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Short Communication

Effects of Different Types of Moina Preparation on the Growth and Survival of Giant Freshwater Prawn Post-Larvae, *Macrobarchium rosenbergii* (De Man, 1879)

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ABSTRACT

The giant freshwater prawn *Macrobrachium rosenbergii* is an economically important aquaculture species, with post-larval nutrition playing a critical role in early growth and survival. This study evaluated the effects of different Moina feed preparations on the growth performance and survival of *M. rosenbergii* post-larvae (PL10). A 14-day feeding trial was conducted using a randomized complete block design with four dietary treatments: commercial pellet (control), frozen Moina, freeze-dried Moina, and live Moina, each in triplicate. A total of 552 post-larvae (initial weight ≈ 0.01 g) were stocked and fed daily at 20% body weight. Growth performance was assessed through mean weight gain (MWG) and specific growth rate (SGR), while survival rate was recorded at the end of the experiment. Post-larvae fed with live Moina exhibited significantly higher MWG (0.024 ± 0.004 g) and SGR (8.741 ± 1.15% day^{-1}) compared to those fed commercial pellets and freeze-dried Moina ($P < 0.05$), and showed comparable performance to frozen Moina. Survival was also highest in the live Moina group (35.3 ± 1.0%). The superior performance of live Moina is likely attributed to its higher palatability, nutritional availability, and movement-induced feeding response. These findings indicate that live Moina is a promising and effective live feed for improving growth and survival of *M. rosenbergii* post-larvae

1. INTRODUCTION

The giant freshwater prawn, also known as *Macrobrachium rosenbergii*, is a remarkable species with both ecological and economic significance. Its large size, vibrant colors, and unique lifecycle make it an intriguing subject of study and a valuable resource for aquaculture [1]. Its succulent meat and versatile culinary applications make it a sought-after delicacy in various cultures. The prawn's relatively rapid growth and adaptability to different water conditions have led to successful aquaculture ventures in multiple countries [2,3]. Overexploitation, disease outbreaks, and habitat destruction have raised concerns about the sustainability of its cultivation [4]. Efforts to address these concerns are ongoing. Sustainable aquaculture practices, disease management strategies, and habitat preservation initiatives are crucial to ensuring the long-term viability of both wild populations and aquaculture operations.

Throughout the entire life cycle, water quality, temperature, and nutrition play critical roles in the successful development of giant freshwater prawns [5,6]. Proper care and management are necessary at each stage to ensure healthy growth and optimal development [7]. The life cycle of a giant freshwater prawn typically consists of several stages, from the initial larval phase to the adult stage. Post-larvae are relatively larger and more developed than earlier stages. They are capable of swimming actively and exhibit more defined body characteristics [8]. As the post-larvae continue to grow and develop, they transition into the juvenile stage. During this crucial life stage phase, the prawns start to exhibit behaviors and characteristics more similar to those of adult prawns. They continue to moult as they grow [9].

During postlarvae stage, livefeed can mimic the natural diet of postlarvae found in their native habitats. This is important for the development and adaptation of the prawns to

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their environment, enhancing their chances of survival and successful aquaculture production [5]. The livefeed items can help in the development of the digestive system of postlarvae. This is crucial for the efficient utilization of nutrients from the diet and contributes to the overall health of the post larvae [10]. In some cases, providing livefeed can help reduce cannibalism among postlarvae by offering alternative food sources. Cannibalism can be a significant issue in the early stages of prawn farming [11].

Moina, commonly known as water fleas, can serve as a valuable live feed option in giant freshwater prawn (M. rosenbergii) culture, particularly during the larval stages. Moina are rich in essential nutrients such as protein, lipids, vitamins, and minerals [12]. Moina are larger than some other live feed options, making them suitable for slightly older prawn larvae that are capable of capturing and consuming larger prey [13]. Moina can be relatively easy to culture, especially in controlled environments like ponds or tanks. They reproduce rapidly, providing a consistent and readily available source of live feed. Moina can contribute to the enrichment of the cultural environment by adding natural prey items to the water column. This can stimulate natural feeding behaviors and help improve water quality [14].

Moina can play an important role in providing nutrition and stimulating feeding behaviors in giant freshwater prawn culture [15]. The use of Moina in giant freshwater prawn post-larvae, M. rosenbergii, has long been practised in aquaculture, but practice of using Moina as feed has not been thoroughly investigated. However, like any live feed, their successful use requires careful attention to culturing techniques and their integration into the overall feeding strategy for M. rosenbergii postlarvae. This study was done to evaluate the effects of different types of Moina preparation including live, frozen, and freeze-dry Moina diet on the growth and survival of giant freshwater prawns post-larvae.

