Influence of Different Levels of Turmeric Curcuma longa and Red *Paprika Capsicum* annum L. Supplements on Growth Promoter and Chemical Composition of Common Carp *Cyprinus carpio* L.

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ABSTRACT

A total of 105 fingerlings of common carp *Cprinus carpio* L. were allotted into seven groups with three equal replicates for each to investigate the effect of dietary supplementation of three levels of turmeric (curcuma) *Curcuma longa* and Red paprika *Capsicum annum* on growth performance throughout the experimental period. Fish of the first treatment fed on basal diet and served as a control while fish of the 2nd, 3rd and 4th treatments were fed on basal diet supplemented with Curcuma powder at levels 1.0, 1.5 and 2% respectively, whereas the diet 5th, 6th and 7th groups were supplemented with 1.0, 1.5 and 2% of Paprika powder. The results showed a significant effects($p \leq 0.05$) of the fed diets contained herbs on growth performance (final weight, weight gain, daily weight gain, relative specific growth rate(except fish was fed at diet 7 that contains 2% Red Paprika) and feed conversion ratio compared with control diet. The best influence on growth performance and food conversion ratio of common carp were obtained in the fish fed at diet contains 1.5% Curcuma. The results also revealed that the supplementation of fish diets with medicinal plants (2%) reduce lipid significantly ($p \leq 0.05$) in the chemical body composition of fish compared with control diet. Therefore, the fish fed diet supplemented with Curcuma and Red paprika enhances the productive performance and chemical body composition of the fish.

Keywords: Paprika, Curcuma, Growth performance, Chemical body composition, *Cyprinus carpio* L.

INTRODUCTION

Aquaculture is the fastest growing industries around the world with about 80 million tons being produced annually (Kolkovski and Kolkovski, 2011). Stressors including overcrowding, high or sudden changing of temperature, handling, low dissolved oxygen, poor nutritional status and fungal or parasitic damage of epidermis, contribute physiological changes and heighten susceptibility to infection. Medical plants as immunostimulants can be used not only against disease but also as growth promoters, stress resistance boosters and preventative of infections (Bastardo *et al*., 2012).

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There are a large number of feed additives available to improve fish growth performance, some of these additives are chemical products especially hormones and antibiotics which may cause unfavorable side effects (Anne Rebecca, 2014). Recently consumer demand for farm fish has increasingly stressed quality and safety, and the absence of concomitant pollution, antibiotics, and carcinogens. Therefore the rearing strategy needs to focus on meal quality through feed hygiene in addition to growth performance, which was often the only focus in the past. This strategy has hastened the search to identify and develop safe dietary supplements and additives that enhance the live activity, health, and immune systems of farm fish (Al-Salahy, 2002 ; Ai *et al*., 2004).

The uncontrolled and repeated uses of antibiotic to treat bacterial infections have in some cases led to the development antibiotic- resistance pathogens (Flores *et*

al., 2003; Food and Agriculture Organization, 2006).Many studies have proved that herbal additives enhanced the growth of fishes and protected drugs or feed have beneficial role in fish nutrition, reproduction, growth and indices (Madhuri *etal.,* 2012).

Curcuma longa (curcuma or turmeric) is a rhizomatous mono cytyledonous perennial herbaceous plant member of the ginger family (Zingibera). Curcuma contains 60-70% carbohydrate, 8.6% protein, 5-10% ,fat ,7% fiber,3-5% curcumoid (50-70% curcummin) and up to 5% essential oil and resins(Aggarwal *et al.*,2007 and Anad *et al.*,2008 ; Goel and Aggarwal, 2010) and the most active component in turmeric is curcumin. In aquaculture field *Curcuma longa* has been reported as a carotenoid pigmentation of *Poecilia reticulate* (Mukherjee *et al.*, 2009).The herbal synergistic effect has been reported in fish including, Japanese flounder (Ji, *et al.*, 2007), Nile tilapia (AbdEl-Maksoud, *et al.*, 2002), *Mugil cephalus* (El-Bahr and Saad, 2008), Asia see bass (Abdelwahab and El-Bahr, 2012) and *Labo rohita* (Sahu *et al.*,2008).

