

Original Research Article

## Effect of Mulberry Leaves Extract (*Morus alba*) on Growth of Post Larvae in Giant Freshwater Prawn (*Macrobrachium rosenbergii*)

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**Abstract:** The study was conducted to assess the effect of mulberry leaves extract (*Morus alba*) on the growth rate of giant freshwater prawn, *Macrobrachium rosenbergii*. In the present study, the mulberry leaves extract was mixed with commercial pellets using the spray method; pellets with 5 % and 10 % mulberry leaves extract. Meanwhile, the control treatment was a commercial pellet with no mulberry leaves extract. *M. rosenbergii* were fed with the experimental pellets for 30 days and each treatment had 10 tails of *M. rosenbergii* juveniles. The result showed that the juveniles fed with pellet with 10 % mulberry leaves extract had the highest survival rate and the total number of moulting. As a conclusion, the mulberry leaves demonstrated a good effect on the growth of *M. rosenbergii* and reduced the mortality rate, thus, the present study suggests the use of mulberry extract as a potential nutrient supplement in the feed to increase the production of *M. rosenbergii* post-larvae.

**Keywords:** *Macrobrachium rosenbergii*, mulberry leaves extract, growth, moulting

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### 1. Introduction

Formulating feed for *Macrobrachium rosenbergii* represents a challenge to farmers and industry partners (Rahman *et al.*, 2017). The most economical way of feed formulation is normally achieved by using available ingredients that provide the essential nutrient content and composition in the final diet (Bhilave, 2015). However, the best combination of the most appropriate ingredients is still difficult to be obtained due to various constraint requirements, such as nutrition value and cost. *M. rosenbergii* are crustaceans and one of the most important species that are being farmed in Malaysia. It contributes to the fast-growing aquaculture

industry in the food-production sector. In the aquaculture industry, providing a better feed at minimum cost is essential to help farmers to increase the cost-benefit ratio of farming activities. It is important to use suitable ingredients that could supply appropriate nutrients and has an attractive physical appearance to entice prawns.

*M. rosenbergii* is capable of digesting a wide range of foods comprising of both plant and animal origin. Characterisation of the activities of the digestive enzymes in the alimentary tract indicates the presence of trypsin, amino peptidases, proteases, amylases, chitinase, cellulase, esterases and lipases (Mitra *et al.*, 2005). Therefore, plant-based nutrients might be added to the diet to improve the growth performance of *M. rosenbergii*.

Mulberry grows well in the tropics and subtropics and is reported to have an outstanding nutritional value (Riyadh *et al.*, 2013). Mulberry leaves are high in protein (15–35%), minerals (2.42–4.71%) calcium (Ca); 0.23–0.97% phosphorus (P) and metabolizable energy (1130–2240 kcal/kg) with the absence of or negligible anti-nutritional factors (Omar *et al.*, 1999; Sarita *et al.*, 2006; Wang *et al.*, 2011). Furthermore, mulberry leaves were used as silkworm food, animal feed and medicine mostly in eastern countries (Sarkhel *et al.*, 2020). Fantastic results have been obtained with mulberry leaves as poultry feed (Chowdary *et al.*, 2009). From these studies, it is hypothesised that the addition of mulberry extract in the feed of *M. rosenbergii* would enhance the growth, survival and total number of moulting in *M. rosenbergii*. The objective of the study was to determine the effect of mulberry leaves extract (*Morus alba*) on the growth of *M. rosenbergii* through the survival, body weight, body length and the total number of moulting.

## 2. Materials and Methods

### 2.1 Sample and Study Site

The experiment was conducted at Fish Propagation House, Politeknik Jeli Kelantan, Malaysia. There were 90 tails for post larvae (2–5 cm) of *M. rosenbergii* that were used in the study and the samples were bought from a local seller in Kuala Krai, Kelantan.

