

Effect of enhanced *Artemia* with gamat emulsion on growth performance and survival rate of white shrimp *Litopenaeus vannamei* larvae

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Abstract. The objective of this research was to determine the effect of nauplius *Artemia* sp. enriched with different doses of gamat emulsion extract on growth performance and survival rate of white shrimp, *Litopenaeus vannamei* larvae. We used a completely randomized design with six treatments and three replication. Tested treatments were A; *Artemia* sp. without enriched by gamat emulsion extract (control), B; *Artemia* sp. enriched with 1 ml / L gamat emulsion, C; *Artemia* sp. enriched with 5 ml / L gamat emulsion, D; *Artemia* sp. enriched with 10 ml / L gamat emulsion, E; *Artemia* sp. enriched with 15 ml / L gamat emulsion and F; *Artemia* sp. enriched with 20 ml / L gamat emulsion fed for 12 days. Results showed that the administration of nauplius *Artemia* sp. enriched with gamat emulsion extract had a significant effect on larval weight gain (WG), length gain (LG) and survival rate (SR) ($P < 0.05$), but no significant effect on specific growth rate (SGR) ($P > 0.05$). The optimum weight gain (WG), length gain (LG) and survival rate were found at treatment D; 10 ml / L gamat emulsion extract concentration with 0.00065 ± 0.000057 g, 3.43 ± 0.12 cm and 86.67 ± 7.09 % respectively. Thus it can be concluded that the use of gamat emulsion extract is recommended to enrich nauplius *Artemia* as live feed for white shrimp *Litopenaeus vannamei* larvae feeding.

1. Introduction

White shrimp *Litopenaeus vannamei* has high nutritional value, rapid growth and great prospects as the leading commodity exchange earners in the country because of the high demand for domestic consumption and export. Increasing demand for the shrimp has consequences on the supply of high-quality larvae. Furthermore, the good quality larvae were highly determined by the quality feed provided to the shrimp broodstock [1].

One of the decreasing factors of shrimp larvae quality is due to the mismatch of feed used in shrimp hatchery. The discrepancy of the lacking of nutrition content in shrimp diet can lead to larvae production failure. The incompatibility of shrimp feed size also affects the shrimp nutritional needs [2, 3]. To overcome failure in shrimp larvae production, the use of live feed is necessary due to its high nutritional content, especially protein and amino acids.

Artemia sp. is a kind of tiny shrimp. *Artemia* sp. is one of common live feed used in shrimp larvae hatchery. *Artemia* sp. contains lots of nutrients, especially proteins and amino acid acids [4, 5]. *Artemia* sp. is a non-selective filter feeder so that the nutritional quality depends on the quality of its media [6]. One effort to enhance the nutrient content of *Artemia* sp. is to enrich the nauplius *Artemia* sp. through its feed. [6] mentioned that the nutritional value of *Artemia* sp. can be increased through the feed. Enrichment efforts are considered to be more efficient because nauplius *Artemia* sp. can be used as a medium that can bring ingredients to improve its nutrition [7].

In *Artemia* sp. contains up to 52.7% protein, but the low content of essential fatty acids such as EPA, DHA, and vitamins. One of the efforts to improve the nutrition of *Artemia* sp. to fit the needs of the shrimp is to enrich the Nauplius of *Artemia* sp. through the feed [8]. Gamat emulsion is the extract of sea cucumber from genus Holothuroidea. Gamat emulsion is economically known for its high nutritional



content. Sea cucumber extract contains high protein as 82%, 1.7% of lipid, 8.9% of water, 8.6% ash, 4.8% of carbohydrate and essential amino acid like 3.69% of DHA [9]. There is very limited research about the use of gamat emulsion to enrich artemia recently. Therefore, the objective of this study was to investigate the effect of nauplius *Artemia* sp. enriched with different doses of gamat emulsion extract on growth performance and survival rate of white shrimp, *Litopenaeus vannamei* larvae.

2. Materials and Methods

2.1 Time and site

This research was conducted at the SUPM N Ladong Hatchery. Jln. Laksamana Malahayati, km. 27 Desa Ruyung, Kecamatan Mesjid Raya, Aceh Besar during January to February 2018.

