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SALINITY TOLERANCE RANGE TEST ON *Channa striata* (Bloch, 1793) FINGERLINGS: ANALYSIS OF THE EFFECTS OF DIFFERENT SALINITY LEVELS ON GROWTH PERFORMANCE AQUACULTURE SUSTAINABILITY

Muhammad Avesena[1*], Eddy Supriyono[1], Kukuh Nirmala[1], Yuni Puji Hastuti[1], Mohammad Rasyid Ridho[2]

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[1]IPB University
[2]Sriwijaya University
Corresponding Author:
[*]Muhammad Avesena
E-mail: kweeavincentt10@gmail.com

ABSTRACT

Channa striata, a fish species endemic to Indonesian waters, faces pressure on its wild populations due to high market demand, necessitating environmental engineering interventions, such as increased salinity, to enhance aquaculture practices. This study was conducted in two stages using fingerlings measuring 6.06 ± 0.30 cm in length and weighing 1.96 ± 0.30 g. In the initial stage, salinity tolerance was assessed by incrementally adding 1, 2, 3, and 4‰ salinity every 24 hours to a cohort of 100 fish in a 250L pond, aiming to determine the maximum salinity level based on mortality rates. The subsequent stage involved maintaining 10 fish in 48L aquariums for a duration of 45 days. The findings indicated that fingerlings could tolerate salinity levels up to 21‰. Four salinity treatments—3, 6, 9, and 12‰—alongside a control group at 0‰, were evaluated. Fish exposed to 9‰ salinity exhibited enhanced growth, feed efficiency, and quality, as evidenced by blood and flesh chemistry, proximate composition, amino acid, and fatty acid profiles, with statistically significant differences ($P<0.05$). The maximum tolerated salinity was identified as 21‰. At 12‰ salinity, mortality reached 56%, accompanied by diminished growth and quality, whereas at 9‰, mortality was 37%, with optimal performance observed.

Keywords: environmental engineering in aquaculture, fisheries in aquaculture, management of aquaculture, sustainability in aquaculture, management of fisheries

INTRODUCTION

Channa striata is an endemic fish species in Indonesia, particularly in South Sumatra, where its population is becoming endangered due to the depletion of natural stocks and the absence of a sustainable aquaculture system to meet market demand (Said, 2017; Triyanto et al., 2018). Although the natural habitat of C. striata is freshwater, it is also found in estuarine waters with a salinity range of 0.5–30‰ (Razi et al., 2023; Santoso & Wahyudewantoro, 2019; Sofarini et al., 2018). The cultivation system for C. striata in Indonesia remains semi-traditional, necessitating a relatively long rearing period to reach harvest size, as the demand for consumption and market supply is primarily met through wild catches from natural stocks. This reliance on wild fishing reduces natural stocks, potentially leading to the classification of these fish as endangered (Beverton, 1990). To address this issue, the implementation of aquaculture systems is proposed, although the domestication process requires significant time (Ali et al., 2014; Dubey et al., 2016; Pongthana et al., 2010; Purnamawati et al., 2019; Santoso & Wahyudewantoro, 2019; Tran et al., 2022). The domestication of wild fish populations for aquaculture presents distinct species-specific challenges, contingent on the species and habits of the fish (Nguenga et al., 2008; Samad et al., 2024; Samuel et al., 2017). Consequently, research related to engineering is necessary, with a focus on the safest engineering technique that avoids side effects, utilizing environmental engineering by adding salinity to accelerate growth and enhance the quality of C. striata as an aquaculture product (Dubey et al., 2016; Lan et al., 2020; Nakkrasae et al., 2015; Purnamawati et al., 2019). Salinity is a critical environmental factor affecting the growth and feed consumption of fish. It is well-established as one of the most significant parameters influencing the survival, growth, and distribution of fish in both freshwater and marine environments. Alongside other environmental factors specific to aquatic ecosystems, salinity has been extensively studied for its effects on fish growth, metabolism, and aquaculture quality (Lan et al., 2020; Pongthana et al., 2010; Purnamawati et al., 2019). The impact of salinity on the growth of various euryhaline species has been comprehensively documented (Razi et al., 2023; Santoso & Wahyudewantoro, 2019; Sofarini et al., 2018).

Freshwater resources in interior regions are estimated to possess a salinity concentration of less than 0.5‰/day-1 (Bunch et al., 2022). Nevertheless, numerous inland freshwater bodies are experiencing increased salinity due to anthropogenic activities and climate change, including factors such as rainfall, evaporation, coastal flooding, and storms (Tran et al., 2022). In tropical regions, characterized by distinct rainy and dry seasons, these fluctuations can be particularly significant (Razi et al., 2023; Tran et al., 2022). The Intergovernmental Panel on Climate Change (IPCC) has repeatedly highlighted in its assessment reports the accelerating rise in sea levels and the increased frequency of extreme events, such as coastal flooding, cyclones, and storm surges in low-lying delta regions (IPCC 2001, 2007). These phenomena contribute to salinity-induced water stress on freshwater

aquaculture in inland areas. This issue is especially pronounced in freshwater bodies located in semi-arid and arid regions, including lakes, rivers, and groundwater (Alhejoj et al., 2017; Aral & Taylor, 2011). The consequences of freshwater salinization are extensive, detrimental, largely irreversible, and insufficiently understood, necessitating a comprehensive global study to evaluate the environmental, biological, social, and economic impacts (David Raj et al., 2024; Guild et al., 2024; Tran et al., 2022).

Fish inhabit aquatic environments, making salinity a critical environmental parameter influencing their growth performance. Salinity serves as the primary abiotic factor regulating the activity, distribution, and metabolic processes of aquatic organisms (Ali et al., 2014; Dubey et al., 2016; Pongthana et al., 2010; Powell et al., 2021; Tran et al., 2022). In freshwater fish farming, salinity significantly enhances growth efficiency, which holds substantial economic potential and market opportunities. The growth performance of fish is largely dependent on feed intake, nutrient absorption, and the conversion of feed into body mass (Powell et al., 2021; Purnamawati et al., 2019; Samad et al., 2024). Consequently, understanding the adaptive capacity of various organisms to ecological changes, such as freshwater salinization, is crucial (Lan et al., 2020; Razi et al., 2023; Santoso & Wahyudewantoro, 2019). These insights will bolster adaptation strategies for freshwater fish production in brackish and marine environments, as well as in inland waters impacted by salinization.

