

USE OF (OLIVE CAKE, SUGAR BEET PULP AND MOLASSES) AS NON-CONVENTIONAL ENERGY FEED SOURCES IN NILE TILAPIA (*OREOCHROMIS NILOTICUS*) DIETS

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Abstract

This study was designed to determine the effect of practically replacing yellow corn with non-conventional energy sources at (10,20% Olive cake and 10,20% Sugar beet pulp with or without 3% Molasses). A total number of 180 Nile tilapia (2g) were randomly distributed into nine experimental treatment groups each in two replicates, and were fed daily at a rate of 3% of fish live body weight through 10 week experimental period, to study the effect of nine diets contained 32% crude protein on growth performance, feed utilization, body composition and economical efficiency. The results showed that yellow corn energy could be replaced by (10 and 20% Olive cake), without harmful effect on the performance and feed utilization of fish. Results also showed that best growth performance was recorded with control groups followed by fish fed diets containing (10, 20% Olive cake). But the diets contained (10, 20% Sugar beet pulp) and (10, 20% Sugar beet pulp and 3% Molasses) showed the lowest values of growth performance and protein utilization. Carcass composition of the experimental fish was relatively affected by different dietary treatments. Cost benefit analysis showed that low profit index and high incidence cost were obtained by the control diet.

Keywords: Nile tilapia, olive cake, sugar beet pulp, growth performance, feed utilization

INTRODUCTION

Nutrition plays an important role in intensive fish production depending upon the type of feed availability and its cost. Feeding cost exceeds 50% of operation costs (Scharoder, 1977). In Egypt, a considerable attention has been paid to use non-conventional feed stuffs either from protein or energy sources, instead of fish meal and yellow corn which represent the largest part balanced diets. On the other hand, yellow corn became very expensive since it represents the main energy source in livestock feeding and there are high competition on it between farm animals, i.e., poultry and fish. For these reasons nutritionists try to replace part of the yellow corn as the main source of energy by another non-conventional energy sources. Providing the optimum energy level in diets for fish is important. Deficiency of energy in diet results in reducing growth rate since energy needed for maintenance and voluntary activity must be satisfied before energy is available for growth. According to recommendation on nutrients requirements of fish by NRC (1993), ratios of digestible

protein to DE (mg/kcal) for maximum weight gain for several fish species ranged from 81-117 mg/kcal. El-Husseiny *et al.* (1993) showed that the economical energy requirements for the best tilapia performance were 3000 kcal metabolizable energy/kilogram diet. Lovell (1979) recommended that, 6 to 10 kcal DE per gram of protein were adequate for formulating fish diets, also, Fineman and Comacho (1985) mentioned that growth rate of tilapia nilotica was significantly increased with increasing energy level at the 30% protein feeds but decreased at high energy levels in the 20 and 25% protein feeds. Huisman (1991) showed that growth rate of carp increased with the increase in feeding rate. Moreover, increasing energy intake of Nile tilapia increased specific growth rate. Ragab and Mohamed (2002) when they studied the effect of dietary protein and energy levels on growth and body composition of *O. niloticus*, they reported that the best results on growth performance was recorded with fish fed diets containing 3400kcal/ kg and weight gain percentage decreased with increasing in body weight. The highest weight gain attained after 4 weeks, at the same time weight gain increased as protein or energy levels increased. El-Komy (2006) studied the partial replacement of yellow corn by broken rice meal and potato waste meal source energy in fish diets. The results showed that no significant differences between the live body weight up to 40% replacement level, but high significant was recorded with level higher than 60%. Carbohydrate plays an important role in sparing protein to be utilized as an energy source especially in omnivorous fish (Shiau, 1997).

