The efficacy of dietary yeast mannan Oligosaccharide on growth and survival rate in *Amphiprion ocellaris* fingerlings

Vellaichamy Ramanadevi, Kaliyan Muthazhagan, Thangappan Ajithkumar, Muthusamy Thangaraj*

**ABSTRACT**

This study was done in order to evaluate the efficacy of dietary prebiotic yeast (*Saccharomyces cerevisiae*) cell wall mannan oligosaccharide (MOS) on growth indices and survival of the clownfish, *Amphiprion ocellaris* fingerlings. Totally 240 captive bred fingerlings weighted 17 ± 0.03 mg (± SD) were reared for 90 days fed by four different diets including 0, 0.5, 1 and 1.5% MOS enriched nauplii. The trial was carried out in twelve 100L FRP tank with density of 20 fish in each tank, in the form of 4 treatments with 3 replicates were randomly distributed. At the end of trial, growth indices and survival rate were determined. Growth indices such as final weight, length and specific growth rate in all treatments showed no statistical significant differences in compared with the control (P>0.05). Condition factor in treatment 2 showed significantly higher than control. Survival rate in all treatments was significantly higher than the control group. The experiment indicated that MOS didn’t influence on growth indices and it improves the survival rate of *A. ocellaris* fingerlings.

**Keywords**: Mannan Oligosaccharide (MOS), Growth Performance, Survival Rate, *Amphiprion ocellaris*

1. Introduction

The marine ornamental fishes are one of the most popular attractions worldwide due to their beauty and adaptability to live in confinement. Over the past two decades, the marine aquarium industry has undergone a significant transformation globally and it is readily growing day-by-day due to high commercial value. The present marine ornamental fish trade in all over the world is entirely dependent on natural stocks. *Amphiprion percula* and *A. ocellaris* are the highly demanded species in East Asian and Western countries. To prevent the extinction of these fishes, captive culture up to marketable size give economic benefits and can reduce the strain on wild stock. Disease problem is currently an important constraint to the growth of ornamental aquaculture, which has impacted both socio-economic development and rural livelihoods in some countries. Application of chemotherapeutants has created problems with toxicity, resistance, residues and possibly affect public health and environmental consequences. So to avoid the usage of such type of complicated drugs, this study was planned to investigate the efficacy of dietary MOS on growth and survival rate of *A. ocellaris* fingerlings. BIO-MOS is yeast (*Saccharomyces cerevisiae*) cell wall called mannan oligosaccharides (MOS) commercially supplied by Alltech Biotechnology, India. Among the established prebiotics MOS is most commonly used as the dietary supplementation for fish and crustacean species [1]. MOS is a glucanmannoprotein complex derived from the cell wall of *S. cerevisiae*. Several researchers have been reported the beneficial effects of yeast cell wall, MOS, and beta-glucan on the growth indices and survival rate of several fish species [2, 3, 4, 5, 6]. The aim of this study, was to evaluate the efficacy of dietary *S. cerevisiae* cell wall MOS on growth indices and survival rate of *A. ocellaris* fingerlings.
2. Materials and Methods

*Artemia franciscana* (Red jungle brand) cysts were incubated for 24 h, at 28 °C in 33 ppt salinity seawater under strong illumination (2000 lux) and aeration [7]. After 24 h post-hatch, instar II *Artemia* nauplii (580 µm average length) were harvested by exploiting the positive phototactic behaviour of the nauplii. Instar II *Artemia* nauplii were stocked at rate of 20 nauplii /ml in total volume of 2L water and aerated continuously. Nauplii were fed with microalgae (Nanochloropsis sp.) at concentration of 100 cells/ml in control. The three different treatments having 0.5%, 1.0% and 1.5% MOS enriched for 24 h. The enriched nauplii were delivered to the fish fingerlings in two doses at 12 h intervals. Totally 240 captive bred *A. ocellaris* fingerlings (Fig. 1) with an average weight of 17 ± 0.03 mg (± SD) 7.61 ± 0.01 g were used for this study. The feeding trial was continued for a period of 90 days. The treatments in twelve 100L fiberglass tank with density of 20 fish in each tank, in the form of 4 treatments with 3 replicates were randomly distributed. At the end of trial, growth indices such as final weight and length, condition factor and specific growth rate along with the mean survival rate was also estimated according to the formulas mentioned in Akrami [8].

Temperature, salinity, pH and dissolved oxygen were measured on a daily basis during the study period. All the measurements were made in triplicate and presented as mean ± S.D. The results were subjected to analysis of variance (ANOVA) followed by least significant differences (Duncan’s multiple range) test. Correlation coefficients were significant at P<0.05 level.

