



# **The Use of Bread Yeast (*Saccharomyces cerevisiae*) in Increasing Growth, Disease Resistance, and as Immunostimulating for Various Kinds of Fish: A Review**

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## **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## **ABSTRACT**

Apart from providing benefits to bread, *Saccharomyces cerevisiae* can provide benefits to fish by providing it as a probiotic, and immunostimulant can be used as a feed substitute. *Saccharomyces cerevisiae* can provide benefits to increase growth and disease resistance in cultivated fish, both consumption fish and ornamental fish. Therefore, this journal review will look at which treatments are suitable for utilizing baker's yeast which will later be given to fish. The materials used to review this journal are related reference sources. The method used in this journal review is a systematic,

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explicit and reproducible method for evaluating and identifying the results of a study that has been produced by previous researchers and then draws a conclusion from the best treatment. From the review results, the best dosage is to use 5 g/kg of baker's yeast.

**Keywords:** *Fish; bread yeast; probiotics; immunostimulants; growth; resistance; Saccharomyces cerevisiae; aquaculture.*

## 1. INTRODUCTION

Fish farming directly or indirectly can be affected by the growth rate of fish and fish resistance to disease. However, if fish are exposed to disease, it will automatically affect the growth rate and level of resistance to disease, both diseases such as bacteria, fungi, parasites, and viruses, as well as diseases due to genetics, nutritional deficiencies, and others [1]. Because this is also what can cause economic losses for fish cultivators. Therefore, the management and control of fish health need to be considered in detail so as not to harm farmers [2].

Several methods have been applied to deal with diseases that can attack fish. Efforts that have been implemented by cultivators at this time are providing vaccines to prevent disease attacks, giving antibiotics to cure fish infected with pathogens and diseases, and also administering immunostimulants and probiotics to keep the fish's body healthy and can increase the immune response in the body. In addition to those mentioned above, several other efforts can be applied to prevent the entry of disease attacks on fish, such as implementing biosecurity [3,4]. Biosecurity can not only be applied to fish however but biosecurity can also be applied to another aquatic biota such as shrimp. The application of biosecurity that is carried out consistently and well can reduce the impact of disease [5]. The results of this study certainly have a positive effect on controlling diseases in shrimp caused by *Vibrio* bacteria and acute hepatopancreatic necrosis disease (AHPND). Due to the application of biosecurity, it is almost impossible to find some of these pathogens in shrimp farming units.

Talking about prevention efforts, farmers usually use antibiotics as an alternative to cure sick fish. However, some cases say that the administration of this antibiotic can cause resistance to the pathogen if the administration exceeds the recommended dose. Giving antibiotics in ponds or ponds will require not small ingredients and can use materials that are considered expensive in addition, these materials must be able to

accumulate in the fish's body and if the material from antibiotics is not safe it will endanger the health of the fish [6,7]. Actually, in addition to giving antibiotics, vaccines can be given to fish to prevent disease, but even though some fish species have responded positively to vaccines, vaccines have not been sold freely. In addition, the vaccine is also considered still not effective in curing the disease [1].

## 2. USE OF IMMUNOSTIMULANT

Various efforts have been made by farmers to reduce mortality in fish, in addition to giving antibiotics and vaccines, farmers use immunostimulants which are considered more effective than antibiotics and vaccines. The use of immunostimulants mixed into feed can increase the fish's body's resistance to disease. Increasing the fish in addition to this disease can be through an increase in non-specific responses. The use of this immunostimulant can be used as an alternative to the use of chemical-based drugs and antibiotics. When compared with vaccines that are less suitable when given to shrimp, immunostimulants can be given to shrimp. This is because immunostimulants work simultaneously at the same time against pathogens by increasing the non-specific immune system in shrimp [8,9]. One research journal stated that the advantages of giving immunostimulants to fish or shrimp will not leave residues in the body and are safe for the aquatic environment especially if humans consume fish or shrimp that are given immunostimulants, will not be harmful to their health [10]. Immunostimulants will react by activating non-specific immune defense mechanisms which will increase phagocytic activity, complement activity, lysozyme, and resistance to disease [11].

This immunostimulant can be added to fish feed. Several researchers have tried to examine the administration of immunostimulants mixed with fish feed. The results of this study prove that naturally, fish respond positively to the administration of immunostimulants by showing increased appetite and resistance to disease. Directly, the administration of immunostimulants

affects the growth rate of fish. Immunostimulants can be mixed with natural ingredients such as those from medicinal plants, seaweed, and yeast [8]. Talking about baker's yeast, baker's yeast can be used as a source of material for immunostimulants because baker's yeast contains immunostimulant ingredients.

