Abbassa International Journal for Aquaculture

Volume (3) Number (1), 2010

ISSN 1687-7638

Egyptian Society for Water, Aquaculture and Environment

Abbassa, Abou Hammad, Sharki, EGYPT

EVALUATING THE USE OF CARAWAY SEEDS AS A NATURAL FEED ADDITIVE IN PRACTICAL DIET FOR NILE TILAPIA *OREOCHROMIS NILOTICUS*

Fayza E. Abbass[1], Amal S. Hassan[1] and Mohammad H. Ahmad[2]*

[1]Department of fish production and aquaculture systems
[2]Department of fish nutrition, central laboratory for aquaculture research, Abbassa, Abo-Hammad, Sharqia, Egypt.

Received 16/ 5/ 2010 *Accepted 13/ 6/ 2010*

Abstract

The main objective of this study was determining the effect of different levels of caraway seeds meal *Carum carvi* (CSM), used as a feed additive compared on growth performance, feed utilization, and whole body composition of Nile tilapia, *Oreochromis niloticus.* All experimental diets were iso-nitrogenous (30.31% crude protein) and iso-caloric (4.46 k cal/g diet). Five experimental diets were formulated to contain 0.0 (control), 0.5, 1.0, 1.5 or 2.0 % CSM. The study was conducted in triplicates where three100-L aquaria have been randomly allocated to each treatment. Each aquarium was stocked with 20 fish (3.6 ± 0.02g). Experimental diets were offered at a rate of 4 % of live body weight of fish. The diets offered twice daily for six days per week for 12 weeks for 12 weeks. Results showed that the optimum growth was obtained in diet contained 1.0 % CSM, whereas the control diet produced the lowest fish growth. There were no significant changes in fish survival among the different treatments and its range was 98.52 – 100 %. The optimum feed intake (FI), protein efficiency ratio (PER), apparent protein utilization (APU), and energy utilization (EU) and feed conversion ratio (FCR) were obtained at diet containing 1.0% CSM. No significant difference were observed in dry matter, protein, lipid, or ash content in fish bodies when fed diets containing various levels of CSM. The reduction in CSM – treated feed cost compared with control diet to produce one kg fish gain of treatment containing 1.0 % CSM levels was 16.41%.

Keywords: Medicinal plants, caraway seeds, Nile tilapia, growth performance, feed utilization, whole body composition, economic evaluation.

* Corresponding author email: md_ahmad55@yahoo.com

INTRODUCTION

The use of natural feed additive is useful for fish feeding rather than classic chemical feed additives because of the accumulative effect of the chemical compounds. Medicinal herbal is a growing area of alternative medicines. Nowadays many of the active ingredients in manufactured drugs are derived originally from plant compounds and have a wide range use because the natural plant compound is less toxic and safer than prepared chemical compound that induces deterrent effects on human health (El-Dakar *et al.,* 2008).

The use of medicinal herbs for humans is well known. The most recent studies showed successful use of spices and natural herbs in fish nutrition including, fenugreek seeds, Shalaby, (2004), cinnamon meal, Ahmad *et al*., (2009) and *Origanum vulgar* Seden *et al*., (2009). Use of natural herbs-medicinal in fish feeding is still limited on the experimental and commercial scales and further studies are needed to find out new herbs that may be used in fish diets. Caraway *Carum carvi* is distributed throughout the northern and central parts of Europe and Asia, and it is considered as a natural spice (Murray *et al.* 1991).

Tilapia farming has grown extremely fast in the last decade, where they are cultured worldwide with annual growth rate of about 12.2% (El-Sayed, 2006). Nile tilapia, *Oreochromis niloticus* was selected for this study because it is considered one of the most important species within all tilapia species. The present study aimed to evaluate the effect of different levels of caraway seeds meal (CSM) on growth performance, feed efficiency, protein utilization and whole body composition. It also, comprised on economic evaluation a new formulated CSM supplemented diet for feeding Nile tilapia, *O. niloticus*.

MATERIALS AND METHODS

Diet preparation:

Five experimental diets (30% crude protein and 7.5 % lipid) were formulated to contain 0.0, 0.5, 1.0, 1.5 or 2 % of *Carum carvi* (CSM). The diets were approximately similar in nutrient contents but containing different levels of CSM and they were formulated to meet the nutritional requirement of fish NRC (1994). In the present study, CSM was obtained from the local market. The proximate chemical composition of the main diet ingredients and CSM is shown in Table (1). Diets formulation and their proximate composition are shown in Table (2).

