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Impact of Varying Synthetic Hormone on *Mystus cavasius* (Hamilton): Fertilization, Hatching, and Survival Rates

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Abstract

An experiment was carried out to identify the perfect dose of Flash hormone for induced breeding of *Mystus cavasius* at the Reliance Aqua farm hatchery during the period from 29th June to 25th August, 2015. Three treatments (T1, T2, and T3), each with three duplicates, made up the experiment. From the brood rearing ponds, 45 pairs of female and male were selected, with a male to female sex ratio of 1:1. A single injection of Flash hormone, specifically 0.166, 0.125, 0.1 ml/kg body weight for males and 0.33, 0.25, 0.2 ml/kg body weight for females respectively in three treatments, was given to the brood fishes. The T1, T2, and T3 treatments showed a fertilization rate of 79.0, 88.7, and 77.51%, a hatching rate of 56.61, 60.03, and 37.78%, and a survival rate of 40.56, 50.86, and 32.07%, respectively. For all treatments, the incubation times for fertilized eggs were between 23 and 28 hours. The findings of the data analysis reported that the use of Flash hormone in T2 treatment resulted in the highest rates of fertilization (88.7%), hatching (60.03%), and survival (50.86%). When comparing the three Flash dosages, there were notable changes ($P<0.05$) in the rates of hatching, fertilization, and survival. A single dosage of Flash hormone (0.125 ml/kg body weight of male and 0.25 ml/kg body weight of female) in T2 was the hormonal combination that produced the greatest results for *M. cavasius* induced breeding.

Keywords: Synthetic Hormone, Fertilization, Hatching, Survival Rate, *Mystus cavasius*

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Introduction

Bangladesh is one of the top fish-producing countries in the world because of its abundance of inland, coastal, and marine water resources. Over the past few decades, the nation's economy has relied heavily on these resources. (Shamsuzzaman et al., 2017 and Sunny et al., 2020; Chakma et al., 2023). Because of its advantageous geographic location, Bangladesh boasts a diverse array of fisheries resources, including 260 species of freshwater fish and 475 species of marine water

species (Ghose, 2014; FRSS, 2020, Sunny et al., 2021a). Out of Bangladesh's 260 freshwater species, roughly 143 are classified as Small Indigenous Species (SIS), with a maximum maturity length of 25 cm (Felts et al., 1996). The IUCN Red List (2015) lists 253 freshwater species, of which 64 are considered vulnerable. Of them, 30 species (12%) are endangered, 25 species (10%) are in vulnerable condition, and 9 species (3%) are critically endangered. Bangladesh's inland waters are home to 55 distinct species of catfish (Rahman & Akhter, 2019; Kuddus et al., 2020; Kuddus et al., 2022; Hasan et al., 2023). Among these, one of the most delicate freshwater SIS is Mystus cavasius, also referred to as Gulsha or Khabashi Tengra in Bengali. It is considered to be one of Bangladesh's most important Small Indigenous Species (SIS), belonging to the genus Mystus and family Bagridae. (Chakrabarty & Ng, 2005; Rao, 2017). However, because of its superior taste and nutritional prominence, it has been attracting attention (Latif et al., 2018). Local consumers like most catfish for their flavor and fewer intermuscular bone (Gupta, 2015; Jabed et al., 2020). Commercially speaking, this species is valuable. It can be cultivated in ponds alongside other species or as a single species for export or domestic consumption. IUCN Bangladesh (2015) and Iqbal et al. (2015) state that factors that have led to the species' current status as a vulnerable Small Indigenous Species (SIS) in Bangladesh include water pollution, destruction of breeding and feeding grounds, habitat degradation, construction of dams in floodplain areas, and the use of insecticides and pesticides in agriculture. (Rahman, 2005; Islam et al., 2018; Islam et al., 2023; Sazzad et al., 2023).

