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STUDY ON UTILIZING MEDICINAL PLANTS FOR DISEASE TREATMENT IN AQUACULTURE IN "FRESH WATER ORNAMENTAL FISHES"

Mukkula Akhila[1*], Dr.T. Jagadeeshwara Chari[2], D.Ram Kumar[3]
[1]M. Sc Fisheries Student (II[nd] Year), [2&3]Lecturer in Fisheries
CRL-Central Research Lab, Government Degree College (A), Siddipet

ABSTRACT
Medicinal plants in aquaculture are receiving the importance of environmentally eco-friendly and sustainable medicinal drugs and antibiotic production. Freshwater ornamental fish, which are highly compound bacterial, fungal, and parasitic infections, affected by health disorders that contribute to inferior survival and market value. Organic plants like Turmeric, Garlic, Ginger, Aloe vera, Neem, and the rapeutic value with antibacterial, antifungal, antiparasitic, and immunostimulatory activity. Bioactive products not only assist in the healing and prevention of diseases but also stimulate the immune system and growth rate of fishes. Compared to chemical therapy, plant therapy is inexpensive, biodegradable, and causes minimal harm to the aquatic ecosystem and consumers. This is a sustainable approach to enhancing fish health and secure production of decorative forms in aquaculture.
KEYWORDS: *Medicinal Plants, Aquaculture, In Ornamental Fishes, Disease Treatment, Immunostimulants, Eco-Friendly, Fish Health Management.*

INTRODUCTION

Aquaculture in India has long history. Potentially dating back (2000 years) early forms involved trapping and holding fish paddy and low-lying. The aquaculture industry is one of the fastest growing industries in the world especially the most important in the food sector (Jagadeeshwara CT, et al. 2024). The declining fishery harvesting, wild fish food -safety issues environmental concerns, increased fish consumption, and increasing market share of organic food have combined to focus towards "Organic Aquaculture". Traditionally fish diseases have been managed using antibiotics and chemical treatments, but overreliances and such intervention has contributed to antimicrobial resistances [AMR] environmental degradation, and the accumulation of chemical residues in aquatic organisms. Considering these challenges medicinal plants have emerged of promising nature-based intervention that refer both physiological and Eco-logical benefits. Several species such Garlic [*Allium sativum]* Giner *[Zingiber officinale]* Neem *[Azadirachta indica]* and have demonstrated efficacy activity and increasing growth rates, and better nutrients absorption and feed conversation with copper. Recently medicinal agents having antifungal action utilizing botanical spices like Turmeric *[Curcuma longa]* and extracts are being employed against infection in the infected fish. Medicinal and natural remedies like Garlic and they thyme were used for fish disease. Aquaculture is the farming of fish and aquatic plants as a crop that contributes to needs global sea food. Ayur Ved plants like Neem, Garlic, Ginger, Turmeric, Alo vera, were employed for their antibacterial causes/futures.

The International Federation of Organic Agriculture Movements (IFOAM) stated federation four main principle of organic agriculture are health ecological fairness and care (IFOAM,2014; Lembo et al., 2018; Gould et al., 2019).

Table 1: Organic plants were increasingly used to naturally treat bacterial, fungus, parasite, infections in fishes

S.no	Plant name	Scientific names	Author
1.	Garlic	*Allicin sativum*	Carl Linnaeus (1707-1778)
2.	Neem	*Azadirachta indica*	A.H.de Jussieu (1797-1853)
3.	Ginger	*Zingiber officinale*	William Roscoe (1753-1831)
4.	Turmeric	*Curcuma longa*	Carl Linnaeus (1707-1778)
5.	Aloe vera	*Aloe Barbadensismiller*	Nicolaas Laurens Burman (1734-1793)

Medicinal plants that offer natural and environmentally sound ways to enhances fish health and mange diseases. All these old traditional practices have had significant contribution to the definition of modern botanical approaches in aquaculture. The use of medicinal plants in aquaculture has gradually grown from conventional practices process in early 20[th] century research started. However, diseases outbreak in fish farmers can severely impact production and farmer livelihoods traditional disease treatment often antibiotics and chemicals which may lead to environmental pollution and development. Alternative medicinal plants have gained attention for nature antimicrobial anti-inflammatory. Recent study base highlight needs the technology effective strategical marketing growth to drive the of organic medicinal aquaculture and overcome chances. The combination of the tools allowed use to identify the main challenges and innovation global trends in organic medicinal aquaculture.

