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## List of abbreviations

| Abbreviation | Elaboration |
|---|---|
| DM | Dry matter |
| CP | Crude protein |
| CF | Crude fiber |
| EE | Ether extract |
| NFE | Nitrogen free extract |
| NS | Non significance |

# Abstract

The study was conducted to estimate proximate composition of four aquarium fish feeds optimum, Osaka 2000, Osaka green and super nova which are available in different feed markets of Chittagong, Bangladesh. Chemical analyses of the samples were carried out in triplicate for dry matter (DM), moisture, ash, crude protein (CP), crude fiber (CF) and ether extract (EE) in the animal nutrition laboratory, Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh during March to September, 2014 were collected, compiled and analyzed. Results indicated that , there were wide ranges of variations in chemical compositions for different parameters. DM contents varied from 95.4 to 93.5 g/100g and CP contents varied from 28.5 to 23.3 g/100g. similarly CF contents varied from 5 to 3.5 g/100g and EE contents varied from 6 to 4.4 g/100g. TA varied from 7.5 to 5.9 g/100g. It was concluded that, chemical composition of four estimated ornamental fish feed is widely variable. In this study no significant ($p>0.05$) relations were found in biochemical composition of the collected four feed samples. Nutritional quality of the aquarium fish feed was qualified to some extent to meet the minimum requirement of the aquarium fish. There should be a monitoring cell from the government to assess the quality of this expensive imported feeds for aquarist.



**Keywords:** Ash, Crude protein, Crude fiber, Dry matter, Ether extract.

## Introduction

Ornamental fishes popularly known as "Aquarium Fishes" usually mean attractive colorful fishes of various characteristics, which are kept as pets in confined space of an aquarium or a garden pool for fun and fancy. Aquarium fish feed is plant or animal material intended for consumption by pet fish kept in aquariums or ponds. Fish foods normally contain macronutrients, trace elements and vitamins necessary to keep captive fish in good health (**Mostafizur *et al.*, 2009**). Aquarium fishes or ornamental fish rearing has became very popular in Bangladesh because of creating attractive look in houses as well in offices by their presence. Most of ornamental fishes found in Bangladesh are exotic species (**Chowdhury *et al.*, 2005**). Among different ornamental fishes, gold fish and comets are now artificially managed in 'Rokomari' hatchery in the district of Feni in Chittagong division (**Kangkon, 2013**). Aquarium fish trade is an expanding market with considerable growth in last two decades because of its operating systems and comparatively easy maintenance. Moreover it increases the sales of aquarium and its accessories like air pump, medicine and most important the aquarium fish feed (**Cheong, 1996**).

Global import of ornamental fish is approximately raised to US$ 321 million a decade ago. In which US$ 21-48 million is involved in marine ornamental fish trade (**Wood, 2001**). In 2000 the global whole sale value of ornamental fish was approximately US$3 billion (**Whittington and Chong, 2007**). Approximately 75% freshwater aquarium fishes imported into the United States come from Southeast Asia (**Chapman *et al.*, 1997**). Bangladesh has huge resources in fish diversity but in ornamental fishes it holds marginal position. Most of the ornamental fishes are trading from Katabon which located in the capital of Bangladesh the Dhaka city (**Chowdhury *et al.*, 2005**). But it is good news for us that its trade is developing currently in our country (**Mostafizur *et al.*, 2009**).

Fish seed, feed and diseases are three major factors important for rearing of aquarium fishes where most of the cost is involved in feeding. So optimum feeding as well as best quality feed is essential in fish rearing. Good quality feed prevents

the fish from diseases. Poor quality feed not only raise the rearing cost but also it favors diseases by deteriorating water quality. So feed having well nutritional and good microbial quality will reduce the cost of aquarium fish rearing as moisture level exceeding 25% in feed can deteriorate it by microbial damage (**Silva and Anderson, 1995**). Aquarium fish feed is either plant or animal origin intended for consumption by pet fish kept in aquariums or in tanks. Fish feeds usually contain macro nutrients, trace elements and vitamins necessary to keep captive fish in good health (**Guillaume *et al*., 2001**).

