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ORIGINAL ARTICLE

Influence of Supplemental Barley and Commercial Dry Feed Feeding on The Growth, Survival and Fillet Chemical Composition of Farmed Common Carp (*Cyprinus carpio* Linnaeus, 1758)

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ABSTRACT
This study was carried out to determine the growt , survival and Fillet chemical composition of farmed Cyprinus carpio fed with (1) commercial dry feed (2) 50:50 mix of barley and commercial dry feed (3) barley under semi intensive conditions in shahid ahmadian warm water fish pond. 1000 fingerlings of common carp (Cyprinus carpio) with average weight of 11.2±2.7 gram are stocked at a rate 3500 fish per pond and were fed at %4 body weight per day for 240 days. The results showed that No significant differences in growth index were found between carp fed commercial dry feed and 50:50 mix of barley and commercial dry feed (p≥0.05). Higher levels of fat and ash were observed in muscle of carp fed barley (P<0.05). The highest protein content was observed in carp fillet fed with commercial dry feed This study had shown that the supplemental feed type directly affects the growth index and carcass composition fillet of common carp (Cyprinus carpio) and Formulated t Feed can be considered for common carp culture.
Key words: *Commercial Dry Feed, Barley, Common Carp (Cyprinus carpio). Chemical composition*

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INTRODUCTION

Cultured fish species in the world Common carp (*Cyprinus carpio*) is one of the most [1]. Semi-intensitve production system is the dominant type of carp production in the world [2]. Carp production in earthen ponds is the main form of semi- intensive production encountered, with 100 793 tonnes produced in 2009 from high quality protein component of the diet [3]. Nowadays, the main contribution to the diet of common carp in traditional semi-intensive system supplied with carbohydrate feed in the form of grains. Grains Are known easily available economic source of energy but they cannot meet the protein and essential amino acid (methionine, cystine, lysine and tryptophan) needs of the fish in stages of growth. Carp contains carbohydrate enzyme systems that can consume high amounts of this nutrient. Their oversupply results in deposition of fat and glycogen in the liver and flesh [4] .

One of the sources of protein supply in the diet is the application of commercial dry food which is today used mainly in commercial livestock farming centers.The selection of Complementary *Feed* in semi-intensive system of production depends on the nutritional requirements of fish species, availability, price and quality of feed [2]. Few studies were conducted on the Effect of feeding regimes (natural food, grains and formulated feed) on growth, survival and chemical composition of common carp[5,6,7,8]. this study was designed to evaluate

the the growth, survival and Fillet chemical composition of farmed *cyprinus carpio* fed with varius feeding (commercial dry diet, 50:50 mix of barley and commercial dry diet and barley) under semi intensive conditionsin a tropical region in Southwestern Iran (Khuzestan province).

MATERIALS AND METHODS

The experiment was performed in nine ponds (1 ha) at farm which located around khorramshahr, Iran (2013). In each pond were stocked 1000 juvenile common carp (11.22±2.7 gr), 1500 silver carp (*Hypophthalmichthys molitrix*) (30±10 gr), 400 grass carp (*Ctenopharyngodon idella*) (40±10 g), 250 big head (*Hypophthalmichthys nobilis)* (40±10 gr), 250 *barbus sharpyi* (40±10) and 100 *barbus grypus* (40± 10 gr) in poly culture system for 8 months, the supplements feed used in the diet were, (1) commercial dry feed containing 28-32% protein, 10-12% lipid and 5.5% fibre (2) 50:50 mix of barley and commercial dry diet(3) barley containing 10% protein, 3.5% lipid and 6% fibre. The feed was supplied to the ponds twice a day(feed ration equivalent to 4% of actual biomass). Temperature, dissolve oxygen (Do) and salinity were measured daily. The water temperature was in the range from 20-35°C during the trial.

SAMPLING AND ANALYTICAL METHODS

Fish samples

Fresh cultured common carp were obtained from the experimental pond and immediately shipped to the Department of fisheries science at Islamic Azad University, branch of ahvaz. Upon arrival, fillets were e they were washed with cold water, weighed , measured and frozen immediately at -20 C.

Compositional analyses

Fish fillets were *dried* at *60*°C for up to 24 *h*, then stored at -20°C until further use and were analyzed in triplicate for lipid (Soxhlet method) [9], crude fiber [9], moisture [9] and Kjeldahl protein, which was calculated using the Kjeldahl nitrogen and conversion factor 6.25 (N×6.25) [9].

Weights of all collected common carps from each pond were determined at initial and the end during the 240 days experiment, which treated as initial weight and final weight, respectively.