Cultivation of olive and sugar beet in Egypt has been increased in the newly reclaimed land in the desert during the last three decades. According to the estimate of agriculture income of Ministry of Agriculture and land Reclamation (E.A.I., 1990) and (Hayam *et al.*, 2005), there are (44457 faddan) cultivated with Olive and (168000 faddan) cultivated with sugar beet in Egypt and produce about 62242 ton Olive cake and 3,444,000 ton sugar beet. The residues after oil extraction and sugar beet extraction are estimated to be 30-40% and 5% of the original quantity, respectively (Nefzaoui, 1993). Incorporation of olive cake, sugar beet and molasses as energy source in animal and poultry diets was used since long time and participate in solving the problem of feed shortage and alleviate the pollution problems (Ahmed, 1998, El-Ashry *et al.*, 2000, Samia *et al.*, 2002, Talha *et al.*, 2002, Al-Shanti, 2003, El-Badawi *et al.*, 2003, Yacot *et al.*, 2003 and Hayam *et al.*, 2005).

This study aimed to investigate the effect of using olive cake, sugar beet pulp and molasses as non-conventional energy source instead of yellow corn in Nile tilapia (*Oreochromis niloticus*) diets on growth performance, feed utilization, body composition, somatic index, and economic efficiency.

MATERIALS AND METHODS

1-Fish culture system:

Fingerlings of tilapia niloticus (*Oreochromis niloticus*) were collected from Moassasa farms, tolompate 7. Prior to the start of the experiment, all collected fish were placed in a fiberglass tank where they were fed commercial diets for three weeks (acclimation period) under the laboratory condition. The average body weight of fingerlings was 2g/fish. Fish were graded and divided into nine similar groups. The first nine groups were fed nine levels of dietary energy ranged between (17.16 to 18.96/GE,MJ/Kg DM) with (32% CP) on diets. Fish were stocked at a rate of 10 fish in each aquarium. Two aquaria as replicates were represented for each treatment. Each aquarium, which measured (60x35x40 cm) containing 70 L well aerated and dechlorinated tap water, nine air stones were used for aerating the aquaria water. Dissolved oxygen was measured weekly by oxygen meter model 9070. Analysis of NO₂, NO₃ and hardness was carried out using commercial kits (Hach International Co., Cairo, Egypt). Analysis of PO₄ and Alkalinity was estimated also by kits (Hach International Co., Cairo, Egypt). Light was controlled by a timer to provide 14-h light: 10h dark as daily photoperiod. Fish faeces and residual were removed by siphoning and about 50% of water in each aquarium was daily replaced by well aerated freshwater.

2- Diet formulations:

The fish were fed the experimental diets at a rate of 3% of live body weight; the daily rations was introduced at 2 equal meals at 8 am and 2 pm through 10 week (experimental period). The fish were weighting biweekly intervals during the experimental period and the feed quantities were readjusted according to the change in live body weight. Olive cake pulp, sugar beet pulp and molasses was added in the experimental diets to replace (10, 20% olive cake and 10, 20% sugar beet pulp with or without 3% molasses) by yellow corn. The chemical analyses of feed ingredient used in the experimental diets are presented in Table (1). These diets were designated as diet (1) to (9), respectively. Nine average isonitrogenous (31.22 to 32.80 % crude protein) and isocaloric between (17.16 to 18.96GE, MJ/Kg DM). Composition of the mixed diets is presented in Table (2).

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Table 1. The proximate analysis of tested ingredients (% on DM basis).

Ingredients	DM	OM	CP	EE	CF	Ash	NFE*	(MJGE)**
Fish meal	94.25	94.42	71.95	14.84	0.91	5.58	6.72	24.02
Yellow corn	92.92	98.65	9.67	7.48	3.03	1.35	78.42	19.19
Soybean meal	89.89	92.12	45.87	1.49	8.70	7.88	36.06	19.01
Wheat bran	94.43	95.13	12.95	7.31	8.48	4.87	66.39	18.77
Olive cake	94.33	94.13	13.90	10.38	22.33	5.87	47.52	19.34
Sugar beet pulp	94.64	96.12	9.14	3.81	18.98	3.88	64.19	17.91

*NFE= 100-(CP +EE + CF+ Ash).

** Gross energy was calculated by multiplication the factor 4.1, 5.6 and 9.44 kcal GE/g DM carbohydrate, protein and fat, respectively (Jobling, 1983).

Table 2. Ingredients composition of the experimental diets.

