



## Effect of artificial and natural feed on growth, development and breeding of *Poecilia reticulata*

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Received: 18.06.2024

Revised and Accepted:  
12.10.2024

**Key Words:** Artificial and  
Natural feed, Breeding,  
*Poecilia reticulata*

### Abstract

The present study was conducted to study the effect of artificial feed and natural feed in the growth development and breeding of guppy fish (*Poecilia reticulata*). The experimental fish guppy was cultured for 3 months in aquarium. There were 2 experimental diets, one is natural feed and another is artificial feed. The natural feed is prepared with two natural protein source and fed to the fish twice a day. The water quality in the entire aquarium was maintained periodically. From this study, it could be concluded that the natural feed is more effective in growth, development and breeding of guppy fish than artificial feed.

### 1. Introduction

Ornamental fishes are nowadays rapidly gaining importance because of their aesthetic value and also due to their immense commercial value in the export trade world over. Feed additives facilitate feed ingestion and consumer acceptance of the product. Carotenoids are the primary source of pigmentation on the skin of fishes. In natural environment, the fishes meet their carotenoid requirements by ingesting aquatic plants or through their food chains. But fishes cannot synthesize carotenoid de novo. Carotenoids are responsible for many of the red, orange and yellow hues of plant legumes, fruits and flowers. The colour enhancing diets should contain additional natural pigments to enhance the colour of ornamental fishes (Abhilan, 2008).

Guppies (*Poecilia reticulata*) are widely distributed tropical fish native to Antigua and Barmuda, Barbados, Brazil, Guyana, Jamaica, the Netherlands Antilles, Trinidad and Tobago, the USA virgin islands and Venezuela. They become one of the

most popular aquarium fish they have been introduced to many countries worldwide and can be found globally everywhere except Antarctica. They are also known by other names such as Million fish and Rainbow fish. They are belong to freshwater fish family *Poeciliidae*. They are highly adaptable and thrive in many different environmental and ecological conditions, hence where introduced to many habitats and are now found in all over the world (Alexander *et al.*, 2004).

Guppies are viviparous. The size of guppies ranges from 1.5-3.5cm long in males and 3-6cm in females. In wild guppy generally feed on a variety of food sources, including benthic algae and aquatic insect larvae. Guppies are prolific livebearer fishes with the gestation period of 20-30 days. Reproduction occurs throughout the year, and the female become ready for conception again soon after parturition (Abdull *et al.*, 2014). Male guppies possess a modified tubular anal fin called the gonopodium located directly behind the ventral fin. The

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gonopodium transfers bundles of spermatozoa called spermatozeugmata to females through a channel like structure. Female guppies can store sperm in their ovaries and gonoducts after insemination, which can contribute to fertilize the ova up to eight months after copulation (Clydesdale, 1993).

Nutrition is most important factor influencing the ability of cultured fish to exhibit its genetic potential for growth and reproduction. In artificial tank and ponds or natural habitats which are used exclusively for the fish farming and the natural feed availability is limited. Most commonly used fish feed contains fish meal as protein source, which range between 10-50% of operational costs (Ezhil *et al.*, 2008). Increasing cost and short supply of fish feed has created the need to search for an alternative (Ezhil & Narayanan, 2013). Feed additives are edible substance that is added to animal feeds in small quantity to enhance the feed quality so that it enhances growth performance and reduces mortality in fish (Chumark *et al.*, 2008). As there are strict regulations on the application of antibiotics and chemotherapeutics in aquarium feeds due to bioaccumulation (Crampton *et al.*, 2010). Use of low cost feed supplement as feed additives is highly accepted and encouraged due to its eco-friendly nature (Ansaroi *et al.*, 2011).

Recently, some scientists proved the positive effect of medicinal plants or herbs as feed additives. These herbs improved the growth and feed utilization of fish and also reduced diseases by regulating pathogens in gastro intestinal tract (Foidlet *et al.*, 2001). Some researchers

found that the use of plant based protein in fish feed improved growth performance (Francis *et al.*, 2001). Some studies concluded that salt can be used as additives in fish diet to enhance growth. Fish nutrition must be carefully analyzed and there is a requirement to search for the novel feed additives or supplements which ensure low feed cost and maximum digestibility with minimum side effects (George, *et al.*, 2001).

Fish meal is the most preferred protein source in aquaculture formulated fish feed as it has high protein content, balanced amino acid profile, high digestibility, palatability, and a good source of fatty acids. The potential of shrimp waste meal as an alternative protein source in monogastric feeding is not in doubt (Ezhil *et al.*, 2008). Shrimp waste contribute proteins, calcium, pigments and lipids. The *Moringa oleifera* is a fast growing plant belongs to the family Moringaceae. Moringa having great economic importance in the food and medical industry (Gatlin *et al.*, 2007).

