DRIED POULTRY MANURE (DPM) AS AN UNCONVENTIONAL PROTEIN SOURCE IN DIETS OF NILE TILAPIA (OREOCHROMIS NILOTICUS) AND COMMON CARP (*CYPRINUS CARPIO* L.)

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Abstract

Different levels of dried poultry manure (DPM) 0,10,20 and 30% in isonitrogenous (30% CP) and isoenergetic (4.0 Kcal GE/g) diets were incorporated in diets of Nile tilapia (*Oreochromis niloticus*) and common carp (*Cyprinus carpio*) reared in cotton net enclosures in an earthen pond for 112 days. The results showed that DPM in fish diets did not affect survival rates of tilapia, however, common carp was slightly affected. Fish gains and standing crops were significantly (P<0.01) higher in carp than tilapia, however, specific growth rates (SGR) were significantly higher (P<0.01) in tilapia than carp. The inclusion of more than 10% DPM in diets significantly (P<0.01) decreased fish gain, SGR% and standing crop as compared to the control diet (0% DPM), however, the reduction rates were higher in carp than tilapia especially at 30% DPM level. Tilapia contained significantly (P<0.01) higher dry matter (DM), crude protein (CP) and energy (GE, Kcal/g DM) than carp. Artificial feeding of fish significantly (P<0.01) increased DM%, CP%, EE% and energy content, while, ash% decreased as compared to natural feeding of both tilapia and carp. The inclusion of DPM in fish diets significantly (P<0.01) decreased fish body DM, CP, EE% and energy content, however, ash% increased. Feed intake was significantly (P<0.01) higher in carp than tilapia, however, values of feed and nutrient utilization {feed efficiency ratio (FER), protein efficiency ratio (PER), protein productive value (PPV%) and energy utilization (EU)} were significantly (P<0.01) higher in tilapia than carp. The depressive effect on values of feed and nutrient utilization (FER, PER, PPV, and EU%) were more pronounced in carp than tilapia with diets containing over 20% DPM as compared with the control diet. Inclusion of DPM decreased CP and phospholipids contents of fish, however, values of cholesterol increased significantly (P<0.05). Cost of test diets (LE/ton) decreased with increasing the level of DPM in the diet. However, cost of feed required to produce one Kg gain was high with the diet containing 20% DPM for tilapia and carp and low with that containing 30% DPM for carp.

INTRODUCTION

The high cost of dietary protein from conventional feedstuffs has forced fish nutritionists to consider less expensive alternative protein sources. One of the challenges they face is to replace completely or partially expensive protein sources (Fish meal) with less expensive unconventional protein sources. Omar and Nour (1993a) showed that the range of potential protein from unconventional feed resources in Egypt could be devided into three groups: a) byproducts of plant origin, b) by-products of animal origin, and C) industrial waste products. Several attempets have therefore been made to test the potentiality of some unconventional feed sources for some warm fresh water fish (tilapia and carp) and prawns through the following three main approaches. a-efficient utilization of by-products (Nour *et al.*, 1985, Nour 1990, Omar and Nour, 1993 b), b-effect of physical, chemical (Nour *et al.*, 1989) and microbiological treatments in improving nutritional values of fish feeds (Omar *et al.*, 1994), and c-supplementation with some limiting amino acids (Abdel-Halim *et al.*, 1992). However, novel feed sources should meet several characteristics before they can be incorporated into fish diets, the most important of which are the availability of ample supply, acceptability, nutritionally valuable and free from anti-nutritional factors.

The direct inclusion of poultry wastes in fish diets has produced ambiguous results. Shiloh and Viola (1973) and Hassan (1989) have found that the inclusion of dried poultry waste at 10 to 30% levels were deleterious to growth of carp (*C.carpio*). However, the minimum cost of producing one kg of fish gain was obtained when fish were fed on diets containing 10 and 20% poultry droppings. Hegazy (1990) found that 20% poultry droppings was optimal for tilapia.

The present work was carried out to evaluate the use of dried poultry manure (DPM) as an unconventional protein source in Nile tilapia (*O.niloticus*) and common carp (*C.carpio* L.) diets.

