

Food Diversity and Feeding Preference in Ornamental Fishes - A Comparative Study

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Abstract

Ornamental fishes are attractive and colorful species of fishes with peaceful nature (Jayasankar, 1998; Mukherjee et. al. , 2000; Singh and Ahmed, 2005) and they are most popular pets in present day world (Singh, 2005). Keeping ornamental fishes and its propagation has been an interesting activity for many, which provide not only aesthetic leisure but also financial openings. Among the indigenous and exotic fresh water species, the varieties having good demand can be breed and reared for commercial purposes. Good knowledge on the biology, feeding behavior and ambient condition of the fish are prerequisites for breeding. So, in this study we have focused on the food preference of four popular ornamental fishes – Black Molly (*Poecilia sphenops*), Goldfish (*Carasius* sp.), Gourami (*Trichogaster* sp.) and Guppy (*Poecilia reticulata*). Some vegetables like Carrot, Lettuce, Cabbage, Pea, Potato and fruits like Apple, Orange, Grape, Banana and an animal food source i.e. *Tubifex* sp. were given to observe which is more preferable for these four fishes. Goldfish showed generalized food preference for the food items (Food in fused with lettuce, peaextract, potato, grape, apple, orange, banana, mixed food with the above ingredients, *Tubifex* sp) Gaurami seems to be highly selective species. *Tubifex* sp, peas, potatoes and grapes showed better performance than the rest and can be considered as an alternate natural food source.

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1. Introduction

Ornamental fish keeping and its propagation has been an interesting activity for many, which provide not only aesthetic pleasure but also financial openings. Among the indigenous and exotic fresh water species, the varieties having good demand can be breed and reared for commercial purpose. As thousand of species

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comprise the aquarium hobby ornamental fish nutrition is an art and a science that must be approached systematically and holistically. Examinations of species specific anatomy and natural history are useful starting points. Food fish research provides fundamental nutritional information but food fish are not ideal models for all ornamentals (Nutrition of ornamental fish, Roy P.E. Yanong, VMD). For better growth and survival of fishes it is essential to provide them mixed and balanced diet. So in this study we selected four ornamental fishes – Black Molly (*Poecilia sphenops*), Goldfish (*Carasius* sp), Gourami (*Trichogaster* sp) and Guppy (*Poecilia reticulata*) to observe their food preference. Vegetables like carrots, lettuce, cabbage, peas, potato and fruits like apple, orange, grapes, banana and protein rich live fish food such as *Tubifex* sp were given to observe which is more preferable for these four fishes.

2. Research Method

A rearing tank of 18''x10''x10'' and Four experimental tanks of 10''x10''x12'' were taken for the experiment. Four different fishes- – Black Molly (*Poecilia sphenops*), Goldfish (*Carasius* sp), Gourami (*Trichogaster* sp) and Guppy (*Poecilia reticulata*). of six week age were chosen for the study. Food was prepared from (i) **Plant source** (vegetables like Carrot, Lettuce, Cabbage, peas, potato and fruits like Apple, Orange, grapes, banana) and (ii) **Animal source** (*Tubifex* sp). Filter, Thermostat, Aerator were provided to maintain the appropriate environment.

During food preparation at first any one of the vegetable or fruit was taken and washed properly with clean water. Boiled vegetables and not boiled fruits were mashed into a food processor separately until it turned into a smooth paste. To prepare mixed food all the preferable ingredients (Carrot, Peas, Potato, Grapes, Apple, and Orange) were mashed together into a food processor until it make a thick paste. Then some flour (as required) were added to the paste and mixed properly until it became soft dough. [Flour here act as a binding agent]. From the dough tiny balls were made by hand. The size of the food particles was almost equal to that of artificial food particles available in markets. Then the tiny food particles were baked until it become hard in a very low temperature upon hot plate. [Baking is required to make sure that the food particles do not break apart or dissolve into water].

At first each four fish species of Black Molly, Guppy, Gourami, Gold Fish of moderate sized were brought from local market and transferred in college. During transport proper oxygen supply should be maintained. Then fishes were kept in a rearing tank of 18''x10''x10'' with appropriate aeration and filter setup for at least 3 days to acclimatize the fishes with the environment of aquarium. Next individuals of each 4 fish species were placed in separate experimental tanks with appropriate aeration and filter setup.