### 2.2 Feed Preparation and Experiment

The raw materials for this study were mulberry leaves extract and *M. rosenbergii*. A standard pellet was purchased for the sinking pellet. A spray bottle had been used to keep the mulberry leaves extract solvent. The mulberry leaves powder was purchased online (Chemie Connex). After that, the pellet was fed to the giant freshwater prawn twice a day and the data were recorded every week. A total of 90 g mulberry extract powder was dissolved in 10 mL ethanol. The mulberry leaves extract solution was sprayed on the sinking pellet and the pellet was dried for one day before use. In the study, post-larvae of *M. rosenbergii* were fed with three different treatments (commercial pellets (control), pellet with 5% mulberry leaves extract (P5) (5 mL were taken from 100 mL mulberry leaves extract dilution) and pellet with 10% mulberry leaves extract (P10) (10 mL were taken from 100 mL mulberry leaves extract dilution) for two months. The body weight, body length and survival of *M. rosenbergii* were

measured every one week and the total number of moulting was checked daily. Besides, the moulting process (checked daily) was also taken during the study period of 30 days.

### 2.3 Data Collection and Analysis

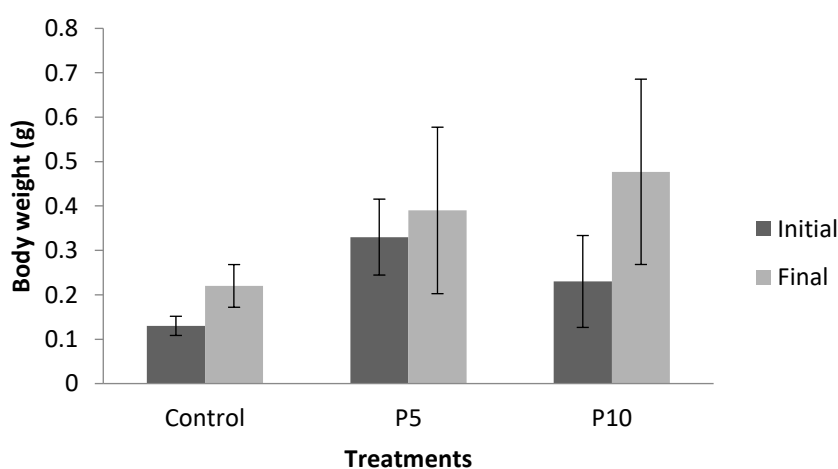
Data was collected based on the survival rate and the total number of moulting. The body weight and body length of *M. rosenbergii* were measured every 7 days. Besides, the data collected were analysed using Microsoft Excel (One-way ANOVA). The survival rates were calculated using Equation 1:

$$\text{Survival Rate} = \frac{\text{Number of live PL}}{\text{Total of PL}} \times 100 (\%) \quad (1)$$

