Effect of using germinated for common vetch seeds *Vicia sativa* on growth performance of common carp *Cyprinus carpio* L.

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Summary

This investigation was carried out to utilize common vetch *Vicia sativa* in formulating diets for 84 common carp *Cyprinus carpio* L. with initial weight 28±2g/fish distributed randomly over seven experimental diets with three replications for each. The fish fed experimental diets for 56 days contained 30% and 45% of common vetch Vicia sativa of total diets treated with germinated for 5 days (diet 2 and 3), 7 days (diet 4 and 5) and the last diets contained crude vetch (diet 6 and 7). The statistical analysis of data showed that the fish fed at diet 3 was significantly different (P≤0.05) as compared to fish fed at other diets in total weight, total weight gain, relative growth rate, specific growth rate and feed conversion ratio. In conclusion germinated common vetch seed can be successfully used as an inexpensive plant protein source at level of 45% (germinated seed for 5 days) in common carp diets without adverse effects on fish performance.

Keywords: Common carp, Germinated common vetch, Vicia sativa, Growth, Feed conversion ratio.

Introduction

Legume is a plant in the family of fabaceae (or Leguminase). Legumes seeds are important source of energy and protein in many parts of the world both in animal and human nutrition (1-3). The legumes have not been extensively used in fish feeds. Researchers began to evaluate the acceptability of grain legume such as lupin (4 and 5), *Cassia fistula* (6) feed pea (7). *Sesbenia aculeate* (8) in fish diets. Culban *Vicia peregrina* (9), common vetch *Vicia sativa* (10). A pea is a legume crop widely viable and abundant in region of north of Iraq and south Mediterranean of Turkey (9 and 10). The seeds contain about 25% protein with a partially balance amino acids profile source by now on aquatic animal, except (10 -13), Nile tilapia *Oreochromis niloticus* (14). Legumes are a rich source of antinutrients in human and animals diet like phytic acid, saponins, polyphenols, lathyrogens, α-galactosidase, protease inhibitors, trypsin inhibitors, α-amylase and lectins which are found in grains and forage legumes (15).

Methods for reducing ant nutrients in food were varied according to their physical (dehulling/ cooking, autoclaving/ pressure, cooking, dry roasting, soaking, milling\ ultrafiltration or biochemical (enzyme processing, fermentation and germination). Character processing temperature must be applied as overheating can cause protein and amino acid damage (16). Germination is a natural biological process of all superior plants. In this process the seed comes out of its latency stage germination and causes significant improvement in nutritional value of cereal and legume (17 and 18).

This study was designed to determine the potential nutritional value of germinated common vetch *Vicia sativa* seeds for five and seven days at different levels in spite of soybean meal in diet as plant protein source for common carp *Cyprinus carpio* L. depending up on the results of Khadom (18) who found a higher reduction in trypsin and phytic acid activity at 7days of germination for both tested seed groups this results indicated that 30% substitution of germinated seeds have no negative effect on growth criteria for common carp fish.

Materials and Methods

Common vetch seeds were cleaned, washed and soaked in 4-5 volumes of distilled water for two hours under ambient condition before being germinated. At the end of this period the water was drained and the seed samples were allowed to germinate under a wet muslin cloth in the dark at 25°C for 5 and 7 days. Seeds samples were removed periodically. After