MATERIALS AND METHODS

Nile tilapia (*O.niloticus*) and common carp (*C.carpio*) fingerlings averaging 1.1g (1.0-1.2 g/fish) and 2.1 g (1.9-2.1 g/fish), respectively, obtained from Berseek Fish Hatchery, El-Behera Governorate were used in this study. Thirty cotton net enclosures measuring 1x1x1 m, each with a mesh size of 100 micron were used for rearing the fish in the present work. Nets were fixed with nylon rope on ordinary wood sticks that were fixed in the bottom of 4200 m2 fresh water earthen pond (1.5 m depth). Twenty fish from each species were randomly assigned to each net enclosure in monoculure. One hundred fish from each species were frozen for initial proximate body chemical analysis. About 30% of the water in the earthen pond was replaced bi-weekly with fresh water from irrigation canal in order to maintain good water quality. No artificial or organic fertilizers were applied to the rearing pond. Four isonitrogenous (30% crude protein) and isoenergetic (4.0 kcal/g DM) diets were preparred (Table 1). The experimental diets contained 0, 10, 20 and 30% dried poultry manure (23.5% CP) to partially replace fish meal and yellow corn. Cellulose powder and ash obtained from ashing of DPM (in a Muffle at 600^{o}C for 2 h) were used to balance both crude fiber and ash in the diets, respectively. The diets were prepared in pellets (0.6 mm diameter and 2.0 mm length) using a customary laboratory procedure using mincing machine after mixing dry ingredients with oil and water, and thereafter, drying under room temperature. The pellets were hand broken to small granules during the 1st month of feeding. The pellets were soft enough for fish to take and retain.

Ten treatments were applied as follows: two without feeding (one for carp and one for tilapia), and eight with the four experimental diets fed to both fish species. Three replicates for each treatment were applied. Fish were handfed three times daily, 6 days per week, except on the weighing days. Fish in each net enclosure were fed at 10%, 8%, 6% and 4% of fish body weight per day during the 1-4, 5-8, 9-12 and 13-16 weeks of the experimental period, respectively. All fish were completely removed every two weeks from each net enclosure and weighed to determine their average weight gains, and daily feed allowance was adjusted accordingly. At the end of the experiment, the fish were removed from each net enclosure, weighed and immediately killed by cutting the spinal cord directly behind the skull using sharp knife and frozen for final body composition analysis.

Water samples from the earthan pond were collected biweekly at 8.30 am. One liter glass bottles were used for collecting water samples which were analyzed in triplicates in the laboratory after collection according to the American Public Health Association (APHA, 1965). Water quality parameters tested included the following: temperature (^{o}C), oxygen (mg DO2/1), pH, ammonia nitrogen (mg NH3-N/1) and carbon dioxide (m mol CO 2/1). The recorded water quality along experment values was as follows: Temp. 22-30.5^{o}C, D^{o}2, 5-9-68 mg/l, pH, 7.4-7.8, NH3-N, 0.06-0.20 mg/L and Co2, 2.0-3.4 m mol/l, respectively.

Proximate chemical composition including crude protein, lipid, crude fiber, ash and moisture of diets and fishes were determined according to AOAC methods (1980). Total protein in liver was determined by the method of Lowery *et al.*, (1951). Bovine serum albumin was used for preparing calibration curve. Total lipids in the liver were determined according to the method of Folsh *et al.*, (1957) using a mixture of chloroform and methanol (2:1 v/v) as an extractant. The method mentioned by Zlatkis *et al.*, (1953) was followed for determination of cholesterol in the liver. The reagent (concentrated sulfuric acid and ferrichloride) was added to the tubes containing the tested samples with glacial acetic acid. The developed violet colour was measured after 20 min. at 570 nm using Spectronic 20 Boch & Lamb. Phospholipids were colorimetricaly determined according to the method described by Kates (1972) who precipitated the proteins with trichloroacetic acid and digested the precipitate containing the phospholipids with sulphuric-perchloric acids mixture. The developed blue colour was measured after 15 min at 700 n.m. using Spectronic 20 Boch & lamb. The malondialdehyde was using as an indicator for lipid peroxidation as described by Placer *et al.*, (1966) with a calibration curve established by using malondialdehyde-dietary acetate (M.D.A.) (Merk, F.R.G. company).