Ingredients	Diets								
	1** Control	2	3	4	5	6	7	8	9
Fish meal	15	15	15	15	15	15	15	15	15
Yellow corn	35	25	15	25	15	22	12	22	12
Soybean meal	30	30	30	30	30	30	30	30	30
Wheat bran	12	12	12	12	12	12	12	12	12
Sunflower oil	5	5	5	5	5	5	5	5	5
Vit.&Min*	3	3	3	3	3	3	3	3	3
Olive cake	---	10	20	---	---	10	20	---	---
Sugar beet pulp	---	---	---	10	20	---	---	10	20
Molasses	---	---	---	---	---	3	3	3	3
Total	100	100	100	100	100	100	100	100	100

*Vitamin and mineral mixture (product of HEPOMIX) each 2.5 kg contain: 12,000,000 IU Vit.A; 2,000,000 IU Vit. D3; 10 g, Vit. E; 2g, Vit. K3; 1g, Vit. B1 5g, Vit. B2; 1.5 g, Vit. B 6; 10g, Vit.B12; 30 g, Nicotinic acid; 10 g, Pantothenic acid; 1g, Folic acid; 50g, Biotin; 250g, Choline chlorid 50%; 30g, Iron; 10g, copper; 50g, Zinc; 60g, Manganese; 1g, Iodine; 0.1g, Selenium and Cobalt 0.1g.

** T1(control), T2 (10% olive cake), T3 (20%olive cake),T4 (10% sugar beet pulp),T5 (20% sugar beet pulp), T6 (10 % olive cake and 3% molasses),T7 (20% olive cake and 3% molasses),T8 (sugar beet pulp and 3% molasses), T9 (20% sugar beet pulp and 3% molasses).

A basal diet was formulated from the commercial ingredients (fishmeal, soybean meal, yellow corn, wheat bran, Vitamin, Mineral and oil). The dry ingredients were grounded through a feed grinder to very small particle size (0.15mm). The ingredients were weighed and mixed by a dough mixer for 20 minutes to homogeneity of the ingredients. The estimated amount of oil components (sunflower oil) was gradually added (few drops gradually) and the mixing operation was continued for 20 minutes. After homogenous mixture was obtained, forty ml water per hundred g diet was slowly

added to the mixture according to Shimeino *et al.* (1993). The diets were cooked on the water evaporator for 20 minutes. The diets were pelleted through fodder machine and the pellets were dried under room temperature. The diets collected and saved in plastic bags and stored in refrigerator at 4°C during the experimental period to avoid the deterioration of nutrients.

3-Growth parameters:

Average weight gain (AWG), Average daily gain (ADG), Specific growth rate (SGR), Feed conversion ratio (FCR), Protein efficiency ratio (PER), protein productive value (PPV %) and Survival rate (SR) were calculated according to the following equations:

a- $AWG \text{ (g/fish)} = [\text{Average final weight(g)} - \text{Average initial weight(g)}]$.

b- $ADG \text{ (g/fish/day)} = [AWG \text{ (g)}/\text{experimental period (d)}]$.

c- $SGR \text{ (\%/day)} = [\text{Ln final body weight} - \text{Ln initial body weight}] \text{ } 100/\text{experimental period (d)}$.

d- $FCR = \text{Feed Intake, dry weight (g)}/\text{Live weight gain (g)}$.

e- $PER = \text{Live weight gain (g)}/\text{protein intake (g)}$.

f- $PPV \text{ (\%)} = 100[\text{final fish body protein (g)} - \text{initial fish body protein (g)}/\text{crude protein intake (g)}]$.

g- $SR = 100[\text{total No. of fish at the end of the experimental}/\text{total No. of fish at the start of the experiment}]$.

4 – Proximate analysis:

Dry matter, Crude protein, Ether extract and ash contents of the tested diets and whole body of fish were performed according to A.O.A.C. (1984).

5 – Organs indices:

All fish were killed and soon abdominal cavity was opened to remove liver, kidneys, gonads and spleen which were weighed individually. Liver (HSI), Kidney (KSI), gonads (GSI), and spleen (SSI) indices were calculated as follow:

- $HSI \text{ (Hepato-somatic index)} = \text{Liver weight} \times 100 / \text{Gutted fish weight}$ (Jangaard *et al.*, 1967).

