

## Effect of dietary phytoextracts supplementation on chemical composition of common carp (*Cyprinus carpio* L.), cultivated in recirculating system

Kremena Georgieva\*, Georgi Zhelyazkov, Yordan Staykov, Dian Georgiev

Trakia University, Faculty of Agriculture, Department of Biology and Aquaculture, Students Campus, 6014 Stara Zagora, Bulgaria

\*Corresponding author: georgieva.kremena1983@gmail.com

### Abstract

Georgieva, K., Zhelyazkov, G., Staykov, Y. & Georgiev, D. (2019). Effect of dietary phytoextracts supplementation on chemical composition of common carp (*Cyprinus carpio* L.), cultivated in recirculating system. *Bulg. J. Agric. Sci.*, 25 (Suppl. 3), 178–181

This study was conducted to investigate the effects of the dietary phytoextracts supplementation on the chemical composition in the meat of common carp (*Cyprinus carpio* L.). The fish were divided into 6 groups: one control (C) and five experimental groups whose feed was supplemented with 1g of curcumin (EC), paprika (EP), thyme (ET), oregano (EO) and garlic (EG). Significant influence was found on the water content and dry matter in EO group. The addition of phytoextracts to the diet of carp did not change significantly the protein, lipid and ash contents ( $P > 0.05$ ).

**Keywords:** common carp; phytoextracts; chemical composition

### Introduction

Phytoadditives are a relatively new class of additives and the knowledge regarding their use or mode of action is sometimes partially or totally absent (Erol-Florian et al., 2011). They have a number of effects among which, most notable are the antioxidant, antimicrobial, bioproductive and immunostimulating effects. Studies were carried out and focused on cultured species (rainbow trout, tilapia, carp etc.) using a wide variety of plants (garlic, oregano, paprika, thyme, curcumin, ginger, onion, nettle etc.) revealed the positive effects of the phyto-additives on growth performance and chemical composition of the meat.

The addition of garlic to the feed of rainbow trout had positive effects on growth and chemical composition of the meat (Farahi et al., 2010). The same influence of garlic supplementation was established to african catfish (Agbebi et al., 2013), benni fish (Maniat et al., 2014) and *Oreochromis niloticus* (Mehrim et al., 2014). Some data reported for better

chemical composition of the meat of rainbow trout fed with thymol-carvacrol (Ahmadifar et al., 2011). The supplementation of thyme led to higher growth performance of *Oreochromis niloticus* (Antache et al., 2014). According some authors the addition of curcumin to the diet of *Cyprinus carpio* and *Oreochromis niloticus* had positive effect on growth (Arunkumar et al., 2016; Mahmoud et al., 2017).

Therefore, this study was conducted to investigate the effects of the dietary phytoextracts supplementation on the chemical composition in the meat of common carp (*Cyprinus carpio* L.) cultivated in a recirculation system.

### Material and Methods

#### Experimental design

The common carps used in this research were raised in concrete tanks with efficient water volume 0.8 m<sup>3</sup>, part of a recirculation system. Fish were divided into six groups of 10 fish each: one control (C) and five experimental groups whose feed was

**Table 1. Nutritional content in the feed for common carp (*Cyprinus carpio* L.), cultivated in a recirculation system**

№	Parameters	Experimental groups					
		C	EC	EP	ET	EP	EG
1	Crude protein, %	30.00	30.00	30.00	30.00	30.00	30.00
2	Crude fat, %	8.00	8.00	8.00	8.00	8.00	8.00
3	Crude fibre, %	5.00	5.00	5.00	5.00	5.00	5.00
4	Crude ash, %	8.50	8.50	8.50	8.50	8.50	8.50
5	Calcium, %	1.40	1.40	1.40	1.40	1.40	1.40
6	Phosphorus, %	1.10	1.10	1.10	1.10	1.10	1.10
7	Sodium, %	0.20	0.20	0.20	0.20	0.20	0.20
8	Curcumin, %	–	1.00	–	–	–	–
9	Paprika, %	–	–	1.00	–	–	–
10	Thyme, %	–	–	–	1.00	–	–
11	Oregano, %	–	–	–	–	1.00	–
12	Garlic, %	–	–	–	–	–	1.00
13	Metabolisable energy, MJ/kg	16.60	16.60	16.60	16.60	16.60	16.60

