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- RESEARCH ARTICLE-

The Effect of Suplementary *Pelargonium sidoides* Extract on Growth of the African Catfish (*Clarias gariepınus* (Burchell, 1822))

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Abstract

A preliminary study was conducted to evaluate the effect of dietary supplementation of the *Pelargonium sidoides* extract on African catfish, *Clarias gariepinus* growth performance, feed efficiency and body composition. The catfish (mean body weight 1.09±0.32 g) were fed with experimental diets prepared by using supplementation of *P. sidoides* extract (0, 5 and 10 ml 100 g^{-1}) for 90 days. Growth rate significantly increased in catfish fed with *P. sidoides* extract-supplemented diets in comparison with the control groups ($P<0.05$). Specific growth rate (SGR) ranged from 2.29 ± 0.05 (control) to 2.54 ± 0.21 (5 ml *P. sidoides* extract 100 g^{-1} diet). Feed conversion ratio (FCR) and protein efficiency ratio (PER) were also significantly improved in group fed diet with 10 ml 100 g^{-1} *P. sidoides* extract than that with control groups ($P<0.05$). These results demonstrate that *P. sidoides* extract may be used as a potential growth promoter in catfish culture.

Keywords:

African catfish, *Clarias gariepinus*, *Pelargonium sidoides*, Growth

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Introduction

In the last decade, improvement of aquaculture industry has generally expanded, with the goal that its annual development rate has been more than different industries (FAO 2016). Globally, aquaculture is venturing into new bearings, intensifying and enhancing. Several growth promoters and hormones have been tried for upgrading feed conversion efficiency and for

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expanding aquaculture productivity (Makkar et al., 2007). But, they cannot be prescribed since unsatisfactory and constant utilization of antibiotics agents may prompt potential improvement of antibiotic resistant bacteria, environmental pollution and the accumulation of residues in fish (Ringo et al., 2010). Many countries have forbidden the use of certain chemotherapeutics, and also refuse to import aquaculture products treated with antibiotics and chemicals (Syahidah et al., 2015). In this way, scientists have intensified efforts to exploit natural products, for example, herbs and plants being developed of elective dietary enhancements that enhance development growth, and health and immune system of cultured fish instead of chemotherapeutic agents.

Numerous herbs and plant extracts have been demonstrated valuable in different applications in fish culture and aquaculture practices. These herbs are included fish feeds rather than synthetic items in order to stimulate or promote the effective use of feed nutrients which result in more quick increase, higher production and better feed productivity (Asimi & Sahu, 2013; Bhatnagar & Lamba, 2018). In view of their synthetic structure, phytochemicals can primarily be ordered into alkaloids, flavonoids, pigments, phenolics, terpenoids, steroids and essential oils. Phytochemicals have been accounted for to improve different activities, for example, growth, feed utilization, act as a tonic in immunostimulation, antistress and to advance antimicrobial properties of fish (Chakraborty & Hancz, 2011).

There are various reports of herbal fish diets promoting growth performance (Ji et al., 2007; Dada, 2012), increasing stress tolerance (Ji et al., 2009), and enhancing immune system effectiveness (Bai et al., 2009; Abdel-Tawwab et al., 2018). More recently such applications have begun to demonstrate positive effects in feeds for various fish species including African catfish, (*Clarias gariepinus*) (Turan & Akyurt, 2005; Turan & Çek, 2007; Turan & Yigitarslan, 2016; Ogueji et al., 2017), tilapia (*Oreochromis aureus*) (Turan, 2006), (*Oreochromis niloticus*) (Rawling et al., 2009), common carp (*Cyprinus carpio*) (Turan et al., 2007) and crayfish (*Astacus leptodactylus*) (Turan et al., 2012).

Pelargonium sidoides extract is a standout amongst the most important medical herbs utilized in folk medicine by the Southern African local population. The root of *Pelargonium sidoides* is utilized in traditional medication to cure irresistible respiratory infections including tuberculosis. These days, Pelargonium containing phytopharmaceuticals, is effectively utilized in present day phytotherapy in Europe. Polymeric polyphenols and coumarins have been recognized as the principal ingredients (Koch & Iber 2003). The vast majority of the coumarins contain a methoxy function; usefulness that is in charge of their antibacterial action. Gallic acid and its methyl ester are available in large sums. These were distinguished as the unmistakable immunomodulatory guideline for this herbal drug (Kayser & Kolodziej 1998). Additionally, *P. sidoides* is wealthy in photochemical, vitamins, minerals and amino acids that improve the body's working and secures it against diseases (Kolodziej et al., 2003). A few examinations have been done in which herbs, as dietary added substances, were encouraged to fish. The focal point of these examinations incorporates their utilization as sustaining attractants and their impacts on development, survival and immune system activity (Harada, 1991; Kwon et al., 1999; Lee et al., 2004; Ji et al., 2007). Additionally, Turan et al., (2011; 2012) revealed that *Pelargonium sidoides* extract is helpful to enhance development, feed utilization and survival rate in common carp and freshwater crayfish, juvenile diets.

