

THE USE OF IMMUNOSTIMULANTS FROM PAPAYA LEAVES TO TREAT DISEASE AND INCREASE NON-SPECIFIC IMMUNITY IN FISH AND SHRIMP

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ABSTRACT

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The use of immunostimulants from papaya leaves as a treatment strategy for fish diseases has gained attention in the field of aquaculture. Initial studies have shown that the active compounds in papaya leaves have the potential as immunostimulants to enhance the fish immune system and combat disease infections. Previous studies have revealed that the administration of papaya leaf extracts in fish feed can stimulate immune responses, including activating immune cells such as macrophages and increasing antibody production. The compounds in papaya leaves also exhibit antimicrobial effects that help fight against pathogens causing diseases in fish. Although research findings indicate the potential use of papaya leaf immunostimulants, further studies are needed to understand their mechanisms of action comprehensively. Factors such as effective dosage, optimal administration methods, and their effects on various diseases must be clarified. Safety aspects should also be considered, including potential side effects and residues in fish intended for human consumption. Consideration should also be given to sustainable fish farming practices and the potential environmental impacts of the widespread use of papaya leaf immunostimulants. In conclusion, using immunostimulants from papaya leaves to treat fish diseases shows promising potential. However, further research is required to understand their effects thoroughly, determine the appropriate dosage, evaluate the safety, and consider sustainable aquaculture aspects before their use can be widely recommended in aquaculture practices.

INTRODUCTION

Papaya (*Carica papaya*) is a plant that has many benefits, including in the health sector. In addition to the fruit being rich in nutrients, papaya leaves also have interesting properties. Several studies have shown that papaya leaves contain active compounds that can act as immunostimulants, stimulating the immune system to increase the immune response (Santoni et al., 2023).

Using immunostimulants from papaya leaves to treat diseases in fish has become an exciting research topic in aquaculture (Monica, 2017). In fish, as in humans and other animals, the immune system plays a vital role in fighting infection and disease. Improving fish's immune system can help protect them from various diseases and increase their survival rate (Satiani et al., 2016).

Several studies have shown that giving papaya leaf extract to fish feed can have a positive immunostimulating effect. Bioactive compounds in papaya leaves, such as alkaloids, flavonoids, saponins, and other compounds, are believed to have the potential to increase the activity of fish immune cells, such as macrophages, lymphocytes, and other cells involved in the immune response (Lase et al. ., 2020).

Immunostimulants from papaya leaves are also believed to increase fish's antibody production and antioxidant enzyme activity (Wardani, 2012). Antibodies are proteins the immune system produces to fight pathogens, while antioxidant enzymes can help protect fish body cells from damage caused by free radicals (Pratiwi, 2020).

However, more research needs to be done to study more deeply the use of papaya leaf immunostimulants in treating diseases in fish. Variables such as optimal dosage, route of administration, different types of fish, and types of disease encountered must be carefully considered. In addition, further safety and effectiveness tests also need to be carried out before immunostimulants from papaya leaves can be widely recommended in aquaculture practices.

Using immunostimulants from papaya leaves to treat diseases in fish shows good potential. The active compounds in papaya leaves are believed to boost the fish's immune system and protect them from various diseases. However, further research is needed to reveal a more detailed mechanism of action, determine the optimal dosage, and thoroughly evaluate its safety and effectiveness before immunostimulants from papaya leaves can be widely implemented in the aquaculture industry.

RESULTS AND DISCUSSION

Using immunostimulants from papaya leaves to treat diseases in fish has become an interesting research topic in aquaculture. Several preliminary studies have been conducted to evaluate papaya leaves' immunostimulant potential in enhancing fish's immune system and overcoming diseases affecting cultivated fish populations (Haryani et al., 2012).