One of the biggest problems in aquaculture is related to the feeding of fish during the first larval stages when their incomplete developments results in the inability to digest some food and their small size hampers eating and swallowing of large food particles. Appropriate feeding protocols for each species should be planned, including the amount of food offered and the periodicity of feeding (Boonyaratpalin & Phromkunthong, 1986). In the present study, the role of nutrient rich natural feed as a potential fish meal and commercial feed was investigated. The effect of these supplements was assessed on breeding



and overall growth and development of guppy fish (*Poecilia reticulata*).

## 2. Methodology

### 2.1. Experimental fish

Experimental fish, guppy (*Poecilia reticulata*) were procured from local ornamental fish trader and acclimatized to laboratory condition in aquaria. The experiment was run with thirty fishes of guppy. The initial length is ranged between 2cm to 2.5cm. The fishes were conditioned and fed with two different diets, commercial feed and natural feed. Before administrating the experimental diets, the fishes were grouped to two aquaria, in which each aquaria has 15 fishes with males and females in the ratio 1:4. The water exchange and aeration were given sufficiently.

### 2.2 Experimental feed preparation

The experimental feed was prepared with basic ingredients such as dried shrimp and moringa leaf powder. Feed ingredients were finely powdered and then pulverized with the help of ball mill grinding machine. Then this mixture is dried and pelleted. In one aquarium, fishes were fed with this naturally prepared feed and in second aquarium fishes were fed with commercial feed (Table-1).

**Table 1: Formation of experimental feed (Ingredients in gm/100gm)**

Ingredients	Composition (%)
Shrimp powder	80
Moringa leaf powder	20
Total	100

### 2.3 Feeding experimental diet

This experiment was carried out for two different treatments, commercial and natural feeding in two experimental aquaria in indoor system. Pelleted feed and commercial feed was fed to the fish twice a day. The experiment was carried out for three months. The water quality in aquaria was maintained by aeration, removal of fecal matter and replacement of at least 20% of water every day.

### 2.4 Growth parameters

Periodic sampling was done fortnightly for monitoring the growth performance in terms of length. From each treatment fishes were collected to observe the length. Length is measured by using a thin thread and a scale.

### 2.5 Breeding method

To impregnate female guppies, mature male and female fishes were kept in a ratio of 1:4 in an aquarium. The gravid female has a swollen belly with fries inside her. Impregnated gravid female have a dark gravid spot near the anal fin and a large bulging belly. The gravid spot is caused by the fry's eye pressing against the female's belly. The gravid fish were kept in separate aquarium in a breeding net made up of iron wires, as the fish has the habit of feeding on their own new born fries. As the fish released fries, mothers were separated from the aquarium and fries were counted. The fries were fed with same diet as the mother fish were fed. Periodic sampling was done fortnightly for monitoring the length, and number of fries.

## 3. Results and Discussion

### 3.1 Growth performance

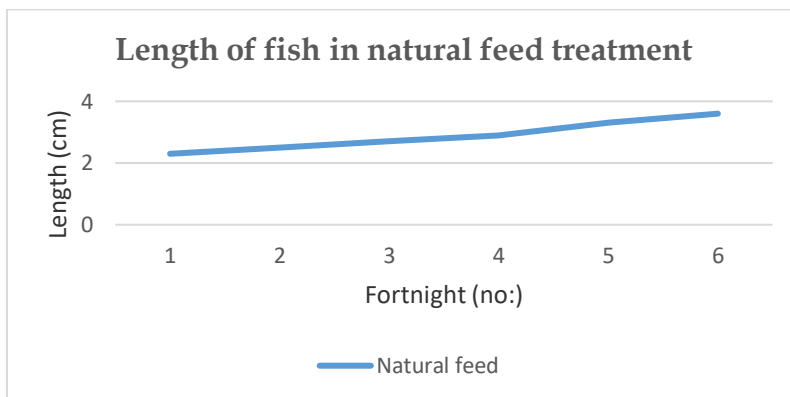
The trend of increase in the length of guppy fishes in natural feed



