Dietary effect of *Lippia citrodora* essential oil on some hematological, biochemical, growth performance and body composition of *Cyprinus carpio* Linnaeus, 1758

H Gholipourkanani[1*], F Jamali[1], H Jafaryan[1], E Gholamalipour Alamdari[2]

[1]Department of Fisheries, Faculty of Agriculture and Natural Resource, Gonbad Kavous University, Golestan, Iran

[2]Plant Production Department, College of Agriculture Science and Natural Resources, Gonbad Kavous University, Golestan, Iran.

[Downloaded from ijaah.ir on 2026-01-22]

[DOI: 10.18869/acadpub.ijaah.3.1.1]

[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 15th 2019]

Abstract

This study was conducted to evaluate the effects of different proportions of lemon bee brush essential oil on growth performance, carcass composition, and hematology and biochemical parameters of common carp (*Cyprinus carpio*). Common carp with an average weight of 8 ± 0.2 g were fed for one month with a diet supplemented with Lemon beebrush essential oil (0.15 and 0.3 ml) and with normal diet as controls.

The growth performance, body composition, biochemical and hematological factors were measured on day 30. Results of the present study showed that specimens fed a diet supplemented with Lemon beebrush EO in both dosages noticeably increased final weight ($p<0.05$). Group of fish fed on 0.15 and 0.3 LB in the diet had the lowest level in Hb and hematocrit indices ($P<0.05$). Lipid content was lower in fish fed 0.15 LB supplemented diet and ash was decreased in fish fed both LB supplemented diet.

Correspondence: H Gholipourkanani**,** Department of Fisheries, Faculty of Agriculture and Natural Resource, Gonbad Kavous University, Golestan, Iran **(**e-mail: gholipourk@gmail.com)

Keywords: Lemon beebrush, Carcass, Blood parameters, Common carp

[DOI: 10.18869/acadpub.ijaah.3.1.1]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 15th 2019]
[DOR: 20.1001.1.23453515.2017.3.1.1.1]
[DOI: 10.18869/acadpub.ijaah.3.1.1]

Introduction

Aquaculture industry is one of the most important sectors of agriculture in the world. Among all cultivated species, the fresh water fish, common carp, *Cyprinus carpio* has the highest interest as human food in the Far East. Elevating the growth rate and immune response of fish species can significantly affect the benefits of fish culturists. There are many extensive researches on using different synthetic or natural compounds to improve growth and enhance fish health to overcome stressful culture condition (Anderson, 1992). Among different compounds, Medicinal plants have been used in traditional systems to treat many diseases (Bhadauria 2012). Secondary metabolites produced by plants are organic chemicals of high structural diversity, which play different functions including chemotherapeutic, bacteriostatic, bacteriocidal and antimicrobial functions (Purohit & Mathur, 1999). As a result, herbal components received much attention in aquaculture industry during the last decade for different purposes such as growth promotion, immunostimualtion, antiviral, antifungal, antibacterial, aphrodisiac as well as appetite stimulators (Citarasu, 2010; Chakraborty & Hancz, 2011).

Lippia citrodora is a species of flowering plant in the verbena family Verbenaceae, native to western South America and growing in many parts of the middle east and Europe in different countries . Common names include lemon verbena and lemon beebrush. *Aloysia citriodora* extract shows antioxidant properties that could play an important role in modulating GSH-reductase activity in lymphocytes and erythrocytes and protecting plasma from exercise oxidative damage (Carrera-Quintanar, Funes, Viudes, Tur, Micol, Roche & Pons 2010). Based on our best knowledge, there was a few scientific literature on the effects of dietary administration of lemon beebrush in fish species. Recent studies assessing the sedative and anesthetic efficacy of the essential oil of *A. triphylla* in fish showed that it prevents stress induced and increase in cortisol (Parodi, Cunha, Becker, Zeppenfeld, Martins, Koakoski, Barcellos, Heinzmann & Baldisserotto (2014); Zeppenfeld, Toni & Becker 2014). Zeppenfeld Hernández, Santinón, Heinzmann , Da Cunha, Schmidt & Baldisserotto (2015) examined the growth, gut morphology and occurance of endocrine cells in the gastrointestinal tract of silver catfish fed diet supplemented by essential oil of *Aloysa triphyla*.

Oral administration is the only method economically suited to extensive aquaculture and is widely used method, which is more effective than the other methods. It is non stressful and allows mass administration regardless of fish size (Sakai, 1999; Galindo-Villegas & Hosokawa, 2004). Therefore, the present study was performed to determine the effects of dietary lemon beebrush essential oil on some growth and biochemical parameters in common carp.

Materials and Methods

[DOI: 10.18869/acadpub.ijaah.3.1.1]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 15th 2019]
[DOR: 20.1001.1.23453515.2017.3.1.3.3]
[Downloaded from ijaah.ir on 2026-01-22]

Fish diet preparation

Dried leaves of lemon beebrush were obtained from local shop. An essential oil was prepared according to Zeppenfeld et al (2015) and mixed with commercial diet (Beiza) to achieve 0.15 and 0.3 ml Lemon beebrush (LB) essential oil (EO)/Kg fish. The experiment was performed for 30 days.