As with other environmental factors, salinity fluctuations can affect the survival rate, growth rate, and physiological functions of freshwater fish (Dubey et al., 2016; Pongthana et al., 2010). Salinity significantly affects the physiological response of fish due to the process of osmoregulation, and this became a measure of their growth and metabolism, such as freshwater and saltwater fish (Lan et al., 2020; Purnamawati et al., 2019; Willett & Aluru, 2024). Freshwater fish regulate their osmotic pressure by consuming energy when the salinity level of their environment changes (Lan et al., 2020; Nakkrasae et al., 2015; Willett & Aluru, 2024). The primary osmoregulation and homeostasis organs of fish that are relevant to mitigating salinity changes are the gills, liver, kidneys, and intestinal tract (Mst. Khatun et al., 2020; Willett & Aluru, 2024). However, sudden changes in salinity that exceed the tolerance limits can cause mortality in aquatic animals (Kefford et al., 2004; Mst. Khatun et al., 2020). Therefore, that is why it is important to understand the effect of salinity on survival and salinity tolerance, especially in freshwater fish when they undergo changes in salinity, because salinity has the potential to stimulate stress in aquaculture commodities. One of the most important physiological parameters when considering animal well-being are blood parameters through hematology and serum biochemistry, where differences in concentration in fish are influenced by factors such as age, type of sex, and stage of sexual maturity, these parameters are also a significant index of the animal's responses to environmental changes (Dawood et al., 2022, 2023; Zidan et al., 2022). Researchers have examined how salinity impacts the tolerance and growth of fish, investigating both the rising salinity levels in freshwater species and the declining salinity levels in saltwater species, discovering considerable differences among various species (Lan et al., 2020; Mst. Khatun et al., 2020; Purnamawati et al., 2019). Salinity impacted metabolic processes in the body, particularly levels of amino acids and fatty acids (Huang et al., 2023), Whether in decreasing the salinity levels of marine species like *Pagrus major* (Sarker et al., 2011) or rising salinity levels in freshwater fish like *Oreochromis aureus* (Zhou et al., 2024) and *Oreochromis niloticus* (Cheng et al., 2022; Kombat et al., 2023). However, studies related to the use of salinity in aquaculture media for *C. striata* are still rarely conducted, especially studies that focus on aquaculture sustainability and the relevance of its application to aquaculture societies (Lan et al., 2020; Mst. Khatun et al., 2020; Nakkrasae et al., 2015; Purnamawati et al., 2019). The majority of this fish's native habitat is freshwater, but it's also found in brackish waters with a salinity range of 0 – 30 ppt (Purnamawati et al., 2019; Said, 2017), while the local aquaculture system in Indonesia does not have any sources that have sustainable fish farming, whether using freshwater or brackish water, and the majority of fish farmers still have failures, especially in the domestication stage. Therefore, this study was conducted to determine the maximum salinity tolerated by *C. striata* and their optimum salinity level to improving the quality of aquaculture production. In Indonesia, studies concerning salinity use in aquaculture have focused only a few aquaculture commodities particularly *Tilapia*, *Pangasius*, and *Clarias*.

MATERIALS AND METHODS

First stage: salinity tolerance range test

This study was conducted in July 2023 with total 1200 (100 fingerlings/pond) *C. striata* fingerlings measuring 6.06 ± 0.30 cm with weight 1.96 ± 0.30 g used tarpaulin pond with a volume of 250 L, and salinity was added to each tarpaulin pond at 1, 2, 3, and 4‰ consistently every 24 h at 11 a.m, with three replications. The sourced salt originates from dried sea salt (rock salt) without any additives, which is taken from the local salt farmers in the Pantai Utara (Pantura) region of Java Island, Indonesia. Fish were fed to apparent satiation 3–4 hours following each salinity adjustment. The cumulative mortality rate was observed at intervals (to minimize the number of dead fish accumulating at the bottom of the aquaculture pond, which could cause contamination and mass mortality)

until the cumulative mortality rate reached 100%. The study duration of this stage depends on the cumulative mortality rate reaching 100% (there is no specific time range as in the second stage).

Second stage: rearing test fish for 45 d

Salinity was based on the results of the salinity tolerance range tests (Figure 1), namely 0 (control), 3, 6, 9, and 12‰ (comparison at cumulative mortality > 50%). The fingerlings *C. striata* used 6.06 ± 0.30 cm with weight 1.96 ± 0.30 g with 10 fingerlings per 48L glass-aquarium (50 × 30 × 40 cm). The method used was a Completely Randomized Design (CRD) with five treatments and four replicates. Fingerlings of *C. striata* were tested and reared for 45 days, for the period from January to March 2024. Commercial feed with a protein content of 41% and lipid content of 5% was provided using the satiation method at 6 a.m., 10 a.m., 2 p.m., and 6 p.m. The water was filtered once a week before the water quality check using a HITECH foam filter (30 × 10 × 4 cm), and the filtered water was pumped back into the tank using a Yamano "WP-104", to reduce stress on the test fish, each aquarium is aerated using three air pumps, including one unit of Yamano "ACO-003" air pump and two units of Yamano "LP-40" air pumps.

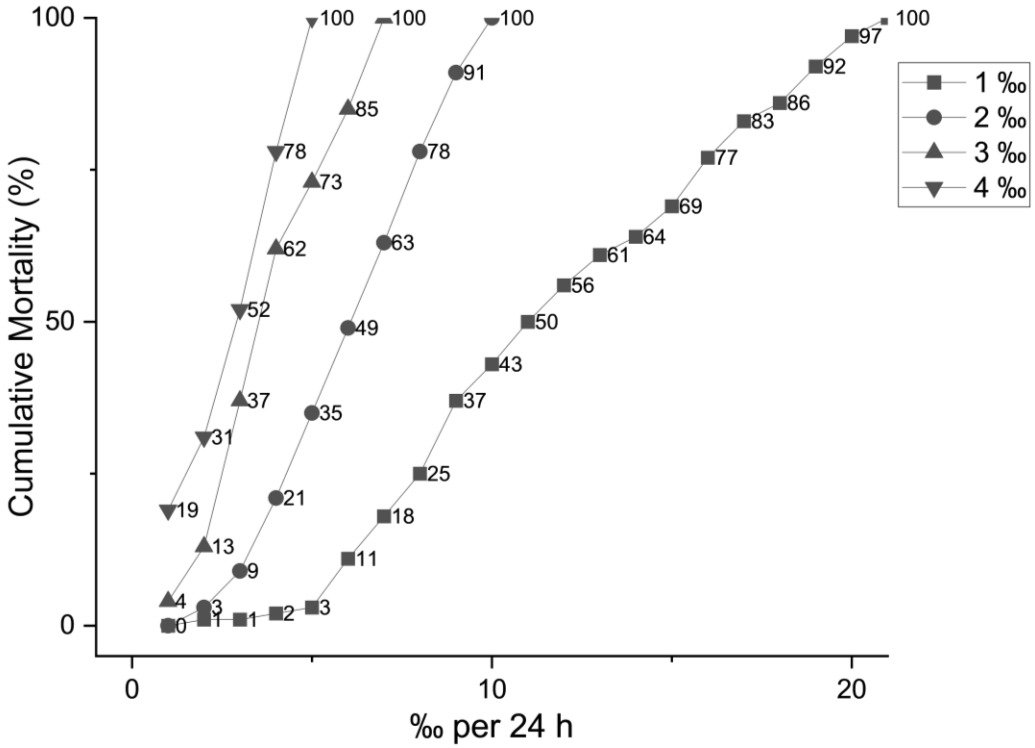


Figure 1. Salinity tolerance range test, cumulative mortality rate of *C. striata*

Acclimatization process of test fish for the second stage of the study

Acclimatization was carried out with the slowly addition of salinity into the medium of 1‰/2 h until the directed level of salinity was reached. The acclimatization process was carried out with 1,431 fish measuring 5.3–6.8 cm, divided in three stages with 500 fish (first and second stages) and 431 fish (third stage). The survived fingerlings were used as test fish according to the size range and number of fish required for each treatment.

