeding period.

Feed utilization parameters:

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

Protein efficiency ratio (PER) = weight gain / protein intake.

Feed efficiency ratio (FER %) = 100x {body weight gain (g) / feed intake (g)}.

Apparent protein utilization (APU %) = 100 x {protein gain / protein intake}.

Energy utilization (EU %) = 100 x {Energy gain / Energy intake}.

Statistical analysis:

The obtained data were subjected to one –way ANOVA. Differences between means were tested at the 5% probability level using Duncan test. All the statistical analyses were done using SPSS program version 10 (SPSS, Richmond. USA) as described by Dytham (1999).

Economical evaluation:

All the ingredients obtained of that from local market. The cost of feed required to produce a unit of fish biomass was estimated using a simple economic analysis. The estimation was based on local retail sale market price of all the dietary ingredients at the time of the study. These prices (in LE/kg) were as follows: herring fish meal, 16; soybean meal, 3.75; corn meal, 2.50; starch 6.0, wheat bran, 2.25; fish oil, 60.0; corn oil, 10.0; vitamins premix, 8.0; minerals mixture, 6.0 and 3.0 LE /kg rocket seed meal.

Table 1. Feed ingredients and chemical analysis (on DM- basis %) of the experimental diets.

Ingredients	By-product Rocket seed meal levels (%)					
	0.0%	**0.1%**	**0.2%**	**0.3%**	**0.4%**	**0.5%**
HFM	12.1	12.1	12.1	12.1	12.1	12.1
BRSM	0.0	0.10	0.20	0.30	0.40	0.50
Soybean meal	39.0	39.0	39.0	39.0	39.0	39.0
Corn meal	21.0	21.0	21.0	21.0	21.0	21.0
Wheat bran	13.74	13.74	13.74	13.74	13.74	13.74
Corn oil	1.8	1.8	1.8	1.8	1.8	1.8
Cod liver oil	2.36	2.36	2.36	2.36	2.36	2.36
Starch	7.0	6.9	6.8	6.7	6.6	6.5
Vit.premix[1]	1.0	1.0	1.0	1.0	1.0	1.0
Min. premix[2]	2.0	2.0	2.0	2.0	2.0	2.0
Total	100	100	100	100	100	100
Chemical analysis:						
Dry matter	92.96	92.28	93.0	92.8	93.42	92.95
Crude protein	30.20	30.13	30.18	30.16	30.11	30.20
Total lipids	7.41	7.16	7.59	7.53	7.56	7.22
Ash	7.84	7.19	7.21	7.19	7.36	7.26
Crude fiber	4.25	4.51	4.61	4.70	4.75	4.79
NFE[3]	50.30	50.41	50.41	50.42	50.22	50.53
GE (kcal/100g) [4]	448.15	449.43	449.42	449.20	448.19	448.17

1- Vitamins premix (per kg of premix): thiamine, 2.5 g; riboflavin, 2.5 g; pyridoxine, 2.0 g; inositol, 100.0 g; biotin, 0.3 g; pantothenic acid, 100.0 g; folic acid, 0.75 g; para-aminobenzoic acid, 2.5 g; choline, 200.0 g; nicotinic acid, 10.0 g; cyanocobalamine, 0.005 g; α-tocopherol acetate, 20.1 g; menadione, 2.0 g; retinol palmitate, 100,000 IU; cholecalciferol 500,000IU.

2- Minerals premix (g/kg of premix): CaHPO4.2H2O, 727.2; MgCO4.7H2O, 127.5; KCl 50.0; NaCl, 60.0; FeC6H5O7.3H2O, 25.0; ZnCO3, 5.5; MnCl2.4H2O, 2.5; Cu(OAc)2.H2O, 0.785; CoCl3..6H2O, 0.477; CaIO3.6H2O, 0.295; CrCl3.6H2O, 0.128; AlCl3.6H2O, 0.54; Na2SeO3, 0.03.

3- Nitrogen-Free Extract (calculated by difference) = 100 – (protein + lipid + ash + fiber).

4- Gross energy (GE) was calculated according to NRC (1993) as 5.65, 9.45, and 4.11 kcal/g of protein, lipid, and carbohydrates, respectively.