Fish

Common carp (N: 180, Weight: 8±0.2g) were purchased from a private farm (Carp Farm, Golestan province, Iran) and were transported to the Gonbad Kavous University, fish health unit. They were distributed in 9 fiberglass tanks (three replicates per group and 20 fish per tank) filled with 100 L water (temperature = 26.5 ºC, dissolved oxygen = 5.2 and PH = 8.01 ppm).

The specimens were fed a commercial diet for 2 weeks to be acclimated to the conditions, and to recover from the stress of transportation.

Data collection and sample analysis

At the end of experiment, the fishes of each aquarium were weighed seprately and average final weight (g/fish) and length (cm) was calculated. After blood sample collection, all fish were scarified and soon the abdominal cavities of three fish from each aquarium were opened to remove viscera which are to be weighed at once.

Chemical analyses of fish

Whole-fish body from each treatment were analyzed according to the standard methods of AOAC (1999) for moisture, crude protein, crude fat and ash.

Growth assessment

Weight , total length, body weight gain (BWI), feed conversion ratio (FCR), specific growth rate (SGR), daily growth rate (DGR) and condition factor (CF) of 30 randomly selected fish in (0.015 & 0.03%) beebrush and control groups were calculated. Final weight and length were measured.

The calculation formula for relative index are listed below:

$$WBI\ (\%) = 100 \times (wf - wi)/wi$$

$$FCR\ (\%) = (\text{dry feed intake (g)}/\text{wet WG (g)}) \times 100$$

$$SGR\ (\%\ day\text{-}1) = (Ln\ wf - Ln\ wi) \times 100/t$$

$$CF\ (\%) = 100 \times [\text{wet weight (g)}/TL3\ (cm)]$$

$$DGR\ (\%) = (wf - wi) \times 100/t$$

wf and wi were final and initial fish weights, respectively; TL was total length and t is the time in days between weighting.

Hematological and serum analysis

The blood was immediately used to determine the number of red blood cells (RBC) and white blood cells (WBC) by means of a haemocytometer slide (Improved Neubauer type) at a magnification of x 400. Haematocrit (Hct) was determined by the microhematocrit method. Haemoglobin (Hb) concentration was conducted by using the cyanohaemoglobin method (Stoskopf 1993). Briefly, 20 µl of

[DOI: 10.18869/acadpub.ijaah.3.1.1]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 15th 2019]

whole blood was mixed with 5 ml of Drabkin's solution (Sigma-Aldrich) in a test tube before allowing to stand for at least 15 min at room temperature. The absorbance (A) was measured at 540 nm. The haemoglobin concentration of the blood sample was calculated from a curve prepared from known standards. Mean corpuscular volume (MCV: Fl), mean corpuscular hemoglobin (MCH: pg) and mean corpuscular hemoglobin concentration (MCHC: %) were measured using the standard routine techniques. Plasma cortisol levels were determined by radioimmunoassay (Grutter & Pankhurst 2000) in samples shipped frozen to the laboratory, using the Diaplas company kit. Plasma levels of glucose were measured using standard spectrophotometric assays (using Parsazmoon kit) and Urea (Chaney & Merbach 1962) by Parsazmoon® kit.

Statistical Analyses

Mean value and standard error (mean ± SE) for each parameter of all treatments was calculated. The results were subjected to a one way analysis of variance. Data was analyzed using SPSS program, Version 16. Differences between means were compared using Bonferoni test at $P < 0.05$ level.

Results

Growth parameters

The Results of growth parameters are shown in table 2. Weight and CF increased in fish fed with both of Lemon beebrush dosage in comparison with control group ($P<0.05$).

Table1 Composition of commercial diet for common carp (5-20 g)

Nutrients	value	Nutrients	value
TVN mg/100 g	<50	Moisture %	<12
Lisin%	1.6-1.8	Crude protein%	32-36
Methionin%	0.42-0.48	Crude lipid%	7-11
Treonin%	1.05-1.25	Ash%	9-13
Phosphorus %	1-1.4	Crude fibre%	2.5-5.5
Gross energy Kcal/Kg	3600-3800		

TVN: Total Volatile Nitrogen

Table 2 Growth performances of fish 30 days after feeding dietary lemon beebrush (LB)

Treatment	BWI (%)	DGR (%)	SGR(%day)	CF (g cm-3)	FCR	Weight(g)	Length(cm)
LB(0.15ml)	3.26±0.95^a	3.26±0.99^a	0.32±0.09^a	116.77±2/00^a	10.52±2.7^a	10.29±0.21^a	8.81±0.04^a
LB (0.3ml)	2.12±0.75^a	2.16±0.75^a	0.2±0.07^a	115.81±3.77^a	9.78±8.9^a	10.45±0.15^a	9.04±0.24^a
Control (0ml)	4.17±1.6^a	3.43±0.81^a	0.4±0.11^a	103.98±4.24^b	8.55±2.6^a	8.88±0.51^b	8.53±0.18^a

Values are mean ± S.E. Values within the same column, not sharing common superscript letters are significantly different ($P< 0.05$, $n=60$).