Approximately 80% of aquarist feed their fish exclusively prepared foods produced in flake, pellet or tablet form (**Riehl and Baensch, 1996**). Prepared foods are non-living and are made by the aquarist or bought already prepared for consumption for fish (**Axelrod *et al*., 1996**). Fish feed should ideally provide the fish with fat and amino acids. Feed whether flaked or pellet must be assimilated in order to prevent build up of intestinal gas, renal failure and infections (such as swim bladder inflammation and dropsy) and to avoid aquarium pollution due to excessive ammonia release from gill, in urine and by feaces (**Godard, 1996**). Some aquarium fish foods also contain additives such as steroids (**Silva and Anderson, 1995**) or beta carotene to artificially enhance the color of the fish (**Guillaume *et al*., 2001**).

Though the sector of ornamental fish and their feed is a developing sector in Bangladesh, there are very few literature found about the species and price of aquarium fish but none about their feed composition or microbial quality. So this study was conducted to assess the biochemical composition of aquarium fish feed commonly found in Bangladesh.

## Materials and methods

### Study area and period

The study was carried out in the department of animal sciences and nutrition, Faculty of Veterinary Medicine, Chittagong Veterinary and Animal Sciences University, Khulshi, Chittagong-4202, Bangladesh during March to September of 2018.

### Collection of sample

Four commercial aquarium fish feed samples of Optimum$^{TM}$, Super Nova$^{TM}$, Osaka 2000$^{TM}$ and Osaka green$^{TM}$ were obtained from the soukhin aquarium, Riazuddin market, Rail station, Chittagong. They are all imported. Various information labeled in the four aquarium fish feed and the biochemical composition as labeled by the manufacturer have shown in Table 1. The biochemical composition of the samples were analyzed in the laboratory of department of Animal sciences and Nutrition, CVASU.

**Table 1:** Biochemical composition (g/100g) and information labeled in the packets

| **Sample name** | **Use** | **Chemical Composition (g/100g)** | | | |
|---|---|---|---|---|---|
| | | **DM (max)** | **CP (max)** | **EE (min)** | **CF (max)** |
| Optimum | Gold fish, fancy carp, angel fish, sword tail, platies, mollies etc | 90 | 28 | 3.0 | 4.0 |
| Osaka 2000 | All types aquarium fish | 90 | 23 | 2.5 | 5.0 |
| Osaka green | All types aquarium fish | 90 | 23 | 2.5 | 5.0 |
| Super nova | Gold fish, fancy carp, guppy | 90 | 20 | 3.0 | 7.0 |

## Proximate analysis

The proximate analysis of feeds showed the following composition: Dry Matter (DM), Moisture, Total Ash (TA), Crude Protein (CP), Crude Fibre (CF), Ether Extract (EE) in Animal Nutrition Lab in Chittagong Veterinary and Animal Sciences University, Chittagong.

## Estimation of DM and Moisture

In oven the enamel disc or crucible was dried which was regulated at 105°C and was cooled in a desiccators and weighted. 5 gm of feed sample was weighted into the enamel disc and kept into the oven for 24 hours. The enamel disc was removed from the oven with metal tong. After that it was cooled in desiccator and the final weight was taken after getting constant weight (AOAC, 2006).

$$\% \text{ Moisture} = \frac{\text{Initial weight (g)} - \text{ Final weight (g)}}{\text{Sample weight (g)}} \times 100$$

% DM = 100 - % Moisture

## Estimation of Ash

The crucible was dried in hot air oven. It was cooled in Dessicator. After that the weight of the empty crucible was taken. 5gm of feed sample was placed in the crucible and it was burned. Burning was done until no smoke was produced in heater. Then the sample with crucible was cooled and transferred to the muffle furnace. After that sample was ignited at 550-600°C for 6-8 hours until white ash is produced. The furnace was cooled at 150°C and the sample was transferred to the dessicator and weight was taken. (AOAC, 2006).

$$\% \text{ Ash} = \frac{\text{Wt. of crucible and ash} - \text{ Wt. of crucible}}{\text{Weight of feed sample (g)}} \times 100$$

## Estimation of Crude Fibre (CF)

Feed sample was weighted and 2gm sample was taken into a beaker. 125 ml of 1.25% $H_2SO_4$ was added in that beaker. After that it was fitted in condenser and placed on heater. It was cooled and filtered by using cloth. The sample was then washed until it was free from acid. After washing the residue of sample was transferred into same beaker. Then 125 ml of 1.25% NaOH was added there and again fitted in condenser and placed on heater. It was boiled for 30 minutes and removed from heater. After removing from heater it was cooled and filtered through filtering cloth. The sample was washed until it was free from alkali. After washing the residue of sample was transferred in a previously weighted crucible. The crucible was placed into the muffle furnace and ignited at $600^0$C temperature for 5 hours. Then it was cooled and weight was taken.

