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Growth promoter effect of garlic (*Allium sativum*) on carp (*Cyprinus carpio* L)

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Abstract: The research aimed to examine the effect of garlic on growth performance of carp (*Cyprinus carpio* L). Carp juveniles were obtained from Freshwater Aquaculture Board in Talelu, Minahasa Regency. Fish were put in oxygenated-plastic bags and transported to Tateli Village at the Aquaculture Development and Training Board (BP3I) where the research was conducted.. After acclimatization for two weeks, juveniles were stocked in 15 net pens (L=0.8, W=0.5, D=1 m) positioned in a pond ((L= 40 m, W=25 m, D= 1.2 m) with a density of 10 juveniles per net pen. During the experiment, fish was fed with pellet containing 0, 5, 10, 15 and 20 g garlic powder per kg pellet at 5% of body weight per day, twice a day at 08.00 am and 16.00 pm. Feeding period was four consecutive weeks. Growth of fish was measured at the end of feeding period. The result showed that feeding the carp with garlic-supplemented pellet for four weeks had significant effect ($p<0.05$) on fish growth as compared to that of control fish. The highest weight gain was achieved in fish fed pellet supplemented with 15 g garlic per kg pellet. As conclusion, incorporation of garlic into fish feed improved the growth performance of fish.
Keywords: garlic, *Allium sativum*, *Cyprinus carpio*, weight gain.

Introduction

Carp (*Cyprinus carpio* L) is one of the most popular aquaculture species in North Sulawesi, Indonesia. This species has higheconomic value and high demand in this region. People usually serve the fish in many events such as Christmas Eve, New Year, and other celebration parties. But since the last decade, production of carp in this region has decreased significantly due to two major problems, slow growth and disease outbreak mainly *Aeromonas hydrphila* and KHV[1]. Farmers suffered from significant economic losses that limited the development of carp aquaculture.

Many attempts had been carried out to enhance disease resistance of fish to variety of pathogen and to improve growth performance[2]. Prevention and control of diseases of culture species might involve the use of antibiotic and vaccine. But it was found that the intensive use of chemicals or antibiotics in intensive aquaculture has brought about unwanted developments such as bioaccumulation, pollution, antibiotic-resistant pathogens, immunosuppression, and high expenditure [3]. Antibiotic was dangerous for human health because its residue could be accumulated in the fish body and be transferred to people who eat the fish.Intensive use of antibiotic also has resulted in the increase of antibiotic-resistance pathogen [4]. Vaccine is effective in improving disease resistance of fish, however, it works specifically on specific pathogen, thus its efficacy was limited.

Treatment diseases with various herbs have been safely and widely used in organic aquaculture, veterinary and human medicine[5].

To improve growth performance of aquaculture species, scientists and nutritionists have developedand formulated balance-nutritional feed to meet the need of animals[6,7,8]. This might involve the use of high quality protein source, growth hormone and others low cost feed ingredientswith lowest level of waste .The use of probiotic has been successful[9]. Biofloc technology, besides balancing carbon and nitrogen in in the system in order to preserve the environment and natural resources, also produces proteinaceous feed *in situ*[10,11].

Recently, scientists have focused their researches on the use of immunostimulants to enhance disease resistance and to improve growth performance of fish[12]. Immunostimulants are used as an alternative to antibiotics and chemicals currently being used to control fish diseases in aquaculture[13].Immunostimulants enhance the overall immunity of fish, and present a non-specific immune response against the microbial pathogens. It also increases the humoral and cellular immune response by enhancing cytokine secretion or by directly stimulating B of T- lymphocytes[14]. Immunostimulant does not leave any residue in fish body and environment and not harmful for human health.

Variety of natural products have been used as immunostimulant sources for aquaculture, such as yeast [15,16], seaweed [17], herbs [18,19]. There is increasing interest in using herbs or medicinal plantsin aquaculture as growth-promoting substances, antimicrobial agents, nutrients as well as many other applications. Their potential to control fish diseases and improve growth of fish, including garlic, are also being studied[20].This research was carried out to examine the effect of garlic on growth performance of carp (*Cyprinus carpio* L).

Material and method

Experimental Fish

The fish used in this research was carp juveniles (*Cyprinus carpio* L) with an average weight of 21.7 g. Fish as much as 300 individuals were obtained from Freshwater Aquaculture Board in Talelu, Minahasa Regency. Fish were put in oxygenated-plastic bags and transported to Tateli Village at the Aquaculture Development and Training Board (BP3I) where the research was conducted. Juveniles were stocked into 4x2x1 m3 concrete tank for acclimatization for two weeks. During acclimatization proses, juveniles were fed with standard food (pellet) at 5% of body weight per day, twice a day at 08.00 am and 16.00 pm.

Garlic Preparation

Fresh garlic, *Allium sativum,* was bought from a market and brought to the laboratory. The garlic was then peeled, washed, thin cut and then dried at room temperature for 3days. After dried, the garlic was ground using a grinder and sieved with a sifter (1/16' wire size). Garlic powder was then mixed with commercial fish pellet. The proximate of commercial fish pellet used was 30% protein, 6% lipid, 5%fiber, 10% ash and 12%water.

Feed preparation

Garlic powder was weighed as required, suspended in a small amount of aquades and mixed thoroughly into fish pellet. The mixtures were air-dried at room temperature, coated with egg yolk and air-dried again. After dry, feed was put in plastic bags and stored in a refrigerator at 4^{o}C until use.