[Downloaded from ijaah.ir on 2026-01-22]

[DOR: 20.1001.1.23453515.2017.3.1.3.3]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 16th 2018]

[DOI: 10.18869/acadpub.ijaah.3.1.1]

Hematological property

Hematological parameters are shown in table 2. It shows that Hb and HCT decreased in fish fed with LB in both dosage in comparison with control on 30th days of experiment (P<0.05). No significant difference was observed in RBC, WBC, MCV, MCH and MCHC level between trial groups (P>0.05).

Table 3 Hematological parameters of fish fed diets containing LB after 30 days.

	RBC (10^6mm3)	WBC (10^3mm^3)	HB (g.dl)	HCT (%)	MCV (µm3)	MCH(pg)	MCHC
LB (0.15ml)	0.32 ± 0.06[a]	1.53 ± 0.11[a]	15.63 ± 1.70[a]	8.37 ± 0.48[b]	50.97 ± 5.23[a]	913.95 ± 184.11a	205.99±31.87[a]
LB (0.3ml)	0.28 ± 0.6[a]	1.38 ± .0.13[a]	6.02 ± 1.12[b]	11.82 ± 0.65[b]	71.77 ± 8.40[a]	351 ± 70.85a	146.43±7.32[a]
Control (0ml)	0.41 ± 0.07[a]	1.88 ± 0.29[a]	20.19 ± 3.14[a]	15.37 ± 0.59[a]	67.88 ± 12.38[a]	482.94 ± 55.49a	145±15.08[a]

Values are mean ± S.E. Values within the same column, not sharing common superscript letters are significantly different (P< 0.05, n=60).

Blood biochemical parameters

The changes in Glucose, cortisol and Urea of plasma are shown in table 3. Dietary Lemon beebrush led to a negligible effect on the serum Urea in fish fed with 0.15 LB (p<0.05). Glucose and cortisol level showed no significant change in treatments (P>0.05).

Table 4 Biochemical parameters of fish fed diets containing LB after 30 days.

Treatment	Glu	Urea	Cortisol
LB (0.15ml)	157.67 ± 15.77[a]	15.33 ± 2.84[a]	24.26 ± 0.93[a]
LB (0.3ml)	223.60 ± 23.98[a]	10.20 ± .0.96[b]	25.50 ± 1.23[a]
Control (0ml)	189.80 ± 22.02[a]	8 ± 1.14[b]	21.36 ± 2.41[a]

Values are mean ± S.E. Values within the same column, not sharing common superscript letters are significantly different (P< 0.05, n=60)

[DOI: 10.18869/acadpub.ijaah.3.1.1]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 16th 2018]
[DOR: 20.1001.1.23453515.2017.3.1.3.3]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 16th 2018]
[DOI: 10.18869/acadpub.ijaah.3.1.1]

Fish body composition

Results of proximate analyses of fish fed the Lemon beebrush and control diets are illustrated in Table 4. DM content in different fish groups ranged between 22.11% (LB 0.3) and 24.27% (LB 0.15) which showed no significant difference in comparison with control group (23.49%). Fish fed LB (0.15) has significantly higher Lipid content (22.06%) when compared with fish fed either LB(0.3) or control diets (19.81 and 20.44%, respectively). Ash analyses indicate a significant decrease in its value in fish fed LB (0.15 & 0.3) diets when compared with control diets. Protein content showed no significant differences between groups.

Table 5 Body compositions of fish fed diets containing 0.15 and 0.3 LB and control after 30 days.

Treatment	DM	Pr	Lipid	Ash
LB (0.15ml)	24.27 ± 0.26^{a}	65.05 ± 0.41^{a}	22.06 ± 0.28^{a}	12.24 ± 0.21^{b}
LB (0.3ml)	22.11 ± 0.46^{a}	$66.93 \pm .0.22^{a}$	19.81 ± 0.28^{b}	12.46 ± 0.08^{b}
Control (0ml)	23.49 ± 0.74^{a}	65.29 ± 0.29^{a}	20.44 ± 0.47^{b}	13.60 ± 0.14^{a}

Values are mean ± S.E. Values within the same column, not sharing common superscript letters are significantly different ($P< 0.05$, n=10).

Discussion

Accumulative effects of chemical additives and its possible threats for human health has made obligatory limits for using these components, as a result, in recent years researchers have tried to introduce natural feed additive such as aromatic and medicinal plants. However, despite of positive achievements of applying herbal medicine in fish diet on their weight gain, physiological changes due to medical herbs use, should not remain hidden. Natural plant products have been reported to promote various activities like anti stress, growth promotion, appetite stimulation, tonic and immunostimulation, and to have aphrodisiac and antimicrobial properties in finfish due to the active principles such as alkaloids, flavanoids, pigments, phenolics, terpenoids, steroids and essential oils (Citarasu, Sekar, Babu & Marian (2002); Sivaram, Babu, Citarasu, Immanuel, Murugadass & Marian (2004)). The herbal extracts, *Astragalus membranaceus*, *Portulaca oleracea*, *Flavescent sophora* and *A. paniculata*, act as an anti-stress and induce the immunological parameters such as serum lysozyme activity, SOD, NOS and levels of total serum protein, globulin, and albumin in *Cyprinus carpio* (Wu, Yuan, Shen, Tang, Gong, Li, Sun, Huang & Han 2007).