The advantage of using immunostimulants is that they increase the immune response. Immunostimulants can enhance the immune system, thereby increasing resistance to disease and overall health in the organism. By strengthening the immune system, immunostimulants can help prevent and control various diseases in fish and shrimp, reduce the risk of infection, and increase survival rates. They are reducing dependence on antibiotics. Immunostimulants provide an alternative approach to disease management, reducing the need for antibiotics. This can help reduce the risk of antibiotic resistance and promote sustainable aquaculture practices. Using immunostimulants in aquaculture practices can provide a cost-effective disease prevention and control solution. Farmers can minimise losses and increase productivity by reducing the incidence of disease. Immunostimulants can be combined with other treatments, such as vaccines or drugs, to increase their effectiveness and provide a comprehensive approach to disease management. Environmentally friendly: Immunostimulants derived from natural sources such as plant extracts are generally considered safe and environmentally friendly. Its use is in line with sustainable and

environmentally friendly aquaculture practices. Performance-enhancing potential: Immunostimulants have shown potential in increasing growth, feed efficiency, and overall productivity in fish and shrimp, resulting in economic benefits for aquaculture operations (Evendi, 2023).

Several studies in Table 1 show that giving papaya leaf extract to fish feed can increase the immune response of fish. Papaya leaf extract activates immune cells, such as macrophages, responsible for attacking and destroying pathogens entering the fish's body. In addition, the study also found an increase in the production of antibodies in fish given papaya leaf extract, which helps fight infection.

Other studies have also shown that active compounds in papaya leaves, such as alkaloids and flavonoids, have antimicrobial effects that can help fight bacteria, viruses and parasites that cause disease in fish. These compounds can also stimulate the production of antioxidant enzymes in the fish's body, which help protect cells from oxidative damage. Wicaksono & Dwinanti, 2019; Monica, 2017). Besides increasing the non-specific immunity of papaya leaf culture fish, it also increases the efficiency of feed utilisation, protein efficiency ratio and relative growth rate in fish culture (Isnawati, 2015).

Table 1. Use of papaya leaf immersion as an immunostimulant in fish and shrimp

No	Species	Method	Improved Results	Reference
1	Catfish (<i>Pangasianodon hypophthalmus</i>)	Oral 20 ml/kg feed	<ul style="list-style-type: none"> • Survival Rate • Total Leukocytes • Phagocytosis Activity 	Puspitowati <i>et al.</i> (2022)
2	Catfish (<i>Clarias</i> sp.)	Immersion 30 ml, 48 hour	Accelerates wound healing	Adli (2020)
3	Vaname shrimp (<i>Litopenaeus vanamei</i>)	Immersion 30 mg/L	<ul style="list-style-type: none"> • Survival rate • Withstand the attack of <i>Vibrio</i> sp. 	Wicaksono & Dwinanti (2019)
4	Vaname shrimp (<i>Litopenaeus vanamei</i>)	Immersion 30 ml/L	<ul style="list-style-type: none"> • Total haemocyte count • Phagocytosis index • Phagocytosis Activity 	Monica (2017)
5	Tinfoil barb (<i>Barbonemus schwanenfeldii</i>)	Oral 10%/kg feed	<ul style="list-style-type: none"> • Survival Rate • Absolute growth • Withstand the attack of <i>Aeromonas hydrophila</i> 	Absah (2021)
6.	Catfish (<i>Pangasiodon hypophthalmus</i>)	Oral 20 ml/kg feed	<ul style="list-style-type: none"> • Total erythrocytes • Hematocrit value • Hemoglobin Levels • Absolute growth • Withstand the attack of <i>Aeromonas hydrophila</i> 	Lase <i>et al.</i> (2020)

Herbs have been widely recognised as an alternative to treating various diseases. One type of plant currently of public concern is the papaya plant, where papaya leaves have various medical benefits, such as increasing endurance, appetite, anti-diabetes, and dengue fever. Some advantages of using herbs as a therapeutic option are relatively mild side effects, do not contain synthetic chemicals, are easy to obtain, and are more economical (Susilowati et al., 2020).

Papaya leaf extract mixed with fish feed can increase survival rate, total erythrocytes, absolute growth, haemoglobin levels and erythrocyte levels (Puspitowati et al., 2022; Absah, 2021; Lase et al., 2020). Besides being given by immersion, previous research has also proven that catfish and shrimp given papaya leaf extract can increase non-specific immunity (Adli, 2020; Wicaksono & Dwinanti, 2019; Monica, 2017).

