

EFFECTIVENESS OF DIFFERENT ADDITIONAL FEEDINGS ON THE GROWTH AND SURVIVAL OF MAHSEER (*Tor tambra*) FISH FROM THE ALAS RIVER

Efektivitas Pakan Tambahan Yang Berbeda Terhadap Pertumbuhan Dan Kelangsungan Hidup Ikan Mahseer (*Tor tambra*) Asal Sungai Alas

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ABSTRACT

Mahseer (*Tor tambra*) is a high-value freshwater fish species that is highly favored by both local and international markets. Its popularity is attributed to its thick flesh, distinctive taste, high oil content, and premium market value. This study aimed to evaluate the effects of different supplementary feeds on the growth performance and survival rate of mahseer originating from Alas River. The experiment employed a Completely Randomized Design (CRD) consisting of four treatments with three replicates each. The treatments included P1 (commercial pellet feed), P2 (commercial pellet feed supplemented with coconut meal), P3 (commercial pellet feed supplemented with sweet potato), P4 (commercial pellet feed supplemented with figs). The results demonstrated that P4 produced the best growth performance, with an absolute weight gain of 0.84 g, an absolute length gain of 0.99 cm, and a specific daily growth rate of 0.69%. The most efficient feed conversion ratio was also observed in P4, with a value of 1.90. Meanwhile, the highest survival rate was recorded in P1 and P3, both achieving 100% survival. Throughout the rearing period, water quality parameters remained within suitable ranges for fish culture, with temperature ranging from 24.3-26.5°C, pH from 7.6 to 7.9, dissolved oxygen (DO) from 4.0 to 4.4 mg/L, and ammonia concentrations ranging from 0.11 to 0.66 mg/L.

Keywords: Mahseer fish, additional feed, growth

ABSTRAK

Ikan tambra (*Tor tambra*) merupakan salah satu komoditas perikanan bernilai ekonomi tinggi yang banyak diminati baik oleh masyarakat lokal maupun pasar internasional. Tingginya minat terhadap ikan ini didukung oleh karakteristik dagingnya yang tebal, cita rasa yang khas, kandungan minyak ikan yang tinggi, serta nilai jual yang relatif mahal. Penelitian ini dilakukan untuk mengevaluasi pengaruh berbagai jenis pakan tambahan terhadap pertumbuhan dan tingkat kelangsungan hidup ikan tambra yang berasal dari Sungai Alas. Penelitian

menggunakan Rancangan Acak Lengkap (RAL) yang terdiri atas empat perlakuan dengan tiga kali ulangan. Perlakuan yang diuji meliputi P1 (pemberian pakan pelet), P2 (pemberian pakan pellet + ampas kelapa), P3 (pemberian pakan pellet + ubi jalar), dan P4 (pemberian pakan pellet + buah ara). Hasil penelitian menunjukkan bahwa perlakuan P4 memberikan respons pertumbuhan terbaik, ditandai dengan pertambahan bobot mutlak sebesar 0,84 g, pertumbuhan panjang mutlak mencapai 0,99 cm, dan laju pertumbuhan harian sebesar 0,69%. Nilai rasio konversi pakan paling efisien juga diperoleh pada perlakuan P4, yaitu sebesar 1,90. Sementara itu, tingkat kelangsungan hidup tertinggi tercatat pada perlakuan P1 dan P3 dengan nilai mencapai 100%. Selama masa pemeliharaan, parameter kualitas air masih berada dalam kisaran yang mendukung kehidupan ikan, dengan suhu antara 24,3-26,5°C, pH 7,6-7,9, oksigen terlarut (DO) 4,0-4,4 mg/L, dan konsentrasi amonia berkisar 0,11-0,60 mg/L.

Kata Kunci: Ikan mahseer, pakan tambahan, pertumbuhan.

