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EFFECTS OF MAGGOT MEAL AND GONGGONG SHELL MEAL ON MOLTING AND GROWTH PERFORMANCE OF MUD CRAB (*Scylla serrata*)

Pengaruh Tepung Maggot dan Cangkang Gonggong Terhadap Molting dan Pertumbuhan Kepiting Bakau (*Scylla serrata*)

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ABSTRACT

Feed efficiency and mineral adequacy to support molting and growth are major challenges in the cultivation of mud crab (*Scylla serrata*). This study aimed to evaluate the effect of supplementing maggot meal (*Hermetia illucens*) and gonggong shell meal in feed formulations on molting frequency, growth performance, and survival rate of mud crabs. The experiment was conducted using a Completely Randomized Design (CRD) consisting of three treatments: A (control—trash fish), B (feed + 5% maggot meal + 1% gonggong shell meal), and C (feed + 10% maggot meal + 3% gonggong shell meal), each with five replications. The crabs were reared for 30 days and fed daily at 5% of the total biomass. Parameters observed included absolute weight gain, specific growth rate (SGR), molting frequency, survival rate, proximate composition of the feed, and water quality. The results showed that treatment C produced the highest growth performance (absolute weight gain of 39.00 g; SGR 1.30%/day) compared to treatment B (18.00 g; 0.60%/day) and A (6.60 g; 0.22%/day). Proximate analysis indicated an increase in protein (36.42%) and ash content (12.35%) in the formulation containing gonggong shell meal. The survival rate remained high across treatments (A = 100%, B = 87%, C = 93%), while no individuals underwent molting during the study period. In conclusion, the supplementation of 10% maggot meal and 3% gonggong shell meal effectively improved the growth performance of *S. serrata* but was not sufficient to stimulate molting.

Keywords: Growth, maggot meal, mud crab, gonggong shell meal.

ABSTRAK

Efisiensi pakan dan kecukupan mineral untuk mendukung molting serta pertumbuhan merupakan kendala utama dalam budidaya kepiting bakau (*Scylla serrata*). Penelitian ini bertujuan untuk menilai pengaruh suplementasi tepung maggot (*Hermetia illucens*) dan tepung cangkang gonggong dalam formulasi pakan terhadap frekuensi molting, pertumbuhan, dan kelangsungan hidup kepiting bakau. Penelitian dilakukan secara eksperimental dengan menggunakan Rancangan Acak Lengkap yang terdiri atas tiga perlakuan, yaitu A (kontrol pakan rucah), B (pakan + 5% tepung maggot + 1% tepung cangkang gonggong), dan C (pakan + 10% tepung maggot + 3% tepung cangkang gonggong), masing-masing dengan lima ulangan. Pemeliharaan dilakukan selama 30 hari dengan pemberian pakan sebanyak 5% biomassa per hari. Parameter yang diamati meliputi pertambahan bobot mutlak, laju pertumbuhan spesifik (SGR), frekuensi molting, kelangsungan hidup, analisis proksimat pakan, dan kualitas air. Hasil penelitian menunjukkan bahwa perlakuan C memberikan hasil pertumbuhan tertinggi (bobot mutlak 39,00 g; SGR 1,30%/hari) dibandingkan dengan perlakuan B (18,00 g; 0,60%/hari) dan A (6,60 g; 0,22%/hari). Analisis proksimat menunjukkan peningkatan kandungan protein (36,42%) dan abu (12,35%) pada formulasi dengan tambahan cangkang gonggong. Kelangsungan hidup kepiting tetap tinggi dengan nilai A = 100%, B = 87%, dan C = 93%, sementara tidak terdapat individu yang mengalami molting selama masa penelitian. Secara keseluruhan, suplementasi 10% tepung maggot dan 3% tepung cangkang gonggong mampu meningkatkan pertumbuhan kepiting bakau, namun belum efektif dalam merangsang proses molting.

Kata kunci: Kepiting bakau, pertumbuhan, tepung maggot, tepung cangkang gonggong.

PENDAHULUAN

Mud crab (*Scylla serrata*) is a high-value fishery commodity widely cultivated in coastal areas of Indonesia. Market demand for mud crab continues to increase in line with the high consumption of animal protein from aquatic sources, both domestically and internationally (Patria *et al.,* 2020). Increasing crab cultivation productivity still faces various challenges, one of which is feed efficiency, which directly impacts growth and the molting cycle, a key indicator of successful crab cultivation (Trino *et al.,* 2001).

