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# Growth Performance of Redclaw, *Cherax quaricarinatus* through Pineapple Waste Utilisation

**Siti Nor Fatihah[1]*, Nur Aina Mardhiah Mazalam[1], Nur Aina Syuhada Abdullah[1], Siti Khadijah Mohamed Hadi[1], and Lim Leong Seng[2]**

*[1]Department of Agrotechnology and Bio Industry, Politeknik Jeli Kelantan Jalan Raya Timur Barat 17600 Jeli, Kelantan, Malaysia*

*[2]Borneo Marine Research Institute, Universiti Malaysia Sabah 88400 Kota Kinabalu, Sabah, Malaysia*

## ABSTRACT

The Australian Redclaw crayfish (*Cherax quadricarinatus*) has significant potential for aquaculture production. This study aimed to produce pellets incorporating pineapple waste and to evaluate the growth performance of redclaw based on body weight, body length, survival rate, and total number of molts. The experiment consisted of four dietary treatments: Diet 1 (0% pineapple waste), Diet 2 (5% pineapple waste), Diet 3 (10% pineapple waste), and Diet 4 (15% pineapple waste). A total number of 80 juveniles were used in the study were 4.7–7±0.69 cm in body length and weighed 3–9 ± 1.53 g. Results indicated that the percentage of pineapple waste in the diet influenced total weight, length, and weight gain. Notably, the pellets containing 10% pineapple waste achieved the highest average growth, with a body weight of 15.26 g and a body length of 8.46 cm, outperforming the other diets. Besides, the survival rate was 100 % during the period of study for 60 days. The total number of molts observed for the diets containing 5%, 10%, and 15% pineapple waste was a cumulative total of 10 times. In conclusion, the use of pineapple waste pellets significantly enhanced the growth of redclaw, demonstrating an effective way to utilise this agricultural byproduct.

*Keywords:* Growth performance, pineapple waste, pellet, redclaw, survival rate

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*E-mail addresses*:
fatihah@pjk.edu.my (Siti Nor Fatihah)
fatihah@pjk.edu.my (Nur Aina Mardhiah Mazalam)
fatihah@pjk.edu.my (Nur Aina Syuhada Abdullah)
fatihah@pjk.edu.my (Siti Khadijah Mohamed Hadi)
leongsen@ums.edu.my (Lim Leong Seng)
* Corresponding author

## INTRODUCTION

Pineapple is a rapidly expanding agricultural product in Malaysia, with various processed goods such as juice, jam, and beverages derived from it. During the production process, by-products including the stem, crown, core, and peel are discarded. This raises concerns about the disposal of pineapple waste, which is considered

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agricultural waste. Each year, approximately 150,000 kg of pineapple waste is generated (Selvanathan et al., 2020). Studies have shown positive effects of pineapple waste on animal growth, with significant improvements in growth rates compared to control groups (Sukri et al., 2022). Building upon this, the current research focuses on developing feed pellets for redclaw, *Cherax quadricarinatus* using pineapple waste as a primary ingredient. *Cherax quadricarinatus* was introduced to Kluang, Johor, Malaysia from Australia in 1990 for aquaculture purposes (Naqiuddin, 2020). The first wild population was recorded in 2012 in Parit Sulong, Johor, and Bintulu, Sarawak (Naqiuddin, 2020). This species has since been classified as invasive in Malaysia due to its environmental and economic impacts (Dali et al., 2023). Although widely cultivated for food, Redclaw has escaped from aquaculture facilities and spread into natural water bodies across the country (Dali et al., 2023). One major challenge in Redclaw farming is the limited availability of specialised compound feeds, which often results in nutritional imbalances, slow growth, and high mortality rates during culture (Chen et al., 2024).

The first wild record of *C. quadricarinatus* on the East Coast of Peninsular Malaysia involved six specimens identified through morphological and molecular analysis. These were captured in their natural habitat in Terengganu, an area with no nearby Redclaw aquaculture operations. This suggests the possibility of accidental release by aquarium hobbyists (Norshida et al., 2021). Further research is necessary to understand the spread and ecological impact of this non-native species along the East Coast and surrounding regions.

Previous studies, such as the investigation into the use of pineapple waste in the diet of Nile Tilapia (*Oreochromis niloticus*), have demonstrated positive outcomes. The fish showed optimal weight gain, improved specific growth rate, and no adverse effects on fillet texture (Sukri et al., 2022). Inspired by these findings, the current study aims to determine whether similar benefits can be observed in *C. quadricarinatus*. The growing interest in pellet production using agricultural and animal waste has also contributed to the motivation behind this research. The objective is to evaluate the effectiveness of pineapple waste-based pellets on Redclaw growth and to identify any potential positive or negative impacts, with a view toward future improvements.