- $KSI \text{ (Kidney somatic index)} = \text{Kidneys weight} \times 100 / \text{fish weight}$ (Alabaster and Lioyed, 1982).

- $GSI \text{ (Gonado somatic index)} = \text{Gonads weight} \times 100 / \text{fish weight}$ (Tseng and Chan, 1982).

- $SSI \text{ (Spleeno somatic index)} = \text{Spleen weight} \times 100 / \text{fish weight}$ (Abdelhamid *et al.*, 2004).

6-Statistical analysis:

The obtained numerical data were statistically analyzed using SPSS (1997) for one-way analysis of variance. When F- test was significant, least significant difference was calculated according to Duncan, (1955).

RESULTS AND DISCUSSION

Chemical composition of the experimental diets.

Chemical composition and calculated energy of different diets are presented in Table (3). The chemical analysis revealed that no differences were observed between all diets in DM, CP and ash, while there was some differences observed between different diets of EE and CF, this differences may due to ingredients contains in different diets.

Table 3. Chemical composition of experimental diets (% on dry matter basis) .

Ingredients	Diets								
	1	2	3	4	5	6	7	8	9
	Control								
DM	92.74	93.49	93.18	93.39	93.71	93.53	93.24	93.40	93.05
CP	32.80	31.38	31.80	32.34	32.69	31.22	31.43	32.32	31.95
EE	9.68	11.30	14.84	12.83	14.66	7.61	8.60	7.84	8.30
CF	4.14	6.13	10.68	7.87	11.76	8.25	10.61	5.42	7.80
Ash	9.79	11.17	12.32	12.12	11.81	11.03	11.57	11.33	11.95
NFE	43.59	40.02	31.36	33.84	28.08	41.89	38.79	43.09	40.00
Calculated energy value									
GEMJ/Kg*	19.70	19.73	20.52	19.80	20.23	18.92	19.24	18.99	18.96
MEMJ/Kg**	15.82	15.58	15.60	15.38	15.22	14.57	14.50	15.03	14.67
MgP/KJGE***	16.65	15.90	15.49	16.33	16.12	16.50	16.34	17.02	16.85

*GE (gross energy) = (CPx5.6)+(EEx9.44)+(CFx4.1)+(NFEx4.1) Kcal/Kg (1 cal = 4.184 J) (Jobling, 1983).

**ME (Metabolizable energy) calculated using the value of 3.49, 8.1, and 4.5, Kcal/g for carbohydrate, fat, and protein, respectively, according to Pantha (1982).

***P/E (protein to energy ratio) = mg crude protein / KJ GE.

The CP content was around between 31.22 to 32.69% on DM basis. Such level was within the range suggested by Jauncy and Ross (1982) and NRC (1993). The calculated energy were similar in the tested diets, where the GE values (ranged from 18.92 to 20.52 /GE, MJ/Kg DM), it was higher than that suggested by NRC (1993) for the practical diets for tilapia. However, it was nearly similar to that used by Hassanen *et al.* (1995) and Abd-El-Maksoud *et al.* (1998).

Water quality parameters:

Water quality parameters are shown in Table (4). The range of them were 25—26 °C, 5-5.5mg/l, 6-8mg/l, 122-135 mg/l, 290-320 mg/l, 0.2-0.5 mg/l, 0.12-0.15 mg/l

for temperature, dissolved oxygen, pH, alkalinity, Hardness, PO₄ and NO₂ concentration, respectively. Such values were within the acceptable limits for Nile tilapia as stated by El-Sayed *et al.*, (1996), Milstein and Svirsky, (1996) and Mahmoud, (2006).

Table 4. Ranges of some important measured Physic-Chemical parameters of fish rearing water throughout the experimental period.

Temperature	pH value	DO ppm	Alkalinity mg/l	Hardness mg/l	Po ₄ mg/l	NO ₂ mg/l	NO ₃ Mg/l
25-26	6-8	5-5.5	122-135	290-320	0.2-0.5	0.12-0.15	2-4

Growth performance:

Data concerning average initial and final body weight, average weight gain (AWG), average daily gain (ADG), specific growth rate (SGR), and survival rate (SR) for the nine experimental treatments of Nile tilapia are presented in Table (5).