Standardization of fish food

At first 5 pices of previously made food particle were given to each 4 experimental tanks (A, B, C, D), After 1 hr. the food intake capacity of each fish was observed and the number of left food particles was recorded and from this data the number of consumed food particles was calculated. It was observed that there was no food particle left in each 4 experimental tanks. In the very next day same experiment was repeated with 10 food particles. Again the number of left food particles was recorded and from this data the number of consumed food particles was calculated. It was observed that there was only 2-3 food particles left in most tanks. Next day the same experiment was repeated with 15 food particles. Again the number of left food particles was recorded and from this data the number of consumed food particles was calculated. 5 food particles was not enough to consumed by the fishes and 15 food particles were a much higher quantity to give. High amount of food consumption may cause harm upon fish health. So, 10 particles were standardized for experiment.

At first 10 food particles were given to each tank A, B, C and D. After about 1hr. number of left and eaten food particles was recorded. Food particles ingested is calculated by subtracting number of Food particles left from number of Food particles introduced. The feeding preference was statistically represented by analyzing the data by performing ANOVA and pair wise comparison was performed by Tukey's Multiple Comparison Test. Statistical Analysis was done by GraphPad Prism™

3. Results and Analysis

From the ANOVA of the feeding data of various species (i.e Molly, Guppy, Gold fish and Gourami) the following results were retrieved. Tukey's Multiple Comparison Test was performed to find statistically relevant differences between all group combinations. In the first part of this section, ANOVA between the fish species was performed for a particular food type to find out the fish that showed the highest acceptance for that particular food type.

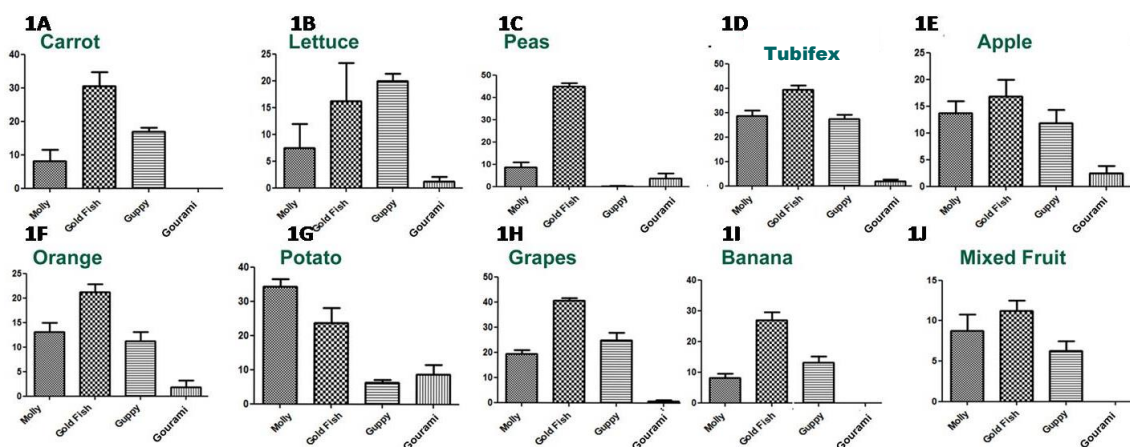


Figure 1. Bar diagram of mean value of food unit (of various type) intake against various fish species

- From Tukey's Multiple Comparison Test and ANOVA result, it was seen that among all the fishes Carrot infused food particle was most preferred by Gold Fish than molly ($P < 0.001$), Guppy ($P < 0.01$), Gourami ($P < 0.001$) as shown in the bar diagram in Figure.1A.
- For Lettuce infused food particle, all fish species showed almost same affinity except Gourami as shown in the bar diagram in Figure 1B.
- For Pea infused food particle, it was most preferred by Gold Fish than Molly ($P < 0.001$), Guppy ($P < 0.001$) and Gourami ($P < 0.001$) as shown in the bar diagram in Figure 1C.
- For *Tubifex* sp Molly ($P < 0.001$), Gold Fish ($P < 0.001$) and Guppy ($P < 0.001$) showed almost same affinity than in Gourami ($P < 0.001$) in the bar diagram in Figure 1D.
- For Apple infused food particle, all fish species showed similar affinity than Gourami as shown in the bar diagram in Figure 1E.
- For Orange infused food particle, Gold fish showed higher affinity than Molly ($P < 0.001$), Gourami ($P < 0.001$) and Guppy.
- For Potato infused food particle, Molly and Gold Fish showed almost similar affinity and that was better than Guppy ($P < 0.001$) and Gourami ($P < 0.001$) as shown in the bar diagram in Figure 1G.
- For Grape infused food particle, Gold Fish showed highest affinity as shown in the bar diagram in Figure 1H.
- For Banana infused food particle, Gold Fish showed highest affinity than Molly ($P < 0.001$), Guppy ($P < 0.001$), and Gourami ($P < 0.001$), as shown in the bar diagram in Figure 1I.
- For Mixed Fruit infused food particle, Molly, Gold Fish and Guppy showed almost similar affinity and that was better than Gourami ($P < 0.05$), as shown in the bar diagram in Figure 1J.

