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A Mini-review: Effect of *Aloe vera* on the Growth and Health of Fish

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ABSTRACT

Fish is a source of animal protein that is relatively cheap compared to other sources of animal protein and is affordable by various levels of society. In connection with this, industrial production in the fishery sector needs to be increased in order to obtain quality fish, namely those that are healthy, free from disease, and whose growth is good and safe for consumption. Various plants can be used as supplements to increase fish resistance to disease and increase fish growth. *Aloe vera* is a medicinal plant that contains several secondary metabolites, namely alkaloids, flavonoids, saponins, steroids, phenols, terpenoids, anthraquinones, tannins which act as antibacterial, antioxidant, immunostimulant and can help increase fish growth and improve fish health. This article aims to explain Aloe vera and the effect of *Aloe vera* on the growth and health of fish. Based on the research above, *Aloe vera* has the potential to be used as an alternative health supplement for various kinds of fish.

Keywords: *Aloe vera*, disease, growth, immunology.

1. INTRODUCTION

Fish is a source of animal protein that is relatively cheap compared to other sources of animal protein and is affordable by various levels of society [1] connection with this, industrial production in the aquaculture sector needs to be increased both in quantity and quality. Quality fish is healthy fish free from disease and fast growth and safe for consumption. Disease attack is a major obstacle in fish farming activities [2], which will affect the growth and decline of the immune system, as well as fish mortality [3]. This can lead to a decrease in production and is very detrimental to the economy for fish farming business actors. As according to [4] in intensive aquaculture, fish are the target of various diseases that cause a decrease in production and cause considerable losses. According to [5] disease attacks not only cause fish growth to slow down, it even has an impact on mass fish mortality (80 - 100%).

In general, farmers treat sick fish using antibiotics. The use of antibiotics for prophylaxis and treatment of disease has an impact on the emergence of antibiotic-resistant bacterial strains, accumulation of residues in cultured fish and the environment [6]. Therefore, a new approach is needed to prevent fish diseases by increasing the fish's body resistance (immunotherapy). Several research results have proven that various types of herbs can be used as supplements to increase the body's resistance (immunostimulant) of fish against diseases, especially bacterial [7, 8, 9, 10].

Aloe vera or *Aloe barbadensis* Miller, a medicinal plant from the family Liliaceae or Aloeaceae, is native to Africa, but is now widely distributed in the tropics and subtropics (11). The mucus or gel portion of *Aloe vera* is commonly used in cosmetics and several other medicinal products (12). The medicinal function of *Aloe vera* is related to its properties as anti-bacterial (13), antioxidant [14], immunostimulant [15] and can help increase fish growth [16]. This article aims to describe the compounds contained in *Aloe vera* and its role for the health and growth of fish.

2. PHYTOCHEMICAL SCREENING of Aloe vera

Based on the results of qualitative phytochemical screening of rind and aloe vera extract gel using 70% ethanol solvent, several secondary metabolites were detected. The content of alkaloids in the rind and gel was high, the content of flavonoids and phenols in the rind was low, while the gel was not detected. Both the rind and the extract gel contained low levels of steroids, while saponins, tannins, and terpenoids were not detected [14]. The results of the phytochemical screening test of 96% ethanol extract of aloe vera skin that have been carried out by [13] show the content of secondary metabolites, namely alkaloids, phenols, saponins, tannins, and anthraquinones (Table 1). According to [12] anthraquinones are only found in the skin, while the gel does not contain anthraquinones. From this, it can be seen that the difference in solvent extracts gives a difference to the detected secondary metabolites. In addition to containing several secondary metabolites that have been mentioned above, Aloe vera also contains specific compounds, namely Acemannan and other constituents [17].

Table 1 Qualitative Phytochemical Screening Results of Aloe vera Rind and Gel Extracts

Pelarut estrak	Bagian tanaman	Alkaloids	Flavonoids/ Tannis	Saponins	Steroids	Fenol/ antrakuinon	Terpenoids	Ref
Ethanol 70%	rind	+++	+/-	-	+	+/-	+	14
	gel	+++	-/+	-	+	-/-	-	14
Etnanol 96%	rind	+++	-/+	+	-	+/+	-	13