### 3. BREAD YEAST (*Saccharomyces cerevisiae*)

The type of mold that is usually present in baker's yeast is of the species *Saccharomyces cerevisiae*. The addition of *Saccharomyces cerevisiae* is thought to increase the specific immune response against several fish species [12]. The addition of *Saccharomyces cerevisiae* cells can also provide other benefits, such as increasing the digestibility of protein and feed to make the growth rate of fish more stable [13]. The use of baker's yeast (*Saccharomyces cerevisiae*) can reduce costs because baker's yeast is available in the market at an affordable price. Previously, *Saccharomyces cerevisiae* has been widely used as an ingredient for probiotics and immunostimulants for livestock such as poultry, however, along with the development of time and technology, *Saccharomyces cerevisiae* is also used in the field of biotechnology.

### 4. *Saccharomyces cerevisiae* ON FISH GROWTH RATE

*Saccharomyces cerevisiae* or known as baker's yeast has the potential to be used as an immunostimulant and is believed to accelerate growth. Bread yeast has good and high nutritional value, these nutrients include fat, protein, vitamins, and minerals [14]. In addition, this baker's yeast (*Saccharomyces cerevisiae*)

can produce biochemical compounds of single-cell proteins, and recombinant proteins [15]. This will give a positive response to nutrient absorption so that the result can increase growth in catfish. It is known that probiotics can accelerate growth and can renew the existing tissue in the digestive tract, namely the intestine, whereas prebiotics reserve the energy source needed [16].

Baker's yeast contains nucleotides in the form of pyrimidines and purines so the presence of this content can increase fish appetite. This can be good for fish. Bread yeast is one of the probiotics that can increase the immune response can provide an enzyme to digest food and can increase feed digestibility [17]. The use of baker's yeast can replace fish meal in the feed mix [18].

The results of many studies have shown that the use of baker's yeast (*Saccharomyces cerevisiae*) mixed into feed can increase the growth rate of fish and improve the immune system [1]. The addition of baker's yeast to the feed per kg can increase the growth rate [19].

From the table below, it can be concluded that this baker's yeast (*Saccharomyces cerevisiae*) is a type of mold that has good nutritional content and is effective in its growth rate. Several studies in the table show that giving bread yeast by mixing it into feed as much as 5-10 g/kg can increase the growth rate of various types of fish. In addition, in this study using baker's yeast as a probiotic mixed with probiotic mannan oligosaccharides into the feed, the results had a good impact on the growth of catfish. The more giving baker's yeast to pomfret, the higher the growth rate of pomfret [20,21].

**Table 1. Comparative analysis of the use of bread yeast on growth rate**

Fish type	Final growth weight (g)	Results	Reference
Clown Fish ( <i>Amphiprion percula</i> )	4.5	The growth rate increased because the feed was added with 1.0-5.0 mg of baker's yeast.	[22]
Tilapia ( <i>Oreochromis niloticus</i> )	56.89	The dosage of giving baker's yeast to feed as much as 5 g/kg can effectively increase growth	[23]
Catfish ( <i>Pangasius sp.</i> )	2525	Effectively increase the growth rate with the addition of 0.2% of the amount of feed with a combination of Mannan oligosaccharide probiotic administration	[20]
Parrot fish ( <i>Oreochromis niloticus</i> )	24	Effectively increase growth rate by adding 5-10 g/kg to feed	[24]

Fish type	Final growth weight (g)	Results	Reference
Pomfret ( <i>Bramidae sp.</i> )	42.49	Giving baker's yeast as much as 20 g/kg is effective in increasing the growth rate	[21]
Baronang fish ( <i>Siganus guttatus</i> )	171.36	Increase growth by giving 2% <i>Saccharomyces cerevisiae</i> to feed.	[17]
Tilapia ( <i>Oreochromis niloticus</i> )	15.00	Increase growth by giving baker's yeast as much as 10 g/kg.	[1]
Goldfish ( <i>Cyprinus carpio</i> )	4.47	Increase growth by giving baker's yeast as much as 5 g/kg.	[25]
White Snapper ( <i>Late calcarifer</i> )	0.507	Increase growth by giving 0.20% baker's yeast	[26]
Dorade Fish ( <i>Salminus brasiliensis</i> )	129.76	Increase growth by giving baker's yeast ( <i>Saccharomyces cerevisiae</i> ) 4 g/kg	[27]
Rainbow Trout ( <i>Oncorhynchus mykiss</i> )	54.1	The provision of baker's yeast supplementation increases the growth	[28]

### 5. GIVING *Saccharomyces cerevisiae* AS IMMUNOSTIMULANT AGAINST DISEASE RESISTANCE AND SURVIVAL

Phagocytic cells have a very important function in the body's defense. *Saccharomyces cerevisiae* is a type of yeast that can be used as a good immunostimulant to provide fish resistance [20,29]. *Saccharomyces cerevisiae* can produce proteases and extracellular siderophores that can bind to lactoferrin [16].