germination seeds were sun dried and ground into powder to pass 1 mm sieve. Experimental growth for fish was conducted indoor system at fish lab., College of Agriculture and forestry, University of Mosul, between 9/11/2013 to 8/2/2014. Experimental fish common carp *Cyprinus carpio* L. average weight 28±2g/ fish were acclimatized to experimental conditions for three weeks before start of the experiment. During this period fish were fed a basal diet (control diet). Four fish were stoked per glass aquarium (96 L) with three replicates for seven experimental diets. Fish were fed two times at rate 3% body weight during experimental period (56 days). Body weight of all fish per treatments were measured every 14 days. Compressed air with air stone was used for maintaining soluble oxygen through- out the experiment, water in each aquarium was changed at a rate of 20% volume per day. Temperature, pH and dissolved oxygen level in water of aquaria were measured. Through the experimental period, the water temperature between 24-28 °C, dissolved oxygen 6-6.5 mg/L and pH 7.4-7.8. Fish fed at seven experimental diets which contained crude and germinated common vetch Vicia sativa at levels 30% and 45% instead of 0% (control diet), 55 and 80% of soybean meal for each level of experimental substitution (Table, 1). Dietary feed ingredients were processed by using laboratory grinder and then blended into a homogenous doughy consistency by adding water and were pelleted by pressing through 3 mm die in a grinding machine (19). Chemical analysis for crude protein, ether extract, crude fiber ash for diets was done according to standard methods (20). Following criteria used to present the effect of substitution of common vetch in spite of soybean meal at fish growth and food utilization were the following:

Body weight gain: (BWG) (g) = (final body weight w1)-(initial body weight w2).
Feed conversion ratio (FCR) = [dry feed consumed (g)/ live body weight (g)].
Specific growth rate (SGR %) = [(Inw2- Inw1)\ days] × 100.
Feed intake (g) per fish= Total feed consumption (g) per a aquaria/number fish per aquaria.

The data were analyzed statically by using SPSS software version 6.0 for windows (21). Data were subjected to one-way analysis of variance. Duncan's new multiple range test was used to determine differences among means for criteria (22). Significantly is reported at (P≤0.05).

Results and Discussion

Chemical component: Crude protein was increased at the number of days of germination of common vetch (CV) increased to 7 days (Table, 2) and was higher (P≤0.05) than the crude protein content of beans from the control groups. Other researchers (1, 23 and 24) also reported an increase of soybean .Similar increases in protein have been reported for another legumes such as kidney mung, soybean and peanut and rice (24), lablab bean (25) mung bean (26) faba bean and horse bean (20). Meanwhile another authors found lesser crude protein content when germinated pigeon pea (27) and negligible in barley (17). While (28) assumed that the increase was due to synthesis of enzyme proteins or a composition change following degradation of other constituents. A further explanation was done by (29) when they noted that protein synthesis occurred during inhibition and that hormonal changes play an important role in achieving the completion of germination.

Another major chemical component of common vetch was lipids, which was a source of nutritional components and bioactive compounds decreased in the time of germination (Table, 2). This is because fat was used as the major source of carbon for seed growth (28). And (30) also, suggested that fatty acids were oxidized to carbon oxide and water during germination. Total dietary fibers were significantly increased in germinated common vetch (P≤0.05). Other studies (24 and 31) reported that the effect of germination on total dietary fiber was depend upon type of legumes. As shown in table (2), following germination to 7 days declined total lipids contents from 0.63% (crude common vetch) to 0.54% (germinated common vetch for 7 days) as 13% reduction was recorded. Similar results occurred in study by (23, 24, 30 and 32-34). The crude fiber content during germination in present study increased by 221% significantly (P≤0.05) compared with control after 7 days (Table, 2). In other studies, a high

concentration (36%) of dietary fiber has been reported in *L. albus* following germination for 2 days (35). The effect of germination on dietary fiber has been also studied in peas where it was found that the total dietary fiber increased substantially during germination by about 100% (31). This increase in dietary fiber was reported to be mostly due to changes in the polysaccharides found in the cell wall such as cellulose and mannose, which suggesting that the changes were due to an increase in the cellular structure of the plant during germination (31). Ash content was increased in both samples but not significantly were found in germinated common vetch. Parallel to observation of Hahm et. al. (30); Khatoon and Prakash (36); Ohtsubo et. al., (37); Ahmad and Pathak, (38) and Al-Chalaby and Mohammad (14) reported that the differences in ash content after soaking for specific time was due to decreased ash content. Mohammad (17) observed that the decreased in ash content for two barley cultivars for 72 hrs.

Table, 1: Dietary ingredient and proximate (% DM) of the experimental diets contains Vicia sativa seed treated with germination for 5 and 7 days.