INTRODUCTION

Fish of the genus *Tor*—widely known as Mahseer and often referred to as the "King of Rivers" due to their potential to grow much larger than other river fish—comprise a distinct group. In Indonesia, this genus is represented by four species: *Tor tambroides*, *Tor tambra*, *Tor douronensis*, and *Tor soro*. Globally, approximately 20 species of *Tor* have been identified, distributed across Asia (Kiat, 2004). These fish are known by various local names throughout Indonesia. In Central Kalimantan, they are called Sapan Fish, while in Sumatra, West Kalimantan, and East Kalimantan, they are known as Semah Fish. In Padang, the fish is called Garieng Fish; in West Java, it is known as Kancera Fish; in Central Java, it is called Tambra Fish; and in Aceh, it is known as Jurung Fish or Keurling Fish (Haryono, 2006).

Tor fish generally inhabit river waters characterized by relatively strong currents and rocky substrates. These species thrive in habitats featuring clear water, high dissolved oxygen levels, and moderate to swift currents. Regarding feeding habits, *Tor* fish are classified as omnivores, capable of utilizing various food sources available in their environment (Wibowo, 2012). A key factor determining the success of fish farming is the provision of suitable feed—specifically regarding its form, size, and nutritional content.

According to Effendie (2002), fish growth is defined as an increase in body size—specifically length and weight—occurring over a certain period. One of the most influential factors in the growth process is the availability and quality of feed. Feed serves as the primary source of nutrients and energy required to support physiological activities, ensure survival, and optimize fish growth. Therefore, the feed provided must meet the fish's nutritional requirements through a balanced composition of protein, lipids, carbohydrates, vitamins, minerals, and energy, tailored to the specific needs of the species and its growth stage (Ayunda, 2011). In fish farming operations, feed represents the most dominant variable cost, accounting for 60–70% of total operating expenses. High feed expenditure is driven by the high cost of raw materials for manufactured feed and the substantial quantity of feed required to support fish growth.

Consequently, efforts are needed to reduce production costs by utilizing supplementary feed as an alternative nutritional source for the fish. Certain types of supplementary feed offer advantages due to their local availability and relatively low cost. However, the selection process must take into account nutritional content, digestibility, safety for the fish, and sustainability of supply (Afriyanto and Liviawaty, 2005). Based on this background, the author is interested in conducting a study titled "The Effectiveness of Different Supplementary Feeds on the Growth and Survival of Mahseer Fish (*Tor tambra*) from the Alas River."

RESEARCH METHODS

Place and Time

The research was conducted over a period of 40 days during July and August 2023 at the Lawe Bekung Fish Seed Center (BBI) in Badar District, Southeast Aceh Regency.

Tools and Materials

The materials used in this study included commercial feed with 30% protein content; supplementary feed consisting of coconut pulp, sweet potato, and figs; and 120 mahseer (Tor tambra) fry measuring 1–3 cm. The equipment used consisted of 30 x 20 x 20 cm aquariums, an aerator, a pH meter, a DO meter, a digital scale, a thermometer, and graph paper (millimeter block) for measuring fish length.

Research Design

This study employs an experimental method utilizing a quantitative approach with a controlled design to evaluate hypotheses, test theories, or assess the effectiveness of a previously unapplied treatment. The process involves administering specific treatments, controlling variables, and observing resulting responses to identify causal relationships between the variables under study (Coggon *et al.*, 2009). A Completely Randomized Design (CRD) was used, comprising four treatments and three replicates, resulting in 12 experimental units. The protein content of the feed additives is 5.78% for coconut pulp (Putri, 2010), 1.80% for sweet potato (Sarwono, 2005), and 10.63% for fig (Aryani *et al.*, 2008).

P1 : Commercial Feed (PK)

P2 : Commercial Feed + Coconut Pulp (PK+AK)

P3 : Commercial Feed + Sweet Potato (PK+UJ)

P4 : Commercial Feed + Figs (PK+BA)

Research procedure

1) Container preparation

A total of 12 rearing containers were used in this study. Prior to use, all containers were cleaned and sanitized to remove contaminants that could affect the research results, and then dried. The containers were subsequently arranged on experimental racks and labeled according to their respective treatments. Each container was filled with 15 liters of water and equipped with an aeration system. The water in the containers was allowed to stand for 24 hours prior to fish stocking to stabilize the rearing medium conditions and reduce the impact of compounds that could potentially compromise water quality.