Weight gain (WG), length gain (LG), Percentage Weight Gain (PWG),Specific growth rate (SGR), Condition factor(CF), FE(feed used) , Economic FCR (EFCR) ,were calculated according to the following formulae:

WG = final weight (g) – initial weight (g)

% Weight gain = (Final weight – initial weight / Initial weight) x 100%

SGR = [(Ln final weight – Ln initial weight) /(Time period [days])]×100

FE= Feed used takes into account all the feed used

EFCR= Economic FCR takes into account number of Kg of feed used to produce one Kg of fish

CF = [Final weight / Final length ^{3}] × 100

STATISTICAL ANALYSIS OF DATA

The mean and standard deviation were calculated for all parameters. Results were subjected to one-way analysis of variance followed by Duncan's entire comparison test ($P<0.05$), using a software SPSS 17.0.For all statistical to determine significant differences among treatment means. All data are presented as the mean ±SD.

RESULTS AND DISCUSSION

Table. 1. Growth performances of common carp(*cyprinus carpio*) fed with experimental diet

Diets	commercial dry feed	50:50 mix of barley and commercial dry feed	barley
Initial body weight (g/fish)	11.22±2.71	11.22±2.71	11.22±2.71
Final body weight (g/fish)	1847.5±165.14^b	1644.3±116.4^b	1159.7±95.1^a
WG	1836.3±165.14^b	1633.1±116.4^b	1148.4±95.1^a
PWG	16364.6±1470.6^b	14555.37±1037.6^b	10235.7±847.6^a
SGR	3.13±0.04^b	3.08±0.03^b	2.93±0.04^a
CF	1.87±0.08^b	1.87±0.14^b	1.63±0.03^a
FE(kg/1000carp)	3836.16±100.18^a	3885.41±34.67^a	3893.88±148.74^a
EFCR	2.08±.13^b	2.37±.15^b	3.37±.2^a
Total yield	1847.5±165.1^b	1644.5±116.6^b	1159.7±95.1^a
Survival rate (%)	100.00	100.00	100.00

*Results were presented as means ± SD

a,b Means in the same row with different superscripts were significantly different ($P < 0.05$)

The growth performance, feed utilization and survival of common carp fed with experimental diets for 240 days are shown in Table 1. The average final weights of the fish in different treatments reached 1847.5±165.14g, 1644.3±116.4 g, and 1159.7±95.1 g after 240 days of feeding trial in commercial dry

feed, 50:50 mix of barley and commercial dry feed, barley treatment , respectively. Growth index in commercial dry feed and , 50:50 mix of barley and commercial dry feed treatments were significantly higher (P<0.05) than those treatments , barley treatment.
EFCR index in commercial dry feed and , 50:50 mix of barley and commercial dry feed treatments were significantly higher (P<0.05) than those treatments , barley treatment.but FE index did not differ significantly between treatments(p≥0.05). EFCR did not differ significantly between in commercial dry feed and , 50:50 mix of barley and commercial dry feed groups (P≥0.05), however the best and the FCRs were obtained from groups of fish fed commercial dry feed. There were no significant difference at in the survival rates between treatments (P≥0.05).

Table.2. Body composition (on Dry matter basis) of Common carp(*cyprinus carpio*) fed experimental diet

Diets	commercial dry feed	50:50 mix of barley and commercial dry feed	barley
Crude protein (%)	61.2±0.63^{b}	59.98±1.41^{b}	56.3±0.48^{a}
Crude lipid (%)	33.41±0.79^{b}	35.83±1.84^{a}	38.31±1.06^{a}
Ash (%)	2.6±0.1^{b}	2.7±0.2^{ab}	2.91±0.2^{a}
NFE (%)	2.52±0.36^{b}	1.52±0.42^{ab}	1.84±0.43^{a}
Fiber	0.44±0.06^{ab}	0.39±0.22^{b}	0.88±0.12^{a}

*Results were presented as means ± SD
a,b Means in the same row with different superscripts were significantly different (P < 0.05)