In Bangladesh, aquaculture is a growing industry with constantly expanding species ranges (Alam et al., 2014; Jayasankar, 2018; Alam et al., 2020; Sunny et al., 2021b). Wild sources, such as rivers, lakes, etc., do not provide sufficient or trustworthy fry and fingerlings (Kumar et al., 2018; Mishra et al., 2018; Müller et al., 2020). In order to artificially reproduce Gulsha, modified synthetic hormones that have been used to spawn a variety of catfish are injected into sexually mature females and males. Hormones are typically administered beneath the peritoneal cavity of catfish (Bhenila & Biswas, 2014; Kumar et al., 2021). For various catfish species, different hormones are utilized at different levels, which may have led to worse fry and fingerling quality as well as decreased hatching and survival rates. Pituitary gland (PG) extract was often not used in the hatchery, especially for catfish because of the low ovulation rate and high requirements (Mondol et al., 2014; Aktar, 2015; Verma et al., 2017;). Finding the right hormones at the right dosage is crucial for studies on artificial propagation since it increases the chances of fertilization, hatching, and survival rate. Primarily, synthetic flash hormone functions as a salmon gonadotropin hormone. Each 10 milliliters of flash hormone contains 0.002% synthetic gonadotropin releasing hormone, 0.998% domperidone, and 99% propylene glycol. Flash hormone activates the hypothalamus and heats the ovary to remove the egg from the follicle in a single injection (Bari et al., 2023; Faruk et al., 2023; Tufael et al., 2023). In order to cause sperm hydration at the same time that the female ovulates, males are likewise given a single injection. In order to optimize the synthetic hormone (flash) dosage and monitor fertilization, hatching, and survival rates, this study examined the impacts of different doses of flash on *M. cavasius* in an induced breeding trial.

Materials and Methods

Area and period of the study

This study was conducted in the Reliance Aqua farm hatchery located at Trishal, Mymensingh during the period from 29th June to 25th August, 2015

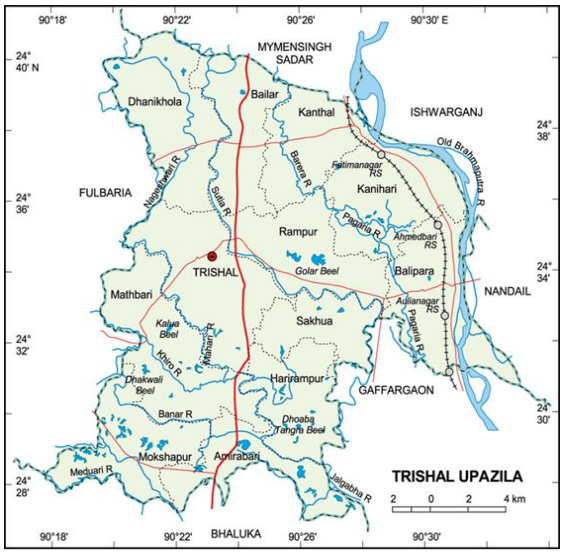

Figure 1. The study area.

Experimental design

This inducing agent was synthetic flash hormone (sGnRH+domperidone+propylene glycol). Each of the three treatments included three replications and involved giving both male and female participants three distinct dosages of flash hormone. Forty-five male and forty-five female participants were injected for each therapy.

Table 1: Doses of Flash hormone for Mystus cavasius male and female broods

Hormone	Treatments	Doses for female (ml flash/kg body wt.)	Doses for male (ml flash/kg body wt.)	No. of replication
Flash	T1	0.33	0.16	3
	T2	0.25	0.12	3
	T3	0.20	0.10	3

Preparation and management of brood pond

Producing fry of expected species requires the availability of mature, healthy brood fish. For a breeding program to be successful, brood stock management and planning are crucial. Healthy fries can only be produced by robust brood fish. When brood stock is correctly maintained, ripe

broods will be available for use during the whole breeding season. A brood pond with 20 decimal areas and an average depth of 3.5 feet was used to raise the *M. cavasius* brood. About 500 *M. cavasius*, both male and female, were taken from the culture pond by drying it out completely, and in May 2015, they were stocked in a pond that had already been constructed. Brood stock management was initiated in early June and continued up to the completion of breeding activity till August. Formulated feed were given during early January for proper gonadal development of brood fish. Predators and unwanted fishes are controlled manually by using net. Control of aquatic vegetation also practiced properly in brood fish pond. Organic fertilizer was used for manuring at a rate of 5 kg/decimal. Inorganic fertilization was done with 200 mg/decimal of urea and 100 mg/decimal of TSP, respectively for enhancing the primary food production. After seven days of fertilization, the brood pond was ready for stocking. Then the brood fish was transferred to the brood rearing pond. Brood fishes were also fed 5-6% body weight with artificial floating feed (Mega feed). Feeding was done twice a day at 6.00 AM and 7.00 PM.