Red Bell (Paprika) relating to family of the Solanaceae, genus Capsicum and the species are *Capsicum annum*, they are a rich source of vitamins A, C and strong antioxidants, Capsanthin in pepper stimulates the immune system and helps in attacking infectious agents (Mobli and Piraste,1994). Capsanthin and capsorubin, which 80% of the active ingredients, contribute the red color to Paprika (Tepiü *et al*., 2009). Red pepper and its products are commercially used as a spice, coloring agent for human food, and as pharmaceutical ingredient, in animal feeds (De, 2003), fish flesh coloration (Diler and Gokoglu, 2004 ; Ingle de la Mora *et al*., 2006), and shrimp pigmentation (Gocer *et al*., 2006). The main purpose of this study was to evaluate the effect of different dietary levels of Curcuma *Curcuma longa* and paprika *Capsicum annuum* L., on growth performance and body chemical composition of common carp *Cprinus carpio* L. which is the main of the aquaculture species in Iraq.

MAERIAL AND METHODS

The curcuma (turmeric) and red paprika powder were obtained from local market in Nineveh city-Iraq. 105 common carp *Cyprinus carpio* L. with initial weight of 40 gm. /fish were fed basal diet (Table 1), supplemented with Curcuma powder 0, 1, 1.5 and 2% (diet 2, diet 3 and diet 4 respectively), and Red Paprika powder with same levels above (diet 5, diet 6, and diet 7), Whereas control group fed on the basal diet only (diet 1). Diets were manufactured as pellets with 3 mm diameter after milling and mixing their ingredients. The treatment groups were subjected to an acclimation period (3 weeks) on environmental aquaria glasses (72 L.) capacity, experimental growth lasted 42 days were conducted at fish Lab. / College of Agriculture & Forestry / University of Mosul .Fish fed at 3% of live body weight with three meals daily. Aquariums were supplied with air by using small electric air pumps as well as another air compressor throw pipe net. Average water temperature 24-28°C was controlled with separate air conditioners, pH average 7.3-7.6 measured by HANA pH meter (Digital pen type portable measuring, China, 2012) as well as dissolved oxygen 6.6-7.8 mg/L. measured by using Jenway tools model 9070(Hand held dissolved oxygen,UK,2010) sensitive balance (0.01gm) for weighting diets and fish were used. The Following criteria were used to assess the effect of the supplemented of Curcuma and Red paprika on fish growth and feed utilization: Daily weight gain (DWG), relative growth rate (RGR), specific growth rate (SGR) and feed conversion ratio (FCR) according to the following equations: Growth daily gain= [(Wt - Wo / t] × 100 Where Wt is final weight of fish (g) and Wo = Initial weight of fish (g), t= time (day). Initial and final weights (IW and FW, respectively) were taken into account for

calculation of specific growth rate and relative growth rate with formula: SGR (%) = Ln FW-Ln IW / time (day) × 100, RGR = FW-IW / IW × 100, Feed Conversion Ratio = g dry feed intake/g wet weight and PER (g/g) = weight gain / apparent protein intake. Six fish from each treatment were randomly sampled and stored at -20°C in freezer for proximate composition at the end of experiment. Proximate analysis of diets and fish were determined according to the method of AOAC (2000). Crude protein content was determined using the Kjeldahl method (Kjedahl apparatus, Henan, China,2008) crude lipid (Soxhlet apparatus) was analyzed by ether extraction, moisture content by a dry oven drying at 50°C for 24 h and ash by a furnace muffler (550°C for 4h).

Table 1. Dietary ingredient and proximate (% DM) of the experimental diets contains different levels of Curcuma and Red pepper.

