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Short communication

Effects of *Ocimum basilicum* extract on growth performance, survival rate, and body composition of white leg shrimp (*Litopenaeus vannamei*)

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Introduction

The crustacean culture is the third largest aquaculture industry with an annual production of 10.5 million tons in 2019 (FAO, 2023). Among the potential shrimp species, whiteleg shrimp (*Litopenaeus vannamei*) is native to the eastern Pacific Ocean and a highly desirable species for culture in many countries. Common basil (*Ocimum basilicum* L.) is a member of the Lamiaceae family which is cultivated commercially in many countries grows in several regions around the world and that has been extensively utilized in food as a flavoring agent (Sajjadi, 2006). Accordingly, it was necessary to throw some more light on using basil in shrimp farmed diets and study its effects on shrimp performance. Nutrition of western white leg shrimp is an area of research that has recently received considerable attention because of the influence of nutrition on growth and health as well as on cost of production. The present study was conducted to investigate the effects of basil extract, as growth promoters and feeding attractants; on growth, feed conversion, nutrient retention efficiencies, body composition, biometric measurement indices for *L. vannamei*.

Materials and methods

Extraction of O. basilicum

O. basilicum were collected from various geographical locations at Behbahan, Iran. The plants were rinsed with tap water and then sterile water, air dried in the shade, ground to a fine powder, sieved and consequently the extraction was done according to Hanachi *et al*. (2018) instructions.

Shrimp rearing

L. vannamei juveniles were obtained from a private shrimp farm in Choebdeh, Abadan, and acclimatized to the laboratory condition for three weeks. Then healthy shrimp juveniles (5.0–5.5g) were randomly distributed in 12 tank (1000-L) at a density of 30 shrimp/tank to represent four treatments (three experimental treatments and one control treatment) in triplicates. The first treatment as a control group did not contain basil extract and the second, third and fourth treatments had 60, 120 and 240 mg/L extracts, respectively. The photoperiod was regulated to a 12:12 dark/light cycle and molts, feces and dead shrimps were daily removed and 30% of water in each tank was exchanged by new sea water. Biometry was done once a week. For each experimental treatment, basil extract was sprayed on food at the concentrations and was ready for consumption after drying (Gudipati, 2017) and animals were fed on the experimental diets up to apparent satiety four times a day at 7:00, 13:00, 17:00 and 21:00 h for 56 days. Water quality parameters were mentioned on weekly basis through the experimental period using the standard methods of APHA (1998). The parameters were water temperature (27±0.43°C), dissolved oxygen (7.8±0.5 mg/L), salinity (18±0.4 g/L), and pH (7.9±0.4).

Carcass analysis

Approximate chemical components of diets and shrimp muscles at beginning and end of the experiment were determined according to methods of AOAC (2012).

Data processing and statistical analysis

At the end of the feeding trial, ten shrimp from each tank were sampled for determination of body indices and whole-body proximate composition. All statistical analyses were done using the SPSS program (V. 23).

Results and discussion

At the end of the 56 days feeding trial, *L. vannamei* samples obtained maximum weight gain of 6.2±0.12 g in 120 mg/L treatment but the minimum weight gain of 5.7±0.1 g was displayed in 240 mg/L treatment that difference was significant (p<0.05). Also, no significant difference (p<0.05) in WG, GR, weight SGR, BWI and CF were found between treatments and the control group (Table 1).

At the end of the 56 days feeding trial, VFI was high in control group and lowest rate for shrimp fed by the diet with 120 mg/L *O. basilicum* extract supplementation (p< 0.05). The FCR followed the same pattern as the VFI (Table 2).

The inclusion of materials/extracts plants in aquatic diets has been studied, and positive results have been documented (Abdel-Tawwab *et al*., 2021). Their phytobiotics activity, such as eucalyptol, α-bergamotene, eugenol, γ-cadinene, linalool, methyl cinnamate, bicyclosesquiphellandrene, and germacrene D (Ahmed *et al*., 2019) has made them suitable substitutes for antibiotics, growth promoters, and immune boosters. Several studies on various plant extracts demonstrated that they can stimulate the appetite and promote weight gain when given to cultured fish (Pavaraj *et al*., 2011).

Table 1: Growth characteristics (± SE) of white leg shrimp *Litopenaeus vannamei*, fed different levels of *Ocimum basilicum* extract (mg/L) for 56 days.

Parameters	Treatments			
	0 (control)	**60**	**120**	**240**
Initial weight(g)	5.3	5.3	5.2	5.4
Final weight(g)	11.45 ± 0.17[ab]	11.46 ± 0.10[ab]	11.73 ± 0.11[b]	11.20 ± 0.22[a]
Final length (mm)	6.73 ± 0.05[a]	6.73 ± 0.05[a]	6.90 ± 0.00[b]	6.63 ± 0.05[a]
Weight gain (g)	5.9 ± 0.18[ab]	5.9 ± 0.10[ab]	6.23 ± 0.12[b]	5.7 ± 0.1[a]
Length gain (mm)	4.73 ± 0.05[a]	4.73 ± 0.05[a]	4.9 ± 0.00[b]	4.63 ± 0.05[a]
SGR in weight (%day)	3.17 ± 0.05[ab]	3.18 ± 0.03[ab]	3.26 ± 0.03[b]	3.10 ± 0.02[a]
SGR in length	2.77 ± 0.02[b]	2.77 ± 0.02[b]	2.83 ± 0.00[b]	2.67 ± 0.04[a]
Body Weight Index (%)	108.2 ± 3.22[ab]	108.53 ± 1.91[ab]	113.41 ± 2.19[b]	103.74±1.65[a]
Growth Rate	0.096 ± 0.005[a]	0.1 ± 0.00[a]	0.1 ± 0.00[a]	0.1 ± 0.005[a]
Condition Factor	3.74 ± 0.07[ab]	3.75 ± 0.12[ab]	3.56 ± 0.03[a]	3.83 ± 0.12[b]
Survival Rate	90 ± 2[a]	83.66 ± 2.08[a]	86.33 ± 0.57[b]	82 ± 3.6[ab]

Means having the same letter in the same row are not significantly different at $p<0.05$.