$$\% \text{ CF} = \frac{\text{Wt. residue with crucible (g)} - \text{ Wt. of ash with crucible}}{\text{Weight of fat free sample (g)}} \times 100$$

## Estimation of Crude Protein (CP)

0.5 gm of sample was weighted and taken into a digestion tube. Then one spoonful of catalyzer mixer (KOH, NaOH, Se) was added there. 10 ml concentrated $H_2SO_4$ was also added and the digestion flask was placed in Kzeldhal Digestion Set. After that heat was increased gradually and continued until clear residue (45 min to 1 hr) is formed. The flask was removed from the digestion set and then cooled. 10 ml 2% boric acid solution, 2 drops mixed indicator were taken in a conical flask. The conical flask was fitted in the collection arm of distillation set. 50 ml distilled $H_2O$ was added in the digestion tube and fitted in the distillation flask. 40 ml of 40% NaOH was added there and the distillation was continued up to 100ml. Then it was titrated against 0.1 N HCl. Titration was continued until the color was changed into pink. Then the reading of titration was taken. (AOAC, 2006)

$$\% \text{ CP} = \frac{(\text{titre} - \text{blank}) \times \text{Normality of HCL } \times 14.007 \times 6.25}{\text{sample weight (g)}} \times 100$$

## Estimation of Ether Extracts (EE)

One gram dry sample was taken in an extraction thimble having porocity, then placed in the Soxhlet flask. The cork of thimble was above the syphone tube. A receiving flask was weighted and fitted with Soxhlet apparatus and was placed in water bath at $50^0$ to $60^0$ C. Ether extract was poured down in to the soxlet falsk. The flask was filled up to ¾th portion with ether and it was sured that water was running through the condenser. When extraction was over, the thimble with sample was removed and heated in the water bath to remove all the ether from receiving flask. The receiving flask was placed into the oven at $105^0$C to eliminate left of the ether and water. After drying, the flask was taken out and weighted (AOAC, 2006).

$$\% \text{ EE} = \frac{\text{Initial weight (g)} - \text{weight after extraction (g)}}{\text{sample weight (g)}} \times 100$$

## Results

The chemical compositions of the feed samples of four different feed companies are shown in table 2. For convenience of better presentation, the quality of a feed with respect to its nutrient contents, the analytical values of nutrients of different feed mills are also discussed in graphical representation.

**Table 2:** Proximate components (g/100g) of feeds

| **Sample name** | **Chemical Composition (g/100g)** | | | | |
|---|---|---|---|---|---|
| | **DM** | **CP** | **CF** | **EE** | **Ash** |
| Optimum | 95.1 | 28.5 | 3.5 | 5.0 | 7.5 |
| Osaka 2000 | 93.5 | 27.0 | 4.1 | 5.6 | 6.7 |
| Osaka green | 94.2 | 27.8 | 4.0 | 6.0 | 5.9 |
| Super nova | 95.4 | 23.3 | 5.0 | 4.4 | 7.0 |

**Table 3:** Statistical analysis of chemical composition of feed (**N=4**)

| **Parameter** | **Min.** | **Max.** | **Mean** | **Median** | **STD** | **SE** | **P value** |
|---|---|---|---|---|---|---|---|
| DM | 93.5 | 95.4 | 94.55 | 94.65 | 0.87 | 0.43 | |
| CP | 23.3 | 28.5 | 26.65 | 27.4 | 2.32 | 1.16 | 0.89 |
| CF | 3.5 | 5 | 4.15 | 4.05 | 0.63 | 0.31 | 0.96 |
| EE | 4.4 | 6 | 5.25 | 5.3 | 0.70 | 0.35 | 0.96 |
| NFE | 50 | 55.7 | 51.7 | 50.55 | 2.68 | 1.34 | 0.94 |
| Ash | 5.9 | 7.5 | 6.775 | 6.85 | 0.67 | 0.34 | 0.98 |

**Dry matter (DM)**

The DM contents did not differ (p>0.05) amomg fish feed samples. The average DM contents of fish feed in this study was 94.55% (Table 2). The maximum and minimum DM percent were 95.4% and 93.5% respectively (Fig.1).