Table 2. Proximate composition of the feeds

Feed	Protein (%)	Lipid (%)	Carbohydrate (%)	Ash (%)	Moisture (%)	Crude Fibre (%)
Artificial Feed (Mega feed)	31.15	8.98	29.86	12.49	12.32	5.20

Water quality monitoring

Seasonal variations in induced breeding are directly related to the parameters of water quality. The factors of water quality have a major impact on the rates of fertilization, hatching, and survival. Throughout the study period, water quality parameters such as dissolved oxygen (mg/l), pH, transparency (cm), and water temperature (0C) were measured fortnightly in brood rearing ponds using a Secchi disk, a Celsius thermometer, a pH meter L20 METTLER TOLEDO (Switzerland), and a DO meter Model Oxi 3150i (Germany).

Fish brood selection and gathering for artificial breeding

Before the day of the breeding trial, the water depth of the brood raising pond was decreased in order to remove the brood fish. Because they are slippery and have spines, gulsha fish cannot be captured with a seine net or cast net. Fish that were collected were stored in a cistern for a later selection process. Selecting the right brood fish is crucial to the effectiveness of induced breeding. For induced breeding, only fish that were fully developed, healthy, and free of injuries were chosen. Several exterior traits were used to identify the male and female broods. Males who were mature may be distinguished by their long, projecting genital papillae and flat abdomens (Figure 2 A). Conversely, the females were clearly identified by their round, enlarged urogenital papillae

and soft, bulging abdomen (Figure 2 B). Prior to the trial day, the chosen broods were housed in cisterns with constant water flow.

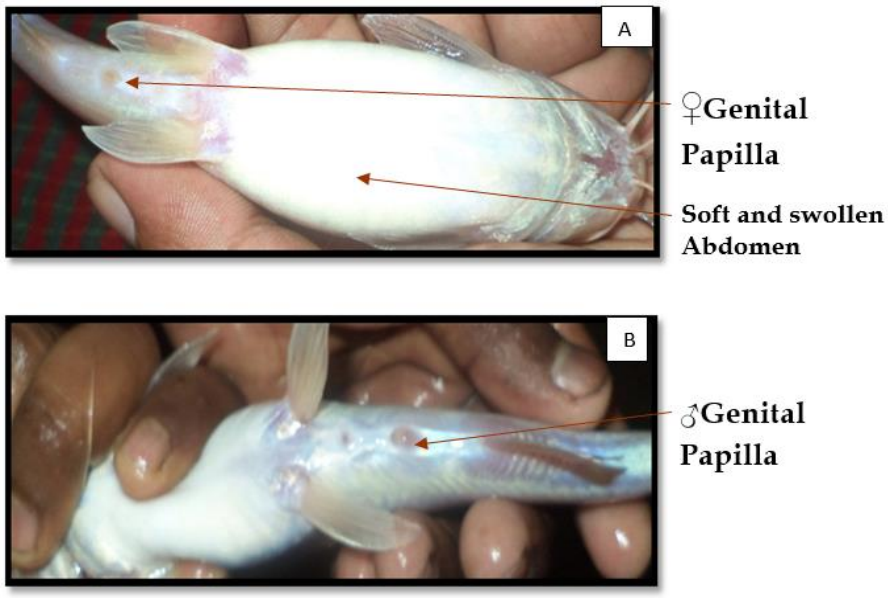

Figure 2: Ready to spawn brood fish of *M. cavasius*. (A). Female, (M). Male

Conditioning of Broods

The fish were moved and left in the tanks for a full day of training. Before the inducing substances were given, the male and female fish were housed apart for training. For the duration of the conditioning phase, the tank received constant water showers. To guarantee enough aeration, the water flow is kept constant. During the conditioning stage, the brood fishes were not fed.

Preparation and Injection of flash hormone

Airtight vials containing synthetic flash hormone that was readily available locally were gathered from the market in a preserved state. Fish body weight was used to determine how much Flash needed to be weighed. After that, the amount of water added to dilute the solution was determined by the weight of the fish. A 1 ml hypodermic syringe was used to extract the necessary volume of flash, taking into account the body weight of both male and female fish. Inducing chemicals were administered to the broods between 7:00 and 9:00 PM. The fish were kept resting on moistened foam and covered with a soft, damp cloth while the injection was being administered. The fish was given an intramuscular injection of the Flash solution on its dorsal side. With a 1 ml syringe, the injection was administered very carefully. Approximately 45° angles were used to put the needle into the body. A single dosage was administered to each male and female.

