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The Effect of Herbal Additives (Curcuma and Garlic) On Feed On the Growth of Green Lobster (Panulirus Homarus) In Vietnamese-Style Cage (Sub-Merge Cage) In Pangandaran Regency

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Abstract

The purpose of this research is to determine the growth (Absolute Weight Growth, Daily Growth Rate, Feed Conversion Ratio, Feed Efficiency, Intestine Description and Water Quality of Green Lobster (*Panulirus Homarus*) given curcuma and garlic in Vietnamese-style cage in Pangandaran Regency. Research has been conducted on the East Coast of Pangandaran Regency from March 2022 to October 2022 with a Completely Randomized Design. Lobsters were given trash fish feed (control = A), rebon shrimp feed (B), rebon shrimp feed plus turmeric extract (C) and rebon shrimp feed plus garlic extract (D) which was repeated 4 times. The best treatment is treatment C and A (rebon shrimp feed plus turmeric extract and trash fish feed) with Daily Growth Rate values of 1.33% and 1.22%, Feed C and A Conversion Ratio (rebon shrimp feed plus turmeric extract and trash fish feed) of 14.5 and 16.53, SR is equally good, and the highest is 95.00% in lobsters fed shrimp plus turmeric, the best feed efficiency in lobsters fed with rebon shrimp plus turmeric was 7.07%.

INTRODUCTION

Lobster is a marine animal that belongs to crustaceans or crustaceans with a hard skin texture and belongs to the group of Arthropods. Lobsters have five life phases starting from the diffusion of egg sperm, then the puelurus or larval phase, post larval, juvenile and adult. Lobsters include nocturnal animals that actively forage at night while during the day lobsters hide in coral holes. Sea lobsters live in rocky, coral and sandy water areas (Rostika *et al*, 2022). Types of lobsters in Indonesia include Green Lobster (*Panulirus Homarus),* Stone Lobster *(P. Penicillatus),* Pearl Lobster (P. *Ornatus)* and Bamboo Lobster *(P. Versicolor) (*Rahman &; Herdianto, 2018). However, in the waters of Pangandaran Beach which are widely cultivated are types of Green Lobster and Pearl Lobster.

Lobster rearing is generally carried out in Floating Net Cages (KJA) to provide conditions that are in accordance with their natural habitat. However, the use of KJA with nets stored on the sea surface has disadvantages where the quality of the waters can easily change due to weather changes.

On the other hand, lobsters have properties that are sensitive to environmental changes or significant changes in water quality. Therefore, the use of floating net cages with the Vietnamese-style cage method immersed in the water column (Vietnamese-style), is thought to be one solution to lobster cultivation (Utama *et al*, 2023).

One of the things that need to be considered in cultivation activities is feeding. Feed is one of the most important cultivation inputs because production costs derived from feed can reach 60% (Afrianto & Liviawaty, 2005). Feed used for lobster cultivation currently still relies

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on natural foods such as trash fish, shrimp, squid, and shellfish, in general, trash fish feed is more often used by farmers (Utama *et al,* 2023). The use of trash fish as feed has disadvantages including the low Feed Conversion Ratio, because the quality varies so that large quantities of trash fish are needed to support the growth of lobsters. In addition, the availability of trash fish feed varies because it depends on the catch, as well as trash fish feed has the potential to be a carrier of disease (Utama *et al*, 2023).

Currently, lobster cultivation carried out in Indonesia is still limited to enlargement which still experiences many problems such as high mortality rates of fry during enlargement, feed problems, and long enlargement times. So that the export supply of Indonesian lobsters is dominated by catches, while in the cultivation phase it still relies on seeds from nature (Utama *et al*, 2023). Feeding is one of the things that need to be considered in lobster farming activities, lobster health can be seen in the appearance of the intestine and hepatopancreas.