++++: very high content, +: low content, −: no content

3. ANTIBACTERIAL ACTIVITY

Fish in aquaculture activities are the target of various diseases, especially bacterial diseases. So research and development of materials as antibacterials that are safe, do not cause side effects are urgently needed to be applied. Antimicrobials derived from plants have been used as research objects because they are considered safer, do not pollute the environment and are relatively cheaper. Aloe vera has been used as an object of research, because it has several benefits, especially its ability as an antibacterial [13]. As mentioned above, Aloe vera contains several secondary metabolite compounds that have the potential as antibacterial, namely alkaloids, flavonoids, tannins, steroids. Several studies have proven that Aloe vera extract acts as an antibacterial for pathogenic bacteria that infect cultured fish, namely Pseudomonas aerugenosa. The ethanol extract of *Aloe vera* Linn skin has antibacterial activity against antibiotic-resistant *Pseudomonas aeruginosa* bacteria. Minimum Inhibitory Concentration (MIC) of ethanolic extract of *Aloe vera* peel against *Pseudomonas aeruginosa* bacteria was at a concentration of 8.5% with an inhibition zone of 6 mm [13]. The results of research conducted by [18] using 70% ethanol extract of *Aloe vera* showed that there was inhibition against *Escherichia coli, Enterococcus faecalis, Staphylococcus aureus* showed 24 mm, 21 mm and 24 mm inhibition zones [18]. Concentration of *Aloe vera* gel and peel extract at a concentration of 25% were effective in inhibiting the growth of Staphylococcus aureus,

but the gel extract was the most effective [19]. The antibacterial test results of *Aloe vera* extract using 95% acetone as solvent against *Staphylococcus aureus, Streptococcus pyogens, Pseudomonas aeruginos* and *Escherichia coli* bacteria produced inhibition zones of 12 ± 0.45 mm, 20 ± 0.35 mm, 20 ± 0.57 mm, and 15 ± 0.38 mm, whereas when using aqueous extract solvent the inhibition zone produced was only on *Streptococcus pyogens* bacteria with an inhibition zone diameter of 9 ± 0.53 mm, in other bacteria no inhibition zone was formed. If using ethanol solvent the inhibition zone was 7 ± 0.37 mm, 19 ± 0.36 mm and 14 ± 0.53 for *Staphylococcus aureus, Streptococcus pyogens, Pseudomonas aeruginos* bacteria, respectively [20].

The mechanism of action of secondary metabolites contained in *Aloe vera* as an antibacterial is different. Alkaloid compounds in inhibiting bacterial growth are by disrupting the peptidoglycan constituent components in bacterial cells so that the cell wall layer is not formed completely and causes cell death [21]. Flavonoids by inhibiting nucleic acid synthesis, impairing the function of the cytoplasmic membrane, inhibiting bacterial metabolism and bacterial cell membrane synthesis and aggregating bacterial cells [22]. Tannins are phenolic compounds which have a mechanism in inhibiting bacterial growth by binding and precipitation of proteins [23], inhibiting extracellular enzymes and bacterial metabolism by inhibiting bacterial oxidative phosphorylation reactions [24]. The mechanism of saponins in inhibiting bacterial growth by reducing surface tension, resulting in increased permeability or cell leakage and resulting in intracellular compounds to come out [25].

4. ANTIOXIDANT ACTIVITY

Several studies have proven that *Aloe vera* has antioxidant activity. As the results of research conducted by [14], there are differences in antioxidant levels between the skin and gel of aloe vera, the skin antioxidant activities in DPPH scavenging base on IC50 value is 113.18 g/mL, while from the gel part it is 291.96 g/ mL. The use of n-hexane as solvent will be effective if more polar solvent is added with methanol. The optimum results of antioxidant levels from aloe vera using n-hexane solvent at a concentration of 60% is 13.78%, whereas if 60% n-hexane solvent is added with methanol solvent, the optimum antioxidant yield from *Aloe vera* is even higher, which is 56.29%. at a temperature of 50oC within 5 hours of extraction [26]The results of the observation of *Aloe vera* ethanol extract showed high DPPH (2,2-diphenyl-1-picryl hydrazyl) and FRAP (ferric reducing power) scavenging activity, indicating that Aloe vera has the potential to be used as an antioxidant. *Aloe vera* gel ethanol extract also exhibited significant antioxidant properties, but at lower levels. exhibited the highest scavenging activity (85.01 ± 0.52%) and the greatest reducing power (185.98 ± 0.41 M), indicating that the skin contained the highest level of antioxidants [27]. The antioxidant activity of Aloe vera extracts and reference compounds followed the order: three-year-old Aloe vera > BHT > four-year-old Aloe vera > alpha-tocopherol > two-year-old *Aloe vera*. The three-year-old extract exhibited the strongest radical scavenging activity of 72.19%, which is significantly higher than that of BHT at 70.52% and alpha-tocopherol at 65.20%. These data suggest that the growth stage plays a vital role in the composition and antioxidant activity of *Aloe vera* [28]