Table 5. Growth performance parameters of Nile tilapia fed the experimental diets.

Treatment	Initial body weight (g/fish)	Final body weight (g/fish)	A.W.G g/fish	A.D.G g/fish/day	SGR %/day	SR%
T1(control)	2.15±5.00	21.95±5.00 a	19.80±1.00 a	0.28±5.00 a	3.41±5.00 a	100±0.00 a
T2	2.15±0.15	21.05±0.15 ab	18.90±0.00 ab	0.27±0.00ab	3.36±0.00 ab	100±0.00 a
T3	2.25±0.15	20.70±0.20 b	18.45±5.00 b	0.26±5.00bc	3.32±5.00 abc	100±0.00 a
T4	2.15±0.15	18.65±0.15 d	16.50±0.00 d	0.23±0.00 d	3.20±6.50 bcd	100±0.00 a
T5	2.35±5.00	17.50±0.00 e	15.15±5.00 e	0.22±0.00ef	3.08±1.50 e	90±1.00 ab
T6	2.15±5.00	19.15±5.00 cd	17.00±0.00 cd	0.24±0.00cd	3.23±0.00 bc	90±1.00 ab
T7	2.15±0.15	19.45±0.15 cd	17.30±0.30 cd	0.24±5.00cd	3.24±2.00 bc	90±1.00 ab
T8	2.25±0.15	18.00±0.20 de	15.75±0.75 de	0.22±1.00ef	3.12±6.50 de	90±0.00 ab
T9	2.15±5.00	17.80±0.20 ed	15.65±0.25 de	0.22±5.00 e	3.10±2.00 e	85±5.00 b

a, b, c, d, e and f means in the same column had different letters significantly ($p < 0.05$) differ.

Results showed that no significant differences ($P < 0.05$) in the initial fish weight among different experimental groups which indicate that there are homogenous at the experimental start of the experimental groups. Results indicated that the highest values for weight gain, daily gain, specific growth rate and survival rate were obtained by the control group, followed by olive cake groups (diet 2 and 3). There were no significant differences between control group (diet,1) and diet 2 (10% olive cake), while the lowest weight gain values of daily gain and specific growth rate were obtained by group fed diets. The present results agree with those reported by Hayam *et al.* (2005) found that the yellow corn energy could be replaced by olive cake up to 10% without harmful effect on the growth performance of Nile tilapia (*O. niloticus*).

Also, Osman *et al.* (2004) and El-Komy (2006) suggested that, broken rice as a non conventional energy source could be replaced up to 75% of yellow corn meal in tilapia diets. El-Kholy (1999) showed that yellow corn could be replaced successfully by 25% of either the fruit or the pulp up to 75% with the peel of the prickly pear with any harmful effect on the growth performance of tilapia hybrid.

High levels of dietary fiber have been showed to reduce growth in other species of fish and are not recommended (Leary and Lovell, 1975). For many species of fish, a general recommendation of approximately 8% dietary fiber could be applied and it would seem wise to follow this recommendation in the case of tilapia (Jauncey and Ross, 1982).

Feed utilization:

Average of feed Intake, average of feed conversion ratio (FCR), average of protein efficiency ratio% and average protein productive value% are presented in Table (6). In all treatments it was clear that replacement of yellow corn by other energy sources not affected significantly, results obtained that also FCR during the whole experimental period had ranged from 1.31 to 1.78, PER ranged from 1.72 to 2.33, PPV ranged from 15.59 to 34.64. The best rate was recorded with T1 (control), T2 (10% olive cake), and T3 (20% olive cake), while the lowest values were recorded with another treatments.

Table 6. Average of feed intake, feed conversion, protein efficiency ratio and protein productive value% of Nile tilapia fed the experimental diets.