Molting is a physiological process that significantly determines crab growth. During this phase, crabs shed their old exoskeletons to allow for body size increase. Optimal molting success depends heavily on the nutritional composition of the feed, particularly the availability of protein, calcium, and other micronutrients that support biomineralization and tissue regeneration (Nurdiani *et al.,* 2016; Linder *et al.,* 2020).

Artificial feed for mud crabs is still dominated by relatively expensive and unsustainable conventional ingredients, such as fish meal and other animal-based ingredients. On the other hand, the potential of alternative feed ingredients from organic waste and local sources has not been optimally utilized (Henry *et al.,* 2015). Maggot meal from Hermetia illucens is an alternative protein source that is beginning to be widely researched due to its high protein content and its ability to convert organic waste into quality biomass (Makkar *et al.,* 2014; Diener *et al.,* 2015).

Gonggong shell meal (*Strombus* sp.), a marine waste product, contains high levels of calcium carbonate ($CaCO_3$) and has the potential to support the mineralization process in molting crabs (Nuryati *et al.,* 2021). The addition of external calcium sources has been shown to enhance exoskeleton hardening and post-molting survival in crustaceans (Gong *et al.,* 2017).

The combination of maggot meal and gonggong shell meal is expected to provide an alternative feed formula that supports growth and accelerates the molting cycle in mud crabs, with more efficient production costs and an environmentally friendly approach. However, to date, there has been little research specifically examining the effect of combining these two ingredients on the physiological parameters and growth of mangrove crabs.

Based on this background, this study was conducted to answer the question of whether the combination of maggot meal and gonggong shell meal in feed can significantly increase the molting frequency and growth of mangrove crabs. The results are expected to provide scientific and practical contributions to the development of alternative feed technologies based on local resources.

RESEARCH METHODS

The research was carried out from August to October 2025 at the Marine Aquaculture Laboratory, UMRAH Senggarang campus.

The tools used during the research included Derigen as a crab container, digital scales, DO meter, aerator, stationery, siphon hose, thermometer, pH meter. Meanwhile, the ingredients used are mangrove crabs, maggot flour, gonggong shell flour, commercial pellets.

Research Design

The method used during the research was an experimental completely randomized design (CRD) with three treatments and five replications. Treatments consisted of A (control), B (5% maggot meal and 1% gonggong shell meal), and C (10% maggot meal and 3% gonggong shell meal).

Table 1. Dosage of Maggot Meal and Gonggong Shell Meal

Treatment	Description
A	100 % Rucah fish
B	5 % Maggot Flour and 1% Gonggong Shell Flour
C	10% Maggot Flour and 3% Gonggong Shell Flour

Research Procedures

The test mud crabs were reared in 15 10-liter drums. The drums were cleaned with a sponge and then rinsed with water until clean. The cleaned drums were then filled with clean seawater to a height of 10 cm. An aerator and an aeration device were installed to increase oxygen, and each drum was then coded for treatment.

The production process for crab feed based on maggot flour and gonggong shell flour involves several main stages: raw material preparation, formulation, mixing, molding, and drying. The main ingredients used were fresh maggots and gonggong shell flour, along with commercial feed as the base. Additional ingredients, such as commercial feed and tapioca flour, were also used as a feed binder. Maggots were obtained from maggot larvae collected from clean organic media, washed, and dried for three days until the moisture content was below 10%. Afterward, the dried maggots were ground into a fine powder and sieved. Gonggong shell flour is made by washing and cleaning the shells of dirt and soft tissue. The shells are then boiled and dried in the sun for approximately three days until dry. The dried shells are ground into a fine powder to increase calcium availability.

The commercial feed used as the base ingredient is ground until smooth for easy mixing with other ingredients. All dry ingredients are weighed according to the established formulation, with proportions corresponding to the treatment using maggot flour and gonggong shell flour mixed into the commercial feed. All dry ingredients are mixed until homogeneous, then tapioca flour is added as a feed binder until the mixture is easy to shape or mold. The dough is then molded using a feed molder to the size of the crab feed to be fed.