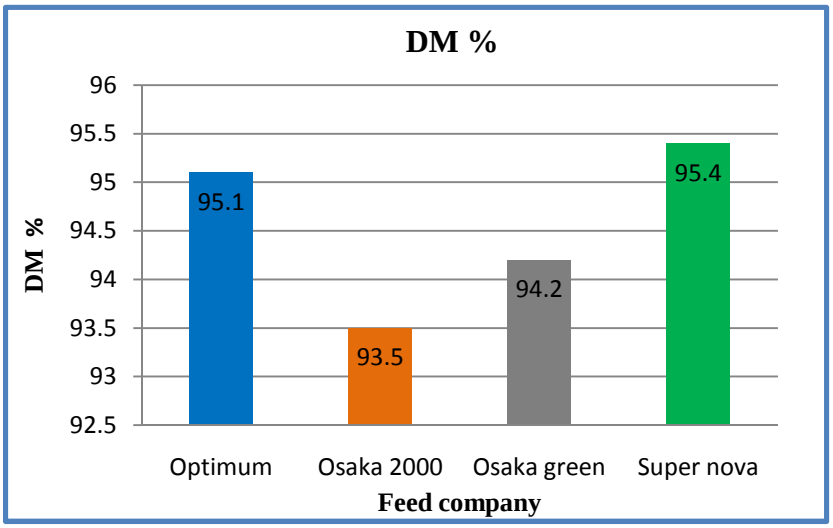


**Figure 1:** DM (%) of different aquarium fish feed.

**Total Ash (TA)**

TA contents did not differ significantly (p>0.05) amomg the samples. The average TM contents of fish feed in this study was 6.78 (Table 2). The maximum and minimum TM percent obtained in current study were 7.5% and 5.9% respectively.

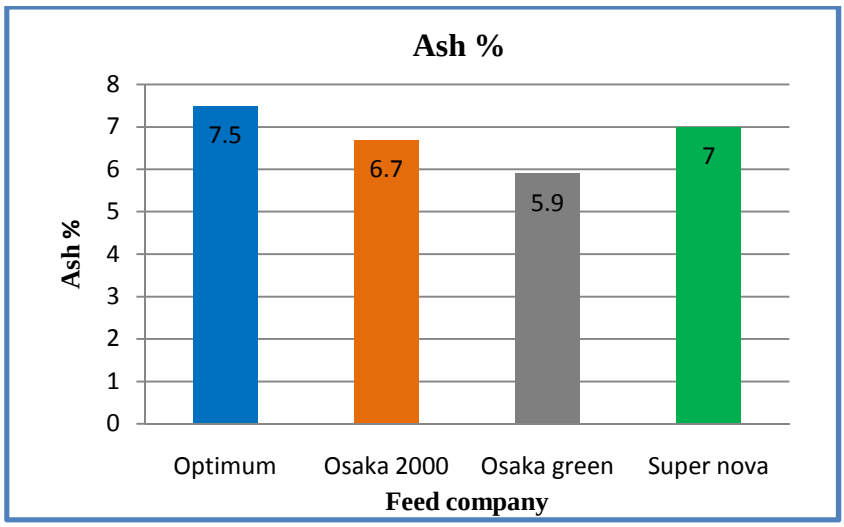


**Figure 2:** Ash (%) of different aquarium fish feed.

## Crude Protein (CP)

The CP contents were similar ($p>0.05$) among the feed samples. The average CP contents of fish feed in this study was 27.4% (Table 2). The maximum and minimum CP obtained in current study were 28.5 and 23.3% respectively (Fig.3).