Growth rate performance

Growth performance includes both length and weight growth, which can be characterized by specific and relative growth rates. Additionally, growth performance can be assessed through the levels of feed and protein utilization. The data were obtained from all test fish and then analyzed statistically. Growth rate performance analysis was calculated based on the following formula (Dawood et al., 2022; Dubey et al., 2016; Felix & Menaga, 2021; Lovshin, 1996), with a survival rate of 100% for each treatment:

Specific growth rate	$SGR = \frac{\left(Ln(Wt) - Ln(W0)\right) \times 100}{t}$
Average daily growth	$ADG = BWG/t$
Body weight gain	$BWG\ (g) = mean\ Wt - mean\ W0$
Relative growth rate	$RGR\ (\%) = \frac{Wt - W0}{W0} \times 100$
Feed efficiency ratio	$FER = \frac{Wt - W0}{Fc}$
Feed conversion ratio	$FCR = feed\ intake/weight\ gain$
Protein efficiency ratio	$PER\ (\%) = \frac{Wt - W0}{Pc} \times 100$
Protein retention	$PR\ (\%) = \frac{Pg}{Pc} \times 100$
Lipid retention	$LR\ (\%) = \frac{Lg}{Lc} \times 100$

Notes: SGR (Specific Growth Rate), Ln (natural logarithm), Wt (final weight), W0 (initial weight), t (days), ADG (Average Daily Gain), BWG (Body Weight Gain), RGR (Relative Growth Rate), FER (Feed Efficiency Ratio), FCR (Feed Conversion Ratio), PER (Protein Efficiency Ratio), PR (Protein Retention), Pg (protein gained), Fc (feed consumed), Pc (protein consumed), LR (Lipid Retention), Lg (lipid gained), Lc (lipid consumed).

Chemistry analysis of blood and flesh

Blood chemistry tests comprised three distinct analyses: fresh blood, blood plasma serum, and fish flesh. The analysis of fresh blood involved measuring glucose, uric acid, and cholesterol levels using an Elvasense EMS-10 blood checker. Data were collected from four randomly selected test fish blood samples. These samples were processed in an LBN-HC122 centrifuge tube to separate blood plasma from erythrocytes. The blood plasma serum analysis assessed albumin, total protein, triglycerides, globulin, total lipids, and phospholipids using the i-Chem-535 device. Data were obtained from four randomly selected samples per treatment. The analysis of albumin in fish flesh was conducted using 2 g samples of dried flesh from four randomly selected fish per treatment, employing the titration method as specified by AOAC 1980, No. 16.050.

Analysis of osmotic work level

The Osmotic Work Levels (OWL) were determined by calculating the difference between the osmotic pressure of the rearing medium and that of the fish blood, as documented by Anggoro and Subandiyono (2012), Permata et al. (2021), and Temmy et al. (2017). The experimental samples comprised four 1 ml PCR tubes containing fresh blood per treatment and eight samples of aquaculture media per treatment. These were analyzed using the "Osmo1® by Advanced Instruments" for blood samples and the "i-Osmometer M by Loser" for water media samples. The OWL were computed using the following formula:

$$OWL = Pressure\ osm\ blood - Pressure\ osm\ media\ (water)$$

Proximate analysis

The samples used were test fish samples that had been dried prior to proximate analysis. Dried test fish used for proximate analysis were collected at the beginning and end of the study period. Five fish were sampled at the beginning of the study, and two fish were sampled at the end of the study per treatment. Test fish samples were dried using a Sharp EO-35SL oven at 100 °C for 60 min. The samples used in each analysis weighed 2 g/fish test/analysis, and the analyses performed included protein [AOAC 1980, No. 2.057], moisture [AOAC 1980, No. 7.003], ash [AOAC 1980 No. 7.009], crude fiber [AOAC 1980 No. 7.065], and lipid [AOAC 1980 No. 7.058].

Amino acid analysis

The samples used were dried fish bodies, with a total of four samples/treatment randomly selected and stored at a deep freeze temperature using the “LDF-9010U”. Amino acid analysis follows the methods and protocols described in Springer [Hirayama & Soga 2012, pp. 77–82] using High-Performance Liquid Chromatography (HPLC) analyzer “SCION LC6000”.

Fatty acid analysis

The analysis was performed using the Gas Chromatography–Mass Spectrometry (GC-MS) method with the "GCMS-TQ8050 NX" instrument based on the springer method and protocol [Gunstone 1996, chap 5, p 100–128]. The samples used were test fish flesh that had been dried using the method mentioned in the proximate analysis section, and samples were taken randomly from four fish per treatment.

Water quality control

Data on the water quality collected included pH, Dissolved Oxygen (DO), temperature, ammonia (NH3), and ammonium (NH4). Measurement of water quality for each parameter was measured using a pH meter (Lutron BPH-231), DO meter (Lutron DO-5510), thermometer checked based on the pH meter and DO meter, and Salifert test kit (ammonia and ammonium). Water quality measurements were taken every Sunday at 6 a.m. and 6 p.m.

Data analysis

The entire data set was input into Minitab version 18 to test for normality and homogeneity. Subsequently, an analysis of variance (ANOVA) test was conducted, if significant results were obtained ($P < 0.05$), then it was followed by Tukey's HSD analysis to identify which treatment provided the best results. The analysis results are presented in tables and graphs.

RESULTS AND DISCUSSION

First stage: salinity tolerance range test

The analysis of the salinity tolerance range tests showed that the maximum salinity tolerated by C. striata fingerlings was 20 – 21‰ (Figure 1). Differences in cumulative mortality were shown based on salinity increases per 24 h until a mortality rate of 100% was reached. Based on the analysis of the salinity tolerance range, it was found that the optimum salinity range was between 1 and 11‰, whereas salinity levels between 12‰ and 21‰ resulted in cumulative mortality rates above 50%. In this study, a salinity level of 12‰ was used as a comparison to determine whether a cumulative mortality rate over 50% indicates a more suitable salinity for promoting growth during the second phase of the experiment, which involved maintaining the test fish for 45 days.