Fertilization and spawning

The fish were allowed to discharge their eggs and milt, allowing the hapa to spontaneously fertilize, after the male and female received a hormone injection. After an 8–9 hours' injection time, it was discovered that all of the brood fish were ovulated. Following the conclusion of ovulation, the broods were then moved from the holding tanks. To gather their eggs, more net was employed by hapa.

Transfer of eggs for incubation

After fertilization, the eggs were carefully moved onto tiny, rectangular hatching trays to prevent bacterial and fungal contamination and damage during the egg collection procedure. Using gravimetric methods, the quantity of eggs put into each tray was estimated. Eggs were submerged in water by puncturing a thin conduit. After that, a constant flow of water was kept for aeration to guarantee that the hatching process would take place in ideal conditions.

Fertilization, hatching, and survival rate calculations

Using the direct counting approach, the total number of eggs and the rate of fertilization were determined one hour after the natural spawning. Fertilized eggs were counted after the eggs were examined under a microscope. The opaque eggs were regarded as dead eggs, while the transparent eggs were regarded as fertilized after two hours of fertilization. The formula used to calculate the fertilization rate was as follows:

$$\text{Fertilization rate (\%)} = \frac{\text{Quantoty of eggs fertilized}}{\text{Total number of eggs (fertilized } + \text{unfertilized)}} \times 100$$

The direct counting approach was used to count the hatching rate. The hatchlings were initially placed in a 1.25-liter white enamel bowl, and the water was subsequently transported to a different bowl using a siphoning technique. The following formula was used to calculate the hatching rate:

$$\text{Hatching rate (\%)} = \frac{\text{Quantity of eggs hatched}}{\text{Total number of fertilized eggs}} \times 100$$

The direct counting approach was used to calculate the survival rate. The following formula was used to calculate the survival rate:

$$\text{Survival rate (\%)} = \frac{\text{No. of eggs hatchlings survives}}{\text{Total number of eggs}} \times 100$$

Examining statistics

One-way analysis of variance was used for the statistical analysis (ANOVA). Duncan's New Multiple Range test (DMRT) at 5% ($P<0.05$) significance level revealed significant differences

between the various treatments. The SPSS version 16 computer program was used to assist in the statistical data analysis.

Results and Discussion

Water quality parameters

Keeping the temperature at the ideal level is essential for breeding. because it's possible that the eggs will experience stress in cold conditions. The embryo may be smaller as a result of energy depletion during the protracted stage of the embryonic condition. As a result, the larvae may develop abnormalities or, in the event of a typical hatch, may shrink, grow weary, and ultimately cease to be viable. From June 29 to August 25, fortnightly observations of the water quality parameters—temperature (ºC), pH, dissolved oxygen (mg/l), and transparency (cm)—were made. Table 3 below shows the observed mean values for temperature (ºC), pH, dissolved oxygen (mg/l), and transparency (cm) for hatching cisterns and brood ponds under various treatments.

Table 3. The value of water quality parameter at brood ponds and hatching cisterns

Treatment	Brood ponds				Hatching cisterns		
	Temperature (ºC)	pH	DO (mg/l)	Transparency (cm)	Temperature (ºC)	pH	DO (mg/l)
T1	29.10	8.2	5.5	20.0	25	7.5	4.7
T2	27.40	8.4	5.6	23.0	27	7.7	4.8
T3	30.20	8.3	5.0	25.0	29	7.9	4.9

Water temperature ranged from 29.10 to 30.20 ºC for ponds and 25 to 29 ºC for hatching cistern during the experiment period. The highest temperature was recorded 30.20ºC in T3 and lowest value was 27.40 ºC in T2 for ponds. The maximum value of temperature of hatching cistern was found 29ºC in T3 and the lowest was 25 ºC in T1. The water pH was varied from 8.2 to 8.4 and 7.5 to 7.9 for ponds and hatching cistern respectively. The highest pH of pond was 8.4 in T2 and the lowest pH was 8.2 in T1 where the maximum pH of hatching cistern was 7.9 T3 and the lowest was 7.5 in T1. The figure of dissolved oxygen ranged from 5.6 to 5.0 mg/l in brood ponds and 4.7 to 4.9 mg/l in hatching cistern. The highest value of pond was found to be 5.6 mg/l in T2 and the lowest value was 5.0 mg/l in T3 treatment. The maximum figure of hatching cistern was 4.9 T3 and the lowest was 4.7 in T1. Water transparency varied in various ponds during the study. The transparency was varied from 20 cm to 25 cm. The highest transparency was 25 cm in T3 and lowest was 20 cm in T1 treatment.