Diets / ingredients	Control	Curcuma			Red paper		
		1%	1.5%	2%	1%	1.5%	2%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Animal protein	10	10	10	10	10	10	10
Soybean meal	30	30	30	30	30	30	30
Curcuma	-	1.0	1.5	2.0	-	-	-
Red pepper Wheat bran	-	-	-	-	1.0	1.5	2.0
Yellow corn	19	19	19	19	19	19	19
Vitam.&Miner.mixt.	18.5	18.5	18.5	18.5	18.5	18.5	18.5
Food salt	1.0	1.0	1.0	1.0	1.0	1.0	1.0
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
	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Determined Analysis							
Crude protein	25.33	25.33	25.33	25.33	25.33	25.33	25.33
Ether extract	3.43	3.43	3.43	3.43	3.43	3.43	3.43
Crude fiber	6.38	6.38	6.38	6.38	6.38	6.38	6.38
Ash	6.38	6.38	6.38	6.38	6.38	6.38	6.38
NFE	61.43	61.43	61.43	61.43	61.43	61.43	61.43
ME(MG/KG)*	14.22	14.22	14.22	14.22	14.22	14.22	14.22

*According to Smith's equation (1979): Protein x 18.5 + Fat x 33.5 + NFE x 13.8.

Data were analyzed using SPSS version 10 windows (SPSS, USA) software, using complete randomized design (CRD). Duncan's multiple range test (Duncan, 1955) were used to determine the significant of differences between groups. All the results were expressed as mean ± SE and significant difference were expressed a significant level of $p \leq 0.05$.

RESULTS and DISCUSSION

The results of growth performance and food utilization of common carp, fish fed at experimental diets were presented in table 2 and 3. The results that showed the use of curcuma (diet 2, 3 and 4) and red paprika (diet 5, 6 and 7) in diet of fish induces an increase in growth performance in all treatments and recorded a significant differences ($p \leq 0.05$) compared with control diet in final weight, daily weight gain, specific growth rate (except diet 5) criteria, whereas there were no significant differences obtained in SGR when fed fish at diet contained paprika at 2% (diet 7).The fish fed at diet 3 (1.5% Curcuma) had the best feed conversion ratio(2.337) and differ significantly ($p \leq 0.05$) with fish fed at control diet(3.48) but there were no significant differences among fish fed at another experimental diets. The results of current experiment showed that the use of different levels of curcuma powder in diets has beneficial effect on growth Performance and feed utilization of common carp. The final weight, weight gain and SGR increased significantly in all groups fed on curcuma, and the highest growth performance was observed in fish fed 1.5% in diet (diet 3). Studies showed that curcumin has a very powerful antioxidant effect (Sreejayan and Rao, 1994 ; Osawa *et al*., 1995). Curcumin proved significantly more effective than other spices in its ability to prevent lipid peroxidation and it's antioxidant effect was eight times more powerful than vitamin E (Reddy and Lokesh, 1992) as well as it was significantly more effective in preventing lipid peroxide formation than the synthetic antioxidant BHT (Majeed *et al*., 2000), can prevent rancidity of foods and provide foodstuffs containing less oxidized fat or free radicals.

Table 2. Growth of common carp fed diets containing supplemental different levels of Curcuma and Red pepper for 42 days (Mean ± SE).

Diets / Criteria	Control	Curcuma			Red pepper		
		1%	1.5%	2%	1%	1.5%	2%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Initial body weight (g/fish)	40.590 a ±0.691	39.880 a ± 0.633	40.777 a ± 0.660	39.917 a* ± 0.782	40.590 a ± 0.713	40.070 a ± 0.640	40.570 a ± 0.695
Final body weight (g/fish)	56.073 c* ± 0.883	54.967ab ± 1.478	57.913ab ± 0.489	55.090 ab ± 1.102	53.527bc ± 0.408	56.073 a ± 2.090	55.45 ab ± 1.138
Total weight gain (g/fish)	16.o47 c ± 0.392	15.190 ab ± 0.682	17.243 a ± 0.570	15.177 ab ± 0.590	12.940bc ± 1.052	16.047 a ± 1.573	14.880ab 0.± 1.212
Daily weight gain (g/fish)	0.241 c ± 0.037	0.360 ab ± 0.018	0.410 a ± 0.013	0.361ab ± 0.014	0.308bc ± 0.025	0.382 ab ± 0.037	0.358ab ±0.027

* Not sharing a common superscript letter are significantly differences ($P \leq 0.05$).