Second stage: rearing test fish for 45 days

Growth rate performance

It was found that the best growth performance was produced by the 9‰ treatment with SGR, ADG, BWG, and RGR of 4.68 ± 0.36%/day^{-1}, 0.32 ± 0.0021 g/day^{-1}, 14.24 ± 0.10 g, and 7.33 ± 0.16%; which were the highest among the treatments. The results showed a significant difference ($P < 0.05$) when compared with the results of the other treatments (Table 1). However, compared to other treatments, it required more feed, with a mean total feed of 62.81±0.78 g at an FCR level of 4.41±0.07 g of feed per 1 g of experimental fish weight produced, and showed significant differences ($P < 0.05$) in the analysis results of FER, PER, PR, and LR.

Table 1. Growth rate performance, feed utilization analysis, protein, and lipid of *Channa striata*

	Treatments (‰)					R-Square	P-Value
	0	3	6	9	12		
SGR (%. day^{-1})	4.03±0.37^{c}	4.11±0.31^{c}	4.38±0.30^{b}	4.68±0.36^{a}	4.60±0.42^{a}	0.35625	<0.0001
Total feed (g)	39.88±0.57^{e}	43.66±0.77^{d}	48.56±0.89^{c}	62.81±0.78^{a}	57.02±0.51^{b}	0.99461	<0.0001
ADG (g. day^{-1})	0.22±0.0026^{e}	0.23±0.0023^{d}	0.26±0.0043^{c}	0.32±0.0021^{a}	0.29±0.0046^{b}	0.99369	<0.0001
BWG (g)	9.79±0.12^{e}	10.53±0.10^{d}	11.82±0.19^{c}	14.24±0.10^{a}	13.22±0.21^{b}	0.99369	<0.0001
RGR (%)	5.20±0.16^{c}	5.40±0.25^{c}	6.24±0.38^{b}	7.33±0.16^{a}	7.07±0.40^{a}	0.9213	<0.0001
FER	24.54±0.41^{a}	24.12±0.32^{a}	24.34±0.53^{a}	22.68±0.35^{b}	23.19±0.35^{b}	0.81169	<0.0001
FCR (g feed. g fish)	4.08±0.07^{b}	4.15±0.06^{b}	4.11±0.09^{b}	4.41±0.07^{a}	4.31±0.07^{a}	0.81994	<0.0001
PER (%)	59.86±0.22^{a}	58.82±0.73^{ab}	59.36±1.21^{ab}	55.32±0.74^{c}	56.55±0.35^{bc}	0.91851	0.00625
PR (%)	32.69±0.38^{a}	31.66±0.31^{ab}	30.39±0.65^{b}	28.01±0.26^{c}	25.15±0.39^{c}	0.98076	0.00018
LR (%)	41.45±1.37^{a}	40.79±2.38^{a}	41.12±0.40^{a}	38.88±1.43^{a}	40.36±0.08^{a}	0.45154	0.47426

Chemistry analysis of blood and flesh

The analysis of uric acid, cholesterol, glucose, total lipids, and phospholipid levels showed a consistent pattern, higher salinity correlated with higher results (Table 2). However, the results of the total protein, albumin, triglyceride, and meat albumin analysis showed opposite results, with the highest results obtained from treatments between 0 and 3‰ with differences that were not significantly different ($P > 0.05$). Based on these results, it was found that the 9‰ treatment still showed relatively the highest results in terms of quantity when compared to the analysis results of the 6‰ or 12‰ with significant differences ($P < 0.05$).

Table 2. Results of chemistry analysis of blood and flesh of *Channa striata*

Sample Types	Analysis	Treatments (‰)					R-Square	P-Value
		0	3	6	9	12		
Fresh blood	Uric acid (g/dL)	4.43±0.33^{d}	5.50±0.34^{c}	6.03±0.28^{c}	7.08±0.33^{b}	9.00±0.32^{a}	0.96942	<0.0001
	Cholesterol (g/dL)	2.75±0.06^{e}	3.05±0.06^{d}	3.40±0.12^{c}	3.65±0.06^{b}	4.00±0.12^{a}	0.97224	<0.0001
	Glucose (g/dL)	3.15±0.21^{d}	3.38±0.15^{cd}	3.73±0.17^{c}	4.63±0.22^{b}	5.65±0.06^{a}	0.97461	<0.0001
Plasma blood serum	Total protein (g/dL)	8.80±0.08^{a}	8.80±0.08^{a}	7.40±0.08^{c}	7.90±0.08^{b}	5.50±0.08^{d}	0.99663	<0.0001
	Albumin (g/dL)	3.30±0.08^{a}	3.10±0.08^{b}	2.80±0.08^{c}	3.00±0.08^{b}	1.90±0.08^{d}	0.97939	<0.0001
	Triglyceride (mg/dL)	323.00±3.27^{a}	323.25±3.30^{a}	288.00±2.45^{c}	300.00±2.45^{b}	219.00±3.27^{d}	0.9955	<0.0001
	Globulin (g/dL)	0.23±0.01^{d}	0.25±0.01^{cd}	0.30±0.01^{b}	0.27±0.02^{bc}	0.70±0.02^{a}	0.99449	<0.0001
	A:G ratio	14.72±1.20^{a}	12.69±0.99^{b}	9.42±0.55^{c}	11.18±1.14^{bc}	2.71±0.18^{d}	0.96516	<0.0001
	Total lipid (mg/dL)	292.75±3.40^{e}	302.50±3.87^{d}	337.50±4.51^{b}	327.75±4.11^{c}	409.50±3.42^{a}	0.99334	<0.0001
	Phospholipid (mg/dL)	71.25±2.50^{d}	79.00±2.94^{c}	92.50±2.89^{b}	88.00±2.16^{b}	139.00±2.94^{a}	0.99032	<0.0001
Flesh	Albumin	2.20±0.08^{a}	2.00±0.08^{b}	1.70±0.08^{c}	1.90±0.08^{b}	0.80±0.08^{d}	0.97939	<0.0001

Analysis of osmotic work level

OWL showed the range of osmoregulation work patterns of test fish between hypoosmotic and hyperosmotic, whereas the higher the salinity level used, it increased the osmotic pressure of the environment on the body (Table 3), 0‰ treatment reveals a hypoosmotic osmoregulation pattern, with an OWL of -86±1.26 mOsm/L H_2O, while the 12‰ treatment indicates a hyperosmotic osmoregulation pattern, presenting an OWL of 172 ± 6.19 mOsm/L H_2O.