Statistical analysis of the results was conducted according to Snedecor and Cochran (1974) using 2x2x4 factorial experimental design (2 fish species x 2 feeding regimes (natural and artificial) x 4 levels).

RESULTS

As shown in Table1, the experimental diets were similar in crude protein content and gross energy. Energy to protein ratio ranged from 14.29 to 14.41 (Kcal GE/g CP).

The recorded water quality values along the experiment were as follows: Temp., 22-30.5^{o}C; DO2, 5.9-6.8 mg/l; pH, 7.4-7.8; NH3-N, 0.06-0.20 mg/l and CO2, 2.0-3.4 m mol/l, respectively, which were found to be within the acceptable levels for rearing tilapia and carp (Boyd 1981).

Table 2 shows that survival rates of tilapia were significantly ($P<0.01$) higher than that of carp. Inclusion of higher levels of DPM (20 and 30% DPM) significantly ($P<0.01$) reduced fish survival rate compared to the control (0% DPM). Fish gains, SGR and standing crops (kg/f) were significantly ($P<0.01$) higher with fish fed on the experimental artificial diets as compared to natural feeding. The value of

Table 1. Feed Ingredients (%) and Chemical Analysis (%) of the Experimental Diets (on dry matter basis).

Items	Diet No.			
	1	2	3	4
Feed Ingredients				
Fish meal (62%)	19.0	16.0	13.0	10.0
Soybean meal (44%)	15.0	15.0	15.0	15.0
Cottonseed meal (41%)	15.0	15.0	15.0	15.0
Yellow corn	19.0	15.0	11.0	7.0
Dried poultry manure (DPM)*	0.0	10.0	20.0	30.0
Silos wheat by-products	19.8	19.8	19.8	19.8
Corn oil	3.0	3.0	3.0	3.0
Cellulose powder	3.0	2.1	1.0	0.0
Ash from DPM	6.0	4.0	2.0	0.0
Vitamin mix. **	0.1	0.1	0.1	0.1
Mineral mix**	0.1	0.1	0.1	0.1
Chemical composition (%)				
Dry Matter (DM)	90.11	90.65	89.91	90.54
Crude Protein (CP)	29.88	29.62	29.76	29.56
Ether Extract (EE)	5.54	5.32	5.16	5.11
Ash	14.69	14.57	14.43	14.25
Crude Fibre (CF)	8.13	8.22	8.31	8.40
Nitrogen Free Extract (NFE)	41.76	42.27	42.34	42.68
Gross Energy (GE Kcal/g)***	4.27	4.26	4.26	4.26
- Energy/Protein Ratio (Kcal GE/g CP)	14.29	14.38	14.32	14.41

* Dried poultry manure obtained from the 15 million Egg Project, Alexandria Governorate, ABISS, Alexandria, Egypt. The fresh material was sun dried for four days. The chemical analysis of the sun dried material was 88.59% dry matter (DM%). The dry matter contained 23.50% CP. 1.98% EE, 14.52% CF, 29.80% ash and 30.20% NFE.

** Vitamin mixture: kg premix containing the following: 33000 IU vitamin A, 3300 IU vitamin D3, 410 IU vitamin E, 2660 mg vitamin B1, 133 mg vitamin B2, 580 mg vitamin B6, 410 mg vitamin B12, 50 mg biotin, 9330 mg coline chloride, 4000 mg vitamin C, 2660 mg Inositol, 330 mg para-amino benzoic acid, 9330 mg niacin, 2660 mg pantothenic acid. Mineral mixture: kg premix containing the following: 325 mg Manganese, 200 mg iron, 25 mg Copper, 5 mg Iodine, 5 mg Cobalt.

*** Calculations were based on the mean values of heat of combustion of protein, lipid and being 5.64, 9.44 and 4.11 kcal/g protein, lipid and carbohydrate, respectively according to NRC, 1993.

Table 2. Mean effect of species and feeds on survival rate, growth performance and standing crop of tilapia and carp fed on different level dietary DPM.