The redclaw was chosen to observe the growth after consuming pineapple waste. Additionally, the aim is to gain knowledge of redclaw feeding behavior and the nutritional protein needed for their growth. Redclaw displays several physical, biological, and commercial attributes that make them suitable aquaculture candidates. Other positive characteristics include gregariousness, non-aggressive and non-burrowing behavior, and tolerance to relatively high stocking densities. This species can tolerate wide ranges of water quality conditions including low oxygen concentrations (> 1 ppm), wide ranges of hardness and alkalinity (20 to 30 ppm), and pH (6.5 to 9). Regarding pineapple waste, the crown part was selected. It contains higher amounts of cellulose, hemicellulose, and lignin.

The wastes are rich in fibre and bioactive substances and can be used as energy sources as well as digestible feedstuffs. The waste is typically non-toxic and represents a source of plant crowns, and stems that have a rich supply of bromelain along with additional cysteine proteasesPellet production specifically for *C. quadricarinatus* remains limited in Malaysia. As a bottom-feeding species, Redclaw typically consumes available zooplankton in its environment. In indoor culture systems, suboptimal growth and increased cannibalism are common issues. This study also addresses environmental concerns by exploring the potential of pineapple waste pellets to reduce agricultural waste pollution. Furthermore, findings from this research may support sustainable aquaculture practices and enhance Redclaw cultivation for local production. The ultimate aim is to develop effective pineapple waste-based pellets for *C. quadricarinatus* and assess their impact on growth performance and survival.

## MATERIALS AND METHODS

### Site Selection and Experimental Design

The experiment was taken place at the Fish Propagation House, located in Politeknik Jeli, Kelantan (N 5.712074, E 101.850085) The experiment was lasted for a period of three months. The starting point involves creating the pellet (Figure 1). Prior to pellet processing, it is necessary to prepare both the material and machine. Following that, four tanks are required for a trial experiment involving pellets. These tanks include a control tank (without any pineapple waste), treatment tank 1 (with 10% pineapple waste), treatment tank 2 (with 20% pineapple waste), and treatment tank 3 (with 30% pineapple waste). Each tank contains varying percentages of pineapple waste crude protein content as this experiment aims to investigate the impact of pineapple waste on *C. quadricarinatus*. Furthermore, each tank has 20 specimens of *C. quadricarinatus*, commonly known as red claw, measuring 2 inches in length, b for each sample. A total of 80 juvenile *C. quadricarinatus* tails, were used for the samples.

### Culture Quality Control and Feeding Method

Various types of substrates, such as PVC pipes, bricks, and palm leaves, are used to protect the aquatic animal (redclaw) from predators. These substrates serve dual functions: stabilising the pH of the water and providing shelter for redclaw. Additionally, nursery nets are employed to shield redclaw from threats and reduce stress. This control system helps maintain the quality of the aquatic animal and minimise the risk of death. The method of feeding is 2 times a day, morning and evening. Food is given at a rate of 10% of total biomass. The feeding weight was changed every 10 days after sampling the redclaw (Fatihah et al., 2020; Fatihah & Cheng-Ann, 2022).


*Figure 1.* Utilisation of pineapple waste for pellet production: (a) Pineapple waste was collected for the drying process; (b) After drying process, the pineapple waste was ground by using a blender; (c) Mixed all the ingredients, mix it up and shape it into a circle; (d) Put it in the grinder to form pellets; and (e) Dry it out under the sunlight and in the oven (70-100 °C)

### Data Collection and Analysis

The project to be developed is the effectiveness of pineapple residue on redclaw to help the process of growth and maturation of Red Claw. The data of this project is analysed depending on the objectives that have been set. Among the objectives is to produce high quality and healthy pellets for *C. quadricarinatus*. In addition, to obtain the growth performance and molting frequency on *C. quadricarinatus* uses the pellet from the waste of pineapple. This data helps us to obtain the effectiveness of pineapple waste on Red Claw. Data was collected on survival rate, body weight (g), body length (cm), and total number of moults for *C. quadricarinatus*) every 10 days over the 60-day experimental period.