According to our knowledge, there are a few studies of *Lippia citrodora* essential oil on fish species. Anesthetic activity of the essential oil of *Aloysia triphylla* and effectiveness in reducing stress during transport of albino and gray strains of silver catfish, have been

[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 13th 2015]

[DOR: 20.1001.1.23453515.2017.3.1.1.1]

[Downloaded from ijaah.ir on 2026-01-22]

[DOI: 10.18869/acadpub.ijaah.3.1.1]

[DOI: 10.18869/acadpub.ijaah.3.1.1]

determined by Thylise, Parodi, Cunha, Alexssandro, Becker, Carla, Zeppenfeld , Dirlaine , Martins , Gessi Koakoski , Leonardo Gil Barcellos , Heinzmann & Baldisserotto (2014). Their research indicated that the EO of *A. triphylla* is an effective anesthetic for albino and gray silver catfish.

The positive effects of different plant components as a growth promoter in aquaculture has been reported previously, e.g. in common carp by using Rheum officinale extract (Xie, Liu, Zhou, Su, He, Pan, Ge, Xu, 2008). Livol (IHF-1000) is an herbal growth promoter containing different plant ingredients such as *Bohaevia diffusa*, *Solanum nigrum*, *Terminaelia arjuna*, Colosynth and black salt has been found to significantly improve digestion, thereby leading to better growth, production and health in cultivable fishes (De Baulney, Quentel, Fournier, Lamour, & Le Gouvello (1996); Shadakshari (1993); Unnikrishnan (1995)). Maheshappa (1993) studied the effect of Livol (IHF-1000) on the rohu, *L. rohita*, the Livol incorporated diet stimulated digestive enzyme activity and led to increased consumption.

In the present study, an improvement in common carp final weight and CF indices was recorded in fish fed diet containing lemon beebrush diet after 30 days but the other measured indices were insignificantly affected among groups. Dietary effect of *Aloysia triphylla* essential oil on fish species has only been determined by Zeppenfeld et al (2015). According to above authors, there was no significant difference for the growth parameters evaluated at 30 days of experiment in silver catfish, which was in contrast with our findings. The highest final weight, RW and SGR were attained after 60 days in fish fed 2.0 mL EO of *A. triphylla* per kg of diet (Zeppenfeld et al, 2015). Most of growth performance in carp species was in high dosage plant supplemented diet. Replacement of fish meal by more than 25% of *spirulina platensis* could significantly increase rohu growth performance (Nandeesha Gangadhar, Varghese & Keshavanath 1998). However, the final weight gain, specific growth rate, food conversion ratio and protein efficiency ratio of common carp were not affected by 25-100% of *Spirulina* supplementation (Nandeesha et al, 1998). Other plant additives, as garlic and ground dried ginger, needed a higher dietary supplementation (10 – 20 g kg^{-1} feed).

Assessment of blood parameters is one of key indices, indicating the physiological statues of fish. Applying herbal supplements has main effect on fish hematology. In present study, Hb and HCT showed considerable decrease in treatments with supplemented diet. The haemoglobin concentration got decreased with increase in concentration of the plant extracts of Mucuna pruriens in lobea rohita (Ojha, Chadha, Sain ,Damroy , Chandraprakash & Sawant 2014) similar to those reported in *C. gariepinus* to cassava effluents and tobacco (*Nicotina tobaccum*) leaf extracts (Adeyemo (2005); Omoniyi, Agbon & Sodunke (2002)) and aqueous leaf extracts of *Lpidagnathis alopecuroides* (Gabriel, Obomanu & Edori 2009). On contrary, a significant increase was found in hemoglobin and hematocrit level in labeo rohita fed diets enriched with mango

[DOI: 10.18869/acadpub.ijaah.3.1.1]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 15th 2019]
[DOR: 20.1001.1.23453315.2017.3.1.3.3]
[DOI: 10.18869/acadpub.ijaah.3.1.1]

kernel powder and garlic (Sahu, Das, Mishra, Pradhan & Sarangi 2007) , in flanders fed with a mixture of herbs including Medicata fermentata, Crataegi fructus, *Artemisia capillaries* and *Cnidium officinale* increased hemoglobin and hematocrit (Ji, Jronh, Gwang-Soon, Lee, Yoo & Takii 2007). Moreover, Dietary effect of *Silybummarianum* extract increased HCT level in common carp (Alishahi, Soltani & Mesbah 2011) and *Zataria multiflora* and *Eucalyptus globolus* essential oil had little effect of hematocrit of common carp (sheikhzadeh, Soltani, Ebrahimzadeh-Mousavi, Shahbazian & Norouzi 2011). The decrease that occurred in the current hematological parameters could be attributed to the fact that the active ingredients in *Aloysia triphylla* play inhibitory roles on the level of these blood indices body.