Items	Species	Natural food	Artificial feeding (Diets with different levels of DPM%)				$\overline{X}$
			0	10	20	30	
Survival rate %	T	75.90	89.89	88.61	85.13	85.22	84.95A±2.44
	c	71.10	85.79	84.05	82.27	85.46	81.73B±2.73
	$\overline{X}$	73.50c±2.41	87.84a±2.06	86.33ab±2.29	83.70b±1.43	85.34b±0.12	---
Initial weight (g)	T	1.10	1.00	1.10	1.10	1.10	1.08B±0.02
	c	2.10	2.00	2.10	2.10	2.10	2.08A±0.02
	$\overline{X}$	1.60±0.50	1.50±0.50	1.60±0.50	1.60±0.50	1.60±0.50	---
Final weight (g)	T	3.02	14.26	13.83	13.23	10.66	11.00B±2.09
	c	3.83	16.72	14.99	13.53	12.20	12.25A±2.23
	$\overline{X}$	3.43e±0.41	15.49a±1.24	14.41b±0.58	13.38c±0.15	11.43d±0.77	---
Gain (g)	T	1.92	13.26	12.73	12.13	9.56	9.92B±2.09
	c	1.73	14.72	12.89	11.43	10.10	10.17A±20.02
	$\overline{X}$	1.83e±0.11	13.99a±0.73	12.81b±0.08	11.78c±0.35	9.83d±0.27	---
Average daily gain	T	17.14	118.39	113.66	108.30	85.35	88.57A±18.70
	c	15.45	131.42	115.09	102.05	90.18	90.84A±20.02
	$\overline{X}$	16.30c±0.85	124.91a±6.53	114.83a±0.717	105.18a±3.13	87.77b±2.42	---
SGR %	T	0.90	2.37	2.26	2.22	2.03	1.96A±0.24
	c	0.54	1.90	1.75	1.66	1.57	1.48B±0.38
	$\overline{X}$	0.72e±0.18	2.14a±0.24	2.01b±0.26	1.94c±0.28	1.80d±3.42	---
Standing crop/fedan*	T	192.54	1076.74	1029.40	946.07	763.09	801.57B±255.93
	c	228.74	1204.90	1058.32	935.02	875.79	860.55A±265.99
	$\overline{X}$	210.64e±0.71	1140.82a±64.27	1043.86b±14.50	940.55c±5.54	819.44d±56.52	---

* Average final weight (g/fish) x 20 (fish/m3 net enclosure x survival rate % x 4200 (1 feldan/pond).

Averages in the same row having different superscripts per each item are significantly differed (P<0.01).

standing crop of naturally fed fish was only 18.4% of the average standard crop achieved with fish fed on the control diet. The specific growth rate (SGR%) of tilapia was significantly (P<0.01) higher than that of carp. However, values of gain, and standing crop were significantly (P<0.01) higher in carp than tilapia. Differences in the average daily gains of fish on 0.10 and 20% DPM were not significant, whereas, the standing crop values showed significant gradient decrease with the inclusion of 10%, 20 and 30% DPM, respectively.

Tilapia contained higher DM%, and CP% than carp, however, carp had higher EE and ash contents (Table 3). The presence of DPM in the diet decreased body DM, CP and the percentage of energy content (Kcal/g). Better results were obtained with 10% DPM diet when compared with diets containing 20 or 30% DPM (Table 3). The control diet gave higher DM, EE% and energy content as compared to the other treatments. Species variations were also observed as well.

Feed intake was significantly (P<0.01) higher in carp than tilapia (Table 4). The inclusion of DPM resulted in a significant (P<0.01) increase in feed intake as compared to 20 and 30% DPM diets. Feed utilization (FER and FCR) protein utilization (PER and PPV%) and energy utilization (EU%) values were significantly (P<0.01) higher in tilapia than carp. However, these values decreased significantly (P<0.01) with increasing the levels of DPM in the diets fed to the two species of fish.