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Materials and Methods

- **STEP 1: Selection of Disease Fish Species**
- Choosing a suitable Ornamental fish species e.g. Goldfish, Koi fish,
- **Fish Selection and Adaption or (Adjustments)**
- Choose fish species relevant to aquaculture and disease challenges.
- Adjustment the fish laboratory condition.
- Example: Water, temperature, pH, and Salinity.
- Monitor fish health and behaviour during acclimation in aquarium.
- **STEP 2: Fish Disease challenges**
- Expose fish to disease-causing pathogens like
- Bacterial, Fungal, Parasitic
- Montier fish for disease symptoms and morality rate.
- Confirm the disease diagnosis using microbial and pathogenesis analysis.

Bacterial disease in Goldfish



Fig1: Bacterial disease and observation of white spots on fish scales

Ecto- Parasite disease in Koi carp fish



Fig2: Parasite disease and observing in microscope and we find out Argulosis



Fig3: Cottonmouth diseased



Fig4: Nutritional diseased

STEP 3: Treatment with medicinal plants extracts

- Collect fresh plant extracts such as Garlic clove, Turmeric clove, Neem leaf's Onion, Ginger, Aleo vera
- Wash properly with clean water to remove the dirt parts and containers.
- Dry under the fan or dry under the sun out said and grind into fine powder.

Neem leaf's extracts boost fish immunity and use for various purpose. Immunity and protect them parasites, fungal, bacteria diseases. Its natural compounds have a strong Antimicrobial making bit useful in aquaculture disease control.

Ginger boosts fish growth like immunity, and feed use ginger protect against bacteria and improves disease resistance. Recommended feed level 0.1-0.5% combining with probiotics enchances gut health and fish survival.
Garlic improves fish growth, feed and immunity protect like against bacterial and anti-fungal effects.

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Garlic can apply through feed and works well in combination with antibiotics fight with bacterial resistance.
Onion is natural medicinal clove with antibacterial, and immune-boosting fish health onion can improve growth, and immunity, health, enhance, feed efficiency. Its bioactive compounds al so use overall fish health and growth reduce disease and strengthening immunity.

Aloe vera improves fish immunity and fish growth. When added to fish feed or water in controlled amounts and aloe vera like aloin, Saponins and vitamins which help improving immunity boost, recovery from stress and disease.
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For Extracts

- Medicinal plants extract to disease fish viva feed.
- Montier the fish health and growth and behaviour
- Reduced mortality and improved growth treat with Garlic, Neem, Ginger, Turmeric, medicinal plants.

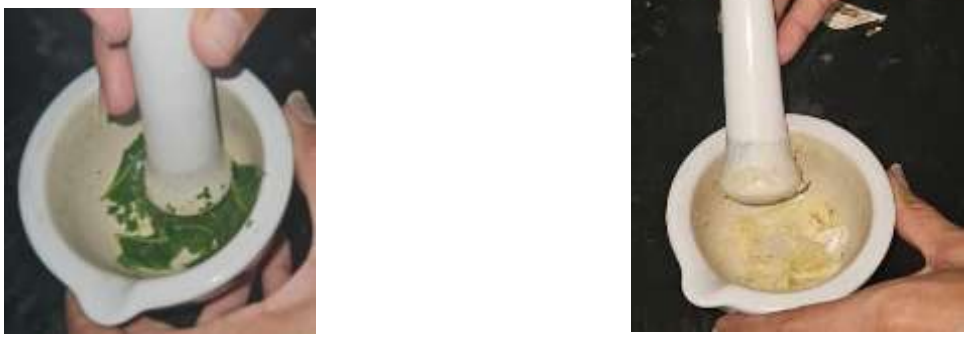


Fig5: Collecting Ginger, Neem Leaf's extraction



Fig6: Hanging Turmeric plant



Fig7: Hanging Garlic clove

STEP 4: Herbal Feed preparation and Formulation
Blend the plant extracts powders in the basal fish feed at suitable concentration 1-5% off feed weight
Air-dry the medicated feed and store in cool and dry condition.
Mix herbal powder or extract and add small quantity of water or fish oil to mix the feed properly.
Dry the feed at room or else Lab temperature and store in airtight containers.

