Calcium Supplementation on Feed to Increase Molting Frequency of Freshwater Crayfish (Cherax quadricarinatus)

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ABSTRACT

The purpose of this research was to determine the effect of calcium supplementation on feed on molting frequency of freshwater crayfish (*Cherax quadricarinatus*). This research was done for 30 days at the Indoor Laboratory of Fisheries, Faculty of Animal Husbandry and Fisheries University of Muhammadiyah Malang.

The results showed that the calcium supplementation in the feed can increase the molting frequency of freshwater crayfish. This is demonstrated with treatment B (2%) which has the highest frequency of molting, which is 1.47 times per head. Then followed by treatment D (6%) = 1.40 times per head, the treatment A (0%) = 1.27 times per head, and treatment C (4%) = 1.13 times per head. The calcium supplementation in the feed is also a positive influence on the survival rate and growth of freshwater crayfish. In all feed treatments that given calcium supplementation indicate survival rate higher than the feed treatment that is not given calcium supplementation. Average data survival rate freshwater crayfish in a sequence is as follows; treatment B (2%) = 93.33%, D (6%) = 93.33%, C (4%) = 86.67%, and A (0%) = 80%. While the average data freshwater crayfish growth in sequence is as follows; treatment B (2%) = 0.85 g, D (6%) = 0.79 g, C (4%) = 0.78 g, and A (0%) = 0.73 g.

**Key words**: freshwater crayfish; calcium; molting; survival rate; growth
INTRODUCTION

There are several factors that affect growth and survival rate of freshwater crayfish. One of them is the quality of seeds, type of feed, water quality, disease and molting success, the new skin replacement. Molting plays a very important role in the growth of crayfish, because crayfish can only grow through molting (Ahvenharju, 2007). The more frequent molting crayfish do, then the growth is better. Molting own success depends heavily on the existing reserves of calcium in the body of the crayfish and until now, crayfish are often found dead due to the inability of molting crayfish in doing perfectly. One cause of failure is not successful molting crayfish gastrolisation process, namely the absorption of calcium in the body. The role of calcium is very significant here in the process of hardening of the new shell after shell crayfish managed long. Calcium is absorbed by the crayfish can be derived from food, water, and the result of cannibalism old shell.

In previous research about the calcium supplementation to support the success of crayfish gastrolisation through deeping method was still less than optimal results. This is presumably because a given calcium concentration (2.5 ppm, 5 ppm and 7.5 ppm) is still low and the methods used provide limited support for the process of calcium absorption maximum (Hakim, 2008). Therefore, in this study will use a concentration higher calcium and mixed in the feed (oral method), which is expected to be immediately absorbed in the body.

MATERIALS AND METHODS

This research was done for 30 days in Indoor Laboratory of Fisheries, Faculty of Animal Husbandry and Fisheries, University of Muhammadiyah Malang. Materials used in this study include freshwater crayfish seed age 1 month (1 inch), pure calcium (lactas calsicus) from PT. Nufarindo, feed pellets formulation of his own. While used equipment is the size of 60x30x30 cm aquarium, analytical and digital scales, water quality meter (pH pen and oxymeter), blowers, tools EDU (plastic bottle of mineral water, timber and paralon).
Research method used is experimenting with methods of data retrieval techniques are direct observation. This research uses Complete Random Design (RAL) with the addition of one variable calcium concentration on feed with each of 2%, 4%, 6%, and as the feed control is not calcium supplementation. Each treatment will be repeated 3 times, so there are 12 units of the experiment.

Maintenance freshwater crayfish done in the aquarium with a density of 5 fish per aquarium. The feed was given pellets of feed formulation of his own. In the manufacture of feed formulation is added calcium concentrations different, namely 2%, 4%, 6%, and as the feed control is not added calcium. Calcium is used is pure calcium (lactas calsicus) from PT. Nufarindo. As for the protein content in feed is the same, namely 24%.

During the maintenance period of one month, feed the freshwater crayfish will be given as much as 5% of the weight of biomass. Conducted feeding twice a day, ie in the morning as much as 25% and in the afternoon as much as 75%. Once every three days will be clean water media. During the treatment period will be observed frequency of molting, survival rate, and the growth of test crayfish, and measured water quality parameters (temperature, dissolved oxygen, and pH).

RESULTS

The results showed that the calcium supplementation in the feed can increase the frequency of molting, survival rate, and the growth of freshwater crayfish. Furthermore, the data in detail can be seen in Table 1 and Table 2.

