Acceptability of Newly Formulated Fish Feed by Freshwater Fish *Oreochromis Mossambicus*

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Abstract:
In India, fishery sector has great share of inland fishery. Though the availability of resources is high aquaculture has only 10% contribution as many factors are responsible for success in aquaculture. One of them is feed production for aquaculture fishes. Alimentary canal of chicken is a good source of protein which goes waste as it is not consumed by humans, considering the rich protein content we used dried chicken gut powder along with wheat flour and garlic juice; and tested it on fresh water fish *Oreochromis mossambicus* for its feeding rate. The results indicated that the formulation of feed with ratio 7:3 (dried chicken gut powder: wheat flour) and 10 drops of garlic juice has maximum feeding rate as compared to others.

Key Words: Dried chicken alimentary canal, fish feed, *Oreochromis mossambicus*

Introduction:
Only planet where life does exist is the Earth. It has comprised of plants, animals and microbes. In an ecosystem, plants play vital role as producer which fix the solar energy into chemical energy (sugar). This chemical energy used as food by animals that become consumers, while microbes serve as decomposers. This interdependency gives rise to different tropical levels which are based on food chains. Human is one of those animals which are known as tertiary consumer and reserve place on top of tropical pyramid. Human is omnivorous, so it depends on plants as well as animals as source of food. To fulfill this need human started agriculture around 9000 BC and animal husbandry around 8000 BC (Zender,2015). Blend of agriculture with animal husbandry enabled many fold growth in agricultural yield while byproducts from agriculture are used as nutritious food for livestock in that way agriculture and animal husbandry become integral part of each other (Powell *et. al.* 2004). Along with the rearing of traditional animals like cattle, goats, sheep, pigs, horses, donkeys, mules and insect like silkworms from ancient period, recently we also have started keeping fishes, mollusks and crustaceans to meet with hunger of world, according to FAO, 2020, among these aquatic animals, fish has a large share in farming.
Amongst all the living organisms, fishes are most numerous vertebrates on the earth. More than 25000 species of fishes have been recorded till now around the world. Fishes constitute slightly more than one-half of the total number of approximately 54,711 recognized living vertebrate species (Nelson, 2006). Though the distribution of fish fauna is not uniform throughout the world, the species richness is higher in tropical region than temperate and polar regions. In south Asia, carps and catfishes are predominating groups of fishes (FAO, 2011).
India ranks 9th in terms of freshwater biodiversity (Mittermeier and Mittermeier, 1997). Along with 2200 species India contributes 11.72% to the global fish fauna. Out of this 73 species (3.32%) are from cold fresh water regime, 544 species (24.73%) from warm fresh water; 143 species (6.50%) from brackish water and the largest number is from marine ecosystem and is 1440 species (65.45%) (nptl.ac.in).
The marine and freshwater resources in India together offer more than 4 million tons of fish catch per year and employment to 14.5 million people (FAO, 2006). In 1950 total production of fishes in India was 8,00,000 tons, which increased to 4.1 million tons in 1990, which grown up to 8 million metric tons in 2010, of which 62% contribution comes from rivers, reservoirs, wetlands, ponds and lakes (Roy and Kaushik, 2017). The transformation of fisheries in to traditional to modern enterprises is done in late 1980s (due to use of modern technologies and tools). In between 1970 and 1980 carp farming is started in India followed by recent addition of other fishes like catfishes and Murrells and crustaceans like prawns (FAO, 2009).
Though ponds and lakes are prime resources for freshwater fishery in India, only 10% potential of this is used in aquaculture (IBEF, 2021). Along with carps, other exotic species are also introduced in Indian fisheries. Tilapia is one of those sturdy and economically viable fish. One popular species introduced in India in 1952 is *Oreochromis mossambicus* .
Tilapia is second most farmed fish, yielded over 3 million metric tons in 2009 (FAO, 2011). Tilapia is very significant fish species to meet with protein deficiency in the world. It has been referred to as 'aquatic chicken' (Wing and Nicholas, 2013). In the modern Tilapia farming, appropriate nutrition and feeding management are the major concerns (El-Sayed, 1999 and Ng *et al*, 2011). The success of any formulated feed for aquaculture fishes depends upon many