In aquaculture industry, especially intensive culture, various stressors such as ambient temperature, high stocking density, physicochemical parameters, transport, and confinement induce stress on fish (Chen, Sun, Tsai, Song & Chang 2002). Some Nutritional supplements can alter the levels of cortisol and glucose in the serum of fish which are two key indicators associated to stress response (Li , Burr, Goff, Whiteman, Davise, Vega, Neill & Gatlin (2005) ; Nobahar, Gholipour-Kanani, Kakoolaki & Jafarian 2014). The level of blood glucose abruptly rose in a short time in order to provide the sufficient amount of energy for fish under stress conditions, (Rotllant, Tort, Montero, Pavlidis, Martinez, Wendelaar Bonga & Balm 2003). According to our results, glucose and cortisol have not changed in fish treated with LB essensial oil. Xie et al (2008) showed serum cortisol reduction in stressed common carp treated with anthraquinone extract as an immunostimulant. Moreover, Wendelaar Bonga (1997) reported decrease in glucose and cortisol content in *Megalobrama amblycephala* after temperature stress meanwhile the diet was supplemented with 0.1% Anthraquinone extract or 60 ppm Emodin for 8 weeks . Addition of the 40 and 50 uL L $^{-1}$ EO of *A. triphylla* to the water of transport increased whole-body cortisol levels in silver catfish. On the contrary, the glucose levels were significantly lower in fish transported with EO of *A. triphylla*. Urea level showed increase in 0.15LB treated fish. This raise may be due to kidney dysfunction (Abdelvahab and EL Bahr 2012).

Limited scientific research has been carried out to evaluate the effects of medicinal plant on carcass quality in aquatic animal. Body composition in common carp fed by pellet diet supplemented with LB 0.15 showed significant increase in lipid content. Moreover, in both of LB supplemented diet fish caracass had lower ash content. Common carp body composition in fish fed marshmallow (*Althaea officinalis L.*) extract supplemented diet showed slight changes (Fallahpour, Banaee & Javadzade 2014). Similar results were observed in fish fed with alfa alfa (15 and 20%), soybean meal (30 and 60%) and cottonseed meal (30 and 60%), (Ali, Al-Asgahn, Al-Ogaily & Ali (2003); Toko, Fiogbe & Kestemont (2008)). On contrary, proximate body composition including the levels of moisture, crude protein,

[DOI: 10.18869/acadpub.ijaah.3.1.1]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 15th 2019]
[DOR: 20.1001.1.23453215.2017.3.1.3.3]
[Downloaded from ijaah.ir on 2026-01-22]

crude lipid and ash as % of wet weight were not affected by inclusion of the plant extract in the diets of Nile tilapia, *Oreochromis niloticus* (Abdel, Mostafa, Ahmad, Mousallamy, Samir 2009), red sea bream (Ji et al., 2007). Probably, these differences are due to environmental factors such as temperature (Cordier, Brichon, Weber & Zwingelstein (2002); Tocher, Fonseca-Madrigal, Dick, Ng , Bell & Campbell (2004)) pH and salinity which influence lipid content in fish (De Torrengo & Brenner 1976). In addition, different climate, age and weight of samples have determining effect. In addition, Plant composition as well as the duration of the experiments can affect the response (Citarasu, 2010).

Zeppenfeld et al (2015) reported no significant differences between cat fish fed *A triphylla* EO with regard to the epithelial area. However, the number of folds was higher in fish fed a diet supplemented with 2.0 mL *A. triphylla* EO per kg (Zeppenfeld et al 2015). According to above researchers, the presence of more folds is an indication of enhanced nutrients and electrolytes absorption capacity (Nabuurs (1995); Branco, Soares, Bretas, Cabral, Vieites, Bonaparte & Mota (2010)), this increase may be greater due to higher turnover rate caused by stimuli resulting from the action of active principles of plants and their EOs that promote the rapid growth of villous (Branco et al.2010). Various plant extracts from herbs and spices are reported to improve animal performance by stimulating action on gut secretions or by having a direct bactericidal effect on gut. It seems that, an improvement in the physiological or metabolic status is more responsible for the higher final weight in fish fed 0.15 and 0.3 ml LB/ kg of diet than the diet itself (Escaffre, Kaushik & Mambrini 2007).

In conclusion, the addition of 0.3 mL LB per kg to diet can improve growth performance of common carp. However, its dietary effect on some hematological factors was not encouraging.

Acknowledgements

This research was supported with funding from the Gonbad kavous University. The authors would like to thank to all persons who helped us in doing the experiment.

References

Abdel A., Mostafa Z.M., Ahmad M. H., Mousallamy A., Samir A. (2009) Effect of Using Dried Fenugreek Seeds as Natural Feed Additives on Growth Performance, Feed Utilization, Whole-body Composition and Entropathogenic Aeromonas hydrophila-Challenge of Monosex NileTilapia O. niloticus (L) Fingerlings. Australian Journal of Basic Applied Science 3, 1234-1245.

Abdelwahab A.M., El-Bahr S.M. (2012) Influence of black Cumin seeds (Nigella sativa) and Turmeric (Curcuma longaLinn.) mixture on performance and serum biochemistry of Asian Sea Bass, Lates calcarifer. World Journal of Fish & Marine Science 4(5), 496-503.

[DOI: 10.18869/acadpub.ijaah.3.1.1]

[DOI: 10.18869/acadpub.ijaah.3.1.1]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 15th 2019]
[DOI: 10.18869/acadpub.ijaah.3.1.1]

Adeyemo O.K. (2005) Haematological and histopathological effects of cassava mill effluent in Clarias gariepinus. Afrianc Journal of Biomedical Research 8(3),179-183.

