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Probiotics-herbs of rhizome origin as feed additives and utilization in fish

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Abstract

Fish growth and survival depend on feed. The main factor in determining the quality of feed depends on its nutritional content. Physically and biologically extracted herbal ingredients are the characteristics of herbal probiotics. Herbal probiotics are made by adding microorganisms, enzymes, acidity regulators, minerals, vitamins, and other ingredients depending on the intended use and how to use them. This paper provides an explanation by way of a review method regarding herbal probiotics by adding microorganisms through a herbal fermentation process which and can then be used as a feed additive that has benefits for growth and increases the resistance or immunity of fish.

Keywords: Feed additive; Fish growth; Probiotic; Herbs; Rhizome

1 Introduction

The potential of capture fisheries continues to decline due to overfishing so that fisheries production in Indonesia must be driven more by aquaculture [1]. The Ministry of Marine Affairs and Fisheries (MMAF) noted that nationally fish production reached 23.86 million tons in 2019. In aquaculture business, increased production can be achieved by maximizing environmental conditions both the aquatic environment and the surrounding aquaculture environment, providing feed that is in accordance with the needs of fish, and quality seeds.

In aquaculture, feed is very important to pay attention to, both intensively and semi-intensively because in production, feed costs the highest, which is around 35-70% of operational costs. This is what results in the use of feed must be efficient so that production results can be optimal. One way that can be done is to use feed additives. In addition to feed factors, disease moaning is also one of the factors that can affect the results of fish farming production. The amount of fish production can decrease drastically due to disrupted growth, even to mass death due to disease attacks [2]. Efforts to prevent and control fish diseases can be done with drugs such as antibiotics for bacterial diseases, vaccinations, or by applying good fish farming methods [3].

Antibiotic application can be used to kill microorganisms that are not needed, but excessive use will cause the body's defense system to be disrupted and will give rise to more virulent pathogen strains [4]. The accumulation of too many antibiotics in the body of fish will have an impact on the health of humans who consume these fish [5]. Therefore, in the aspect of development of cultivation and disease prevention, the use of probiotics is one way to reduce the use of antibiotics. In the field of cultivation, the use of probiotics can control pathogens in the digestive tract and maintain microbial balance [6].

Aprobiotic application as a feed additive has been widely done, but the manufacture of additive fees by combining herbal ingredients from physical extraction with probiotics processed by simple fermentation is a useful practical

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breakthrough [1]. Plant origin feed ingredients with practical fermentation treatment by probiotics that are easily available and this affordable price is the advantage of herbal probiotics

1.1 Probiotic Herb as Feed Additive

Probiotics is a term used in the use of microorganisms that can have a good impact on their hosts or other organisms. Dietary supplement that is often used is *Lactobacillus* bacteria, because it has the ability to change substrates with lactic acid content that can function as antimicrobials [7]. Probiotics are ingredients that contain a number of microbes (bacteria) that are added to feed. The added bacteria are beneficial bacteria for the growth and health of fish and can affect the intestinal microflora.

The nutritional value of feed is closely related to the availability of the amount of food substances intended from some substances that are lost after going through the processes of digestion, absorption, and metabolism. The use of herbal probiotics is needed to be able to help the process of absorption of nutrients during the digestive process. If this absorption process is disrupted, the nutrients given to fish cannot be absorbed optimally. In other words, the higher the nutrient there is for the body to absorb, the fat retention and protein retention can increase [8]. Probiotic can increase fish appetite, improve digestion, can also increase fish immune system from diseases that can attack so that the mortality rate of farmed fish can decrease [9].

Plants as phytopharmaceutical products used as an alternative to bacterial disease control and feed supplements are known for being biodegradable, easy to find in nature, and environmentally friendly [10]. Herbs that can be used that act as additive feeds include Aromatic ginger “Kencur”, *curcumin*, and ginger. *Ginger (Zingiber officinale)* is a traditional remedy that can be used singly or to supplement other ingredients. Ginger contains natural antioxidants to treat various diseases, including *shoganol*, *zingeron*, *gingerol*, essential oil, etc. [11].

Aromatic ginger “Kencur” (*Kaempferia galanga*) has antifungal, inflammatory, and antibacterial activities sourced from secondary metabolite compounds such as, quinone, seneol. Polyphenols, tannins, flavonoids, saponins, and essential oils [12, 13]. Temulawak (*Curcuma xanthorrhiza* Roxb) is an ingredient that acts as an immunostimulant to increase fish immunity and can increase fish growth. The content of compounds contained in ginger in the form of starch, protein, essential oils, flavonoids, quinones, and alkaloids [14].

The use of herbal supplements through the fermentation process in feed can increase fish immunity to disease attacks, stimulate appetite, and reduce fish stress levels to environmental changes. Through fermentation, complex compounds that are not easily digested are converted into simpler compounds. In the fermentation process, food undergoes several physical and chemical changes that are beneficial for fish such as the formation of flavors and preferred flavors. This can occur due to the presence of active substances in herbal supplements that can increase growth, fish health, and the body's defense system [16].