The resulting wet pellets are then dried under the hot sun until the moisture content reaches <10% to prevent mold growth and extend their shelf life. Once dry, the pellets are stored in an airtight container at room temperature until use. Before being used in the study, the prepared feed was analyzed for its chemical composition through proximate analysis to determine ash content (SNI 01-2891-1992 method, point 6.1), energy from fat (18-8-9/MU method (calculation), total fat content (18-8-5/MU (gravimetry), water content (SNI 01-2891-1992 method, point 5.1), total energy (18-8-9/MU method (calculation), carbohydrate (by difference) (18-8-9/MU method (calculation), and protein content (18-8-31/MU (titrimetry).

The test crabs were fed twice a day, at 9:00 a.m. and 5:00 p.m. WIB, with a maintenance period of 30 days. The test crabs were fed 5% of their body weight. Growth measurements were carried out every 10 days to determine the growth of the test crabs.

Measurements Water quality in the maintenance media was monitored every 10 days to determine the water quality in the test media container. The water quality parameters observed during the study were temperature, pH, and dissolved oxygen (DO). A 50% water change in the maintenance container was performed to prevent stress on the test crabs.

Research Parameters

The parameters measured included absolute weight gain, daily growth rate (SGR), survival rate, and molting frequency. Weight gain was measured every 10 days.

Data Analysis

Data is stored neatly and correctly using Microsoft Excel 2019 software. Analysis of the data that has been collected using SPSS software version 25 then for the next stage analysis of variance (ANOVA). In data processing, if a significant difference is found between treatments, it is continued with the Duncan test. The data that has been processed is presented in tables, figures and graphs.

RESULT

Absolute Weight Gain

The absolute weight of mangrove crabs fed different feeds indicates growth variation between treatments. Absolute weight is an important parameter that describes the increase in total body mass during the maintenance period and is an indicator of the effectiveness of the feed in supporting biomass growth. The results of observations showed that the absolute weight values for each treatment were as follows: treatment A (trash fish feed) of 6.60 g, treatment B (feed with the addition of 5% maggot flour and 1% gonggong shell flour) of 18.00 g, and treatment C (feed with the addition of 10% maggot flour and 3% gonggong shell flour) of 39.00 g. The absolute weight growth of mangrove crabs can be seen in Figure 3 below.

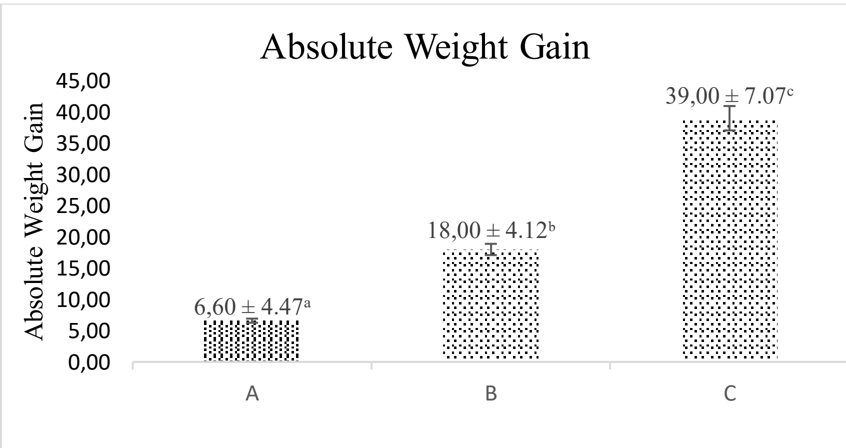

Figure 3: Absolute Weight Growth of Mangrove Crabs

Specific Growth Rate

The specific growth rate (SGR) of mud crabs (*Scylla serrata*) reared on different feeds showed significant growth variation between treatments. The SGR is used to describe the daily growth rate of an organism relative to its initial weight and is an indicator of feed efficiency in supporting biomass growth.

Based on observations, the highest SGR value was obtained in treatment C (feed supplemented with 10% maggot meal and 3% gonggong shell meal) at 1.30%/day, followed by treatment B (5% maggot meal and 1% gonggong shell meal) at 0.60%/day, while treatment A (trash fish feed) showed the lowest value at 0.22%/day. The SGR of mud crabs can be seen in Figure 4 below.

