UTILIZATION OF EGYPTIAN MALLOW IN FEEDING COMMON CARP (*Cyprinus carpio* L.)

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Summary

Two experiments were conducted to study the effect of using Egyptian mallow leaf meal (EMLM) on growth performance and feed utilization of common carp (*Cyprinus carpio* L.) in experiment 1. Four diets containing 0, 5, 15 and 25% EMLM were included at the expense of berseem leaf meal and fed to fingerlings of common carp for 98 days. The results showed that the average daily gain, feed intake and feed coefficient ratio (FCR) were improved ($p < 0.05$) with increasing the level of EMLM in the diet. Fish fed 25% EMLM were similar to control fish (30% berseem leaf meal) in the productive value (PPV%). In experiment 2, five diets were prepared to contain: 1) 30% berseem leaf meal, 2) 25% untreated EMLM, 3) 25% cooked EMLM 4) 25% treated EMLM with 0.5% NaOH and 5) 25% treated EMLM with 1% NaOH. The results showed that diet containing EMLM gave the best growth performance and feed utilization. However, diet containing 1% NaOH treated EMLM superior to the other diets in PPV% and energy utilization. Diets containing 0.5% NaOH-treated EMLM or cooked EMLM decreased the protein utilization compared to those containing EMLM.

(**Key Words**: *Egyptian Mallow, Common Carp, Fish Feeding, Alkali Treatment*)

Introduction

Various sources of greed fodders are thought to have potential as high quality feeds for fish production. Incorporation of cassava root meal as an energy source up to a level of 60% in pelleted feeds for the Nile tilapia (*O. niloticus*) has been reported by wee and Ng (1986). Leucaena leaves are one of the promising sources of plant protein for shrimp feeds in the Philip pines when compared with fish meal (Pascual and Tabbu, 1980). Pantastico and Baldia (1980) found that 33-100% leucaena leaf meal as a component of supplemental feed enhanced the growth of Nile tilapia fingerlings in cages in laguna lake. No adverse effect on weight gain, reproductive behavior or metabolism of the fish were observed when 65% leucaena leaf meal was fed to tilapia mossambica (Ghatnekar et al., 19 82).

Therefore, the present work was aimed to evaluate the utilization of Egyptian Mallow leaf meal as a feed of fish (common carp).

Materials and Methods

Experimental fish

Common carp (*Cyprinus carpio* L.) fingerlings weighing about 0.91 to 1.59 g/fish were obtained from the experimental fish farm, Faculty of Agriculture, University of Alexandria. Fish were fed a basal diet during a 7-days adaptation period. Twenty five fingerlings of fish were killed at the beginning of the experiments and kept at −20℃ for analysis.

Experimental facilities

Two types of aquaria were used in the present study:

Glass jars: Eight glass jars were used for rearing the fish in experiment 1. Each measured 100 × 30 × 40 cm with a capacity of 120 L and each was allowed to contain 105 L of water.

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Plastic tanks: Ten circular plastic tanks of 38.5 cm diameter and 37 cm height were used in experiment 2. Each tank contained 35 L of water.

Experiment 1

Leaves of berseem (*Trifolium Alexandrinum*) and Egyptian Mallow L. (*Malva parviflora*) were collected during March, 1989 from the Experimental farm of the Faculty of Agriculture, Alexandria University and dried at 80°C for 48 hours. Four experimental diets were formulated to contain 0, 5, 15 and 25% Egyptian Mallow leaf meal as replacement for berseem leaf meal. The experimental diets were isonitrogenous and isocaloric. Ingredients composition and chemical analysis of the experimental diets are shown in table 1. The wet mixture of each diet was passed through a commerical meat mincer to produce spaghetti like strands called pellets which were air dried and broken into size particles of 0.3 mm diameter and 2mm length. Eight glass jars, two for each diet, were used. The glass jars were cleaned daily and were refilled with the same source of water in each jar which was partically changed once every three days. Each jar was stocked with 10 carp fingerlings. Fish were fed the experimental diets twice daily at 9 a.m. and 1 p.m. for 14 weeks (98 days):10% of body weight for 28 days, 8% for 14 days, 6% for 14 days and 4% for 42 days. Fish were weighed at 14 days interval and the amount of feed was readjusted according to fish weight. At the end of the experiment, fish in each jar were killed and stored at −20°C for analysis of whole carcass.