The condition of the lobster intestine is an indicator of the health of crustaceans including lobsters (Figure 1). The intestine runs caudally between the hepatopancreatic lobes and connects with the hindgut. The organ is lined by a simple columnar epithelium supported on an irregular PAS-positive basal membrane, followed by a thin layer of connective tissue presenting discrete hemolymph spaces. The intestinal lining epithelium shows one cell type, which presents two different acidophilic characteristics. However, all epithelial cells have a slight brush border (PAS - weak, AB pH 1.0 and pH 2.5 - negative), a cytoplasm with small subapical vesicles, and a central nucleus. Externally, a thick layer of loose connective tissue covers a layer of circular visceral muscle. Small vessels are observed in the connective tissue, as well as hemocytes and an irregular system of hemolymph spaces (Ruiz et al, 2020).

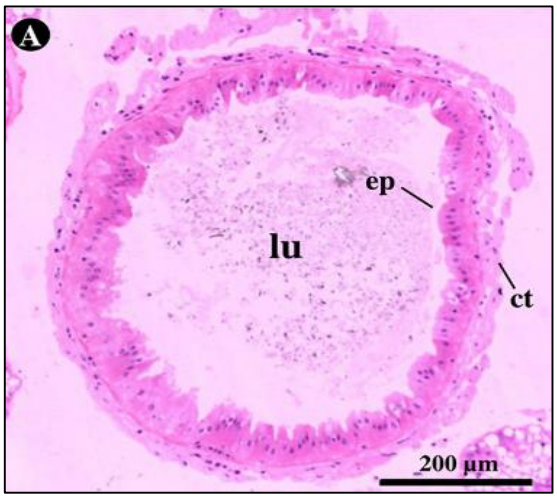

Figure 1: Transverse section of intestine of *Macrobrachium carcinus* showing the epithelium (ep), cytoplasm (ct) and connective tissue surrounding the intestine

Fulfillment of these nutrients can be done by providing high protein and fat feed (15% - 30%) through fresh feed (trash fish) or artificial feed. In addition to trash fish, rebon shrimp (*Acetes*) is also often used as an alternative feed to help the growth rate of lobsters (Mustafa, 2013). Rebon shrimp has a fairly high protein content of 52.35% (Sholichin *et al*, 2012). Therefore, rebon shrimp is very suitable to support the protein needs of lobsters.

The duration of lobster enlargement from larva to adult is felt to be quite long, more than 12 months, lobster survival rate is also low. This is thought to be because lobsters are susceptible to water quality which makes lobster immunity low and feed nutrient absorption is

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disrupted. Some studies say that the addition of turmeric extract to feed can provide a fairly optimal growth rate. Turmeric contains 9.6% curcumin and 3.18% essential oil (Santika *et al*, 2021). Arifin *et al*, (2015) in Santika (2021) suggest that curcumin can stimulate the gallbladder wall to secrete bile into the small intestine. It can improve the digestion of fats, proteins, and carbohydrates so that the absorption of food substances increases. In addition, essential oil in turmeric serves to prevent excessive gastric acid release so as to facilitate the absorption of food substances by the small intestine.

According to Santika *et al*, (2021) the addition of turmeric extract to feed can affect the absolute growth rate and provide an optimal survival rate for white snapper. Meanwhile, Rosyida *et al*, (2022) suggested that the addition of turmeric extract to the viability of vaname shrimp can have a real effect on the survival rate of vaname shrimp, which is 68.3%. But it is not yet known the effect of adding turmeric extract on the growth rate of lobsters.

The problem of lobster cultivation today is also found in the mortality rate of fry that is quite high in the enlargement process caused by disease infection. Some studies say that there are several bacteria and parasites that exist in lobsters. Green lobster originating from Pangandaran Regency is infected with the parasite *Octolasmis* sp. (Sudewi *et al*, 2018). It is mentioned that lobsters are infected with several types of bacteria including *Shigella sp.*, Enterobacter *sp. and* Plesiomonas *sp.* (Mindar *et al*, 2017). Therefore, it is necessary to add *additives* to the feed to minimize the mortality rate of lobster fry. According to Syifa *et al*, (2013) suggested that the addition of garlic extract to feed is quite effective in inhibiting bacterial growth in milkfish farming. However, it is not yet known the effect of adding garlic extract to feed on the mortality rate of lobster fry.