Ingredients / Diets	Control	Germinated seed for 5 days		Germinated seed for 7 days		Crude seeds	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Animal protein	10	10	10	10	10	10	10
Soybean meal	30	14	6	14	6	14	6
Common vetch	0	30	45	30	45	30	45
Wheat bran	19	19	16	19	16	19	16
Yellow corn	18.5	9.5	7.0	9.5	7.5	9.5	7
Vitam. and Miner. mixt	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Food salt	0.5	05	0.5	0.5	0.5	0.5	0.5
Limestone	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Binder (pentonite)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Determined Analysis							
Crude protein	25.33	25.81	26.04	26.59	27.21	24.99	25.00
Ether extract	3.43	3.40	3.38	3.37	3.32	2.88	3.01
Crude fiber	6.38	7.01	7.94	7.01	7.94	4.61	4.64
Ash	6.38	6.60	6.68	6.64	6.85	6.93	6.97
Nitrogen free Ext (NFE)	61.43	61.15	60.04	59.17	58.62	60.41	60.29
ME (MG/KG)*	14.22	15.24	15.22	15.19	15.17	14.07	14.03

*** According to Smith's equation (19): Protein x 18.5 + Fat x 33.5 + NFE x 13.**

Table, 2: Effect of germination of common vetch for 5 and 7 days on crude protein, fat, crude fiber and ash (Rate ± SE).

Treatment / Proximate comp	Germination		Control
	5 days	7 days	-
Crude protein	27.60 ±1.20 ab	30.20 ±1.00 a*	26.03 ±0.98 b
Ether extract	0.56 NS**	0.54	0.63
Crude fiber	5.3 ±0.45 ab	7.1 ±0.44 a*	3.22 ±0.22 b
Ash	3.54 NS**	3.86	3.24
Nitrogen free extract	63.00	58.30	58.59

*** Means not sharing a common superscript letter are significantly differences (P≤0.05). ** NS: mean not significant.**

No mortality occurred during the study. All fish grew normally and no specific sign of disease were observed. Results presented in (Table, 3) showed that fish fed at the diet contained 45% germinated common vetch seeds for 5 days (diet 3) was significantly (P≤0.05) higher For criteria: final body weight, total gain weight, daily weight gain relative growth rate and specific growth rate than that fish fed the control diet (diet 1) and another diets contained 30% germinated common vetch. for 5 days (diet 2). Also than that fish fed at diet contained germinated seed for 7 days at levels 30% and 45% (diet 4 and 5). As well as ungerminated common vetch seeds (diet 6 and 7).

The critical levels of dietary peas which retard growth have been determined 9.7-17.6 in various species (6, 7, 17, 39 and 40). Meanwhile (12 and 14) succeed to increase the level of common vetch and culban *Vicia peregrine* up to 45% and 40% level in diet of mirror carp and common carp diet respectively using heat treatment. Higher inclusion level to 45% of common vetch in the study was used. The reason could be due to processing technology of feed material which have strong effects on some antinutritional components and nutrient digestibility of fish diet. Other researchers (41) reported that germination

caused significant increases in the protein and thiamine levels and similar results was observed in enzymes activities (phytase, α-amlylase and protease) increased significantly and reached maximum during the course of germination up to 72 hrs. for mung bean *phascolus aureus*, cowpea *Vigna catjang*, lentil *Lens culinaris* and chick pea *Cicer arietinum*. Similar results were in agreement with result that study by using culban (11 and 12) common vetch (42) in carp and Nile tilapia (9) up to 30% was due to heating process. The formation of enzymes, germination shown to be good to increase the phenolic content as well as antioxidant activity (40) and digestibility. Using ungerminated seeds common vetch caused a decrease significant (P≤0.05) in growth and food utilization because contained the number of antinutritional factors such as ß- cyanoalanine, canavanine, protease inhibitors, lectine, vaccine and convince (12, 41 and 43).

