Comparative growth performance assessment of Shing (Heteropneustes fossilis) feeding with prepared and commercial diet

Abstract
An experiment was carried out to understand the effect of prepare feed (T1) compare with commercial feed (T2) on growth performance of shing (Heteropneustes fossilis) for a period of 5 months during 15 March to 15 August 2018 at the farmer’s pond Sreepur, Gazipur. Fish were stocked at 100 per decimal in both treatments with triplicate. Average initial stocking weight was 12gm. Over the study period physico-chemical parameters such as temperature, dissolved oxygen, pH, ammonia-nitrogen (NH3-N) remained suitable for shing aquaculture. However, growth performances were remarkably influenced by feed category. Mean weight gain (g) of shing was 58.5±4.62 and 47.29±3.86, specific growth rate (%day-1) were 1.23±0.04 and 1.00±0.03 in T1 and T2 respectively. On the other hand, food conversion ratio was 1.6±0.01 and 1.8±0.01 and survival were 95.17±3.7 and 96.23±1.76 in T1 and T2 respectively. The findings of the present study revealed that the highest weight gain and lowest FCR was found in T1, which dictates that quality feed stuff such as fish meal has a significant impact for better aquaculture production.

Keywords shing, growth performance, prepared feed, commercial feed, survival

Introduction
With the growing demand for food fishes, the aquaculture sector in Bangladesh is significantly moving towards intensification. Due to rapid expansion of this booming industry both horizontally and vertically an exceptional rise in the demand of fish feed since the culture patterns has switched from minimum to maximum stocking density i.e. traditional to semi-intensive or intensive culture. It is undeniable that, improve feed composition and better feed efficiency results in higher fish production, lower feed cost and waste production. To a large extent, the success of intensive and semi-intensive fish heavily relies on the implementation of appropriate feed. Fish feeds provide nutrients for optimal fish development and provide farmers with greater financial returns. One of the most important concerns in aquaculture is feed cost. Feed costs generally constitute the highest single operation cost of semi-intensive or intensive grow-out farming operation. The feed must provide maximum production efficiency at a minimum cost. The relative importance of growth rate and feed conversion efficiency will depend upon the quality and cost of feed concerning the market value of the farmed product. The unit cost of various types of feed and cost of fish production using each of this feed as well as the unit profitability of each system of fish production must be compared before one type of feed is selected. It is therefore of great importance to the fish farmers to utilize their investments in the feed as optimal as possible. The Asian stinging catfish or fossil cat, Heteropneustes fossilis, (Bloch, 1794) is an air-breathing catfish and commonly known as Shingi or Shing in various regions of Bangladesh. This species is very familiar not only for its delicious taste but also for its high nutritional and medicinal properties. It remains a high amount of iron and fairly high content of calcium compared to many other freshwater fishes. This species is considered as a valuable food fish species and recommended as the diet for the sick and convalescents. As a lean fish it is very suitable for people for whom animal fats are undesirable. In recent years, shing has become one of the most popular commercial cultivable species among the fish farmers but one of the main hindrances of this potential fish species is that it depends largely on commercial feed which is cost-effective for fish farmers. Furthermore, as there is no strict legislation by the government over control of feed quality and cost, there is a great possibility that the farmers may be deceived by using the commercial feeds without knowing their nutritive values as farmers shift gradually from handmade feed to factory-made feeds. Nevertheless, no studies have been performed to compare the growth performance of this valuable fish species using prepared feed and then compared with the commercial feed. Therefore, the present study is designed to check and compare the growth performance of shing (Heteropneustes fossilis) using handmade and commercial feeds to get a better understanding of the effect of feed on their growth.

Materials and method
Duration and study site
The experiment was carried out for a period of 150 days form 15 March to 15 August, 2018 at the farmer’s pond of Sreepur, Gazipur.