Feed Management
Feed the fish daily or twice morning and evening and feed amount sustainable should be 3-5% of fish body weight per a day.
During in the day trail 30 to 40 days depending on species.

STEP 5: Experimental Design
Species were divided into control and treatment groups.
Species Control group: normal feed
Each group was kept in separate tanks with replicates treatments. Fish randomly distributed into tanks
N=10-15 per tank

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STEP 6: Water Quality Monitoring
Monitor and maintain the optimal water quality parameters
Temperature:
pH: Potential of Hydrogen
DO: Dissolved Oxygen
Test medicinal plants extract for antimicrobial activity against
fish disease causing pathogens.
Evaluate minimum inhibitory concentration
(MIC) and minimum Bacterial concentration (MBC)

STEP 7: Health and growth Monitoring
The regularly observe fish growth, behaviour, feeding, and fish responses and appearance.
Following the parameters measurement.
Growth performances
specific growth rate (SGR)
feed conversion ratio (FCR)
Regular monitoring the Haematology count and haemoglobin level
Immunity test t respiratory burst and lysozyme activity.
Disease resistances test if applicable, expose fish to known as pathogens to test survival rate.

STEP 8: Pathogen Challenges
After the treatment period fish were challenged with pathogen and mortality clinical symptoms were observed.
Treatment Application:
Plant extract mixed with feed using blinder example: sun dried
Dose 0.5% and 1% or 2% of body weight.
Treatment duration 30 days or else 2-4 weeks

STEP 9: Disease challenge test
After 21-30 days of feeding medicinal treatment for fish were challenge with bacterial suspension
Example: Hydrophilia
Observation period 7 to 10 days range maintained with optimal limits for species.

STEP 10: Data collection And Statistical Analysis
Calculate the Mortality rate, Growth, Performances, and immunity
responses were compared.
Daily monitoring and survival rate and feed consumption.
Water Quality parameters.
Significances level set at $p<0.05$.

RESULT

When we tried to be added medicinal plants like neem garlic Ginger Aloe vera in the fish tanks We noticed some clear improvements in Diseased Fish And adding turmeric with the fish we noticed some clear Fish improvement and immunity and fish growth and fish health improvements. The fish that got this treatment stayed healthy there with a few dying from deceased compared to the untreated groups. We found red spot fin damage and fungal growth healed faster Awesome they grow a bit Better gaining more weight and using their feed more Efficiently. And the water stayed clean and safe These plants are natural and breakdown harmless Also we surprisingly quick in just a few days in the fish this treated tank started to look more active. You also noticed a big difference in deceit symptoms Cotton like fungus around the mouth and fin rot started healing faster in the Treated fish.

Fish diseases in While name and garlic quickly reduce this spread of the parasite spot in tanks. In tanks where we ginger was added swelling and redness reduced within few days and better survival rates compared to control groups especially when the challenged with fungal bacterial Infections parasitic Disease. Improve immune response and indicated by increased Fish grow fish health Enhanced Lysozyme activities. A visible recovery External symptom such as reduced redness around eye healing of cottonmouth and skin ulceration. Higher growth performance reflected in increased weight gain Kingfisher health and feed conversation efficiency. Reducing the mortality rate by up to 60-80 % in some treatments Like Ginger garlic And Neem.

Overall, the whole trial medicinal treatments in in treated groups had a fair few deaths in some cases almost 70-80% Few compared to the untreated fish Also gain more weight and use their feed more efficiently meaning the grow better without extra feed. Another big advantage was that water stayed clean since the plants are natural, they broke down slowly they didn't Released harmful chemicals into the tank this kept the water quality parameters like oxygen ammonia and pH in healthy range for the fish disease.

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During the species observation in the college aquarium fish treated with hanging bundles of neem leaf's, garlic, ginger and aloe vera in the tank. Aquarium water Showed a gradual reduction of symptoms of argulosis and irony and cottonmouth. The healing process was slow but consistent suggesting the plants antimicrobial and anti-inflammatory and antifungal properties contributed to disease suspension.