Only few studies have been done on the use of feed additives in fish nutrition (El-Bahr and Saad, 2008 ; Ahmad and Matty, 1989). Abdelwahab and El-Bahr (2012) found that supplementation of two levels of Black cumin seeds *Nigella sativa* and turmeric mixture improved the growth Performance of Asia sea bass *Lates calcarifer*, whereas feed efficiency remained unchanged significantly. More over Sahu *et al*., (2008) was found a significant growth rate and feed conversion ratio in *Labo rohito* fingerlings fed four different dosage of turmeric. The results also showed that Paprika powder in diets had beneficial effect on growth performance and body composition of carp fish. The final weight, weight gain (except SGR) increased significantly in all groups fed on paprika compared with control diet. Meanwhile the highest growth performance was observed in fish fed with 2% Paprika (diet 7, Table 2).Paprika contains protein, vitamins, coumarone, flavonoid, essential oils, steroid saponins, carotenoid pigments and capsaicin .Capsaicin of Paprika powder has pharmacological (drug) effect that induces fat metabolism in the tissue reserves of body, as well as activation of two liver enzymes, G6PD and lipoprotein lipase. (Nunez *et al.*, 1996) Also, it seems that capsaicin induce to increase protein content of fish because of positive effect on growth performance. Maniat and Ghotheddin (2014) they found the positive effects of Paprika on growth and nutritional factors of Benni fish *Mesopotamichthys sharpeyi*. Our results were in agreement with another studies that addition of herbal promoted growth and feed utilization parameters in fish in red sea bream *Pagrus major* (SC *et al*.,2007and Seung-Cheol *et al*.,2007) ; *L.rohita*(Johnson and Banerji,2007).

Medicinal herb in diets also promoted growth and feed conversion efficiency in shrimp (Olmedo Sanchez *et al*., 2009). Similar results were reported by Zakes *et al*., (2008) also reported that juvenile pike perch *Sander lucioperca* fed on diets supplemented by medicinal plants exhibited faster growth than those fed with the control diet. Similar results were reported for using medicinal plants as growth-promoting agents for common carp *Cyprinus carpio* (Yilmaz *et al.*, 2006), guppy *Poecilia reticulata* (Cek *et al*., 2007a), the cichlid *Cryptoheros nigrofasciatus* (Cek *et al.*, 2007b), and red sea bream Pagrus major(Ji *et al*., 2007). Kim *et al*., (1998) suggested that unknown factors in various medicinal herbs led to favorable results in fish growth trials In addition bioflavonoids are plant chemicals with estrogenic activity, and studies have shown that estrogen promotes growth in common carp (Kocour *et al*., 2005).

The *a*ddition of 2% of Curcuma and Paprika in the diet of fish leads to reduce significantly ($p \leq 0.05$) body fat compared with control group, furthermore the results showed that protein content of fish fed at diet contained Curcuma and Paprika increased at the same time amount of fat was decreased. The fat reducing effect of paprika due to the capsicin effect that leads to decrease glycerol-3-phosphate dehydrogenase (GPDH) and malate dehydrogenase (MDH) and as a result reduce Glycolytic activity and lipid synthesis (Arbabian *et al*., 2012), also it seems that capsicin induce an increase in protein content of fish because of it's positive effect on growth performance. Seung-Cheol (2007) showed that the use of four_herbs in red sea bream diet caused slightly low carcass lipid, higher weight gain and feed efficiency than the control group. These changes might indirectly indicate that the herbs promote cellular lipid and fatty acid utilization and metabolism as an energy source, resulting in good growth performance with protein accumulation (Seung-Cheol, 2007). Meanwhile the body composition values were not differing from that obtained by Dada (2008) and Diab *et al.*, (2002).

Table 3.Growth and feed utilization of common carp fed diets containing supplemental different levels of curcuma and Red paper for 42 days (Mean ± SE).

Diets / Criteria	Control	Curcuma			Red pepper		
		1%	1.5%	2%	1%	1.5%	2%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Relative growth rate (%)	25.250 c ± 3.785	37.917 ab ± 1.399	42.313 a ± 1.171	38.007 a ± 1.319	31.647bc ± 3.112	40.070 a ± 3.785	36.690ab ± 3.069
Specific growth rate	0.5357 b ±0.020	0.7617 a ± 0.025	0.8357 a ± 0.028	0.7620 a ± 0.028	0.6597 a ± 0.056	0.8007 a ±0.065	0.6677 ab ± 0.099
Food consump. (g/fish/day)	0.916 a ± 0.011	0.924 a ± 0.021	0.957 a ± 0.037	0.932 a ± 0.057	0.946 a ± 0.011	0.964 a ± 0.025	0.951a ± 0.009
Feed conversion ratio	3.480 a ± 0.219	2.527 bc ± 0.072	2.337 bc ± 0.133	2.640 bc ± 0.080	3.120 ab ± 0.289	2.567 bc ± 0.204	2.677 bc ± 0.170

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

Table 4. Proximate composition (%) of whole body of common carp fed diets containing supplemental different levels of curcuma and red paper for 42 days (Mean ± SE).