Table 3. Osmotic work level pressure between blood and media of *Channa striata*

Analysis	Treatments (‰)					R-Square	P-Value
	0	3	6	9	12		
Osmotic work level (mOsm/L H_2O)	-86±1.26^{e}	8±1.50^{d}	72±1.73^{c}	114±3.50^{b}	172±6.19^{a}	0.99895	<0.0001

Aquaculture quality performance

Aquaculture quality performance was based on proximate analysis (Table 4), amino acid (Table 5), and fatty acid (Table 6) results. The results of proximate analysis revealed a significant relationship ($P < 0,05$) between salinity and moisture content. Specifically, as the salinity levels increased, there was a marked increase in moisture content. In contrast, other components—such as protein, lipid, ash, and fiber content—showed a clear reliance on moisture content. Notably, lower moisture levels were associated with higher readings in these analyses, especially for protein, indicating a significant interaction among these variables. While lipid content remained fairly stable with no significant differences ($P > 0.05$), the analyses for ash and fiber content revealed considerable variations, with significant differences ($P < 0.05$).

Table 4. Proximate analysis of *Channa striata* flesh samples

Proximate (%)	Treatments (‰)						
Initial study							
Moisture	12.18±0.22						
Protein	60.04±0.53						
Lipid	8.93±0.43						
Ash	16.54±0.16						
Fiber	1.84±0.03						
N.F.E	0.48±0.18						
Final study						R-Square	P-Value
	0	3	6	9	12		
Moisture	23.23±0.28^{c}	24.09±0.68^{c}	26.75±0.11^{b}	28.20±0.10^{b}	31.13±0.49^{a}	0.9903	<0.0001
Protein	54.62±0.42^{a}	53.82±0.14^{a}	51.20±0.04^{b}	50.64±0.22^{b}	48.01±0.40^{c}	0.99289	<0.0001
Lipid	8.45±0.25^{a}	8.46±0.39^{a}	8.45±0.25^{a}	8.57±0.20^{a}	8.71±0.04^{a}	0.24426	0.79971
Ash	12.48±0.34^{a}	12.38±0.16^{a}	11.50±0.19^{b}	11.25±0.17^{b}	10.92±0.06^{b}	0.94874	0.00201
Fiber	0.91±0.03^{a}	0.87±0.02^{a}	0.83±0.02^{ab}	0.76±0.03^{bc}	0.71±0.02^{c}	0.9477	0.00211
N.F.E	0.32±0.08^{b}	0.39±0.25^{b}	1.28±0.31^{a}	0.59±0.08^{ab}	0.53±0.05^{ab}	0.86894	0.1973

Table 5. Amino acids analysis of *Channa striata* flesh samples

Amino acids (%)	Treatments (‰)						
Initial study							
Lysine	6.15±0.03						
Methionine	1.90±0.03						
Arginine	4.90±0.02						
Phenylalanine	3.71±0.03						
Histidine	1.81±0.03						
Isoleucine	3.90±0.03						
Leucine	7.29±0.03						
Threonine	3.94±0.02						
Valine	3.81±0.03						
Tryptophan	1.39±0.02						
ΣEAAs	38.77±0.05						
Aspartic acid	9.22±0.03						
Glutamic acid	12.03±0.05						
Serine	3.40±0.04						
Glycine	3.97±0.05						
Alanine	4.94±0.06						
Tyrosine	2.69±0.05						
Cysteine	0.77±0.03						
ΣNEAAs	37.00±0.15						
Final study	0	3	6	9	12	R-Square	P-Value
Lysine	5.75±0.04^{d}	5.97±0.07^{cd}	6.16±0.13^{bc}	6.47±0.14^{a}	6.34±0.09^{ab}	0.89553	<0.0001
Methionine	1.47±0.02^{d}	1.69±0.05^{c}	1.99±0.06^{ab}	2.18±0.14^{a}	1.97±0.12^{b}	0.91091	<0.0001
Arginine	4.91±0.01^{bc}	5.17±0.07^{a}	4.84±0.03^{c}	4.96±0.05^{b}	4.94±0.02^{b}	0.9027	<0.0001
Phenylalanine	3.98±0.02^{a}	3.93±0.01^{ab}	3.90±0.00^{b}	3.83±0.03^{c}	3.72±0.04^{d}	0.94795	<0.0001
Histidine	2.25±0.02^{a}	2.16±0.05^{ab}	2.08±0.08^{bc}	2.01±0.03^{c}	1.99±0.06^{c}	0.81854	<0.0001
Isoleucine	3.87±0.03^{cd}	4.08±0.03^{a}	3.98±0.03^{b}	3.91±0.02^{c}	3.83±0.03^{d}	0.93377	<0.0001
Leucine	7.29±0.01^{bc}	7.50±0.00^{a}	7.25±0.02^{c}	7.29±0.03^{bc}	7.30±0.03^{b}	0.96491	<0.0001
Threonine	4.29±0.02^{a}	4.13±0.02^{b}	4.00±0.01^{d}	4.06±0.03^{c}	4.08±0.04^{bc}	0.95509	<0.0001
Valine	3.85±0.01^{b}	3.89±0.02^{a}	3.78±0.01^{c}	3.87±0.02^{ab}	3.81±0.01^{c}	0.90808	<0.0001
Tryptophan	1.54±0.01^{a}	1.47±0.02^{b}	1.40±0.01^{c}	1.40±0.01^{c}	1.36±0.00^{d}	0.98557	<0.0001
ΣEAAs	39.17±0.04^{b}	39.97±0.17^{a}	39.35±0.23^{b}	39.99±0.14^{a}	39.34±0.26^{b}	0.82381	<0.0001
Aspartic acid	9.23±0.02^{b}	9.36±0.02^{a}	9.11±0.03^{d}	9.16±0.02^{c}	9.06±0.02^{d}	0.96678	<0.0001
Glutamic acid	12.32±0.02^{a}	12.27±0.02^{a}	12.02±0.04^{b}	12.03±0.02^{b}	12.01±0.03^{b}	0.97185	<0.0001
Serine	3.47±0.01^{b}	3.58±0.01^{a}	3.46±0.02^{b}	3.45±0.03^{b}	3.48±0.03^{b}	0.87414	<0.0001
Glycine	4.60±0.01^{a}	4.35±0.04^{b}	4.09±0.03^{d}	4.09±0.02^{d}	4.23±0.01^{c}	0.98602	<0.0001
Alanine	5.55±0.04^{a}	5.46±0.03^{b}	5.13±0.05^{c}	5.19±0.01^{c}	5.43±0.03^{b}	0.97106	<0.0001
Tyrosine	3.23±0.01^{a}	3.09±0.02^{b}	2.91±0.01^{cd}	2.88±0.03^{d}	2.95±0.04^{c}	0.97324	<0.0001
Cysteine	1.00±0.01^{a}	0.91±0.02^{b}	0.89±0.01^{bc}	0.85±0.02^{cd}	0.84±0.01^{d}	0.93817	<0.0001
ΣNEAAs	39.39±0.09^{a}	39.00±0.06^{b}	37.59±0.03^{d}	37.65±0.07^{d}	37.99±0.08^{c}	0.99316	<0.0001

The analysis of amino acid showed significant differences ($P < 0.05$) between essential and non-essential amino acids, although there were relatively similar results, such as in the analysis of tryptophan with treatments 6 and 9‰, which had a mean and standard deviation of 1.40 ± 0.01%. In other analyses, there were also relatively similar results for arginine, histidine, valine, tryptophan, aspartic acid, glutamic acid, serine, and alanine, these results showed that the values were relatively similar, but with a significance value ($P < 0.05$).