Treatment	Feed intake (g/fish)	FCR	PER	PPV%
T1(control)	25.90±0.20	1.31±5.00 c	2.33±1.00 a	25.50±2.22 a
T2	26.25±0.25	1.39±1.50 bc	2.29±0.28 b	33.80±5.00 a
T3	26.80±0.20	1.45±5.00 b	2.16±0.00 bc	24.28±2.00 a
T4	26.70±0.20	1.62±2.00 a	1.91±1.00 de	21.90±4.00 b
T5	26.90±1.00	1.78±1.00 a	1.72±1.50 e	20.59±2.55 b
T6	26.75±5.00	1.57±0.00 a	2.04±0.00 cd	19.28±0.00 c
T7	27.00±0.10	1.56±3.50 a	2.04±1.50 cd	34.64±3.22 a
T8	25.85±0.15	1.64±8.00 a	1.89±.50 e	18.00±3.00 b
T9	25.90±1.00	1.65±3.00 a	2.01±1.50 e	15.59±2.44 b

a, b and c means in the same column had different letters significantly ($p < 0.05$) differ.

Feed conversion ratio, and protein productive value compared with the control when fed the olive cake at 10% in the diet for Laying hen it may be due to the nature of olive cake oil which consisted mainly of about 96% unsaturated fatty acids. And these not agreement with those of Talha *et al.* (2002), Yacot *et al.* (2003) and El-

Badawi *et al.* (2003), were found that no significant differences in feed utilization compared with the control when fed dried sugar beet pulp at 50 and 75% in animal diets. However, these results are agreement with those of El-Ashry *et al.* (2000) found that significant differences in feed utilization compared with the control when fed dried sugar beet pulp at 50% in animal diets.

Body composition:

Values of dry matter (DM), crude protein (CP), ether extract (EE), ash and energy contain of the whole fish bodies are summarized in Table (7).

Table 7. Chemical composition (%) of Nile tilapia (whole fish) fed on the experimental diets. (On dry matter basis).

Treatment	DM%	CP%	EE%	Ash%	Energy Contain * Kcal/100g
T1Control	27.41±1.26 a	61.14±1.01	18.62±0.32 b	18.24±0.42 b	520.60±0.12 b
T2	21.87±0.22 c	61.84±0.34	19.66±0.61 a	18.50±0.20 b	534.36±0.16 a
T3	22.31±0.57 bc	61.04±0.89	19.33±0.93 a	19.63±0.76 b	526.73±0.22 a
T4	21.85±0.67 c	60.84±1.11	18.35±0.35 b	20.90±1.15 ab	516.35±0.18 b
T5	24.32±1.16 b	60.73±0.46	18.16±0.32 b	21.11±0.90 a	513.94±0.32 c
T6	20.54±0.30 c	60.62±0.75	19.17±0.85 a	20.21±0.76 ab	522.85±0.25 ab
T7	20.15±0.05 c	61.91±1.45	19.56±0.39 a	20.45±1.31 a	533.81±0.10 a
T8	21.41±0.09 c	60.49±1.07	18.11±0.61 b	21.40±0.42 a	512.11±0.16 c
T9	21.33±0.56 c	60.31±1.01	18.10±1.13 b	21.59±0.89 a	511.00±0.25 c

a,b and c means in the same column had different letters significantly ($p < 0.05$) differ.

*Gross energy contents (Kcal/100g of Nut.) was calculated according NRC (1993) using the factors 5.64; 9.44 and 4.11 (Kcal/g) for protein, lipid and carbohydrates respectively.

The results of carcass composition of Nile tilapia showed that no significant ($P \geq 0.05$) differences in crude protein among fish groups. But the results of carcass composition of Nile tilapia showed significant differences ($P \leq 0.05$) in dry matter between fish in the control group (diet, 1) and all other groups. Results showed significant differences ($P \leq 0.05$) in ether extract between fish groups fed diets 2, 3, 6 and 7 (contained olive cake) and those fed the diets 1, 4, 5, 8, and 9. Moreover, the results showed significant differences ($P < 0.05$) in ash and gross energy between different treatments. In this study in Table (7), it is interesting to notice that dietary treatments achieved with low proportional carcass fat as compared with control diet, with increasing olive cake meal level in the diet with or without molasses, this may be due to formation of bite salts from fatty acids to face up to the digestion of oil (Wahba, 1969). In addition, Watanabe *et al.* (1979) found increase in lipid content of tilapia feed from 5 to 23% caused an increase in the digestibility of carbohydrate and

lipids by 7.8 and 12.8% respectively. These results in Table (7) agree with Hayam *et al.* (2005).