TABLE 1. INGREDIENT COMPOSITION AND CHEMICAL ANALYSIS (%) OF THE DIETS USED IN EXPERIMENT 1

Feed ingredients (%)	Diet No.			
	1	2	3	4
Fish meal	10.0	10.0	10.0	10.0
Soybean	17.0	17.0	17.0	17.0
Berseem leaf meal*	30.0	22.0	9.0	–
Egyptian mallow leaf meal**	–	5.0	15.0	25.0
Wheat milling by-products	35.7	38.7	41.7	42.7
Corn oil	4.0	4.0	4.0	4.0
Bone meal	2.0	2.0	2.0	2.0
Vitamin premix (PFizer)	0.3	0.3	0.3	0.3
Mineral mixture	1.0	1.0	1.0	1.0
Chemical analysis (%):				
DM	88.6	90.0	89.5	87.9
CP	28.8	28.1	27.9	29.6
EE	4.5	6.2	5.5	5.9
CF	5.1	4.7	4.4	3.8
Ash	12.6	11.7	11.3	13.9
NFE	49.0	49.7	50.9	46.8
Energy (Mcal/kg)	4.1	4.3	4.2	4.2

* Chemical composition of berseem leaf meal was: 91.9% DM, 25.4% CP, 15.8% CF 4.2%, EE, 10.0% ash and 54.6% NFE.

** Chemical analysis of EMLM was: 94.8% DM, 29.6% CP, 12.4% CF, 4.7% EE, 12.9% ash and 40.5% NFE.

Experiment 2

Egyptian Mallow leaf meal (EMLM) treated by cooking, or spraying with 0.5 or 1% NaOH and were used in fish diets at the level of 25% a replacement for 30% dried berseem leaf meal (Control). Five diets were formulated to contain: 1) berseem leaf meal, 2) untreated Egyptian Mallow leaf meal, 3) cooked Egyptian Mallow

leaf meal, 4) 0.5% NaOH-treated Egyptian mallow leaf meal, and 5) 1% NaOH-treated Egyptian mallow leaf meal. All diets were isonitrogenous and isocaloric. Ingredients composition and chemical analysis (%) of the test diets are presented in table 2. Ten circular plastic tanks were used, two tanks for each treatment. Feeding and experimental systems were as described for experiment 1. At the end of the experiment (14 weeks), fish were killed and stored at -20°C for analysis.

TABLE 2. INGREDIENT COMPOSITION AND CHEMICAL ANALYSIS (%) OF THE DIETS USED IN EXPERIMENT 2

Feed ingredients (%)	Diet* No.				
	1	2	3	4	5
Fish meal	10.0	10.0	10.0	10.0	10.0
Soybean meal	17.0	15.0	15.0	15.0	15.0
Berseem leaf meal	30.0	–	–	–	
Egyptian mallow leaf meal	–	25.0	25.0	25.0	25.0
Wheat milling by-products	35.7	42.7	42.7	42.7	42.7
Corn oil	4.0	4.0	4.0	4.0	4.0
Bone meal	2.0	2.0	2.0	2.0	2.0
Vitamin premix (PFizer)	0.3	0.3	0.3	0.3	0.3
Mineral mixture	1.0	1.0	1.0	1.0	1.0
Chemical analysis (%):					
DM	88.0	87.9	88.1	87.9	86.4
CP	28.8	29.6	28.3	28.6	29.5
EE	4.2	5.9	5.5	5.6	6.1
CF	3.4	3.8	3.1	2.7	3.1
Ash	13.0	13.9	13.1	14.6	15.1
NFE	50.9	46.8	50.0	48.5	46.2
Energy (Mcal/kg)	4.1	4.2	4.2	4.2	4.2

* Diet 1 = control.
2 = untreated EMLM.
3 = cooked EMLM.
4 = treated EMLM with 0.5% NaOH.
5 = treated EMLM with 1% NaOH.

Analytical methods

Chemical analysis of feeds and fish carcass were determined according to the methods of AOAC (1975).

Statistical analysis of the experimental results were conducted according to Snedecor and Cochran (1967) and Duncan (1955).

