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Use of the Greater Duckweed as feed for the Tilapia fish

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Abstract

The fresh weight gain of the Nile tilapia individuals reared on different feeds for 21 days occurred in the order: conventional feed (65%) > conventional feed and duckweed powder in equal proportion (37%) > duckweed powder (09%). The conventional feed and duckweed powder were insignificantly different from each other in protein and phosphorus, but significantly different ($P<0.05$) in fat, total ash and calcium contents. The tilapia individuals reared on the mixture of the conventional feed and duckweed powder had significantly ($P<0.05$) highest concentration of proteins (50.3%) than those reared on either conventional feed (45.34%) or duckweed powder (45.79%) alone.

***Key words*:** Nutrients, *Oreochromis niloticus*, *Spirodela polyrhiza*

Introduction

The Nile tilapia is a cichlid fish native to Africa but nowadays cultured in Nepal's Terai region also. It is a highly nutritious fish, rich in omega 3 oil which is good for patients with heart ailments. The fish contains less bone than other common fish and has a good taste, making it popular among fish lovers. It can survive extreme conditions like low oxygen and abrupt changes in temperature (Kingdon, 1989).

In general, protein component in fish feeds is a very essential factor affecting growth performance of fish and feed cost. The easily available duckweeds (the smallest aquatic angiosperms/Lemnaceae) can solve the problem as they are rich in protein and dietary minerals and low in fiber. They do not produce toxic alkaloids and are palatable to a wide variety of domestic animals and fish (Landolt & Kandeler, 1987). Hence, the present study was undertaken to evaluate the comparative effects of conventional feed (CF) alone, mixture of CF and greater duckweed powder (GD) in 1:1 ratio, and GD alone on the growth and nutrient concentrations of the tilapia fish.

Materials and Methods

The tilapia fingerlings (length 9.97 cm, breadth 2.96 cm, weight 13.43 g) were obtained from the Fishery Section of the Nepal Agricultural Research Council (Tarahara Branch, Sunsari District) and transported to the Bigyan Bhawan (PG Campus, Biratnagar) in polythene bags partially filled with water and oxygen. They were released in a concrete tank for acclimatization for two days. Nine transparent glass aquaria (size 45 cm x 30 cm x 30 cm) filled up to two-third volume with borewell water and having aeration facilities were employed for rearing tilapia fingerlings (3 individuals per aquarium) in three sets of different diet. In the first set of three aquaria, the fish received only the CF; in the second set they received the mixture of CF and GD; whereas only GD was provided to the fishes in the third set of aquaria. Specified diet was provided daily at the rate of 20% of the body

weight of the fish following Kabir *et al*. (2009). Water in each aquarium was replaced with fresh borewell water at 2 days intervals. The experiment was conducted between February 3-24, 2017 during which the minimum and maximum atmospheric temperatures were 15.5 and 30ºC, respectively.

Among the feeds, CF was prepared by mixing wheat flour, soybean flour and powdered local fishes in 2:2:1 ratio, whereas for GD, *Spirodela* biomass, collected from a pool adjacent to the PG Campus, Biratnagar, was washed, dried in oven at 80ºC to a constant weight, and grinded to powder in an electric grinder. AOAC's (1990) methods were followed for all the biochemical analyses.

Results and Discussion

Tilapia reared solely on CF had the highest increment in weight (65%) in comparison to those reared on the mixture of CF and GD (37%) or GD (9%) alone (Table 1). The fish reared on CF alone were golden-white, while those reared on the mixture of CF and GD, and GD alone were white and blackish in appearance, respectively. Comparatively, CF had significantly higher ($P<0.05$) concentration of fats although total ash and calcium were significantly ($P<0.05$) higher in GD. However, proteins and phosphorus were slightly more in CF than the GD (Table 2).

Table 1. Morphological variations in Nile tilapia reared on different feeds for 21 days. (mean ± SE; n = 3)

	Appearance	Length (cm)	Breadth (cm)	Weight (g)	Growth increment (%)
Conventional feed (CF)	Golden-white	11.23 ± 1.93	3.73 ± 1.11	22.19 ± 2.72*	65 ± 5*
Greater duckweed (GD)	Blackish	10.10 ± 1.83	3.73 ± 1.05	14.64 ± 2.21	09 ± 2
CF + GD	White	10.23 1.84	3.16± 1.10	18.40 ± 2.47*	37 ± 4*

* Means significantly different ($P < 0.05$)

Table 2. Nutrients (%) in CF and GD (mean ± SE; n = 3)

	Fats	Proteins	Total Ash	Calcium	Phosphorus
GD	1.56 ± 0.72	19.21 ± 2.52	22.99 ± 2.76*	0.84 ± 0.53*	0.27 ± 0.30
CF	7.89 ± 1.62*	22.98 ± 2.76	4.27 ± 1.19	0.13 ± 0.20	0.40 ± 0.36

* Means significantly different ($P<0.05$)

Tilapia reared on the mixture of CF and GD contained more proteins (50.3%) than those reared on CF (45.34%) or GD (45.79%) alone. However, calcium and phosphorus concentrations were significantly ($P<0.05$) highest in the fish reared on the CF in comparison to those reared on the mixture of CF and GD as well as GD alone (Table 3).

Table 3. Nutrient accumulation (%) in fish reared on different feeds (mean ± SE; n = 3)

	Fats	Proteins	Ash	Calcium	Phosphorus
CF	10.09 ± 1.83	45.34 ± 3.88	20.25 ± 2.60	0.56 ± 0.43*	0.39 ± 0.36*
CF + GD	11.32 ± 1.94	50.30 ± 4.09	19.24 ± 2.53	0.42 ± 0.37*	0.24 ± 0.28
GD	11.44 ± 1.95	45.79 ± 3.91	18.24 ± 2.46	0.21 ± 0.26	0.31 ± 0.32

* Means significantly different ($P < 0.05$)

It may be inferred from the present study that the freely available greater duckweed can partially substitute the costly commercial feed in tilapia culture which is in agreement with the previous findings on other duckweeds (Gaigher *et al.*, 1984; Kabir *et al.*, 2009).

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