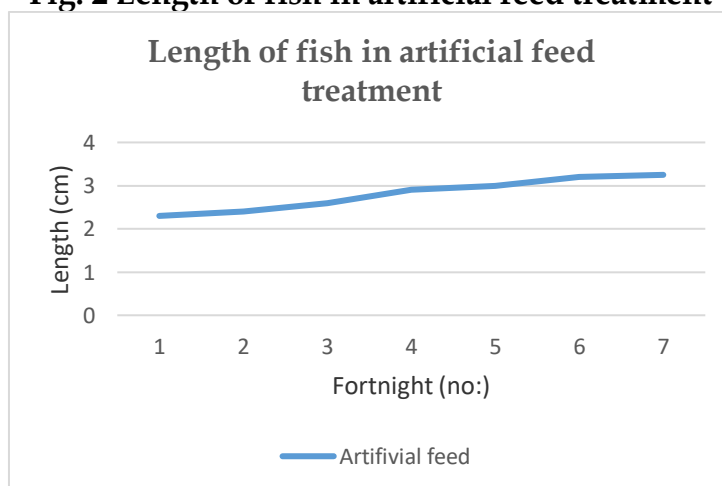
treatment is depicted in fig.4:1 and for commercial feed treatment is depicted in Fig.2. Both figures show an

increment in the length of the fish. In Fig.1 fish shows more growth than fish in Fig.2 at the same time.

**Fig.1 Length of fish in natural feed treatment**



**Fig. 2 Length of fish in artificial feed treatment**



### 3.2 Colour development

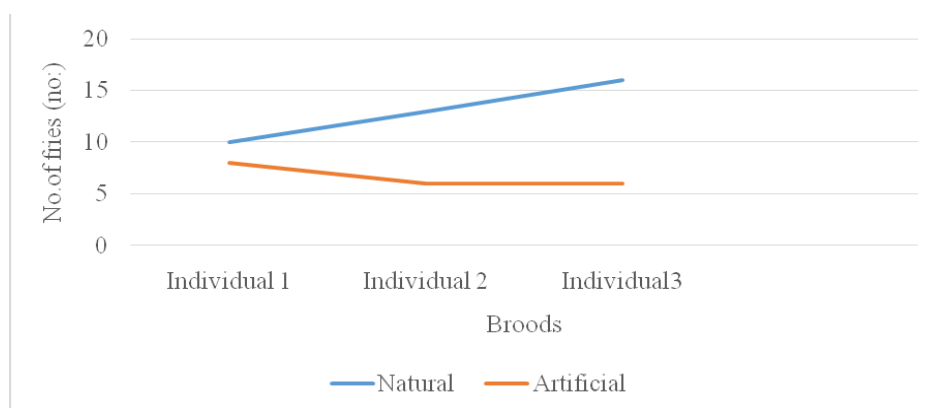
Fish cannot synthesize carotenoids on their own; therefore, for farmed fish supplementation of carotenoids in the diet is necessary, since they cannot access the natural carotenoid source. Fishes store carotenoids in their integument and other tissues by modifying them.

### 3.3 Breeding performance

Fertility of brooder, fry survival and fry length were the parameters used to access the breeding performance of guppy fish. Fertility is the number of young ones produced by an individual. Fertility is presented in Fig.3 for natural feed treatment and artificial feed treatment. Fertility is more in natural feed treatment than artificial feed treatment.



**Fig.3** Fertility of brood with respect to the natural and artificial treatments.



The survival rate of fries in artificial and natural feed treatment is presented in Fig. 4. Survival rate of fry was calculated after one month of their

birth. Highest survival rate was found in natural feed treatment while lowest survival rate was found in artificial treatment.

**Fig. 4** Survival rate fries

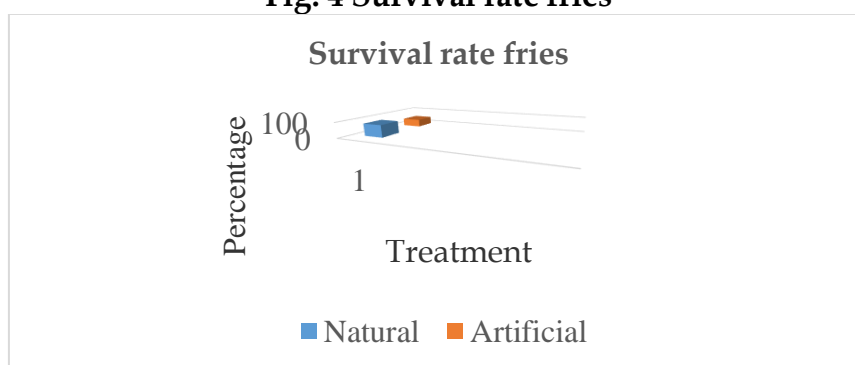
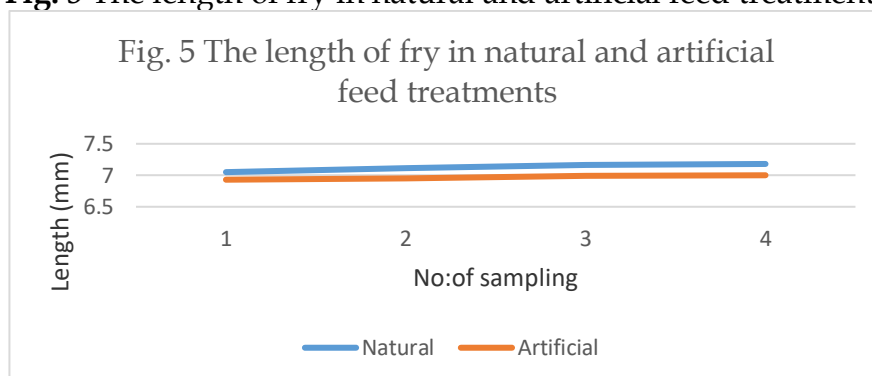