Table 1: Proximate chemical analysis of caraway seeds meal (CSM), herring fish Meal (HFM), soybean meal (SBM), wheat bran (WB) and corn meal (CNM) (%, on dry matter basis).

Items	CSM	HFM	SBM	CNM	WB
Dry matter	93.56	92.42	93.80	90.37	91.01
Crude protein	19.18	72.21	44.03	9.55	14.98
Total lipids	21.36	11.42	1.31	3.98	4.41
Ash	9.15	11.14	5.95	1.50	3.34
NFE*	27.14	4.68	43.09	79.83	66.43
Crude fiber	23.17	0.55	5.62	5.14	10.84
Digestible energy (DE) kcal / 100g**	383.31	480.21	372.76	362.98	347.10

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

**Digestible energy was calculated from NRC (1994) as 5, 9, and 3.5 kcal/g for protein, lipid, and carbohydrates, respectively.

Table 2: Feed ingredients and the chemical composition (on DM-basis) of experimental diets.

Ingredients	Control (0.0)	Caraway seeds meal %			
		0.5%	1.0%	1.5%	2.0%
Herring fish meal	12.1	12.1	12.1	12.1	12.1
Soybean meal	39.0	39.0	39.0	39.0	39.0
Ground corn	22.5	22.5	22.5	22.5	22.5
Wheat bran	15.24	15.24	15.24	15.24	15.24
Cod fish oil	2.36	2.36	2.36	2.36	2.36
Corn oil	1.8	1.8	1.8	1.8	1.8
Minerals premix[1]	2.0	2.0	2.0	2.0	2.0
Vitamins premix[2]	1.0	1.0	1.0	1.0	1.0
Starch	2.0	2.0	2.0	2.0	2.0
Cellulose	2.0	1.5	1.0	0.5	0.0
Caraway seeds meal	0.0	0.5	1.0	1.5	2.0
Total	100	100	100	100	100
Chemical analysis (%)					
Dry matter	92.28	92.15	92.35	92.26	92.30
Crude protein	30.16	30.10	30.13	30.12	30.17
Crude fat	7.29	7.44	7.34	7.32	7.41
Ash	7.34	7.66	7.75	7.55	7.71
Fiber	4.75	4.77	4.77	4.79	4.79
NFE[3]	50.66	49.73	50.01	49.92	49.92
G. E. Kcal/100g4	447.13	447.22	444.76	446.98	445.52

[1]Mineral premix (per kg of premix): $CaHPO_4.2H_2O$, 727.2 g; $MgCO_4.7H_2O$, 127.5 g; KCl 50.0 g; NaCl, 60.0 g; $FeC_6H_5O_7.3H_2O$, 25.0 g; $ZnCO_3$, 5.5 g; $MnCl_2.4H_2O$, 2.5 g; $Cu(OAc)_2.H_2O$, 0.785 g; $CoCl_3.6H_2O$, 0.477 g; $CaIO_3.6H_2O$, 0.295 g; $CrCl_3.6H_2O$, 0.128 g; $AlCl_3.6H_2O$, 0.54 g; Na_2SeO_3, 0.03 g.

[2] Vitamin 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, 500,000 IU.

[3] NFE (nitrogen free extract) = 100 – (protein % + lipid % + ash % + fiber %)

[4] GE (gross energy) was calculated after NRC (1993) as 5.64, 9.44 and 4.11 Kcal/g for protein, lipid and NFE, respectively.

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^{o}C for 24 hours and stored in plastic bags and finally kept in a refrigerator at -2^{o}C for further use.