Internal organs indices:

The effect of dietary (olive cake, sugar beet pulp and molasses) inclusion on fish organs indices (Table, 8) were found to be on all indices except HSI (T1 to T6), GSI male (T1 to T6), KSI (T1 to T5), and SSI (T1 to T9) reflected no significant differences between diet1 (control) and diets (T2 to T6), HSI, shows significant differences between diets (T8, T9) compared with the other treatments. But GSI female there were significant differences between diets (T1, T4, T5, T8, and T9) compared with diets (T2, T3, T6, and T7).

Table 8. Effect of dietary (olive cake, sugar beet pulp and molasses) levels on organs indices of the experimental fish (Means±SE).

Treatment	HSI	GSI(female)	GSI(male)	KSI	SSI
T1(control)	1.62±2.50b	2.25±5.00b	1.21±1.00b	1.40±0.001ab	0.24±0.05
T2	1.64±2.00ab	2.37±1.00a	1.25±5.50ab	1.33±0.007b	0.24±0.05
T3	1.62±2.00b	2.38±2.00a	1.27±5.50ab	1.60±0.001ab	2.25±0.00
T4	1.63±3.50b	2.31±1.00ab	1.23±0.005ab	1.50±0.003ab	0.22±0.02
T5	1.65±5.00ab	2.27±2.50b	1.24±0.001ab	1.70±0.002ab	0.23±0.02
T6	1.70±5.00ab	2.37±5.00a	1.29±0.001ab	1.85±0.005a	0.24±0.02
T7	1.72±2.70a	2.37±2.00a	1.31±0.005a	1.75±1.50ab	0.26±0.01
T8	1.25±5.00c	2.22±2.50b	1.20±0.005b	1.75±0.005ab	0.27±1.50
T9	1.26±5.00c	2.26±4.00b	1.21±0.005b	1.80±0.00ab	0.23±1.50

a, b and c means in the same column had different letters significantly ($p < 0.05$) differ.

Different levels of (olive cake, sugar beet pulp and molasses) affected significantly on HIS and GSI (male and female) and KSI compared with SSI. These results agree with the findings of Mahmoud (2006) and Abdelhamid *et al.* (2006).

Economic efficiency:

The economical parameters of the tested treatments are shown in table (9). The calculation depends on the average price of dietary ingredients at year (2006) where local market price/ton of fish meal 6000 LE, soybean meal 1500LE, yellow corn 1000LE, wheat bran 700LE, Oil 4000LE, Vit&Min.10000LE, Olive cake 150LE, Sugar beet pulp 900LE and Molasses 400 LE. Feeding costs represent about 50% of the total production costs (Collins and Delmendo, 1979). The calculated Figures showed lower cost of one ton of all treatments diets containing olive cake. But treatments containing sugar beet pulp were nearly the same with the control treatment. However, the control diet recorded the highest price (2284 LE/ton) compared with all treatments.

Results obtained that the diets containing 10, 20% sugar beet pulp and 10, 20% sugar beet pulp with 3% molasses showed the lowest fish gain compared with the treatments containing 10, 20% olive cake and 10, 20% olive cake with 3% molasses. Therefore, diets No. T4, T5 and T8, T9 showed high cost/Kg gain but the diets No. T1, T2, T3, T6, and T7 gave the lowest feed cost/Kg gain being, 2.99, 3.05, 2.52, 3.43 and 3.27 L.E/Kg gain respectively.

Table 9. Feed costs (L.E) for producing one kg weight gain by fish fed the experimental diets.

Treatment	Feed intake g/fish	Cost (LE) of One ton diet	Decrease in Feed cost (LE)	Total gain g/fish	Feed cost/Kg gain (LE)*
T1 (control)	25.90	2284	-	19.80	2.99
T2	26.25	2199	85	18.90	3.05
T3	26.80	2114	170	18.45	2.52
T4	26.70	2274	10	16.50	3.68
T5	26.90	2264	20	15.15	4.02
T6	26.75	2181	103	17.00	3.43
T7	27.00	2096	188	17.30	3.27
T8	25.85	2256	28	15.75	3.70
T9	25.90	2246	38	15.75	3.69

* feed cost/kg gain (LE)=feed intake x cost (LE) of one ton feed/1000xtotal gain.