The analysis of fatty acids showed significant differences ($P < 0.05$) for oleic acid (18:1n9), linolenic acid (18:3n3), linoleic acid (C18:2n6), docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA), arachidonic acid (20:4n6), and the n3/n6 ratio, with each results showed that the 9‰ was the best treatment, but the 15:0 (pentadecanoic acid) showed insignificant differences ($P > 0.05$) although the mean and standard deviation produced showed differences with a mean difference of 0.07 – 0.132. Aquaculture performance analysis results for *C. striata* were influenced by water quality, which must be controlled within normal ranges, in accordance with water quality control parameters such as temperature, pH, DO, NH3, and NH4, for which analysis results are shown in Table 7.

Table 6. Fatty acids analysis of *Channa striata* flesh samples

Fatty acids (%)	Treatments (‰)						
Initial study							
C8:0	0.235±0.004						
C10:0	0.603±0.004						
C11:0	0.316±0.003						
C12:0	0.235±0.001						
C14:0	0.653±0.008						
C15:0	0.033±0.001						
C16:0	22.155±0.021						
C18:0	9.533±0.010						
C20:0	0.325±0.019						
C21:0	0.850±0.014						
ΣSFA	34.937±0.029						
C16:1	1.532±0.007						
C18:1n7	3.358±0.028						
C18:1n9	22.523±0.081						
C20:1	2.768±0.023						
C24:1	0.736±0.007						
ΣMUFA	30.916±0.082						
C18:2n6	8.734±0.017						
C18:2n6c	1.451±0.022						
C18:3n3	2.856±0.006						
C18:3n6	0.432±0.003						
C18:4n3	0.530±0.005						
C20:3n3	0.726±0.005						
C20:4n3	0.077±0.001						
C20:4n6	7.307±0.010						
C20:5n3	0.616±0.002						
C22:5n3	1.841±0.002						
C22:6n3	12.709±0.012						
ΣPUFA	37.279±0.017						
ΣPUFA n3	19.356±0.013						
ΣPUFA n6	17.923±0.022						
n3/n6	1.080±0.002						
EPA+DHA	13.325±0.010						
Final study						R-Square	P-Value
	0	3	6	9	12		
C8:0	0.233±0.001^{e}	0.319±0.002^{d}	0.488±0.005^{c}	0.620±0.002^{a}	0.563±0.002^{b}	0.99973	<0.0001
C10:0	0.636±0.010^{e}	0.785±0.003^{d}	0.877±0.025^{c}	1.078±0.010^{a}	0.933±0.006^{b}	0.99405	<0.0001
C11:0	0.330±0.010^{d}	0.349±0.006^{d}	0.446±0.014^{c}	0.634±0.008^{a}	0.546±0.032^{b}	0.98452	<0.0001
C12:0	0.233±0.002^{b}	0.344±0.022^{a}	0.345±0.021^{a}	0.360±0.013^{a}	0.365±0.013^{a}	0.92455	<0.0001
C14:0	0.660±0.025^{d}	0.652±0.017^{d}	0.957±0.018^{c}	1.356±0.020^{a}	1.156±0.012^{b}	0.9965	<0.0001
C15:0	0.033±0.002^{a}	0.040±0.003^{a}	0.165±0.235^{a}	0.066±0.005^{a}	0.060±0.005^{a}	0.2149	0.42547
C16:0	22.143±0.025^{e}	22.448±0.033^{d}	22.725±0.013^{c}	23.295±0.024^{a}	23.153±0.029^{b}	0.99734	<0.0001
C18:0	9.648±0.026^{e}	9.745±0.025^{d}	10.663±0.028^{b}	11.148±0.022^{a}	10.438±0.029^{c}	0.99841	<0.0001
C20:0	0.358±0.026^{d}	0.445±0.031^{c}	0.480±0.014^{c}	0.633±0.013^{a}	0.553±0.015^{b}	0.96306	<0.0001
C21:0	0.838±0.017^{c}	0.865±0.021^{c}	0.918±0.010^{b}	1.095±0.013^{a}	0.943±0.015^{b}	0.97801	<0.0001
ΣSFA	35.110±0.050^{e}	35.992±0.068^{d}	38.063±0.226^{c}	40.284±0.026^{a}	38.709±0.028^{b}	0.99744	<0.0001
C16:1	1.545±0.011^{e}	1.755±0.019^{d}	2.463±0.014^{c}	2.97±0.017^{a}	2.70±0.016^{b}	0.99939	<0.0001
C18:1n7	3.371±0.018^{e}	3.858±0.032^{d}	4.559±0.104^{b}	5.38±0.050^{a}	4.40±0.086^{c}	0.99287	<0.0001
C18:1n9	22.400±0.220^{d}	22.730±0.189^{c}	23.185±0.052^{b}	23.56±0.081^{a}	23.17±0.042^{b}	0.9187	<0.0001
C20:1	2.754±0.024^{d}	2.789±0.006^{c}	2.808±0.009^{c}	2.93±0.014^{a}	2.86±0.009^{b}	0.96338	<0.0001
C24:1	0.730±0.004^{b}	0.741±0.005^{b}	0.777±0.009^{b}	0.81±0.007^{a}	0.77±0.009^{b}	0.95976	<0.0001
ΣMUFA	30.800±0.222^{d}	31.873±0.220^{c}	33.792±0.102^{b}	35.65±0.099^{a}	33.90±0.089^{b}	0.99349	<0.0001
C18:2n6	8.632±0.013^{d}	8.839±0.036^{bc}	8.880±0.009^{b}	9.322±0.073^{a}	8.786±0.035^{c}	0.97771	<0.0001
C18:2n6c	1.453±0.023^{d}	1.478±0.011^{d}	1.640±0.006^{c}	1.928±0.010^{a}	1.729±0.004^{b}	0.99601	<0.0001
C18:3n3	2.824±0.006^{e}	2.958±0.016^{d}	3.256±0.020^{c}	3.518±0.006^{a}	3.455±0.024^{b}	0.99737	<0.0001
C18:3n6	0.422±0.008^{c}	0.453±0.016^{c}	0.552±0.020^{b}	0.638±0.015^{a}	0.553±0.025^{b}	0.96128	<0.0001
C18:4n3	0.536±0.006^{d}	0.579±0.007^{c}	0.618±0.004^{b}	0.641±0.004^{a}	0.575±0.010^{c}	0.97745	<0.0001
C20:3n3	0.721±0.008^{d}	0.766±0.023^{c}	0.824±0.007^{b}	0.884±0.007^{a}	0.748±0.008^{cd}	0.96759	<0.0001
C20:4n3	0.082±0.001^{d}	0.084±0.001^{d}	0.087±0.002^{c}	0.095±0.001^{a}	0.091±0.001^{b}	0.95415	<0.0001
C20:4n6	7.295±0.013^{e}	7.618±0.005^{d}	7.952±0.019^{c}	8.378±0.014^{a}	8.091±0.027^{b}	0.99842	<0.0001