Fish culture technique:

Nile tilapia, *O. niloticus* (3.6 ± 0.02 g) were obtained from the fish hatchery, Central Laboratory for Aquaculture Research, Abbassa, Abu-Hammad, Sharkia, Egypt, they were kept for 2 weeks in indoor tank as an acclimation period to the laboratory conditions. Fish fed a commercial diet containing 30% crude protein. Fifty fish were frozen at – 20 ˚C for proximate analysis at initial. Acclimated fish were distributed a rate of 20 fish/100-L aquarium. Each aquarium was supplied with compressed air via air-stones using aquarium air pumps. Settled fish wastes with one half of aquarium's water were siphoned daily and water volume was replaced by aerated tap water from a storage tank. The daily feeding rate was 4 % of live body weight. The feed was offered to each aquarium twice daily; 6 days a week for 12 weeks. Every two weeks, fish in each aquarium were sampled and the amount of feed was readjusted accordingly. Dead fish once appeared were recorded and removed. All aquaria were maintained at 25-27^{o}c with 12-12 light - dark photoperiod cycle using fluorescent tubes as a light source.

Chemical analysis of diets and fish:

The tested diets and whole-fish body from each treatment at the beginning and at the end of the experiment were analyzed according to the methods of AOAC (1990) for moisture, protein, fat and ash. Crude fiber was estimated according to Goering and Van Soest (1970) and gross energy was calculated according to (NRC 1993).

Analysis of Water Quality:

Water samples were collected biweekly from each aquarium. Water temperature and dissolved oxygen were measured on site with a YSI model 58 oxygen meter (Yellow Spring Instrument Co., Yellow Springs, Ohio, USA). The pH was measured using a pH-meter (Digital Mini-pH Meter, model 55, Fisher Scientific, USA). Unionized ammonia was measured using DREL/2 HACH kits (HACH Co., Loveland, Co., USA).

Growth parameters:

Weight gain (WG) = W2-W1;

Daily gain (DG) = W2 - W1 / T;

Weight gain % = [(W2 – W1) / W1] X 100.

Where: W2 = average final body weight (g), W1 = average initial body weight (g), and T = experimental period (days).

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);

Apparent protein utilization (APU; %) = 100 [protein gain in fish (g)/ protein intake in feed (g)];

Energy utilization (EU %) = 100 [energy gain in fish / energy intake in feed].

Economical evaluation:

The cost of feed required to produce a one kg of fish biomass was estimated using a simple economic analysis. The estimation was based on the local retail sale market price of all the dietary ingredients during the time of this study. These prices (in LE/kg) were as follows: herring fish

meal,10; soybean meal, 2.5; corn meal, 1.50; wheat bran, 1.0; starch 3.0, cellulose 3.0; fish oil, 7.0; corn oil, 5.0; vitamin premix, 7.0; mineral mixture, 3.0 and caraway seeds 15.

Statistical analysis:

The data obtained were subjected to a one-way analysis of variance to evaluate the effect of CSM supplementation. Differences between means were tested at the 5% probability level using the Duncan test. All the statistical analyses were performed using SPSS program version10 (SPSS, Richmond, VA, USA) as scripted by Dytham (1999).

RESULTS AND DISCUSSION

The ranges of water quality parameters i–e. temperature; dissolved oxygen; total ammonia and pH, in aquaria varied during the study period within the range 26.5 °C - 28.6 °C; 6.6 - 7.2 mg/l; 0.4 – 0.6 mg/l; 7.7 - 8.2,.respectively. These data are within the acceptable ranges required for normal growth of tilapia as mentioned by Boyd (1990).

Table (1) shows that *Carum carvi* (CSM) was rich in crude protein, total lipid, nitrogen free extract, and crude fiber. It contained 19.18, 21.36, 27.14, and 23.17% on dry matter basis, respectively (Table 1). Data in Table (3) show the growth performance (final weight, weight gain, weight gain % and daily gain) of Nile Tilapia fed diets containing different levels of CSM. Growth performance (final weight, weight gain, weight gain % and daily gain) of Nile Tilapia fed diets containing different levels of CSM increased significantly ($P<0.05$) with supplemented diets with different levels of CSM. The highest growth rate was obtained in diet containing 1.0 % CSM as compared to the other diets. Medicinal plants used as a natural growth promoters have significant improvements on body weight, weight gain, survival rate and feed conversion rate in fish (Shalaby, 2004, El-Dakar, 2004 and Seden *et a*l., 2009). Similar were observed by Ahmad *et al.* (2009) who conducted

an experiment with Nile tilapia fingerlings fed a basal diet containing 0, 0.5, 1.0 and 1.5% cinnamon for 90 days. They found that the use of 1.0 % level of cinnamon gave the optimum fish growth. On the other hand, El-Dakar (2004) found that hybrid tilapia *Oreochromis niloticu* x *Oreochromis auraus* fingerling fed on 0.5 % CSM gave the optimum body weight, weight gain and specific growth rate. This enhancement in growth performance may be due to the CSM was rich in crude protein, total lipid, nitrogen free extract, and also may contain 3 % and 7 % essential oil which have been essential for growth (Murray *et al* ., 1991).