RESULTS

Results of Table (2) shows that growth performance parameters (final body weight, weight gain and SGR) of Nile tilapia increased significantly ($P<0.05$) with increasing BRCM level in the tested diets. Highest growth was obtained at fish fed at 0.4 and 0.5% BRSM without significant differences (38.00 & 38.57) g/ fish while the lowest one was obtained at control group (27.07g). Also, Table 2 shows that the survival rate was slightly enhanced due to the inclusion of by-product rocket seed meal in fish diets with none-significant differences (P <0.05).

Table (3) shows that feed intake increased significantly with the increasing of by-product rocket seed meal levels in fish diets (P <0.05). The highest feed intake was obtained at fish fed at 0.4 and 0.5% BRSM without significant differences (45.78 & 46.5) g/ fish, while the lowest one was obtained at control group (37.09g / fish). Contrarily, feed conversion ratio value (FCR) improved significantly (P<0.05) with increasing BRSM in the tested diets (1.56, 1.52, 1.44, 1.35 and 1.35, respectively) while the highest FCR value were obtained at control group (1.62). Same results were obtained with FER values where enhanced significantly (P <0.05) when fish fed at BRSM levels, they were (64.01, 65.85, 69.38, 74.09 and 74.19, respectively), while the lowest FER was obtained at control group (61.93). Also, PER values were enhanced significantly (P <0.05) when fish fed at BRSM levels, they were (2.30, 2.35, 2.48, 2.63 and 2.67, respectively), while the lowest PER was obtained at control group (2.21). Similarly, APU and EU increased significantly (P <0.05) with increasing BRSM levels in fish diet. The highest APU was obtained at fish fed at 0.4 and 0.5 % BRSM without significant differences (45.57 & 46.7), while the lowest one was obtained at control group (33.76). The highest EU was obtained at fish fed at 0.4 and 0.5 % BRSM without significant differences (25.70 & 26.46), while the lowest one was obtained at control group (18.53).

Data in table (4) shows that the proximate chemical analysis of whole body of Nile tilapia fingerlings. Dry matter content was enhanced significantly differed due to the inclusion of BRSM in fish diet (P <0.05). Crude protein increased significantly (P <0.05) with the increase in BRSM levels in fish diets. The highest fish body content of crud protein was obtained at fish fed at 0.4 and 0.5 % BRSM without significant differences (67.17 & 67.40), while the lowest one was obtained at control group (64.54). Also, the highest content of total lipids was obtained in fish fed at 0.4 and 0.5 % BRSM without significant differences (17.71 & 17.96), while the lowest one was obtained at control group (16.16). On the other hand the lowest content of ash was obtained at fish groups fed 0.4 and 0.5 % BRSM without significant differences (15.11 & 14.64), while the highest one was obtained at control group (19.31).

Economic evaluation of the experimental diets is shown in Table (5). Results indicated that there was a reduction in feed cost to produce 1 kg of weight gain of fish, it were 16.84 and 16.94 at the level of diet containing 0.4 and 0.5 % BRSM without significant differences compared to the control diet.

DISCUSSION

In the present study results showed that supplemented by-product rocket seed meal in Nile tilapia diets until the levels of 0.5 % improve the growth performance and feed utilization and the highest growth were obtained at the levels of 0.4 and 0.5 % BRSM without significant differences. These results are agreement with El-Dakar (2004) who found that hybrid tilapia (*O. niloticus ×Oreochromis aureus*) fingerlings fed on 0.5% caraway seed meal (CSM) diet gave significantly higher body weight and weight gain than those fed on other CSM levels. Similarly, Abd El Hakim *et al*. (2010) conducted an experiment with Nile tilapia fingerlings fed a basal diet containing 0, 1.0, 2.0 and 3.0% fennel, *Foeniculum vulgare* (belonging to family Apiaceae as caraway) for 14 weeks. They found that the use of 1.0% fennel produced the maximum fish performance. Abdel-Tawwab *et al*. (2010) observed a growth-promoting in flounce of green tea on Nile tilapia and they reported that the optimum growth and feed utilization were obtained at 0.5 g/kg diet.

The enhanced growth in the BRSM-supplemented diet may be BRSM enhanced the nutrient digestibility leading to improved nutrient utilization, which in turn could also explain the better growth. Talpur (2014) showed that addition of *Mentha piperita* in fish diet led to significante improved in survival rate, weight gain and FCR for treated groups over the control in Asian sea bass *Lates calcarifer*.