2.2 Experimental design

This study used a completely randomized design method (CRD), with six treatments and three replication. The treatment tested consisted of enriching *Artemia* sp. with gamat emulsion as follows:

Treatment A; *Artemia* sp. without enriched by gamat emulsion extract (control),

Treatment B; *Artemia* sp. enriched with 1 ml/L gamat emulsion,

Treatment C; *Artemia* sp. enriched with 5 ml/L gamat emulsion,

Treatment D; *Artemia* sp. enriched with 10 ml/L gamat emulsion,

Treatment E; *Artemia* sp. enriched with 15 ml/L gamat emulsion and

Treatment F; *Artemia* sp. enriched with 20 ml/L gamat emulsion.

Preparation of the container began by preparing a container in the form of a bucket of 25 liters and a water reservoir. Containers for jars, water reservoirs, aeration hoses, aeration stones and shavings soaked with chlorine 30 ppm for 30-60 minutes to kill microorganisms [10]. The tools that had been soaked then rinsed with clean water until clean then dried under the sun. The clean container was filled with seawater with a salinity of 30 ppt as much as 20 liters/container.

2.3 Shrimp preparation

Shrimp Larvae were obtained from the SUPM Negeri Ladong from PL1 to PL12. Then shrimp larvae were kept in a 30 L jar with a stocking density of 100 fish/container for 12 days. Length measurements were carried out using calipers with an accuracy level of 0.01 mm and weight measured with a digital scale with an accuracy of 0.0001g.

Enrichment of *Artemia* sp.

Artemia sp. hatched at 7:00 p.m. at 27-30 ppt in a funnel-shaped container with a volume of 1.5 liters. *Artemia* sp. after hatching, it was enriched with gamat emulsion for 5 hours at 09.00 AM and 21.00 PM [11]. During the rearing, shrimp larvae were fed in the form of *Artemia* sp. enriched and artificial feed. The feed was given every five times a day, at 07.00 AM, 11.00 AM, 15.00 PM, 19.00 PM and 23.00 PM [10].

2.4 Water quality parameters

Water quality during the research process was well controlled according to the optimum environment for the maintenance of shrimp larvae. Measurement of water quality parameters was carried out every day.

2.5 Test parameters

The following variables were calculated:

Survival Rate (SR) was calculated using the formula [12, 13]:

$$SR = \frac{N_0 - N_t}{N_0} \times 100$$

Information :

SR = Survival Rate (%), N_t = Total shrimp death during the study, N_0 = Initial number of live shrimp
Weight gain (WG), calculation of absolute weight growth using the formula [4] as follows:

$$\Delta G = W_t - W_0$$

Information:

ΔG = weight gain (g) Wt = Weight of shrimp at end of the experiment (g) Wo = Shrimp weight at the beginning of the experiment (g)

Length gain (LG) of shrimp was calculated using the formula [13]

$$LG = Lt - Lo$$

Information :

LG = Length gain (cm) Lt = Average length of research (cm)

Lo = average length of initial study (cm)

Specific growth rate (SGR) the calculation of specific growth rates [4] as follows:

$$SGR = \frac{(Ln Wt - Ln W0)}{t} \times 100$$

Information:

SGR = Specific growth rate (% / day) Wt = Shrimp biomass test at end of study (g) W0 = Shrimp biomass test at start of study (g) t = Maintenance time (day)

2.6 Data analysis

The data obtained in this study were analyzed using one way ANOVA. The significance of the difference among the means will be analyzed by Duncan's multiple ranges [14]. The statistics software was using SPSS version 22. Data display was presented in tabular form.

3. Results and Discussions

The results showed that the administration of nauplius *Artemia* sp. enriched with gamat emulsion extract gave significant effect on the length gain, weight gain, and survival of white shrimp larvae, *Litopenaeus vannamei* ($P < 0.05$). The result showed that the higher amount gamat emulsion extract, the faster growth performances of shrimp larvae. We assumed that this was due to gamat emulsion extract has the higher content of essential fatty acids like EPA and DHA which *artemia* sp. cannot produce. Lipid or fatty acids is one of the biggest energy sources besides protein and carbohydrates. Fatty acids have an important role, both as an energy source and as an essential substance for shrimp larvae. Lipid function was also to support metabolism, osmoregulation, and maintained the balance of organisms in its habitat. This is in accordance with Purba [15] and Liao [16] mentioned that the best feed for better growth of shrimp larvae contains a high amount of lipid or oil. On the other hand, the fatty acids also have a significant role in supporting shrimp's immunity [17]. Meanwhile, there were several studies about improving the immunity of white shrimp, *Litopenaus vannamei* using immunostimulants [18,19, 20, 21].