Table 1. Comparison between food types (Average Food Unit Intake by the fishes under study.)

	Carrot	Lettuce	Peas	Potato	Grapes	Banana	Apple	Orange	Mixed Food	Tubifex larva
Molly	8.125	7.5	8.75	34.375	19.375	8.125	13.75	13.125	8.75	28.75
Gold Fish	30.625	16.25	45	23.75	40.625	26.875	16.875	21.25	11.25	39.375
Guppy	16.875	20	0.25	6.25	25	13.125	11.875	11.25	6.25	27.5
Gourami	0	1.25	3.75	8.75	0.625	0	2.5	1.875	0	1.875

From the ANOVA of the feeding data of various species (i.e Molly, Guppy, Gold fish and Gourami) the following results were retrieved. Tukey's Multiple Comparison Test was performed to find statistically

relevant differences between all group combinations. In the second part of this section, ANOVA between the various food types was done to find out the most acceptable food type for a species.

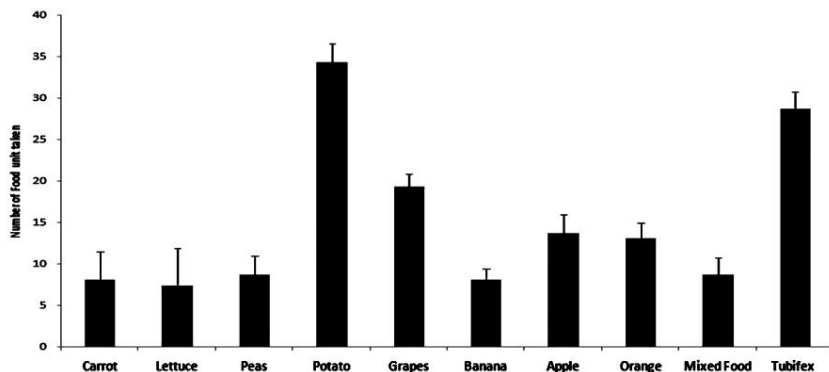


Figure 2. Bar Diagram showing the average number of food unit taken by **Molly**

It can be noticed that Potato infused food particle were consumed more frequently than carrot ($P < 0.001$), Lettuce ($P < 0.001$), Peas ($P < 0.001$), Banana ($P < 0.001$), Apple ($P < 0.001$), Orange ($P < 0.001$) or Mixed Food ($P < 0.001$). The preference of *Tubifex* sp was also noticed as shown in Figure 2.

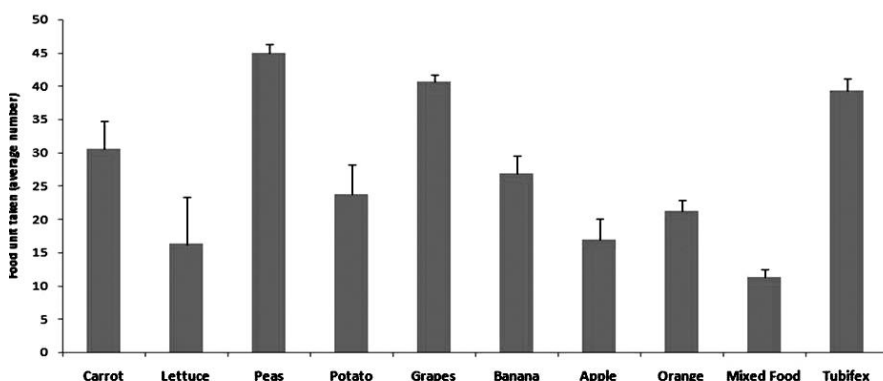


Figure 3. Bar Diagram showing the average number of food unit taken by **Gold Fish**

It can be noticed that Pea infused food particle were consumed more frequently than carrot ($P < 0.001$), Lettuce ($P < 0.001$), Potato ($P < 0.001$), Banana ($P < 0.001$), Apple ($P < 0.001$), Orange ($P < 0.001$) or Mixed Food ($P < 0.001$). The preference of *Tubifex* sp was also noticed as shown in Figure 3.