Papaya leaves contain the enzyme papain, which has proteolytic properties and the alkaloid karpain as an antibacterial agent (Dimas et al., 2014). In addition, papaya leaves contain flavonoids with antibacterial and antioxidant properties that can improve immune system function (Saras, 2023). Research conducted by Monica et al. (2017) regarding the use of papaya leaf extract as an immunostimulating agent in vannamei shrimp by immersing papaya leaf extract at different concentrations. The results of this study indicated that at the highest concentration (30 mg/L), papaya leaf extract could increase vannamei shrimp non-specific immunity.

Papaya leaf extract contains compounds such as papain enzymes, karpain alkaloids, and flavonoids which have antibacterial properties (Jati et al., 2019). This can help fight bacterial infections in fish and shrimp. The active components in papaya leaf extract can stimulate and enhance the immune system response (Tuntun, 2016). This helps increase the body's ability to fight disease and infection. Papaya leaf extract contains antioxidant compounds, such as flavonoids, which help protect body cells from damage caused by free radicals. This can help improve overall health and boost the immune system. Several components in papaya leaf extract have anti-inflammatory properties, which can help reduce inflammation in the bodies of fish and shrimp. This can help speed recovery from injury or infection. Papaya leaves are widely available and easily accessible so the extract can be produced relatively cheaply. This makes it an affordable option for boosting the immune system of fish and shrimp in aquaculture. Papaya leaf extract is generally considered safe and has a low risk of side effects (Adli, 2020). However, paying attention to the proper dosage and following the recommended usage guidelines are important. Papaya leaf extract can be used in many forms, including as a feed additive, soaking solution, or in feed formulations. This provides flexibility in integrating it into existing aquaculture practices. It should be noted that the use of papaya leaf extract as an immunostimulant in aquaculture is still in the research stage, and further research is needed to examine its effectiveness under different conditions.

Although preliminary studies indicate the potential use of immunostimulants from papaya leaves to treat disease in fish, further research is still needed to understand their mechanism of action in more depth. Variables such as the optimal dose, the effective route of administration, and their effect on various diseases need to be studied more deeply. In addition, it is also important to evaluate the safety of using immunostimulants from papaya leaves in cultivated fish. Some aspects to consider are possible side effects, potential residues in fish consumed by humans, and interactions with other drugs used to treat fish. The use of immunostimulants from papaya leaves to treat diseases in fish also needs to be considered in the context of sustainable fish farming practices. Factors such as the sustainability of papaya leaf resources, environmental impact, and production efficiency must be thoroughly considered before implementing this immunostimulant on a large scale. Overall, using immunostimulants from papaya leaves to treat diseases in fish shows an interesting potential but still requires further research to understand its effects thoroughly, determine the correct dosage, evaluate the safety, and consider aspects of sustainable aquaculture.

CONCLUSION

The use of immunostimulants from papaya leaves as a method of treating disease in fish shows interesting potential based on existing research. The active compounds in papaya leaves can be an immunostimulant to boost the fish's immune system and fight disease infections. Giving papaya leaf extract to fish feed can stimulate the immune response and increase antibody production. In addition, the compounds in papaya leaves also have antimicrobial effects that help fight pathogens that cause disease in fish. However, even though the research results show the potential use of immunostimulants from papaya leaves, further research is still needed to understand the mechanism of action in more depth. It is important to determine the correct dose, the optimal route of administration, and its effect on various types of disease. The safety of using immunostimulants from papaya leaves must also be considered, including the potential for side effects and residues in fish for human consumption. In addition, aspects of sustainable aquaculture and environmental impacts also need to be considered before their use can be widely recommended in aquaculture practices. Overall, using immunostimulants from papaya leaves shows an interesting potential in overcoming diseases in fish. However, further in-depth research is needed to fully understand its effects, determine appropriate dosages, evaluate safety, and consider sustainable aquaculture aspects before its use can be widely recommended in aquaculture practice.

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