Results and Discussion

Experiment 1

Effect of different levels of Egyptian Mallow leaf meal (EMLM) on growth performance, carcass composition and feed utilization of common carp are shown in table 3. Increasing the level of EMLM resulted in a significant ($p < 0.05$) improvement in the average daily gain. However, differences in SGR% were not significant. Plant leaves were used as a source of protein, because of its high protein and low fiber content (Pirie, 1971; FAO, 1964; Nour et al., 1989a and b).

Increasing the level of EMLM in the diet increased CP of fish carcasses, however, EE was decreased, Ash content was not affected by the level of EMLM in the diet. Omar and Nour (1986) reported that the protein content of carp carcass fed on fish meal containing diets was higher than those fed diets containing a mixture of plant and animal protein or plant protein respectively. They found that ash content in fish carcass was not affected by the level and source

of protein. Nour et al. (1989b) showed that replacing water-hyacinth leaves instead of wheat milling by-products decreased percentages of DM and EE in fish. Ash content was increased as the protein of water hyacinth leaves increased in the diet.

TABLE 3. EFFECT OF DIFFERENT LEVELS OF EGYPTIAN MALLOW LEAF (EMLM) ON GROWTH PERFORMANCE, CARCASS COMPOSITION AND FEED UTILIZATION OF COMMON CARP (EXPERIMENT 1)

Item	% of EMLM			
	0	5	15	25
Growth performance:				
Initial weight (g)	0.91	0.92	0.91	0.92
Final weight (g)	3.04^{b}	2.97^{b}	3.25^{b}	3.75^{a}
Average daily gain, ADG*	21.74^{bc}	20.92^{c}	23.88^{b}	28.88^{a}
Specific growth rate (%)	1.22	1.19	1.30	1.44
Carcass composition (%)**:				
Dry matter (DM)	23.22^{a}	22.00^{b}	22.97^{ab}	23.47^{a}
Crude protein (CP)	58.62^{b}	59.39^{a}	58.65^{ab}	59.01^{ab}
Ether extract (EE)	30.13^{b}	28.90^{c}	30.58^{a}	28.88^{c}
Ash	11.25^{b}	11.71^{b}	10.77^{c}	12.11^{a}
Feed utilization:				
DM intake (g)***	7.23	7.66	9.04	9.56
Feed conversion ratio	3.40	3.73	3.86	3.38
Protein efficiency ratio	1.02	0.96	0.93	1.01
Protein productive value	15.76^{a}	14.05^{b}	14.01^{b}	15.32^{a}
Energy utilization	11.66^{a}	9.49^{c}	9.83^{c}	11.10^{b}

*. ADG = mg/day/fish.
** Carcass composition of fish at the start was: 16.5% DM, 56.7% CP, 28.27% EE, and 15.03% ash.
*** Total dry matter intake per fish during the 98-days feeding experiment.
^{a,b,c} Values in the same row bearing different superscripts are differ ($p < 0.05$).

Feed intake was greatly increased by increasing the level of EMLM. Feed conversion ratio (FCR) was improved by increasing the level of EMLM in the diet, however the differences were not significant. PER and PPV% were similar for the control diet and the diet contained 25% EMLM, however, poorer PER and PPV were observed with 5 and 15% EMLM.

The results indicated that the values of PER and PVV% were not affected by replacing berseem leaf meal containing diet (control) with 25% EMLM, however, Nour et al. (1989) reported that the PPV% decreased with increasing the water-hyacinth leaves and they recommended to use it in diets containing a mixture of fish meal and soybean meal in carp diets. Energy utilization (EU%) was decreased by increasing the level of EMLM till 15% in the diet then a slight improvement was obtained with 25% EMLM. However, EU was significantly ($p < 0.05$) higher in the control diet than diets contained EMLM.

Experiment 2

Effect of different treatments of Egyptian Mallow leaf meal (EMLM) on growth performance, carcass composition and feed utilization of common carp are shown in table 4. The results indicated that the highest growth performance, ADG and SGR% were obtained when EMLM was previously treated with 1.0% NaOH (diet 5). Treatment with autoclaving or with 0.5% NaOH did not improve the growth performance over the untreated EMLM. Several investigations showed that autoclaving improved the quality of seaweed for common carp (Zaki, 1990) and for broiler chicks (Taher, 1986). However, no improvement in growth performance was obtained in the present study with autoclaving of EMLM.

