MEDDOCS Open Access Publisher

ISSN: 2640-1223

Journal of Veterinary Medicine and Animal Sciences

Open Access | Research Article

Effect of chosen artificial fish feeds on the growth rate of the black molly, *Poecilia sphenops*

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Received: Aug 28, 2019

Accepted: Oct 10, 2019

Published Online: Oct 15, 2019

Journal: Journal of Veterinary Medicine and Animal Sciences

Publisher: MedDocs Publishers LLC

Online edition: http://meddocsonline.org/

Keywords: Black molly; *Poecilia sphenops*; Growth; Fish feed

Abstract

In the present experiment, the black mollies *Poecilia sphenops* brought from the local market were fed with naturally prepared diets such as Diet 1, Diet 2, Diet 3 and also with commercially available diet Osaki fish food (pet store food). The weight, fork length and whole length of the fishes were determined once in every ten days. After fifty days, the fishes were sacrificed and dried in hot air oven and analysed for energy value, protein, carbohydrate and fat content. In the prepared diets using natural ingredients, Diet 2 had high energy level followed by Diet 1 and Diet 3. The protein content was high in Diet 1 followed by Diet 3 and Diet 2.

Introduction

The black molly, *Poecilia sphenops* is a common aquarium fish native to freshwater streams and brackish water habitats in Central South America (from Mexico to Columbia), which often interbreeds with the sailfin molly [1]. In natural aquatic systems, fish can control their food intake and nutritional requirements. The feed requirements of fish vary in quantity and quality according to their feeding habits and digestive state. Feed requirements are influenced by environmental factors like temperature and food availability [2]. Fish feed on natural food and artificial feeds. When balanced diet is provided, fish grow fast and remain healthy. In ornamental fish, a correct formulation of the diet improves the nutrient digestibility and supplies the metabolic needs, reducing the maintenance cost and at the same time water pollution. Such feed should contain around 25-50% protein, 10-15% carbohydrates and 12-15% of fat [3-5]. Artificial feeds are prepared as a mixture of feedstuffs in mash or pellet form. They supply all the ingredients necessary for the optimal growth and health of the fish.

The body of Black Molly is oblong with a round caudal peduncle and a small dorso-ventrally flattened head with protruding jaws that function as a scraping tool, ideal for rasping algae from benthic surfaces. Its mouth has many rows of very small teeth. *Poeciilia sphenops* displays sexual dimorphism whereby males are smaller with 8cm length compared to 12cm of females and more colorful, particularly males with larger caudal fins. Males also have a gonopodium to transfer sperm during mating. The black molly has many artificially selected varieties sold commercially. Naturally occurring populations of the short-finned molly may contribute to control mosquito populations

Cite this article: Devi A, Surendran A, Thatheus AJ. Effect of chosen artificial fish feeds on the growth rate of the black molly, *Poecilia sphenops*. J Vet Med Animal Sci. 2019; 2(1): 1011.

by feeding on the larvae and pupae of these vectors. *P. sphenops* has been introduced all over the world. Due to its generalist adaptation characteristics, this species thrives in its new environment and has resulted in adverse effects such as outcompeting natural organisms [6].

Nutrients essential to fish are the same those required by most other animals. They include water, proteins (amino acids), lipids (fat, oils, fatty acids), carbohydrates (sugars, starch), vitamins and minerals. In addition, pigments are commonly added to the diet of salmonid and ornamental "aquarium" fishes to enhance their flesh and skin colouration, respectively. Based on their primary diet, fish are classified as carnivorous (consuming largely animal material), and herbivorous (consuming primarily plant materials). However, regardless of their feeding classification, inactive fish can be taught to readily accept various prepared foods which contain the necessary nutrients. An abundant supply of feedstuffs is available, and farmers and hobbyists are now able to prepare their own fish feeds from locally available ingredients. Prepared (or) artificial diets may be either complete. Complete diets supply all the ingredients (protein, carbohydrate, fats, vitamins, and minerals) necessary for the optimal growth and health of the fish. Most fish required protein (18-50%), lipid (10-25%), carbohydrate (15-20%), ash (<8.5%), phosphorus (<1.5%), water (<10%) and trace amount of vitamins and minerals especially when reared in high densities, required a high-quality, nutritionally complete, balanced diet to grow rapidly and remain healthy. Many fish farmers and ornamental fish hobbyists buy the bulk of their feed made commercially and small ornamental fish farms with an assortment of fish required, small amount of various diets with particular ingredients. It is not cost effective for commercial manufacturers to produce very small quantities of specialized feeds. Short-finned mollies are omnivores, feeding primarily on algae and other plant materials, but aquatic invertebrates including a variety of zoobenthos and detritivores such as mosquito larvae, contribute to their diet. They also feed on blood worms. Though *P. sphenops* occurs in groups, feeding occurs independently [7,8].