Pond preparation
Prior to start of experiment, several times netting and application of padmatop gas tablet were done to remove unwanted fishes from ponds. After renovation, liming was done at a standard rate of 1kg CaO per decimal. Lime was mixed with water and kept overnight and distributed on the pond surface early in the morning.

Experimental design
Six earthen ponds with the size of each were 14 decimal and average water depth of 1.5 meter was used for the present study. The

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Two types of feed were used during experiment. Prepared pellet feed treated as treatment 1 (T₁) including Mustard Oil Cake (MOC), Rice Bran (RB), Maize (M), Wheat Flour (WF) and Vitamin pre-mix (Vit.) whereas commercial pellet feed named “Mega Feeds Limited” treated as treatment 2 (T₂) were designed for the present study. Major ingredient of prepared feed was Fish Meal (FM) supplied by “Virgo Fish and Agro Process Limited” and the other five different types of feed elements were collected from local market. The proximate compositions of hand-made feed and Mega fish feed are given in the Table 1. Feed was delivered by spreading method manually twice or thrice in a day. First 14 days fish were fed at 12% of their body weight. Then, it was reduced to 5% next 16 to 45 days. Finally, last 46-150 days feeding rate was again increased at 12% of fish body weight. The power is adjusted based on the weight of the fish during sampling. Fish sampling was done randomly catching 15 fish from each tank every 15 days and the fish were caught with a cast net and the weight was taken by the weight of a precision balance (accurate to 0.1g).

Table 1 Proximate composition of prepared and Mega feed

| Components | Amount (%) in Prepared Feed | Amount (%) in Mega feeds starter fish feed | Amount (%) in mega feeds grower fish feed |
|------------|-----------------------------|------------------------------------------|----------------------------------------|
| Moisture   | 13.0                        | 12.9                                    | 13.8                                   |
| Crude protein | 32.1                      | 31.20                                   | 26.4                                   |
| Lipid (Oil) | 6.87                       | 6.72                                    | 7.26                                   |
| Ash        | 10.5                        | 13.2                                    | 17.1                                   |
| Crude Fibre | 5.0                        | 11.58                                   | 12.2                                   |

Water quality parameters

Throughout the experimental period, three major water quality parameters were recorded after every 15 days. Water quality measurements and sample collection were made between 9.00 and 10.00am on each sampling day. Dissolved oxygen, pH and ammonia-nitrogen (mg/l) were measured.

Analysis of growth parameters

To evaluate the fish growth and production, following parameters were used:

\[ \text{Weight gain (g)} = \text{Mean final weight (g)} - \text{Mean initial weight (g)} \]

\[ \text{SGR (\% per day)} = \frac{\text{Ln final body wt} - \text{Ln initial body wt}}{\text{Day}} \times 100 \]

\[ \text{FCR} = \frac{\text{Total feed used}}{\text{Total weight gain}} \times 100 \]

\[ \text{Survival rate} = \frac{\text{No. of fish harvested}}{\text{No. of is stocked}} \times 100 \]

Statistical analysis

For the statistical analysis of the data, a one-way ANOVA (Analysis of Variance) was done by using the SPSS (Statistical Package for Social Science) version- 16.0. Only percent data had to be arcsine transformed before analysis. Significance was assigned at the 0.05% level of significance.