These results didn't agreed with Oyedapo (2004) who found that weight gain and feed utilization in catfish decreased significantly as inclusion level of roquette seed meal increased up to 60% of total protein which had the poorest performance. Thus, increasing the level of roquette seed meal exerted deleterious effects in catfish. This was attributable to decreasing levels of some essential amino acids (arginine, isoleucine, leucine, lysine, methionine, phenylalanine) provided by roquette seed meal. As well as increasing levels of glucosinolates and other antinutrients (phytic acid, tannin, protease inhibitors). El-Nattat and ElKady (2007) reported that addition roquette seed meal to red tilapia diet at the rate of 9% gave the best final body weight and feed conversion ratio compared to fish fed at control diet. Ahmad and Abdel Tawwab (2011) showed that feed intake increased significantly while FCR decreased significantly ($P<0.05$) when Nile tilapia fed caraway seed meal (CSM) as a supplemented diets compared to fish fed at a control diet. Also, they found that best FCR were obtained in fish fed at diet containing 10 g CSM/kg diet. These results agree with Abd Elmonem *et al*. (2002) who studied the effect of different levels of roquette seed meal on growth performance and feed utilization of red tilapia fry.

On the other side, Soliman (2001) evaluated the nutritive value of using roquette seed meal as a replacement for soybean meal in diets of Nile tilapia. He found that growth performance decreased significantly with increasing the substitution level of soybean meal with roquette seed meal.Moreover, El-Marakby *et al*. (2014) found that fish fed diet containing 1% dry rocket leave meal (DRLM) were the highest in the final body weight, weight gain, relative gain% and SGR compare to control group.Also, survival rate in all treatments was high and ranged between 93.3 to 95.6% indicating that DRLM has no toxic effect. Harikrishnan *et al*. (2011) and Citarasu, *et al*. (2006) reported that Promoted growth in the fish fed diet containing medicinal plants may be due to improving nutrients digestibility and growth stimulant effect. However, this enhancement may be attributed to that DRLM contains a relatively large amount of vitamins B1, B2, C and pro-vitamin A, folic acid, glucosinolates, iodine, iron, protein and especially calcium and sulphur compounds, which influence its characteristic odor, but also adds to its nutritional benefits (Palaniswamy *et al*., 2003).

In the present study results showed that dry matter, protein and ether extract content increased significantly ($P<0.05$) with increasing BRSM level in the fish diets, while body ash content decreased significantly. Soliman (2000) reported similar results with Nile tilapia (*Oreochromis niloticus*) fed diets containing increasing levels of rocket seed meal. Also, these results are in agreement with the results obtained by Sakr (2003) who found that body composition of hybrid tilapia (*Oreochromis niloticus* × *Oreochromis aureus*) strongly affected by adding of graded levels of dried marjoram leaves (DML) where protein content increased as the level of DML and dried basil leaves (DBL) increased in the experimental diets. However, deposit of lipid and ash contents decreased with increasing DML and DBL levels in the diets of hybrid tilapia fingerlings. El-Dakar *et al*. (2004) found that deposit of lipid decreased when hybrid tilapia fed graded levels (0, 0.5, 1 and 2 %) of dried marjoram leaves. Furthermore, they showed that shrimp fed 2% marjoram leaves resulted in low lipid deposit in the whole body with increasing protein content and decreased markedly lipid and ash contents. Contrarily, Shalaby (2004) showed that no significant difference ($P>0.05$) was detected in moisture, crude protein, ether extract, ash and energy contents of Nile tilapia when fed diets containing various levels of fenugreek seeds. Also, Ahmad *et al*. (2011) found no significant differences in the chemical body composition of Nile tilapia fed diets containing fennel or cinnamon.

With respect to economic evaluation of the experimental diets in the present study, results showed that there was a reduction in feed cost to produce one kg fish gain of Nile tilapia (*Oreochromis niloticus*). They were 16.84 & 16.94% at the diet containing 0.4 and 0.5% BRSM without significant differences compared to the control diet.Previous studies showed that the use of spices at small amounts reduced cost and increased profit in feeds of other fish species (Abd El Hakim *et al*., 2010). El-Marakby *et al*. (2014) found that the reduction in feed cost to produce one kg fish gain of Nile tilapia (*Oreochromis niloticus*) fed on diet containing 1% DRLM level was 13.4 % compared with fish fed at control diet .

In conclusion, the results of the present study demonstrate that supplementation fish diets with the level of 0.4% by-product rocket seed meal can enhance growth performance, feed utilization and reduction the feed cost of Nile tilapia fingerlings.