C20:5n3	0.616±0.004^{e}	0.684±0.004^{d}	0.749±0.006^{c}	0.885±0.004^{a}	0.811±0.011^{b}	0.99654	<0.0001
C22:5n3	1.838±0.003^{e}	1.942±0.008^{d}	2.049±0.012^{c}	2.236±0.014^{a}	2.101±0.022^{b}	0.99268	<0.0001
C22:6n3	12.694±0.019^{e}	12.721±0.007^{d}	12.753±0.002^{c}	12.940±0.013^{a}	12.817±0.004^{b}	0.98876	<0.0001
ΣPUFA	37.113±0.034^{e}	38.122±0.096^{d}	39.360±0.053^{c}	41.464±0.075^{a}	39.756±0.082^{b}	0.99826	<0.0001
ΣPUFA n3	19.311±0.032^{e}	19.734±0.045^{d}	20.336±0.037^{c}	21.198±0.014^{a}	20.597±0.028^{b}	0.99814	<0.0001
ΣPUFA n6	17.802±0.022^{e}	18.389±0.058^{d}	19.024±0.034^{c}	20.266±0.064^{a}	19.159±0.062^{b}	0.99716	<0.0001
n3/n6	1.085±0.003^{a}	1.073±0.002^{bc}	1.069±0.003^{c}	1.046±0.003^{d}	1.075±0.003^{b}	0.97004	<0.0001
EPA+DHA	13.310±0.023^{e}	13.405±0.010^{d}	13.502±0.006^{c}	13.825±0.011^{a}	13.628±0.007^{b}	0.99621	<0.0001

Table 7. Water quality control during experimental fish reared

Water quality control	Treatments (‰)				
	0	3	6	9	12
Temperature (°C)	26.88 – 27.31	26.86 – 27.31	26.86 – 27.30	26.88 – 27.29	26.86 – 27.30
pH	6.95 – 7.18	6.94 – 7.18	6.96 – 7.19	6.94 – 7.19	7.01 – 7.19
DO (ppm)	5.42 – 5.84	5.44 – 5.82	5.65 – 0.14	5.62 – 0.13	5.66 – 0.11
NH_3 (ppm)	0.0025 – 0.01	0.0025 – 0.0125	0.0025 – 0.0175	0.005 – 0.025	0.005 – 0.0275
NH_4 (ppm)	0.25 – 1.00	0.25 – 1.00	0.25 – 1.00	0.25 – 1.00	0.25 – 1.00

The optimum salinity level for the growth rate and aquaculture quality performance was 10‰ for *C. striata* sourced from freshwater rivers (Dubey et al., 2016; Lan et al., 2020). Although there has been considerable study of salinity engineering in *C. striata*, there has not been any study which has provided a fundamental basis about the reason why that salinity levels were applied. Salinity tolerance as determined by laboratory tests is correlated with the maximum salinity resembling the natural conditions in whom the organisms live, the maximum tolerance of fish in relation to salinity cannot be precisely determined based on laboratory observations only, as it may be influenced by other factors (Bringolf et al., 2005; Kasim, 1983; Kefford et al., 2004). The optimal salinity for freshwater fish survival appears to vary depending on the species, as each species has different physiological, morphological, and metabolic characteristics that influence the osmoregulatory performance between the body's osmotic pressure and their environment (Nakkrasae et al., 2015; Temmy et al., 2017). If the salinity of the environment changes rapidly and exceeds tolerable limits, aquatic biota will die due to osmoregulatory imbalance (Anggoro & Subandiyono, 2012; Bodinier et al., 2010; Nakkrasae et al., 2015).

Growth performance indices such as SGR (%, day^{-1}), BWG (%), and RGR (%) obtained during this experiment were highest in fish cultivated at a salinity of 9‰, compared to other treatments, it required more feed, with a mean total feed of 62.81 ± 0.78 g at an FCR level of 4.41 ± 0.07 g of feed per 1 g of experimental fish weight produced, followed by fish cultivated at a salinity of 12‰, while the lowest results were obtained in fish cultivated in freshwater media (Table 1). In other studies, on *P. hypophthalmus*, Mandal et al. (2020) found that growth rates at a salinity of 2‰ were not significantly different from those in freshwater, but growth rates decrease at salinities of 4‰ to 14‰, Furthermore, they observed that weight gain, feed conversion ratio, and body proximate composition were significantly influenced by salinity. Kang'ombe et al. (2008) observed that the growth rate of *Tilapia rendalli* fingerlings at a salinity of 10‰ showed was significantly different compared to the growth rate of *T. rendalli* fingerlings reared in freshwater. The growth rate, hatching rate, and survival rate of *C. striata* were influenced by salinity, with the optimal range being 5 – 11 ppt (Amornsakun, 2017). The findings of this study are in line with trends from other studies concerning the positive effects of salinity on the growth performance and aquaculture quality (proximate analysis, amino acid, and fatty acid) of the freshwater fish *C. striata*. According to Woo and Kelly (1995), in freshwater conditions, fish expend a certain amount of energy to compensate for the loss of salt through passive diffusion, whereas low salinity brackish water reduces energy expenditure and consequently accelerates growth.

Salinity has an important impact on nutrient utilization of fish (Gonzales & Brown, 2007; Krogdahl et al., 2004; Ma et al., 2015). Therefore, Comprehensive studies investigating the correlation between media salinity and nutrient retention remain limited between salinity of fish aquaculture media and nutrient utilization, especially in the analysis of protein and lipid retention value, has not been performed by researchers. However, the present study indicates that salinity has a significant effect ($P < 0.05$) on protein retention ($R^2 = 0.98$) and lipid retention ($R^2 = 0.45$) in fish bodies, showing a negative effect where higher salinity results in lower protein retention, while lipid retention increases at a salinity of 12‰. The value of feed retention (protein, lipids, carbon, nitrogen, sulfur, and energy) is obtained based on the amount of feed consumed and successfully utilized by the body to convert into flesh, thereby increasing body weight (Keast, 1975; National Research Council, 2011).

Fish regulate their plasma ions such that the internal osmotic pressure of their body fluids is equivalent to approximately 10 g l^{-1} salinity with a range of 2 g l^{-1}. Salinity makes a difference to osmolarity, and when salinity is different from the iso-osmotic level, aquatic organisms maintain their osmolarity by using energy (Nakkrasae et al., 2015; Permata et al., 2021; Temmy et al., 2017). Increased plasma osmolarity at high salinity is a common

response of stenohaline species (Nordlie, 2009; Soldatov, 2000). While the pattern of osmoregulation in this study approached iso-osmotic levels as indicated by the results of the analysis for the 3‰ treatment, which showed an OWL of 8 ± 1.50 mOsm/L H_2O overall growth rates and aquaculture quality performance did not appear improvement.