Table 1. Average Molting Frequency, Survival Rate, and Growth of Freshwater Crayfish during Treatment

<table>
<thead>
<tr>
<th>Calcium Supplementation on Feed</th>
<th>0 %</th>
<th>2 %</th>
<th>4 %</th>
<th>6 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molting Frequency (times per head)</td>
<td>1,27</td>
<td>1,47</td>
<td>1,13</td>
<td>1,40</td>
</tr>
<tr>
<td>Survival Rate (%)</td>
<td>80,00</td>
<td>93,33</td>
<td>86,67</td>
<td>93,33</td>
</tr>
<tr>
<td>Growth (g)</td>
<td>0,73</td>
<td>0,85</td>
<td>0,78</td>
<td>0,79</td>
</tr>
</tbody>
</table>
Table 2. Water Quality during Treatment

<table>
<thead>
<tr>
<th></th>
<th>Calcium Supplementation on Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 %</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>24</td>
</tr>
<tr>
<td>Dissolved Oxygen (ppm)</td>
<td>7.29</td>
</tr>
<tr>
<td>pH</td>
<td>8.30</td>
</tr>
</tbody>
</table>

DISCUSSION

*Molting frequency of Freshwater Crayfish*

Results The average frequency of molting crayfish (*Cherax quadricarinatus*) during 30 days of maintenance with the density of 5 fish per aquarium can be seen in Figure 1.

In Figure 1, can be seen that the calcium supplementation in the feed (through the oral method) can increase the frequency of molting crayfish. Please note that during his life, until molting crayfish experienced a dozen times. Substitution of skin began to occur at 2 - 3 weeks (Wiyanto and Hartono, 2007). At 2% calcium supplementation gives higher yields molting frequency rate compared to other treatments, ie for 1.47 times per head. This frequency value is greater than previous research that calcium supplementation through submersion,
where the value of the highest frequency achieved by the treatment D (calcium concentration of 7.5 ppm) with an average value of molting frequency of 1.03 times per head (Hakim, 2008). When crayfish test used in this research are 1 month old, is expected within 1 month of maintenance during molting crayfish experience 1 - 2 times. So that the results of the supplementation of 2% calcium in the feed can be said to be effective in increasing the frequency of molting, because it could produce molting frequency of 1.47 times per head.

As it is known that molting is an important part in the life cycle of freshwater crayfish. This is because success will determine the growth molting crayfish. In addition, calcium is very significant role in the molting process as forming gastrolith, gastrolith which will later be absorbed again to harden the shell crayfish after molting process. Actually, calcium is an environmental factor that can affect the growth of crayfish. Several abiotic environmental factors that affect the growth of crayfish are temperature, latitude, photoperiod, water quality (especially dissolved oxygen, calcium and pH), nutrient level and composition of their habitats (Aiken and Waddy, 1992). Moreover, the addition of calcium is expected to stimulate molting crayfish to do, so that the treatment given the addition will look much calcium crayfish molting. To reserve calcium, crayfish will absorb calcium from the water, food and old shells (Pavey and Fielder, 1990). If in previous research with the calcium supplementation to the medium water (deeping method), test crayfish less able to absorb calcium properly, then the results of this research crayfish are able to absorb calcium test is added to the feed well. It is believed there are several factors that led to the effective calcium supplementation in the feed, such is the method used, the supplementation of calcium concentration, and water quality.

Method of calcium supplementation to feed is one effective method to provide calcium supplementation for crayfish, because this method can be digested directly calcium along with the feed provided. So that all calcium in the feed given will be put to good use for backup stored calcium in the body of a crayfish. Calcium reserve was then be used for shell hardening process after molting lobster experience.
Water quality factors such as temperature, dissolved oxygen, and pH are important environmental factors in influencing the process of absorption of calcium. If the research of calcium added to the feed, the calcium absorption process will be largely determined by the power of appetite crayfish. Environmental factors that support, it will give a good impact on appetite crayfish. Water temperature measurements during the study average of 24°C, 7.52 ppm dissolved oxygen, and the degree of acidity (pH) 8.33. Three values of water quality parameters are still in good range for the life of crayfish, which will affect the body's metabolic processes. Increasing the metabolic processes of this course will increase your appetite to take advantage of crayfish feed given. So if crayfish good appetite, then the calcium contained in the feed will be able to be absorbed by the crayfish optimally.

**Survival Rate of Freshwater Crayfish**

Survival rate of crayfish during the maintenance period to 30 days of each treatment is high, as shown in Figure 2.