Table 3: Growth performance of Nile tilapia fed diets containing different levels of caraway seeds meal for 12 weeks. (Initial weight of Nile tilapia was 3.6 ± 0.02 g).

Items	**Control (0.0)**	**Caraway seeds meal %**			
		0.5%	**1.0%**	**1.5%**	**2.0%**
Final weight (g)	24.57± 0.43^{c}	29.0± 0.40^{b}	32.3± 0.29^{a}	30.07± 0.75^{b}	28.4± 0.81^{b}
Weight gain (g)	20.97± 0.43^{c}	25.4± 0.40^{b}	28.7± 0.29^{a}	26.47± 0.75^{b}	24.8± 0.81^{b}
Weight gain %	582.50± 12.04^{c}	705.56± 11.23^{b}	797.22± 8.02^{a}	735.28± 10.78^{b}	688.89± 12.54^{b}
Daily weight gain(g/day)	0.25± 0.02^{c}	0.30± 0.01^{b}	0.34± 0.01^{a}	0.32± 0.02^{b}	0.30± 0.03^{b}
Survival rate (%)	98.52± 1.48^{a}	99.26± 0.74^{a}	100.00± 0.00^{a}	100.00± 0.00^{a}	99.26± 0.74^{a}

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

No significant differences were reported in fish survival rate among different treatments ($P>0.05$); it ranged from 98.52 to 100 % (Table 3). This may indicate that CSM has no toxic effect. Similar results were obtained by Seden *et al.,* (2009) who studied that the effect of *Origanum vulgare* (0.5%, 1%, 1.5%, and 2%) as a feed additive on survival rate of

Nile tilapia. They found no significant differences in survival rate among different treatments and its range was 95.0 - 100 %.

Feed intake increased significantly while FCR decreased significantly ($P<0.05$) when fish fed CSM-supplemented diets (Table 4). Moreover, PER, APU and EU values increased significantly with CSM-supplemented diets. The lower FCR and higher values of FI, FER, PER, APU, and EU were obtained when fish fed diet contained 1.0% CSM. Increased feed intake was the result of a high demand for nutrients with stimulated growth or due to improved appetite because of sensory stimulation resulting from the presence of CSM in the feed. Similarly**,** Ahmad *et al.* (2009) found that feed consumption was higher in the cinnamon-fed Nile tilapia throughout the experimental period and the control group exhibited the lowest feed intake. Platel *et al*. (2002) reported that spices are desirable for stimulating digestion, and had the highest stimulatory influence particularly on bile secretion and pancreatic enzymes activity. In anther way, olfactory feed ingredients enhanced growth through their ability to act as feeding enhancers by fish to eat more feed than in normal (Adams *et al.,* 1988). The increased feed intake as affected by adding CSM may confirm the results obtained by (El-Dakar 2004).

Fish fed diet containing 1.0% CSM was the best supplemented level for FCR, PER, APU and EU in comparison to the control diet and other s containing different levels of CSM. The seniority of CSM in improving these parameters may be due to its contents of essential oil and effective components (Murray *et al*., 1991). The aroma of the essential oil of CSM is mostly dominated by corvine (50 - 85%) and limonene (20 - 30%); the other components carveol, bihydrocaveol, α- and β-pinene, sabinene and perillyl alcohol) are of much minor importance (Murray *et al*., 1991). These effective components have a strong stimulating action bile secretion as well as antispasmodic and anti-inflammatory effect (Murray

et al., 1991). In this concern, Harada (1990) found that CSM was strong attractants of spices for oriental weather fish and cumin for yellowtail; however their attractive effect of these herbs depended on their concentrations used.

Table 4: Feed utilization by Nile tilapia fed practical diets containing different levels of caraway seeds meal for 12 weeks.