Artifical feeding of fish resulted in significant (P<0.05) increase in the livers contents of CP and EE, cholesterol, phospholipids and lipid peroxidation (Table 5) Direct inclusion of DPM in fish diets significantly (P<0.05) increased cholesterol in livers of tilapia and carp. The results showed a significant (P<0.05) decrease in CP, EE and phospholipids in tilapia livers with increasing level of DPM. In common carp, liver content of CP, EE, phospholipids and lipid peroxidation were similar, however, cholesterol was significantly (P<0.05) higher with DPM inclusion in diets. Liver contents of EE, cholesterol and lipid peroxidation were significantly (P<0.05) higher in carp than tilapia. Table 6 shows that cost of the tested diets tended to decrease as the level of DPM increased. However, the cost of feed to produce on kg gain from fish was nearly similar with the exception of 20% DPM diet which was not economic compared to other diets for tilapia, but the 30% DPM diet was more economic for carp than other tested diets.

DISCUSSION

Results presented in Table 2 show that growth of tilapias and carp significant-

Table 3. Mean effect of species and feeds on body chemical composition (on DM basis) of tilapia and carp fed on different levels of dietary DPM.

Items	Species	% DPM				$\overline{X}$
		0	10	20	30	
% Dry matter (DM)	T	25.31	24.47	24.14	24.31	24.56A±0.26
	c	20.23	19.36	19.06	19.23	19.47B±0.26
	$\overline{X}$	22.77a±2.55	21.92b±2.56	21.60b±2.55	21.77b±2.54	---
%on DM basis: Crude protein (CP%)	T	60.35	59.64	59.12	58.75	59.47A±0.35
	c	56.37	55.66	55.16	54.77	55.49B±0.35
	$\overline{X}$	58.36a±2.01	57.65b±2.01	57.14c±1.99	56.76d±2.01	---
Ether extract (EE%)	T	24.48	24.35	23.15	22.95	23.73B±0.41
	c	26.88	26.75	25.53	25.33	26.12A±0.40
	$\overline{X}$	25.68a±1.20	25.55a±1.20	24.34b±1.19	24.14b±1.19	---
Ash %	T	16.84	17.02	18.64	18.94	17.86A±0.54
	c	15.42	15.58	17.20	17.50	16.43B±0.54
	$\overline{X}$	16.13c±0.71	16.30c±0.72	17.92b±0.72	18.22a±0.72	---
Energy content (Kcal GE/g DM)	T	5.75	5.67	5.54	5.49	5.61A±0.06
	c	5.73	5.66	5.52	5.48	5.60B±0.06
	$\overline{X}$	5.74a±0.01	5.67b±0.01	5.53c±0.01	5.49c±0.01	---

Averages in the same row having different superscripts per each item are significantly differed ($P<0.01$).

Table 4. Mean effect of species and feeds on feed and nutrient utilization of tilapia and carp fed on different levels of dietary DPM.

Items	Species	% DPM				$\overline{X}$
		0	10	20	30	
Feed intake/Fish /Period (FI)	T	29.30	31.45	38.57	34.80	33.66B±1.99
	c	37.24	36.87	38.29	38.18	37.65A±0.35
	$\overline{X}$	33.27c±3.98	34.41c±2.67	38.43a±0.14	36.49b±1.70	---
Feed conversion ratio (FCR)	T	2.21	2.51	3.18	3.64	2.88B±0.32
	c	2.53	2.86	3.35	3.78	3.13A±0.24
	$\overline{X}$	2.37b±0.16	2.69c±0.18	3.27b±0.09	3.71a±0.07	---
Protein efficiency ratio (PER)	T	1.52	1.35	1.06	0.93	1.22A±0.13
	c	1.32	1.18	1.00	0.89	1.11B±0.11
	$\overline{X}$	1.42a±0.10	1.27b±0.09	1.03c±0.03	0.91d±0.02	---
Protein productive value % (PPV%)	T	24.72	21.20	17.54	15.86	19.83A±1.97
	c	18.44	14.92	11.26	9.58	13.55B±1.97
	$\overline{X}$	21.58a±3.15	18.06b±0.19	14.40c±3.15	12.72d±3.15	---
Energy utilization (EU%)	T	17.99	15.30	12.52	11.21	14.26A±1.50
	c	14.08	11.39	8.61	7.30	10.35A±1.57
	$\overline{X}$	16.04a±1.96	13.35b±1.96	10.57±1.96	9.26d±1.96	---

Averages in the same row having different superscripts per each item are significantly differed ($P<0.01$).