Result and discussion

Water quality parameters

All of the water quality parameters recorded in both treatments was found more or less similar and almost all of them were within the desirable range for fish culture. During the experimental period, water temperature varied from 24 to 32°C in T₁ and 26 to 31°C in T₂ respectively. The highest temperature was 32°C which was found in T₁. However, during the first week of July temperature was jumped from 26 to 32°C. The recorded temperature ranged from 22 to 29.5°C and 17 to 33.5°C, respectively which was more or less similar than the findings of the present study reported that water temperature varied from 25.60°C to 33.00°C in farmers carp polyculture ponds, which is almost similar with the value of the present study. The dissolve oxygen content of the water was varying from 3.44 to 7.58mg/L in T₁ and 3.56 to 7.46mg/L in T₂ respectively. However, the statistical analysis showed that a significant difference (P<0.05) was found between the means values of dissolved oxygen which were 5.95mg/l and 5.19mg/L in both treatments. It may be due to difference in temperature, decomposition rate; turbidity etc. reported that the range of dissolved oxygen suitable for fish culture would be 5.0 to 8.0mg/l. The concentration of dissolved oxygen in the present study was also similar to the findings of and who recorded dissolved oxygen ranged from 4.0 to 7.0, 2 to 7.04, 3.4 to 8.1, 4.3 to 6.9 and 1.2 to 7.2mg/l, respectively which indicates that the range of DO was within the suitable range for fish production. In the present experiment, the value of pH was found 5.89 to 10.8 T₁ and 7.12 to 10.23 T₂. The statistical analysis showed that there was no significant difference (P>0.05) found among the treatments. In an investigation from summer to winter season conducted in Kaiilla oxbow Lake of Mymensingh, pH value was found 7.15 to 7.60 which was slightly lower than the present study reported pH from 7.50 to 8.00 in five prawn ponds, which are almost similar with the findings of present experiment. The mean pH values observed in the present study were slightly alkaline in both treatments, which dictate that study ponds were highly productive and congenial for fish culture.

The range of NH₃-N in the present study was varying between 0.24 to 0.93 T₁ and 0.12 to 0.69 T₂. The statistical analysis showed

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that there was no significant difference (P>0.05) found among the treatments.\textsuperscript{16} revealed that ammonia-nitrogen value ranged from 0.01 to 0.82 mg/l\textsuperscript{12} and 0.203 to 0.569 mg/l respectively.\textsuperscript{13} found that the value ranged from 0.50 to 0.62 mg/l in extensive management of Chinese and Indian major carps, which was lower than the findings of present study (Table 2).

### Table 2 Water quality parameters with mean (±SE) in all treatments during the study period

| Parameters          | T\textsubscript{1}   | T\textsubscript{2}   | Level of significance |
|---------------------|----------------------|----------------------|-----------------------|
| Temperature (°C)    | 28.08±2.58           | 28.40±2.03           | NS                    |
| Dissolve oxygen (mg/l) | 5.95±1.18          | 5.19±1.04            | **                    |
| pH                  | 8.46±1.31            | 8.57±1.22            | NS                    |
| Ammonia (mg/l)      | 0.55±0.33            | 0.49±0.29            | NS                    |

Values with the same superscript are not significantly different at p>0.05

### Growth and production of Shing, Heteropneustes fossilis

Growth, production and survival of shing (Heteropneustes fossilis) during study period are shown in Table 3. The mean stocking weight of shing was equal in T\textsubscript{1} and T\textsubscript{2} treatments which weighed about 12g. The mean harvesting weight of shing was 70.5±4.62g, 59.29±3.86g, in T\textsubscript{1} and T\textsubscript{2} treatments, respectively. The result showed that the mean weight gain of shing at the end of the experiment was 58.5g, 47.29g in T\textsubscript{1} and T\textsubscript{2}, respectively which was significantly different (p<0.05) from each other. Mean length of shing at the end of this study was presented in Figure 1. It is observed from the experiment that, handmade feed is more preferable than industrial feed for the fish growth. The highest mean weight gain in T\textsubscript{1} might be due to use of good quality protein source and fish might use it appropriately. The food conversion ratio (FCR) of shing fish species at different treatments was observed at 1.6±0.01 and 1.8±0.01 in T\textsubscript{1} and T\textsubscript{2}, respectively which was differ significantly. The highest FCT was found in T\textsubscript{2} (1.88) while the lowest was in T\textsubscript{1} (1.6).\textsuperscript{16}