5. GROWTH ACTIVITY

Several studies have proven that Aloe vera has activity in increasing fish growth. The results of research conducted by [29 khanal] showed that for 90 days carp (Cyprinus carpio) whose rations were added with 70% aloe vera ethanol extract, the percentage of weight gain, specific growth rate, protein efficiency ratio, and feed conversion efficiency were significantly higher. compared to control (0.0%). Gastrosomatic index, condition factors, and

gut histology were found to perform better in the carp group fed 0.4% and 0.8% aloe vera after 90 days. So, carp whose diet was given aloe vera extract between 0.4% - 0.8% kg -1 of feed would produce better growth. The results of another study showed that the administration of Aloe vera extract for two months through feed at concentrations of 0.2 and 0.5% gave a better effect on the growth of Tor grypus fish, compared to control and extract concentration of 0.1%. At concentrations of 0.2 and 0.5%, the specific growth rate (SGR) values were 0.68±0.08 and 0.31±0.01, respectively, the protein efficiency ratio (PER) was 1.84±.30 and 1.53±.10, the feed conversion value. ratio (FCR) of 1.38±0.25 and 1.64±0.08, the value of feed efficiency (FE) is 0.74±0.12 and 0.61±0.03, respectively. SGR, PER, FCR and FE values in control fish were 0.26±0.05, 0.52±0.10, 4.89±0.65 and 0.21±0.02 [16 safari], respectively. The results of research conducted by [30 yunus [2021] addition of Aloe vera extract at a dose of 5 g / kg in feed can improve the growth performance in terms of length gain of tilapia (Oreochromis niloticus). The weight growth rate (WGR) and length growth rate (LGR) produced were 3.855±0.474 g and 2.889±0.356 cm, respectively, while the WGR and LGR control fish produced were 3.789±0.154 g and 1.833±0.173 cm respectively.

The oral administration of 0.1-0.2% concentration of the crude extract of *A. vera* improved investigated growth factors in *Oncorhynchus mykiss* fish during a 60-day rearing period. Value of Percentage Weight Gain (PWG), Specific Growth Ratio (SGR), Food Conversation Ratio (FCR), Food Efficiency Rate (FER), Protein Efficiency Ratio (PER) and Condition Factor CF in fish fed with crude Aloe vera extract 0.1 % were 210±25.2 g, 0.98±0.04%, 1.41±0.09, 70.86±5, 2.02±0.11 and 1.62±0.1, respectively. At the extract concentration the PWG, SGR, FCR, FER, PER and CF values produced were 222±31.52 g, 1.01±0.1%, 1.32±0.13, 75.48±12.83, 2.16±0.34 and 1.55±0.1, while the PWG value , SGR, FCR, FER, PER and CF in control fish were 162.01±19.44 g, 0.84±0.07%, 1.77±0.16, 56.44±8.46, 1.61±0.19 and 1.77±0.2 [31].

6. EFFECT OF ALOE VERA ON HEALTH OF FISH

Aloe vera has antibacterial and antioxidant activity which certainly has a positive effect on fish health, because it can also act as an immunostimulant to improve fish health. Research on *Aloe vera* as an immunostimulant to increase fish resistance to disease has been carried out. The results of a study conducted by [6] showed that feeding supplemented with 80% *Aloe vera* ethanol extract supplementation at a rate of 1% for two weeks had a higher immunological response to rainbow trout (*Oncorhynchus mykiss*) compared to the placebo group. Seen from the increased phagocytic activity of blood leukocytes, the respiratory burst activity and lysozyme significantly ($p<0.05$). Therefore, *Aloe vera* supplements can be used as a supplement that is mixed with feed to increase the body's nonspecific immune response of rainbow trout (*Oncorhynchus mykiss*) especially during outbreaks. The results of another study showed the concentrations of 0.2 and 0.5% ethanol extract could increase the white blood cell count of *Tor grypus* fish. An increase in white blood cells indicates an increase in body resistance. The higher the concentration, the greater the increase. At a concentration of 0.2% the number of white blood cells was $1.62x10^3$cell/mm^3, while at a concentration of 0.5% it was $1.72x10^3$cell/mm^3 [16]. *Cyprinus carpio* showed resistance to *Aeromonas salmonicida* bacteria attack after being given *Aloe vera* extract through feed, while the solvents used in the extraction process were ethanol, ethyl acetate, and n-hexane. *Aloe vera* extract dose of 2 ppm was the best dose to increase cellular and humoral non-specific immunity, as indicated by an increase in plasma protein levels from 443.0 to 662.0 mg.Kg-1, antibody from 1.2576 to 3.3974, and phagocytic activity from 30.61% to 45.94% . In addition, there was an increase in the differential value of leukocytes, lymphocytes from

