



Powderized Garlic (*Allium Sativum*) and *Elodea Canadensis* Mixture as Growth Enhancer for Nile Tilapia Fingerlings (*Oreochromis Niloticus*)

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Abstract— The utilization of garlic (*Allium sativum*) and *Elodea canadensis* powdered mixture as a growth enhancer for Nile tilapia (*Oreochromis niloticus*) in controlled environments was investigated to ascertain its efficacy. The study aimed to evaluate the impact of this mixture on the length, girth, and weight of Nile tilapia over a four-month experimental period at Laguna State Polytechnic University. Results indicated notable differences between the initial and final measurements of the fishes in both groups. In the control group, the initial mean length was 0.77cm, increasing to 1.35cm by the end of the experiment, with an overall mean difference of 0.57cm. Similarly, significant increases were observed in girth and weight. Conversely, the experimental group exhibited substantial growth enhancement. The initial mean length, girth, and weight were 0.87cm, 1.90cm, and 1.99g, respectively, all experiencing remarkable increments to 4.52cm, 9.04cm, and 5.68g by the study's conclusion. Standard deviations reflected consistency within each group, although the experimental group demonstrated slightly higher variability. The findings suggest that the garlic and *Elodea canadensis* mixture effectively promotes the growth of Nile tilapia, resulting in substantial improvements in length, girth, and weight compared to the control group. This indicates its potential as a viable growth enhancer for tilapia farming, particularly in oligotrophic environments like Pandin Lake.

Keywords— *Elodea canadensis*, garlic, growth enhancer, Nile tilapia.

INTRODUCTION

The fast expansion of the aquaculture business to suit commercial demand may result in an epidemic of infectious illnesses owing to high-density rearing. Locals have been open about a few issues relating to fish farming and the lake's ecotourism potential because Pandin Lake is one of the Seven Crater lakes that has been actively engaged in aquaculture business. Brillo (2013) asserts that the eco-tourism development was an endogenous initiative because neither the (Laguna Lake Development Authority) LLDA nor the local administration had any projects pertaining to development.

Pandin Lake is one of the recipients of this culture, however being an oligotrophic lake, fish farming seemed to be more expensive than the other lakes as it is poor in nutrients, low in organic matter but high in dissolved oxygen in the deeper parts of the lake. Hence, opting for alternative ways to increase the growth of Nile Tilapia, such as using the plants that served as the food according to the locals, is one of the feasible ways to lower the costs of fish farming and increase the growth of the Tilapia inside the cages.



While examining the aforementioned lake Pandin, the researcher came across this *Elodea canadensis* type of weed. Uka and Chukwuka (2011) noted that aquatic macrophytes serve as an important food source that helps in nutrient recycling. *Elodea canadensis*, is a type of macrophyte in slow-moving water. It can be seen in freshwater ponds, lakes, and reservoirs on various bodies of water. It is an oxygen producer, home to a large number of small aquatic invertebrates that are consumed by fish and other wildlife and contributes to the fish's growth rate since it serves as a source of food. According to Etlikova Adamek (2019), *Elodea canadensis* species have rapid growth rates, great environmental tolerance, minimal vulnerability to external stressors, and resilience to weed management.

In order to create a mixture that intends to generate development improvement, the researchers chose to begin coming up with thoughts and ideas on phase and procedures. By comparing the differences between food that is frequently purchased from the market (market food) and the combination that the researchers will create, it will be possible to determine how effective the stated mixture is in terms of the animals' gird, length, and weight.

Fishing and tourism became the main sources of income for lake locals as a result of the researchers' analysis. How one of the noxious weeds would be transformed into a growth-promoting mixture so that *Elodea canadensis*' rapid expansion, which could harm locals and lake visitors alike, can be effectively controlled. Furthermore, because the mixture would be made with organic elements, it would aid in Tilapia development and production acceleration while also protecting the lake's ecosystem.

In addition, garlic (*Allium sativum*) has a variety of bioactive chemicals that have biological characteristics for animal health. Among them are ajoene, alliin, and allicin, all of which have biological capabilities such as growth stimulation, antibacterial, antiviral, antioxidant, and antiparasitic properties. Using garlic, *Allium sativum* has some advantageous features for culture such as rapid growth, good survival in high-density culture, disease resistance and ability to reproduce in captivity and high adaptation to a wide extent of supplemented nutrients, since it includes a variety of bioactive substances like allicin, alliin, diallyl sulfide, diallyl disulfide, diallyl trisulfide, ajoene, and S-allyl-cysteine, garlic is advised (Gao and Lee, 2012). Thus, this claim that it is a fantastic natural source of bioactive sulfur-containing compounds and has potential uses in the creation of functional meals as well as contributing to the expansion of species.