## RESULTS AND DISCUSSION

Figure 2 showed the survival of *C. quadricarinatus* throughout the study period. The rate of molting occurs when changing the water in each treatment tank and this results in the new of *C. quadricarinatus* after molting preferring to be in the substrates such as PVC

pipes. *C. quadricarinatus*'s skin after molting is still soft and weak so handle carefully to avoid death. Figure 3 showed the total number of molting on each sampling day. While, Figure 4 and Figure 5 showed the means body weight (BW) and body length (BL) for *C. quadricarinatus* until days 100.

A comparable study is the research on mulberry leaves (*Morus alba*) as a potential protein source in tilapia feed. In that study, fish were weighed weekly over a five-week period, while *C. quadricarinatus* in the current experiment were sampled every ten days. The results indicated that mulberry pellets yielded a higher absolute growth rate compared to commercial pellets, with a lower feed conversion ratio (FCR) of 2, as opposed to 3 for commercial feed. Both pineapple waste and mulberry-based pellets demonstrated effectiveness in promoting growth in tilapia and *C. quadricarinatus*.

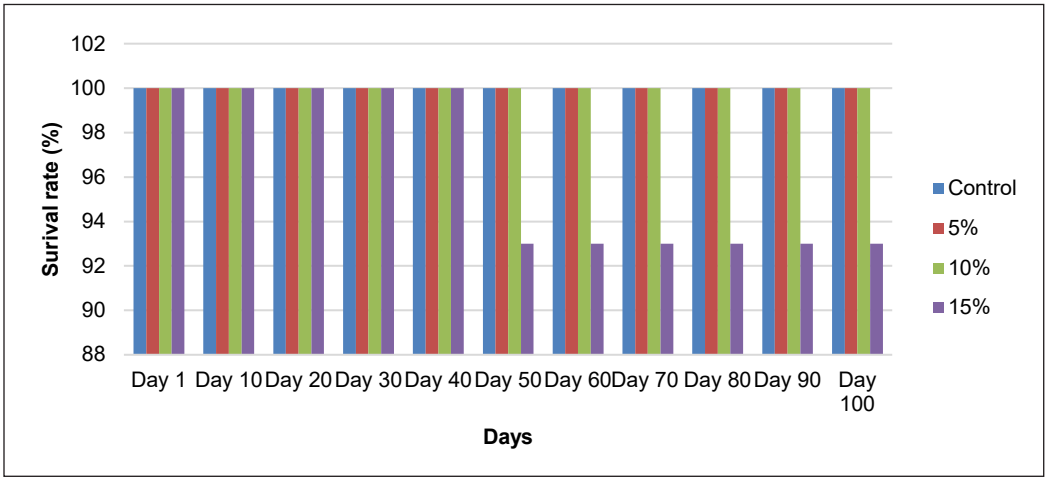


*Figure 2.* Survival rate for redclaw, *Cherax quadricarinatus* until days 60

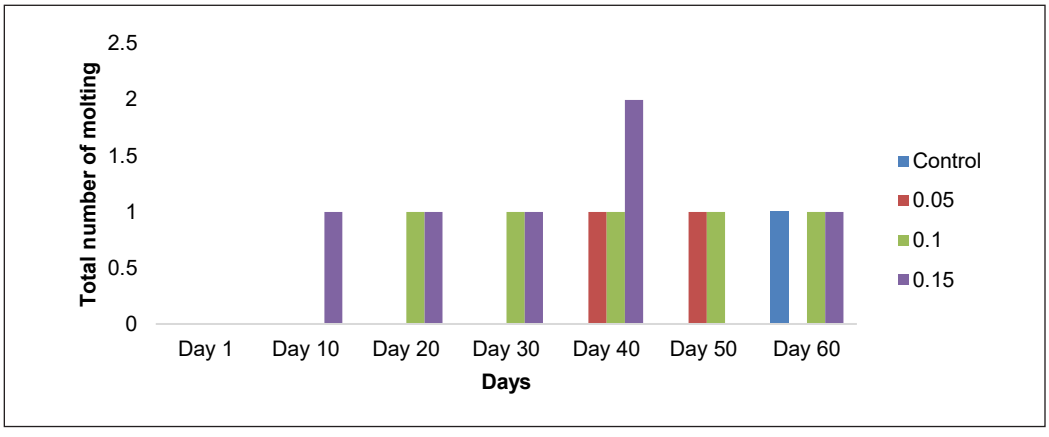


*Figure 3.* Total number of molting for redclaw, *Cherax quadricatinatus* until days 60