![Figure 2. Survival Rate of Freshwater Crayfish](image)

In the figure shows that the treatment was given extra feed to produce calcium crayfish survival rate higher than the treatment without the
supplementation of calcium feed. This can be seen in all three treatments were given calcium supplementation (2%, 4%, 6%), survival rate average reached 91.11%, while the treatment without the calcium supplementation (0%) produces an average of 80% survival rate.

Maintenance system that is used during the maintenance period is the system EDU (Extreme Density Unit). With this EDU system cannibalism among the crayfish can be avoided, because each crayfish maintained at each different bottle. Please note that crayfish possess a very high cannibalism against each other. Wie (2006) states crayfish including animals that have characteristics generally cannibals and crayfish are doing molting stage is very weak and vulnerable to attack each other. Freshwater crayfish have just done the turn of the skin (molting) need a place to hide or shelter since crayfish during molting new very weak physical condition and crayfish have preyed on each other's character (Setiawan, 2006). Therefore, maintenance of crayfish with EDU system can reduce cannibalism to 0%. This is different from previous research that have been made by Hakim (2008), which does not use the EDU system, so survival rate below 90%. In these research, the treatment is known to frequent molting crayfish actually produces a lower survival rate. This is because the crayfish are often vulnerable molting crayfish of cannibalism from the other, so if there is no adequate shelter the crayfish will be easily attacked by other crayfish. If EDU system using crayfish that were found dead, the death of a crayfish is more likely caused by the disease, poor water quality, the quality and quantity of feed provided, and failure at the time of molting.

During the research is not known crayfish molting failure, except in treatment A (0%) without calcium supplementation on feed two crayfish found dead due to failures molting process, which is not able to harden their shells after the old shell peeling. This inability is caused by a lack of calcium reserves in the crayfish body. The presence of adequate calcium in the body of the crayfish is expected to help the molting success perfectly, especially in the process of hardening of the new shell, so that molting failure followed by death of crayfish does not occur. Thus, crayfish are given feed with the calcium supplementation
can avoid the process of molting failure, because it already has sufficient reserves of calcium for shell hardening process again.

**Growth of Freshwater Crayfish**

During the maintenance period, given the test crayfish feed pellets that are the result formulation itself. Average results crayfish growth during 30 days maintenance can be seen in Figure 3.

In the figure showed that the treatment was given extra feed to produce calcium crayfish growth higher than the treatment without the calcium supplementation on feed. Treatment B with the supplementation of calcium concentrations capable of producing 2% on average higher growth than others in the amount of 0.85 grams. Then followed by treatment D (6%) of 0.79 grams, and treatment C (4%) of 0.78 grams and the treatment A (0%) without calcium supplementation to produce growth of 0.73 grams.

The results of this research as expected by researchers because of the calcium supplementation in the feed to produce crayfish growth higher than crayfish fed feed without the calcium supplementation. Because if the absorption of calcium occurs well, the crayfish is expected to stimulate molting. With the frequency of molting crayfish that often, then the growth will also be a good
crayfish. Crayfish growth will be marked with the change of shell known as molting. The better growth, the more frequent changing of crayfish shell.

In addition, in crayfish cultivation one major factor affecting the success of optimal growth is the available food should be enough in terms of quantity and quality (Hastuti, 2006). Feeding as much as 5% of the weight of biomass per day to provide good growth for the crayfish. This is also due to a given feed pellets have a distinctive odor, making it easier to detect crayfish feed given (Hakim, 2007).

Environmental factors, especially the water quality is also greatly affect the growth of freshwater crayfish. Several abiotic environmental factors that affect crayfish growth are temperature, latitude, photoperiod, water quality (especially dissolved oxygen, calcium and pH), nutrient levels and habitat composition, whereas biotic factors such as nutrition, predators, density, age and maturity level (Aiken and Waddy, 1992; Reynolds, 2002).

Good water quality is also very important role in supporting the crayfish appetite, so the appetite for crayfish research well enough. This can be seen from the feed pellets are always given out. The existence of a good feed and water quality backed by good also, cause the growth of crayfish in a given calcium treatment is higher, because the feed is able to provide the stimulus for molting crayfish.

Other important factors that could affect growth is the behavior of crayfish. Such behavior in eating competition, habitat selection, and the interaction of crayfish movement and aggressiveness (Gherardi and Cioni, 2004; Karplus and Barki, 2004).

**CONCLUSION**

Based on the results of research on the calcium supplementation in the feed to the frequency of molting crayfish, it can be concluded that the calcium supplementation in food (oral method) can increase the frequency of molting, survival rate and growth of freshwater crayfish. Several factors including the
supplementation of calcium the method used, the supplementation of calcium concentration, and good water quality.

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