METHOD

This research was carried out in Floating Net Cages located on the East Coast, Pangandaran Regency for 40 days in August 2022 - September 2022.

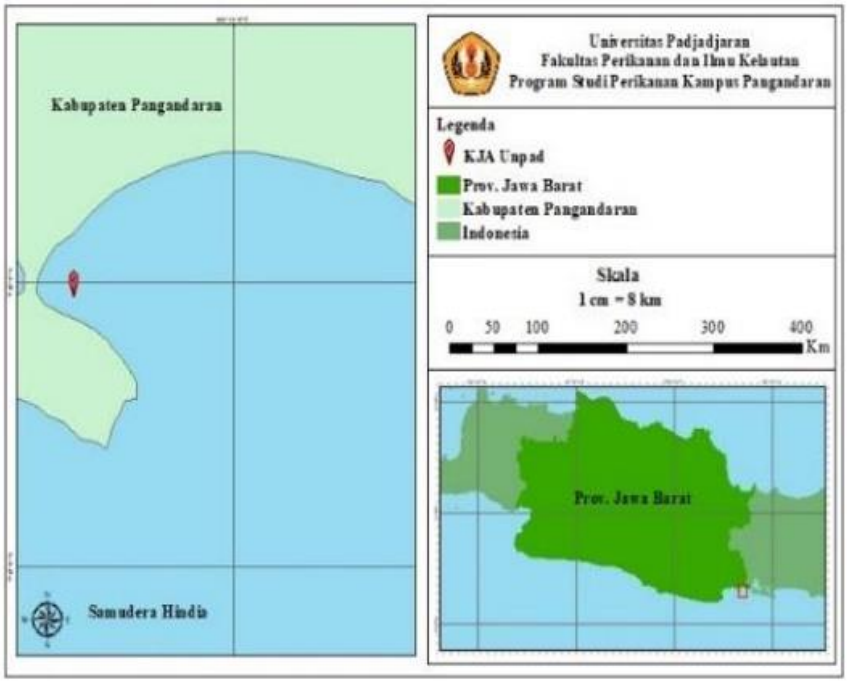

Figure 3: Peta Lokasi Penelitian (Sumber: Seadass 2022)

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Tools that will be used during the research include submerged cage (Figure 3), digital scales, baskets to accommodate trash fish and rebon shrimp, steel scissors, DO meters, pH meters, thermometers and refractometers.

Figure 3: Lobster Fishing Cage

The materials to be used during the research include 40 grams of lobster seeds obtained from around 160 fishermen (picture 4A), Test Feed in the form of trash fish (picture 4B) and rebon shrimp (picture 4C) obtained from local fishermen, turmeric extract (picture 4D) and garlic extract (4E) obtained from the nearest market.