2. MATERIALS AND METHOD

2.1 Post-larvae source

A total of 552 disease-free post-larvae (PL 10) giant freshwater prawns with an average initial weight of 0.01 g were obtained from a local hatchery in Manjung, Perak, Malaysia. Prior for feeding trial, the PLs were acclimatised for three days in circular tanks in the Breeding Hatchery Complex, Fisheries Research Institute Glami Lemi, Negeri Sembilan. This experiment was conducted in May 2022. At the beginning of the experiment, PLs were starved for 24 hours, weighed, and randomly distributed into 16 rectangle aquarium tanks aquariums with dimensions of 40cm (L) x 23cm (W) x 28cm (H). The PLs were stocked in the aquarium at a rate of 50 individuals per m^3.

This study was carried out in strict accordance with the recommendations in the Guide for the Care and Use of Laboratory Animals of the Department of Fisheries Malaysia. The protocol was approved by the Committee on the Ethics of Animal Experiments, Department of Fisheries Malaysia (DOF) (Protocol Number: DOF/KAKH/03/2020).

2.2 Moina sp. source and diet preparation

Moina sp. used in the study was obtained from the hygienic culture system at the Fisheries Research Institute Glami Lemi. Moina was cultured in a controlled and hygienic conditions to ensure that it was free from pathogen contamination using the open culture system [16]. The hygienic culture system involves controlled water sources, regular monitoring of water quality, and the use of clean culture media to minimize contamination. Moina was harvested daily using the techniques as mentioned in the manual by [17]. The frozen Moina was made by freezing freshly harvested Moina at 20 °C for 24 hours. Meanwhile, the freeze-dry Moina was made by drying the Moina in a tabletop freeze-dry machine for 24 hours. The commercial pellet used as control diet in the study was from the brand Blanca 7701.

2.3 Experimental design

The experiment was carried at the Breeding Hatchery Complex, Fisheries Research Institute Glami Lemi, Negeri Sembilan, Malaysia. The study was done in a randomized complete block design (RCBD) using four (4) feed treatments, commercial pallet Blanca 7701 (control) (G1), frozen Moina (G2), and freeze-dry Moina (G3) and live Moina (G4), in three (3) corresponding replications. The PLs were fed 20% of their total body weight daily. The study was carried out for 14 days. The aquarium was filled with 10 liters of filtered freshwater.

2.4 Growth and survival monitoring

The survival and weight of the prawn were taken at the initial and final stages of the study. Weight measurement was taken using an electronic balance with an accuracy of 0.01g. All the measurements were recorded and feeding was adjusted accordingly. Experimental tanks were inspected daily mortalities were recorded if any. The weight measurements were used to determine the mean weight gain (MWG), specific growth rate (SGR). Calculations were done as follows:

Mean weight gain (MWG):

$$MWG = W2 - W1 \quad (1)$$

where W1 is the initial mean weight and W2 is the final mean weight.

Specific growth rate (SGR):

$$SGR = [(\ln \text{final weight} - \ln \text{initial weight})/\text{days}] \times 100 \quad (2)$$

2.5 Water quality

Analysis of physico-chemical parameters were carried out for each experimental tank or pond. Physicochemical parameters pH, salinity, temperature, and dissolved oxygen (DO) were recorded weekly in water samples of experimental tanks and ponds using electric analysers (YSI-ProPlus, Yellow Springs Instruments Inc., OH, USA; pH-100 meter, LICHEN Sci-Tech, Co., Ltd., Shanghai, China). The chemical parameters of water quality for total ammonia (NH3) and nitrite (NO2) were determined using spectrophotometer (model HACH, DR 2800). The water quality was monitored on weekly basis.

2.6 Statistical analysis

Data were presented as mean ± standard deviation (SD). The data were analyzed using SPSS (version 15.0) one-way ANOVA. The data were considered significant at the $P<0.05$ level.

3. RESULTS AND DISCUSSION

The mean weight gain (MWG) and specific growth rate (SGR) of giant freshwater prawn post-larvae are presented in Table 1. The group fed with live Moina showed the highest MWG at 0.024 ± 0.004 g, which is slightly higher than the group fed with frozen Moina and significantly higher than the group fed with pellet and dry Moina. The group fed with dry Moina showed the lowest MWG, which is 0.006±0.004 g. Groups fed with live Moina also showed the highest SGR at 8.741±1.15 g, which is significant with group-fed pellets and dry Moina but not significant with group-fed frozen Moina.

The high result MWG and SRG obtained postlarvae in the group fed with live Moina is in agreement with the discussion by Manickam et al., 2020, which states that live Moina is more suitable to be used as feed in giant freshwater prawn culture than dead Moina. Live Moina is more nutritious than dry and frozen Moina and more attractive to be eaten by fry [18]. Prawn postlarvae have a preference for live creatures as opposed to prepared food [10]. Living organisms serve as biological reservoirs of essential nutrients, encompassing proteins, lipids, carbohydrates, vitamins, minerals, amino acids, and fatty acids [19]. Meanwhile, Frozen Moina likely retained better structural integrity and nutrient composition compared to freeze-dried Moina showing better results. Freeze-drying can cause cellular damage, oxidation of lipids, and reduced rehydration efficiency, making nutrients less accessible.