factors such as feed formulation and manufacture, on farm management and aquatic environment etc. (Tacon, 1992). The formulation of any feed also practically viable when a series of technical and economical factor are taken in consideration (New, 1987 and Lall, 1991). The market value of species to be fed, economical condition of farmer, nutritional requirements of fish, its natural habitat, availability of required ingredients, composition and cost, process of manufacture to be used, and stocking density are the factors also important for formulation of fish feed (Albert, 1992).
Chicken is the popular and ideal source of protein in the world. Therefore, chickens are slaughtered across the world in tons daily. The whole chicken is not used for consumption, remnant like skin, lower legs, beak and some part of head and entire alimentary canal except crop and gizzard are thrown as waste. Some of these remnants like skin with plumage is used in some industries but other are left to decay without proper disposal. This may lead to sever health issues in society. The alimentary canal constitutes a larger share in the thrown material; and it becomes source of pathogens during decaying processes, if not, disposed in proper scientific way.
In the light of above discussion, we planned to formulate fish feed from alimentary canal of poultry birds that may have very low economic value but high nutritional value. In India about 4.5 MT poultry birds were sacrificed during year 2017 (DAHD & F, 2015) for meet, and their whole alimentary canal in several tons were thrown as waste. This alimentary canal has good nutritional value; it is a good source of proteins, fats and vitamins. Therefore, the present work was undertaken to formulate feed from the intestine of sacrificed bird that is economically cheap, but good quality, and easily preferred by *Oreochromis mossambicus.*

Objective:
To formulate fish feeds from intestinal tract of chicken, wheat flour and juice of garlic in various ratio and selection of best formulation on the basis of rate of consumption of feed by experimental fishes.

Materials and Methods:
To formulate fish feed, alimentary canals, except crop and gizzard of sacrificed birds were collected form butcher's shop. The gut was then cleaned thoroughly in distilled water to remove semi-digested and undigested food material from inside. The cleaned gut was then cut into smaller pieces and kept in oven for drying for 24hrs at 80^0C. The dried pieces of gut then ground to make fine powder. This powder was used in the formulation along with wheat flour and garlic juice in various ratio as mentioned in table no. 1.
Pellets, each of 200 mg were made from the above combinations. The dose of feed given was 10% of mean body weight of sample fishes of 2 months old.
Based on the mean weight of experimental fish, a fixed dose of fish feed was calculated. The dose of fish feed was 10% of the mean body weight of fish. Since the mean body weight of experimental fish was 20 gm, the dose of fish feed administered was 2 gm. Three sets with one fish in each set, were run. Based on number of pellets consumed by fish, there feeding rates were calculated and depicted in table no. 3.
F1- Number of pellets given
F2 –Number of pellets eaten by fish
F0- Number of pellets remain unconsumed

Parent stock of fishes was collected from Vashishthi river with cast net. Fishes bred in tank of size 4x4x6 feet. Fries were reared for two months after being released after mouth brooding by female around 10 days and mother fish was removed. Two-month old fingerling of mean weight 20 gms (.± 0.942291) were used for the experiment. Three sets for each formulation were established, each set was containing one fish in separate container of 2-liter capacity. The mean body weight of fishes was 20gm (± 0.942291), 10% of this body weight is 2gm (10 pellets 0.2gm each) feed was fed to each fish once in a day, rate of consumption was checked on the basis of number of pellets eaten by fish in 24 hrs for 3 days. The best formulation was confirmed on the basis of higher consumption rate.

Results:
In this investigation, the goal was to determine how well *Oreochromis mossambicus* (Mozambique tilapia), a commonly farmed freshwater species, would accept a newly formulated feed. The trial outcomes revealed that the fish generally adapted to the new diet, as evidenced by strong feed consumption and positive growth over the course of the study.
To confirm the dose of formulated fish feed, the mean weight of experimental fishes was taken into consideration (Table no. 2)

Table No. 2 shows mean weight of fishes used in experiment with standard deviation 0.942291, shows less variation in weight of fishes used. Hence calculated 10% (2gm) dose of feed to body weight is considerable.
Table number 3 shows administration of all five formulations of feed to experimental fishes. Fishes were categorized in group of 3, five It was confirmed that the average rates of consumption of fish feed for formulations 1, 2, 3, 4 and 5 are 48.88%, 78.88%, 50.00%, 43.33% and 42.22% Respectively, **Formulation 2** was the most consumed, indicating a possible preference by the fish. **Formulation 5** had the lowest consumption rate, suggesting lower palatability or acceptance by the fish. Across all formulations, **Formulation 2** was consistently consumed at maximum levels, indicating a general preference. This confirms that the formulation number two is the best formulation accepted by experimental fishes, *Oreochromis mossambicus*.

Discussions:

Evaluation of the acceptance of new fish feeds for *Oreochromis mossambicus* is essential for optimizing aquaculture practices. Studies done by Hoskins *et al*. (2012), highlight that the acceptance of fish feed depends on sensory attributes like colour, smell, texture and feeds that mimic their natural diet. Smith *et. al*, (2005) showed that the inclusion of ingredients such as plant proteins and natural attractants in feed formulations significantly enhances the acceptance leading to higher feed consumption and better growth. Hence It is necessary to regularly review and refine feed formulations to ensure that feed meets the sensory and nutritional requirements of *Oreochromis mossambicus*.