2) Seed preparation

Mahseer (Tor tambra) fry used as test subjects were obtained from the Alas River in Southeast Aceh Regency, Aceh Province, using a net with a 1 cm mesh size. Prior to the study, the fish were acclimatized for approximately one hour to adjust their physiological condition to the rearing environment. Subsequently, the fish were stocked into experimental containers at a density of 10 individuals per container and maintained for a seven-day adaptation period before the treatments were administered.

3) Pisciculture

The test fish were reared for a period of 40 days. Throughout the study, the fish were fed a commercial diet supplemented with coconut pulp, sweet potato, and figs. Commercial feed was administered three times daily—at 08:00, 12:00, and 16:00 WIB—while the supplementary feed was provided twice daily at 10:00 and 14:00 WIB. Water quality management involved siphoning the tank every morning prior to feeding to remove accumulated uneaten feed and waste. Additionally, 50% of the total rearing water volume was replaced every three days to maintain optimal environmental conditions for fish growth.

4) Supplementary feeding technique

Supplementary feed—consisting of coconut pulp, sweet potato, and figs—is prepared by finely grating the ingredients, shaping them into small clumps, and then feeding them to the fish.

Data collection

Data collection involved measuring fish weight and length at three observation points: the beginning, middle, and end of the study period. Fish weight was measured using a digital scale, while length was measured using millimeter-grid paper. In addition to growth parameters, water quality—including temperature, dissolved oxygen (DO), ammonia, and pH—was measured to provide supporting data for evaluating the culture medium conditions. Fish mortality was monitored daily throughout the study; the number of dead fish was recorded, and their weights were measured for data analysis purposes.

Observation Parameters

1) Feed Conversion Ratio

Feed conversion is calculated based on the formula of Kusriani *et al.* (2012), namely:

$$RKP = \frac{F}{(Wt + Wd) - Wo} \times 100$$

Description:

RKP = Feed conversion ratio

Wt = Final fish weight at the end of the rearing period (g)

Wd = Weight of fish that died during the rearing period (g)

Wo = Initial fish weight at the start of the rearing period (g)

F = Amount of feed provided (g)

2) Absolute Weight Growth

Absolute weight growth is calculated using the formula (Effendie, 2002), namely:

$$PBM = Wt - Wo$$

Description:

W = Absolute weight gain (g)

Wt = Final average weight (g)

Wo = Initial average weight (g)

3) Absolute Length Growth

Absolute length growth is calculated using the formula (Effendie, 1997), namely:

$$PPM = Lt - Lo$$

Description:

P = Absolute length growth (cm)

Lt = Final average length (cm)

Lo = Initial average length (cm)

4) Daily Growth Rate

Daily growth rate was calculated using the formula Zonneveld *et al.*, (1991).

$$LPH = \frac{\ln Wt - \ln Wo}{t} \times 100$$

Description:

LPH = Daily growth rate (%/day)

Wt = Average fish weight at the end of the study (g)

Wo = Average weight of the fish at the start of the study (g)

t = Maintenance time (days)

5) Survival Rate

Fish survival is calculated using the formula according to Goddard (1996) as follows:

$$KH = \frac{N_t}{N_o} \times 100$$

Description:

KH = Survival Rate (%)

N_t = Number of live fish at the end of maintenance (tail)

N_o = Number of live fish at the start of maintenance (tails)

6) Water Quality

Water quality parameters monitored during the rearing period included temperature, dissolved oxygen (DO), ammonia, and pH. Temperature was measured using a water thermometer, while dissolved oxygen (DO) levels were measured using a DO meter. Water pH was analyzed using a pH meter, and ammonia concentration was measured via a chemical test method using an ammonia kit. Water quality observations were conducted at three time points—the beginning, middle, and end of the period—to monitor changes in the rearing environment conditions.

Data Analysis

Data obtained during the study were analyzed using Analysis of Variance (ANOVA) to examine the effects of the applied treatments. If the analysis indicated significant differences, further testing was conducted using Duncan's test at a 95% confidence level to determine the differences between treatments in greater detail. Meanwhile, water quality data were analyzed descriptively to characterize environmental conditions during the rearing period.