58.6% to 73.70%, neutrophils from 6.09 to 8%, and monocytes from 5.70% to 7.72% [15]. The results of research conducted by [30] *A. vera* extract at the dosage of 5 g / kg of feed given to tilapia (*Oreochromis niloticus*) for 14 days showed the highest average total leucocytes of 50,150 cells / mm^3, the value was greater compared to control and other treatments. From the description above, it proves that *Aloe vera* can be used as an immunostimulant to increase fish resistance to bacterial diseases in particular. This is related to the content of secondary metabolites and acemannan and other constituents of *Aloe vera* which have been shown to increase macrophage activity tenfold, increase the effectiveness of macrophages in modulating the entire immune system, in stimulating, producing, and releasing antibodies (17).

CONCLUSION

Aloe vera a positive effect on the growth and health of fish. *Aloe vera* can increase the weight of fish. *Aloe vera* also has antibacterial and antioksidan effect. So, this herbal may be an excellent source to develop as a fish feed ingredient, antibacterial, antioksidan and immunostimulant agent.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Dawood MAO. Nutritional immunity of fish intestines: important insights for sustainable aquaculture. Rev. Aquac. 2021;13 : 642–663. doi: 10.1111/raq. 12492.
2. Rusmawanto, Prajitno A, Yuniarti A. Minimum inhibitory concentration of marine microalgae Dunaliella salina on fish pathogenic bacteria Edwardsiella tarda. Research Journal of Life Science. 2019; 6(2):72-82.
3. Shourbela, R. M., Khatab, S. A., Hassan, M. M., Van Doan, H., and Dawood, M. A. O. The effect of stocking density and carbon sources on the oxidative status, and nonspecific immunity of Nile tilapia (*Oreochromis niloticus*) reared under biofloc conditions. Animals. 2021;11:184.
4. Phillip, H.K., Evans, J. J., Shoemaker, A.C., Pasnik, D.J. (2006) A vaccination and challenge model using calcein marked fish. Fish Shellfish Immunol. 20: 20-28.
5. Austin B., Austin D.A.: Bacterial fish pathogens. Disease of farmed and wild fish, 6th ed., Springer International Publishing Switzerland, 2016.
6. Haghighi M, Rohani MS, Samadi M, Tavoli M, Eslami M, Yusefi R. Study of effects Aloe vera extract supplemented feed on hematological and immunological indices of rainbow trout (*Oncorhynchus mykiss*). Int J Adv Biol Biom Res. 2014; 2(6):2143-2154.
7. Rosidah, Buwono ID, Lili W, Suryadi IB, Triandika AR. The resistance of sangkuriang catfish (*Clarias gariepinus* Burchell 1822) against *Aeromonas hydrophila* bacteria given moringa leaf extracts (*Moringa oleifera* L.) through the feed. Jurnal Iktiologi Indonesia. 2019. 19(1): 97-113.
8. Ahamad, M.H., El Mesallamy, A.M.D., Samir, F and Zshran, F. (2011). Effect of cinnamon (*Cinnamomum zeylanicum*) on growth performance, feed utilization, whole body composition and resistance to *Aeromunas hydrophilain* nile tilapia. J Appl Aquacul, 23: 289-298.

9. Subeena Begum, S and Navaraj, P.S (2012). Synergistic effect of plant extract supplemented diets on immunity and resistance to *Aeromonas hydrophila* in Mystus. IOSR J Pharmacy Biological Sci 2(4): 30- 36.

10. Maqsood, S., Samoon, M.H. and Singh, P. (2009). Immunostimulatory and growth promoting effect of dietary levamisole in *Cyprinus carpio* fingerlings against the challenge of *Aeromonas hydrophila*. Turkish J Fisheries Aquatic Sci 9: 111-120.

11. Mahdavi, M., Hajimoradloo, A., & Ghorbani, R. (2013). Effect of *Aloe vera* extract on growth parameters of common carp (*Cyprinus carpio*). World Journal of Medical Sciences, 9(1), 55–60.

12. Marshall, J.M. (1990). Aloe vera gel: What is the evidence? The Pharmaceutical J. 24: 360-362.

13. Sari N, Apridamayanti P, Sari R. Determination of Mic Value of Ethanol Extract of Aloe Vera (*Aloe vera* Linn) Skin Against Antibiotic Resistant *Pseudomonas aeruginosa* Bacteria. Journal of Informatics and Science Education. 2018; 7(2) : 219 – 232.