\* 1 kg compound feed contains: vitamin A – 10000 IU; vitamin D3 – 1750 IU; vitamin E – 175 mg; vitamin C – 100 mg

\*\* 1 kg compound feed contains: Fe – 80 mg; Mn – 35 mg; Cu – 10 mg; Zn – 107 mg; J – 2.3 mg; Se – 0.4 mg

supplemented with curcumin (EC), paprika (EP), thyme (ET), oregano (EO) and garlic (EG). The feed of the fish from experimental groups was supplemented with 1 g dry extract of the above mentioned spices, which was dissolved in 9 ml distilled water and sprayed onto 100 g feed one hour before feeding. The fish from the control group (C) did not receive any phytoextracts. Each of trial variants was with two replications. The fish were fed three times per day with extruded pellets produced by „Aqua garant“ Co, with pellet size 6 mm. The nutritional content of extruded feed for the different groups is presented in Table 1. The duration of the experiment was 60 days.

After feeding period, 4 fish of each group were randomly selected for evaluation of the chemical composition in the fillets. The experiment was conducted in accordance with the requirements of Regulation 20/1.11.2012 for minimum requirements for the protection and welfare of experimental animals and the requirements to sites for use, growth and / or their delivery.

### Chemical composition

Meat samples were prepared according to AOAC (2006; method 983.18) and subjected to determination of water content (%) using air drying (AOAC, 1997; method 950.46). Crude protein content (%) was calculated by converting the nitrogen content, quantified by Kjeldahl's method, using an automatic Kjeldahl system (Kjeltec 8400, FOSS, Sweden). Lipid content (%) was determined by the method of Soxhlet, using an automatic system (Soxtec 2050, FOSS, Sweden). Ash content (%) was investigated by incineration in a muffle furnace (MLW, Germany) at 550°C for 8 h. Crucibles were brought about the room temperature and weighed.

### Statistic

The results were statistically evaluated to determine the effect of the phytoextracts in the diet of common carp on the chemical composition of the fillets. The statistical evaluation was performed using STATISTICA 6.0 software (StatSoft Inc., 2002).

### Results and Discussion

The supplementation of oregano extract in the diet had significant effect on the water content in the fillets of common carp –  $77.92 \pm 0.16\%$  as compared to that of control and fish, fed with extruded pellets, supplemented with curcumin, paprika, thyme and garlic extracts. It is statistically ( $P < 0.01$ ) significantly higher than values of this parameter of carps from a control and other experimental groups by 1.28% (C), 1.45% (EC), 1.79% (EP), 0.60% (ET) and 1.37% (EG). The protein content in the fish of control and experimental groups was as followed: C –  $17.89 \pm 0.84\%$ , EC –  $16.33 \pm 1.53\%$ , EP –  $17.00 \pm 1.55\%$ , ET –  $17.06 \pm 1.32\%$ , EO –  $17.33 \pm 0.92\%$ , and EG –  $16.70 \pm 0.93\%$  but differences among groups were insignificant ( $P > 0.05$ ) (Table 2). The phytoextracts supplementation had no significant influence on the lipid content in the fillets of fish from experimental groups. The lower lipid content was established in fish, fed with pellets, enriched with oregano extract (EO) –  $3.57 \pm 0.98\%$ , compared to the values of this parameter of individuals from C and EC, EP, ET, EG groups. Nevertheless, the values of this parameter in carp from a control and experimental groups were relatively close –  $4.00 \pm 0.65$  –  $5.75 \pm 4.62\%$  ( $P > 0.05$ ).