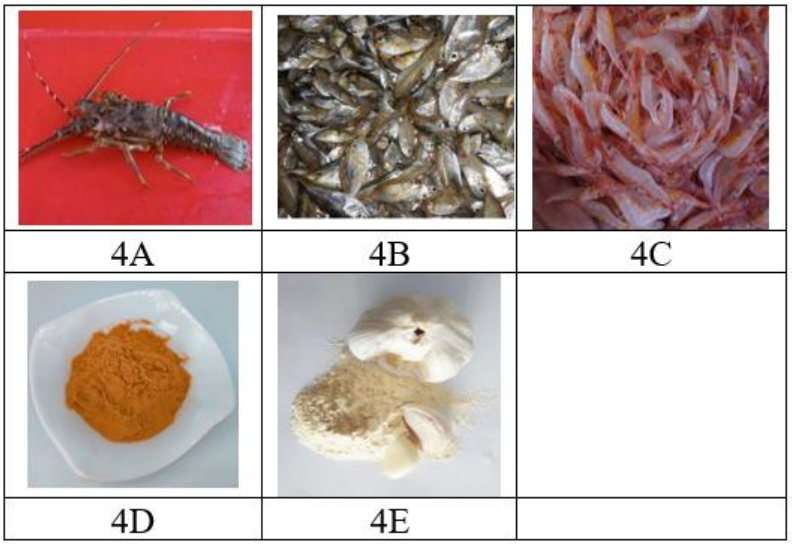

Figure 4: Materials to be used in the study: 40 grams of lobster seeds obtained from around 160 heads (figure 4A), trash fish (figure 4B) and rebon shrimp (figure 4C) turmeric extract (figure 4D) and garlic extract (figure 4E)

The method used in this study is an experimental method with a Complete Randomized Design (RAL) consisting of 4 treatments and 4 repeats and each treatment has a different type of feed.

1. Treatment A: Trash fish feed
2. Treatment B: Rebon shrimp feed
3. Treatment C: Rebon shrimp feed plus turmeric extract
4. Treatment D: Rebon shrimp feed plus garlic extract

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The stages carried out in this research are the preparation stage (preparing tools, materials and placement of research containers) and the research stage. The lobster seed preparation used in this study measured about 40 grams as many as 160 heads. Then the preparation of the maintenance container is a cage with a diameter of 80 cm with a height of 90 cm. Then the maintenance of test animals was carried out for 40 days using the cages with each container containing 10 lobster fry. The frequency of feeding 2 times a day in the morning at 7.00 and in the afternoon at 16.00. In addition, the death rate of lobsters was also observed by looking at the number of lobsters that died every day. Then sampling activities are carried out every 10 days to measure the growth of lobsters so that their growth rate can be observed. Water quality measurement as supporting data to determine the effect of this type of feed on water quality and determine the feasibility of water quality is carried out every 10 days along with sampling time. Some of the parameters observed are temperature, salinity, dissolved oxygen (DO) and acidity (pH).

The data obtained were analyzed using variety analysis (ANOVA) with F test at a 5% test interval to determine the effect of each treatment then to see the difference between treatments, followed by Duncan's multiple distance test with a confidence level of 95%.

RESULT AND DISCUSSION

Survival rate

The results of the calculation of the survival rate for 40 days of maintenance showed the highest survival rate in treatment B (rebon shrimp feed) of 88.75%, D (rebon shrimp feed plus garlic extract) and A (trash fish feed) of 90.00%, C (rebon shrimp feed plus turmeric extract) of 95.00% this treatment did not differ significantly from one another. However, the best lobster survival rate is found in treatment C. The results of observations of lobster survival rates can be seen in Table 1.

Table 1: Average Lobster survival rate during the study (SR)

Treatment	Feed	Average (%)
A	Trash Fish	90,00
B	Rebon Shrimp	88,75
C	Rebon Shrimp + Turmeric Extract	95,00
D	Rebon Shrimp + Garlic Extract	90,00

From the data that shows that the treatment given does not have a significant effect on the *survival rate* of the lobster itself. Because every treatment given has results that are not significantly different. Allegedly because the quality of water at the research site is still good for cultivation activities. As stated by Prasetya (2021) the optimal salinity for lobster growth ranges from 29-34 pp, this salinity range is able to support the life of lobster fry well and is directly able to affect the growth rate, amount of food and survival of lobsters in nature.

Lobster Growth

Based on observations (Figure 5), different types of feed can provide varying results for the growth of sand lobsters. This can be seen from the increase in the average weight of lobsters every time sampling is done (10 days). The average weight of lobsters in each treatment increased over time from the study.