RESULT

Growth Parameters

ANOVA results indicated that the inclusion of different supplementary feeds significantly influenced most growth parameters of mahseer fish (**Tor tambra**) ($P < 0.05$), with the exception of the survival rate (SR) parameter ($P > 0.05$). The highest Daily Growth Rate (DGR) was observed in treatment P4 (PK+BA) at $0.69 \pm 0.05\%$ /day, followed by P2 (PK+AK) at $0.67 \pm 0.02\%$ /day and P3 (PK+UJ) at $0.61 \pm 0.09\%$ /day. These three treatments differed significantly ($P < 0.05$) from the control, P1 (PK), which exhibited the lowest DGR value of $0.46 \pm 0.47\%$ /day. A similar pattern was observed for Absolute Weight Growth (AWG); treatment P4 yielded the highest value at 0.84 ± 0.06 g, followed by P2 (0.76 ± 0.03 g) and P3 (0.72 ± 0.11 g), whereas P1 reached only 0.49 ± 0.03 g. The analysis demonstrated that the addition of supplementary feed significantly enhanced fish weight growth compared to the control feed.

Regarding Absolute Length Growth (ALG), treatment P4 again showed the highest value at 0.99 ± 0.00 cm, followed by P2 (0.81 ± 0.05 cm) and P3 (0.76 ± 0.01 cm), while P1 reached only 0.40 ± 0.01 cm. Duncan's post-hoc test results indicated that P4 did not differ significantly from P2 and P3, although all three tended to show higher values than the control treatment. Conversely, the Feed Conversion Ratio (FCR) showed the best (lowest) value in treatment P4 (1.90 ± 0.11), followed by P2 (1.92 ± 0.02) and P3 (2.07 ± 0.15), whereas P1 exhibited the highest FCR value at 2.73 ± 0.26 . This indicates that feed utilization efficiency in treatments involving supplementary feed was superior to that of the control treatment.

Survival Rate (SR) parameters were relatively high across all treatments, reaching 100% in P1 and P3, and slightly lower levels in P2 and P4. However, statistical analysis revealed that these differences did not significantly affect fish survival rates. Overall, the study results demonstrate that the provision of supplementary feed—specifically in treatment P4 (PK+BA)—yielded the best growth performance for mahseer (*Tor tambra*) based on Daily Growth Rate (DGR), Absolute Weight Growth (AWG), and Absolute Length Growth (ALG) parameters, accompanied by relatively good feed efficiency.

Table 1. Growth performance of mahseer (*Tor tambra*) fed different supplemental feeds

Parameter	Treatment			
	P1 (PK)	P2 (PK+AK)	P3 (PK+UJ)	P4 (PK+BA)
LPH (%/days)	0,46 ±0,47 ^a	0,67 ±0,02 ^b	0,61 ±0,09 ^b	0,69 ±0,05 ^b
PBM (g)	0,49 ±0,03 ^a	0,76 ±0,03 ^b	0,72 ±0,11 ^b	0,84 ±0,06 ^b
PPM (cm)	0,40 ±0,01 ^a	0,81 ±0,05 ^{ab}	0,76 ±0,01 ^{ab}	0,99 ±0,00 ^b
RKP (%)	2,73±0,26 ^b	1,92±0,02 ^a	2,07±0,15 ^a	1,90±0,11 ^a
KH (%)	100,00±0.00 ^a	93,33±11,54 ^a	100,00±0.00 ^a	96,66±5,77 ^a

Description : Values followed by the same letter do not differ significantly according to Duncan's Multiple Range Test (DMRT) at $\alpha = 5\%$.

Water Quality

In this study, water quality management and measurements were conducted, including pH, dissolved oxygen, temperature, and ammonia. The results of water quality measurements during maintenance are presented in Table 2. Water Quality for Fish Maintenance (*Tor tambra*).