The Table 1 showed that there was no significant difference in the *Artemia* sp. enriched gamat emulsion extract on the shrimp specific growth rate. We assumed that this was due to the short period of larvae rearing thus the treatment had not sufficiently affected the growth of shrimp postlarva. Water quality measurements were carried out during the study. Table 2 showed that the measured water temperature range from 27 - 32 °C, measured water pH range from 6.6-8.2, DO range from 4.5 - 5.9 ppm and amonia average concentration was 0.5 ppm. According to [22], the water quality parameters during the study were still tolerable in shrimp larvae.

Table 1 Growth parameters white shrimp larvae (*Litopenaeus vannamei*) fed with *Artemia* sp enriched with gamat emulsion extract for 12 days. Means in a column with different superscript were significantly different ($P < 0.05$)

Treatment	Parameters			
	Length gain (cm)	Weight gain (cm)	Specific Growth Rate (SGR) (%/day)	Survival Rate (SR) (%)
A	2.30 ± 0.17^a	0.00043 ± 0.000023^a	54.53 ± 0.41^a	73 ± 3.61^a
B	2.46 ± 0.29^a	0.00050 ± 0.000027^b	54.76 ± 0.07^a	72.33 ± 7.37^a
C	3.23 ± 0.38^b	$0.00054 \pm 0.000035^{bc}$	54.83 ± 0.30^a	84.67 ± 4.04^b
D	3.20 ± 0.20^b	0.00059 ± 0.000023^c	54.96 ± 0.14^a	86.67 ± 7.09^b
E	3.40 ± 0.44^b	0.00065 ± 0.000057^d	54.97 ± 0.15^a	84.67 ± 4.04^b
F	3.43 ± 0.12^b	0.00065 ± 0.000010^d	54.97 ± 0.45^a	80.33 ± 6.66^b

Note: Treatment A; *Artemia sp.* without enriched by gamat emulsion extract (control), Treatment B; *Artemia sp.* enriched with 1 ml / L gamat emulsion, Treatment C; *Artemia sp.* enriched with 5 ml / L gamat emulsion, Treatment D; *Artemia sp.* enriched with 10 ml / L gamat emulsion, Treatment E; *Artemia sp.* enriched with 15 ml / L gamat emulsion and Treatment F; *Artemia sp.* enriched with 20 ml / L gamat emulsion.

Tabel 2. Water quality parameters

Parameter	Water quality parameters					
	Treatment A	treatment B	Treatment C	Treatment D	Treatment E	Treatment F
Temperature (°C)	28-30	27-30	28-31	29-32	28-30	27-29
pH	6.8-7.3	7 – 7.5	7.3-8	6.9-7.4	6.6-8.2	7.6-7.9
DO (mg/l)	4.6 – 5.0	4.7 – 5.9	5.0 – 5.8	4.6 – 5.6	4.5 – 5.0	5.0 -5.8
Amonia (ppm)	0.5	0.5	0.5	0.5	0.5	0.5

Conclusion

The administration of nauplius *Artemia sp.* enriched with gamat emulsion extract had a significant effect on larval weight gain (WG), length gain (LG) and survival rate (SR) ($P < 0.05$), but no significant effect on specific growth rate (SGR) ($P > 0.05$). The optimum weight gain (WG), length gain (LG) and survival rate were found at treatment D; 10 ml / L gamat emulsion extract concentration with 0.00065 ± 0.000057 g, 3.43 ± 0.12 cm and 86.67 ± 7.09 % respectively. The use of gamat emulsion extract is recommended to enrich nauplius artemia as live feed for white shrimp *Litopenaus vannamei* larvae feeding.

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