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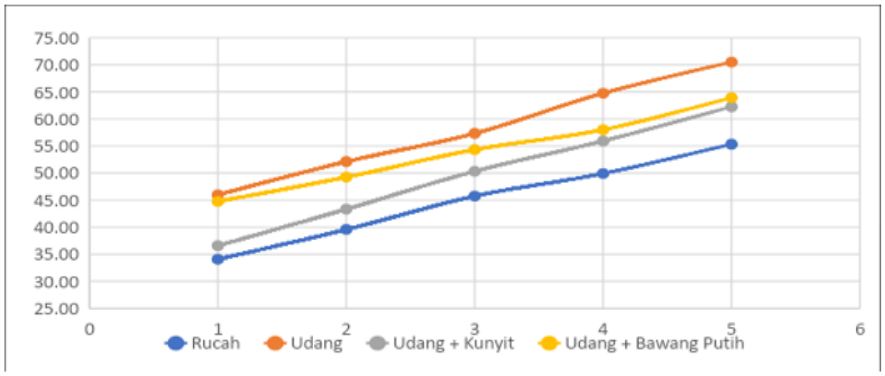

Figure 5: Lobster growth for 40 days

The overall lobster growth pattern starting from day 1 to day 40 shows a logarithmic phase or phase where in this phase growth runs quickly and the weight of the lobster increases every day.

Absolute Weight Growth

The absolute weight growth is the result of the weight of the test animal at the end of the study minus the weight of the test animal at the beginning of the study, previously the weight of the final test animal of the study plus the weight of the dead test animal during the study. Based on the observations, the absolute growth value is as shown in figure 6 below.

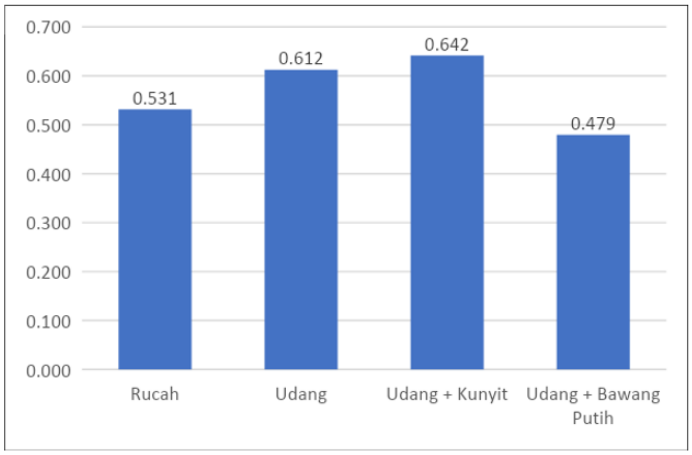

Figure 6: Average growth of absolute weight of lobsters

Based on Glubisz and Becker (2023), curcumin can reduce neurological disorders, cardiovascular and metabolic diseases, microbactial infection diseases, cancers, infalamatory diseases, skin diseases, respiratory diseases, kidney and endocrine diseases, gastroinstinal diseases, other diseases. It can be ascertained that lobsters fed turmeric shrimp feed are significantly higher compared to other treatments.

Daily Growth Rate

Growth in fish is influenced by internal factors and external factors. Internal factors include heredity, sex, and age while external factors include food and water quality. The daily growth rate serves to calculate the percentage of fish growth per day (Figure 7).

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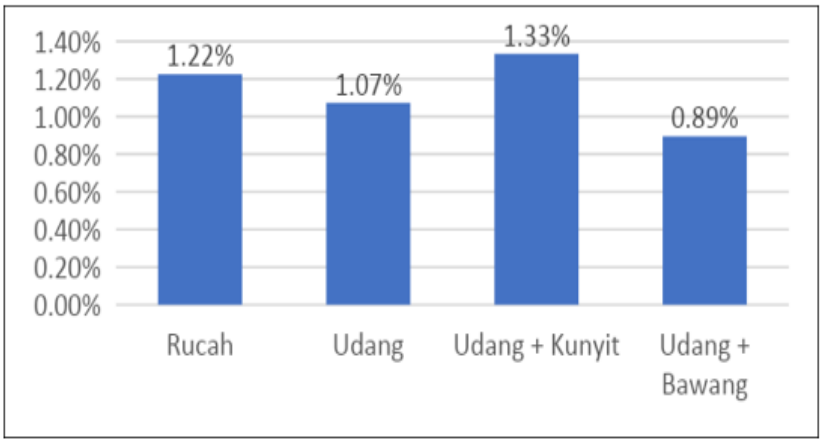