The exposure of rearing media to salt can influence the feed intake of fish, including both freshwater and saltwater fish, each of which has a different optimum salinity level to support growth rates based on nutrient intake and feed response (Kang'ombe & Brown, 2008; Mervat A. M. Ali, 2021; Mirera & Okemwa, 2023). Decreased growth due to reduced food intake at increased salinity levels has been reported for several species, as it has the potential for salinity-related changes in appetite (Alcalá-Carrillo et al., 2016; Britz & Hecht, 1989; Nirmala et al., 2007; Purnamawati et al., 2019). Low appetite in fish may be caused by a decrease in the sensitivity of the olfactory nerves to amino acids, thereby reducing the stimulus to eat at salinity higher than 9 ppt in this study (Jun et al., 2012; Likongwe et al., 1996; Purnamawati et al., 2019). These findings are consistent with the results of the present study, which showed that the satiation feeding method resulted in a significant difference in growth performance, even though the feed conversion ratio was relatively high at ±4 g of feed to gain 1 g of weight, indicating the relatively high adaptive capacity of this species to high salinity exposure.

The nutritional quality of *C. striata* has been investigated as a source of protein and fatty acids (Aliyu-Paiko et al., 2012; Dutta & Dutta, 2020; Pratama et al., 2020). This species was rich in amino acids (Table 5) and fatty acids (Table 6). Based on the total fat content in the proximate analysis, C. striata contained >8% of its body weight. Fish with a lower fat content had a higher water content (Castillo-Vargasmachuca et al., 2017; Mandal et al., 2020; Suprayitno et al., 2013), as observed in this study (Table 4). The proximate content is influenced by differences in species, geographic region, age, and diet (Meyer-Rochow et al., 2021; Payne et al., 1999; Suprayitno et al., 2013). *C. striata* has been shown to contain all essential amino acids and fatty acids, which are highly beneficial in the field of health (Mohd Shafri & Abdul Manan, 2012; Rahman et al., 2018).

Freshwater fish require water from a hyperosmotic environment into their bodies to replace the loss of water due to osmosis, which can affect amino acid and fatty acid levels through the metabolism of aquatic biota, especially fish in the fingerling stadia, because their digestive and metabolic systems are immature, so the environment can affect metabolic patterns, especially protein and fatty acid composition (Anggoro et al., 2018; Lovshin, 1996; Merrifield & Ringø, 2014; Willett & Aluru, 2024). In our study, the levels of fatty acids and amino acids have shown a significant increased with increasing salinity up to 9‰, while at 12‰ salinity has shown a decrease, this indicates that the optimum level for support of the aquaculture process of C. striata is within the range of 8–10‰. Our results regarding fatty acids are compatible with the result of the study on mummichog fish (*Fundulus heteroclitus*), which is euryhaline fish originating from the Atlantic Coast of North America, which were incubated and reared in water with salinities of (2, 20, 40, and 60 ppt), which showed an optimum salinity level, where fish exposed to salinity of 20–60 ppt showed higher fatty acid levels compared with fish in low salinity conditions (Torres-Rodríguez et al., 2025). This is influenced by osmoregulation activities that occur in the bodies of fish, thereby affecting body compositions which include fatty acids, amino acids, proteins, and lipids (Hai et al., 2018; Willett & Aluru, 2024). The mechanism of nutrient absorption on feed is influenced by metabolic processes caused by the OWL mechanism between the body and its environment, each fish has a different optimal salinity level, based on species, feeding patterns, physiology, and adaptability (Cheng et al., 2022; El-Sayed, 2006; Kang'ombe & Brown, 2008; Sinha et al., 2015).

This study's water quality range was between 26.86–27.31 °C (temperature), 6.94–7.19 (pH), 5.41–5.84 ppm (DO), 0.0025–0.0275 ppm (NH3), and 0.25–1 ppm (NH4). Thus, the water quality obtained is suitable for sustaining the aquaculture process of C. striata, where these fish have a tolerance limit for water quality ranging from 25–32 °C (temperature), 6.5–9 (pH), 3.4–6.8 ppm (DO), >1 ppm (NH3), and 1–5 ppm (NH4) (Arkhipov, 2022; Dubey et al., 2016; Hai et al., 2018). Water quality is an important parameter for determining the carrying capacity of water in aquaculture processes, each species of fish has a different range of water quality, but if the water quality is showing less than the minimum limit or exceeding the maximum limit, it will affect the growth and health of the fish, and can even cause mass mortality (Hai et al., 2018; Santoso & Wahyudewantoro, 2019; Symposium, 2004).

Freshwater and marine fish are important components in contributing to the nutritional value of Indonesia, with fish accounting for approximately 50% of protein intake in Indonesia (Napitupulu et al., 2022). These fish can be an alternative source of protein and fat for the populations of developing countries (Napitupulu et al., 2022). Therefore, the use of saline water for freshwater fish can support the sustainability of aquaculture processes aimed at supporting the nutritional intake of the world's population regardless of freshwater supply concerns, as the implemented aquaculture system focuses on the utilization of saline water (Kasim, 1983; Lan et al., 2020; Powell et al., 2021).

CONCLUSION

The inclusion of the 12‰ salinity treatment served as a benchmark to evaluate physiological and growth thresholds under hyperosmotic stress, whereas in the first stage of the study, this salinity level showed a cumulative mortality rate of >50%. The results showed that salinity with a cumulative mortality rate >50% indicated a decrease in growth performance, although the growth rate was better than that of the treatment at a salinity level < 9‰ , which is the salinity level of 9‰, is considered the optimum salinity level to support accelerated growth rates and improved aquaculture production quality (proximate analysis, amino acid, and fatty acid) in *C. striata* reared from fingerlings measuring 6.06 ± 0.30 cm with weight 1.96 ± 0.30 g and originating from the Musi River with a salinity of 0‰. For future study, we suggest to add physiological and morphological analysis, as well as genetic analysis related to this fish using a salinity range of 8–10‰.

Data Availability

All data results are included in tables and graphs, statistical data including descriptive analysis are included in the supplementary file.

Credit Authorship Contribution Statement

Muhammad Avesena: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Visualization, and Writing-Original draft. Eddy Supriyono: Investigation, Methodology, Leader Supervision, and Validation. Kukuh Nirmala: Investigation, and Member Supervision. Yuni Puji Hastuti: Investigation, Methodology, and Member Supervision. Mohammad Rasyid Ridho: Conceptualization, Investigation, Member Supervision, Validation, and Writing-Review & Editing.

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