Items	Control (0.0)	Caraway seeds meal %			
		0.5%	1.0%	1.5%	2.0%
Feed intake (g feed / fish)	30.37± 0.43^{c}	32.23 ± 0.21^{ab}	32.47± 0.43^{ab}	33.78 ± 0.26^{a}	32.00 ± 0.24^{ab}
Feed conversion ratio (FCR)	1.45± 0.04^{a}	1.27± .02^{b}	1.13± 0.01^{c}	1.28± 0.03^{b}	1.29± 0.04^{b}
Protein efficiency ratio (PER)	2.48± 0.08^{c}	2.84± 0.05^{ab}	3.28± 0.03^{a}	2.82± 0.07^{ab}	2.7± 0.09^{ab}
APU (%)	43.31± 2.07^{c}	48.55± 0.03^{bc}	56.74± 0.84^{a}	53.25 ± 1.89^{bc}	54.10± 2.45^{ab}
E U (%)	23.40± 1.19^{b}	26.49± 0.40^{b}	31.11± 0.41^{a}	26.38 ± 0.99^{b}	26.71± 1.41^{b}

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

Results of proximate analysis of the whole body of Nile tilapia (moisture, protein, fat and ash) at the end of the study are shown in Table (5).Results indicated that no significant differences ($P>0.05$) were observed in moisture, crude protein ether extract and ash of Nile tilapia fed diets containing various levels of CSM (Table 5). Similar results were obtained by El-Dakar (2004) who used among individuals different levels of CSM (0, 0.5, 1 and 2% of dried CSM) on growth, survival, and body composition of hybrid tilapia, *O. niloticus* × *O. auraus* fingerlings (13 g). He found that no significant difference ($P>0.05$) in moisture, crude protein, ether extract and ash content in fish body. Also similar results were obtained by Ahmad *et a*l. (2009), they found no significant

differences (P<0.05) in moisture, crude protein, ether extract and ash content in Nile tilapia fed diets containing various levels of cinnamon.

Table 5: Proximate chemical analysis (%; on dry matter basis) of whole body of Nile tilapia fed practical diets containing different levels of caraway seeds meal for 12 weeks.

Items	Initial	Control (0.0)	Caraway seeds meal %			
			0.5%	1.0%	1.5%	2.0%
Dry matter	21.16± 0 .18[a]	25.29± 0 .38[a]	24.87± 0.12[a]	25.22 ± 0.58[a]	24.83 ± 0.21[a]	25.33 ± 0.61[a]
Crude protein	64.90± 0.29[a]	66.89± 0.49[a]	66.99± 0.50[a]	67.14± 0.11[a]	67.16± 0.41[a]	66.99± 0.11[a]
Total lipids	11.40 ± 0.19[a]	16.67 ± 0.19[a]	16.72± 0.18[a]	16.90 ± 0.10[a]	16.82± 0.11[a]	17.09± 0.58[a]
Ash	28.80± 0.14[a]	16.97± 0.104[a]	16.74± 0.15[a]	16.54 ± 0.31[a]	16.81± 0.11[a]	16.38 ± 0.22[a]

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

The economical evaluation of the experimental diets contained different CSM levels (0.0, 0.5 %, 1.0 %, 1.5 % and 2.0 %) are shown in Table (6). The highest reduction in feed cost to produce one kg fish gain was obtained at 1.0 % CSM; it was 16.41 %. Previous studies showed that the use of spices in small amounts gave lower incidence cost and higher profit index of fish species (Abd-Elmonem *et al.,* 2002; Sakr, 2003; Shalaby *et al*., 2003 and El-Dakar *et al.*, 2004). The present study concluded that CSM positively enhanced the growth performance and feed efficiency of Nile tilapia. In addition, the optimum inclusion of CSM in a practical diet should be 1.0%.

Table 6: Economic efficiency for production of one Kg gain of Nile tilapia fed diets containing different levels of caraway seeds meal for 12 weeks.

Items	Control (0.0)	Caraway seeds meal levels			
		0.5%	1.0%	1.5%	2.0%
Price/ kg feed P.T	3.19	3.25	3.31	3.37	3.43
FCR (kg feed/kg gain)	1.45	1.27	1.17	1.28	1.29
Feed cost / kg gain P.T	4.63	4.13	3.87	4.31	4.42
Reduction cost in kg gain	100	10.8	16.41	6.91	4.54

REFERENCES

Abd-Elmonem A.I.; S.M.M. Shalaby and A.Y. El- Dakar. 2002. Response of red tilapia to different levels on some medicinal plant by-products black seed and croquette seed meals. Proceeding the 1st Scientific Conference on Aquaculture. 13-15 December, Egypt, pp. 247-280.