Experimental Design

The research used Complete Randomized Design with five different treatments in which each treatment had three replications. The treatments consisted of 0 (control feed), 5, 10, 15 and 20 g of garlic powder per kg of feed (pellet).

Research procedure and data collection

The research was carried out using 15 net pens measuring 0.8 x 0.5 x 1 m^3 (L x W x D) each. The net pens were positioned in a pond (L= 40 m, W=25 m, D= 1.2 m) belonging to Aquaculture Development and

Training Board (BP3I), Marine and Fisheries Office of North Sulawesi Province. Each treatment was located randomly among the net pens.

At the end of acclimatization period, the juveniles were captured from the acclimatization tank and then restock in the net pens with a density of 10 juveniles per net pen. During the experiment, fish was fed with treatment diets at 5% of body weight per day, twice a day at 08.00 am and 16.00 pm. Feeding period was four consecutive weeks. Water quality during the experiment was kept stable by regular monitoring. To maintained the optimal level of pond water, water exchange as much as one-third was conducted once every three days. Fish weight was measured at the end of feeding period. Weight gain was calculated as follows:

$W_G = Wt - Wo$

Where: W_G = weight gain (g)

Wt = weight of fish measured at the end of experiment (g)

Wo = initial weight of fish (g)

Statistical analysis

One-way analysis of variance (ANOVA) was conducted to evaluate the effect of garlic-supplemented pellet on fish growth. The difference effect between means was analyzed by Duncan Test using SPSS 21 for windows. Significant level was set at 0.05

Result and Discussion

Feeding the carp with garlic-supplemented pellet for four weeks period had significant effect ($p<0.05$)on fish growth as compared to that of control fish, especially in the fish fed 15 and 20 g garlic powder per kg pellet (Table 1.). At lower doses, fish fed pellet supplemented with 5 and 10 g garlic per kg pellet displayed no significant difference in growth compared to control fish.

Table 1. Weight gain of carp fed with pellet supplemented with garlic powder for four consecutive weeks

Treatments (g garlic per kg of pellet)	Wo (g)	Wt (g)	W_G (g)
0	21,7	28,7	7.0 ± 1.60^{a}
5	21,7	29,5	7.93 ± 1.67^{ab}
10	21,7	29,8	8.26 ± 1.10^{ab}
15	21,7	33,03	11.33 ± 2.30^{c}
20	21,7	32,23	10.53 ± 0.92^{bc}

Different super scribes in the same column were significantly different

It was observed that the highest weight gain was achieved in fish fed 15 g garlic per kg pellet. In this treatment, weight gain of fish was 61.85% greater than that of control fish. At higher dose (20 g garlic per kg pellet), weight gain was 60.42% greater than weight gain in control fish but smaller as compared to fish fed 15 g garlic per kg pellet. There was no significant difference in growth between fish fed with 15 g garlic per kg pellet and 20 g garlic per kg pellet. This results explained that dose and administration time should be considered well in the application of garlic as growth promoter and immunomodulator in aquaculture. Long-term administration and overdoses might suppress growth and immune system in fish[21].Thus for the effective use of herbal as growth promoter and immunomodulator, dosages, method of administration, administration time and the physiological condition of fish need to be considered because those are essential in health management[22].

Many research on the use of hormone, antibiotics, vitamin and other chemicals have been tested in aquaculture operation to control diseases or promote growth. But, even though the give positive effect, they cannot be recommended due to their residue and other side effects[23]. Herbal products including garlic contain compounds such as phenolic, polyphenols, alkaloid, quinones, terpenoid, lectines and polipeptides. Garlic contains potential active chemical constituents including sulfur compounds (such as aliin, allicin, allypropyl

disulfide, diallyl trisulfide, s-allylcysteine, vinyldithiines, S-allylpropyl), enzymes (such as allinase, peroxidases, myrosinase), amino acids (arginine), minerals (selenium, germanium, tellurium, and other trace mineral[24]. Herbal products used in aquaculture operation have the characteristics of growth promoting ability and tonic to improve the immune system and increase appetite[23]. These products also increase consumption, induce maturation, and have antimicrobial capability and antistress. In this research, it was found that incorporation of garlic in fish feed induced fish growth.

Result of this research showed that garlic was potential to increase growth of fish. In our previous study, nile tilapia (an average weight of 10.4 g per individual) fed with 20 g garlic powder per kg for weeks had better growth, total leucocytes and phagocytosis activity compared to control fish[25]. Another report also showed that nile tilapia with an average weight of 7 g had the highest growth performance and the lower Food Conversion Ratio after feeding 30 g garlic-supplemented feed [26].

Supplementation of garlic in fish feed significantly increases fish growth because it contains bioactive such as allicin[27]. Allicin positively influences the intestinal micro flora and thus improves food digestibility, nutrient supply and energy use that resulted in better fish growth[27,28]. In rainbow trout, *Oncorhynchus mykiss* (Walbaum), there was a significant increase in growth, feedconversion and protein efficiency after feeding diet supplemented with 0.5 and 1.0 g garlic per100 g of feed 29 (Nya and Austin, 2009..use of garlic)

Conclusion

The present study showed that feeding the carp with garlic-supplemented pellet for four weeks had significant effect on fish growth. The highest weight gain was achieved in fish fed pellet supplemented with 15 g garlic per kg pellet. At the higher dose, weight gain started to decrease, thus dose and administration time should be considered well in the application of garlic as growth promoter in aquaculture.

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