Determine the Growth Performance of Redclaw, *Cherax quadricarinatus* in Aquaponics System

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Abstract
There is a little report obtainable about the redclaw, *Cherax quadricarinatus* in Malaysia. Therefore, the present study was come out. The study aimed to determine the growth performance of redclaw, *Cherax quadricarinatus* and Pak Choi, *Brassica rapa chinensis*. A total of 28 individuals for *C. quadricarinatus* were used in the present study. There were two treatments; control (without aquaponics) and treatment (with aquaponics). In the present study, *C. quadricarinatus* were cultured for 28 days at Fish Propagation House, Politeknik Jeli Kelantan. Body weight (BW), body length (BL) of *C. quadricarinatus* and length of Pak Choi were measured for every week. BL and BW for control and treatment for day 28 were 9.58 ± 0.17 cm, 11.13 ± 0.60 cm, 17.08 ± 0.53 g and 19.93 ± 0.48 g. The lengths of Pak Choi for day 0 were 2.58 ± 0.11 cm and after day 28, the lengths of Pak Choi were 9.08 ± 0.37 cm. The results showed BW and BL increased when cultured in aquaponics system than without aquaponics system. Besides, the survival rate (%) was higher (75 %) in aquaponics system than without aquaponics system. In the present study, growth performances of *C. quadricarinatus* and Pak Choi in aquaponics system give a high chance in survival and grow faster rather than *C. quadricarinatus* that cultured without aquaponics system. Thus, the aquaponics system was a suitable system to culture the *C. quadicarinatus*.

Keywords: growth performance, *cherax quadricarinatus*, aquaponics

1.0 Introduction

Numerous small-scale of *Cherax quadricarinatus* culture facilities were set up in the Peninsular Malaysian states where they obtained their broodstocks from Australia and Indonesia (Naqiuddin et al., 2016) and the wild species from Machap River in Johor. Aquaponics is the combination of aquaculture and hydroponics system that aquatic animals and plants can cultivate together in one combined system (Fadhilah et al., 2019). In aquaponics, it combines the activities of rearing fish and plants together in one system without using soil. For this aquaponics system, the present study used *Cherax quadricarinatus* as an alternative species rather than using common fish species. Crayfish is a species of freshwater crustacean that have high durability towards any kind of diseases so it will be easy to culture the species in the bucket aquaponics system. Biodynamic concepts of aquaponics system increase the importance in integrated culture and reduce the demand for externalities owing to its efficacy in production and process (Estim and Mustafa, 2010). The culture of *C. quadricarinatus* has become an attention for the local population and regarded as a way to raise extra income. In addition, the culture of *C. quadricarinatus* are commonly for food with target size of 6-

8 inch in body length but high demand on the juveniles prompts more focus on breeding rather than grow out activities (Naquiddin et al., 2016). In addition, there are more than 100 species of Australian crayfishes but only three species of the genus Cherax are currently being farmed due to their high marketable potential; *Cherax tenuimanus*, *Cherax destructor* and *Cherax quadricarinatus* (Viau et al., 2010). In Malaysia, *C. quadricarinatus* was locally well-known as freshwater lobster due to its lobster-like appearance and habitat (Naquiddin et al., 2016). Study by Naquiddin et al. (2016) give the information that the wild populations of invasive, *C. quadricarinatus* can be originate in lakes small rivers and waterways of several locations in Malaysia.

Stocking density of *C. quadricarinatus* was overcrowded that the problem in the present study. When it comes to run an aquaponics system, there is one thing must be considered. It is important to keep the stocking density low, thus it will be easy to keep the aquaponics system manageable. *C. quadricarinatus* was a cannibalism behaviour, thus if there were many *C. quadricarinatus* in the tank, they will fight, kill and eat each other. It will be unprofitable for the farmer and causing many losses of *C. quadricarinatus* and increasing the cost. Other than that, if the stocking density was high, the *C. quadricarinatus* will release lots of wastes that over the limit so the plant will be unable to filter all the waste. Thus, before put the *C. quadricarinatus* into the tank, plan the number of crayfish wisely and make sure it not becomes overstock (Holdich et al. 2002).