This study's observations of the temperature seemed appropriate for fish cultivation, which was consistent with the conclusions made by Hossain et al. (1997) and Wahab et al. (2001). The

primary factor influencing the rate of the metabolic process is temperature (Bhatt, 1971a). All treatments had temperatures between 25 and 30.2 degrees Celsius during the study period, which was consistent with Akinwole and Faturoti's (2007) findings.

Catfish can withstand low oxygen levels, however careful control of dissolved oxygen at the ideal amount is essential for effective fish culture (Stickney, 1979). Water with dissolved oxygen levels between 5.00 and 7.00 mgl-1 was deemed productively fair or good, whereas water with levels below 5 mg/l was deemed unproductive (Alikunhi, 1957; Banerjee and Banerjee, 1967). For channel catfish to grow, dissolved oxygen concentrations over 3 mg/l were advised (Weeks and Ogburn, 1973). The dissolved oxygen concentration in the water fluctuated between 4.7 and 5.6 mg/l in the current investigation, which was roughly comparable to what Ali et al. (2008) found.

A water body's pH (hydrogen ion concentration) shows its acidity or alkalinity. This is the water body's productivity index. The pH of most water bodies is between 6.5 and 8.5. For fish culture, the pH that is slightly alkaline works best. Fish development, metabolism, and other physiological processes are all slowed down by water with an acidic pH (Swingle, 1967). The pH range in the current study was 7.5 to 8.4. The results of this investigation were largely consistent with those of Bhuyan's (1970) study.

Transparency is typically used to gauge pond productivity. It is invasive that it is associated with the number of plankton. For fish culture, a transparency range of 15 to 40 cm is appropriate, according to Boyd (1990). The transparency in the current study ranged from 20 to 25 cm, which is in line with Uddin's (2002) and Rahman's (1999) findings.

Breeding response of fish with different doses of flash hormone

Once the hormone injection was administered, the breeding behavior was regularly monitored. Both the male and the female exhibit typical movements and activities immediately following injection. They remained at one corner of the tank's bottom at that time. The male fish's movements and activities increased four to five hours after treatment. After being injected for six to seven hours, the male fish began to circle the female, nudging her ventral region with its snout. Female fish were shown to have a greater opercula movement rate during that period. We repeatedly watched the actions of both male and female fishermen. Afterwards, the male approached the female abruptly and bowed its body. Both the female fish's abdomen and the male fish's ventral region experienced pressure. The male discharged milt and ejected the eggs simultaneously. The male waited for the female to expel eggs before releasing sperm. Fish that had laid eggs and released milt were moved to a different holding tank. Throughout the trial, Gulsha's response levels were also recorded. Their times for ovulation and hatching differed in varying degrees from one another.

Optimizing the dosage of flash hormone to stimulate *Mystus cavasius* breeding

The current study aimed to determine the optimal dose of Flash hormones to induce ovulation in *Mystus cavasius* by experimenting with various doses of the hormone. For each of the three treatments, three distinct dosages of Flash were administered per kilogram of fish body weight. The study involved optimizing the dosage of Flash hormone for Gulsha. Specifically, male fish were treated with 0.166 (T1), 0.125 (T2), and 0.1 (T3) ml/kg body weight, while female fish were treated with 0.33 (T1), 0.25 (T2), and 0.2 (T3) ml/kg body weight, respectively, in a sex ratio of 1♂: 1♀. The effects of flash hormone dosages on the Gulsha's rate of fertilization, hatching, and survival are displayed in Table 4.

Table 4. Results of varying Flash dosages on *Mystus cavasius* induced breeding

Treatment	Fertilization rate (%)	Hatching rate (%)	Survival rate (%)	Ovulation period (h)	Hatching period (h)
T_1	79.00 ± 2.91^a	56.61 ± 2.50^b	40.56 ± 1.26^b	8-9	27-28
T_2	88.70 ± 2.37^c	60.03 ± 3.18^a	50.86 ± 3.91^a	9-10	23-24
T_3	77.50 ± 1.07^b	37.77 ± 3.31^c	32.07 ± 2.92^c	11-12	25-26

(M±SE); The parameter values in each column with distinct superscripts (a, b, and c) range considerably from one another. (p<0.05)