The quality of feed refers to the nutrients as well as the physical characteristics of the feed that allow it to be consumed and digested by the fish, in the right properties for good performance (growth and health). The specific nutrient requirements for fish vary with the fish's size and reproductive state. The physical attributes of the feed determine the degree to which the feed affects water quality and consumption rates by the fish. The nutrients essential to fish are the same as those required by most other animals. Fish meal, soybean meal, fish hydrolysate, skimmed milk powder, legumes, and wheat gluten are excellent sources of protein and free amino acids, such as lysine and methionine are commercially available to supplement the diet. Fish feeds are the fine particles of ground feed stuffs given to fish in small compact, cylindrical and head like forms called 'pellets'. The pellets could be moist, dry or extruded dry such as spleen, ground liver, heart and raw fish. They also have the desirable floating qualities, water stability, and the feed can easily be observed on introduction. Dry fish feeds are more popular because they are easier to manufacture, transport and store. Their nature reduces leaching of nutrients [9,10].

Use of larvivorous fish like *Poecilia reticulata* in different mosquito breeding habitats in mosquito control has been well established. *P. sphenops* are small, usually brightly-colored, viviparous fishes of fresh or brackish warm waters. Black mollies are voracious, feeding on mosquito larvae in breeding sites like drains and tanks. Bloodworms, microworms, fruit flies, Daphnia and chopped up earthworms are other examples of suitable food for molly. The black molly, *P. sphenops* is a common ornamental fish widely occurring in the Indian sub-continent [11-14]. Hence the present study has been designed to test the efficiency of different diets on the growth enhancement of *P. sphenops*

Materials and methods

The Black Mollies were brought from local fish market at Kadachanendhal in Madurai, Tamil Nadu, India. In Triplicate way setup method, 5 fishes in each tank and totally 60 fishes in 12 tanks were maintained. Different naturally prepared diets were used to feed the fish. Osaki fish food (Pet store food) was used to feed the control. The body weight, fork length and whole length of the fishes were determined once in ten days, up to fifty days. The details of ingredients of the diets are shown in Table 1. The protein content and energy value of the fish diets 1, 2, and 3 and control diet were analysed following standard procedures. Biochemical composition of the fish before and after experiment was also determined [15].

Results

Table 1 exhibits the quantity of ingredients used in the preparation of fish diets. To study the influence of natural diets on the development of fishes, the newly prepared diets were assessed by comparison with control. Three types of diets were selected to serve as an alternative to commercially available fish feed (Plate 1). These diets were made with three components like tapioca powder as carbohydrate substitute, skimmed milk powder as lipid substitute and dry fish as protein source. Natural colouring agents like beetroot, carrot and *Spirulina* were added to differentiate the diets. Table 2, shows the protein content and energy value of fish diets used in the experiment. In the prepared diets using natural ingredients, Diet 2 had high energy level followed by Diet 1 and Diet 3. The protein content was high in Diet1 followed by Diet 3 and Diet 2.

Plate 1: Diets used in the experiment

Table 1: Quantity of ingredients used in the preparation of fish diets

S. No.	Ingredients (g)	Diet 1	Diet 2	Diet 3
1.	Tapioca Powder	70	10	10
2.	Skimmed Milk Powder	10	70	10
3.	Dry Fish	10	10	70
4.	Colour Substance	Beetroot powder	Carrot Powder	*Spirulina*

Table 2: Protein content and energy value of fish diets used in the experiment

S. No.	Parameters	Diet 1	Diet 2	Diet 3
1.	Energy (Kcal/100g dry wt)	365	393	343
2.	Protein (g/100g dry wt)	24.6	5.3	11.9

Table 3 exhibits the weight of *P. sphenops* during the experiment. There is a gradual increase in the weight of the fishes fed with natural food compared to commercial feed. Diet 3 shows the highest weight followed by diet 1 and diet 2. Table 4 divulges the fork length of *P. sphenops* during the experiment. There is a gradual increase in the fork length of the fishes fed with natural diets compared to commercial feed. Diet 3 showed the highest fork length followed by diet 1 and diet 2 after fifty days of experiment.

Table 3: Weight (g) of *Poecilia sphenops* during the experiment

Diet	Experimental period (days)					
	0	10	20	30	40	50
Control	0.46±0.077	0.53±0.077	0.56±0.077	0.55±0.077	0.67±0.077	0.67±0.077
Diet 1	0.46±0.077	0.59±0.077	0.62±0.077	0.6±0.077	0.63±0.077	0.58±0.077
Diet 2	0.46±0.077	0.35±0.077	0.38±0.077	0.43±0.077	0.51±0.077	0.51±0.077
Diet 3	0.46±0.077	0.55±0.077	0.57±0.077	0.59±0.077	0.67±0.077	0.74±0.077

Table 4: Fork length (cm) of *Poecilia sphenops* during the experiment

Diet	Experimental period (days)					
	0	10	20	30	40	50
Control	2.3±0.337	2.7±0.337	2.7±0.337	2.8±0.337	3.2±0.337	3.2±0.337
Diet 1	2.3±0.337	3.2±0.337	2.6±0.337	2.7±0.337	3±0.337	3±0.337
Diet 2	2.3±0.337	2.5±0.337	2.5±0.337	2.4±0.337	2.7±0.337	2.8±0.337
Diet 3	2.3±0.337	2.8±0.337	2.9±0.337	2±0.337	3.1±0.337	3.3±0.337