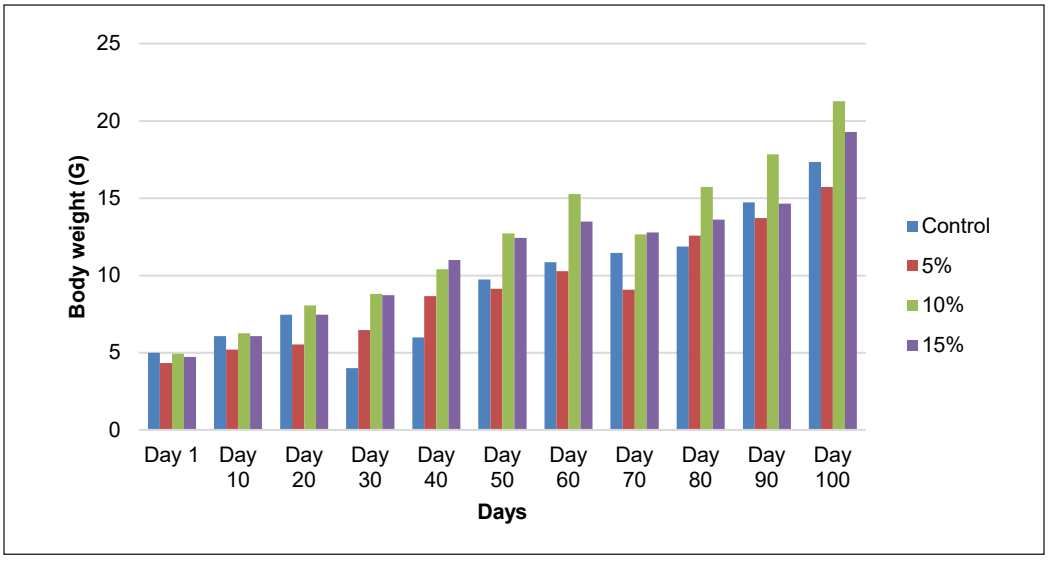


*Figure 4.* Means body weight (BW) for redclaw, *Cherax quadricarinatus* until days 60

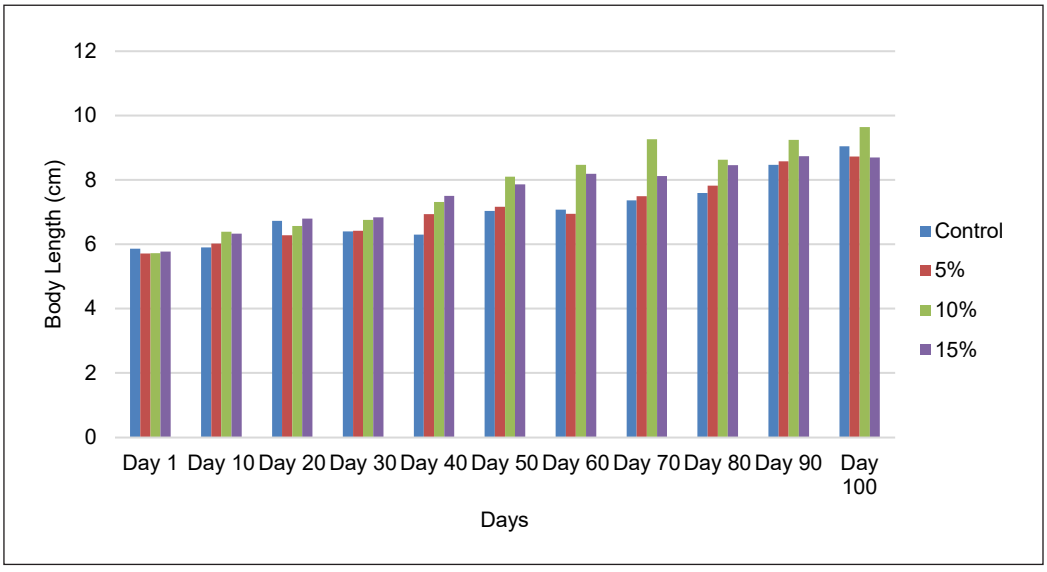


*Figure 5.* Means body length (BL) for redclaw, *Cherax quadricarinatus* until days 60

Previous research supports these findings. Fatihah et al. (2020) conducted a 60-day study on juvenile Redclaw using various substrates to assess their effects on growth, survival, and molting. Sukri et al. (2022) examined the influence of pineapple waste on growth, texture quality, and flesh color in Nile tilapia (*O. niloticus*) fingerlings. Similarly, Khumsrisuk et al. (2022) evaluated the use of pineapple waste to improve growth and resistance to *Aeromonas*

*hydrophila* in *O. niloticus*. Besides, study by Fatihah and Cheng-Ann (2022) showed the culture the C. quaricarinatus in aquaponics system and it was significant in growth performance of *C. quadricarinatus* when cultured in aquaponics system.