With 88.70 ± 4.11% fertilization rate and 60.03 ± 5.51% hatching rate, the fish given with Flash hormone at 0.25 (T2) and 0.125 (T2) ml/kg body weight for females and males, respectively, exhibited the best performance. It was determined that the Flash doses of 0.33 (T1) and 0.166 (T1) ml/kg body weight for the male and female, respectively, were inappropriate because to the comparatively poor rates of egg fertilization and hatching. The fish that were not ovulated, however, were given 0.2 (T3) and 0.1 (T3) ml/kg body weight for the male and female, respectively. Sometimes, fish given larger doses of Flash induce the death of their female counterparts. Because the eggs began to bleed as well. Instead of regular ovulation, this could be the cause of abortion. In terms of fertilization, hatching, and survival rates, males with 0.125 ml/kg body weight and females with 0.25 ml/kg body weight demonstrated the best results when using Flash hormone.

According to Rahi et al. (2011), the optimal PG dose for M. vittatus produced a sex ratio of 2♂: 1♀, with 8 mg/kg/body weight for females and 4 mg/kg body weight for males. Carp PG dosage of 2.5 mg/kg body weight of female demonstrated maximum ovulation, hatching (80%) rate for Mystus guillo, according to Mijkherjee et al. (2002). According to some experts, catfishes respond well to injections of mammalian gonadotropins and fish and frog pituitary gland extract rather than spawning in a lab setting (Ramaswami and Sundararaj 1958; Ramaswami 1962; Barua and Mollah 1987). There is still uncertainty regarding the doses reported by different workers, despite the fact

that numerous scientists (Thakur and Das 1974; Khan 1972) carried out research with the goal of standardizing the dosage of PG for successful ovulation in some species. However, Maya (2011) researched several reproductive features of *Mystus cavasius*, and found that the month of June–July had the greatest gonado-somatic index.

Table 5: An ANOVA chart illustrating the degree of significance for various dosages of flash hormone

		Sum of Squares	df	Mean Square	F	Sig.
Fertilization Rate	Between Groups	221.556	2	110.778	7.241	0.025
	Within Groups	91.787	6	15.298		
	Total	313.343	8			
Hatching Rate	Between Groups	861.773	2	430.886	15.744	0.004
	Within Groups	164.214	6	27.369		
	Total	1025.987	8			
Survival Rate	Between Groups	531.428	2	265.714	10.410	0.011
	Within Groups	153.154	6	25.526		
	Total	684.582	8			

Rate of Fertilization (%)

According to Table 5, the average fertilization rates were noted 79.00 ± 5.05%, 88.70 ± 4.11% and 77.50± 1.86% for T1, T2, and T3. On the other hand, the female fish (0.25 ml/kg) and male fish (0.125 ml/kg) received injections of the Flash hormone, which caused the eggs and milt to be released at the present time and resulted in the highest fertilization rate (88.7%) in T2. At a dose of 0.2 ml/kg body weight of the female and 0.1 ml/kg body weight of the male in T3, a lower fertilization rate (77.50± 1.86%) was seen when males lost the majority of their milt prior to the female's ovulation. The results of the ANOVA test showed that the variations in fertilization rate were significant ($p<0.05$) (Table 4). Fi demonstrates the fish fertilization rate caused by Flash in various treatments, with T2 showing the highest value and T3 showing the lowest.

In T1, T2, and T3, the corresponding fertilization rates were recorded as 79.0, 88.7, and 77.51%. In T2, the female and male recorded the maximum fertilization rate (88.7%) with 0.25 ml and 0.125 ml/kg body weight, respectively, while the lowest rate (77.51%) was observed with a dose of 0.1 ml/kg and 0. 2 ml/kg in T3. In *M. cavasius*, the fertilization rate was reported to be 71±8.98% with 6 and 2 mg/kg body weight of PG for female and male, respectively (Karmakar, 2014), which is lower than the current data. Similar to the current work, Monira (2015) similarly reported an 89.6% fertilization rate for C. batrachus using 1.0 ml/kg of Flash.