Elodea canadensis is not the only topic of this experiment; rather, the researcher also includes garlic (*Allium sativum*) as part of the growth enhancer mixture. This experiment intends to study the concept of growth enhancement.

Conceptual Framework

The researchers adapted the input process output (IPO) model to include all of the materials and information that are required in the process.

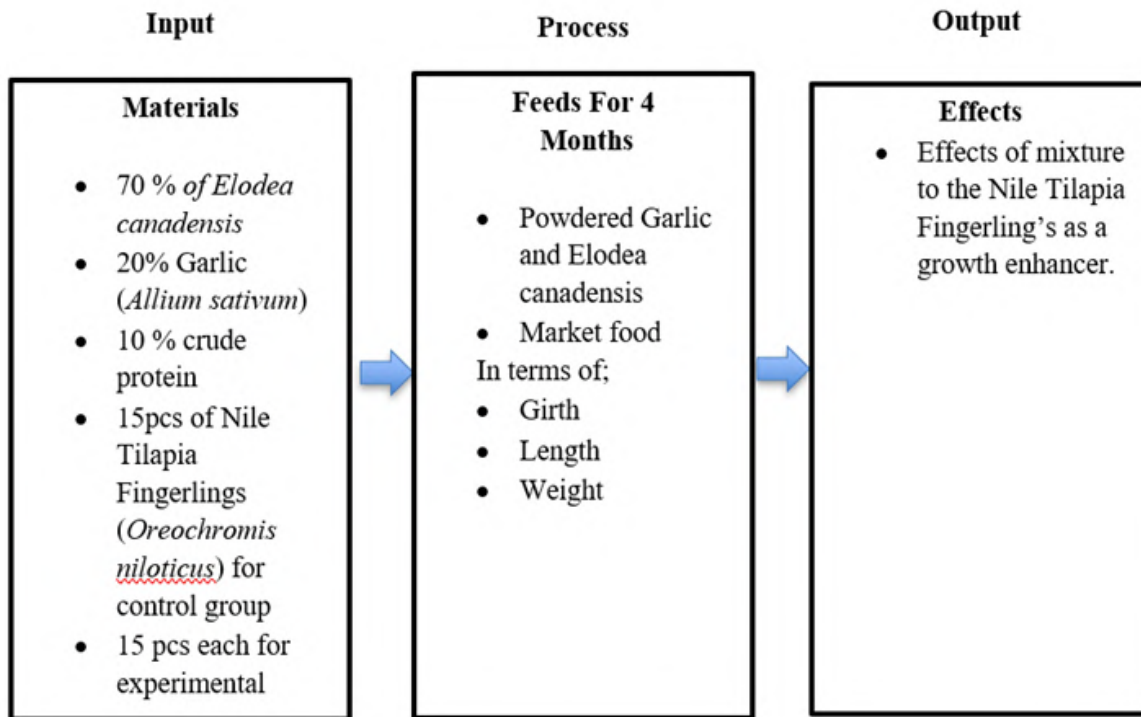


Figure 1. Research Paradigm

The concept model as shown in figure 1, shows the process on Efficacy of Powdered *Elodea canadensis* and Garlic (*Allium sativum*) as Growth Enhancer to Nile Tilapia Fingerlings (*Oreochromis niloticus*). It consists of the Nile Tilapia fingerlings as the independent variable of the experiment.

It also includes the process being held for the next two weeks of the experimentation by monitoring the effect of powdered *Elodea canadensis* and garlic (*Allium sativum*) in the controlled environment in the first container, market feeds for second container and no food intakes for the third container for two weeks observation.

It comprises the overall result of the Nile Tilapia fingerlings growth after two weeks of experimentation.

OBJECTIVES

This study aimed to find out the efficacy of powdered garlic and *Elodea canadensis* mixture as growth enhancer for Nile Tilapia fish as to with.

Specifically, it sought to determine following objectives:

1. The initial and final measures of the fishes under control and experimental setup as to:
 - 1.1. length;
 - 1.2. girth; and
 - 1.3. weight



2. The efficacy of garlic and Elodea Canadensis as a powdered mixture as growth enhancer of Tilapia fish in terms of girth;
3. The efficacy of garlic and Elodea canadensis as a powdered mixture as growth enhancer of Tilapia fish in terms of length; and
4. The efficacy of garlic and Elodea canadensis as a powdered mixture as growth enhancer of Tilapia fish in terms of weight.