Table 1. Growth performance of *M. rosenbergii* postlarvae fed with different types of Moina preparation for two weeks.

Parameters	G1: Commercial pellet, (control)	G2: Frozen Moina	G3: Freeze-dry Moina	G4: Live Moina
IW (mg)	10.0±2.0	9.0±1.0	12.0±2.0	9.0±1.0
FW (mg)	18.0±6.0	25.0±6.0	16.0±4.0	34.0±4.0
MWG (mg)	8.0±6.0	15.0±6.0	6.0±4	24.0±4.0*
SGR%	4.198±3.06	6.545±1.15	3.357±3.06	8.741±1.15*

IW: Initial weight, FW: Final weight, MWG: Weight gain, SGR: Specific Growth Rate

According to Rottwan 2018, in addition to being less palatable than live animals, frozen and dry Moina are also less popular with fry. Nutrients do leak out quickly into the water, even though freezing or freeze-drying does not dramatically change the nutritional value of Moina [20]. Approximately, ten minutes after the Moina is introduced to fresh water, the enzyme will lose most of its activity due to leaching. The rapid loss of enzyme activity (within ~10 minutes) in dead Moina is mainly due to leaching when exposed to water. Digestive enzymes and other bioactive compounds diffuse into the surrounding medium, reducing the nutritional and functional value of the feed before ingestion. After one hour, all of the free amino acids and a large portion of the bound amino acids disappear [21]. Dead Moina (both frozen and freeze-dried) are prone to rapid leaching of free amino acids and other soluble nutrients once immersed in water. This reduces their nutritional density prior to ingestion, leading to suboptimal protein intake and impaired growth. In contrast, live Moina function as "nutrient reservoirs," retaining these compounds until consumed. This condition makes the fry that consume the frozen and dry Moina stunt in growth due to the lack of nutrition value needed from the feed [18].

The survival rate of giant freshwater prawns when fed with pellet, frozen Moina, dry Moina, and live Moina is shown in Graph 2. Groups fed with live Moina showed the highest survival rate at 35.3±1.0%, significantly compared with groups fed with pallet, frozen Moina, and dry Moina. Group fed with pallet as a control group showed a survival rate of 14.7±2.5%, significantly lower than group fed with live Moina but significantly lower than group fed frozen and dry Moina. Groups fed with dry Moina showed the lowest survival rate at 7.3±2.5%, but were not significantly different from groups fed frozen Moina. Live Moina are more preferable to fry compared with frozen and dry Moina, probably due to their movement, because, according to [22], the larvae's feeding responses are probably stimulated by live feed writhing motions. The writhing motions refer to the continuous swimming, jerking, and pulsating movements of live Moina within the water column. Live food organisms possess the ability to move unrestrictedly within the water column, ensuring continuous availability for finfish and crustacean larvae, in contrast to manufactured feed [23]. Unlike pellets, which may sink or disperse unevenly, live Moina actively move, increasing encounter rates with post-larvae. This reduces starvation risk and cannibalism, both of which are major contributors to mortality at the PL stage. Formulations feed also have a tendency to gather on the surface of water or gradually sink to the bottom, diminishing their accessibility to larvae [24]. According to [25], the low survival of cultured freshwater prawn may also be attributable to hunger resulting from insufficient feed intake.

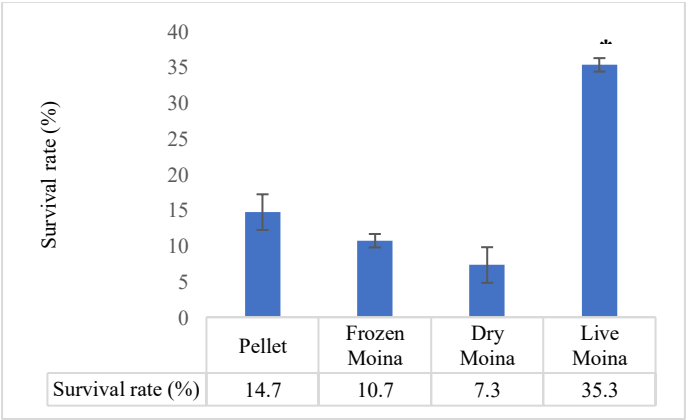

Fig. 1. Survival rate (%) of *M. rosenbergii* postlarvae post-larvae in different Moina feed preparation.

As a conclusion, live Moina is more suitable to be used as livefeed for giant freshwater prawn post-larvae culture compared to frozen Moina and freeze-dry Moina. The growth analysis showed that both MWG and SGR of postlarve fed with live Moina were significantly higher compared to other groups. Live Moina are more preferable probably due to their movement inducing the larvae's feeding responses as stimulated by live feed writhing motions. Besides, living organisms like live Moina serve as biological reservoirs of essential nutrients, encompassing proteins, lipids, carbohydrates, vitamins, minerals, amino acids, and fatty acids for fry. Thus, based on

the findings, live Moina could be used as another promising livefeed option for *M. rosenbergii* breeders.

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