Aquaponics proposals a good alternative that is more resilient and well-organized (Estim et al., 2020). The challenges are linked to combination of two technologies (recirculation aquaculture) and hydroponics (Konig et al., 2018) to ensure sustainability of an efficient integrated food production system. There were many research studies that used the aquaponics system to culture the fish and crustaceans; for example, study by Fadhilah et al. (2019), Gallardo-Colli et al. (2014), Sundar and Chen (2020), Saufie et al. (2020), Oladimeji et al. (2020) and many researches on that. In the present study, it used the Pak Choi (*Brassica rapa chinensis*) because the plant or vegetable easy to grow and can harvest after three weeks. Thus, the objective in the present study was to determine the growth of redclaw (*Cherax quadricarinatus*) and Pak Choi (*Brassica rapa chinensis*) in aquaponics system.

2.0 Methodology

2.1 Sample and experimental design

This study was conducted at Fish Propagation House (FPH), Politeknik Jeli Kelantan, Malaysia (5.7097 ° N, 101.8511 ° E). In the present study, a total of 28 individuals (random of sexes) for *C. quadricarinatus* were used during the experiment for 28 days. There were two treatments in the present study; control (without aquaponics) and treatment (with aquaponics) and each treatment has 14 individuals of *C. quadricarinatus.* The body weight and body length of *C. quadricarinatus* that used in the present study were 12.03 ± 0.01 g and 7.55 ± 0.07 cm. Both treatments were cultured in 0.5 tons fibre tanks (1 m width x 1.1 m length x 1 m depth).

Pak Choi was used as a plant in the aquaponics system. Each tank was put the PVC pipes as a shelter for *C. quadricarinatus*. *C. quadricarinatus* were cultured in both treatments for 28 days and every day; *C. quadricarinatus* were fed with commercial marine shrimp diet (Royal Dragon Vannamei Prawn Feed) for twice a day in the morning (8 am) and in evening (5 pm). *C. quadricarinatus* were fed for 10 % of total body weight. For every 7 days, the body weight, body length and length of Pak Choy were measured. Besides, the survival rate was also measured using the following formulas (Fatihah et al., 2020):

Survival (%)
= (Final no. of *C. quadricarinatus*/ Initial no. *C. quadricarinatus*) x 100%

3.0 Results and discussion

3.1 Results for body length, body weight of redclaw, *Cherax quadricarinatus*, length of Pak Choi, *Brassica rapa chinensis* and survival (%) until 28 days

Body length and body weight for control and treatment for day 0 were 5.41 ± 0.12 cm, 7.55 ± 0.07 cm, 11.99 ± 0.04 g and 12.03 ± 0.01 g (Figure 1 and Figure 2). While, body length and body weight for control and treatment for day 28 were 9.58 ± 0.17 cm, 11.13 ± 0.60 cm, 17.08 ± 0.53 g and 19.93 ± 0.48 g (Figure 1 and Figure 2). The lengths of Pak Choi for day 0 were 2.58 ± 0.11 cm and after day 28, the lengths of Pak Choi were 9.08 ± 0.37 cm (Figure 3). Survivals (%) for control and treatment until day 28 were 42.86 % and 71.43 % (Figure 4).