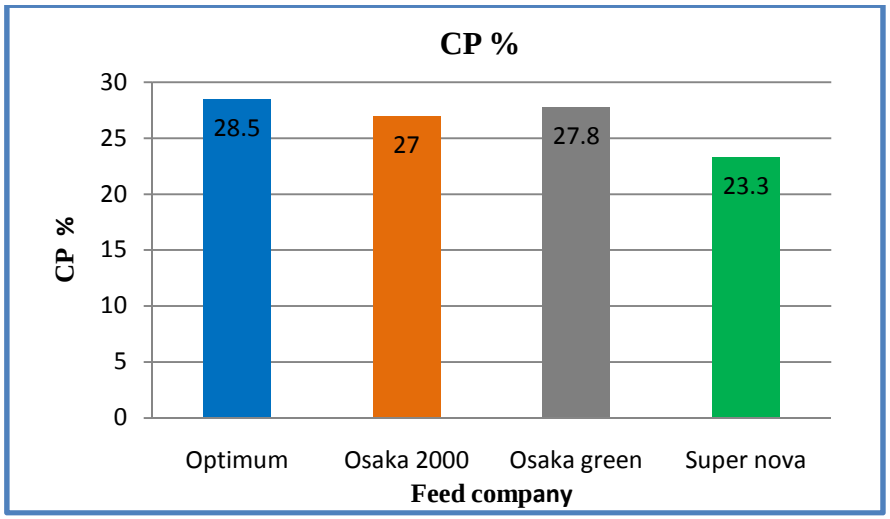


**Figure 3:** CP (%) of different aquarium fish feed.

## Ether Extract (EE)

The EE contents were similar ($p>0.05$) among the feed samples. The average EE contents of fish feed in this study was 5.25% (Table 2). The maximum and minimum EE obtained in current study were 6% and 4.4% respectively (Fig.4).

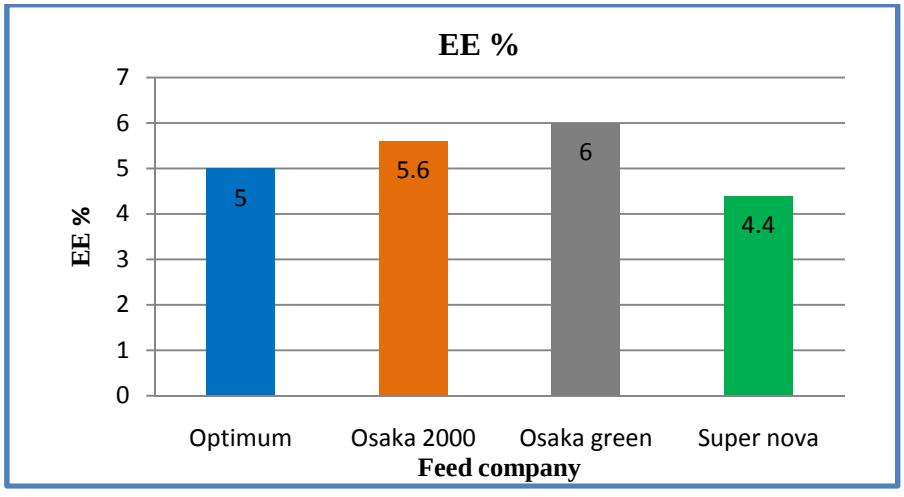


**Figure 4:** EE (%) of different aquarium fish feed.

**Crude Fibre (CF)**

The CF contents did not differ ($p>0.05$) among the collected feed samples. The average CF contents of fish feed in this study was 4.15% (Table 2). The maximum and minimum CF obtained in current study were 5% and 3.5% respectively (Fig.5).