Tabinda *et. al.* (2013) found that chicken intestine has a rich protein content and good amount of fat, but no carbohydrates and dietary fibers with less vitamins. In the present investigation, we formulated dry powder of chicken intestine with wheat flour (to compliment deficit of carbohydrates, fibers and vitamins) and crude extract of garlic as garlic is appetite enhancer and source of anti-oxidants (Marwane *et. al*, 2015). In present study, the feeding behaviour of *O. mossambicus* toward newly formulated feeds was assessed by observing their intake. The fish showed a clear inclination towards the new diet by consuming it eagerly during the trial period. This finding is coincides with earlier research, which indicates that tilapia are non-selective feeders, adaptable to diverse feeds which are nutritionally balanced and palatable (El-Sayed, 2006).

According to Hemre *et. al.* 2002, FAO 2009 and Michael *et. al.* 2012 the nutrient profile and physical characteristics, such as pellet texture and size having combinations of protein sources like fishmeal, soybean meal, along with fats and carbohydrates are more appealing to the fish. Comparative study in commercial fish diet conducted by Ng and Romano in 2013 showed that protein content is vital for promoting growth in tilapia. Whereas according Furuya *et al.,* (2004) soybean meal is more efficient in fish growth. This indicates that proteins from natural sources are crucial in the growth of fishes and hence acceptability of formulated feed, in current investigation provides sufficient cause for promoting enhanced and modified fish feed obtained from dried chicken intestine powder.

According to Singh *et. al.* (2017) acceptability of three feed formulations made up of rice bran with floating feed, fish meal and Mustard oil cake by fish *Tor tor* was up to 10.0%, 14.0% and 17.0% in first three days while 60.0%, 71.0% and 85.50 % from 4 to 35 days span respectively, these results are coinciding with our results, remarkably, within three days acceptability of all five combinations was more than 40% showing acceptability of our selected feed with 78.88% by *O. mossambicus*. Here, selected feed is readily accepted by *O. mossambicus*, which may give better yield. It is crucially important that feed must be acceptable by farm-fishes for their overall growth and resultant yield of farm, because it directly influences feed conversion efficiency, growth rate and health. In the present investigation selected feed have good acceptability and may show desirable efficacy towards growth in short period of time which would be an important aspect in achieving maximum yield in tilapia farming.

Tables :

Table No. 1: Ratio of components used for formulation of feeds.

Sr. No	Powder of alimentary canal of chicken	Wheat flour	Juice of garlic
1	09 parts	01 parts	10 drops
2	07 parts	03 parts	10 drops
3	05 parts	05 parts	10 drops
4	03 parts	07 parts	10 drops
5	01 parts	09 parts	10 drops

Table No. 2: Mean weight (gm) of experimental fish.

Sample no.	Weight of sample in gm
1	19.44
2	20.10
3	19.50
4	18.85
5	19.90
6	20.00
7	18.55
8	21.15
9	20.56
10	21.45
11	19.55
12	18.70
13	21.56
14	20.45
15	19.57
Total weight in gm	299.33
Mean weight in gm	19.955 (approximately 20 gm)

Table No. 3: Rate of consumption of fish feed by experimental fish during three days of feeding.

Formulation	Number of experimental fishes	Day 1			Day 2			Day 3			Average feeding %
		F1	F2	F0	**F1**	F2	F0	**F1**	F2	F0	
1	1	**10**	05	05	**10**	05	05	**10**	04	04	48.88
	1	**10**	06	04	**10**	04	06	**10**	06	06	
	1	**10**	05	05	**10**	04	06	**10**	05	05	
2	1	**10**	07	03	**10**	08	02	**10**	10	00	78.88
	1	**10**	06	04	**10**	08	02	**10**	08	02	
	1	**10**	08	02	**10**	08	02	**10**	08	02	
3	1	**10**	06	04	**10**	04	06	**10**	06	04	50.00
	1	**10**	04	06	**10**	05	05	**10**	05	05	
	1	**10**	05	05	**10**	05	05	**10**	05	05	
4	1	**10**	04	06	**10**	03	07	**10**	04	06	43.33
	1	**10**	05	05	**10**	06	04	**10**	05	05	
	1	**10**	04	06	**10**	04	06	**10**	04	06	
5	1	**10**	05	05	**10**	05	05	**10**	06	04	42.22
	1	**10**	04	06	**10**	03	07	**10**	04	06	
	1	**10**	03	07	**10**	04	06	**10**	04	06	

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