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Mussel Meat Boosts Catfish Performance

Chandan Debnath

Occasional Feeding with Mussel Meat Boosts Productive and Reproductive Performance in *Ompokbimaculatus*

Chandan Debnath

ICAR Research Complex for NEH Region (Meghalaya)- 793103

*Correspondence:chandannath23@gmail.com

ABSTRACT

This study investigated the effects of occasional mussel meat (*Lamellidensmarginalis*) supplementation on the growth and reproductive performance of *Ompokbimaculatus*, a fish species with high market demand and price in India. Fish with an initial weight of 20.1g were reared in 500-liter FRP tanks for three months. The experimental group received mussel meat supplementation 2-3 times per week in addition to standard feed, while the control group received only standard feed. Results showed significant improvements in growth parameters and reproductive performance in the supplemented group. The experimental group exhibited a 38.3% higher weight gain (38.3 ± 2.5g vs. 27.7 ± 2.1g) and a 23.5% higher specific growth rate (1.42 ± 0.07%/day vs. 1.15 ± 0.08%/day) compared to the control. Feed conversion ratio improved from 1.85 ± 0.12 to 1.53 ± 0.09. Reproductive parameters also showed enhancement, with the gonadosomatic index increasing by 27.6% (15.7 ± 1.3% vs. 12.3 ± 1.1%) and fecundity improving from 4182 ± 312 to 4876 ± 287 eggs per female. Egg diameter increased from 1.12 ± 0.08mm to 1.28 ± 0.07mm. This study suggests that occasional mussel meat supplementation could be an effective strategy to enhance the aquaculture production of *O. bimaculatus*.

KEYWORDS: Aquaculture nutrition,Growth performance, *Lamellidensmarginalis*, Mussel meat supplementation, *Ompokbimaculatus*, Reproductive enhancement.

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Ompokbimaculatus, commonly known as Indian butter catfish, is an economically important freshwater fish species native to South and Southeast Asia (Talwar and Jhingran, 1991). Its popularity in local markets, coupled with its declining wild populations due to overfishing and habitat degradation, has led to increased interest in its aquaculture potential (Mukherjee et al., 2002; NBFGR, 2011; Debnath et al., 2016). However, the successful cultivation of *O. bimaculatus* faces challenges, particularly in terms of optimizing growth and reproductive performance (Raizada et al., 2013).

Nutrition plays a crucial role in fish growth, development, and reproduction (Debnath et al., 2018a,b; Nahakpam et al., 2019). In recent years, there has been growing interest in the use of alternative protein sources in aquaculture to enhance fish performance and reduce reliance on conventional feed ingredients (Kumar et al., 2013; Das et al., 2021). Freshwater mussels, such as *Lamellidensmarginalis*, are rich in proteins, essential amino acids, and micronutrients, making them a potential dietary supplement for cultivated fish species (Sicuro et al., 2024).

The objective of this study was to evaluate the effects of occasional feeding with mussel meat (*L. marginalis*) on the productive and reproductive performances of *O. bimaculatus* under controlled conditions. We hypothesized that supplementing the diet with mussel meat would positively influence growth parameters and reproductive indices compared to a standard feed-only diet.

Experimental design

The experiment was conducted over a period of three months using twelve 500-liter Fiberglass Reinforced Plastic (FRP) tanks. A total of 240 *O. bimaculatus* with an initial average weight of 20 ± 1.5g were randomly distributed among the tanks at a stocking density of 20 fish per tank. The tanks were divided into two treatment groups with three replicates each:

1. Control group (C): Fed with standard commercial feed (Table 1) only

2. Experimental group (E): Fed with standard commercial feed + mussel meat supplementation 2-3 times per week

Table 1. The proximate composition of standard commercial feed

Nutrient	Composition (% dry matter)
Crude Protein	35.2 ± 1.3
Crude Lipid	8.5 ± 0.7
Ash	9.8 ± 0.5
Fiber	4.2 ± 0.3
Nitrogen-free extract	42.3 ± 1.8
Gross energy (MJ/kg)	18.7 ± 0.6

Feed and feeding

The control group received a standard commercial feed (35% crude protein) two times daily at 5% of their body weight. The experimental group received the same standard feed but with the addition of minced mussel meat (*L. marginalis*) at 10% of their body weight, given 2-3 times per week, replacing one of the standard feed meals on those days. Mussels were collected locally and their meat was extracted, minced, and stored at -20°C until use. Feeding rates were adjusted biweekly based on sampling weights.

Water quality management

Water quality parameters including temperature, dissolved oxygen, pH, and ammonia were monitored daily and maintained within the optimal range for *O. bimaculatus*. Partial water exchange (30%) was performed every week to maintain water quality.

Data collection

Growth parameters

Fish were weighed individually at the start of the experiment and every two weeks thereafter. The following growth parameters were calculated:

- Weight gain (WG) = Final weight - Initial weight

- Specific growth rate (SGR) = [(ln Final weight - ln Initial weight) / Days] × 100

- Feed conversion ratio (FCR) = Total feed given (dry weight) / Total weight gain

Reproductive parameters

At the end of the three-month period, three females from each tank were randomly selected for reproductive analysis. The following parameters were assessed:

- Gonadosomatic index (GSI) = (Gonad Weight / Body Weight) × 100

- Fecundity: Total number of mature eggs in the ovary

- Egg diameter: Measured using an ocular micrometer

Statistical analysis

Data were tested for normality using the Shapiro-Wilk test and homogeneity of variance using Levene's test. After confirming these assumptions were satisfied, data were analyzed using one-way analysis of variance (ANOVA), followed by Tukey's Honest Significant Difference (HSD) post-hoc test to identify specific differences between treatment means.