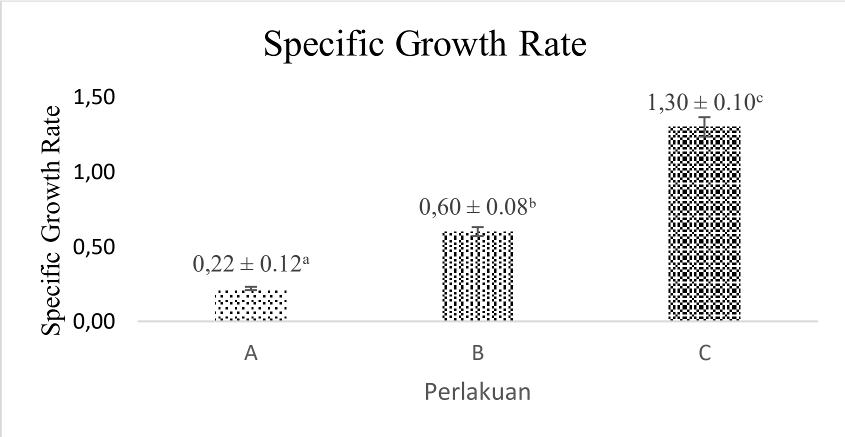

Figure 4: Specific Growth Rate of Mangrove Crabs

Water Quality

Water quality is a crucial environmental factor for successful mangrove crab cultivation, as it affects physiological activity, metabolism, and feed utilization efficiency during growth. Water quality parameters observed during the study included salinity, temperature, pH, and dissolved oxygen (DO) levels.

Based on observations, water quality values during the cultivation period ranged from 25-26 ppt salinity, 27.70-28.10°C temperature, 7.00-7.20 pH, and 7.00-7.30 mg/L DO. These values are within the optimal range for mangrove crab growth and survival. The water quality of the mangrove crab culture can be seen in Table 1. Water Quality Observations below.

Table 1. Water Quality Observations

No	Parameter	Unity	Optimum Quality
1	Salinity	ppt	25-26
2	Temperature	^{0}C	27,70-28,10
3	pH		7,00-7,20
4	DO	mg/L	7,00-7,30

Proximate Analysis of Feed

Proximate analysis was conducted to determine the basic chemical composition of the feed used during mangrove crab cultivation. Parameters analyzed included moisture, ash, total fat, protein, carbohydrate, and total energy content. This data is crucial for assessing the nutritional quality and energy balance of the feed, as both factors directly influence the growth efficiency and health of the cultured organisms.

The results of the proximate analysis showed that the feed in treatment B (with the addition of 5% maggot meal and 1% gonggong shell meal) had a protein content of 35.53%, a fat content of 6.50%, ash content of 10.03%, moisture content of 13.07%, carbohydrate content of 34.43%, and a total energy content of 338.98 kcal/100 g. Meanwhile, the feed in treatment C (with the addition of 10% maggot meal and 3% gonggong shell meal) had a protein content of 36.42%, a fat content of 6.09%, ash content of 12.35%, moisture content of 12.82%, carbohydrate content of 32.88%, and a total energy content of 332.01 kcal/100 g. A proximate analysis of the mangrove crab feed can be seen in Table 2 below.

Table 2. Proximate Analysis of Mangrove Crab Feed

No	Parameter	Unit	Treatment B	Treatment C
1	Ash Content	%	10.03	12.35
2	Energy from Fat	kcal/100 g	58.50	54.81
3	Total Fat Content	%	6.50	6.09
4	Moisture Content	%	13.07	12.82
5	Total Energy	kcal/100 g	338.98	332.01
6	Carbohydrate	%	34.43	32.88
7	Protein Content	%	35.53	36.42

Source: Laboratory Test Results

Molting Frequency during the Study

Based on observations during the rearing period, no individual crabs in any of the treatments (A, B, and C) experienced molting. This indicates that during the study period, nutritional and environmental factors were not able to stimulate molting. The molting frequency of mangrove crabs can be seen in Table 3 below.

Table 3. Molting Frequency of Mangrove Crabs

No	Treatment	Replications					Amount
		1	2	3	4	5	
1	A	-	-	-	-	-	-
2	B	-	-	-	-	-	-
3	C	-	-	-	-	-	-

Survival Rate

Survival rate is a crucial parameter in assessing the success of mangrove crab cultivation. This parameter indicates the organism's ability to adapt to environmental conditions, feed type, and the applied rearing system.