Table, 3: The effect of germinated common vetch *Vicia sativa* seeds for 5 and 7 days on final weight, total and daily weight gain, relative growth rate and specific growth rate for common carp (Rate ± SE)

Diets	Control	Germinated seed for 5 days		Germinated seed for 7 days		Crude seeds	
Parameter	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Initial body weight (g/fish)	28.67 a* 0.01±	28.54 a ±0.26	27.97 a ±0.29	28.32 a ±0.42	28.85 a ±0.30	29.39 a ±0.24	28.08 a ±0.37
Final body weight (g/fish)	43.09 b ±0.96	40.82 bc ±0.80	49.88 a ±0.18	40.92 bc ±0.78	38.88 c ±0.58	41.26 bc ±0.36	40.37 c ±0.49
Total weight gain (g/fish)	14.42 b ±0.95	12.29 c ±0.55	21.92 a ±0.47	12.60 c ±0.36	11.603c ±0.275	11.870 c ±0.12	12.30 c ±0.12
Daily weight gain (g/fish)	0.225 b ±0.02	0.220 bc ±0.10	0.390 a ±0.10	0.225 b ±0.01	0.195 c ±0.01	0.210 bc ±0.01	0.220 b ±0.01
Relative growth rate (%)	50.29 b ±3.30	43.04 c ±0.52	78.39 a ±20.46	44.01 c ±0.14	38.21 c ±0.56	40.39 c ±0.09	43.80 c ±0.16
Specific growth rate	0.732 b ±0.04	0.640 cd ±0.02	1.002 a ±0.01	0.657 c ±0.01	0.578 d ±0.01	0.606 c ±0.001	0.648 c ±0.002
Food consumption (g/fish/day)	0.798 a ±0.02	0.725 b ±0.12	0.787 a ±0.01	0.765 a ±0.02	0.791 a ±0.01	0.781 a ±0.01	0.794 a ±0.17
Feed conversion ratio	3.13 c ±0.11	3.30 bc ±0.20	2.02 d ±0.07	3.40 b ±0.17	4.06 a ±0.08	3.86 ab ±0.12	3.61 b ±0.08

*** Means not sharing a common superscript letter are significantly differences (P ≤ 0.05).**

In conclusion, germinated common vetch seeds for 5 days can be successfully used an inexpensive plant source up to a level of 45% in common carp diets without adverse effects on the growth performance and feed utilization. It would be essential to present other studies about anti-nutritive factors.

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تأثير استعمال الإنبات لحبوب البيقيا الشائعة *Vicia sativa* في مظاهر النمو لأسماك الكارب الشائع *Cyprinus carpio* L.

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الخلاصة

أجريت هذه التجربة لمعرفة إمكانية استعمال البيقيا الشائعة *Vicia sativa* في توليف علائق أسماك الكارب الشائع *Cyprinus carpio* L. 84 سمكة ووزعت بمعدل وزن ابتدائي 28.2 غم/سمكة عشوائيا على سبعة علائق تجريبية وبواقع ثلاث مكررات لكل منها. غذيت الأسماك لمدة 56 يوما على علائق احتوت على البيقيا الشائعة المنبتة بنسبة 30% و 45 % لمدة خمسة ايام (عليقة 2 و3) وسبعة أيام (عليقة 4 و5) أما العليقتان الاخيرتان فقد احتوت على البيقيا الخام (عليقة 6 و7). بينت نتائج التحليل الإحصائي للبيانات أن الأسماك المغذّاة على العليقة الثالثة اختلفت معنويا ($P\leq0.05$) عن الأسماك المغذّاة على العلائق الأخرى في صفات الوزن الكلي والزيادة الوزنية الكلية والنمو النسبي والنمو النوعي وكفاءة التحويل الغذائي. يتبين مما ذكر ان حبوب البيقيا الشائعة يمكن ان تستعمل بنجاح كمصدر رخيص للبروتين النباتي مقارنة بالمركزات التقليدية الأخرى وبنسبة 45 % من العليقة الكلية (إنبات الحبوب لمدة خمسة ايام) في علائق اسماك الكارب الشائع دون أن يكون لها تأثيرٌ سلبيٌ على مظاهر النمو للأسماك.

الكلمات المفتاحية: كارب شائع، انبات البيقيا الشائعة، *Vicia sativa*، نمو، معامل التحويل الغذائي.