Better growth and health

Supplemented diet in agriculture Fish feed with the use of name and garlic most significant haematological and immunological response in deceased fish medicinal plants improving growth metrics.
Average weight gain increase by 18-25%
Specific growth rate (SGR) 10-20%
Feed conversation ratio (FCR)10-15% Control to 1.6% in treated disease fish group.
The use of Neem and garlic Most significant growth and immunity improvements.
Fish administrated with Name garlic ginger Like Ashwagandha Notable Improvement in immune parameters such as totally Leukocyte count red blood cells count, and haemoglobin concentration treated with fish species. The immunity boosting effect of medical plans like garlic, ginger, turmeric, Neem, Pathogens attacks. additionally herbal supplementation also positively influenced growth Performance.

Diseased Resistances

Medicinal treatment Conferred.
The survival compared rate 50-60 %
Medicinal plant disease absents in treated fishes.
The challenge test medicinal plants revealed 70-90%



Fig8: Diseased Koi carp fish, Treating with Garlic and turmeric clove and reduced diseased

Potential Benefits

Medicinal plants can be used to address virus health challenges in aquaculture Including Disease control by targeting viral bacteria and parasitic infection. Immune system enhancement stimulating the fish natural defence. Potentially Improving overall growth and productivity.

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Fig9: Diseased goldfish and treating with neem leaf's and improving fish health

Water Treatments
Introducing plant extracts directly into the water.
Adding plan extracts or powders to the fish feed. Providing plant-based supplements to chance fish health

Leads to: Antimicrobial resistance
Environmental pollution
Chemical accumulation in aquatic life

Medicinal plants natural solution
Eco friendly sustainable disease management.
Provide the health and environmental benefits in aquaculture.

Water Quality Impact
Water tank with herbal additives showed stable water quality parameters such as pH (7.2–8.0) and dissolved oxygen (5.5 – 7.0 mg/L) ammonia with optimal range. indicates no harmful impact in aquatic environment.

TABLE 2: Effect of medicinal plants on disease recovery in freshwater ornamental fishes

S.NO	Types of disease	Causative agent	Medicinal plant used	Recovery Date and time period
1	Parasite Disease	Argulosis	Garlic Clove	Good recovery within 6-9 Days
2	Bacterial Disease	Aeromonas hydrophila	Turmeric Clove	Reduced disease within 5-9 Days
3	Fungal Disease	Flavobacterium	Neem Leaf's	Visible recovery within 8-11 Days

TABLE 3: Water Quality Parameters Monitoring

S.NO	Parameters	Before Application	After Application	WHO Standard	Remark
1	pH	6.5–6.8	7.0–7.2	6.5–8.5	Improved, stabilized
2	Dissolved Oxygen (mg/L)	4.4	6.1	>5.0	Increased, suitable for fish
3	Ammonia (mg/L)	0.8	0.3	<0.5	Reduced, safer
4	Nitrite (mg/L)	0.6	0.2	<0.3	Reduced
5	Nitrate (mg/L)	45	25	<50	Within safe limit
6	Hardness (mg/L $CaCO_3$)	100	120	75–150	Balanced
7	Turbidity (NTU)	12	6	<10	Improved clarity
8	Total Alkalinity (mg/L)	80	90	75–200	Improved buffering

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Graph: Fish Disease reducing with herbal medicinal plants