1.2 Method of Preparation Probiotic-Herb

Fermentation of herbal ingredients through the addition of yeast is a commonly used method in the manufacture of herbal probiotics. Bioherb commercial probiotics usually contain molasses, *Streptococcus thermophilis* bacteria, *Lactobacillus acidophilus*, and *Bifidobacterium*. In addition, there are also herbal ingredients such as turmeric, ginger, Aromatic ginger, and others. This is in accordance with [9] that the manufacture of probiotics is fermented first for 7 days using the addition of herbal ingredients that are easy to find with a sugar composition of 10 g/L water (carried out gradually 2 g/day for 7 days fermentation), bran 50 g/L water, turmeric 50 g/L water, and yeast 5 g/L water. Then, after 7 days of fermentation probiotics can be applied to the feed.

2 Optimal Probiotics-herbs for Growth

The use of herbal ingredients in probiotics for fish growth in fermented form aims to improve the nutritional value contained in feed ingredients [17]. The results of [18] previously showed that the use of herbal probiotics in artificial feed with a maintenance time of 30 days can increase the growth of tilapia length (3.4 cm), at a dose of 200 ml/kg of feed. These doses have not been effective in efficient applications, some research results on the use of herbal probiotics can be seen in Table 1.

Table 1 A Few of utilization of Probiotics-herbs for Fish Growth

Treatment	Optimum Dose	Result	Ref.
Addition of probiotics at doses of 0, 2, 4, 6, and 8 ml/kg	Provision of probiotic plus herbs on feed at a dose of 2 ml/kg	Increased protein retention value by 4.766% of red tilapia	[8]
Herbalvit in feed at a dose of 0.30 ml/kg, 50 ml/kg, 60 ml/kg + 2, 50 ml air/kg	Best treatment 60 ml/kg + 250 air/kg feed	Extended gain of 4.2 cm and weight gain of 4.6 g of saline tilapia fry.	[19]
Fish herbs from rhizomes, herbs and yeast, doses 0, 50, 100, 150 and 200 ml / kg in catfish	The effective dose is 150 ml/kg of feed.	SGR (4.6%), FCR (0.62) and survival (92%); protein meat content of 20.27% with the lowest fat (10.01%).	[20], [21]
Fish herbs from rhizomes, herbs and yeast, doses of 0, 25, 50, 75, and 100 ml/kg of feed	Effective dose 50 ml/kg	SGR 0.65%, FCR 0.51, and protein efficiency ratio 1.29, in of bonylip barb	[22]
Fish herbs from herbal rhizomes and yeast, doses 0, 100, 200 300 and 400 ml/ kg, test with <i>Aeromonas hydrophila</i>	Effective dose 200 ml/kg	increase survival rate and resistance of bonylip barb fish bonylip barb.	[23]
Fish herbs from rhizomes, herbs and yeast, doses of 0, 25, 50, 75, and 100 ml/kg of feed	Feeding with the treatment of 50 ml Kg-1 was the best	Feed resulted in the smallest FCR of 1.34 of Nile tilapia seed	[24]

Ket. : SGR : specific growth rate, FCR : feed conversion ratio

Probiotics that enter the body of fish play a role in the digestive process so that it can increase the digestibility of fish to feed, so as to efficiently utilize feed by fish because feed nutrients will have been absorbed by fish. This is in line with a statement, that probiotics can increase growth because probiotics can produce enzymes that can break down complex compounds into simpler so that they are ready for consumption by fish [25]. This can increase fish growth caused by the presence of bacteria in probiotics that produce enzymes. In addition, carbohydrate retention, fat retention, and protein retention will also increase due to the absorption of feed nutrients [26]. Microbes contained in probiotics are usually gram-positive bacteria such as the genus *Lactobacillus* and *Bifidobacterium* [27].

Lactic acid bacteria are gram-positive bacteria that can produce lactic acid in the process of carbohydrate fermentation, and is a normal flora in the digestive tract of both terrestrial and aquatic animals. Lactic acid bacteria play an important role in helping the digestive organs and naturally these bacteria can increase the specific and non-specific immune system, such as macrophagy activity, lysozyme in the body, and respiratory explosions. Lactic acid bacteria have the ability to control pathogens. These bacteria produce acetic acid and lactic acid which can lower intestinal pH and prevent the growth of bad bacteria [28]. This is also in accordance with [16] states that lactic acid bacteria can change carbohydrates that can lower pH, so that conditions in the digestive tract become acidic, this is what causes pathogenic bacteria in the digestive tract to be eliminated so that the absorption of nutrients can run properly.

In some research results show that the weight gain and length of fish are also influenced by the dose of probiotics given to the feed. If the dose of probiotics used cannot be met, there will be an imbalance between bacteria that still exist in the digestive tract with bacteria that already exist in the digestive tract. This can affect the enzymes produced by these bacteria. However, if the concentration of bacteria is too much it will cause overgrowth, where the density of bacteria that is too high can cause competition in taking nutrients so that bacterial activity becomes inhibited [29]. This is in line with the opinion of [30], six bacterial ingredients with a large number can cause bacteria that quickly sporulate so that the activity and function of *Lactobacillus sp.*

3 Conclusion

Giving herbal probiotics-herbs of rhizomes of 50-150 ml/kg of feed can have an influence on the growth and health of fish.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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