Based on the research results, the survival rate of mangrove crabs throughout the rearing period showed relatively high results across all treatments: 100% in treatment A (trash fish feed), 87% in treatment B (feed supplemented with 5% maggot meal and 1% gonggong shell meal), and 93% in treatment C (feed supplemented with 10% maggot meal and 3% gonggong shell meal). These results indicate that all feed treatments supported good survival rates. The survival rate of mangrove crabs can be seen in Figure 5 below.

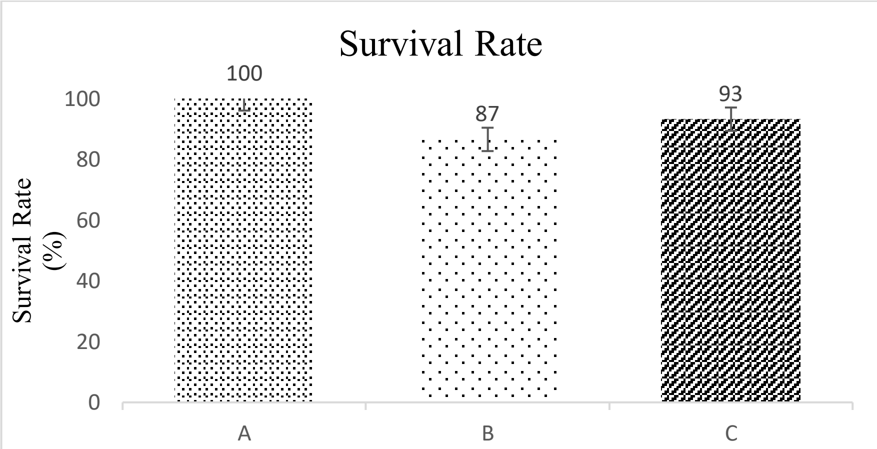

Figure 5: Survival of Mangrove Crabs

DISCUSSION

Absolute Weight Gain

The results showed that the highest absolute weight gain for mangrove crabs was achieved in treatment C (39.00 g), followed by treatments B (18.00 g), and A (6.60 g). This difference indicates that the addition of maggots and gonggong shells to the feed has a positive effect on mangrove crab growth. Treatment C, thought to be a combination of maggot- and gonggong-based feed, produced the highest weight gain due to its more balanced nutritional composition, particularly in terms of protein, essential amino acids, and easily digestible fats. Successful crab growth is strongly influenced by the nutritional balance of the feed, particularly protein and lipid content, which support tissue synthesis and energy metabolism (Christianus, 2019).

The significant absolute weight gain in treatment C can also be attributed to increased feed efficiency (feed conversion ratio) and protein retention in the crabs' bodies. Improving the quality of easily digestible animal feed ingredients, such as insects and mollusks, can accelerate crab growth by increasing energy intake and reducing metabolic waste. Furthermore, the softer texture of the feed facilitates consumption, especially during the intermolt phase, when crabs are more sensitive to hard feed (Trino *et al.,* 2022).

The highest growth in treatment C indicates a positive synergy between the high protein content of maggots and the minerals from gonggong shells. This combination produces a feed with a balanced nutritional content that supports tissue anabolism and accelerates absolute weight gain. These results align with those of Effendi et al. (2022), who reported that a combination of animal feed ingredients and natural minerals increased the growth of mangrove crabs by up to 2.5 times compared to the control without supplements.

Treatment A, which used trash fish feed, showed the lowest absolute weight (6.60 g). This is strongly suspected to be due to the low content of degraded protein and an imbalance in the ratio of essential amino acids contained in the trash feed. Trash fish generally decline in quality over time due to fat oxidation and protein degradation by microbial activity, especially if not properly preserved. This condition results in suboptimal intake of essential nutrients such as lysine, methionine, and arginine, which play a vital role in muscle tissue formation and exoskeleton chitin synthesis (Catacutan, 2002).

Specific Growth Rate

The results showed that the highest specific growth rate (SGR) for mangrove crabs was achieved in treatment C (1.30%), followed by treatment B (0.60%), and the lowest in treatment

A (0.22%). This difference indicates that the addition of maggot meal and gonggong shell meal to the feed formulation significantly contributed to increased mangrove crab growth.