Adams, M.A., P.B. Johansen and Z. Hong. 1988. Chemical enhancement of feeding for the herbivorous fish *Tilapia zillii*. Aquacult.72: 95 – 107.

Ahmad, M.H.; A.M. El Mesallamy; F. Samir and F. Zahran. 2009. Effect of different levels of cinnamon (*Cinnamomum zeylanicum*, NEES) on growth performance, feed utilization, whole-body composition and entropathogenic *Aermonas hydropila*- challenge of all male Nile tilapia *Oerochromis niloticus* L. Fingerlings. Egypt. J. Appl. Sci., 24 (5A).

AOAC. 1990. Association of Official Analytical Chemists. The Official Methods of Analyses Association of Official Analytical Chemists International.15th edition, Arlington, VA, 2220, USA.

Boyd, C.E. 1990. Water Quality in Ponds for Aquaculture. Birmingham Publishing Co., Birmingham, Alabama, USA

Dytham, C. 1999. Choosing and Using Statistics: A Biologist's Guide. Blackwell Science Ltd., London, UK. pp 147.

El Dakar, A.Y.; G.D.I. Hassanien; S.S. Seham; Gad and S.E. Sakr. 2008. Use of dried basil leaves as a feeding attractant for hybrid tilapia, *Orochromis niloticus* X *Oreochromis aureus*, fingerlings. Med. Aquacult. J., (1): 35-44.

El-Dakar, A.Y. 2004. Growth response of hybrid tilapia, *Oreochromis niloticus x Oreochromis auraus* to diets supplemented to different levels of caraway seeds. Agric. Sci. Mansoura Univ., 29 (11): 6083- 6094.

El-Dakar, A.Y.; G.D.I. Hassanien; S.S. Gad and S.E. Sakr. 2004. Use of medical and aromatic plants in fish diets: 2. Effect of dried basil leaves on performance of hybrid tilapia (*Oreochromis niloticus* x *Oreochromis auraus*) fingerlings. J. Egypt Acad. Soc. Environ. Develop.; (B-Aquaculture), 5 (2): 43-67.

El-Sayed, A.F.M. 2006. Tilapia Culture. CABI publishing, CABI International Willingford, Oxfordshire, United Kingdom.

Goering, H.K. and P.G. Van Soest 1970. Forage fiber analysis (apparatus, reagent, procedures, and some applications). US Dept. Agric. Handbook, Washington D.C., USA, P, 379.

Harada, K. 1990. Attraction activities of spices for oriental weather fish and yellowtail. Nippon-Suisan-Gakkaishi, 56: 2029 – 2033.

Murray, R.K.; D.K. Granner,; P.A. Mayes and V.W. Rodwell. 1991. The

Textbook of Herb's Biotechnology. Twenty-second edition, Appleton & Large, Norwalk, Connecticut Los Anglos, California, USA.

NRC (National Research Council). 1993. Nutrient requirements of fish. Committee on Animal Nutrition. Board on Agriculture. National Research Council. National Academy Press. Washington DC, USA

NRC (National Research Council). 1994. Nutrient requirements of fish. Committee on Animal Nutrition. Board on Agriculture. National Research Council. National Academy Press. Washington DC, USA.

Platel K.; A. Rao; G. Saraswathi and K. Srinivasan 2002. Digestive stimulant action of three Indian spice mixes in experimental rats. Nahrung, 46 (6): 394-398.

Sakr, S.E. 2003. Studies on the feeding attractants for fish. M.Sc. Thesis, Fac. Environ. Agric. Sci., El-Arish, Suez Canal Univ., Egypt.

Seden, M.E.A.; F.E. Abbass and M.H. Ahmed. 2009. Effect of *Origanum vulgare* as a feed additive on growth performance, feed utilization and whole body composition of Nile tilapia (*Oreochromic niloticus*) fingerlings challenged with pathogenic *Aeromonas hydrophila*. J. Agric. Sci. Mansoura Univer., 34 (3): 1683- 1695.

Shalaby, S.M.M. 2004. Response of Nile tilapia, *Oreochromis niloticus* fingerlings to diets supplemented with different levels of fenugreek seeds (Hulba). J. Agric. Mansoura Univ., 29: 2231-2242.