## CONCLUSION

The study successfully achieved its objectives, as demonstrated by data indicating that the application of pineapple waste in pellets can enhance growth performance in *C. quadricarinatus.* The experiment was conducted over a two-month period, with data collected every ten days by measuring weight, length, and molting frequency. Pineapple waste pellets proved effective even without the addition of probiotic ingredients. Four different tank setups were used: one with commercial pellets, and three with 5%, 10%, and 15% pineapple waste inclusion, respectively. After 50 until 100 days, the tank with 10% pineapple waste showed the highest average values in weight, length, and molting rate. Additionally, all tanks recorded a 100% survival rate, although growth performance varied between groups. Despite these promising results, the study has several limitations that should be addressed to improve pellet quality. Recommendations include adding attractant flavours to increase Redclaw's appetite for the pellets, enriching the formulation with essential nutrients such as calcium, magnesium, and carbohydrates to support optimal growth, and incorporating more natural substrates like sand and gravel to enhance habitat conditions. Beyond pellet formulation, packaging also plays a critical role in maintaining pellet quality by preventing damage and fungal contamination, which can cause disease in *C. quadricarinatus* and increase treatment costs. Furthermore, selecting a research location with minimal disturbances is advised to reduce environmental stress on the specimens.

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## REFERENCES

Chen, C., Jiang, Z., Liang, Z., Wu, S., Yang, H., Xu, C., & Li, E. (2024). Response of growth performance, antioxidant capacity, and gut microbiota to dietary cholesterol and lecithin in the juvenile Redclaw crayfish, Cherax quadricarinatus. *Aquaculture*, *581*, Article 740401. https://doi.org/10.1016/j.aquaculture.2023.740401

Dali, M. Z. M., Nasir, M. S. A. M., Khaleel, A. G., Madiran, N. A., Ismail, N., & Kamarddin, A. S. (2023). Genetic variability of wild populations of invasive redclaw crayfish (*Cherax quadricarinatus*) von martens 1868 across Peninsular Malaysia. *Malaysian Applied Biology, 52*(1), 35-42. https://doi.org/10.55230/mabjournal.v52i1.2427

Fatihah, S. N., & Cheng-Ann, C. (2022). Determine the growth performance of redclaw, *Cherax quadricarinatus* in aquaponics system. *Politeknik & Kolej Komuniti Journal of Social Sciences and Humanities 7*(1), 96-102.

Fatihah, S. N., Muhd-Farouk, H., Raduan, N. I. I., Leong-Seng, L., & Ikhwanuddin, M. (2020). Effect of substrate on growth, survival and molting in juvenile redclaw, *Cherax quadricarinatus*. *Journal of PeerScientist 3*(2), 1-6.

Khumsrisuk, P., Mapanao, R., & Nithikulworawong, N. (2022). Evaluation of pineapple waste crude extract in improving growth performance and resistance to Aeromonas hydrophila in Nile tilapia (Oreochromis niloticus). *International Journal of Aquatic Biology, 10*(5), 417-428. https://doi.org/10.22034/ijab.v10i5.1744

Naqiuddin, A. S. (2020). *Distribution and potential culture of introduced crayfish Cherax quadricarinatus (von martens 1868) in Malaysia* [Unpublished doctoral thesis]. Universiti Malaysia Sarawak.

Norshida, I., Mohd Nasir, M. S. A., Khaleel, A. G., Sallehuddin, A. S., Idrus, S. N. S., Istiqomah, I., & Ahmad, S. (2021). First wild record of Australian redclaw crayfish, *Cherax quadricarinatus* (von Martens, 1868) in the East Coast of Peninsular Malaysia. *BioInvasions Records 10*(2), 360-368. https://doi.org/10.3391/bir.2021.10.2.14

Sukri, S. A. M., Andu, Y., Harith. Z. T., Sarijan, S., Pauzi, M. N. F., Wei, L. S., Dawood, M. A., & Kari, Z. A. (2022). Effect of feeding pineapple waste on growth performance, texture quality and flesh colour of nile tilapia (Oreochromis niloticus) fingerlings. *Saudi Journal of Biological Sciences, 29*(4), 2514-2519. https://doi.org/10.1016/j.sjbs.2021.12.027