### Table 3 The growth parameters of (Heteropneustes fossilis) observed during the study in both treatments

| Parameters                      | T\textsubscript{1} | T\textsubscript{2} | Level of significance |
|---------------------------------|--------------------|--------------------|-----------------------|
| Mean Stocking Weight (g)        | 12±0.00            | 12±0.00            | NS                    |
| Mean Harvesting Weight (g)      | 70.5±4.62          | 59.29±3.86         | **                    |
| Mean Weight Gain (g)            | 58.5±4.62          | 47.29±3.86         | **                    |
| Specific growth rate (% day\textsuperscript{a}) | 1.23±0.04         | 1.00±0.03          | **                    |
| Food conversion ratio (FCR)     | 1.6±0.01           | 1.8±0.01           | **                    |
| Survival                        | 95.17±3.79         | 96.23±1.76         | NS                    |

Values with the same superscript are not significantly different at p>0.05

Conducted a six week growth trial using glass aquariums on shing fish and found that the conversion ratio was 1.8 while using pelleted feed which was very close to the findings of the present study. From the result of the experiment, it can be mentioned that being a carnivore, virtue shing could perform better growth on protein which is form animal source. Specific growth rate (SGR) of shing was 1.23%day\textsuperscript{1} and 1.00%day\textsuperscript{1} in T\textsubscript{1} and T\textsubscript{2}, respectively. The highest SGR value (1.23) was recorded in T\textsubscript{1} while the lowest (1.00) was obtained in T\textsubscript{2}.\textsuperscript{11} was the first person to recognize that for most animals the specific growth rate is highest early in life and that it typically decreases with increasing age, becoming zero in some animals and his epigram. The SGR\% value of shing fish in present investigation matching the same trend mentioned in\textsuperscript{12} fifth law. The survival was 95.17 and 96.23 in T\textsubscript{1} and T\textsubscript{2}, respectively. The highest survival was obtained in treatment T\textsubscript{1} (96.23 %) and the lowest was in treatment T\textsubscript{2} (95.17 %) and there was no significantly different between two treatments.\textsuperscript{11} also got 100% survival rate of Heteropneustes fossilis in a study with formulated pelleted feed which was more or less similar to the output of present study\textsuperscript{18} reported that survival rates were 93.33% at the end of 15, 35 and 60 days in treatment A while in treatment B, it was 1.37±0.19%, 1.08±0.14%, 1.13±0.03% at the end of 15, 30 and 60 days respectively. In both treatments SGR values were decreased with increasing the day which was very similar to the outcomes of this study.\textsuperscript{14} was the first person to recognize that for most animals the specific growth rate is highest early in life and that it typically decreases with increasing age, becoming zero in some animals and his epigram. The SGR\% value of shing fish in present investigation matching the same trend mentioned in\textsuperscript{15} fifth law. The survival was 95.17 and 96.23 in T\textsubscript{1} and T\textsubscript{2}, respectively. The highest survival was obtained in treatment T\textsubscript{1} and the lowest was in treatment T\textsubscript{2} and there was no significantly different between two treatments.\textsuperscript{11} also got 100% survival rate of Heteropneustes fossilis in a study with formulated pelleted feed which was more or less similar to the output of present study\textsuperscript{18} reported that survival rates were 93.33% at the end of 15, 35 and 60 days in treatment A while in treatment B, it was 93.33% at the end of 15 & 30 days and 90% at the end of 60 days which was lower than the present study.

### Conclusion

Shing (Heteropneustes fossilis) is an attractive and popular species to the people of Bangladesh due to delicious and nutritious food value. In the present study, highest weight gain observed in treatment T\textsubscript{1} with lower FCR 1.6. By considering the highest weight gain and lowest FCR from this study, we can conclude that treatment T\textsubscript{1} (hand-made feed) might be the best shing culture technology in the seasonal ponds of farmers in Bangladesh to get higher production and net return.
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Conflicts of interest
The author declares that there are no conflicts of interest.

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