Zaki (1990) found that NaOH treatment followed by autoclaving improved the quality of seaweed for carp. The autoclaving of EMLM resulted in lower performance than NaOH treatment.

TABLE 4. EFFECT OF DIFFERENT LEVELS OF EGYPTIAN MALLOW LEAF (EMLM) ON GROWTH PERFORMANCE, CARCASS COMPOSITION AND FEED UTILIZATION OF COMMON CARP (EXPERIMENT 2)

Item	Treatment*				
	1	2	3	4	5
Growth performance:					
Initial weight (g)	1.56	1.56	1.56	1.56	1.55
Final weight (g)	4.31^{c}	4.93^{a}	4.03^{d}	4.33^{c}	4.66^{b}
Average daily gain, ADG*	28.06^{c}	34.49^{a}	25.20^{d}	28.27^{c}	31.74^{b}
Specific growth rate (%)	1.04	1.06	0.97	1.05	1.13
Carcass composition (%)**:					
Dry matter (DM)	20.42^{c}	23.48^{a}	19.17^{b}	19.80^{c}	20.80^{b}
Crude protein (CP)	57.27^{c}	58.98^{a}	58.07^{b}	58.31^{b}	58.31^{b}
Ether extract (EE)	29.40^{c}	28.87^{d}	29.20^{c}	29.77^{b}	30.13^{a}
Ash	13.33^{a}	12.15^{c}	12.72^{b}	11.92^{c}	11.56^{d}
Feed utilization:					
DM intake (g)***	12.14	11.36	11.81	11.66	11.94
Feed conversion ratio	4.41	3.36	4.78	4.21	3.48
Protein efficiency ratio	0.79	0.85	0.74	0.83	0.88
Protein productive value	10.35^{c}	10.80^{b}	9.09^{d}	10.58^{bc}	11.90^{a}
Energy utilization	7.53^{c}	8.30^{b}	6.35^{d}	7.60^{c}	8.91^{a}

* See table 2.

** Carcass composition of fish at the start was: 16.5% DM, 56.70% CP, 28.27% EE, and 15.03% ash.

*** Total dry matter intake per fish during the 98-days feeding period.

^{a,b,c,d} Values in the same row bearing different superscripts are differ ($p < 0.05$).

Feeding of untreated EMLM (diet 2) resulted in a significant increase in DM% and CP% of carp carcass. Treatment of EMLM with autoclaving or with NaOH (0.5 and 1.0%) diets 3, 4 and 5 respectively showed a negative effect on the DM% and CP% of carp carcass, while, EE increased and ash decreased. The differences were significant ($p < 0.05$). Feed conversion ratio (FCR) was improved by inclusion of untreated EMLM in the diet instead of berseem leaves containing diet (diets 2 and 1 respectively). Autoclaving or treatment of EMLM with NaOH decreased FCR. The differences of (FCR) were not significant among the 4 treatments. Inclusion of EMLM instead of berseem leaves in the diets significantly increased the protein and energy utilization ($p < 0.05$). Treatment of EMLM with 1.0% NaOH significantly improved the PPV% and EU% ($p < 0.05$). However, treatment of EMLM with 0.5% NaOH or with autoclaving decreased the protein utilization and EU% compared to EMLM treatment.

With the rising cost of fish protein researchers are searching for a fish which can utilize cheaper protein sources. Fish meal remains as an important but expensive ingredient in most fish diets. It is especially rich in essential amino acids (lysine and methionine) and minerals and is highly digestible for fish (FAO, 1983). Many authors report the possibility of replacing fish meal by other animal proteins (Koch, 1984; Omar, 1984), plant proteins (Nour et al., 1985; Omar, 1986); single cell protein (pfeffer and Meske, 1978; Omar et al., 1989), leaf protein concentrate from berseem and water-hyacinth (Nour et al., 1989a and b). It could be concluded that inclusion of untreated EMLM or treated EMLM with 1% NaOH in the diet significantly improved feed and nutrient utilization of common carp.

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