**Table 2. Chemical composition of the fillets of common carp (*Cyprinus carpio* L.) cultivated in a recirculation system (%)**

Parameter	n	C	EC	EP	ET	EO	EG
		$\bar{x} \pm SD$	$\bar{x} \pm SD$	$\bar{x} \pm SD$	$\bar{x} \pm SD$	$\bar{x} \pm SD$	$\bar{x} \pm SD$
Water	4	76.92±0.12 <sup>a</sup>	76.79±3.10	76.52±2.46	77.45±0.59	77.92±0.16 <sup>a</sup>	76.85±0.98
Protein	4	17.89±0.84	16.33±1.53	17.00±1.55	17.06±1.32	17.33±0.92	16.70±0.93
Lipids	4	4.00±0.65	5.75±4.62	5.33±4.13	4.38±2.04	3.57±0.98	5.36±1.87
Dry matter	4	23.09±0.12 <sup>b</sup>	23.21±3.10	23.48±2.46	23.05±0.11	22.08±0.16 <sup>b</sup>	23.15±0.98
Ash	4	1.20±0.07	1.14±0.01	1.16±0.12	1.12±0.13	1.19±0.22	1.10±0.04

\*Values with same superscripts in the same row are significantly different, a-a:  $P < 0.01$ , b-b:  $P < 0.05$

Significant influence concerning dry matter was found in oregano group. The dry matter content in the meat of the fish from EO group was 22.08±0.16% and it was significantly lower than that of the fish from control and experimental groups by 4.57% (C), 5.11% (EC), 6.34% (EP), 4.40% (ET) and 4.84% (EG) ( $P < 0.05$ ). The data revealed that the ash content in fillets of carp from a control and experimental groups were almost equal, with no significant differences among groups ( $P > 0.05$ ).

The present study demonstrated that the addition of 1 g oregano extract to dietary of common carp, cultivated in recirculation system increased significantly the water content in fillets. This is contrary to the results of others authors who established no significant influence on water content in the meat of rainbow trout (*Oncorhynchus mykiss*), fed with thymol – carvacrol powder (Ahmadifar et al., 2011). However, the data of our research revealed no differences in water content in the fillets of carp received fed, supplemented with curcumin, paprika, thyme and garlic extracts compared to fish from control group. Similar results were established using different dietary paprika levels in the feed of *Zacco platypus* and *Paralichthys olivaceus* (Lee et al., 2010; Pham et al., 2014). According some data, insignificant influence on the water content also were observed in the meat of *Oreochromis niloticus* fed with thyme extract (Antache et al., 2014). Some authors found that the addition of curcumin to the diet of *Oreochromis niloticus* had no positive effect on the water content (Mahmoud et al., 2017). Similar results were established on the influence of garlic added in the diet of *Dicentrarchus labrax* (Saleh et al., 2015). In the present study, the inclusion of phytoextracts did not change significantly the protein content in fillets of the carp from a control and experimental groups. However, the supplementation of curcumin in the diet showed insignificantly lower protein content as comparison to that of the fish from control group. On the contrary, other authors having fed curcumin to *Sebastes schlegeli* and *Cyprinus carpio* L. reported its positive effect on the protein content (Hwang et al., 2013; Arunkumar et al., 2016). The recent experiment showed relatively close values of lipids in the fillets of *Cyprinus carpio* L., re-

ceiving phytoextracts. Although, insignificantly lower lipid content was observed in fish from the group fed feed, added with oregano extract. This is contrary to the results of some authors who found significantly higher lipid content in the meat of rainbow trout (*Oncorhynchus mykiss*) fed with pellets, supplemented with oregano extract (Ahmadifar et al., 2011). According to the experimental data from the present study dietary oregano decreased significantly the dry matter content in fish fillets. Contrary to these results, another researches found significantly higher dry matter in the meat of rainbow trout fed with oregano extract (Erol-Florian et al., 2011). The results of feeding experiment with carp, revealed almost equal values of ash content to the fish from C, EC, EP, ET, EO and EG groups. Similar results were established with different dietary paprika and lipids levels in the feed of *Zacco platypus* and *Paralichthys olivaceus* (Lee et al., 2010; Pham et al., 2014). Phytosupplement thyme added to the feed of Nile tilapia (*Oreochromis niloticus*) led to equal values of ash content, as well (Antache et al., 2014). According to some data the addition of curcumin had no significant effect on the chemical composition in the meat of *Carassius auratus* (Jiang et al., 2016).

#### Acknowledgements

We appreciate the support of the Department of Biology and Aquaculture, Faculty of Agriculture, Trakia University, Bulgaria to conduct this study.