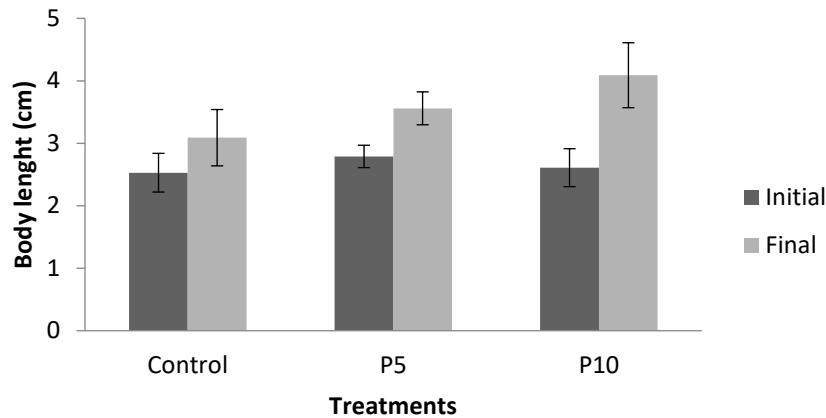
## 3. Results

### 3.1 Body Weight and Length of *M. rosenbergii*

There were three treatments: control, pellet with 5% mulberry leaves extract (P5) and pellet with 10% mulberry leaves extract (P10). The initial body weights were  $0.13 \pm 0.02$  g (control),  $0.33 \pm 0.09$  g (P5) and  $0.23 \pm 0.10$  g (P10) (Figure 1). While, the final body weights were  $0.22 \pm 0.05$  g (control),  $0.39 \pm 0.10$  g (P5), and  $0.48 \pm 0.21$  g (P10) (Figure 1). The study showed that P10 produced the highest body weight as compared to the other treatments. Thus, it proved that P5 and P10 can accelerate the growth of *M. rosenbergii*. Besides, the body lengths of *M. rosenbergii* were also measured before and after the experiment. The initial body lengths of *M. rosenbergii* were  $2.53 \pm 0.31$  cm (in control treatment),  $2.79 \pm 0.18$  cm (in treatment P5), and  $2.61 \pm 0.30$  cm (in treatment P10) (Figure 2). The final body length of *M. rosenbergii* was  $3.09 \pm 0.45$  cm (control),  $3.56 \pm 0.26$  cm (P5), and  $4.09 \pm 0.52$  cm (P10) (Figure 2). This showed that P10 had the highest body weight and body length at the end of the experiment.



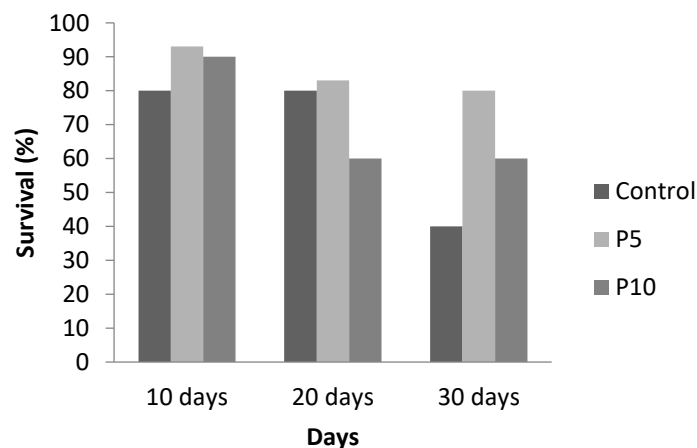
**Figure 1.** Initial and final body weight of giant freshwater prawn, *M. rosenbergii* fed with three different treatments: control treatment (commercial feed with no mulberry leaves extract), P5 (commercial feed coated with 5% mulberry leaves extract), and P10 (commercial feed coated with 10% mulberry leaves extract).



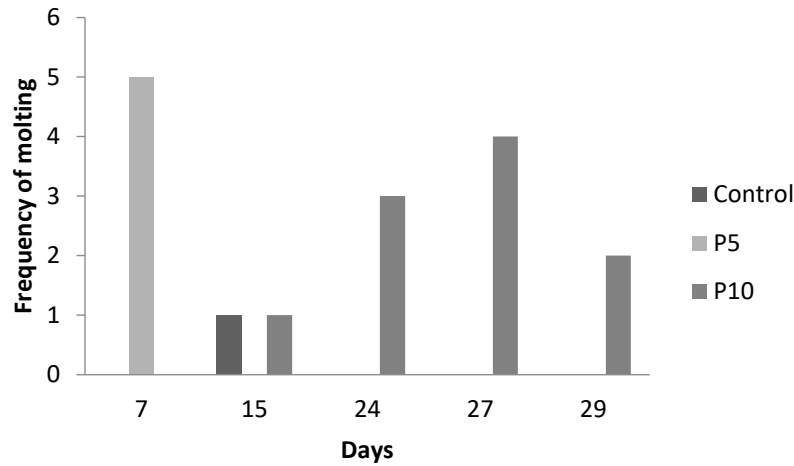
**Figure 2.** Initial and final body length of giant freshwater prawn, *M. rosenbergii* fed with three different treatments: control treatment (commercial feed with no mulberry leaves extract), P5 (commercial feed coated with 5% mulberry leaves extract), and P10 (commercial feed coated with 10% mulberry leaves extract).