Diets / Criteria	Control	Curcuma			Red paper		
		1%	1.5%	2%	1%	1.5%	2%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Crude protein	15.91 ab ± 0.28	15.73 b* ± 0.10	15.92 ab ± 0.14	16.08 ab ± 0.40	15.95 ab ± 0.11	16.01 b ± 0.08	16.52 a ± 0.10
Crude lipid	8.22 a ± 0.18	7.87 ab ± 0.24	7.69 ab ± 0.14	7.56 c ± 0.21	7.98 ab ± 0.27	7.93a b ± 0.23	7.65 bc ± 0.21
Dry matter	27.28 ab ± 0.07	27.85 ab ± 0.30	27.28 ab ± 0.07	27.65 ab ± 0.18	27.65 a ± 0.29	27.2 b ± 0.14	27.31a b 0.± 0.18
Ash	3.36 b ± 0.14	4.21 a ± 0.16	3.36 b ± 0.14	3.29 b ± 0.05	3.41 b ± 0.22	3.62 b ± 0.28	3.43 b ±0.07

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

From the results of this study, it said that the fish fed diet supplemented with Curcuma and Red paprika enhances the productive performance, feed conversion ratio and decreased fat of chemical body composition of the fish compared with control diet.

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تأثير إضافة مستويات مختلفة من الكركم *Curcuma longa* والفلفل الأحمر *Capsicum annuum* على فاعلية النمو والتركيب الكيميائي لأسماك الكارب الشائع *Cprinus carpio* L.

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ملخص

تم توزيع 105 من أسماك الكارب الشائع *Cprinus carpio* L. على سبعة مجاميع وبواقع ثلاثة مكررات لكل معاملة لاختبار تأثير ثلاثة مستويات من الكركم *Curcuma longa* والفلفل الأحمر *Capsicum annum* على مظاهر النمو خلال مدة التجربة. غذيت الأسماك في المعاملة الأولى على عليقة السيطرة، فيما غذيت الأسماك في المعاملة الثانية والثالثة والرابعة على عليقة السيطرة مضافا إليها مسحوق الكركم بنسبة 1,0 و 1,5 و 2,0% على التوالي، بينما مجاميع الأسماك المغذاة على العليقة الخامسة والسادسة والسابعة أضيف إليها مسحوق الفلفل الأحمر بنسبة 1,0 و 1,5 و 2,0% على التوالي. بينت النتائج التأثيرات الإيجابية للعلائق الحاوية على هذه الأعشاب الطبية على مظاهر النمو (الوزن النهائي والزيادة الوزنية الكلية واليومية والنمو النسبي والنوعي(عدا الأسماك المغذاة على العليقة السابعة الحاوية على 2% من الفلفل الأحمر) ومعامل التحويل الغذائي مقارنة بعليقة السيطرة. إن أفضل التأثيرات الإيجابية سجل في المجموعة المضاف إليها الكركم بنسبة 1,5%. أدى استخدام الإضافة من هذه النباتات الطبية إلى انخفاض نسبة الدهن معنويا($P\leq 0.05$) في المحتوى الكيميائي لجسم الأسماك مقارنة بعليقة السيطرة. يتبين مما ورد ذكره آنفا أن الأسماك المغذاة على العلائق الحاوية على الكركم والفلفل الأحمر قد عزز من قيم معايير المظاهر الإنتاجية ومحتوى التركيب الكيميائي لجسم الأسماك مقارنة بعليقة السيطرة.

الكلمات الدالة: الفلفل الاحمر، كركم، مظاهر النمو، التركيب الكيميائي للجسم، الكارب الشائع.

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