Table 2. Water Quality for Rearing *Tor tambra*

Treatment	Water Quality Parameters			
	pH	DO (mg/L)	Temperature (°C)	Ammonia (mg/L)
PK	7,6 - 7,8	4,0 - 4,1	24,3 - 26,5	0,60
PK+AK	7,7 - 7,8	4,0 - 4,4	25,1 - 26,3	0,11
PK+UJ	7,7 - 7,8	4,0 - 4,4	24,8 - 26,1	0,52
PK+BA	7,7- 7,9	4,0 - 4,3	24,9 - 26,2	0,60
Optimal requirements *	6-8	>4	22-32°C	<2 mg/L

* Source: Arifin *et al.* (2019)

DISCUSSION

The growth of *Tor tambra* fish in treatments P2, P3, and P4 was attributed to the protein content in the supplementary feeds provided. The protein levels in these supplements were 5.78% for coconut pulp (Putri, 2010), 1.80% for sweet potato (Sarwono, 2005), and 10.63% for figs (Aryani *et al.*, 2008). This aligns with the views of Subagja & Radona (2017), who stated that protein is essential and plays a crucial role in supporting fish growth, particularly in the formation of body tissues.

In addition to nutritional factors, the increased growth of *Tor tambra* was also linked to the fish's positive response to the provided feed. According to Kiat (2004), figs (*Ficus sp.*) serve as a natural food source for river-dwelling fish, providing the energy necessary for survival. Ripe figs that fall into the water are typically consumed by fish—especially herbivores like the Mahseer, which inhabit river ecosystems.

The study results showed that treatment P4 (a combination of commercial feed and figs) yielded the best results compared to the other treatments, as evidenced by the lowest RKP (Feed Conversion Ratio) value. This indicates that the feed combination constituted the most suitable formulation, allowing the *Tor tambra* to utilize and digest the feed optimally.

These findings are consistent with the statement by Madinawati *et al.* (2011) that the feed conversion ratio is influenced by the quality and quantity of the feed provided. Higher nutritional quality—particularly regarding protein content—results in a higher fish growth rate. Additionally, Irawan (2013) noted that feed conversion efficiency is influenced by palatability—a factor linked to feed characteristics such as shape, size, color, taste, and aroma,

all of which affect the fish's response to the feed. Furthermore, Abidin et al. (2015) explained that feed with high protein and low crude fiber content promotes fish growth, a process generally accompanied by a decrease in the Feed Conversion Ratio (FCR). The survival rate of Tor tambra fry during the study was considered good, as it exceeded 50%. Mulyani et al. (2014) classified survival rates above 50% as "good," 30–50% as "moderate," and below 30% as "low." Beyond feed-related factors, survival is also influenced by the fish's ability to adapt to its environment; the better the adaptability, the higher the chances of survival. Murjani (2011) stated that fish survival rates are influenced by various factors, including environmental quality, feed availability, fish health, and stocking density.

Water quality measurements taken during the study indicated relatively optimal conditions. pH values ranged from 7.6 to 7.9, falling within the optimal range for fish farming (7.0–8.5) as cited by Kordi (2010). Water temperatures during the rearing period ranged from 24.3°C to 26.5°C, which is consistent with the optimal range for fish farming (25–30°C) according to Khairuman (2002). Deviations from optimal temperatures can affect fish physiological processes and impact other water quality parameters, particularly dissolved oxygen. Monalisa (2010) noted that rising temperatures can accelerate fish respiration rates, thereby increasing oxygen demand and potentially reducing dissolved oxygen availability in the water. The relatively stable temperature conditions during the study supported dissolved oxygen (DO) levels in the 4.0–4.4 mg/L range, which is considered normal for aquaculture operations; Monalisa (2010) stated that the minimum dissolved oxygen concentration for fish farming is 3–5 mg/L. Meanwhile, ammonia measurements ranged from 0.11 to 0.60 mg/L, remaining within safe limits for the growth of Tor tambra. This aligns with Pangestu (2020), who stated that the optimal ammonia level for Tor tambra growth is <2 mg/L.

CONCLUSION

The study concludes that the administration of different supplementary feeds significantly influenced the growth of Mahseer (Tor tambra) but did not have a significant effect on survival rates. Furthermore, the combination of commercial feed and fig fruit proved to be the best treatment, enhancing growth performance and lowering the feed conversion ratio for Tor tambra.

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