Table 5 exhibits the whole length of *P. sphenops* during the experiment. Diet 3 showed the highest whole length followed by diet 2 and diet 1 after fifty days. Table 6 shows the biochemical composition of fish before and after fifty days of experiment. The components of the four different diets were analyzed for carbohydrate, fat, energy, protein and vitamin levels. Based on the results, diet 2 had high amount of energy, fat and vitamin. Protein content was less and other components were in moderate level. Diet 3 had high amount of carbohydrates and other components are slightly lesser than diet 3. Diet 1 had high protein content and low carbohydrate content.

Table 5: Whole length (cm) of *Poecilia sphenops* during the experiment

Diet	Experimental period (days)					
	0	10	20	30	40	50
Control	2.5±0.448	2.7±0.448	2.9±0.448	3±0.448	3.4±0.448	3.9±0.448
Diet 1	2.5±0.448	3.1±0.448	2.8±0.448	2.9±0.448	3.2±0.448	2.6±0.448
Diet 2	2.5±0.448	2.5±0.448	3±0.448	2.8±0.448	3.2±0.448	3.2±0.448
Diet 3	2.5±0.448	4.6±0.448	3.2±0.448	3±0.448	3±0.448	3.5±0.448

Table 6: Biochemical composition of fish before and after fifty days of experiment

S.No.	Parameters	Before experiment	After experiment			
			Control	Diet-1	Diet-2	Diet-3
	Energy (Kcal/100g) dry wt	366	432	435	457	438
	Carbohydrates (g/100g) dry wt	25.8	13.7	17.5	24.8	29.3
	Fat (g/100g) dry wt	13.2	25	26	28	24
	Protein (g/100g) dry wt	36.0	38.1	32.7	26.5	26.2
	Vitamins (%) dry wt	4.7	4.2	4.9	5.1	4.5

Discussion

There has been a rapid advancement of aquaculture practices recently, both in breeding of fish for consumption and fry–stocking [16]. Tropical and ornamental species have also become increasingly popular [17]. Now there has been an increase in research towards rearing and breeding of ornamental fish. The most studied aspects include using different feeds, both live and artificial. Ensuring proper environment conditions for fish is one of the major problems in rearing fish larvae in controlled condition. Salinity in molly breeding is certainly one of these conditions [18-21].

Use of plant products as protein source in fish feeds shows considerable application potential for aquaculture worldwide [22]. Spirulina is a multicelluar and filamentous blue-green algae that has gained considerable popularity in the healthy food industry and increasingly as a protein and vitamin supplement to aquaculture diets [23]. In the present study, use of Spirulina in molly diet was evaluated and it was found that increasing level of it in diet provided better growth comparing to the other commercial feeds and it was consumed fondly.

In aquaculture, diet cost accounts to over 50% of the operating cost, in intensive aquaculture, depending upon many factors, such as protein level, source, type of ingredient, and manufacture's practices. The Animal Byproducts Meal (ABM), such as the one like snail, fresh water fish waste, marine water fish waste, squid, and poultry industry waste can be used as substitute. These do not cause any deleterious effects on the fishes. Many workers used dry fish, poultry egg shell dust, plant rhizome and wheat flour as a substitute, for commercial fish meal. Their studies revealed better growth, length, gonad development and fertility in the fishes fed with specially prepared feed, followed by dried fish diet. Chong and coworkers [24] observed higher body length in red sword tail, *Xiphophorus helleri*, when they were fed several times. They reported that, more energy food is required, before spawning, for gonad development and production of eggs. James and Sampath [25] reported females of *X. heller* with frequent meals exhibiting high gonad weight and gonado-somatic index. Hexter [26] reported that scarcity of food will result in reduced fertility, in guppy fishes. He further reported that, female fish needs adequate protein, fat, vitamins and minerals for egg development and spawning, as yolk is composed of phospholipids, proteins, and an a amalgam of minerals. Protein is also required for forming follicle in embryo.

In the present study, replacement of high cost fish meal, with the Animal by product meal (ABM) and agro-based products, was carried out to formulate fish feed for Black Molly to observe the growth and dietary performance. The study indicated that, the growth was better, in the fish fed with diet containing tapioca powder, skimmed milk powder and dry fish. Thus, it can be concluded that, such substitution could be used to replace the costly commercial fish feed.

Conclusion

In rearing black molly fishes *P. sphenops*, cost-effective substances like tropica powder, skimmed milk powder and dry fish can be employed along with beet root, carrot and Spirulina to achieve better growth rate. Diets having these ingredients can replace costly commercial fish feeds.

Acknowledgement

The authors thank the authorities of the American College, Madurai, Tamil Nadu, India for the facilities and encouragement.

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