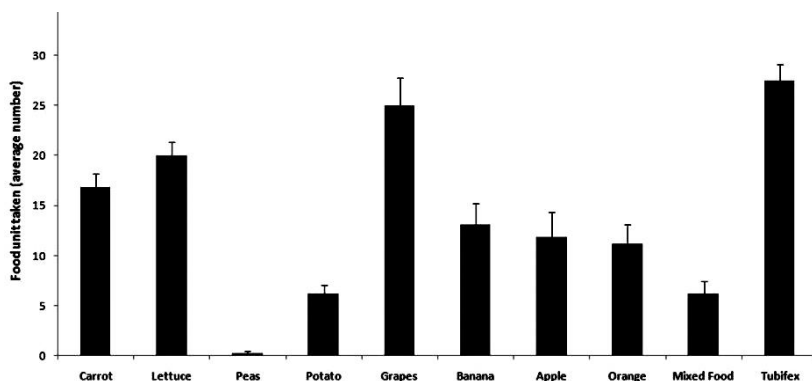
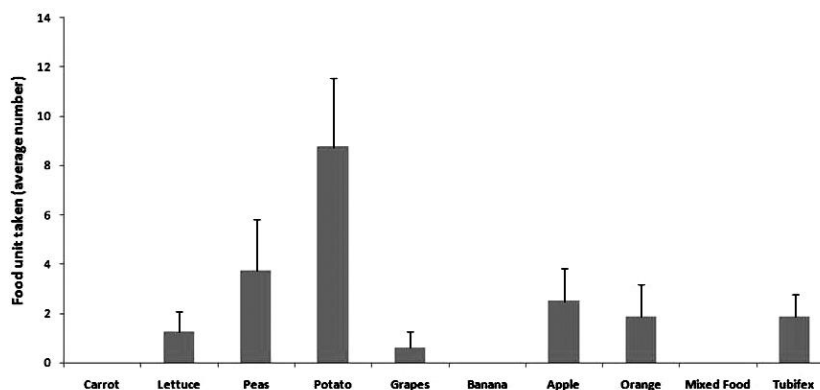


Figure 4. Bar Diagram showing the average number of food unit taken by **Guppy**

It can be noticed that Grape infused food particle were consumed more frequently than carrot ($P<0.001$), Lettuce ($P<0.001$), Potato ($P<0.001$), Banana ($P<0.001$), Apple ($P<0.001$), Orange ($P<0.001$) or Mixed Food ($P<0.001$). Guppy didn't take Pea infused food particle at all. The preference of *Tubifex* sp was also noticed as shown in Figure 4.

Figure 5. Bar Diagram showing the average number of food unit taken by **Gourami**

It can be noticed that Potato infused food particle were consumed more frequently than Lettuce ($P<0.001$), Pea ($P<0.001$), Grape ($P<0.001$), Apple ($P<0.001$), Orange ($P<0.001$). Little preference of *Tubifex* sp was also noticed as shown in Figure 5.

4. Conclusion

- From ANOVA and multiple comparison tests we have found out that food infused particles with carrot extract is more preferred by Gold fish than Molly and Guppy (Bar Diagram in Figure 1A).
- Food infused with Lettuce extract is preferred by all the species alike as there is no significant difference in the acceptance of food. However Gourami shows less tendency of feeding on lettuce infused food (Bar Diagram in Figure 1B).
- In case of food particles with pea extract, Gold fish shows highest feeding activity than the other species. Surprisingly Guppy shows least interest towards the food particles than the other fishes (Bar Diagram in Figure 1C).
- As evident from the multiple comparisons test (Bar Diagram in Figure 1G). Potato infused food is taken in amount more or less similar between Molly and Gold fish. However, both the species showed significant amount of high feeding preference than Guppy and Gourami.
- Grape infused food showed high acceptance in molly, gold fish, and guppy than Gourami (Bar Diagram in Figure 1H) where as Guppy and Molly shows similar behavior towards grape infused food. Gold fish showed the highest acceptance for grape infused food particles.
- Banana shows similar tendency as grapes and orange shows similar tendency as grapes. (Bar Diagram in Figure 1I). In case of apple and orange infused food Gold fish shows highest and the Gourami showed least interest to the given food.
- For mixed fruit (Bar Diagram in Figure 1J) and *Tubifex* sp (Bar Diagram in Figure 1D) Gold fish still shows the highest feeding activity followed by Molly and Guppy. In comparison between food types Molly prefers potato infused food and *Tubifex* sp than other food particles.
- Gold fish prefers more or less all the food particles types however it showed positive tendency towards carrot, pea, grapes and *Tubifex* sp.
- Guppy showed least interest in pea infused food and showed highest activity for *Tubifex* sp, grape and carrot.
- Gourami seems to be a highly specialized species in terms of food preference as it shows least interest for all the food items. However it showed relatively higher acceptance for potato infused food.

- Summing up all the finding it can be concluded that Gold fish shows generalized food preference for the food items we selected and Gourami seems to be highly selective species. *Tubifex* sp, peas, potato, & Grapes showed better performance than the rest and can be considered as a alternate natural food source. However, no comparison has been done between the Commercially available formula fish food and food pallet prepared by us.

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