METHODOLOGY

This study utilized the experimental method of research, experimental is the most scientifically sophisticated research method. It is defined as observation under controlled conditions. Experimental research design is concerned with examination of the effect of independent variable and dependent variable where the independent variable is manipulated through a controlled environment and the effect of the interventions is observed on the dependent variable.

Fingerling Nile Tilapia were raised in a controlled setting. Elodea canadensis and garlic (*Allium sativum*) were first dried by the researchers. Once the materials for the growth enhancer had been dried, they were blended into a fine powder. Fifteen (15) Nile Tilapia were fed in a controlled environment by the researchers using the powdered garlic and Elodea canadensis mixture, which was observed for 4 months. The other fifteen (15) Nile Tilapia were provided market feed in the second pond and underwent the same procedures as observed in pond one. The initial amount of feed for both containers was two cups, with an additional one cup added every two weeks of intake. The researcher also took the girth, length, and weight of the Nile Tilapia fingerlings every week for 4 months of experimentation.

The researchers used experimentation as their tool to gather data to determine the efficacy of Elodea canadensis and garlic mixture as growth enhancers for Nile Tilapia fingerlings. The first thing that the researchers did was to obtain the Nile Tilapia from the Bureau of Fisheries and Aquatic Resources and take the average initial girth, length, and weight of the fingerlings.

Then the researchers got the Elodea canadensis from Pandin Lake as their main ingredient in the mixture, and dried the Elodea canadensis together with garlic, making it powdered through a blender. After the said process, the researcher fed the Nile Tilapia three times a day for 4 months. After 4 months, the researchers gathered the girth, length, and weight of all the Nile Tilapia in the pond. The researchers used the equation "Final Weight – Initial Weight = Gain Weight".

The following scale and formats were utilized in data analysis and interpretation using T-Test. T-Test was a statistical analysis that contrasted the means of two groups. It was frequently employed in hypothesis testing to establish whether a procedure or treatment truly affected the population of interest or whether two groups differed from one another.

RESULTS AND DISCUSSION

This chapter presents the result, the analysis, and the interpretation of data gathered from the experiment conducted by the researcher. The said data were presented in tabular form in accordance with the specific data the researchers gathered.

Table 1. Descriptive Measures of the Fishes from 2 Different Setups

		CONTROL GROUP		EXPERIMENTAL GROUP	
		Mean	SD	Mean	SD
Length (in cm.)	Initial	0.77	0.259	0.87	0.235
	Final	1.35	0.548	4.52	0.441
	Difference	0.57	0.341	3.65	0.234
Girth (in cm.)	Initial	1.75	0.471	1.90	0.326
	Final	2.74	0.496	9.04	0.896
	Difference	0.99	0.507	7.14	0.639
Weight (in g.)	Initial	1.84	0.294	1.99	0.337
	Final	2.29	0.351	5.68	0.333
	Difference	0.46	0.214	3.69	0.113

Result shows the descriptive measures of the fishes from the two different setups through the mean and standard deviation in terms of length, girth, and weight of the Nile Tilapia in four (4) months of experimentation. For the control group the mean between initial and final length is 0.57 cm, while in girth it is 0.99 cm, and lastly, the weight it is 0.46 g. In terms of standard deviation in control group the length between initial and final is 0.314 cm, in girth it is 0.507 cm, and in weight it is 0.214 g. For the experimental group the mean of the length between initial and final is 3.65 cm, in girth 7.14 cm, and 3.69 g. While in terms of standard deviation of the experimental group the length between initial and final is 0.234 cm, in girth 0.639 cm, and in weight 0.113g.

The tabulated results indicate a significant difference in the initial and final measurements of Nile Tilapia, particularly in terms of length, weight, and girth. The researcher has concluded that over the course of four months, both the experimental and control groups of Nile Tilapia exhibited notable gains in length, weight, and girth.

Table 2. Independent Samples t Test between the Initial Measures of fishes from 2 Different Setups (control set-up and experimental set-up)

	t	p	Interpretation	Mean Difference
Initial Length	-1.085	0.287	Not Significant	-0.098
Initial Girth	-1.028	0.313	Not Significant	-0.152
Initial Weight	-1.373	0.181	Not Significant	-0.159

Legend: * - Significant at $p < 0.05$; ** - Significant at $p < 0.01$



Table 2 shows the independent samples t test between measures from 2 different setups. For the initial length the t-value shows -1.085, p-value is 0.287 which is based on the legend the interpretation is not significant with the mean difference of -0.098, for the initial girth the t-value shows -1.028, p-value is 0.313, with the interpretation of not significant with the mean difference of -0.159, and for the initial weight the t-value shows -1.373, p-value is 0.181, with the interpretation of not significant with the mean difference -0.159.