Ali A., Al-Asgahn N.A., Al-Ogaily M.S., Ali S. (2003) Effect of feeding different levels of Alfalfa meal on the growth performance and body composition of Nile Tilapia (Oreochromis niloticus) Fingerlings. Asia. Fishereries Science 16, 59-67.

Alishahi M., Soltani M., Mesbah M. (2011) Effects of Dietary Silybum marinum extract on immune parameters of the Cyprinus carpio. Journal of Vetrinary Research 65(3) 255-263.

Anderson D. P. (1992) Immunostimulants, adjuvants and vaccine carriers in fish: application to aquaculture. In: Faisal, M., Hetrick, F.M. (Eds.), Annual Review of Fish Diseases. Pergamon Press, New York, pp. 281–307.

AOAC (1990) Official methods of analysis,14th edn. Association of official analytical chemists, Washington DC, USA.

Bhadauria M. (2012) Propolis prevents hepatorenal injury induced by chronic exposure to carbon tetrachloride. Evidence-Based Complement & Alternative Medicine, Article ID 235358, 12 pages.

Branco P.A.C., Soares R.T.R.N., Bretas A.A., Cabral N.O., Vieites F.M., Bonaparte T.P., Mota T. (2010) Oleos essenciais em dietas para leit ~ oes rec em-desmamados. Global Science Technology 3, 75 – 83.

Carrera-Quintanar L., Funes L., Viudes E., Tur J., Micol V., Roche E., Pons A. (2010) Antioxidant effect of lemon verbena extracts in lymphocytes of training program. Scandinavian Journal of Medical Science 22(4), 454-61.

Chaney A.L., Merbach E.P. (1962) Modified reagents for determination of urea and ammonia. Clinical Chemistry 8,130-132.

Chen W. H., Sun L. T., Tsai C. L., Song Y. L., Chang C. F. (2002) Cold stress induced the modulation of catecholamine, cortisol, immunoglobulin M, and leukocyte phagocytosis in tilapia General & Comparative Endocrinology. 126, 90–100.

Citarasu T. (2010) Herbal biomedicines: a new opportunity for aquaculture industry. Aquaculture International 18,403–414.

Citarasu T., Sekar R.R., Babu M.M., Marian M.P. (2002) Developing Artemia enriched herbal diet for producing quality larvae in Penaeus monodon. Asian Fisheries Science 15, 21–32.

Chakraborty S.B., Hancz C. (2011) Application of phytochemicals as immunostimulant, antipathogenic and antistress agents in finfish culture. Review in Aquaculture 3, 103-119.

Cordier M., Brichon G., Weber J. M., Zwingelstein G. (2002) Changes in the fatty acid composition of phospholipids in tissues of farmed sea bass (Dicentrarchus labrax) during an annual cycle, Roles of environmental

temperature and salinity. Comparative Biochemistry and Physiology B 133, 281–288.

De Baulny M.O., Quentel C., Fournier V., Lamour F. and Le Gouvello R. (1996) Effect of long-term oral administration of ß-glucan as an immunostimulant or an adjuvant on some non-specific parameters of' the immune response of turbot *Scophthalmus maximus*. Distinguished Aquaculture *Org*. 26, 139-147.

De Torrengo M. P., Brenner R. (1976) Influence of environmental temperature on the fatty acid de saturation and elongation activity of fish (*Pimelodus maculatus*) liver microsomes. *Biochimistry Biophysic Acta*. 424, 36–44.

Escaffre A., Kaushik S., MambriniM. (2007) Morphometric evaluation of changes in the digestive tract of rainbow trout (*Oncorhynchus mykiss*) due to fish meal replacement with soy protein concentrate. Aquaculture 273, 127 – 138.

Fallahpour F., Banaee M ., Javadzade N. (2015) The effects of hydro-alcohol extract of follower of marshmallow (*Althaea officinalis* L.) on some biochemical and hematological parameters in common carp (*Cyprinus carpio* L.). Journal of herbal drug **2**(6), 73-83.

Gabriel U.U., Obomanu F.G., Edori O.S. (2009) Haematology plasma enzymes and organ indices of Clarias gariepinus after intramuscular injection with aqueous leaves extracts of Lepidagathis alopecuroides. African Journal of Biochemistry Research 3(9), 312-316.

Galindo-Villega J., Hosokawa, H. (2004) Immunostimulants: towards temporary prevention of diseases in marine fish. In: Cruz Suarez, L. E., Ricque Marie, D., Nieto Lopez, M. G., Villarreal, D., Scholz, U. and Gonzalez, M. 2004. Avances en Nutricion Acuicola VII. Memorias del VII Simposium Internacional de Nutricion Acuicola. 16-19. Hermosillo, Sonora, Mexico.

Grutter A. S., Pankhurst N. W.(2000) The effects of capture, handling, confinement and ectoparasite load plasma levels of cortisol, glucose and lactate in the coral reef fish *Hemigymnus melapterus.* Journal of fish biology 57, 391-401.

Ji S.C., Jronh G.S., Gwang-Soon I.M., Lee S.W., Yoo J.H., Takii K.(2007) Dietary medicinal herbs improve growth performance, fatty acid utilization, and stress recovery of Japanese flounder. Fisheiesr Science 73(1), 70-76.