### 3.2 Survival Rate and Molting

The treatment of different doses of mulberry leaves extract (5% and 10%) coated on the experimental was insignificant ( $P < 0.05$ ) on the survival rate of *M. rosenbergii*. On day 10, treatments P5 and P10 exhibited more than 90% in survival rate. While on day 30, the highest survival rate was 80% for treatment P5 and the others treatments, control and P10, exhibited 40% and 60% in survival rates, respectively (Figure 3). Figure 4 showed the frequency of moulting in *M. rosenbergii* during the study period of 30 days. At the beginning of the experiment, there was no sign of the moulting process occurring in all the treatments until day-7. There was a moulting process on day-7 for P5 and on day 15 for control treatment and P10, respectively (Figure 4). Furthermore, on day 24, 27, and 29, there were moulting processes in P10 and thus, P10 was seen to have the highest frequency of moulting during the 30 days of the experiment (Figure 4).



**Figure 3.** Survival rate of *M. rosenbergii* in different treatments up to 30 days



**Figure 4.** The frequency of molting in *M. rosenbergii* up to 30 days

## 4. Discussions

### 4.1 Body Weight and Body Length of Post Larvae *M. rosenbergii*

Body weight and body length of *M. rosenbergii* post-larvae in the present study were higher when the *M. rosenbergii* were fed with the commercial feed coated with mulberry leaves extract than the *M. rosenbergii* fed with control feed. The same observation was found in other study by Fujaya *et al.* (2014) where a high frequency of moulting in larvae of blue swimming crab, *Portunus pelagicus* was observed when fed with mulberry leaves extract. A previous study by Li *et al.* (2020) showed that the final body weight, weight gain rate, specific growth rate and feed intake of Chinese giant salamander, *Andrians davidianus* were increased with the increase in the dietary of mulberry leaves extract up to 9.0 g/kg and declined subsequently, while the feed conversion ration exhibited an opposite trend.

### 4.2 Survival Rate and Molting of Post Larvae *M. rosenbergii*

The mulberry leaves extract in sinking pellet feed was affecting the survival rate of post larvae in *M. rosenbergii*. Post-larvae *M. rosenbergii* for P5 showed high survival rate in 30 days. However, the post-larvae for *M. rosenbergii* in control and P10 were shown to have a high mortality rate after day 30 for control and day 20 for P10, respectively. An appropriate dose of mulberry leaves extract will stimulate the growth and survival rate in post-larvae of *M. rosenbergii* growth and survival rate while the high dose of mulberry leaves extract in *M. rosenbergii* had no responses in the present study. Besides, the survival rate in P5 was higher than control and P10 on day 30 of the experiment and so, the present study suggested that P5 was the effective coated level of mulberry leaves extract for post-larvae of *M. rosenbergii*. Based on a previous study by Fujaya *et al.* (2018), the higher the dose (up to 4 g/100 ml) of mulberry leaves extract in the feed of orange mud crab, *Scylla olivacea*, resulted in the increase in the concentration of haemolymph ecdysteroids. Same findings from the present

study with previously published work by Fujaya *et al.* (2014) showed that the mulberry leaves extract has a significant influence on the survival rate, stage growth and mortality rate of larvae in blue swimming crab, *Portunus pelagicus* due to moulting syndrome.

Moulting process starts once the epidermal cells react to the hormonal change through the rate of protein synthesis (Meyer, 2007). The moulting process happens when the larvae start to grow to the next phases. Mulberry leaves extract comprises the phytoecdysteroid, a compound which is analogous to moulting hormone in crustaceans (Fujaya *et al.*, 2014).

## 5. Conclusions

Mulberry leaves extract can be used to enrich commercial feed to enhance the survival rate, reduce mortality rate and increase the total number of moulting in *M. rosenbergii*. Treatment P5 gave a higher survival rate while treatment P10 gave the highest total number of moulting when compared with the control treatment. Nevertheless, further studies to determine the optimal dose of mulberry leaves extract are needed to ensure that moulting will happen simultaneously, which may further reduce the mortality rate. Moreover, the present study suggests the use of mulberry leaves extract as a nutrient supplement in commercial feed as it will accelerate the growth performance of *M. rosenbergii* and it also will reduce the mortality rate and increase the production of *M. rosenbergii* which also leads to an increase in economic income.

**Author Contributions:** Siti Nor Fatihah designed the experiment, ran the experiment and wrote the manuscript; Harman Muhd-Farouk wrote, edited and added the information related to the present study.

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**Conflicts of Interest:** The authors declare no conflict of interest.

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