Figure 7: Daily growth rate of sand lobster for 40 days

Curcumin, a natural polyphenol widely used as a spice, coloring and food additive, has been shown to have therapeutic effects against a variety of diseases, largely due to its antioxidant properties. Curcumin also reduces the efficiency of melanin synthesis and affects cell membranes. However, curcumin can act as a prooxidant when exposed to blue light, because when exposed to light, curcumin can produce singlet oxygen. This is the dual role of curcumin from a biophysical perspective, given its concentration, modification of increased bioavailability and membrane interactions, as well as environmental conditions such as light. In low concentrations and without irradiation, curcumin shows positive effects and can be recommended as a beneficial dietary supplement. Conversely, if used excessively or irradiated, curcumin can be toxic. Therefore, various attempts have been made to test curcumin as a potential photosensitizer in photodynamic therapy (PDT).

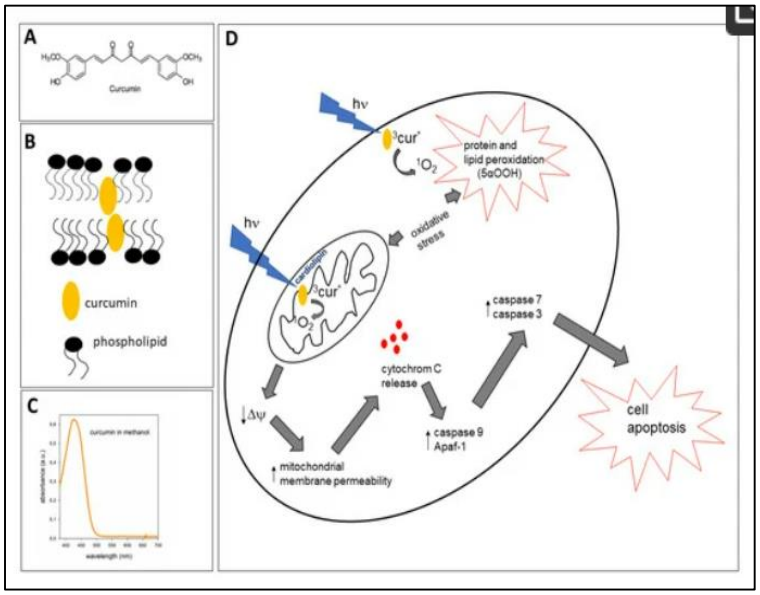

Figure 8

Figure 8: Curcumin chemical structure (A), location of curcumin in the membrane (B), absorption spectrum of curcumin (10 μM) in methanol in 380–700 nm range (C), scheme of phototoxic action of curcumin (D). Curcumin localizes in the plasma and inner mitochondrial membranes. Upon blue light absorption, curcumin undergoes activation and eventually forms

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an excited triplet state (3cur*). In the presence of oxygen in a Type II photosensitized reaction, due to energy transfer between 3 cur* and oxygen, singlet oxygen (1O2) is produced as ROS. As a result of 1O2-induced oxidative stress, protein and lipid peroxidation occurs, forming, for example, cholesterol hydroperoxides (mainly 5αOOH). In mitochondrial membranes, where mainly cardiolipin is peroxidized, oxidative stress leads to a decrease in membrane potential, an increase in membrane permeability and release of cytochrome c. This activates caspase 9 and Apaf-1. Both caspase 8 and caspase 9 lead to activation of caspase 3 and caspase 7 and consequently to cell apoptosis.

