# Study on Utilization of Moringa Leaves (*Moringa Oleifera)* as a Protein Replacement in Wet Pellet Ball of *Oreochromis* sp. Larvae

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**ABSTRACT**

*Fish meal (FM) has long been considered as an essential ingredient for the formulation of aquaculture feed. However, the declined in fisheries catching affect the production and cost of the feed formulation. The objective of this study is to reveal an alternative cheap source for replacement ingredients to fish diet formulation of Tilapia larvae. This study discovers the potential of using abundance plant based protein which is moringa leaves (moringa oleifera) as FM replacement in fish diet. Moringa leaves is an ingredient that has been used widely in human and animal supplemental consumption for the protein benefit. Moringa leaves was processed into dry meal and was added into the feed formulation. In order to test the hypothesis, an experiment of test feeding was conducted in 8 weeks duration with 2 treatment with 3 replicates respectively. The experimental treatment (treatment 1) consist of wet diets of moringa ball while the control treatment (treatment 2) were formulated by using commercial 30% of FM wet diet for Oreochromis sp larvae. Data collection consist of survival rate, specific growth rate (SGR) and feed conversion ratio (FCR). The result shows that the average of survival rate for treatment 1and treatment 2 was 100% ($P<0.05$). Survival rate is 100% for all treatments which means all fish can survive and growth continuously from beginning to the end of the study. The Specific growth rate (SGR) is 3.74% for moringa ball fed diet and 3.79% per day for commercial diet. The FCR data for treatment 1 was 1.3 and treatment 2 was 1.32. From the data, it shows that there are no significant difference in effect of using both treatment. The high potential of using moringa leaves as protein replacement is a promising ingredients to control the cost of feed management and promising the sustainable aquaculture.*

## INTRODUCTION

Aquaculture industry was one of field that produced a large economic network. However, those who involved in this field acknowledge that 2/3 of operating costs are due to feeding costs [1]. Besides that, the increase in the cost of the formulated food is significantly higher than the sale price of aquaculture. Therefore, those who succeed in this field are those who can overcome and dominate the effectiveness and expertise in applying the feeding cost. One of the most effectives methods for reduce the feed cost is to replace protein content in the feed formulation with sustainable raw materials. Protein is macronutrients in fish feed that responsible mostly for growth. The price of fish pellet depends directly on the percentage and quality of protein inside the feed. However, the decline in fish supply from the sea affected the price of the trash fish/ fish meal, which is the main ingredient for protein in fish pellet. Therefore, this research has been done to find the replacement sources of protein which has equal or better contribution for fish growth, but at the same time sustainable and able to reduce dependency of aquaculture industry on fishmeal [2,3]. Other than animal based protein, plant based is getting attention to be a replacement due to widely available and can be planted in abundance. A common plant source that has been use was soybean meal and corn meal [2, 4].

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This research were attempted to use moringa leaves (*Moringa oleifera*), which is a species that has been consumed by human as a protein supplement which contain favourable amino acid profile and wide availability throughout the tropical and subtropical regions. *M. Oleifera* native to India, it is commonly known as 'drumstick tree' or 'horseradish tree'. Moringa can withstand both severe drought and mild frost conditions and hence widely cultivated across the world. The crude protein content varies from 25%, [3,4] to 32%. The protein comprises high levels of sulphur containing amino acids and compares well with soybean, which is usually considered as a source of high quality plant protein [5,6]. The young leaves are edible and are commonly cooked and eaten like spinach or used to make soups and salads. The leaves can be consumed either in raw, cooked or dried over a screen for several days and ground into a fine powder that can be added to almost any food as a nutrient supplement [7]. According to [8] this tree is considered as one of the World's most useful trees, as almost every part of the moringa tree can be used for food, medication and industrial purposes, and also no strangers as livestock feed [9], which proven to it increases animal productivity as it has nutritional, therapeutic and prophylactic properties [10]. Due to vastly available, moringa leaves can be regarded as a potential feed component of fish diet to make aquaculture production cost effective [11]. The aims of this study are to produce moringa leaf meal to be incorporated in the wet pellet ball and to study the effectiveness of particular wet pellet for fish growth and development.

## EXPERIMENTAL

### Experimental Design

The research has been done in two phase which is the moringa ball preparation and processing and followed by the second phase, test feeding.