CONCLUSION

In conclusion, from the results of the present study, it could be recommended to use safely up to 20% olive cake in Nile tilapia diets instead of yellow corn without any adverse effect on the growth performance.

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استخدام تفل الزيتون و تفل البنجر والمولاس كمصادر غير تقليدية للطاقة في علائق أسماك البلطي النيلي

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تم إجراء هذا البحث بمعمل بحوث الأسماك بقسم الإنتاج الحيواني بكلية الزراعة بكفر الشيخ وذلك من أجل دراسة كيفية استخدام بعض المكونات غير التقليدية الناتجة من بعض العمليات التصنيعية في بعض المصانع بغرض تصنيع علائق رخيصة الثمن بالإضافة إلى التخلص من هذه المخلفات بطريقة اقتصادية لذلك تم دراسة إمكانية إضافة كسب بذرة الزيتون وكسب بنجر السكر بالإضافة إلى المولاس كمواد علف بديلة ورخيصة للذرة الصفراء كمصادر غير تقليدية للطاقة في علائق أسماك البلطي النيلي وذلك بمستويات (١٠ ، ٢٠ % كسب بذرة الزيتون و ١٠ ، ٢٠ % كسب بنجر السكر مع أو بدون ٣ % مولاس) و كل معاملة في مكررتين وتم دراسة مدى تأثير هذه المعاملات الثمانية بالإضافة للمعاملة القياسية الكنترول ودراسة تأثيرها على معدلات النمو للأسماك وبعض القياسات الإنتاجية المختلفة الهامة لكي نتعرف على أحسن معدل استبدال يمكن استخدامه في العلائق ، تم استخدام ١٨٠ سمكة متوسط وزن السمكة الواحدة ٢ جرام وزعت عشوائيا بمعدل ١٠ سمكات في كل حوض و تم تكوين العلائق المستخدمة في التجربة بحيث تحتوى على حوالى ٣٢ % بروتين خام و متوسط كمية الطاقة من (١٧- ١٨ ميجاجول/كيلوجرام مائه جافه) وتم تغذية الأسماك بمعدل ٣ % من وزن الأسماك الحية مرتين يوميا (٨ صباحا و ٢ ظهرا) مع إعادة ضبط هذه الكمية كل أسبوعين و تعدل كمية العليقة المقدمة للأسماك تبعا للتغير في الوزن خلال فترة التجربة وهى ١٠ أسابيع. ومن أهم النتائج التي تم التوصل إليها من خلال هذا البحث أنه يمكن استخدام كسب بذرة الزيتون بتركيزات ١٠ و ٢٠ % كبدايل للذرة الصفراء في علائق أسماك البلطي حيث لم يؤثر سلبيا على معدلات النمو ومعدلات التحويل الغذائي بالإضافة إلى زيادة الاستفادة من البروتين و أيضا تم الحصول على علائق منخفضة في تكلفة تصنيع طن العليقة وأيضا انخفاض في تكلفة إنتاج كيلو لحم . وعلى العكس حدث انخفاض في معدلات النمو ومعدلات الاستفادة من البروتين باستخدام كسب بنجر السكر بتركيز ١٠ و ٢٠ % وأيضا حدث انخفاض في المعدلات الإنتاجية للأسماك بإضافة المولاس إلى تفل الزيتون و تفل بنجر السكر. وحدث اختلافات بسيطة في التركيب الكيماوي لجسم أسماك التجربة. لذلك يمكن استخدام كسب بذرة الزيتون بتركيز يصل إلى ٢٠ % ولكن إضافة تفل بنجر السكر لم يعطى نتائج مقبولة عند استخدامه بتركيزات ١٠ ، ٢٠ % من الذرة الصفراء في علائق الأسماك وأيضا عند إضافة المولاس لهم بتركيز ٣ %.