Table 5. Effect of inclusion of different levels of dried poultry manure (DPM) in diets on some parameters of Nile tilapia (T) and common carp livers*.

Items	Species	Natural feed	Artifical feeding (Diets with different levels of DPM %)				Mean
			0	10	20	30	
Crude protein (g/100g)	T	3.50	5.45	5.25	5.19	4.50	4.78±0.36
	c	3.70	5.08	5.08	5.11	4.80	4.77±0.45
	Average	3.6±0.10c	5.3±0.15a	5.17±0.09a	5.15±0.04a	4.65±0.15a	---
Ether extract (g/100g)	T	2.75	4.10	3.95	3.80	3.55	3.67±0.22B
	c	3.38	4.70	4.58	4.70	4.50	4.41±0.23A
	Average	3.07±0.32c	4.40±0.30a	4.27±0.32ab	4.25±0.45ab	4.03±0.48b	---
Phospholipids	T	0.37	0.52	0.42	0.35	0.32	0.40±0.03
	c	0.40	0.45	0.40	0.42	0.39	0.41±0.02
	Average	0.39±0.02bc	0.49±0.04a	0.41±0.01b	0.39±0.04bc	0.36±0.04c	---
Cholesterol (mg/100g)	T	42.0	85.5	95.0	91.56	99.4	82.69±10.41B
	c	46.0	96.0	108.0	104.0	105.5	91.9±11.63A
	Average	44.0±2.01d	90.8±5.27c	101.5±6.52a	97.8±6.24b	102.5±3.06a	---
Lipid peroxidation (nM/g)	T	37.6	38.6	40.5	41.1	39.8	39.52±0.45B
	c	40.0	40.8	43.1	44.6	42.8	42.26±0.83A
	Average	38.8±1.20c	37.7±1.10b	41.8±1.30a	42.8±1.76a	41.3±1.50a	---

* Each value was an average of five fish per each net enclosure or ten fish/treatment.

± Means in the same row having different small capital superscripts are significantly different (P<0.05).

Table 6. Economical analysis of the feasibility of utilization of dried poultry manure (DPM) as a feed ingredient in tilapia and carp diets.

Items	% DPM							
	0		10		20		30	
	T*	C*	T*	C*	T*	C*	T*	C*
Cost of feed ingredients (LE/ton)**	1180	1180	1064	1064	948	948	732	732
FCR	2.21	2.53	2.51	2.86	3.18	3.35	3.63	3.78
Cost of feed/kg gain (LE/kg gain)	2.61	2.99	2.67	3.04	3.01	3.18	2.66	2.77
% Change	100a	100b	102.30a	101.67b	115.3a	106.35b	101.92a	92.64b
Value of imported ingredients (LE/ton)***	88.6	886	802	802	718	718	634	634
% Reduction in imported ingredients	100	100	90.52	90.52	81.04	81.04	71.56	71.56

* T and C: Tilapia and carp.

** Price of one ton of feed ingredients was calculated according to the following prices (LE/ton, 1 $ = 3.4 LE): fish meal, 2 800; soybean meal, 1120; cottonseed meal, 850; yellow corn, 820; DPM, 100; Silos wheat by-products, 250; corn oil, 3000; wood pulp, 100; ash from mixture 10000.

*** Imported feed ingredients were: Fish meal, soybean meal, yellow corn, vitamin premix and mineral premix. a and b for tilapia and carp, respectively.

ly (P<0.01) decreased with increasing the level of dietary DPM. Similar trends were obtained for carp (Hassan, 1989) and tilapia (Hegazy, 1990), respectively. However, butter growth performances were obtained in the present trial than by Hassan (1989) and Hagazy (1990). the reduction in growth was more pronounced in carp than tilapia, especially with the diet containing 30% DPM. The standing crop was also reduced with increasing the level of dietary DPM.