The highest crude protein (61.2±0.63%) and were observed on the commercial dry feed treatment and these were not significantly higher than in the 50:50 mix of barley and commercial dry feed treatment(p≥0.05). The lowest value for lipid content (33.41±0.79 %) was achieved by group of fish in commercial dry feed treatment and the highest value was barley treatment. The highest crude ash (2.91±0.2 %) were observed on the barley treatment(P < 0.05) however all the groups in Carbohydrate content. did not display any significant differences(p≥0.05).
Commercial dry feed provided highest growth performance and nutrition index (Table 1). However, there was no significant difference (P > 0.05) in average harvest weight production, weight gain , Economic FCR in common carp when fed commercial dry feed and 50:50 mix of barley and commercial dry feed. After 240 days of experiment, statistically significant decrease were found (P < 0.05) in growth performence and nutrition index in common carp when fed barley. Carbohydrates are the least expensive dietary energy feedstuffs for fish but their utilization efficiency varies among fishes [10].
Average individual weight, individual length, and specific growth rate were significantly higher for fish fed the commercial catfish diet than for fish fed either unpelleted or steam-pelleted DDGS [11]. [12] However reported that inclusions of grains at high levels (65-75%) decreased growth performance in both carp and tilapia.Herbivorous and omnivorous fishes (such as common carp) appear to digest starchy components of plant materials more effectively than carnivorous fishes [13]. [14] Examined the effects of different carbohydrate sources on the growth of carp. The results showed that, the growth performance and FCR affected by the kind and level of dietary carbohydrate. It should be noted that other factors such as energy and protein content, the amount and frequency of feeding, temperature, water and minerals in the diet and age affect growth and feed conversion [15].
The protein content of barley ranges from 9% to15%. Lysine, Arginine and methionine limiting amino acid in barley protein. Dry matter digestibility increased from 44% to 67% when barley was extruded and energy digestibility increased to 70%. Barley protein is well digested, and carbohydrate and energy only moderately digested by hybrid tilapia with protein, carbohydrate and energy digestibility coefficients of 87%, 60% and 63% respectively [16].
The highest value *for fillet lipid content* (38.31±1.06 %) and ash(2.91±0.2 %) was achieved by group of fish in barley treatment and the lowest value (33.41±0.79 %) , and ash(2.6±0.1 %) was commercial dry feed respectively. The amount of fillet protein content (61.2±0.63%) and was higher in carp in which diet was commercial dry feed . According to research conducted by [8] ,The amount of protein(15.5±0.21) and ash (1.03±0.0) was higher in carp in which diet was pelleted food, compared with carp whose diet were as corn and wheat, (15.59±0.2), (.89±0.04), respectively (p<0.01). The percentage of fat in carp fed with pelleted food was (3.19±0.05), and for carp fed with corn and wheat was (6.85±0.14).[17] found higher fat content in common carp(*Cyprinus carpio*) supplementally fed with rye. [18] Showed fat content in common carp flesh fed with triticale was 97.20 g kg ^{1}, for maize 132.60 g kg ^{1}and for wheat 112.20 g kg ^{1} .

[19] reported a 9.4% fillet fat content in carp on a diet of rye; [20] reported a fillet fat content of 7.5% for the same diet. [19] Carp fed exclusively on barley showed a mean fat content of 6.4%. [21] Concluded in a review on meat quality that the main factor controlling fat content was the diet. In addition, differences in fat content may be based on behavioural and metabolic differences, which can have a genetic basis.[22] grouped Fish into four categories according to their fat and protein content (% dry weight): lean fish(protein= 88.0 , lipid=4.6), Fairly fatty fish (protein= 74.0, lipid=20.0) Fatty fish (protein= 61.0, lipid=34.0) and Very fatty fish(protein= 42.0, lipid=54.4).In present study fillet protein and fat content in common carp (*Cyprinus carpio*) fed with barley were 56.30±0.48 and 38.31±1.06 (% dry weight), Whereas,The same parameters in fish fed with commercial dry diet were 61.2±0.63 and 33.41±0.79 and for 50;50 mix were 59.98±1.41 and 35.83±1.84, respectively. [23] reported an increase in the Hepatosomatic Index and hepatic glycogen and lipid contents in carp with the increase of digestible carbohydrates.Channel catfish fed a high carbohydrate diet exhibited marked stimulation of several lipogenic enzyme activities in both liver and mesenteric adipose tissues [24]. Specific enzymatic system with high activities of amylase and maltase enables the common carp to utilize high amounts of carbohydrates [4]. Their oversupply results in deposition of fat [25,26].Furthermore, [20] found that common carp (*Cyprinus carpio*) with fat content over(100 g/ kg^{-1}) had bad organoleptic properties of fillet. According to [27,28] fish with higher fat content have spongy consistency of flesh, leaving a negative tendency in the consumer. Farmed common carp (*Cyprinus carpio*) Diet Changes had significant effect on the fillets chemical composition, growth and nutritional index .Fillet Protein and fat content of farmed common carp (*Cyprinus carpio*) fed commercial dry feed was better than other treatments, However, growth and nutritional index was not significantly different between commercial dry feed treatment and 50:50 mix commercial dry feed and barley. Growth, nutritional index and fillet quality (especially, lipid content) of Carp fed with barley was not optimal.

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