Feed *Conversion Ratio* (FCR)

The ratio of the total amount of feed given with the weight gain produced is the conversion ratio of feeding. The results of the FCR calculation can be seen in figure 9 below.

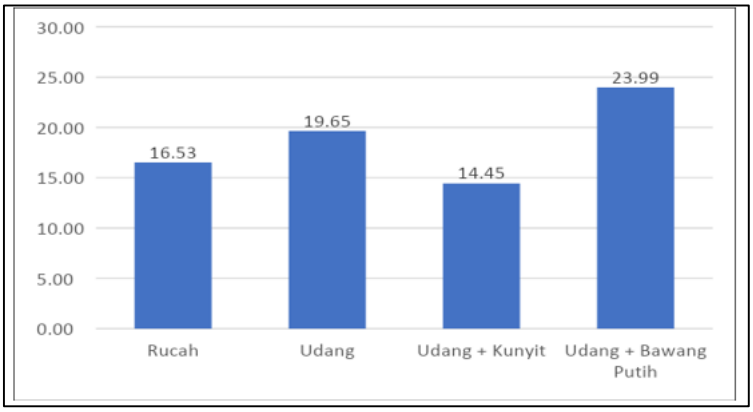

Figure 9: Feed Conversion Ratio of Green lobster

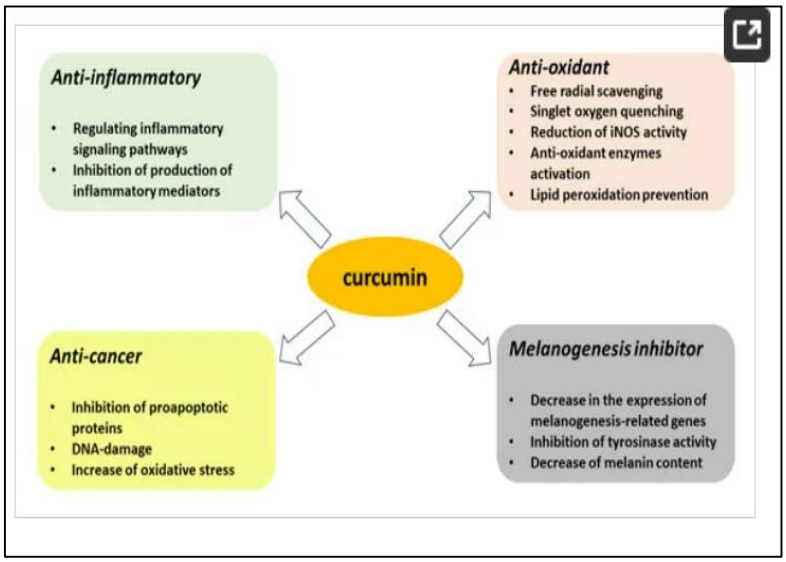

Figure 10: Curcumin Protective Activity

Based on figure 10, curcumin is indeed an anti-inflammatory and anti-oxidant agent that plays a real role in increasing anti-infectives that increase body weight and length. Therefore, lobsters fed shrimp plus curcumin are better FCR than others.

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Feed Efficiency

The efficiency of feed use shows the value of feed that can convert into weight gain of test animals. Feed efficiency can be seen from several factors where one of them is the feed conversion ratio. The value of feed efficiency can be obtained through the results of a comparison between the growth of the weight of test animals with the amount of feed consumed by test animals during the maintenance period. The results of the calculation of feed efficiency can be seen in figure 11 below.