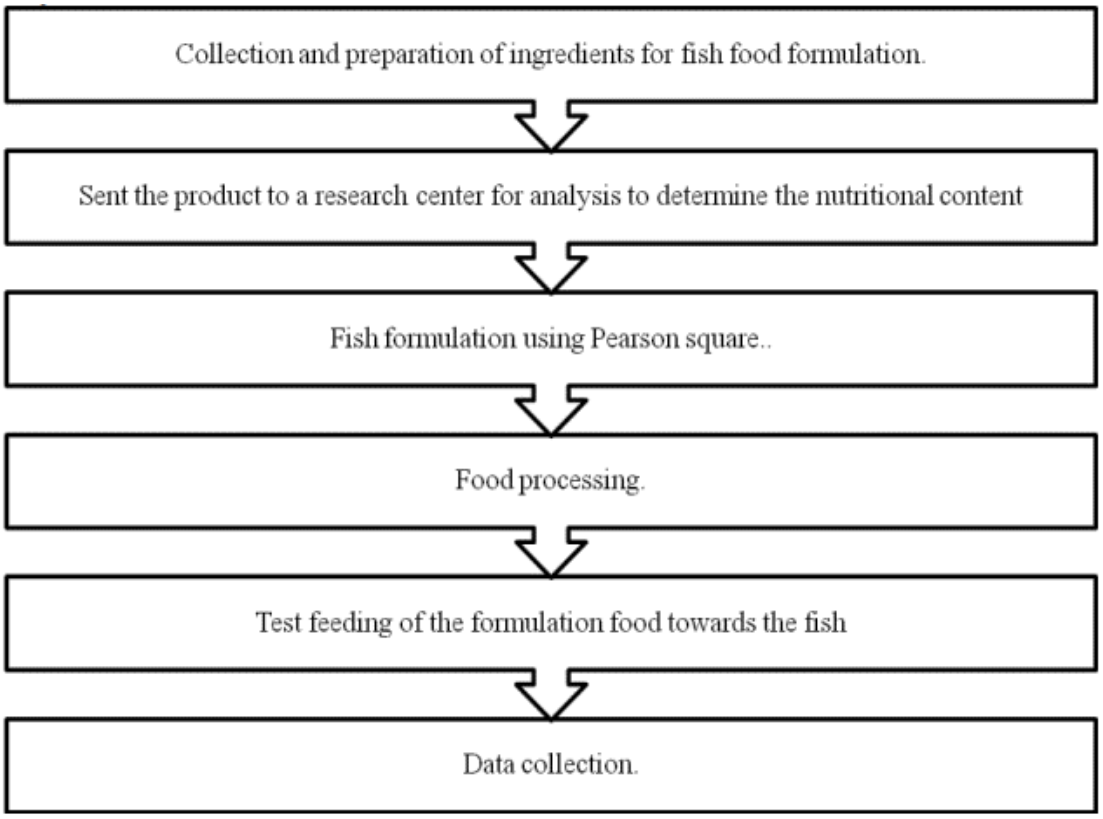


**Figure 1.** Overview of project execution flow chart.

## Methodology

### Moringa Ball Processing

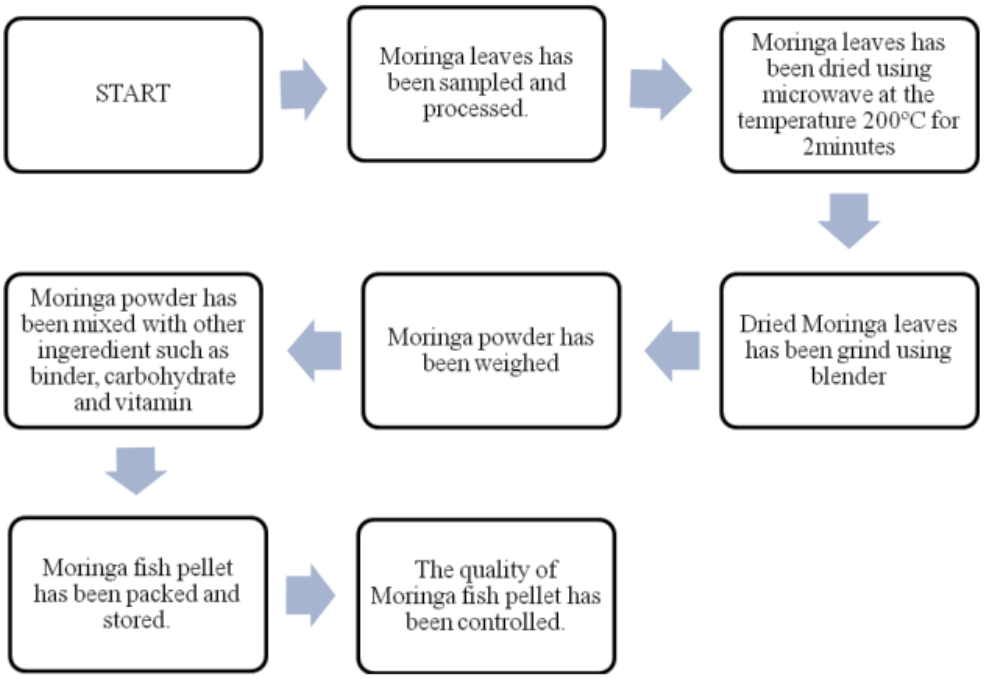


**Figure 2.** Moringa ball process.

This research has been done starting from sampling of moringa leaves from nearby location. The leaves have been processed through drying and grinding until resulted in moringa powder. The powder has been sent to laboratory for proximate analysis. The formulation for feed by using moringa powder, carbohydrate and lipid sources has been done by