Table 2: Feed utilization (± SE) of white leg shrimp *Litopenaeus vannamei*, fed different levels of *Ocimum* basilicum extract (mg/L) for 56 days.

Parameters	Treatments			
	0 (control)	**60**	**120**	**240**
Voluntary Feed Feed Intake (g)	28.22 ± 0.5[b]	27.44 ± 0.38[ab]	25.44 ± 1.26[a]	26 ± 0.88[a]
Feed Efficiency (%)	21.09 ± 0.98[a]	21.75 ± 0.68[ab]	24.56 ± 1.73[b]	21.95 ± 0.45[ab]
Feed Conversion Ratio	2.53 ± 0.12[b]	2.45 ± 0.07[ab]	2.18 ± 0.15[a]	2.43 ± 0.04[ab]
Protein Efficiency Ratio	0.136 ± 0.00[ab]	0.136 ± 0.00[ab]	0.143 ± 0.00[b]	0.130 ± 0.00[a]

Means having the same letter in the same row are not significantly different at $p<0.05$.

The present study revealed that the Decrease in shrimp weight and survival rate with the increase in the extract levels in diets more than the control diet. The reduction in final weight gain, mean weight gain, PER, FE and SGR in weight and growth rate of shrimp beyond ≥ 240 mg/L were similar to (Adewole and Faturoti, 2017) who reported similar reduction in the live weight of *Clarias gariepinus* beyond 2.0 g/100g body weight. *O. gratissimum*, which implied a reduction in growth rate. It appears that neem bioactive compounds such as estragole are responsible for depression in nutrient utilization and growth in aquatics. Similarly, the leaves of *O. gratissimum* have been repeated to contain saponins. Saponins are known to be toxic to body systems (Edeoga *et al*., 2006). Edeoga *et al*. (2006) further reported that it is likely that the toxic potential of the *O. gratissimum* oil is due to thymol. Similarly, there are reduce in all growth and nutrition parameters in shrimp fed with 240 mg/L diets. The extract herbs being used as spices, could be better tolerated at lower inclusion levels, because spices or additives have some chemical compounds that may be harmful to aquatic especially if used in excess of recommendation Bameri *et al*. (2021). Mansour *et al*. (2023) reported that fish fed ethanol extracts of *Ocimum* *basilicum* gained higher final weight than those fed aqueous extracts supplemented diet. Nguyen *et al*. (2021) reported that the extraction techniques could affect the phytochemical constituents of the extract and consequently the biological properties. *Ocimum basilicum* ethanolic and aqueous extracts have several compounds as alkaloids, flavonoids, saponins, coumarins, reducing sugar, terpenoids, and tannins (Nguyen *et al.*, 2021). However, reducing sugar and saponin were not detected in ethanolic extracts as well as alkaloids were not present in aqueous extracts, which could interpret the difference in fish responses with both extracts. Analysis of the carcass composition is a good biomarker of the quality of shrimp muscles, in the present study, no significant changes were observed in contents of moisture, crude protein, total lipids and ash (Table 3). Abdel-Tawwab *et al*. (2020) found no significant differences in proximate body composition of *Penaeus indicus* fed diets supplemented with diets containing *O. basilicum* oil. On the other hand, Bameri *et al*. (2021) found the highest value for carcass crude protein content in *L. vannamei* fed a diet containing 5 g/kg diet of *Salicornia persica* ethanolic extract.

Table 3: Proximate chemical composition (%) of muscles of white leg shrimp, *Litopenaeus vannamei*, fed different levels of *Ocimum basilicum* extract, for 56 days.

Parameters	Treatments (mg/L)			
	0 (control)	**60**	**120**	**240**
Crude protein	17.1± 0.13	19.2± 0.43	18.1± 0.11	18.8± 0.33
Moisture	76.12± 2.23	72± 2	74± 3.23	76.12± 2.03
Total lipids	0.52± 0.063	0.51± 0.052	0.42± 0.050	0.41± 0.021
Total ash	2.4± 0.06	2.1± 0.07	2.1± 0.08	1.8± 0.07
Fiber	0.21± 0.02	0.22± 0.08	0.20± 0.05	0.19± 0.04
Carbohydrate	2.85± 0.16	2± 0.05	2± 0.06	1.65± 0.09

No significant changes were observed (mean±SE, $p<0.05$).

In conclusion, dietary *O. basilicum* extract supplementation had no significant effects on the growth performance, survival rate**,** Feed utilization and carcass composition of Western white leg shrimp juveniles. The positive results obtained encourage conducting further research on the administration of *O. basilicum* extract on Western white leg shrimp or other economically important species but with longer duration of culture period. Determination of the mechanisms of action and optimal inclusion levels is a topic recommended for further research.

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