Table 2. Growth performance (means ±SE) of Nile tilapia fed diets containing different levels of by-product rocket seed meal.

Items	By-product rocket seed meal levels (%)					
	0.0	0.1	0.2	0.3	0.4	0.5
Initial weight (g)	4.10 [a] ±0.05	4.13 [a] ±0.01	4.05 [a] ±0.04	4.10 [a] ±0.05	4.08 [a] ±0.04	4.07 [a] ±0.07
Final weight (g)	27.07[e] ±0.82	29.14[d] ±0.58	32.74 [c] ±0.32	35.33[b] ±0.52	38.00[a] ±0.12	38.57[a] ±0.60
Weight gain (g)	22.97 [e] ±0.79	25.01 [d] ±0.57	28.69 [c] ±0.36	31.23 [b] ±0.54	33.92[a] ±0.11	34.50[a] ±0.67
Growth rate (g/day)	0.27 [e] ±0.09	0.30 [d] ±.07	0.34[c] ±0.04	0.37 [b] ±0.06	0.40 [a] ±0.01	0.41 [a] ±0.08
SGR (%)	2.26 [d] 0.03	2.35 [c] 0.02	2.49[c] 0.13	2.58 [b] 0.11	2.66 [a] 0.02	2.68 [a] 0.04
Survival rate (%)	86.67 [a] ±1.7	86.67 [a] ±1.5	90.0 [a] ±1.4	90.0 [a] ±1.2	90.0 [a] ±0.08	90.0 [a] ±0.7

Means with different superscripts in the same row are significantly different (P<0.05).

Table 3. Feed intake, feed conversion ratio (FCR), feed efficiency ratio (FER), protein efficiency ratio (PER), apparent protein utilization (APU) and energy utilization (EU) of Nile tilapia fed diets containing different levels of by-product rocket seed meal.

Items	By-product rocket seed meal levels (%)					
	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%
Feed intake (g feed/fish)	37.09 [c] ±0.30	39.07[c] ±0.68	43.57 [b] ±0.10	45.01[ab] ±0.85	45.78[ab] ±0.42	46.5 [a] ±1.78
FCR	1.62[a] ±0.07	1.56[ab] ±0.03	1.52[ab] 0.02	1.44 [b] ±0.05	1.35 [c] ±0.02	1.35[c] ±0.07
FER (%)	61.93 [d] ±0.12	64.01 [c] ±0.20	65.85[c] ±0.17	69. 38 [b] ±0.22	74.09 [a] ±0.15	74.19 [a] ±0.11
PER	2.21[d] ±0.09	2.30[c] ±0.03	2.35[c] ±0.03	2.48 [b] ±0.08	2.63 [a] ±0.05	2.67 [a] ±0.13
APU (%)	33.76 [d] ±0.35	37.47 [c] ±0.38	39.51 [b] ±0.78	42.50[ab] ±1.75	45.57 [a] ±0.53	46.7 [a] ±1.43
EU (%)	18.53[c] ±0.25	20.72 [b] ±0.16	21.96 [b] ±0.36	23.95[ab] ±0.86	25.70 [a] ±0.35	26.46 [a] ±1.20

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

Table 4. Proximate chemical analysis (%; on dry weight basis) of whole body of Nile tilapia fingerlings fed diets containing different levels of by-product rocket seed meal.

Items	By-product rocket seed meal levels (%)					
	0.0%	**0.1%**	**0.2%**	**0.3%**	**0.4%**	**0.5%**
Dry matter (%)	23.77 [b] ±0.56	24.70[ab] ±0.74	25.44[ab] ±0.27	25.69 [a] ±0.18	25.76[a] ±0.22	25.96 [a] ±0.17
Crude protein (%)	64.54 [b] ±0.56	65.56[ab] ±0.74	65.85[ab] ±0.27	66.63 [a] ±051	67.17[a] ±0.50	67.40 [a] ±0.70
Ether extract (%)	16.16 [b] ±1.45	16.56[ab] ±0.46	16.84[ab] ±0.31	17.34[ab] ±0.35	17.71[a] ±0.28	17.96 [a] ±0.33
Ash (%)	19.31 [a] ±0.18	17.89[a] ±0.28	17.31[ab] ±0.12	16.03[ab] ±0.71	15.11[b] ±0.35	14.64 [b] ±0.39

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

Table 5. Economic efficiency for production of one kg gain of Nile tilapia fed diets containing different levels of by-product rocket seed meal.