using Person's Square method [12]. Processing of the feed has been done through weighing and mixing of each ingredient and stored in freezer until used for test feeding.

## Test Feeding

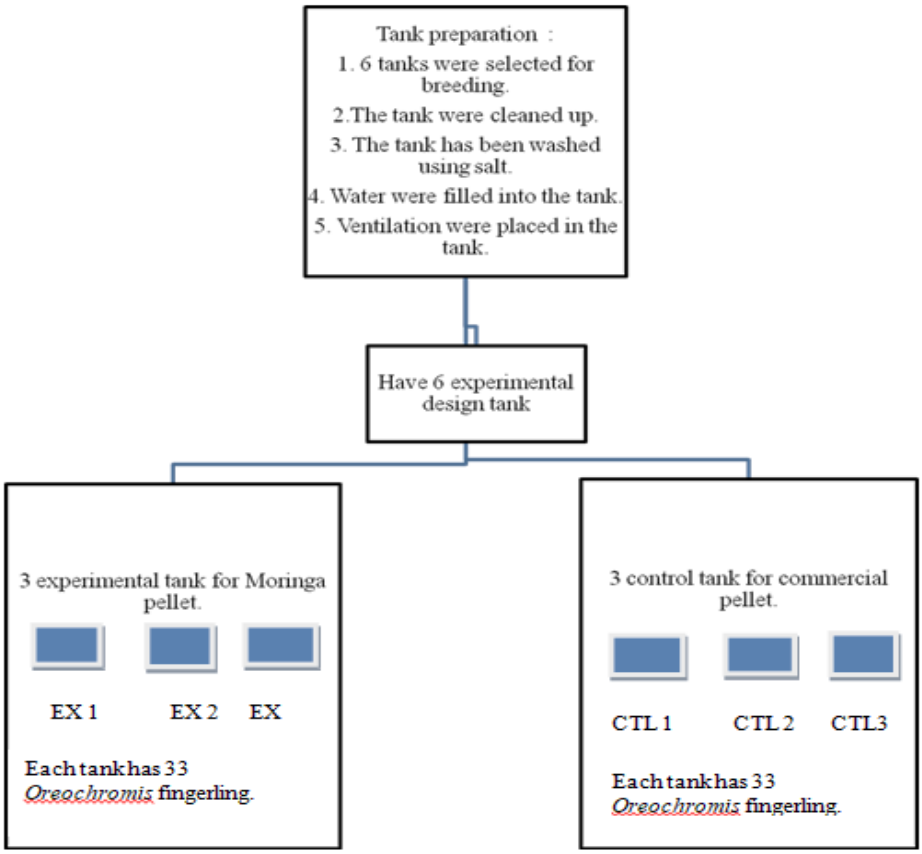


**Figure 3.** Test feeding process.

Test feeding has been done for 8 weeks duration by 2 treatments with 3 replicates respectively. The experimental treatment (treatment 1) consist of wet diets of moringa ball while the control treatment (treatment 2) were formulated by using commercial 30% of FM wet diet for *Oreochromis* sp larvae.