Although previous studies have mostly investigated on effects of *P. sidoides* extract on growth and body composition of carp and crayfish, there is a lack of data on the use of *P. sidoides* extract in diets for catfish growth. In the present study we intended to ascertain whether *P. sidoides* extract included in the diet enhance the growth performance, feed utilization and carcass composition of the African catfish.

Material and Method

A sum of 300 African catfish with mean weight of 1.09±0.32 g were placed in nine glass aquarium (100 L, triplicate for every treatment). The aquaria were outfitted with air circulation and provided with persistently flowing water (2L min-1), and controlled temperature (25±1°C). The photoperiod was kept up on a 12-h light: 12-h dark African catfish were fed with trout diets (Aquamaks, Turkey: 48% protein, 18% lipid). Proximate composition of the trial diet is determined by analysis (AOAC, 1990). *Pelargonium sidoides* extract (UMCA®) was supplied by Dr. Willmar Schwabe GmbH&Co. (Ettlingen, Germany). In the preparation of experimental diet, liquid *P. sidoides* extract were mixed with a pulverized trout diet in which, water (450 mL kg-1) was added and extruded through a food grinder with a 2 mm diameter die plate (Lee et al., 2004). Two diets containing *P. sidoides* extract with amounts of 5 and 10 ml 100 g^{-1} of diet and a control diet (without *P. sidoides* extract) were prepared. The control diet was also mixed with 450 ml water. All the groups were fed with their respective diet to ca. 4% body weight day^{-1} twice daily for 90 days.

The average water temperature was 25±1^{o}C, and the oxygen content of the water was 5.32±0.42. At pH 7.2±0.5, the ammonia nitrogen content did not exceed 0.1 mg N-NH_4/l, and nitrite nitrogen was not higher than 0.03 mg N-NO_2/l. During the experiment, the mortality was recorded daily and fish in each aquarium were counted and weighed individually at biweekly intervals after anesthetization for 2.5 min in water that contained 0.4 g L^{-1} tricaine methanesulphonate (TMS) and 0.8 g L^{-1}sodium bicarbonate as a buffer. Growth was monitored to determine the growth in each treatment groups during the experiment. Each fish was individually weighed and measured (total length) to the nearest 0.01 g and 0.01 cm, respectively. Weight gain feed conversion ratio, specific growth rate, protein efficiency ratio and survival rate were calculated in this experiment.

Toward the beginning of investigation, 50 fish arbitrarily were treated with an overdose of phenoxyethanol (1.5 mg l^{-1}) solution, and stored at – 20oC for body proximate composition. Toward the finish of the experiment, 10 fish from each dose group (n=30 fish\per dose) were analyzed for final whole body proximate composition (AOAC, 1990). All information was subjected to a one-way analysis of variance to determine if there is a difference in weight gain and body composition among treatments. Duncan test was utilized to compare the means of the treatments when differences occurred.

The effects of different concentrations of dietary *P. sidoides* extract on growth and survival of on the African catfish (*Clarias gariepinus*) for 90 days are shown in Table 1.

Table 1. The effects of different concentrations of dietary *P. sidoides* extract on growth and survival of African catfish (*C. gariepinus*)*

	P. sidoides extract (ml 100 g^{-1})		
	0	5	10
Weight gain (g)	6.61±0.19[a]	7.55±0.23[a]	9.22±0.57[b]
SGR	2.29±0.05[a]	2.54±0.21[a]	2.44±0.31[a]
FCR	2.77±0.06[c]	1.99±0.66[b]	1.64±0.09[a]
PER	0.91±0.03[a]	1.05±0.03[a]	1.28±0.08[b]
Survival (%)	92.78±2.64[a]	87.66±3.92[a]	89.66±3.93[a]

*Values (mean ± S.E. of triplicate) with different superscripts in each line indicate significant differences (P<0.05).
WG (Weight Gain) (g) = Final weight-Initial weight.
SGRW (Specific Growth Rate Weight) (%)= $[(\ln W^2-\ln W^1) \setminus (T^2-T^1)] \times 100$, where W^1, and W^2 are mean body weight at times when the first and second samples were taken (T^1 and T^2)
FCR (Food Conversion Ratio) = Dry feed intake (g) / wet weight gain (g).
PER (Protein Efficiency Ratio) = Live body weight gained (g) / protein intake (g).

Weight gain significantly expanded in catfish fed with *P. sidoides* extract-supplemented diets in comparison with the control groups (P<0.05). Among the *P. sidoides* extract-supplemented groups, the fish fed diet with 10 ml 100 g^{-1} *P. sidoides* extract showed significantly higher growth than fish fed diets with 5 ml 100 g^{-1} and control groups (Table 1). Feed conversion ratio (FCR) and Protein efficiency ratio (PER) were also significantly improved in group fed diet with 10 ml 100 g^{-1} *P. sidoides* extract than that with control and other group (P<0.05, Table 1).