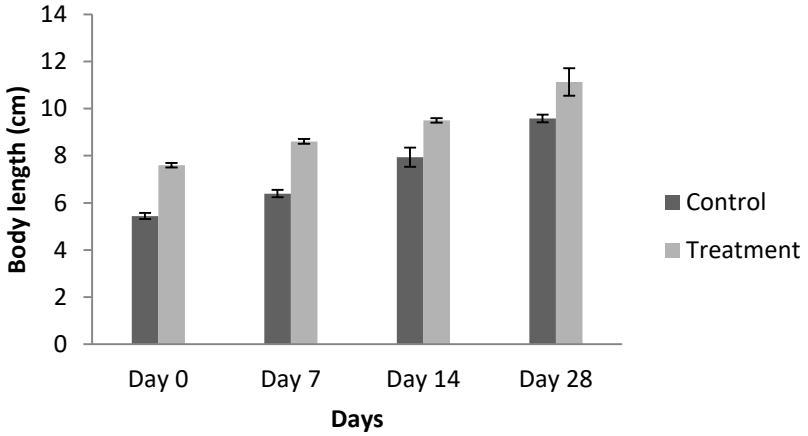

Figure 1: Body length until day 28 for control (without aquaponics) and treatment (with aquaponics) (n= 14)

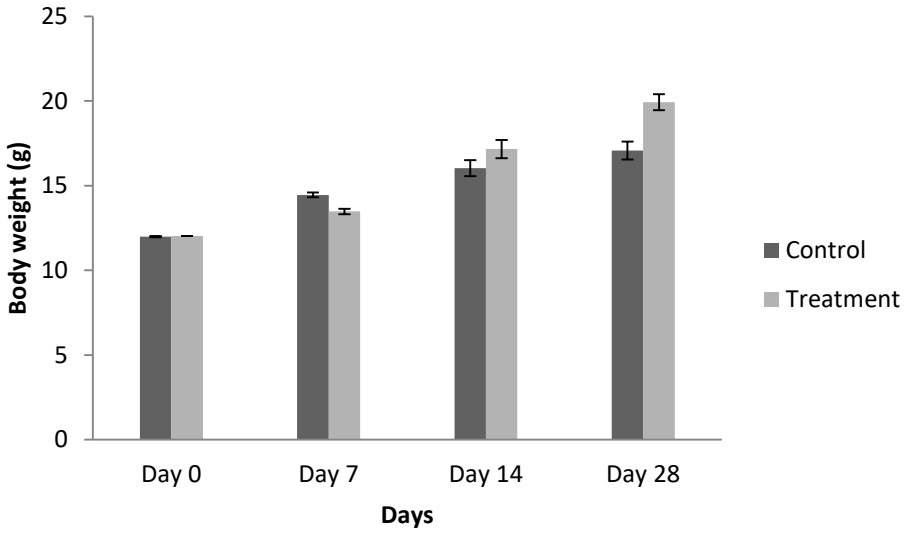

Figure 2: Body weight until day 28 for control (without aquaponics) and treatment (with aquaponics) (n= 14)

