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## A mini review-effect of *Dunaliella salina* on growth and health of shrimps

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### Abstract

*Dunaliella salina* is a unicellular green algae that can be used as a natural food for shrimp. This microalgae provides various nutrients such as protein, carbohydrates, lipids, pigments and others. Several studies have shown that *Dunaliella salina* can increase the growth performance of shrimps. Not only that, *Dunaliella salina* also grant various health effects. High  $\beta$ -carotene and phenol in *Dunaliella salina* can increase immune system. This review was examined the optimum growth condition for *Dunaliella salina*, nutrition contained in *Dunaliella salina*, and effect of *Dunaliella salina* for growth and health of shrimps such as *Fenneropenaeus indicus*, *Penaeus monodon*, and *Litopenaeus vannamei*. This review recommendation for *Dunaliella salina* as a potential feed for other.

**Keywords:** *Dunaliella salina*, *Fenneropenaeus indicus*, *Penaeus monodon*, *Litopenaeus vannamei*, growth, health

### 1. Introduction

Shrimp is one of popular seafood in the world community. The United States, China, Europe, and Japan are the major consuming regions, while Indonesia, China, India, Vietnam are major producing regions. In 2019, the global shrimp market size reached a volume of 5.10 Million Tons <sup>[1]</sup>. Popular types of shrimp for consumption are *Litopenaeus vannamei*, *Penaeus monodon* <sup>[1]</sup> and *Fenneropenaeus indicus* <sup>[2]</sup>. The covid pandemic has an impact on all sectors including the shrimp industry. However, marketing of shrimp among small traders is increasing. Shrimp exports from Ecuador, India and Indonesia also increased during this pandemic <sup>[3]</sup>. To maintain shrimp production and disease protection during a pandemic and post-pandemic, a good cultivation system is needed. One of the main factor for cultivation is the quality of feed. *Dunaliella salina* is one of good feed for shrimps. *Dunaliella salina* contains various nutrients that are proven to increase growth performance and have health effects on shrimp. This article aims to describe the nutritional content of *Dunaliella salina* and its effects on growth and health of shrimp such as *Fenneropenaeus indicus*, *Penaeus monodon*, and *Litopenaeus vannamei*.

### 2. *Dunaliella salina*

*Dunaliella salina* is a unicellular green algae which can be green, orange or red in color and has two flagella. *Dunaliella salina* can synthesize and accumulate carotene, especially under stressful conditions due to changes in osmotic pressure. This is what causes *Dunaliella salina* to have an orange or red color <sup>[4]</sup>. The shape and size of cells can vary according to growth, stage of development, and environmental conditions. *Dunaliella salina* can live in marine water and grow in alkaline conditions. It can tolerate pH from pH 6-11, but the optimum pH for *Dunaliella salina* growth is 8 <sup>[5]</sup>. *Dunaliella salina* can grow optimum at high salinity (45 psu) <sup>[6]</sup>, low temperature (18-20 °C) <sup>[6, 7]</sup>. *Dunaliella salina* can reproduce sexually or asexually by binary fission <sup>[8]</sup>.

### 3. Chemical Composition of *Dunaliella salina*

*Dunaliella salina* contains various nutrients, such as carbohydrates, proteins, fats, amino acids, vitamins, pigments <sup>[9]</sup>, antioxidants <sup>[10]</sup> and others. The total carbohydrate content was 40.21 g/100 g dry weight, protein 25.67 g/100 g dry weight, lipids 18.02 g/100 g dry weight <sup>[11]</sup>. The ash content and water content in *Dunaliella salina* were 58.29% and 15.58%, respectively <sup>[9]</sup>.

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The main component of *Dunaliella salina* is protein. Total protein 25.67 g/100 g dry weight <sup>[11]</sup>. The amino acids contained include aspartic acid (0.73%), glutamic acid (90.73%), serine (0.37%), histidine (0.07%), glycine (0.39%), lysine (0.25%), leucine (0.45%), isoleucine (0.29%), phenylalanine (0.32%), valine (0.37%), methionine (0.06%), tyrosine (0.21%), alanine (0.46%), arginine (0.33%), threonine (0.29%) <sup>[9]</sup>. Apart from protein, *Dunaliella salina* also contains 15.34 g/100 g dry weight nitrate <sup>[11]</sup>. *Dunaliella salina* has antibacterial activity because it contains various pigments such as lutein <sup>[12]</sup>, chlorophyll a, chlorophyll b,  $\beta$ -Carotene <sup>[11]</sup>, zeaxanthin <sup>[13]</sup>. It also contains vitamins such as tocopherol, and ascorbic acid <sup>[9]</sup>. Bacteria that can be inhibited include *Bacillus cereus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Lactococcus garvieae*, *Yersinia ruckeri*, *Vibrio anguillarum*, *Vibrio alginolyticus* <sup>[13]</sup>.

#### 4. Effect of *Dunaliella Salina* on Growth Performance and Health

*Dunaliella salina* has been shown to have a positive effect on the growth of some species of shrimp. Provision of fusion of *Dunaliella salina* and *Chlorella vulgaris* protoplasts in feed can increase the weight of the larvae of *Penaeus monodon* from week to week. In addition, fusion of *Dunaliella salina* and *Chlorella vulgaris* protoplasts in feed increased the survival rate of *Penaeus monodon* (88%) compared to controls (72%) <sup>[14]</sup>. In another study, giving 300 mg of *Dunaliella salina* extract to *Penaeus monodon* for 8 weeks also increased growth by 392.40% while control only increased growth by 323.32% <sup>[15]</sup>. This alga has not only been shown to increase the growth of *Penaeus monodon* but also to increase the growth of *Fenneropenaeus indicus* for 180 days <sup>[16]</sup>. Table 1: shows the effect of giving *Dunaliella salina* on the growth of *Penaeus monodon* and *Fenneropenaeus indicus*.

**Table 1:** Effect of giving *Dunaliella salina* on shrimp feed

Shrimps	Initial weight (g)	Final Weight (g)	Survival Rate (%)	References
<i>Penaeus monodon</i>	1.22 ± 0.01	6.00 ± 0.73	100 ± 0.00	15
<i>Fenneropenaeus indicus</i>	4.4 ± 0.1	17.6 ± 2.9	60 ± 2.00	16

*Dunaliella salina* not only has a positive effect on the growth of several species of shrimp, but also has a positive effect on health. The survival rate of *Litopenaeus vannamei* infected with WSSV and ed diets enriched with 2% *Dunaliella* sp increased compared to controls, namely 80%, while control was 56% <sup>[17]</sup>. The 300 mg *Dunaliella salina* extract also increased the survival rate of *Penaeus monodon* infected with wssv compared to controls, namely 33.3%, while control was 10% <sup>[15]</sup>. *Dunaliella salina* can decrease bacteria amount in hepatopancreas and tails of *Litopenaus vannamei* which showed clinical signs of vibriosis infection <sup>[18]</sup>.

#### 5. Conclusion

In conclusion, *Dunaliella salina* contains various nutrients such as protein, carbohydrates, lipids, pigments which give a positive effect for growth and health of *Fenneropenaeus indicus*, *Penaeus monodon*, *Litopenaus vannamei*. *Dunaliella salina* may produce compounds that have antiviral and antibacterial activity. So that, *Dunaliella salina* may be an excellent source in order to develop as a shrimp feed ingredient.

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