

Handling Technique Development of Live Carp, *Cyprinus carpio*, In Cold Dry Styrofoam Box

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Abstract. The study focused on several following aspects: temperature and time optimization for fainting, holding media optimization, temperature and time optimization for recovery, and their correlation with mortality rate of carp, *Cyprinus carpio*. Fainting occurred at the optimum time of 11 minutes and 03 seconds, temperature of 8°C, and holding time of 6 hours. Holding medium was rice husk. The fastest consciousness of the fish was found in 6 volt-aerated water medium. The fish consciousness after 6 hours of storing in the rice husk at the fainting temperature of 8°C was found faster ($p < 0.05$), 11 minutes and 15 seconds, than that added with 0.02% of clove oil, 25 minutes and 16 seconds. The fish mortality rate after 6 hours of storage in the rice husk at fainting temperature of 8°C was lower ($p < 0.05$), 46%, than that with addition of 0.02% of clove oil, 75%.

1. Introduction

Live fish transportation in Indonesia is conducted using a water-containing plastic bag filled with either oxygen addition or not, depending upon its necessity. Such a packing and transporting technique has some weaknesses, such as less efficient in weight, volume, and transport cost, decreasing water oxygen content, increased water temperature, fish poisoning from their feces, and relatively long transportation.

Nowadays, live fish transportation has been developed using a dry medium through low-temperature fainting method. It is done by cooling the water down to the fainting temperature of the fish. Low temperature is maintained in the Styrofoam box by placing some ice cube. Cool media for fish storage use either rice husk or sawdust.

One of the main goals in live fish transportation is to yield low mortality rate, and therefore, the fish must faint. Immobilization is necessarily done that the fish metabolism activity is in basal condition. At very low respiration and metabolism rate, the fish can be transported in long duration at low mortality rate. There are several immotilization techniques, such as the use of low temperature or the use of natural or artificial antimetabolite [22].

Before storing, the fish is previously wrapped with paper to avoid the fish mouth filled with the media material [17]. The wrapped fish is then placed and set in the styrofoam containing cool sawdust of 10-15°C. The fish placement is done in layers, mediafish-media etc., and the top layer is media. The media thickness is more or less 2-3 cm. To maintain the temperature stability, the Styrofoam is filled some ice cube [18].



Re-awaking carp after fainted and stored can be done by returning the fish into a sufficiently aerated tank at their habitat temperature, 25-27°C. The survival of live fish packed in unconscious condition is affected by initial condition of the fish, fainting temperature, fish origin, and shocks from overlapping at the lower level that causes fish mortality during the transportation [9, 18]

[15, 13, 11, 1, 3, 6] also supported that live fish transportation was aimed to maintain the fish survival during the transportation reaching the target location. Close distance transportation does not need specific treatment, but long-distance transportation requires particular treatments to maintain the fish survivorship. Therefore, an appropriate live fish transportation technology following the commodity and condition requirements is needed. There are two live fish transportation methods, the use of water as media called wet system and the use of dry system (media without water).

The principle of live fish handling is maintaining the fish survivorship as maximum as possible up to accepted by the consumer. For this, there are several handling phases, pre-transport, transport, and post-transport handlings. Closed transportation will yield CO₂ accumulation and pH decline [7, 12, 4].

2. Methodology

Fainting media used low temperature of 8°C, and low temperature of 8°C added with 0.02% of clove oil. Storing media employed rice husk. Sawdust was not used as storing media because it has hazardous material for fish. The ice cube placed in a storing box was 1.8 kg. The fish were held for 8 hours and observed every 2 hours. Holding time treatments were 0, 2, 4, 6, and 8 hours with 2 replications.

Parameters recorded were fainting rate time [16, 21], reawaking time [2, 21], and fish mortality [10, 21]. This study used Factorial Complete Randomized Design with two factors as follows:

1. Fainting method (A) with two levels: A1 – fainting at 8°C and A2 – fainting at 8°C plus 0.02% of clove oil
2. Storage duration (B) with five levels: B1: 0 hours, B2- 2 hours, B3- 4 hours, B4- 6 hours, and B5- 8 hours.

3. Results and Discussion

3.1. Fainting Speed Time of *C. carpio*

Mean value of fainting speed time ranged from 1.2 to 14.16 minutes (Fig. 1). ANOVA showed that fainting method treatment, storing time, and their interaction did not significantly influence the fainting speed time ($P > 0.05$). Faster fainting time occurred in the method using clove oil since addition of clove oil into water media caused the dissolved oxygen in the water be reducing. Clove oil could function as insulator or barrier for oxygen diffusion process into the water. According to [5], dissolved oxygen decline is directly proportional to the increase in clove oil concentration, since oxygen diffusion process into the water is inhibited. The higher the clove oil concentration is, the lower the oxygen diffusion into the water will be. Eugenol as water-soluble anesthetic will reduce respiration rate of the fish. The decline in the respiration rate results in loss of all feelings on the fish body due to reduced nerve function so that nerve impulse action and delivery are inhibited [15]. According to Smith and Breet *in* [23], the ionic balance disturbance in fish brain causes the gill unable to normally function, and the osmoregulation of dissolved oxygen in the water into blood cells and gill be disturbed. Statistical analysis found that the treatment of holding duration did not give significant effect on the fainting speed time of the carp. It could result from that holding duration treatment was done after the fainting process ended so that it did not affect the fainting time