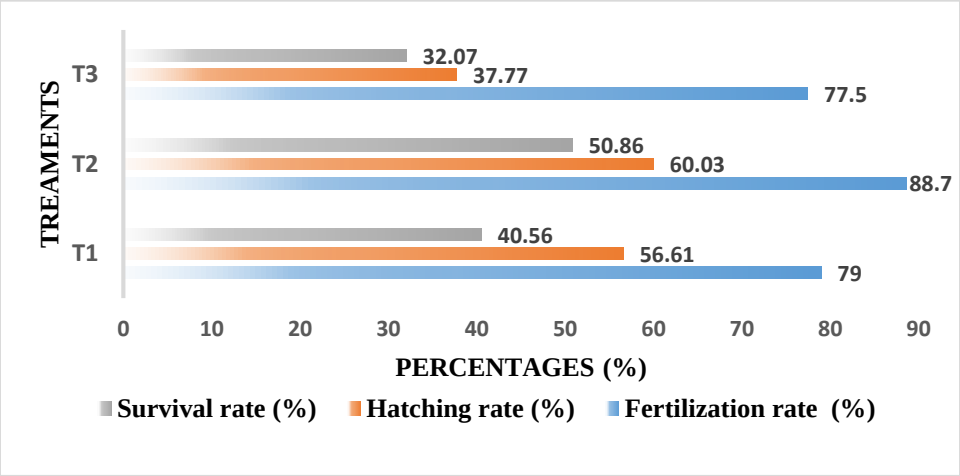

Figure 3. percentages of fertilization, hatching, and survival for each therapy.

Rate of Hatching (%)

In T1, T2, and T3, the average hatching rates were 56.61 ± 4.34%, 60.03 ± 5.51%, and 37.77 ± 5.73%, respectively (Table 8). The T2 dose of Flash produced the highest hatching rate (60.03 ±5.51%) when it was administered at 0.25 and 0.125 ml/kg body weight of the male and female, respectively, while the T3 dose produced the lowest hatching rate (37.77± 5.73%) when it was administered at 0.2 and 0.1 ml/kg body weight of the male and female, respectively. The results of the ANOVA test showed that the variations in fertilization rate were significant ($p<0.05$) (Table 4).

The average hatching rates were recorded as 56.61, 60.03 and 37.78% for T1, T2 and T3. In T2 of Flash, the female and male bodies weighed 0.25 and 0.125 ml/kg, respectively, had the highest hatching rate (60.03%), while the female and male body weights weighed 0.02 and 0.1 ml/kg had the lowest hatching rate (36.78%). The maximum hatching rate of 65.33±7.37% was recorded by Karmakar (2014), with male and female PG levels of 6 and 2 mg/kg body weight, respectively, exceeding the current findings. Utilizing mGnRHa, Kristan et al. (2013) also found a 50.6±17.7% hatching rate for pikeperch (Sander lucioperca L.). These results diverge from the current experimental outcome.

Rate of Survival (%)

After ten days of experimentation, the survival rates of *M. cavasius* larvae generated by three distinct hormone dose treatments (Table 5) were 40.56± 2.18%, 50.86± 6.78 %, and 32.07± 5.07% in T1, T2, and T3, respectively. The findings showed that there was a difference between the three Flash hormone doses, and therapy T2 had a significantly ($p<0.05$) higher survival rate than treatments T1 and T3. (Table 5). The survival rate of fish induced by Flash is displayed in Figure 3 for each treatment, with T2 showing the highest value and T3 showing the lowest.

In T1, T2, and T3, the average survival rates were 40.56, 50.86, and 32.07%, respectively. The female and male T2 Flash samples with body weights of 0.25 and 0.125 ml/kg had the highest survival rate (50.86%), whereas the T3 sample with body weights of 0.02 and 0.1 ml/kg had the lowest hatching rate (32.07%). Islam (2002) conducted an experiment with PG doses of 14–20 mg/kg body weight for females and 12 mg/kg body weight for males. Twenty-one days after the breeding experiment, the dose of 18 mg/kg fish had the highest survival rate. According to Akhteruzzaman et al. (1991), A. testudineus had a survival rate that ranged from 60 to 80%.

Conclusion

Using the synthetic hormone Flash, induced breeding of *Mystus cavasius* was accomplished with success. Larval fertilization, hatching, and survival rates vary primarily because of hormone dosage, brood stock management, brood quality, egg quality, seasonal variation, incubation density and water flow, hatchery water quality, and brood care practices. Enhancing catfish output in terms of reproductive performance in aquaculture is best accomplished with the use of synthetic hormones. Flash hormone stimulation greatly improved the breeding performance of both males and females. After careful analysis, it may be recommended to use flash hormones at a rate of 0.25 ml for female fish and 0.13 ml for male fish per kg body weight for hatchery-induced *M. cavasius* reproduction.

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