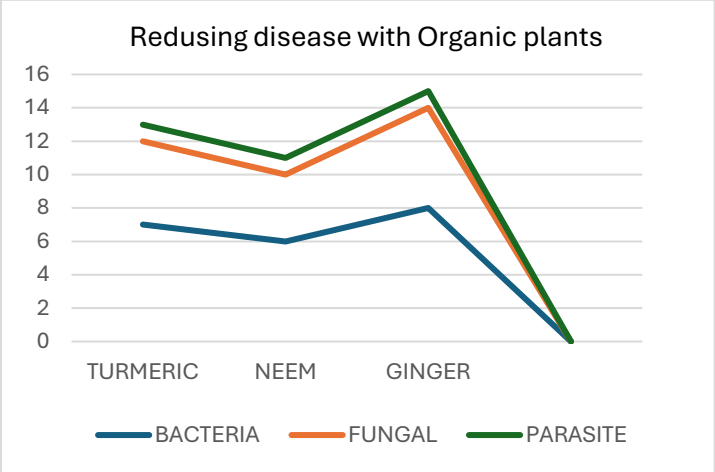


Fig10: Graphical representation of Reducing disease in organic way

DISCUSSION

This finding matches with what yearly researchers also found a Citarasu et al. (2010) explained that medicinal plants can improve fish health and growth immunity and reduce the disease and need for antibiotics. From the study It was clear that medicinal plants Really works for fish disease in freshwater ornamental fishes. Garlic *(Allium sativum)* works well on parasites disease like argulosis, and fish recovered. within a week. And all so I used Turmeric clove *(Curcuma longa)* helped to reducing bacterial infection caused by Aeromonas hydrophila and we noticed that recovery was within 5-9 days. Neem leaf's (*Azadirachta indica)* and extract Ginger *(Z. officinale)* extraction where effective against fungal disease problems caused by Flavobacterium disease could be recovery within all most 8-11 days. The use of medicinal plants in aquaculture especially in freshwater ornamental fishes and all so medicinal plants importance an eco-friendly and sustainable and alternative to synthetic antibiotics. Traditionally organic plants are like reducing fish disease and improving fish growth and immunity.

Harikrishna et al. (2011) medicinal plants providing a natural solution for their bioactivity compounds like antibacterial, antifungal, antiparasitic, properties. Practical studies in aquariums and small setup like I have shown that hanging or else adding Pant extraction into the aquarium water can reduce the symptoms of common disease like fin rot, cotton mouth, white spots on scales and compared to antibiotic, herbal remedies works very well on fishes improving health, growth and all immunity fish making them more responsive to reducing the disease. However medicinal plants are more effectiveness depends on preparation methods fresh juice, dried powder, or extract and exposure time. Overdose may lead to stress to toxicity in fishes. Plant based treatment are still controlled experiments required to recommended for different spices. Another important aspect is consumer safety and sustainable environmental. Herbal remedies, being less toxic providing safe option. The use of chemical drugs can be risky to Handel may harm the aquatic environment.

One of the major advantages in using medicinal plants biodegradable and nontoxic and natural environment and additionally their cost and sustainability. The small scale who often lack stop advanced medicinal treatment in aquaculture. The frequent of medicinal plants extracts use of antibiotics to the emerge antibacterial resistant bacteria environmental pollution. Medicinal plants play vital rolling here mitigating oxidative stress and immunity and improving disease resistances in natural pathways.

For example, Turmeric has known as very anti-inflammatory and hepato protective effective in improving liver function and metabolic efficacy. Garlic has an antibacterial effect improving digestion system in fishes. Comparing to other bacterial disease antibiotic the treatments work a bit slower but make the fishes healthier and strong in the long run. While slower in action than chemical drugs, contribute to long term fish health by enchaining the immune system.

Medicinal plants are very low-cost and sustainable and budget friendly for managing reduced the fish disease approach in freshwater ornamental fishes.

And we notice that dose how long the plants were in the aquarium tank mattered and all so support the idea that natural remedies could replace or important because overusing antibiotics can led to disease resistant and right fish immunity, growth, fish balances.

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CONCLUSION

As usually regular monitoring for using medicinal Plants in aquaculture really work well and a safe eco-friendly the way to keep fish healthy and improving growth rate. The hell fight disease gives immunity boost and reduces diseases and keep the environment clean and clear if farmers start using medicinal extracts like Neem, Garlic, Ginger, regularly they could spend less than avoid chemical reduce in the fish in aquaculture and produce the health their food for people it's as winning for the fish the farmers and people's and safe environment. Turmeric and garlic really do help fight diseases and make fish stronger. These plants not only helped in improved water quality and encouraged the fish eat to more and grow fast and better growth. These plants are don't leave harmful residues in fish so they for peoples. when we used Organic herbal plant extracts the fish recovery and showed better resistance and a common like fish disease bacterial or fungal or parasite attracts. Moving forward we just need farmers need to apply Garlic, Neem, in their ponds in aquaculture. Need a former using medicinal plants its help for farming and profit and easy way to using herbal plants even small-scale farmers can benefits and plant-based treatment should be a normal part of culturing fish farm everywhere in the aquaculture industry both productive and sustainable and aquaculture become a safe and eco-friendly and healthier.

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