Fig. 5 presents the fry length for different treatment with natural feed with moringa and shrimp and commercial feed. The highest length of fry was obtained from natural feed, while the lowest was from artificial feed. The analysis of variance showed

significant difference in the length of fries within both artificial and natural feed treatments. In natural treatment there was a significant increment in the length of fries was observed, while in artificial feed treatment, there is no significant difference in the fry length.

**Fig. 5** The length of fry in natural and artificial feed treatments





The present work was carried out to determine how both the artificial feed and natural feed affect the growth, development and breeding of guppy fish. This study demonstrated that how the feed dramatically affect growth, coloration and breeding of guppy fish. According to Gatlin *et al.* (2007), carotenoids are also vital nutrients for healthy growth, metabolism and reproduction. Use of practical or semi practical diets in this type of study of imperative for limiting the effects of dietary deficiencies or energy difference on pigment assimilation that may occur with commercial diet formation. The result of present work confirms the above study. The use of natural feed results in the healthy growth, coloration and reproduction.

Garner, *et al.*, (2010), observed decreased the growth at 20% and above moringa level as the effect of anti-nutritional factors begins to appear in higher moringa concentration. The result of present study also stipulate with the above results. In the present study 15% of moringa leaves powder used to prepare natural feed. This results in the better growth, coloration and breeding of guppy fish.

According to Bjerken *et al.* (1992), the amounts of tannins and phytate were increased by increasing moringa leaf in the diets. The result of present study corroborate with the above results. In the present study 15% of moringa leaf concentration in natural feed resulted in better coloration of guppy. Siddhuraju, Becker, Ritcher (2003) conducted a study to evaluate the suitability of

freeze-dried moringa leaf meal, *Moringaoleifera*, as an alternative protein source for Nile tilapia. The result suggested that moringa leaf can be used to substitute up to 10% of dietary protein in Nile tilapia. The present study supports the above result. Natural feed dramatically affect the better development of guppy.

Similar results were obtained with Garner *et al.* (2010) and they fed red Zebra cichlids (*Maylandiaestherae*) with different carotenoid source and found spirulina and lutein diets increased the orange and yellow tint and astaxanthin diets increased the red orange colour in the skin of red zebra cichlid. In the present study the red orange colour of fish tail increased. The present study supports the above result.

The poor growth from commercial feeds might be resulted because commercial feeds are not always prepared following recommended requirement of major nutrient components. Among those, protein is considered as one of the crucial nutrients for the early stages of fish. Becker *et al.* (1999) also observed the same thing that generally, the commercial feed contain a minimum of fishmeal and additional animal by-products. According to Abdull *et al.* (2014), pelleted feeds lose essential nutrients like water soluble vitamins and amino acids during exposure to water within a short period. Claik, (1985) demonstrated that artificial feed changes the relationship between the animal feed and its environment.

#### **4. Conclusion**

From the present experiment it could be concluded that dietary



supplementation of mixture of moringa leaf and shrimp feed can be used for enhancing the colouration, breeding and growth in guppy (*Poecilia reticulata*). Since synthetic carotenoids are pricey, cheap and readily assessable natural carotenoid sources such as shrimp and moringa can be incorporated into the diet to enhance better growth coloration and breeding. This will help ornamental fish sellers to get superior cost in the trading of fish. Synthetic carotenoids have several limitations, firstly, synthetic processes have only specific carotenoid such as beta-carotene; more over they involve petrochemical solvents as well as complex organic solvents causing residual problems. The use of natural carotenoids instead of synthetic carotenoids do not results in such side effects and promotes the healthy growth of fish.

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