The high growth rate in treatment C is thought to be due to the optimal animal protein content of the maggots and the availability of calcium and phosphorus from the gonggong shell meal. Maggots are known as a high-quality protein source, with a crude protein content of 40–60% and a complete range of essential amino acids, including lysine, methionine, and threonine (Barragan et al., 2017). Maggot fat also contains lauric acid, which serves as a fast energy source to support protein synthesis and muscle tissue formation (Makkar et al., 2014).

Gonggong shell flour contributes the minerals Ca and P, which play a crucial role in the post-molting exoskeleton hardening process and enzymatic activity associated with new tissue growth (Rachmawati et al., 2021). This combination of protein and mineral sources supports metabolism and tissue regeneration, ultimately increasing feed conversion efficiency and growth rate (Das, 2016).

In contrast, treatment A, which used trash fish feed, showed the lowest growth rate. Trash fish often have unstable nutritional content, especially when not stored properly, leading to protein degradation and lipid oxidation, which reduce their biological value (Trino & Millamena, 1999).

Water Quality

Observations indicate that water quality parameters during the mangrove crab cultivation period were within the optimum range for the growth and survival of *Scylla serrata*. Salinity values ranged from 25–26 ppt, temperature 27.70–28.10°C, pH 7.00–7.20, and dissolved oxygen (DO) 7.00–7.30 mg/L. Generally, these parameters are within the recommended range for mangrove crab cultivation.

Salinity is a major environmental factor affecting osmotic balance and crab physiological processes. A salinity of 25–26 ppt is considered ideal for mangrove crabs because it supports energy efficiency in osmoregulation and metabolism. Optimal salinity for mangrove crabs ranges from 15–30 ppt, as extreme fluctuations can cause osmotic stress and reduce growth efficiency (Hill, 1979).

Water temperatures during the study were also within the optimal range (27.70–28.10°C). This temperature supports metabolic and digestive activity in mangrove crabs. Temperatures that are too low can slow metabolism, while temperatures above 32°C can increase oxygen consumption and cause stress. This aligns with findings by Baylon (2010), who stated that optimal growth and survival of mangrove crabs occur at temperatures between 27 and 30°C.

A pH of 7.00–7.20 indicates relatively neutral water conditions, suitable for enzymatic activity and ionic stability in aquatic organisms. A pH below 6.5 can disrupt the respiratory system and the absorption of minerals such as calcium, while a pH above 8.5 can increase the toxicity of free ammonia (Boyd, 2015).

Dissolved oxygen (DO) concentrations range from 7.00–7.30 mg/L, which is excellent for crab growth. DO levels above 5 mg/L are necessary to support respiration and the energy-intensive molting process (Fotedar et al., 2010). The availability of sufficient oxygen has a significant impact on feed efficiency and crab growth in semi-intensive cultivation systems (Chand *et al.,* 2015).

Proximate Analysis of Feed

Proximate analysis results showed that the feed in treatment B (5% maggot meal and 1% gonggong shell meal) contained 35.53% protein, while treatment C (10% maggot meal and 3% gonggong shell meal) had a slightly higher protein content, at 36.42%. The increased protein content in treatment C directly contributed to the increase in absolute weight (39.00 g) and specific growth rate (1.30%) of mangrove crabs compared to treatment B (18.00 g; 0.60%). This is in line with the opinion of Suprayudi *et al.,* (2020) who stated that adequate protein availability in the feed is crucial for muscle tissue formation and exoskeleton growth in mangrove crabs.

The total fat content in both treatments was relatively similar, at 6.50% in treatment B and 6.09% in treatment C. Fat serves as the primary energy source for aquatic organisms to support metabolic processes and the efficient use of protein as a tissue building material (Suryaningrum, 2021). The relatively high total energy content (338.98–332.01 Kcal/100 g) also supports optimal growth activity in treatment C. According to Purnamasari *et al*., (2021), a balance between energy and protein in the feed is crucial for achieving an optimal protein-energy ratio (P/E ratio) to promote growth without wasting metabolic energy.

The increase in ash content from 10.03% (treatment B) to 12.35% (treatment C) indicates the mineral contribution of gonggong shell flour, which is rich in calcium carbonate ($CaCO_3$). This mineral plays a crucial role in the calcification of the exoskeleton after molting, a critical stage in mud crab growth (Suryati & Pratiwi, 2022). These results align with research by Arifin *et al.,* (2022), which reported that calcium mineral supplementation from natural sources such as mollusk shells can increase exoskeleton thickness and strength and accelerate carapace hardening.