This ability can be antagonistic to some pathogens whose virulence is iron- dependent [30,20]. The ingredients contained in *Saccharomyces cerevisiae* are -1,3- glucan, chitin, nucleic acid, complex mannoprotein, and nucleotides [31]. If the immunostimulant contained in *Saccharomyces cerevisiae* is combined with prebiotic Mannoligosaccharides, it can have a positive effect in increasing the immune response [20]. This can affect disease resistance.

**Table 2. Analysis of administration of *Saccharomyces cerevisiae* as immunostimulant to disease resistance and fish survival**

Fish type	Results	Reference
Clown Fish ( <i>Amphiprion percula</i> )	Succeeded in increasing disease resistance in clown fish at a dose of 2.0 g/kg.	[22]
Tilapia ( <i>Oreochromis niloticus</i> )	Can increase the survival of Tilapia by up to 76.6%	[24]
Pomfret ( <i>Bramidae sp.</i> )	Positive effect on fish survival at a dose of 5 g/kg-20 g/kg	[21]
Parrot fish ( <i>Oreochromis niloticus</i> )	Increases resistance to disease with the enhanced nonspecific immune response given 5 g/kg.	[1]
Goldfish ( <i>Cyprinus carpio</i> )	Increase resistance to disease by administering 5 g/kg baker's yeast	[1]
Goldfish ( <i>Cyprinus carpio</i> )	Increases resistance to disease with the increased nonspecific immune response given 5-10 g/kg.	[10]
Persian Sturgeon ( <i>Acipenser persicus</i> )	A positive effect of the addition of baker's yeast and other probiotic mixtures on the immune system of fish.	[15]
Dorade Fish ( <i>Salminus brasiliensis</i> )	Increase growth by giving baker's yeast ( <i>Saccharomyces cerevisiae</i> ) 4 g/kg	[27]
Rainbow Trout ( <i>Oncorhynchus mykiss</i> )	Supplementation with baker's yeast ( <i>Saccharomyces cerevisiae</i> ) increases the immune response.	[28]
Rainbow Trout ( <i>Oncorhynchus mykiss</i> )	Fermentation of 5 g/kg of baker's yeast ( <i>Saccharomyces cerevisiae</i> ) increases the immune response	[28]

Thus, the study showed that the addition and administration of baker's yeast in tilapia feed could increase the number of leukocytes present in fish [9]. Other studies have also shown that survival in carp can be achieved by giving 5–10 g/kg of bread yeast feed. Giving 5 g/kg of baker's yeast to tilapia feed can achieve the highest survival after the fish is infected with *A. hydrophila* bacteria [19].

The use of baker's yeast (*Saccharomyces cerevisiae*) which is given to fish by mixing it into feed can produce the nutrient content that is needed by fish, namely protein [18,32, etc]. This can be used as another option to replace the basic ingredients of feed such as fish meal which is still considered expensive.

From the Table 2, the administration of baker's yeast (*Saccharomyces cerevisiae*) as an immunostimulant at a dose of 5 g/kg can increase disease resistance. This is reinforced by the statement. Thus, the study showed that the addition and administration of baker's yeast in tilapia feed could increase the number of leukocytes present in fish [1,9 etc]. Other studies have also shown that survival in carp can be achieved by giving 5–10 g/kg of bread yeast feed. Giving 5 g/kg of baker's yeast to tilapia feed can achieve the highest survival after the fish is infected with *A. hydrophila* bacteria [1]. It can be seen in the table that Rainbow Trout, Carp, Tilapia, and Pomfret with the addition of 5 g/kg baker's yeast can increase specific and non-specific immune responses.

## 6. CONCLUSION

By looking at the discussion of the various studies that have been carried out, it can be concluded that the addition of baker's yeast as an immunostimulant or mixed directly into the feed can increase growth and increase the immune response in fish with the most widely used and effective dose of 5 g/kg of baker's yeast.

## 7. RECOMMENDATION

After reading the research of experts reported in the journal, it can be seen that yeast can provide enormous benefits for fish, therefore research is needed on ornamental fish and other fish to see the effect of baker's yeast broadly.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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