Research article

Effect of Different Dietary Nutritional Compositions on Clark's Anemonefish (*Amphiprion clarkii*) Growth

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Abstract Clark's Anemonefish (*Amphiprion clarkii*) is one of marine ornamental fish. The nutritional requirements of *A. clarkii* are important for their growth. This study aimed to assess the effect of different diets on *A. clarkii* growth performance. The experiments comprised of three treatments including (1) grinding pacific white shrimp (*Litopenaeus vannamei*), (2) grinding white perch fish (*Lates calcarifer*), and (3) grinding surf clam (*Paphia undulata*). Growth rate, survival rate, and other growth parameters were studied within 30 days after starting of the experiments. Results indicated that growth rate of *A. clarkii* based on weight and length was highly significant on grinding white perch fish treatment. Average daily growth was also the best on grinding white perch fish treatment (0.46±0.09 g), followed by ground pacific white shrimp (0.37±0.04 g) and grinding surf clam (0.35±0.03 g), respectively. Survival rate showed significant difference on grinding surf clam (97.78±3.85%), followed by grinding pacific white shrimp (75.57±8.38%) and grinding white perch fish (64.44±5.09%), respectively. Food conversion ratio tended to be better on grinding white perch fish. This finding indicates that grinding white perch fish could be used as dietary source of *A. clarkii*.

Keywords Clark's Anemonefish, marine ornamental fish, nutritional requirement, nutritional composition

INTRODUCTION

Marine ornamental fish are one of the most popular attractions world-wide due to adaptability to live in confinement. The tropical ornamental fish has increased trust among aquarists due to their multitudinous color and gorgeousness (Ghosh et al., 2011). Thus, marine ornamental aquaculture has become economically feasible, and much interest has been generated for inland (Watson and Hill, 2006). Feed composition and water management in containing tank are important. Dietary

sources are important to fish growth (Koedprang ,2006), especially fish are rare in high density indoor systems or confined in cage and cannot forage freely on natural feeds. They must provide complete diet (Craig and Helfrich, 2009). The protein requirements of fish seem to be higher than terrestrial animals (Lovell, 1988). The commercial fish feed was designed to complete nutritional intake for the marine ornamental fish growth, which has an impact to the high price. The enriched live feed, the rotifers and artemia had to prepare by using microalgae for feeding the fish (Madhu et. al., 2013). Artemia could be a good alternative live feed to be used in the hatchery of ornamental fish but lack of the facilitated supplies (Lim et. al., 2003). Limited supply and high cost of fish meal have forced fish nutritionists to search for alternative protein sources (Silva et al., 2010). The application of live feeds in marine ornamental fish culture has been hampered by the lack live feed information for feeding the fish. Live feeds of nutritional composition were the alternative diets with comparable nutritional quality that needed to maintain the cost competitiveness of marine ornamental fish and remained healthy in suitable diet, which could be contributed to enhancing growth of Clark's Anemonefish culture.

OBJECTIVE

This study aimed to assess the growth rate, survival rate, and other growth parameters of Clark's Anemonefish fed by three different nutritional compositions.

METHODOLOGY

Fish source

Two hundred and seventy larvae of Clark's Anemonefish (*Amphiprion clarkii*) were obtained from the ornamental fish culture at Krabi Coastal Fisheries Research and Development Center, Krabi province and transported to the hatchery at Division of Fisheries, Rajamangala University of Technology Thanyaburi, Pathum Thani province. The total of *A.clarkii* all between 1.5-3 cm in length was acclimatized in a conditioning tank for three days by using natural seawater with salinity maintained at 30 psu after passing through a sandy filter. Then, fish were distributed into nine 100-liter tanks (100 L capacity; 30 individuals per tank). The experiments were assigned for 30 days study period.

Experimental design

The experiments followed a completely randomized design (CRD) comprising three feed treatments of grinding pacific white shrimp (*Litopenaeus vannamei*) (T1), grinding white perch fish (*Lates calcarifer*) (T2), and grinding surf clam (*Paphia undulata*) (T3). The larvae were fed on the three different diets twice a day, 08:30 and 16:00 h, at a rate of 3–4% of their body weight per day. After one hour of each feeding, uneaten diet and fecal matter were siphoned out of the tanks.

The proximate nutritional compositions (protein, lipid, fiber, ash, moisture, and dry matter) in the experimental diets were analyzed according to Association of Analytical Chemists (AOAC, 2000). The number of dead fish was recorded during the experiments. Length and weight data were recorded at the 30th day after the start of the experiment to determine the growth performance. Average daily growth (ADG) as in Eq. (1) , survival rate (SR) as in Eq. (2), and food conversion ratio (FCR) as in Eq. (3) were calculated using the equations,

$$ADG = (W_e - W_s)/t \quad (1)$$

where W_e was the weight at the end of the experiment, W_s was the weight at the start of the experiment, and t was the number of days.

$$SR = ((N_e - N_s)/N_s) \times 100 \quad (2)$$

where N_e was the number of fish alive at the end of the experiment, and N_s was the number of fish alive at the start of the experiment.

$$FCR = W_f/W_t \quad (3)$$

where W_f was the feed intake, and W_t was the total weight of fish at the end of the experiment.
The general water quality factors, namely temperature, salinity, and pH were measured with a multi-parameter probe (YSI-6600 Sonde instrument, USA).