Items	By-product rocket seed meal levels (%)					
	0.0%	**0.1%**	**0.2%**	**0.3%**	**0.4%**	**0.5%**
Price/ kg feed (L.E)	6.45	6.45	6.44	6.44	6.44	6.43
FCR (kg feed/kg gain)	1.62	1.56	1.52	1.44	1.35	1.35
Feed cost / kg gain(L.E)	10.45	10.06	9.79	9.29	8.69	8.68
Reduction in feed cost/ kg gain(L.E)	0.0	0.39	0.66	1.16	1.76	1.77
Reduction in feed cost/ kg gain (%)comparing with the control	0.0	3.73	6.32	11.10	16.84	16.94

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تأثير استخدام مسحوق مخلفات بذور الجرجير فى غذاء اسماك البلطى النيلى على معدلات النمو والاستفادة من الغذاء

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الملخص العربى

أجريت هذه الدراسة لتقييم إضافة مستويات مختلفة من مسحوق مخلفات بذور الجرجير إلى غذاء الأسماك وتأثير ذلك على معدلات النمو والاستفادة من الغذاء والعائد الاقتصادى لأسماك البلطى النيلى.

تم تكوين ستة علائق تجريبية تحتوى كل منها على (٣٠ % بروتين ،٧,٥ % دهن ، ٤,٤٨ كيلو كالورى/١٠٠جم غذاء) وأضيف إليها مسحوق مخلفات بذور الجرجير بنسب صفر (كنترول) ، ٠,١ ، ٠,٢ ، ٠,٣ ، ٠,٤ ، ٠,٥% على التوالى.غذيت المعاملات التجريبية (ثلاث مكررات/ معاملة) من إصبعيات البلطى النيلى (١, ٤ جم/إصبعية) بإحدى العلائق التجريبية بنسبة ٤ % من الوزن الحى للجسم طوال فترة التجربة (١٢ أسبوع) بمعدل مرتين يومياً.

أشارت نتائج هذه الدراسة إلى أن: كل من الوزن النهائي وزيادة الوزن ازدادت معنويا مع زيادة نسبة الإضافة من مسحوق بذور الجرجير فى الغذاء وقد حققت أسماك المعاملة التى تناولت غذاء يحتوى نسبة ٠,٤ أ، ٥, ٠% مسحوق مخلفات بذور الجرجير أعلى معدلات نمو دون معنوية مقارنة بالكنترول، تحسن معدل إعاشة الأسماك مع إضافة مسحوق مخلفات بذور الجرجير للغذاء ولكن بنسبة غير معنوية، ازدادت كمية الغذاء المأكول وانخفض معدل التحويل

الغذائى فى الأسماك التى تناولت غذاء يحتوى نسبة ٠,٤ ، ٠,٥ % مسحوق مخلفات بذور الجرجير دون معنوية مقارنة بالكنترول، معدل كفاءة كل من البروتين والغذاء والاستفادة من البروتين ومعدل النمو النوعى والاستفادة من الطاقة تحسنت معنويا بإضافة مسحوق مخلفات بذور الجرجير وكانت أعلى نسب حققتها الأسماك التى تناولت غذاء يحتوى نسبة ٠,٤ ، ٠,٥% مسحوق مخلفات بذور الجرجير دون معنوية بينما المغذاة على الكنترول حققت اقل نسب، تحسنت نسبة المادة الجافة والبروتين في جسم الأسماك معنوياً مع زيادة نسبة إضافة مسحوق مخلفات بذور الجرجير فى غذاء الأسماك، انخفضت تكلفة كمية الغذاء اللازمة لإنتاج ا كجم من الأسماك بإضافة مسحوق مخلفات بذور الجرجير في غذاء الأسماك وكانت أعلى نسب (٨٤, ١٦ ، ٩٤, ١٦%) حققتها المعاملات التي تناولت أسماكها غذاء يحتوى نسبة ٠,٤ ، ٠,٥ % مسحوق مخلفات بذور الجرجير دون معنوية مقارنة بالكنترول.

مما سبق تشير هذه الدراسة إلى أن إضافة مسحوق مخلفات بذور الجرجير إلى غذاء أسماك البلطى النيلى بنسبة تصل إلى٠.٤% يحسن من معدلات النمو والاستفادة من الغذاء والعائد الاقتصادى.