The relatively high carbohydrate content (32.88–34.43%) serves as an additional energy source for daily activities and maintains energy homeostasis (Laining & Tambunan, 2020). The combination of high protein content, balanced energy, and minerals from gonggong shells in treatment C makes the feed formulation more efficient in increasing the growth of mangrove crabs. Overall, these results indicate that the synergistic use of maggot meal and gonggong shell meal can increase feed efficiency and growth performance compared to trash fish-based feed (treatment A).

Molting Frequency during the Study

The results of the study showed that during the rearing period, no individual mangrove crabs underwent moulting (exoskeleton shedding) in all treatments (A, B, and C), including treatments supplemented with maggots and gonggong flour in the feed formulation. This indicates that neither the basal feed nor the supplementation treatments were able to stimulate ecdysis in mangrove crabs.

Moulting is a crucial physiological stage in crab growth, where exoskeleton shedding allows for an increase in body size. This process is controlled by a complex interaction between ecdysteroid hormones, nutrition, and environmental factors (Chang & Mykles, 2011). Failure to moult is generally caused by nutritional imbalances, particularly calcium and phosphorus, as well as low levels of cholesterol and essential fatty acids required for ecdysteroid hormone synthesis (Romano, 2017).

The rearing environment also significantly influences moulting success. Previous research has shown that fluctuations in temperature and salinity, as well as low dissolved oxygen, can inhibit ecdysteroid hormone secretion and delay molting (Wahyudi, 2021). If the environmental conditions in this study were unstable, this could exacerbate the effects of the nutritional imbalance in the feed.

Maggots are also known to have an unbalanced Ca:P ratio (around 5:1), which can disrupt mineral metabolism in aquatic organisms, including the formation of new exoskeletons (Spranghers, 2018). This imbalance may be one of the reasons why moulting did not occur in treatments using maggot-supplemented feed.

Meanwhile, gonggong flour is a local ingredient rich in calcium and animal protein. However, the mineral bioavailability of gonggong flour can decrease if the processing is not optimal, such as excessive heating, which causes the calcium mineral to precipitate as calcium carbonate, which is difficult for the crab's body to absorb (Alfitri, 2020). Thus, despite its high mineral content, the effectiveness of calcium absorption for new exoskeleton formation can be reduced.

Survival Rate

The results of the study showed that the survival rate of mangrove crabs during the rearing period varied between treatments: 100% in treatment A, 87% in treatment B, and 93% in treatment C. This difference indicates the influence of maintenance management and environmental quality on crab survival.

The highest survival rate in treatment A (100%) indicates that the environmental conditions and feeding management implemented optimally supported the crabs' survival. While the decline in treatments B and C is thought to be due to an imbalance in environmental factors resulting from excessively frequent water changes, which caused stress in the mangrove crabs. Mangrove crab survival is strongly influenced by the interaction between density, food availability, and aquatic environmental conditions. Increased density and competition for space can trigger stress and cannibalistic behavior, which reduces survival rates (Baylon, 2017).

Throughout the study, water changes were performed routinely and frequently because the feed used easily contaminates the water. This condition is caused by increased organic matter and ammonia content from leftover feed and feces, which tends to degrade water quality. Water changes are carried out to maintain water quality so that parameters such as dissolved oxygen (DO), pH, and ammonia remain within the optimum range for crabs. Uneaten food residue will biodegrade and increase ammonia concentrations in the water, which can cause physiological stress and death in aquatic organisms. Water changes also have the potential to cause fluctuations in salinity and temperature if done too frequently, which can cause additional stress on mangrove crabs (Boyd & Tucker, 1998).

CONCLUSION

A feed formulation with the addition of 10% maggot flour and 3% gonggong shell flour has been proven to significantly increase the growth of mud crabs (*Scylla serrata*) compared to the control, with a high survival rate (≥87%). The mineral content of the feed increased, but was not able to stimulate the molting process during the 30-day rearing period. Therefore, it is necessary to optimize calcium bioavailability through better shell processing and extend the rearing period to obtain a more significant physiological effect on molting and exoskeleton quality.

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