The results presented in the table indicate that there is no significant difference in the initial measurements between the two groups. This lack of disparity can be attributed to the absence of experimentation. Consequently, the researcher has concluded that the results demonstrate no significant difference in the initial measurements between the experimental and control groups. Therefore, there is no significant difference between the initial measures of the fishes under control and experimental setup in terms of length, girth, and weight.

Table 3. Independent Samples t Test between the Final Measures of fishes from 2 Different Setups (control and experimental setup)

	t	p	Interpretation	Mean Difference
Final Length	-17.492**	< 0.001	Significant	-3.17800
Final Girth	-23.821**	< 0.001	Significant	-6.29867
Final Weight	-27.138**	< 0.001	Significant	-3.39000
Legend: * - Significant at p < 0.05; ** - Significant at p < 0.01				

Table 3 shows the independent sample t test between the final measure from 2 different setups. Result shows the t-value in final length is -17.492, p-value is <0.001, with the interpretation based on the legend is significant with the mean difference of -3.17800. For the final girth the t-value is -23.821, p-value is <0.001, with the interpretation of significant with the mean difference of -6.29867. And for the final weight the t-value is -27.138, p-value is <0.001, with the interpretation of significant with mean difference of -3.39000.

The table illustrates a substantial difference in the final measurements of Nile Tilapia compared to their initial measurements, observed in both the experimental and control groups. The experimental intervention was effective, as evidenced by the notable gains in measurements, particularly in the experimental group. This further, suggests that the researcher's experiment aimed at growth enhancement has proven successful.

Therefore, there is significant difference between the final measures of the fishes under control and experimental setup in terms of length, girth, and weight. Mahmoud H. (2017) indicates that when dietary garlic supplementation increased, so did the relative levels of protection. Garlic stimulates a number of defense systems that work against the challenge infection, such as the generation of superoxide anions that attack the hydrophilic disease.

Table 4. Dependent Samples t Test between the Initial and Final Measures of fishes in the Control Setup

	t	p	Interpretation	Mean Difference
Length	-6.525**	< 0.001	Significant	-0.57467



Girth	-7.569**	< 0.001	Significant	-0.99133
Weight	-8.249**	< 0.001	Significant	-0.45667
Legend: * - Significant at p < 0.05; ** - Significant at p < 0.01				

Table 4 shows the dependent samples t test between the initial and final measures of the control setups. The result of t-value in the final length is -6.525, p-value is <0.001, with the interpretation based on the legend is significant with the mean difference of -0.57467. For the girth the t-value is -7.569, p-value of <0.001 with the interpretation of significant with the mean difference of -0.99133. And for the weight the t-value is -8.249, p-value of <0.001 with the interpretation of significant with mean difference of -0.45667.

The results from the initial and final measurements in the controlled group reveal a significant difference in all recorded parameters. Results indicates that the market feeds utilized in the experiment effectively enhance the growth of Nile Tilapia. Additionally, the researcher inferred that by employing the market feeds for the controlled group, there is a high probability of these feeds serving as growth enhancers for Nile Tilapia. Therefore, there is a significant difference between the initial and final measures of the fishes under control setup in terms of length, girth, and weight.

The result of the study is in consonance to the study conducted by Ajiboye (2016) that using organic feeds out of garlic is effective and by the end of the experiment, all garlic supplemented groups had a considerably higher survival rate than the control group (0% graded level). The latest findings demonstrated how garlic stimulates the immune system, which is related to increased fry survival. Overall, the group fed *A. sativum* showed considerable ($P < 0.05$) growth rates when contrasted with the control group in this study that was given a basal diet. This could be explained by the fact that different organosulfur compounds, such as allicin in garlic, enhance a variety of activities, including growth and hunger. They also play a crucial role as immunostimulants and stress relievers.

Table 5. Dependent Samples t Test between the Initial and Final Measures of fishes in the Experimental Setup

	t	p	Interpretation	Mean Difference
Length	-60.395**	< 0.001	Significant	-3.65467
Girth	-43.253**	< 0.001	Significant	-7.13800
Weight	-107.310**	< 0.001	Significant	-3.68800
Legend: * - Significant at p < 0.05; ** - Significant at p < 0.01				

Table 5 shows the dependent samples t test between the initial and final measures of the experimental setups. The result of t-value in the final length is -60.395, p-value of <0.001 with the interpretation based on the legend of significant with the mean difference of -3.65457. For the girth the t-value is -43.253, p-value of <0.001 with the interpretation of significant and mean difference of -7.13800. And for the weight the t-value is -107.310, p-value of <0.001 with the interpretation of significant with the mean difference of -3.68800.