Protein, which is required by tilapia at 32% and common carp at 35% levels of the diet (NRC, 1993), is the most expensive component in fish diets. Fish meal still remains an important, but expensive ingredient in most fish and crustacean diets. It is an excellent source of high quality protein, essential amino acids, minerals and vitamins. Fish meal is also highly palatable and digestible by fish (Tacon, 1993). Its use appears to be limited only by high cost and availability. Substituting fish meal by DPM reduced growth performance, and this reduction was mainly attributed to protein quality of DPM as a limiting factor for fish growth as compared with fish meal. About 44.7% of crude protein in DPM is protein-nitrogen consisting of unutilized ingested feed, microorganisms, sloughed-off gut, and feathers (Flegal, 1976). The remaining nitrogen fraction is non-protein nitrogen and consists of uric acid, urea, and ammonia salts. White *et al.* (1944) found that 70.2% of the nitrogen in poultry wastes was of urinary origin. Kerns and Roelofs (1977) reported that growth rate of common carp (*C.carpio*) was inversely related to the level of poultry waste in the diet. However, Green (1992) noted that chicken litter can replace 27 to 58% of pelleted supplemented feed without significant effect on tilapia yield. In addition, Anuta (1992) reported that chicken manure significantly reduced yields of tilapia production reared in fresh water concrete tanks. The author reported that fish yield with chicken manure was 808 kg/ha compared with 3625 kg/ha for fish fed on the control diet. Recently, Yousif and Al-Hadhrami (1993) fed blue tilapia (*O.aureus*) fry, (0.523 g) and young tilapia (41.48 g) on 5 isonitrogenous diets containing 35% crude protein made up of fish meal, dried poultry waste (DPM), or mixtures of both. They found that maximum growth was obtained with the fish meal diet and over 5% DPM markedly decreased growth.

The inclusion of DPM in fish feed resulted in a slight decrease in body DM, EE% and energy, whereas, ash content tended to increase in tilapia and carp bodies, respectively (Table 3). Similar trend was obtained by Hassan (1989) and Hegazy (1990) for carp and tilapia, respectively. Parova and Par (1987) found that, when dried broiler droppings replaced 29, 28 and 27% of traditional feed ingredients, for carp, carcass ash content of the fish increased by 19-23%. The reduction in the retained nutrients (Protein, fat and energy) in fish were mainly attributed to the lower quality of DPM as a dietary protein or energy source instead of fish meal and corn grains. Kerns and Roelofs (1977) reported that ash content of common carp tissues varied directly with the level of poultry waste in the diet (r=0.962). The amount of dietary mineral retained is proportional to the quantity ingested (NRC, 1993).

It appears that the inclusion of DPM in diets of tilapia and carp is of high metablolic cost of the fish. Similar results were obtained by Kerns and Roelofs (1977) with common carp.

The inclusion of increasing levels of DPM in fish diets resulted in a significant (P<0.01) decrease in feed utilization (FER and FCR), protein utilization (PER and PPV%) and energy retention (EU%) of tilapia and carp (Table 4). However, the reduction was more pronounced in carp than tilapia, especially with diet containing 30% DPM. The digestive tract of tilapia is much longer than that of carp. Therefore, it is possible that bacterial population of the tilapias gut is able to decompose part of the more complex composition of DPM and to derive energy from it. On the other hand, carps along with other cyprinidis do not have stomachs. The pH of their digestive systems is neutral to alkaline. Protein digestion in carp occurs mainly in the 3rd final limb of the intestine and in the rectum. Carp have efficient carbohydrate digesting enzymes but rather weak proteases (Al-Hussaini 1949). Based on stomach analysis, Lim (1989) reported that up to half the food intake by tilapia in intensively fed ponds was natural food, which indicated a substantial contribution to tilapia growth in earthen ponds. On the other hand, common carp, a bottom feeder, feed mainly on diatoms, cyclops, moines, cereodaphnia, ostracods, insects including chironomid larvae (Kumar, 1992). These differences in the natural feeding habits could also explain the differences in the values of feed and nutrient utilization between tilapia and carp, and explain why higher levels (20 and 30%) of DPM was not suitable for carp diets as compared to tilapia.