14. Mahadi SB, Handayani AS, Widowati W, Wilsen, Dewani Y, Fachrial E, Lister INE. Antioxidant and Anti-tyrosinase Activities of *Aloe vera* Rind and Gel Extracts. Global Medical and Health Communication. 2019;7(3) : 170 -176.

15. Andayani S, Dadiono MS, ElwiraWT, Setyawan FH. Potency of Aloe extract as immunostimulant for carp (*Cyprinus carpio*) against *Aeromonas salmonicida*. Biodiversitas. 2020; 21 (3): 860-864.

16. Safari M, Chelemal Dezfoul Nejad M, Mesbah M, Nejad J. Effects of *Aloe vera* extract on growth and some hematological parameters of shirbot, *Tor grypus* (Heckel, 1843). Iranian Journal of Fisheries Sciences. 2019; 18(3) : 445-456.

17. Baseline of Health Foundation. *Aloe vera* & saccharides as immune system boosters, Barron report. Super saccharides & Aloe vera for the immune system. January (2002). Available from: http://www.jonbarron.org/article/super-saccharids-aloe-vera-imm

18. Athiban PP, Borthakur BJ, Ganesan S and Swathika B. Evaluation of antimicrobial efficacy of *Aloe vera* and its effectiveness in decontaminating gutta percha cones. Journal of Conservative Dentstry. 2012; 15(3): 246–248.

19. Olaleye MT, Bello-Michael CO. Comparative antimicrobial activities of *Aloe vera* gel and leaf. Afric J Biotech 2005;4(12):1413-14.

20. Barandozi FN. Antibacterial activities and antioxidant capacity of *Aloe vera*. Org Med Chem Lett. 2013; 3: 5.

21. Darsana IGO. Potential of Binahong (*Anredera cordifolia* (tenore) Steenis) Leaves in Inhibiting the Growth of *Escherichia coli* Bacteria in Vitro. Indonesia Medicus Veterinus. 2012; I (3): 337 - 351.

22. Xie Y, Yang W, Tang F, Chen X, Ren L. Antibacterial activities of flavonoids : structure-activity relationship and mechanism. Curr. Med. Chem. 2015; 22:132–149.

23. Huang Q, Liu X, Zhao G, Hu T, Wang Y. Potential and challenges of tannins as an alternative to in-feed antibiotics for farm animal production. Anim. Nutr. 2018; 4: 137–150.

24. Scalbert A. Antimicrobial properties of tannins. Phytochemistry. 1991. 30, 3875–3883.

25. Nuria MC, Arvin F, Sumantri. 2009. Test of antibacterial activity *Jatropha cuircas* L ethanol extract against Staphylococcus aureus ATCC 25923, Escheria coli ATCC 25922 and Salmonella typhi ATCC 1408. Jurnal Ilmu Pertanian 5: 26–37.

26. Kusumaningrum M and Harianingsih. Extraction of Antioxidants in *Aloe Vera* (*Aloe Vera*) with Microwave Assisted. Chemical Engineering Innovation. 2018; 3(2): 27-30.

27. Moniruzzaman M, Rokeya B, Ahmed S, Bhowmik A, Khalil I Md and Gan SH. In Vitro Antioxidant Effects of *Aloe barbadensis* Miller Extracts and the Potential Role of These Extracts as Antidiabetic and Antilipidemic Agents on Streptozotocin-Induced Type 2 Diabetic Model Rats. Molecules. 2012; 17: 12851-12867.

28. Hu Y, Xu J, Hu Q. Evaluation of Antioxidant Potential of *Aloe vera* (*Aloe barbadensis* Miller) Extracts. Journal of Agricultural and Food Chemistry. 2003; 51(26):7788-91.

29. Khanal M, Lamichhane S, Bhattarai A, Kayastha BL, and Labh SN. Extract of *Aloe vera* (*Aloe barbadensis* Miller) Enhances the Growth, Protein Contents, and Gastrosomatic Index (GaSI) of Common Carp *Cyprinus carpio*. Hindawi Journal of Nutrition and Metabolism. Volume 2021, Article ID 8029413, 14 pages

30. Yunus YE, Anshary H, Zainuddin EN. Effect of *Aloe vera* Extract on Growth and Hematological Performance in Nile Tilapia (*Oreochromis niloticus*). International Journal of Scientific and Research Publications. 2021; 11(2) : 574-580.

31. Alishahi, M., Ranjbar, M.M., Ghorbanpour, M., Mesbah, M. and Razi Jalali, M. (2010). Effects of dietary *Aloe vera* on some specific and nonspecific immunity in the common carp (*Cyprinus carpio*). Int J Vet Res 4: 189-195.