Data analysis

Analysis of variance (ANOVA) was used to consider the growth factors for each treatment. The significance between the means was compared by using Duncan's new multiple range test (DMRT) at a probability level of 0.05 ($p<0.05$).

RESULTS AND DISCUSSION

Average weight of *A. clarkii* at the end of the experiment (W_e) was significantly affected by different types of diets ($p<0.05$), the highest average weight was on grinding white perch fish treatment (0.46±0.09 g), followed by ground pacific white shrimp (0.37±0.04 g), and grinding surf clam (0.35±0.03 g), respectively. The final length of fish varied between 2.49±0.13 cm, as found in T3 to 2.86±0.15 cm, as found in T2 ($p<0.05$). The results indicated that growth rate of *A. clarkii*, in terms of weight and length,were better in grinding white perch fish treatment (T2) (Table 2). According to Chambel et al. (2015), it was reported that Percula Clownfish (*Amphiprion percula*) averaging 1.92±0.01 cm size was treated by using commercial marine fish diets with different crude protein levels, 52.5, 48, 41, and 38%. Results showed the final length of *A. percula* varied between 2.865±0.066 to 3.108±0.066 cm.

Different types of diets also significantly affected on average daily weight (ADG) and survival rate ($p<0.05$), the highest ADG were recorded on grinding white perch fish (0.008±0.001 g/day), and the lowest one in those fed on grinding surf clam (0.004±0.000 g/day). Survival rate (SR) values showed the highest significant in T3 (97.78±3.85%). No statistically significant difference was found on food conversion ratio (FCR) fed on different diets. However, T2 tended to reveal the highest value (10.92±2.47) as shown in Table 2. This study indicated that the diets effected to *A. clarkii* growth performance.

Water quality during culture period showed that water temperature, pH, and salinity varied from 21.0-26.0 ^oC, and 7.0-8.0, and 30-32 psu, respectively. Those parameters had no significant difference by different diets ($p>0.05$). In this study, the water quality factors were similar to results obtained by Chambel et al., (2015) in the *A. percula* culture.

Table 1 Growth parameters (mean±SD) of Clark's Anemonefish fed on the three diet treatments

Parameters	Diets		
	Treatment 1	Treatment 2	Treatment 3
W_s (g)	0.19±0.06a	0.19±0.05a	0.20±0.06a
W_e (g)	0.37±0.04b	0.46±0.09a	0.35±0.03b
L_s (cm)	1.94±0.25a	1.93±0.16a	1.98±0.21a
L_e (cm)	2.69±0.13b	2.86±0.15a	2.49±0.13c
ADG (g/day)	0.005±0.000b	0.008±0.001a	0.004±0.000b
SR (%)	75.57±8.38b	64.44±5.09b	97.78±3.85a
FCR	12.55±4.36a	10.92±2.47a	14.80±3.85a

Weight at the start (W_s) and the end (W_e) of the experiment, length at the start (L_s) and the end (L_e) of the experiment, average daily growth (ADG), survival rate (SR), and food conversion ratio (FR). The values in each row followed by the same letter are not significantly different ($p<0.05$).

Growth performance of fish could be assessed from protein requirement depended on the dietary feed intake of fish. The nutritional composition of the three diets is shown in Table 2. Protein and lipid composition showed high level in T2 (19.81% and 0.03%) followed by T1, and T3, respectively (Table 2). The optimal protein level in dietary feed played the key role to produce maximum weight gain in the least time (Martínez et al., 2004). Chuapoehuk (1999) reported that the kinds of aquatic animal that had the high level of protein and energy were fish (20.4% and 111 calories/100g), shrimp (19.7% and 94 calories/100 g) and clam (12.3% and 63 calories/100 g), respectively. The optimal protein level in the diet of fish raised in captivity and most fish farmers used complete diets containing required protein 18-50% (Craig and Helfrich, 2009). In addition, Chambel et al. (2015) indicated that the compound diet of 40% protein would provide nutrients that would ensure optimal growth of *A. percula*.

Table 2 Composition of the feeds (%) in each treatment

Parameters	Diets		
	Treatment 1	Treatment 2	Treatment 3
Protein	18.31	19.81	14.25
Lipid	0.01	0.03	0.02
Fiber	0.04	0.08	0.12
Ash	1.09	1.11	1.32
Moisture	77.35	79.54	79.91
Dry matter	22.65	20.46	20.09

CONCLUSION

This study indicated that grinding white perch fish had significant effect on Clark's Anemonefish growth in terms of weight, length, and average daily growth. Based on this study, grinding white perch fish had the optimal protein levels for growth performance and could be included in diet for Clark's Anemonefish culture.

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