Shalaby, S.M.M; A.I. Abd-Elmonem and A.Y. El-Dakar. 2003. Enhancement of growth performance, feed and nutrient utilization of Nile tilapia, *Oreochromis nilotics*, using of licorice roots (Erksous) as a feed attractive. J. Egypt. Acad. Soc. Environ. Develop. (B-Aquaculture), 4 (2): 119-142.

تقييم إستخدام مسحوق بذورالكراوية كإضافة غذائية لزريعة أسماك البلطي النيلى

فايزة السيد عباس[١] ، أمل سيد حسن[٢] ، محمد حسن أحمد[٣]

[١]قسم بحوث إنتاج الأسماك ونظم الإستزراع السمكى، [٢]قسم بحوث إنتاج الأسماك ونظم الإستزراع السمكى، [٣] قسم بحوث تغذية الأسماك- المعمل المركزي لبحوث الثروة السمكية-العباسة – أبو حماد – شرقية.

أجريت هذه الدراسة لمعرفة تأثير مستويات مختلفة من مسحوق بذور الكراوية كإضافات غذائية على معدل النو والكفاءة الغذائية وتركيب الجسم وكذلك التقييم الإقتصادى لكمية العلف اللازمة لإنتاج ١كجم من زريعة أسماك البلطى النيلى ومقارنة ذلك بالكنترول. جميع العلائق كانت متساوية فى محتواها من البروتين والطاقة (٣٠.٣١% بروتين خام و ٤.٤٦ كيلو كالورى/جم عليقة).وهذه الدراسة تتكون من ٥ معاملات وكل معاملة تتكون من ٣ مكررات وتم توزيع الأسماك فى ١٥ حوض زجاجى سعة (١٠٠ لتر) بمعدل ٢٠ سمكة /حوض بمتوسط وزن ٣.٦ جم/ السمكة. تغذت المعاملة الأولى على عليقة بدون إضافة بذور الكراوية (كنترول) والمعاملة الثانية، الثالثة، الرابعة ،الخامسة كانت تتغذى على نفس عليقة الكنترول ولكن مضافا إليها مسحوق بذور الكراوية بنسبة(٠.٥ %، ١.٠ % ،١.٥ %، ٢.٠ %)على التوالي. غذيت الأسماك على العلائق التجريبية بمعدل ٤ % من وزن الجسم من بداية التجربة ولمدة ١٢ أسبوع (حتى نهاية التجربة) وكان يتم وزن الأسماك كل أسبوعين وتعديل كمية العلف حسب الزيادة فى الوزن.

أظهرت نتائج هذه الدراسة وجود زيادة الوزن النهائي ومعدل الزيادة في النمو والزيادة اليومية. وكانت أعلى زيادة حصلنا عليها في المعاملة التي غذيت على عليقة بها١ % بذورالكراوية واقل قيمة لها كانت في المعاملة التي غذيت على عليقة بدون إضافات (الكنترول). تحققت أعلى قيم للغذاء المأكول وأفضل قيم لمعامل التحويل الغذائي تحققت عند تغذية الأسماك على عليقة بها ١ % من بذور الكراوية. لم تتأثر نسبة الإعاشة معنويا بالمستويات المختلفة من الكراوية وكانت النسبة ما بين ٩٨.٥٢ – ١٠٠ %. وارتفعت قيم الكفاءة النسبية للبروتين والقيم البيولوجية للبروتين والاستفادة من الطاقة بدرجة معنوية في اسماك المعاملة المغذاة على عليقة بها ١% من بذورالكراوية مقارنة بمثيلاتها فى عليقة الكنترول والتى كانت منخفضة معنويا. لم

يتأثر التركيب الكيماوى لجسم الأسماك فى نهاية التجربة بمستويات الإضافة المختلفة من بذور الكراوية.

المجال التطبيقي للبحث : بناءا على ماسبق فإن المستوى الامثل لإضافة بذور الكراوية فى علائق زريعة أسماك البلطي النيلى هي ١% وذلك لتحسين النمو ورفع معدل الاستفادة من العلف وكذلك خفض التكلفة الإقتصادية لإنتاج ١ كجم وزن حى من الأسماك بنسبة ١٦.٤١ %.