The artificial feeding significantly (P<0.05) increased CP, EE, phospholipids, cholesterol and lipid peroxidation in tilapia and carp livers (Table 5). Chapman and Wallach (1968) reported that artifial feed contains the necessary nutrients (protein and energy), which, in turn, increase the structural protein and lipids in the liver and prevent the degradation of their fatty acids. Cholesterol content of fish livers was slightly increased with feeding on diets containing DPM. Similar results were obtained by Rady *et al.* (1991) Saber *et al.* (1993) who showed that, cholesterol contents in tilapia and carp livers significantly are affected with the type of protein in the diets. The higher cholesterol contets were observed when fish were fed on diets containing a mixture of cottonseed meal and meat meal as a source of protein in the diets, however, lower values were obtained with diet containing fish meal instead of meat meal. The present results and the previous results (Rady *et al.*, 1991 and Saber *et al.* (1993) clearly showed that the studied parameters in the liver were related to the dietary feeding and type of fish. The present results show that cholesterol and lipid peroxidation values were higher in carp than tilapia. Similar results were obtained by Rady *et al.* (1991).

The cost of feed to produce one kg of fish gain was similar in diets containing 0 and 10% DPM, however, it increased at 20% DPM for both tilapia and carp and decreased at 30% DPM for carp (Table 6). However, the feed cost to produce one kg gain was lower in tilapia than carp. Green (1992) observed that the production costs per kg of tilapia were less when chicken litter was added to the feed. The observed net returns to land, labour and management were greater when manure was substituted for feed. Profitability of pond tilapia culture could be increased if inputs costs were reduced while total yield was unchanged.

The present results clearly show that tilapia utilized DPM better than carp. The direct inclusion of (DPM) in tilapia and carp feeds should be considered from the viewpoint of both fish growth (production), nutritional, biochemical evaluations and economic potential. Therefore, the direct inclusion of DPM in tilapia and carp diets did not appear to be a promising means of reducing the amount of fish meal required in fish rations.

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زرق الدواجن المجفف كمصدر غير تقليدى للبروتين في علائق البلطى النيلي والمبروك العادى

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أستخدمت مستويات مختلفة من زرق الدواجن المجفف (صفر ، ١٠ ، ٢٠ ، ٣٠٪ زرق دواجن مجفف) في علائق متساوية في الأزوت والطاقة في تغذية البلطى النيلي والمبروك العادى المرباه في تحاويط شبكية في بركة ترابية لمدة ١١٢ يوماً. أوضحت النتائج أن إحلال زرق الدواجن لم يكن له تأثير جوهرى على معدلات بقائها حية في حين تأثرت أسماك المبروك قليلاً. وكانت معدلات الزيادة في وزن الجسم وكمية المحصول أعلى معنوياً في المبروك عن البلطى وأدت زيادة زرق الدواجن لأكثر من ١٠٪ في العليقة إلى تقليل نمو الأسماك وكمية المحصول خاصة في أسماك المبروك عنه في البلطى والعليقة المحتوية على ٣٠٪ زرق دواجن مجفف. وكانت المادة الجافة والبروتين الخام والطاقة في جسم البلطى أعلى من المبروك العادى والتغذية تزيد المادة الجافة والبروتين الخام والطاقة في جسم البلطى أعلى من المبروك العادى والتغذية تزيد المادة الجافة والبروتين والدهن والطاقة في حين ينخفض مستوى الرماد في جسم الأسماك. وزيادة زرق الدواجن في العلائق يقلل من نسب كل من المادة الجافة والبروتين الخام والمستخلص الأثيرى والطاقة في جسم الأسماك في حين يزيد محتوى الجسم من الرماد. وكان إستهلاك الغذاء أعلى معنوياً من معدلات إستهلاك الغذاء في حين إنخفضت كفاءة الإستفادة من الغذاء والعناصر الغذائية وخاصة في المبروك عن البلطى والعليقة المحتوية على ٢٠٪ زرق دواجن.

وقد أدت إضافة زرق دواجن إلى العلائق إلى خفض معنوى في البروتين والفسفوليبيدات في الكبد وزيادة الكليسترول. وقد كان المبروك يحتوى على دهن وكليسترول أعلى عن البلطى النيلي.

وكانت تكلفة العلائق تنخفض مع زيادة الإحلال المباشر لزرق الدواجن بها في حين أن تكلفة إنتاج الكيلو من الزيادة في وزن الأسماك تزيد بزيادة زرق الدواجن. ولكن إنخفضت هذه التكلفة في العليقة المحتوية على ٣٠٪ زرق بالنسبة للمبروك.