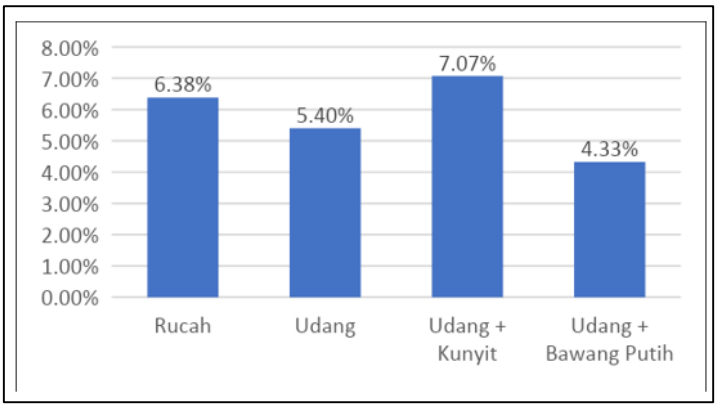

Figure 11: Lobster Feed Efficiency

The efficiency of lobster feed in this study showed that shrimp feed plus turmeric provided the best value (7.07%) along with trash feeding treatment (6,385). This proves that the provision of turmeric additives has a good effect than others, but trash fish feed also gives the same good results. Trash fish tissue clearly shows that the average water content was 78.46%. Protein ranges from 12%- 18%. which will be useful to prepare the fishmeal. Fat content was about 12.62% and 1.30% respectively. Ash value was about 0.49% - 2.33% (Kasthuri S, D. Sathees and Wijenayake, 2021). While shrimp has a fairly high protein content of 52.35% (Sholichin *et al*, 2012). So the value of Feed Efficiency for lobsters is the same value.

Intestine Lobster

Based on the observations of lobster intestines, the data can be seen as follows (Figure 10).

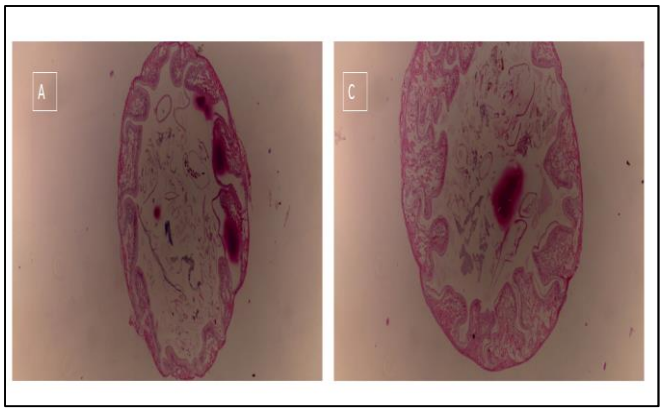

Figure 12: Description of lobster intestines fed with trash fish without herbal ingredients (a) and lobsters fed lobster with herbal ingredients / turmeric extract (c).

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The health of the organism can be represented from the health of its instine, can be seen from the thickness of the intestine, the width of the villi base, the height of the villi and others.

Water Quality

One of the factors that influence the growth of lobsters is water quality. Water quality plays an important role in the field of fisheries, especially for aquaculture activities and in the productivity of aquatic animals. Some parameters that can determine the water quality of a body of water are temperature, salinity, acidity (pH), and dissolved oxygen (DO). The average water quality parameters can be seen in table 2.

Table 2: Average Water Quality Parameters

No	Treatment	Depth	Observation Parameters			
			do (mg/L)	Temperature (°)	pH	Salinitas (ppt)
1	A	2,5	6,5	28	8	33
2	B	3,5	5,55	28	8	34
3	C	5	5,22	28	7	34

CONCLUSION

The best treatment is treatment C and A (rebon shrimp feed plus turmeric and trash fish feed) with Daily Growth Rate values of 1.33% and 1.22%, Feed Conversion Ratio C and A (rebon shrimp feed plus turmeric and trash fish feed) of 14.5 and 16.53, SR is equally good, and the highest is 95.00% in lobsters fed shrimp plus turmeric, the best feed efficiency in lobsters fed with rebon shrimp plus turmeric was 7.07%.

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