Li P., Burr G. S., Goff J., Whiteman K. W., Davise K. B., Vega R. R., Neill W. H., Gatlin D.M. (2005) A preliminary study on the effects of dietary supplementation of brewer's yeast and nucleotides, singularly or in combination, on juvenile red drum (*Sciaenops ocellatus*). Aquaculture research 36, 1120-1127.

Maheshappa K. (1993) Effect of different doses of livol on growth and body composition

[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 19th 2021]
[DOR: 20.1001.1.23453515.2017.3.1.3.1]
[Downloaded from ijaah.ir on 2026-01-22]
[DOI: 10.18869/acadpub.ijaah.3.1.1]
[DOI: 10.18869/acadpub.ijaah.3.1.1]

[DOI: 10.18869/acadpub.ijaah.3.1.1]
[Downloaded from ijaah.ir at 1:13 +0430 on Monday April 15th 2019]
[DOR: 20.1001.1.23453515.2017.3.1.3.3]
[Downloaded from ijaah.ir on 2026-01-22]
[DOI: 10.18869/acadpub.ijaah.3.1.1]

of rohu, *Labeo rohita* (Ham.) M.F.Sc Thesis, University of Agricultural Science, Bangalore, p 59

Nabuurs M.J.A. (1995) Microbiological, structural and functionalchanges of the small intestine of pigs at weaning. *Pig News Information* 16 , 93 – 97.

Nandeesha M.C., Gangadhar B., Varghese T.J., Keshavanath P. (1998) Effect of feeding *Spirulina platensis* on the growth, proximate composition and organoleptic quality of common carp, *Cyprinus carpio* L. Aquaculture Research 29(5), 305–312.

Nobahar Z., Gholipour-Kanani H., Kakoolaki S.H., Jafarian H. (2014) Assessment of stress response in great sturgeon (*Huso huso*) associated with dietary intake of some herbal plants. Iranian Journal of Aquatic Animal Health 1(1) 63-69.

Ojha M.L., Chadha N.K., Sain V.P,, Damroy I., Chandraprakash S., Sawant P.B.(2014) Effect of ethanolic extract of *Mucuna pruriens* on growth, metabolism and immunity of *Labeo rohita* (Hamilton, 1822) fingerlings. International Journal of Fauna & Biological Studies 1 (5), 1-9.

Omoniyi I, Agbon A.O., Sodunke S.A. (2002) Effect of lethal and sub lethal concentrations of tobacco (*Nicotiana tabacum*) leaf dust extract on weight and hematological changes in *Clarias gariepinus* (Burch.). Journal of Applied Science and Environmental Management 6(2), 37-41.

Parodi T.V., Cunha M.A., Becker A.G., Zeppenfeld C.C., Martins D.I., Koakoski G., Barcellos L.G., Heinzmann B.M., Baldisserotto B. (2014) Anesthetic activity of the essential oil of *Aloysia triphylla* and effectiveness in reducing stress during transport of albino and gray strains of silver catfish, *Rhamdia quelen*. Fish Physiology and Biochemistry 40(2), 323-34.

Purohit S.S., Mathur S.K. (1999) Drugs in Biotechnology fundamentals and applications. Purohit SS. Maximillan publishers, India. p. 576.

Rotllant J., Tort L., Montero D., Pavlidis M., Martinez M., Wendelaar Bonga S. E., Balm P. H.(2003) Background color influence on the stress response in cultured red porgy *Pagrus pagrus*. Aquaculture 223, 129–139.

Sahu S., Das B.K., Mishra B.K., Pradhan, J ., Sarangi, N. (2007) Effect of *Allium sativum* on the immunity and survival of *Labeo rohita* infected with *Aeromonas hydrophila*. Journal of Applied Ichtyology 23, 80-86.

Sakai M. (1999) Current research status of fish immunostimulants. Aquaculture 172, 63-92.

Shadakshari G.S. (1993) Effect of bioboost forte, Livol and Amchemin AQ on growth and body composition of common carp, *Cyprinus carpio* (Linn.). M.F.Sc. Thesis, University of Agriculture Sciences, Bangalore, p 155

Sheikhzadeh N., Soltani M., Ebrahimzadeh-Mousavi H. A., Shahbazian N., Norouzi M.(2011) Effects of *Zataria multiflora* and *Eucalyptus globolus* essential oils on haematological parameters and respiratory burst activity in *Cyprinus carpio*. Iranian Journal of Fisheries Science 10(2), 316-323.

Sivaram V., Babu M.M., Citarasu T., Immanuel G., Murugadass S., Marian M.P. (2004) Growth and immune response of juvenile greasy groupers (*Epinephelus tauvina*) fed with herbal antibacterial active principle supplemented diets against Vibrio harveyi infections. Aquaculture 237, 9–20.

Stoskopf M.K. (1993) Fish medicine. Philadelphia, PA: Saunders W.B.

Thaylise V., Parodi M., Cunha A., Alexssandro G., Becker C., Carla C., Zeppenfeld ., Dirlaine I. M. , Gessi Koakoski , Leonardo G.B., Heinzmann M., Baldisserotto, B. (2014) Anesthetic activity of the essential oil of Aloysia triphylla and effectiveness in reducing stress during transport of albino and gray strains of silver catfish, *Rhamdia quelen*. Fish Physiology and Biochemistry 40, 323 – 334.