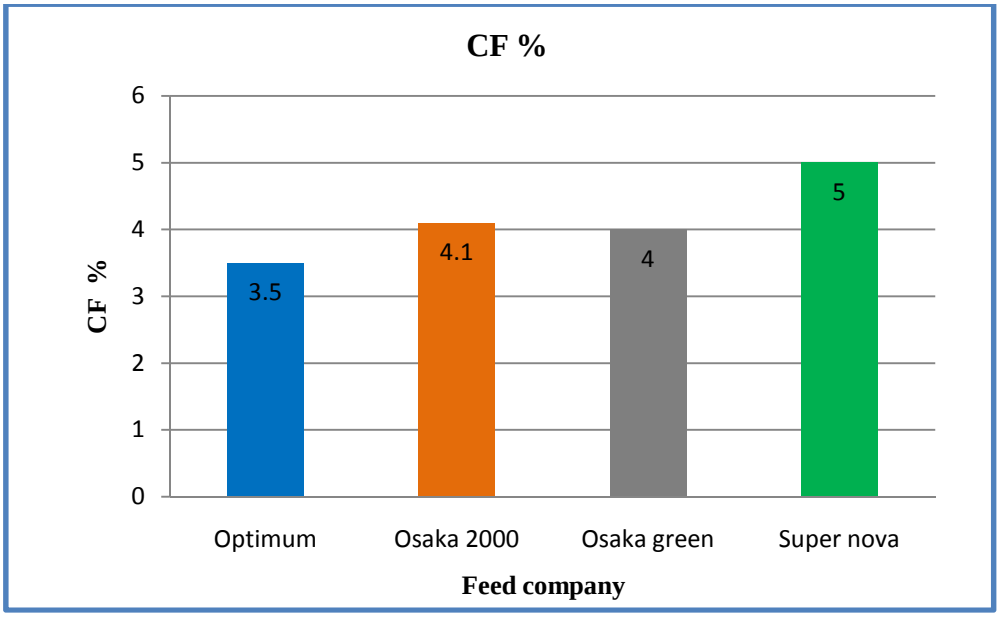


**Figure 5:** CF (%) of different aquarium fish feed.

## Discussion

Chemical composition of different samples of ornamental aquarium feeds particularly DM, CP, CF, EE and TA contents have been presented in Table 1. This imported feeds are used throughout the world for their good nutritive value. DM content of fish feeds affects the quality of feed. High moist feeds sometimes invite the bacterial growth (**Kabir *et al.*, 2014).**The DM level found in the study is higher the range of values supplied by the manufacturer. All four feeds contained minimum 93.5% and maximum 95.4% DM. No information was provided by the manufacturers about ash content in the feeds (**Kabir *et al.*, 2014**). But in my study I have found 5.9% minimum and 7.5% maximum level of Ash. The standard level of Ash in ornamental fish feed is 6-7 % (**Satoh 2000; Wilson 2000**).

Protein plays an important role for body growth as well as in costing of feed. Protein requirements of ornamental fish depend on size, water temperature, feeding rate and available digestible energy in diets (**Satoh 2000; Wilson 2000**). Protein level found in the present study meets the requirement of ornamental fish according to the values supplied by the manufacturer. Protein requirement for tropical cat fish is 35-40% for fry, 25-35% for grow out and 28-32% for broodstock (**Boonyaratpalin, 1988**). The fish body growth solely depends on protein utilization rate (**Watanabe *et at.*, 1990**). In the present study protein level was minimum 23.3 and maximum 28.5 which is suitable for better growth of ornamental fish. In general 10-20% of EE in most freshwater fish diets gives optimal growth (**Cowey and Sergeant, 1979**) but optimum level of lipid is 5-6% (**Wilson, 2000**) and for tilapia 5-6% is Optimum (**Luquet, 2000**). The range of EE content in this study was minimum 4.4 and maximum 6.0 which is suitable for better growth for ornamental fish (**Kabir *et al.*, 2014).** The EE value is found higher than the Companies value.

The standard level of crude fibre in ornamental fish feed is 4-5% (**Satoh 2000; Wilson 2000**). In our present study we have found minimum 3.5% and maximum 5.0 % crude fiber. So we can say all companies provide crude fibre almost around to the standard level. Super nova provides higher CF than others.

## Limitations

- During estimation of %CF, acid & alkali boiling is going on the hemicelluloses is partially destroyed. So there can be a little variation from the real value of %CF.
- In this proximate analysis, we estimate total $N_2$, not the ultimate protein & NPN (Non Protein Nitrogenous Substance).
- Again it estimates %CP from $N_2$ multiplying by 6.25 assuming that all protein contains 14-18% $N_2$. So over & under estimation of $N_2$ can be happened.
- We can't estimate vitamins, calcium and phosphorus level of feed by using this method.
- Any deviation in results may be due to environmental or experimental error.
- The study area was also limited.

## Conclusion

Demand of aquarium fishes become very popular in our country day by day. The deficiency of a nutrient in fish ration can greatly affect on its health. So it is very important to know about their feed ingredients for making a balanced ration. In my study I have selected 4 different company ornamental fish feed (Optimum, Osaka 2000, Osaka green and Super nova). After ending the study I saw the nutritive value of Osaka 2000 and green is comparatively better than the other 2 feed. But all the feed can be up to the standard if the owner can maintain a good management on his fish.

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## The Author

# Biography

**Rupom Devnath**, 3rd son of **Manik Lal Nath** and **Bela Rani Nath,** passed Secondary School Certificate (SSC) examination from Feni Govt. pilot high school, Feni in 2009 and then Higher Secondary Certificate (HSC) examination from Birshrestho Noor Mohammad Public College, Dhaka in 2011. He enrolled his internship program for Doctors of Veterinary Medicine (DVM) Degree in Chittagong Veterinary and Animal Sciences University (CVASU), Bangladesh. He has immense interest to be a Veterinary Practitioner and try to be developed his sector in his country.