The effects of different concentrations of dietary *P. sidoides* extract on the chemical composition of the whole-body African catfish (*Clarias gariepinus*) for 90 days are shown in Table 2.

Table 2. The effects of different concentrations of dietary *P. sidoides* extract on the chemical composition of the whole-body African catfish (*C. gariepinus*) *

Chemical composition (%)	Initial	*P. sidoides* extract (ml 100 g^{-1})		
		0	5	10
Moisture	74.82±0.45	74.80±0.82[a]	75.12±0.86[a]	74.19±0.49[a]
Crude protein	18.90±0.31	19.06±0.44[a]	18.35±0.66[a]	19.02±0.78[a]
Crude lipid	5.30±0.15	4.96±0.09[a]	5.31±0.35[a]	5.72±0.22[a]
Ash	1.01±0.02	1.18±0.10[a]	1.22±0.17[a]	1.05±0.06[a]

*Values (mean ± S.E. of triplicate) with different superscripts in each line indicate significant differences (P<0.05; P<0.01). Body composition data presented on a wet basis.

No significant differences were obtained in whole body moisture, lipid, protein and ash among the dietary treatments (P>0.05).

Discussion

The findings of the present work have plainly shown that *Pelargonium sidoides* extract-based diet promote growth in catfish. The therapeutic utilization of *P. sidoides* extract in traditional medicine for the cure of infectious respiratory diseases and its present utilization in modern phytotherapy in Europe incited our investigations on the use of *P. sidoides* extract as dietary added substances in catfish culture. This is a preliminary report to our knowledge regarding the potential of *Pelargonium sidoides* extract as a feed additive in catfish culture.

There was no adverse influence of diet with *P. sidoides* extract on survival, weight gain and feed intake of fish in the present study. Among *P.sidoides* extract-supplemented groups, the best growth rate and food conversion ratio were observed at 10 ml 100 g^{-1} *P. sidoides* extract-supplemented diet. This finding indicated that the *P. sidoides* extract is a positive dietary additive to induce effective technical and economical propagations for cultured catfish.

A number of studies have reported a positive improvement in biomass and specific growth rate as well improvement in other growth parameters in crayfish, *Astacus leptodactylus* on *P. sidoides* extract supplementation (Turan et al., 2012). Similarly, in African catfish *Clarias gariepinus* (Turan & Akyurt, 2005; Turan & Yigitarslan, 2016), tilapia *Oreochromis aureus* (Turan, 2006) and common carp *Cyprinus carpio* (Turan et al., 2007) herbs in diets promoted growth and feed efficiency.

The positive estimations of fish growth parameters obtained in fishes fed herbal were maybe because of the expanded enzymatic action in the gut; increasing the digestibility and hence nutrients were utilized properly. These outcomes are in accordance with the results of Al-Sagheer et al (2018) who announced that incorporation of *Pelargonium graveolens* into *O. niloticus* (Nile tilapia) diets resulted in significant effects in growth, intestinal microbiota, antioxidant and immune activities of Nile tilapia. Numerous reports have archived the effect of herbs as appetizers and growth promoters in aquatic species (Syahidah et al., 2015). According to Lee & Gao (2012) herbs play out their underlying movement in encouraging as a flavor and in this manner impact eating designs, the secretion of digestive fluids and total feed intake. The stimulation of digestive secretions including saliva, digestive enzymes, bile and mucus is considered an important action of feed additives. In another way, olfactory feed fixings enhance the growth through their ability to act as feeding enhancers for fish to eat more feed than normal.

Despite the fact that the outcomes appear to demonstrate a stimulatory impact of *P. sidoide*s extract on fish growth, holes exist in the comprehension of the components of activity of *P. sidoides* extricate in fish. *P. sidoides* is wealthy in photochemical, vitamins, minerals and amino acids that upgrade the body's functioning and protects it against diseases (Kolodziej et al., 2003), and the nearness of these phytochemical in the *P. sidoides* concentrate may invigorate development in catfish. Further experimental results might clarify whether specific components possess higher potency as appetite enhancers in fish. Moreover future research around there should focus on understanding the physiological systems by which dietary *P. sidoides* extract enhances development in catfish.

In conclusion, this study represents the first approach to assess the effects of the dietary intake of *P. sidoides* extract in African catfish culture. The findings demonstrated that expansion of *P. sidoides* extricate at doses of 10 mg 100 g^{-1} feed respectively, enhanced growth performance, feed utilization and protein efficiency parameters of *C. gariepinus*. Henceforth, *P. sidoides* extract seems to be a promising dietary supplement to enhance growth in African catfish.

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