Tocher D. R., Fonseca-Madriga J., Dick, J.R., Ng W.K., Bell J.G., Campbell P.J. (2004) Effects of water temperature and diets containing palm oil on fatty acid desaturation and oxidation in hepatocytes and intestinal enterocytes of rainbow trout (*Oncorhynchus mykiss*). Comparative Biochemistry Physiology B 137(1), 49–63.

Toko I.I., Fiogbe E.D., Kestemont P. (2008) Growth, feed efficiency and body mineral composition of juvenile vundu catfish (Heterobranchus longifilis, Valenciennes 1840) in relation to various dietary levels of soybean or cottonseed meals. Aquaculture Nutrition 14(3), 193–203.

Unnikrishnan G. (1995) Effect of Livol on growth, food utilization and body composition of the Indian major carp, *Catla catla* (Ham.). M.Sc. Dissertation, University of Kerala, India, p 34

Wendelaar Bonga, S.E. (1997) The stress response in fish. Physiol. Rev. 77, 591-625

Wu G., Yuan C., Shen M., Tang J., Gong Y., Li D., Sun F., Huang C., Han X. (2007) Immunological and biochemical parameters in carp (Cyprinus carpio) after Qompsell feed ingredients for longterm administration. Aquaculture Research 38(3), 246–255.

Xie J., Liu B., Zhou Q., Su Y., He Y., Pan L., Ge X ., Xu P. (2008). Effects of anthraquione extract from rhubarb Rheum officinale Bail on crowding stress response and growth of common carp *Cyprinus carpio* var. Indian Aquaculture 281, 5-11.

Zeppenfeld C.C., Toni C., Becker A.G. (2014) Physiological and biochemical responses of silver catfish, Rhamdia quelen, after transport in water with essential oil of *Aloysia triphylla* (L'Herit) Britton. Aquaculure 418, 101 – 107.

[Downloaded from ijaah.ir on 2026-01-22]

[DOI: 10.18869/acadpub.ijaah.3.1.1]

Zeppenfeld C.C., Hernández D.R., Santinón J.J., Heinzmann B.M., Da Cunha M.A., Schmidt D., Baldisserotto B. (2015) Essential oil of Aloysia triphylla as feed additive promotes growth of silver catfish (*Rhamdia quelen*). Aquaculture nutrition 22(4), 933-940.

[DOI: 10.18869/acadpub.ijaah.3.1.1]
Downloaded from ijaah.ir at 1:13 +0430 on Monday April 19th 2021 [DOI: 10.18869/acadpub.ijaah.3.1.1]

[Downloaded from ijaah.iau.ir on 2026-01-22]

[DOR: 20.1001.1.23453515.2017.3.1.3.13]
[Downloaded from ijaah.iau.ir at 4:13 +0430 on Monday April 19th 2021]

[DOI: 10.18869/acadpub.ijaah.3.1.1]

اثر رژیم غذایی اسانس *Lippia citrodora* بر برخی از عملکرد هماتولوژیک، بیوشیمیایی، عملکرد رشد و ترکیب بدن *Cyprinus carpio*

حسنا قلی پور کنعانی*[1]، فاطمه جمالی[1]، حجت ا... جعفریان[1]، ابراهیم غلامعلی پور علمداری[2]

[1] گروه شیلات، دانشکده کشاورزی و منابع طبیعی، دانشگاه گنبد کاووس، گلستان، ایران

[2] گروه تولیدات گیاهی،دانشکده کشاورزی و منابع طبیعی، دانشگاه گنبد کاووس، گلستان، ایران

چکیده

این تحقیق به منظور بررسی تاثیر نسبت های مختلف روغن اسانس بره بر روی عملکرد رشد، ترکیب لاشه و هماتولوژی و پارامترهای بیوشیمیایی کپور معمولی (*Cyprinus carpio*) انجام شد. کپور معمولی با وزن متوسط ۲ ± ۸ گرم برای یک ماه با رژیم غذایی حاوی اسانس مارچوبه (۰/۱۵ و ۰/۳ میلی لیتر) و رژیم غذایی معمول به عنوان شاهد تغذیه شد. عملکرد روزانه، ترکیب بدن، عوامل بیوشیمیایی و هماتولوژیک در روز ۳۰ اندازه گیری شد. نتایج مطالعه حاضر نشان داد که نمونه های تغذیه شده با رژیم غذایی حاوی Beebrush EO در هر دو دوز قابل توجه افزایش وزن نهایی ($p < ۰/۰۵$). گروهی از ماهی های خوراکی با میزان ۰/۱۵ و ۰/۳ LB در رژیم غذایی پایین ترین سطح در شاخص های Hb و هماتوکریت داشتند ($p >۵۰/۰$). محتوای لیپید در ماهی خوراکی ۰/۱۵ لیتر خوراکی و رژیم غذایی افزوده شده ماهیان خاویاری کاهش یافت.

کلمات کلیدی: مارچوبه، هماتولوژی، رشد، کپور

* نویسنده مسئول: gholipourk@gmail.com