![](image)

**Fig 1:** Captive bred *A. ocellaris* fingerlings

3. Results and Discussion

Mean (± SD) temperature, salinity, dissolved oxygen and pH during the culture period were 28.51 ± 3.1 °C, 30 ± 2.2 ppt, 7.22 ± 1.2 mg/L and 7.35 ± 0.41 respectively. Growth indices results of *A. ocellaris* fed with MOS enriched nauplii is shown in Table 1. There was no significant differences between treatments in terms of initial weight and length were present (P>0.05). At the end of the feeding trial, growth indices such as final weight, final length, condition factor and specific growth rate in all treatments had no statistical significant differences in compared with the control (P>0.05). Condition factor only in treatment 2 was significantly higher than control. Survival rate in all treatments was significantly higher than control (Fig. 2). MOS has been reported to increase growth in some terrestrial vertebrate animals [8] and crustacean [10], [11]. Our present study and several recent reports [8], [12], [13], [14], [15], showed the fishes fed with MOS diet exhibited a better feed efficiency. According to our results, with increasing concentration of MOS, a significant increase was achieved in survival rate of *A. ocellaris* juveniles and non-significant increase in items such as final weight, final length, percent weight gain and specific growth rate. So, treatment 3 has the greatest difference in compare with the control. MOS did not improve growth performance and feed efficiency on Gulf sturgeon, *Acipenser oxyrinchus desotoi* [16], African catfish, *Clarias gariepinus* [17], Hybrid tilapia, *Oreochromis niloticus×O. aureus* [18], European seabass, *Dicentrarchus labrax* [18], Kutum, *Rutilus frisii kutum* [19] and great sturgeon juvenile, *Huso huso* [20], which was similar to our observations. Subsequently, single administration of MOS did not improve the weight gain rate of the Japanese flounder, *Paralichthys olivaceus* compared with the control diet [21]. Similar effects after consuming prebiotics Immunostern and Immunowall (MOS and beta-glucan-containing compounds) on condition factor of great sturgeon, *Huso huso* [22] and after consuming BIO-MOS on Hepatosomatic Index of red drum, *Sciaenops ocellatus* (Zhou et al., 2010) stated that the findings of this study are consistent. Dietary treatment containing MOS showed significantly higher survival rate in all treatments of *A. ocellaris* than control which is consistent with the findings of earlier study [24-22]. Stated that dietary treatment containing prebiotics of Immunostern and Immunowall significantly decreased carcass moisture and non-significantly increased carcass crude lipid in *Huso huso*. Different results have been reported with European seabass, *Dicentrarchus labrax* [18], Japanese flounder, *Paralichthys olivaceus* [21] and great sturgeon juvenile, *Huso huso* [20]. Moreover, fish fed a MOS diet exhibited higher survival than in fish fed the control diet as was previously reported by [15] and [13]. Our results also confirmed with the earlier reports especially with more survival rate.
Fig 2: Mean survival rate of *A. ocellaris* fed with MOS enriched Artemia nauplii

Table 1: Growth indices of *A. ocellaris* fed with MOS enriched Artemia nauplii. Each value (X ± SD) is the average performance of ten fishes/treatment at the end of 90 days. Same superscript alphabets in the row are not significantly different at *P* < 0.05 level.

<table>
<thead>
<tr>
<th>Items</th>
<th>Control</th>
<th>0.5 % MOS</th>
<th>1 % MOS</th>
<th>1.5 % MOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial length (mm)</td>
<td>10 ± 0.3</td>
<td>10 ± 0.4</td>
<td>10 ± 0.1</td>
<td>10 ± 0.2</td>
</tr>
<tr>
<td>Initial weight (mg)</td>
<td>17 ± 0.01</td>
<td>17 ± 0.02</td>
<td>17 ± 0.05</td>
<td>17 ± 0.02</td>
</tr>
<tr>
<td>Final length (mm)</td>
<td>26.1 ± 0.43</td>
<td>27 ± 0.58</td>
<td>29.3 ± 0.4</td>
<td>30.2 ± 0.4</td>
</tr>
<tr>
<td>Final weight (mg)</td>
<td>460 ± 3.4</td>
<td>462 ± 3.7</td>
<td>510 ± 2.6</td>
<td>536 ± 3.3</td>
</tr>
<tr>
<td>Weight gain (%)</td>
<td>2604 ± 45</td>
<td>2616 ± 50</td>
<td>2898 ± 27</td>
<td>3051 ± 44</td>
</tr>
<tr>
<td>Specific growth rate (%/day)</td>
<td>2.89 ± 0.16</td>
<td>2.90 ± 0.08</td>
<td>3.22 ± 0.04</td>
<td>3.39 ± 0.07</td>
</tr>
<tr>
<td>Condition factor</td>
<td>2.61 ± 0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.62 ± 0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.65 ± 0.02&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.62 ± 0.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

4. Conclusion
Better growth of the clown fish fingerlings fed with MOS enriched Artemia nauplii could be contributed by increase in apparent energy digestibility, absorption surface of the gut as well as total bacteria in the gut and an up-regulation of the activities of specific digestive enzyme, as it has been documented that MOS supplementation significantly improved nutrients digestion. This experiment indicated that yeast MOS didn’t influence on growth indices in *A. ocellaris* fingerlings. According to the results of survival rate, it seems to be essential to evaluate the haematological and immunological parameters in the blood serum of the fish.

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