After three months of rearing, fish in both groups showed substantial growth, with the experimental group exhibiting significantly better performance compared to the control group (Table 2). The experimental group demonstrated a 38.3% higher weight gain (38.3 ± 2.5g vs. 27.7 ± 2.1g) and a 23.5% higher specific growth rate (1.42 ± 0.07%/day vs. 1.15 ± 0.08%/day) compared to the control. The feed conversion ratio improved significantly from 1.85 ± 0.12 in the control group to 1.53 ± 0.09 in the experimental group.

Table 2. Growth performance of *O. bimaculatus* fed with and without mussel meat supplementation

Parameter	Control	Experimental
Initial weight (g)	20.1 ± 1.3a	20.2 ± 1.4a
Final weight (g)	47.8 ± 3.2a	58.5 ± 2.9b
Weight gain (g)	27.7 ± 2.1a	38.3 ± 2.5b
SGR (%/day)	1.15 ± 0.08a	1.42 ± 0.07b
FCR	1.85 ± 0.12a	1.53 ± 0.09b

Note: Values are mean ± SD. Different superscripts in the same row indicate significant differences ($p < 0.05$).

This enhanced growth performance can be attributed to mussel meat's high nutritional value (moisture 78.5 ± 2.1%, crude protein 12.7 ± 0.9%, crude lipid 2.3 ± 0.3%, ash 1.8 ± 0.2%, and carbohydrate 4.7 ± 0.5%, w/w). Freshwater mussels are rich in proteins, essential amino acids, and various micronutrients (Sicuro et al., 2024). This high-quality protein source likely contributed to better nutrient utilization, as evidenced by the lower FCR in the experimental group (Claessens et al., 2023). These findings align with Ahirwal et al. (2019), who also reported improved growth and feed utilization in catfish fed mussel flesh-supplemented diets.

The reproductive parameters of *O. bimaculatus* were also positively influenced by mussel meat supplementation (Table 3). The experimental group showed a significantly higher gonadosomatic index (27.6% increase) compared to the control group (15.7 ± 1.3% vs. 12.3 ± 1.1%). Fecundity was notably higher in the experimental group, with an average of 4876 ± 287 eggs per female, compared to 4182 ± 312 eggs per female in the control group. Additionally, the eggs from the experimental group were larger in diameter (1.28 ± 0.07mm vs. 1.12 ± 0.08mm), suggesting potentially higher quality.

Table 3. Reproductive parameters of *O. bimaculatus* fed with and without mussel meat supplementation

Parameter	Control	Experimental
GSI (%)	12.3 ± 1.1a	15.7 ± 1.3b
Fecundity	4182 ±	4876 ± 287b
Egg diameter (mm)	1.12 ±	1.28 ± 0.07b

Note: Values are mean ± SD. Different superscripts in the same row indicate significant differences ($p < 0.05$).

The enhanced reproductive performance in the experimental group is particularly noteworthy. Higher GSI values indicate greater gonadal development, crucial for successful reproduction. The improvement in fecundity falls within the range reported for the fish in previous studies (Banik et al., 2012; Malla and Banik, 2015). Larger egg size in the experimental group is a positive indicator of egg quality, as larger eggs often contain more yolk reserves, potentially leading to larger and more viable larvae (Marimuthu and Haniffa, 2007).

The positive effects on reproductive parameters may be attributed to mussel meat's rich nutrient profile, particularly essential fatty acids and micronutrients. These nutrients play crucial roles in gonadal development, vitellogenesis, and overall reproductive success in fish (Nandi et al., 1999). Nayak et al. (2021) observed improved fecundity in fish (*Amblypharyngodon mola*) by enriching the tank environment with the aquatic plant *Hydrilla verticillata*, creating a modified habitat. A similar approach is recommended for *O. bimaculatus* to further enhance their reproductive outcomes.

Throughout the experiment, water quality parameters remained within acceptable ranges for both groups (Table 4), ensuring that the observed differences in growth and reproductive performance were attributable to the dietary treatments rather than environmental variables.

Table 4. Water quality parameters during the experimental period

Parameter	Control	Experimental
Temperature (°C)	27.5 ± 1.2a	27.3 ± 1.1a
Dissolved Oxygen	6.8 ± 0.4a	6.7 ± 0.5a
pH	7.4 ± 0.2a	7.3 ± 0.3a
Ammonia (mg/L)	0.05 ±	0.06 ± 0.03a

Note: Values are mean ± SD. Different superscripts in the same row indicate significant differences ($p < 0.05$).

CONCLUSION

The combined results demonstrate that occasional mussel meat supplementation produced substantial improvements across multiple performance metrics in *O. bimaculatus*. The experimental group achieved a 38.3% higher weight gain and improved feed conversion ratio (1.53 vs 1.85), indicating more efficient nutrient utilization. Reproductive parameters showed marked enhancement, with a 27.6% increase in gonadosomatic index (15.7% vs 12.3%) and 16.6% higher fecundity (4876 vs 4182 eggs per female). The 14.3% increase in egg diameter (1.28mm vs 1.12mm) suggests potential improvements in offspring quality.

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