The table showed the significant disparities between the initial and final measurements for the experimental group. Results indicates that the experimental feeds employed are effective growth enhancers for Nile Tilapia, given the substantial differences observed between the final measurements of the experimental group and those of the controlled group. Therefore, there significant difference between the initial and final measures of the fishes under control setup in terms of length, girth, and weight.

Results is in consonance to the study conducted by Tanekhy and Fall (2015), who found that utilizing organic feeds made of garlic is efficient and came to the conclusion that, when compared to the control, all dietary groups supplemented with garlic had higher levels of immunity.

The findings highlighted significant changes in the initial and final measurements of Nile Tilapia, encompassing length, weight, and girth. Both the experimental and control groups exhibited notable gains over the four-month period, indicating successful growth enhancement efforts. Interestingly, there was no significant difference in the initial measurements between the two groups, suggesting that the absence of experimentation did not impact the starting conditions. The effectiveness of the experimental intervention, evidenced by substantial gains in measurements, particularly in the experimental group, underscores its success in promoting growth. Moreover, the significant disparities observed in the final measurements of the experimental group, compared to both its initial measurements and those of the control group, affirm the efficacy of the experimental feeds as growth enhancers for Nile Tilapia. These findings shed light on the potential of experimental feeds to serve as effective growth enhancers in Nile Tilapia farming practices.

CONCLUSIONS

Determining the efficacy of garlic and *Elodea Canadensis* as a powdered mixture as growth enhancer of Tilapia fish in terms of girth, the researchers have found out that the efficacy of garlic and *Elodea canadensis* as a powdered mixture as growth enhancer of Tilapia fish in terms of length contained a significant difference under the control setup between the initial and final measures of the fishes. The t-value in the final length is -6.525, with the interpretation based on the legend is significant with the mean difference of -0.57467. Then a significant difference between the initial and final measures of the fishes under control setup with t-value final length is -60.395, with the interpretation based on the legend of significant with the mean difference of -3.65457. Therefore, the result showed that the powdered mixture of garlic and *Elodea canadensis* possess the components that contribute as growth enhancing agent for the Nile Tilapia Fingerlings.

Moreover, a significant difference between the initial and final measures of the fishes under control setup, with the t-value is -8.249, with the interpretation of significant with mean difference of -0.45667. Continuing, a significant difference between the initial and final measures of the fishes under control setup with t-value value is -107.310, with the interpretation of significant with the mean difference of -3.68800. Hence, the researchers have come to a decision that the mixture of garlic and *Elodea canadensis* as a powdered mixture as growth enhancer of Tilapia fish in terms of weight is effective.



According to the gathered data of the researchers to determine the significant difference on the level of growth enhancement of Nile Tilapia fingerlings between setups, the researchers have concluded that the null hypothesis is rejected as the interpreted results in final controlled and experimental setup which showed that the p-values implies significant relevance to length, girth, and weight as they all showed values greater than the alpha level of significance, 0.05.

RECOMMENDATIONS

Based upon the outcome and conclusion researchers recommend to the future researchers to utilize and consider the growth enhancing properties of garlic and *Elodea canadensis* in order to formulate better and find alternative foods for Tilapia fish utilized in the study. Additionally, the experiment might have been conducted in a larger pond to assist and avoid overfeeding and overpopulation. Furthermore, the future researcher they should communicate with professionals from the government or regional groups like the Bureau of Fisheries and Aquatic Resources (BFAR); moreover, a laboratory analysis of the ingredients to determine the precise amount of crude protein that the fish require, as each species has distinct needs for crude protein in order to support growth should be considered. To the Local Government Unit, they could make the necessary action by establishing a program that could educate fish farmers to expand their knowledge regarding the effectivity, safety, eco-friendly and costs effective use of organic feeds through the proper utilization of pond weeds and garlic. They can also promote the benefits of adopting organic fish feeds for the ecology and fisheries.

Additionally, to the fish farmers the researchers would like to exhort to the fish farmers to utilize organic fish feeds that are widely available in homes and lakes resulting in having access to a cost-effective fisheries input. Moreover, fish growers have the ability to alter the efficacy of garlic in promoting fish growth.

To the community organic fish feeds can be produced using sustainable farming practices that minimize negative impacts on the surrounding environment. This may include reducing pollution from excess nutrients and chemicals, minimizing habitat destruction and preserving water. Furthermore, organic fish feeds can be made from natural ingredients that do not contain harmful chemicals to maintain the health of the fish reducing the risk of diseases and promoting overall well-being.

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