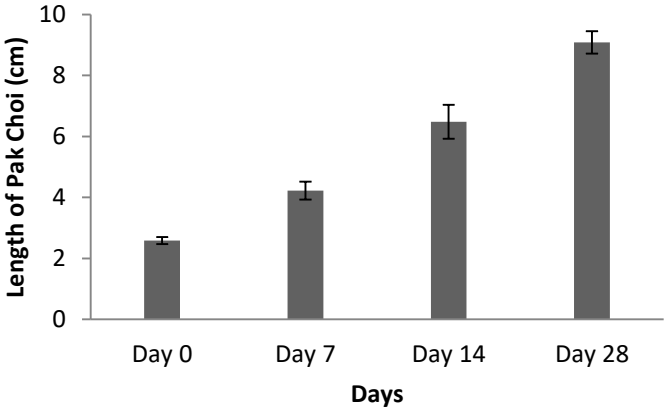

Figure 3: Length of Pak Choi, *Brassica rapa chinensis* until 28 days

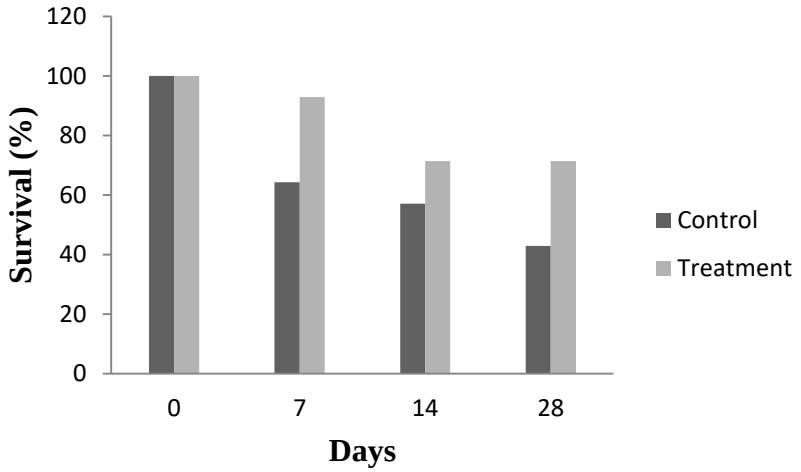

Figure 4: Survival (%) until day 21 for control (without aquaponics) and treatment (with aquaponics)

3.2 Growth performance of redclaw, *Cherax quadricarinatus* with and without aquaponics system

In the present study, the growth performance of *C. quadricarinatus* was increased in terms of body weight and body length when cultured in aquaponics system. Besides, Pak Choi also was increased in length until day 28. From the previous study, Sundar and Chen (2020) showed the growth performance of lettuce (*Lactuca sativa*) and Pak Choi (*Brassica chinensis*) and culture the redclaw (*Cherax quadricarinatus*) in different aquaponics system. From the previous study by Sundar and Chen (2020), the study also cultures the *C. quadricarinatus* and used the Pak Choi in aquaponics system and same study with the present study. The aquaponics system was circulating from tank of *C. quadricarinatus* to tank of vegetable, Pak Choi. In the tank of *C. quadricarinatus* in the present study, the water was clear and low ammonia than the tank without aquaponics system. Thus, the aquaponics system improved the culture tank of *C. quadricarinatus*.

In the present study, *C. quadricarinatus* that live comfortably showed the molting, the Pak Choi was growing healthy and the roots of Pak Choi were also growing long. The relation growth rate results showed that the suitable environmental conditions were provided for lettuce and Pak Choi to grow successfully in all the four aquaponics growing systems (Sundar and Chen, 2020). Study by Fadhilah et al. (2019) showed the growth performance of giant freshwater prawn, *Macrobrahium rosenbergii* and green bean, *Phaseolus vulgaris* in aquaponics system at different flow rates. The design of aquaponics system at different flow rate was able to treat the *M. rosenbergii* waste water and *P. vulgaris* grow well (Fadhilah et al., 2019). The present study also indicated *C. quadricarinatus* high survival and Pak Choi also grows better during the study. Furthermore, there was to relate the ability of nutrient reduction of *C. quadricarinatus* waste water cultured in aquaponics system using the vegetable plant, water spinach (*Ipomea aquatic*) (Effendi et

al., 2015) same with the present study that cultured of *C. quadricarinatus* with Pak Choi in aquaponics system.

The present study showed *C. quadricarinatus* was cultured in aquaponics system and in the system, the PVC pipe was put as a shelter to avoid the cannibalism and when there was a shelter, there was a low cannibalism in the aquaponics system. Previous study by Fatihah et al. (2020) was conducted to determine the effects of different substrate of survival, growth and total number of molting in juvenile of *C. quadricarinatus* for aquaculture purpose. Gallardo-Colli et al. (2014) study about the biculture tilapia/crayfish in aquaponics system biculture of tilapia (*Oreochromis niloticus*) and crayfish (*Pracambarus acanthophorus*) and production of green corn fodder (*Zea mays*) in aquaponics system.

4.0 Conclusion

The growth performance of *C. quadricarinatus* was performed well when cultured in the aquaponics system and same with the plant, Pak Choi also grow out during the period study until day 28. In the present study, it has been proven that *C. quadricarinatus* in aquaponics system has higher chance of survival and grow faster rather than *C. quadricarinatus* that cultured without aquaponics system.

6.0 References

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