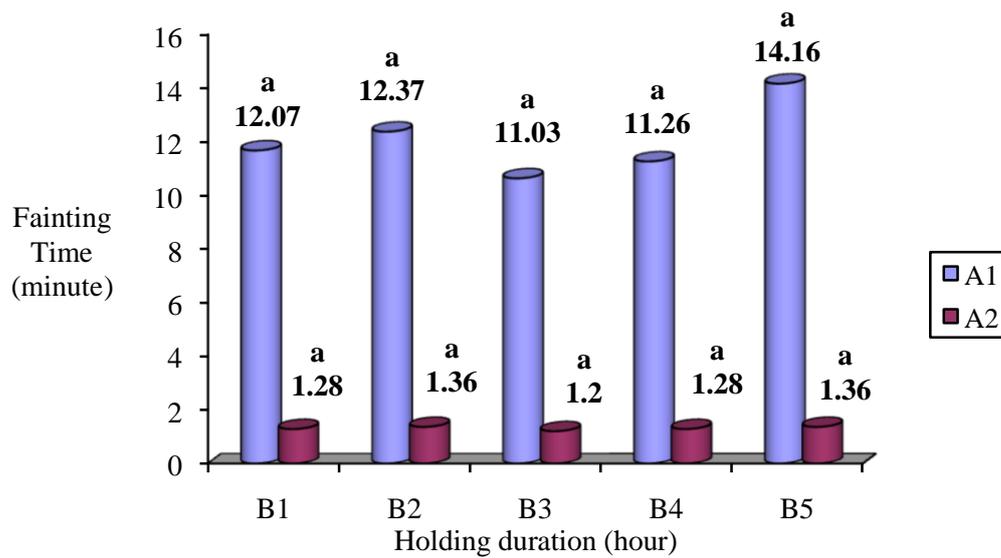


Figure 1. Fainting method and storage duration with fainting speed of *C. carpio*. A1: temperature of 8°C, A2: temperature of 8°C + 0.02% of clove oil. B1 : 0 hours, B2: 2 hours, B3: 4 hours, B4: 6 hours, B5: 8 hours.

3.2. Re-awaking Time of *C. carpio*

The mean value of re-awaking time of *C. carpio* ranged from 0.3 – 25.16 minutes. ANOVA indicated that at the confidence level of 95% fainting method, holding duration, and the treatment interaction gave significant effect on the re-awaking time of *C. carpio* ($P \leq 0.05$).

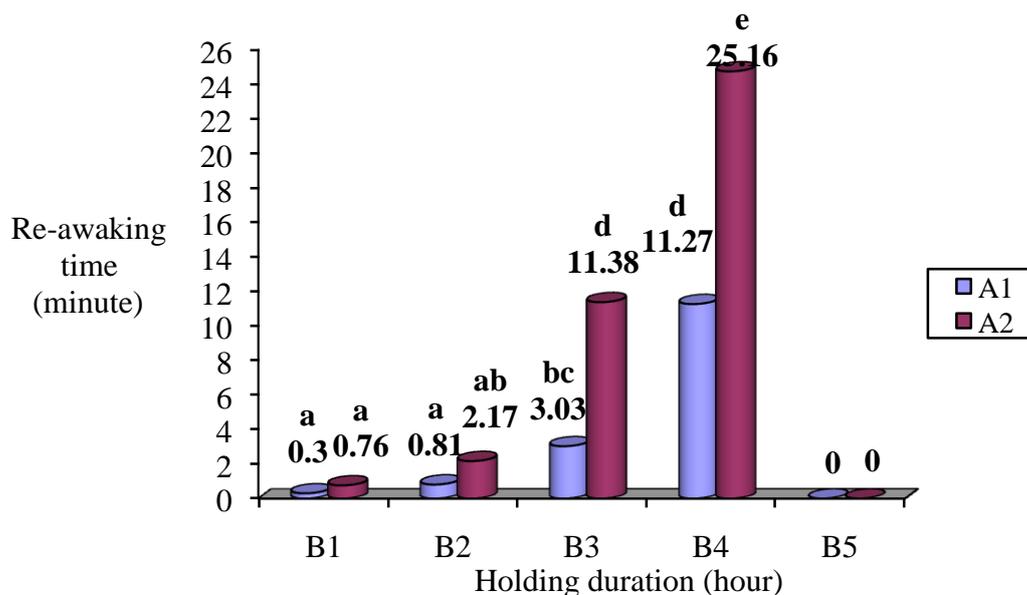


Figure 2. Fainting method and holding duration relationship with re-awaking time of *C. carpio*. A1: temperature of 8°C, A2: temperature of 8°C added with clove oil of 0.02%; B1: 0 hours, B2: 2 hours, B3: 4 hours, B4: 6 hours, B5: 8 hours.