#### References

- Agbebi, O., Ogunmuyiwa, T. & Herbert, S. (2013). Effect of dietary garlic source on feed utilization, growth and histopathology of the African catfish (*Clarias gariepinus*). *Journal of Agricultural Science*, 5, 26 – 34.
- Ahmadifar, E., Falahatkar, B. & Akrami, R. (2011). Effects of dietary thymol-carvacrol on growth performance, hematological parameters and tissue composition of juvenile rainbow trout, *Oncorhynchus mykiss*. *Journal of Applied Ichthyology*, 14, 1 – 4.
- Antache, A., Cristea, V., Grecu, I. & Crețu, M. (2014). The synergistic influence of thymus vulgaris and vitamin E on growth

- performance and oxidative stress at *Oreochromis niloticus* species. *Lucrări științifice – Seria zootehnie*, 62, 85–90.
- AOAC**, 1997. Official Methods of Analysis of Association of Official Analytical Chemists, (16<sup>th</sup> edition).
- AOAC**, 2006. Official Methods of Analysis of Association of Official Analytical Chemists, (18<sup>th</sup> edition).
- Arunkumar, P., Ramasubramanian, V. & Munirasu, S.** (2016). Effect of *Curcuma Longa* enriched *Mesocyclops Thermocyclopoidea* on fresh water fish, *Cyprinus carpio*. *International Journal of Research and Development in Pharmacy and Life Sciences*, 6, 2484-2492.
- Erol-Florian, G., Şara, A., Molnar, F. & Benţea, M.** (2011). The influence of some phytoadditives on growth performances and meat quality in rainbow trout (*Oncorhynchus mykiss*). *Scientific Papers: Animal Science and Biotechnologies*, 44, 13–18.
- Farahi, A., Kasiri, M., Sudagar, M., Iraei, S. M. & Shahkolaei, M.** (2010). Effect of garlic (*Allium sativum*) on growth factors, some hematological parameters and body compositions in rainbow trout (*Oncorhynchus mykiss*). *Aquaculture, Aquarium, Conservation & Legislation Bioflux AACL bioflux*, 3, 317-323.
- Hwang, J., Rha, S., Han, K. & Kim, S.** (2013). Body composition of black rockfish *Sebastes schlegelii* fed on diets containing different levels of Turmeric *Curcuma longa* L. *Korean Journal of Fisheries and Aquatic Sciences*, 46(5), 540-545.
- Jiang, J., Wu, X., Zhou, X., Feng, L., Liu, Y., Jiang, W., Wu, P. & Zhao, Y.** (2016). Effects of dietary curcumin supplementation on growth performance, intestinal digestive enzyme activities and antioxidant capacity of crucian carp *Carassius auratus*. *Aquaculture*, 463, 174–180.
- Lee, C., Pham, M. & Lee, S.** (2010). Effects of dietary paprika and lipid levels on growth and skin pigmentation of pale chub (*Zacco platypus*). *Asian-Australasian Journal of Animal Science*, 23 (6), 724-732.
- Mahmoud, H., Al-Sagheer, A., Reda, F., Mahgoub, S. & Ayyata, M.** (2017). Dietary curcumin supplement influence on growth, immunity, antioxidant status, and resistance to aeromonas hydrophila in *Oreochromis niloticus*. *Aquaculture*, 475, 16-23.
- Maniat, M., Ghotbeddin, N. & Ghatrami, E.** (2014). Effect of garlic on growth performance and body composition of benni fish (*Mesopotamichthys sharpeyi*). *Journal of Biosciences*, 5, 269-277.
- Mehrim, I., Khalil, F. & Refaey, M.** (2014). Evaluation of dietary addition of garlic (*Allium sativum* L.) lobes on growth performance, feed utilization and physiological responses of *Oreochromis niloticus*, fingerlings. *Abbassa International Journal for Aquaculture*, 7, 342-361.
- Pham, M., Byun, G., Kim D. & Lee, M.** (2014.) Effects of dietary carotenoid source and level on growth, skin pigmentation, antioxidant activity and chemical composition of juvenile olive flounder *Paralichthys olivaceus*. *Aquaculture*, 431, 65–72.
- Saleh, N., Michael, R. & Mohamed, M.** (2015). Evaluation of garlic and onion powder as phyto-additives in the diet of sea bass (*Dicentrarchus labrax*). *Egyptian Journal of Aquatic Research*, 41, 211–217.