## Data Collection

In order to analyses the effectiveness of the feed, several parameter has been collected during the test feeding. The following table was used to show data collected on the dates and weeks of the livestock, the number of the fish, the average weight of the fish per week, the percentage of feeding rate, the number of feeding per week and the frequency of feeding. Apart from that, water quality parameter also has been collected.

**Table 1** Table of Data Collection

| Weeks | Initial Weight (g) | Final Weight (g) | Growth Rate (g/day) | FCR |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |

This data has been recorded in order to determine survival rate, specific growth rate (SGR) and feed conversion ratio (FCR). The formulation that has been used [13]:

Specific growth rate = (Lnfw – Lniw) /t x 100
Feed Conversion Ratio = Feed fed (g/kg) / Weight gain (g/kg)
Survival rate = (Number of fish during harvested / Number of fish stocked) x 100

### Statistics

(ANOVA) One-way analysis of variance has been done to test the variation of significant among the treatments. Statistical test were performed based on statistical software SPSS (statistical package for social science) version 10.00. The findings of the research were presented in text. The statistical units were defined as tanks and he level of significance was set to 0.05 [14]

## RESULTS AND DISCUSSION

### Moringa Ball Processing

Moringa ball wet pellet has been successfully produced by using Pearson's Square formulation and pellet processing process. The amount of moringa powder to achieved 30% inclusion in the diet is 160g for feed preparation of 500g. Drying process of the leaves takes 2 minutes at 200 degrees Celsius. During the grinding process, the vein and stem of the leaves must be removed for a better texture of the fine powder.

The moringa ball is a wet pellet that has moisture content of 18% compared to dry pellet which has only 8% of moisture [10]. The use of wet pellet is to maximize the fish palatability towards the pellet. Wet pellet has advantages to be more favourable by fish due to the texture that similar to natural feed. This could influence the digestion rate in fish and make this research reliable without outside factor.

### Fish Performance

The test feeding results shows that the average of survival rate for treatment 1and treatment 2 was 100% ($P<0.05$). Survival rate is 100% for all treatments which means all fish can survive and growth continuously from beginning to the end of the study. This results show that utilization of amino acid ranges in the moringa leaves was appropriate. Apart from the feed that has been given, water quality management influences the survival of the fish. The cultures require adequate

ventilation as the 3 inch *Oreochromis* fingerling are very sensitive. The data of water quality parameters were temperature, 27.8±0.40 °C; dissolved oxygen, 5.7±0.32 mg/l and pH range of 7.5 – 8. The optimum levels of water quality parameters make the test subject in high acceptability of feed, so any cause of the mortalities is not due to culture condition. The specific growth rate (SGR) is 3.74% for moringa ball fed diet and 3.79% per day for commercial diet. The fish weight gained observed in the experimental pellet are indications of the variation of protein utilization by *Oreochromis* sp. The acceptance of moringa meal by fish and the high nutrient value of this ingredient indicate that their commercial exploitation could be profitable to feed industries and fish farmers. The FCR data for treatment 1 was 1.3 and treatment 2 was 1.32. From the data, it shows that there are no significant differences in effect of using both treatment. The lower value of feed conversion ratio indicates better utilization of the feed by the fish fed this diet. The feed conversion ratio results from this study which is 1.3 for experimental is within the reported range by the authors. According to De Silva & Anderson, 1995 the range between 1.2-1.5 is appropriate for fish fed carefully prepared diets. This results also shows that plant or animal protein origin in fish feed acts as both energy and structural components [15] which quantity and quality have influence on the growth rate of fish if other physiological requirements are fulfilled [16].

**Figure 4**. Moringa ball wet pellet.

## CONCLUSION

Human population is increasing year by year, food supply is scarce, open sea did no longer able to catch up the demand for protein consumption in human. Aquaculture is the only industry that able to replace the supply of protein. Yet, aquaculture also facing the great challenge to supply protein sources in fish pellet due to the same problems. The replacement of protein sources from fish meal to more sustainable and abundance raw materials could guarantee the nation food security. The successful story of sustainable aquaculture should come from different aspect and one of it is to stabilized the protein supply in the fish diet. Utilization of moringa leaves is one of the best choices left, with many advantages. This research was supported by Politeknik Jeli Kelantan. We also would like to thank everyone who involved in this project.

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