LSD test on comparison between treatments against the re-awaking time is presented in Fig. 2. The use of fainting method at 8°C and holding duration of 0 hours (A1B1) showed the fastest recovery

time, 0.3 minute and the longest recovery time was recorded in fainting method treatment of 8°C added with clove oil of 0.02% for storing duration of 6 hours (A2B4), 25.16 minutes.

This finding reflects that the use of fainting method added with clove oil of 0.02% for 6 hours of storage results in longer re-awaking time than that a without clove oil addition. It could result from that active compounds in the circulatory system of the fish body at a certain amount make the fish need longer time to return to normal condition. Eugenol as active compound in the clove oil is an antiseptic material that can weaken the nerve and disturb the nerve system [8].

Based on re-awaking time data, it is apparent that fainting method of 8°C is an effective method to faint the fish with storage duration up to 6 hours compared with the fainting method using temperature of 8°C with clove oil addition of 0.02%.

3.3. Mortality of *C. carpio*

The mortality rate of *C. carpio* is presented in Fig. 3. Mean mortality rate ranged from 0 to 100%.

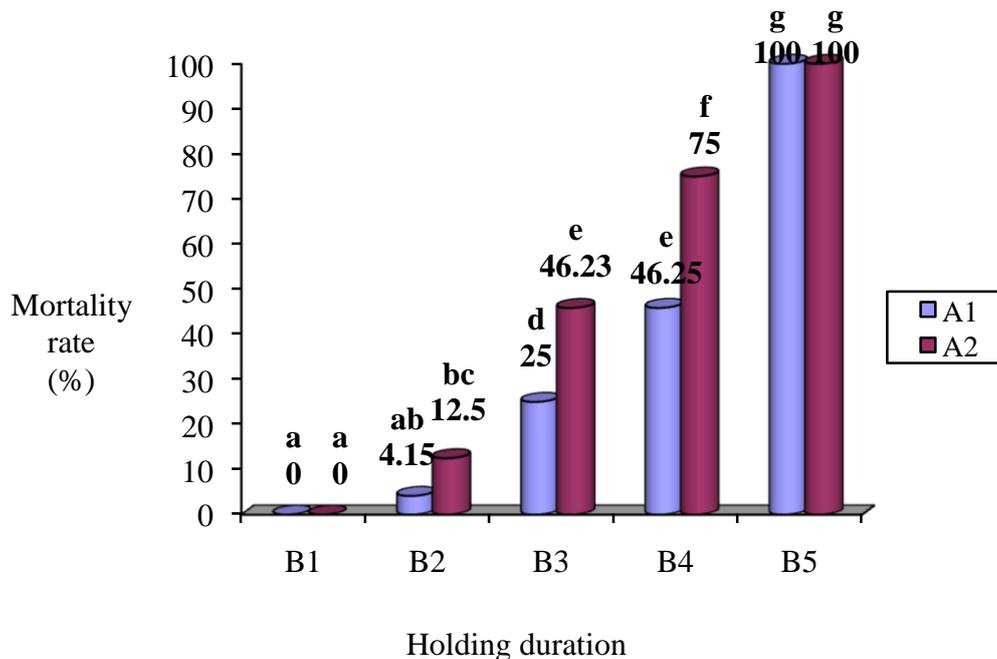


Figure 3. Fainting method and holding time relationship with the mortality rate of *C. carpio*. A1: temperature of 8°C, A2: temperature of 8°C + 0.02% of clove oil; B1: 0 hours, B2: 2 hours, B3: 4 hours, B4: 6 hours, B5: 8 hours;

ANOVA indicated that fainting method, storing duration and treatment interaction gave significant effect on the mortality rate of *C. carpio* ($P \leq 0.05$). LSD test reflected that the mortality rate of *C. carpio* for 6-hour storage using fainting method of 8°C was found lower than that in fainting method of 8°C added with clove oil of 0.02%, 46.25%, and 75%, respectively. It means that the use of fainting method of 8°C is better than that of 8°C added with clove oil of 0.02%.

This study also found that the longer the storing duration was, the higher the fish mortality could be. The fish, particularly *C. carpio*, were only capable of surviving up to 6 hours of storage. All *C. carpio* died in 8 hours of storage.

4. Conclusion

Optimum fainting time was 11.26 minutes and temperature of 8°C through treatment combination with 6-hour storage. Good holding media was rice husk, because the sawdust, despite implementation of initial washing and re-drying, the effect of wood latex on the mortality is still high. Optimum mortality rate, 46%, was obtained at the holding media of rice husk and 6 hours of storage using fainting method of 8°C without clove oil addition. Optimum re-awaking time was found at 11.27 minutes through treatment combination of 6hour holding time and optimum fainting temperature of 8°C. Re-awaking was conducted using 1.5 volts and 3.0-volt aerator, but the fish awake faster at the use of 3.0-volt aerator, since more dissolved oxygen was supplied at the 3.0-volt aerator application than that at 1.5 volts.

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